
## Environmental Services

Specialising in:

Acid Sulphate Soils
Contaminated Site Assessment
Air Quality Investigations
Remediation Advice and Design
Groundwater Management
Facility Maintenance

**ABN 36 835 856 256**

# NUTRIENT AND IRRIGATION MANAGEMENT PLAN

## 456 Rapids Road, Serpentine

PREPARED FOR:

Hope Valley Nursery Pty Ltd

Mobile Dewatering Environmental Services as trustee for
Mobile Dewatering Environmental Services Unit Trust
U1/22 Elmsfield Road, Midvale, Western Australia 6056
U1/69 Pinjarra Road, Mandurah, Western Australia 6210
P: +61 (0) 8 9250 6960 F: +61 (0) 8 92508269
W: www.environmentalservices.com.au

Environmental Services

# DOCUMENT DETAILS

| | |
|---|---|
| **Title:** | Nutrient and Irrigation Management Plan (NIMP) |
| **Project Address:** | Nursery Development at 456 Rapids Road, Serpentine Western Australia |
| **Job Number:** | E2011-109 |
| **Project Manager:** | Greg Watts |
| **Email:** | greg@environmentalservices.com.au |
| **Date:** | Final |
| **Synopsis:** | This document and subsequent investigation has been prepared in accordance with Water Quality Protection Note 33, June 2010 and Water Quality Information Sheet 04, August 2010, Department of Water, Western Australia. |

# DOCUMENT DISTRIBUTION

| Version No | Written by Date | 1st Review Date | 2nd Review Date | Distributed to Date | Copies |
|---|---|---|---|---|---|
| **DRAFT** | J Latchford<br>10/09/2013 | G Watts<br>10/09/2013 | N/A | email | |
| **FINAL** | R Burnell<br>10/10/2013 | G Watts<br>14/10/2013 | N/A | Hope Valley Nursery P/L<br>DER<br>Rowe Group | 2 (email/print)<br>1 (print)<br>2 (email/print) |
| **Signed** | | | | | |

# Disclaimer

This document has been prepared in accordance with a scope of works, set out in a proposal, or as otherwise agreed, between the client and MDW Environmental Services (MDWES). The scope of work may have been limited by time, budget, access and or other constraints and has been prepared in the absence of any knowledge of the study area other than that stated.

This document has been prepared on behalf of and for the exclusive use of the client, and is subject to and issued in accordance with the agreement between MDWES and the client. MDWES accepts no liability or responsibility whatsoever in respect to its use, or reliance upon, by any third party outside of its intended use. This document has commercial confidence status. Copying of this report or any part thereof is not permitted without the authorisation of the client, for the expressed purpose of regulatory assessment. Unless specifically agreed otherwise, MDWES retains intellectual property rights over the contents of this document.

Unless otherwise stated, MDWES regards the extent of investigations and assessments reasonable in the context of the scope of works and the purpose of the investigation. The information contained in this document is provided in good faith in the general belief that no information, opinions, conclusions or recommendations made are misleading, but are reasonable and appropriate at the time of issue of this document. This document must be read in its entirety. Users are cautioned that assumptions made in this document may change over time and it is the responsibility of the user to ensure that assumptions remain valid. Reported results, while accurate at the time of reporting cannot be considered absolute or conclusive without long term follow up studies. If future uses of the "Site" change there may be a need to appoint an auditor. The scope of works of this investigation is not necessarily sufficient to meet an auditor's needs.

Comments and opinions presented in this document are based on the extent of the scope of works and / or on information supplied by the client, their agents and / or third parties. In preparing this document MDWES has relied upon reports, data, surveys, analyses, designs, plans and / or other information provided by the client and other individuals and organisations outside its control. Except as stated otherwise in the document MDWES has not verified the accuracy or completeness of this information. To the extent that the statements, opinions, facts, information, conclusions and / or recommendations in the document are based in whole or part on this information, those are contingent upon the accuracy and completeness of the information. MDWES will not be liable in relation to incorrect conclusions should any information be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

Within the limitations imposed by the scope of work, the assessment of the study area and preparation of this document have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants and occupational hygienists under similar circumstances. No other warranty, expressed or implied, is made. MDWES will not be liable to update or revise the document to take into account any events, circumstances or facts occurring or becoming apparent after the date of this document.

Specific warning is given that many factors, natural or artificial, may render conditions different from those that prevailed at the time of investigation and should they be revealed at any time, they should be brought to our attention so that its significance may be assessed and appropriate advice may be offered. MDWES, its agents and employees, expressly disclaim any and all liability for representations, expressed or implied, contained in, or omissions from, this report or any of the written or oral communications transmitted to the client or any third party.

Acceptance of this document denotes acceptance of these terms.

# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

## APPENDICES

Appendix A – Hydrological modelling of land clearing on Rapids Road, Serpentine (CDM Smith 2013)

Appendix B – Groundwater Field Sheets (February, June and August)

Appendix C – February Laboratory Documentation

Appendix D – June Laboratory Documentation

Appendix E – August Laboratory Documentation

Appendix F – Contour and Feature Survey (Midland Survey Services)

# EXECUTIVE SUMMARY

MDW Environmental Services (MDWES) was instructed by Hope Valley Nursery Pty Ltd to develop a Nutrient and Irrigation Management Plan (NIMP), for the wholesale nursery development at 456 Rapids Road, Serpentine, Western Australia (the Site). In order to develop the wholesale nursery, 5.462 ha of the 47 ha property will need to be cleared of existing vegetation. To offset this loss the property owners have committed to the rehabilitation of three areas on their property that have been degraded by over-grazing activity over many years. These three areas (16.35 ha in total) are adjacent to groves of mature jarrah and marri trees and currently have a limited understorey.

The property also has contains three wetlands, these are mapped as a damp land wetlands within the Bennett Brook wetland system. One of the wetlands (7402 a damp land with the Management Category of Multiple Use) is located in the north eastern corner of the property. This area is not part of the proposed wholesale nursery. The other two wetlands are within the area for development. These are wetland 15364 and 7590, both damp lands with the Management Category of Resource Enhancement.

The proposed wholesale nursery will have an office, buildings for potting plants, storing chemicals and equipment, tunnel houses, outdoor growing areas, water storage tanks and waste water treatment ponds. The site will be cleared and at least 50 cm of fill used to level and grade the production area ensuring that the slope of the land will allow water to runoff towards the water retention basin. All growing areas and tunnel houses will be covered with limestone roadbase, compacted and rolled until approximately a 100mm thickness is achieved. Contaminant leaching to the groundwater will be controlled by the impermeable roadbase and the subsequent collection of all surface runoff in a nutrient retention basin.

A chemical storage facility for the storage and handling of pesticides will be built on the nursery site. The facility will be constructed using best management practices guidelines for the storage and handling of horticultural chemicals. The facility will have a bunded concrete floor to ensure spills are contained within the facility. All chemicals will be stored in locked cages within the facility. It will be insulated and have roof top ventilation to maintain an even temperature. All drainage from the facility will be collected in a waste chemical evaporation pit, which will have sealed concrete liners and organic material to breakdown residual chemicals from the rinsate. A clear plastic roof, to increase solarisation and evaporation, will be installed on top of the pit.

The nursery will be used to grow a mixture of native and annual flowering plants which will be grown in pots of various sizes. Imported soils will be used in the pots along with slow release fertilisers, which will be blended from an accredited soil provider and stored in fully sealed bunds. In addition to the slow release fertilisers, a fertigation system will operate in conjunction with the irrigation system. The type and quantity of fertiliser used depends upon the species of plant and the time of the year. There will be no broad scale application of fertiliser by mechanical spreading. Through the production of all crops in pots, soil moisture levels can be easily

monitored and the irrigation system matched to the water needs of the crops, thus reducing excessive watering and nutrient leaching. Leaching of fertilisers to the groundwater will be controlled by the cover of a compacted limestone roadbase covering the production areas, and the subsequent collection of all surface runoff in a nutrient retention basin.

Groundwater samples were collected from six bores adjacent to the proposed nursery in February, June and August 2013. The samples were analysed for physicochemical parameters to assist in understanding the groundwater in the superficial aquifer. As an application, for a new licence to take water from this aquifer, for an annual groundwater entitlement of 400,000 kL will be submitted for the nursery operations. The monitoring results indicate that groundwater is mildly acidic with a pH of between 4.6 and 6.5. This indicates that the groundwater may need to be treated prior to use. The groundwater may be affected by the oxidation of sulphides and may need monitoring to continue during the development and operation of the nursery. The elevated metal concentrations in the groundwater in conjunction with the potential acid sulphate soil risk, requires monitoring of the groundwater to keep a check of possible problems. As the nutrient concentrations are already elevated above guideline concentrations, it will be important to ensure that all waste water from the nursery is captured and treated in the nutrient retention basin.

# 1 SUMMARY OF LAND USE PROPOSAL

MDW Environmental Services (MDWES) was instructed by Hope Valley Nursery Pty Ltd to conduct a Nutrient and Irrigation Management Plan (NIMP), for the wholesale nursery development at 456 Rapids Road, Serpentine, Western Australia (the Site). The owners of 456 Rapids Road, Serpentine wish to develop a wholesale nursery on 19.4 ha of the project area (Figure 1). Anticipated start date is when approval has been granted. The duration of the intensive land use is indefinite. Table 1 provides a site summary.

**Table 1:** Summary of Land Use Details

| | |
|---|---|
| **Proponent's Name:** | Hope Valley Nursery Pty Ltd |
| **Postal Address:** | 37 Holmes Road, Oakford, Western Australia. |
| **Telephone:** | 08 9397 1066 |
| **E-mail:** | vaune@hopevalleynursery.com.au |
| **Site Location:** | Lot 838 on deposited plan 202654. The property street address is 456 Rapids Road, Serpentine, Western Australia. |
| **Proposed Site Use:** | Commercial – The proponents wish to develop a wholesale nursery on 19.4 ha of the 47 ha property they own. |

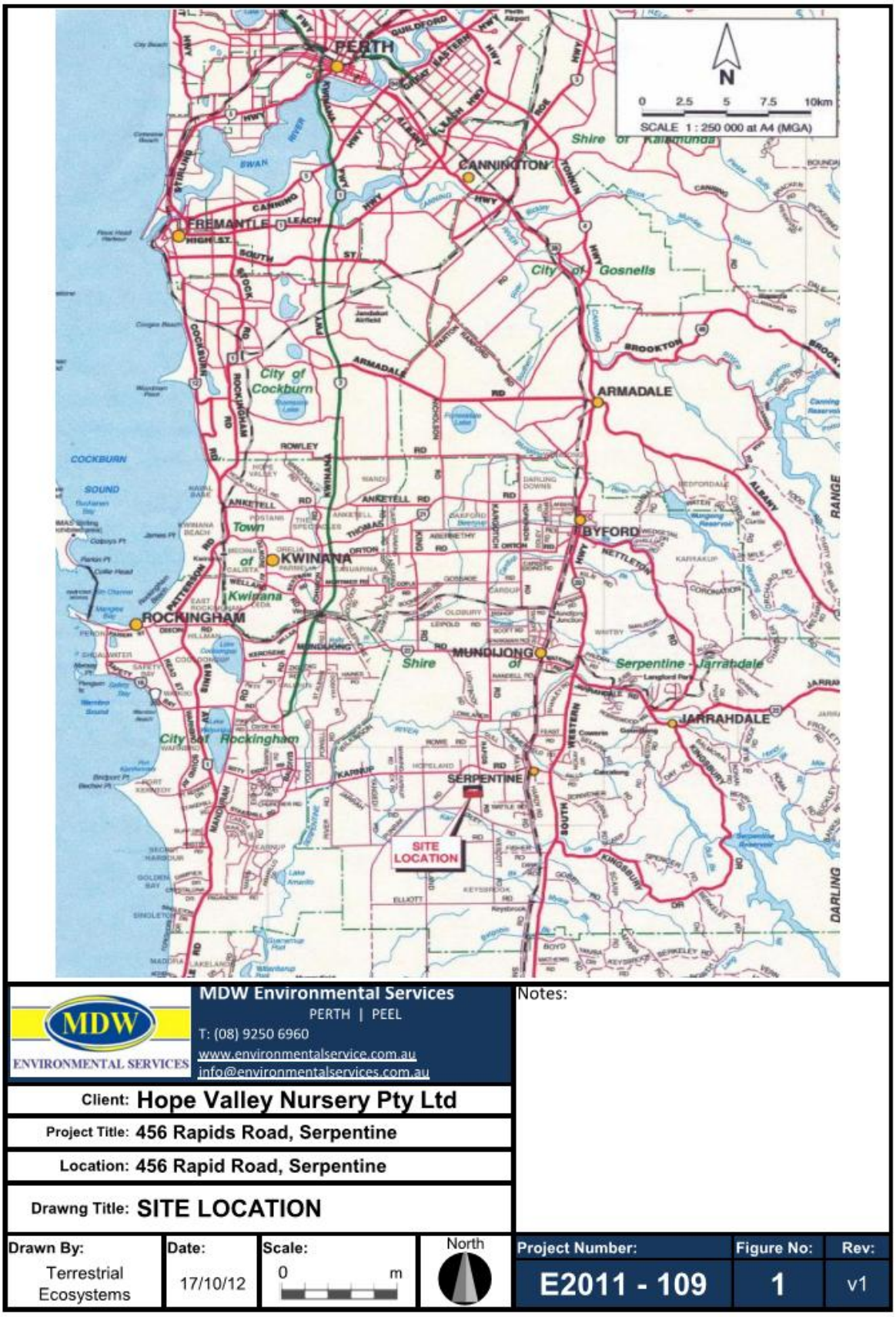



**Figure 1:** Site Location

# 2 PROJECT SETTING

## 2.1 Existing and Historic Site Use

The property is approximately 3.6 km west of the town of Serpentine. It is relatively flat pasture land with several stands of remnant trees and 12 different vegetation associations. The majority of the property has been grazed by cattle for many years and is significantly degraded (Nuts about Natives 2012; Terrestrial Ecosystems, 2012b). A residential dwelling and two sheds currently exist on the property. Table 2 provides a summary of the site setting.

**Table 2:** Project Setting

| | |
|---|---|
| **Site Name:** | 456 Rapids Road, Serpentine, Western Australia |
| **Site Location:** | 456 Rapids Road, Serpentine, Western Australia |
| **Size of the development footprint:** | 19.4 ha of the 47 ha are proposed for development. |
| **Current Site Use:** | Agriculture – The property was previously use for grazing cattle. |
| **Neighbouring Properties and Land use** | Figure 2 is the site layout map showing the site boundary of the property and the approximate location of the nursery. The nursery will be developed in stages, initially from the eastern boundary, then progressing towards the west. |
| **Current Ownership:** | Graeme P Hall and Vaune P Hall |
| **Local Shire:** | Shire of Serpentine - Jarrahdale |
| **Previous Known Environmental Investigations/Reports:** | *Nuts about Natives (2012) - Flora and Vegetation Survey of 456 Rapids Rd, Serpentine.*<br>*Terrestrial Ecosystems (2012a) – Black Cockatoo Assessment of 456 Rapids Road, Serpentine.*<br>*Terrestrial Ecosystems (2012b) – Referral of proposed action, 456 Rapids Road Serpentine, Western Australia.*<br>*Mark Lund (2013) Advice on Dampland at 456 Rapids Road, Serpentine.* |

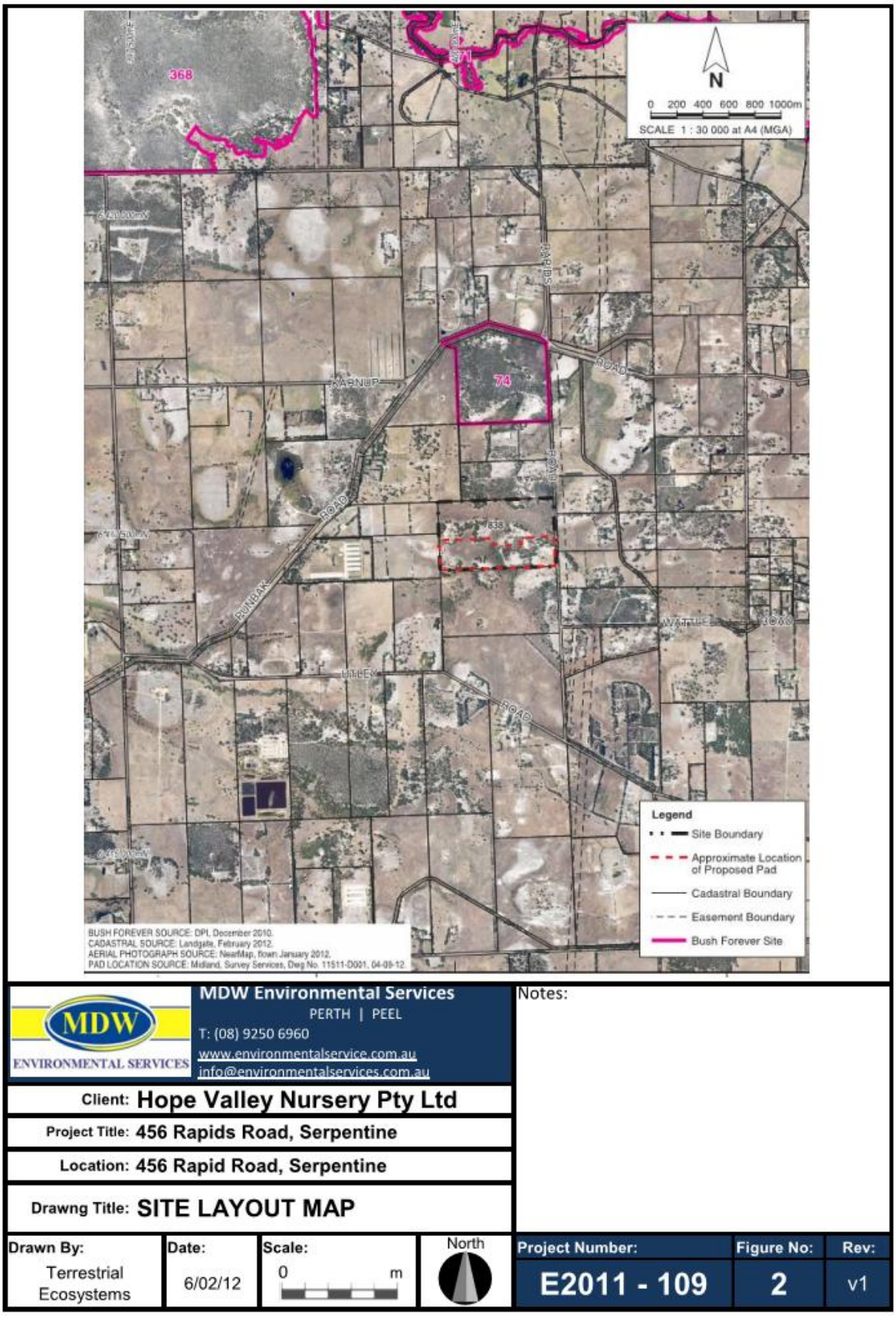



**Figure 2:** Site Layout Map

## 2.2 Compatibility with Local and State Planning Authorities

The property is within the Shire of Serpentine – Jarrahdale and as such a proposal has been made to the Shire for planning approval. The property is zoned Rural under the Town Planning Scheme and the Metropolitan Regional Scheme. The area under application falls within the Serpentine Groundwater and Surface Water Areas. These are proclaimed areas under the Rights in Water and Irrigation Act 1914. The property already has a bore and groundwater licence. An application for additional water will be submitted to the Department of Water.

The application area is within the Environmental Protection (SCP Peel Harvey Inlet) Policy 1992 area, the purpose of which is to set out the environmental quality objectives for the Peel Inlet and Harvey Estuary. It also outlines how these objectives are to be achieved and maintained. One objective of the EPP is to limit the median load of total phosphorus flowing into the estuary. It is implemented in the Shire of Serpentine – Jarrahdale through their planning schemes (DEC, 2013).

The Commissioner of Soil and Land Conservation has advised that the area proposed for clearing may not be suitable for the purpose of a wholesale nursery development as the risk of eutrophication causing land degradation is high to extreme. It recommended that a nutrient management plan be developed to ensure that excess nutrients do not leach into the mapped wetland. Additional hydrological information is also required to determine the impact the proposed development will have on adjacent land, wetlands, rare flora and threatened ecological communities (DEC, 2013).

The proponent has referred this proposal to the Department of Sustainability, Environment, Water, Population and Communities who determined this action is not a controlled action. It therefore does not require further assessment and approval under the Environment Protection and Biodiversity Conservation Act 1999 (SEWPAC, 2012). There are no Aboriginal sites of significance mapped within the application area (DEC, 2013).

The Shire of Serpentine – Jarradale advise that the vegetation found on site is mapped as a Potentially Locally Significant Natural Area, identified under the South West Biodiversity Project and the Perth Region Biodiversity Project. It also has been identified as part of a regional vegetation link for the Perth Metropolitan region (DEC, 2013).

Negotiations have proceeded with the DER regarding the application for the Clearing Permit and the proponent is confident that and “in principle” agreement will be issued imminently.

# 3 LAND USE AND NUTRIENT APPLICATION DETAILS

## 3.1 Planned Land Use

The owners of the Site wish to develop a wholesale nursery on 19.4 ha of their 47 ha property. They currently own and operate a wholesale nursery (Hope Valley Nursery) on Lot 26 Holmes Road, Oakford. Operation of the new nursery will be similar to the current nursery, but where feasible improved management techniques will be used.

The wholesale nursery will be used to grow a mixture of native and annual flowering plants which will be grown in pots of various sizes. Imported soils will be used in the pots along with slow release fertilisers, which will be blended from an accredited soil provider and stored in fully sealed bunds. In addition to the slow release fertilisers, a fertigation system will operate in conjunction with the irrigation system. The type and quantity of fertiliser used depends upon the species of plant and the time of the year. There will be no broad scale application of fertiliser by mechanical spreading.

## 3.2 Human Details

There is an existing residential dwelling and two sheds on the property, adjacent to the proposed nursery. A caretaker lives in the house and domestic waste is treated by septic tanks. The proposed nursery will employ 10 people working in the office, potting shed and growing area. Domestic wastewater from the wholesale nursery will be treated by a septic system.

# 4 LOCAL RAINFALL AND EVAPORATION

## 4.1 Rainfall and Evaporation

The property on Rapids Road has a temperate climate, with hot dry summers and cool wet winters. Most of the rainfall is delivered as winter cold fronts pushed up from the south-west. Intermittent summer rainfall can occur, often as a result of ex-tropical cyclones tracking south. The closest weather station to the property is Serpentine (9039) at the foot of the Darling Scarp. Rainfall data from 1970 to 2010 analysed by the Department of Water calculates the average annual rainfall to be 919 mm. Pan evaporation exceeds rainfall in all years, averaging 1 675 mm. This results in a low ratio of rainfall to runoff, particularly in the warmer months (Department of Water, 2012).

## 4.2 Infiltration

CDM Smith Australia Pty (CDM Smith) was engaged to prepare a hydrologic study of the proposed development of a nursery at the Site. CDM Smith performed a study to understand existing water movement and how the construction of the nursery will cause hydrological changes to surface and groundwater. The report also addressed changes to the retained southern wetland.

Topographic analysis of ground elevations determined that the site contains three subcatchments, which primarily drain to the west and northwest. The proposed development will decrease the area of the subcatchment draining to the northern wetland by 16%, and the area draining to the southern wetland by 33%.

Hydrologic modelling was performed to estimate the impact on surface water flows. The magnitude of extreme flows to the northern wetland was determined with XP-RAFTS, a runoff- routing model. The change in total volume to the wetland was determined with AWBM, a daily water balance model.

The overall impact on the volume and discharge rate of surface water flows is relatively minor, due to the high rates of infiltration and low annual rainfall. This conclusion is reflected in both the design rainfall approach and the AWBM approach. The northern wetland will receive approximately 16% less volume of water and 10% lower peak discharge. The southern wetland will receive approximately 31% less volume of water and 28% lower peak discharge, but will retain all runoff in the post-development design.

Groundwater flow will not be significantly impacted at the site due to low recharge and lateral rates of flow. Development is likely to increase depth to water and is unlikely to result in water- logging. Nitrogen concentrations in groundwater and surface water are unlikely to change significantly due to the proposed development.

The hydrologic study points out that care is needed in the design of the nursery site to avoid waterlogging outside the nursery and provide for sufficient capture of high rainfall events. The full report is presented in Appendix A.

# 5 SOILS AND LANDFORM DESCRIPTION

## 5.1 General Description

The property is located on Bassendean association soils which are described as deep bleached grey siliceous sands of medium texture. Water leaches through this soil association and drains into the Serpentine River, approximately three kilometres away. A contour map for the site is displayed in Figure 3. Land surface elevations vary between 24 and 32 m AHD across the site.

There has been no sampling undertaken for the determination of the Phosphorus Retention Index as all production areas will be covered with limestone, compacted and rolled until approximately a 100mm thickness is achieved. This impermeable barrier will be utilised to prevent water and nutrient loss to groundwater and to increase ability for irrigation water to be recycled through the nursery.

Acid sulphate soil sampling was not undertaken for the site as it is not likely acid sulphate soils would be disturbed by the nursery development and operation. The site is classified as moderate to low risk in the Acid Sulphate Soil Risk Map, Swan Coastal Plain (DEC-001-25.01.2010 15:16:09).

The proposed wholesale nursery layout is displayed in Figure 4. The site will be cleared and at least 50 cm of fill used to level and grade the production area to ensuring that the slope of the land will allow water to runoff towards the water retention basin. All growing areas and tunnel houses will be covered with limestone, compacted and rolled until approximately a 100mm thickness is achieved.

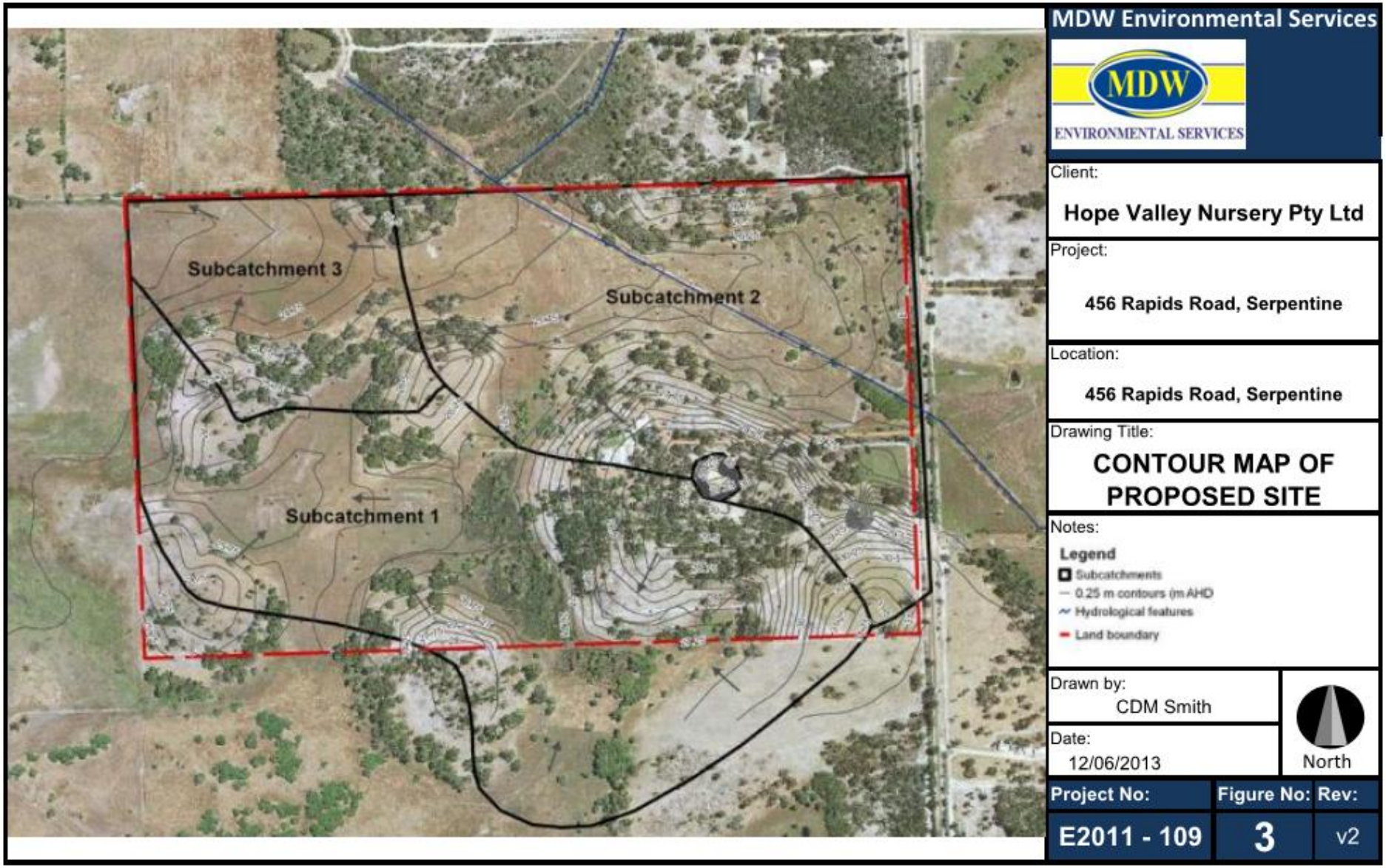



**Figure 3:** Contour Map of the Proposed Site


**Figure 4:** Proposed Nursery Layout

# 6 WATER RESOURCES DESCRIPTION AND USE

## 6.1 Natural Sensitive Water Resources

According to the Geomorphic Wetlands Coastal Plain dataset maintained by the Department of Environment, Western Australia, 456 Rapids Road contains three wetlands (Figure 5). These are mapped as a dampland type of wetland within the Bennett Brook wetland system. One of the wetlands (7402 a dampland with the Management Category of Multiple Use) is located in the north eastern corner of the property (Figure 5). This category means wetlands with few remaining important attributes and functions (EPA, Guidance Statement 33). This area is not part of the proposed wholesale nursery.

The other two wetlands are within the area for development. These are wetland 15364 and 7590, both damplands with the Management Category of Resource Enhancement (Figure 5). These are wetlands which may have been partially modified but still support substantial ecological attributes and functions. The ultimate objective is to manage, restore and protect towards improving their conservation value (EPA, Guidance Statement 33).

Dampland 15364 is largely degraded as it has been grazed for many years. However, dampland 7590 was assessed by Nuts about Natives (2012) to have a vegetation condition of very good. Although there was a significant presence of weeds in part of the wetland, overall, the native vegetation cover was very high.

It is also important to consider the wetlands on adjacent properties as modifications to those in the wholesale nursery area may also impact these. A wetland to the north of this property, dampland 7401, supports rare flora and threatened ecological communities. It may be impacted if water flowing north, from 456 Rapids Road, was altered in quality and quantity.

CDM Smith Australia Pty Ltd were contracted to develop hydrological models on the site to understand the possible impacts of the nursery on the wetlands. Topographic analysis of ground elevations determined that the site contains three subcatchments, which primarily drain to the west and northwest (Figure 5). They predict that the proposed development will decrease the area of the subcatchment draining to the northern wetland by 10% (CDM Smith, July 2013).

Two models were used to estimate the impact on surface water flows. The magnitude of extreme flows to the northern wetland was determined with XP-RAFTS, a runoff-routing model. The change in total volume to the wetland was determined with AWBM, a daily water balance model. The overall impact on the volume and discharge rate of surface water flows is relatively minor, due to the high rates of infiltration and low annual rainfall. The northern wetland will receive approximately 9% less volume of water and 5% lower peak discharge (CDM Smith, July 2013).

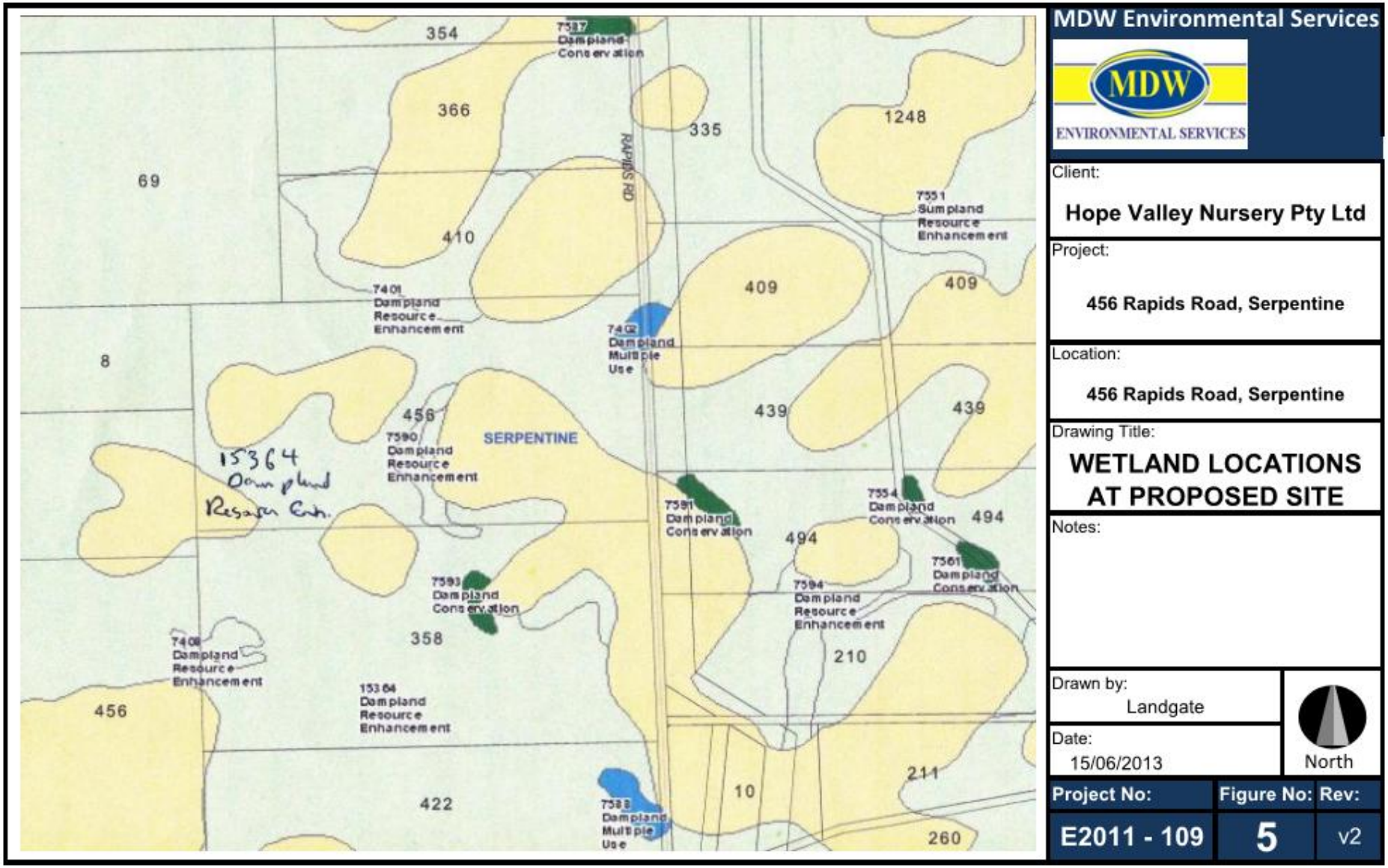



**Figure 5:** Wetland Locations at Proposed Site

## 6.2 Land Subject to Flooding

No flooding issues have been recorded for the site.

## 6.3 Groundwater Description and Depth

The property falls within the proposed Serpentine groundwater plan area. This includes four main aquifers, which are: the superficial aquifer; the Leederville aquifer; the Cattamarra aquifer; and the Yarragadee.

Watertable contours from regional bores measured in May 2003 (DoW, 2013) show that the groundwater flow is in a North-Westerly direction. The seasonal variations in groundwater levels are 2-3 m, with the minimum occurring around May. Across much of the site, recharge to the superficial groundwater is through free draining sandy soils. In areas where the watertable reaches the surface there will be surface flow, which will be of a smaller portion to vertical recharge and evaporative losses (CDM Smith, 2013).

## 6.4 Water Quality Data

Groundwater monitoring was undertaken as a component of the Pre-development nutrient and irrigation management program. The data is presented in Section 13.

## 6.5 Current Water Use

The property owners have a Licence to Take Water from the Perth – Leederville Aquifer, issued by the Department of Water for the period 1 March 2012 to 1 March 2022. The authorised activities are: domestic use; irrigation of up to 0.3 ha of lawns and gardens; and irrigation of up to 2 ha of pasture. The annual groundwater entitlement is 17 250 kL.

# 7 SITE MANAGEMENT

## 7.1 Irrigation

The property owners currently have a Licence to take water from the Perth – Leederville Aquifer, issued by the Department of Water for the period 1 March 2012 to 1 March 2022. The authorised activities are: domestic use; irrigation of up to 0.3 ha of lawns and gardens; and irrigation of up to 2 ha of pasture. The annual groundwater entitlement is 17 250 kL.

A new licence to take water from the Superficial aquifer for an annual groundwater entitlement of 400,000 kL will be applied for, from the Department of Water. Two water storage tanks of 250 kL each will be used, and before the water is used in the groundwater will have the pH amended and the iron removed. Irrigation of the site, using the approved groundwater, will be determined by the differing needs of the individual crops and seasonal climatic changes.

The site will be irrigated in the outside growing area using highly efficient, uniform sprinklers to minimize evaporation and excessive overthrow and drift. The irrigation system will be designed to enable 'double watering' of all crops through the overlap of adjacent sprinklers. A detailed diagram of the irrigation system for the site can be seen in Figure 6. Within the tunnel houses individual drippers/sprays will be used to irrigate the plants.

A highly developed irrigation controller linked to a weather monitoring system will drive the irrigation system to minimise water usage. The weather station gives information on temperature, air pressure, wind speed and humidity. This information will be used to determine the amount of water required for each crop. Not only does using too much water impact environmentally but it also increases the rate of disease and insects. The water will be delivered to the sprinklers through high pressure PVC pipe by two Iowara pumps with a constant pressure Hydrovar attached operating at 3.75 bar. The Hydrovar constantly monitors the in line pressure to minimise water lost due to a pipe burst.

Surface runoff collected from the production areas will be collected within a nutrient retention basin (Figure 7). It will not be used for irrigation of crops due increased risk of water borne pathogens. Through the production of all crops in pots, soil moisture levels can be easily monitored and the irrigation system matched to the water needs of the crops, thus reducing excessive watering and nutrient leaching.

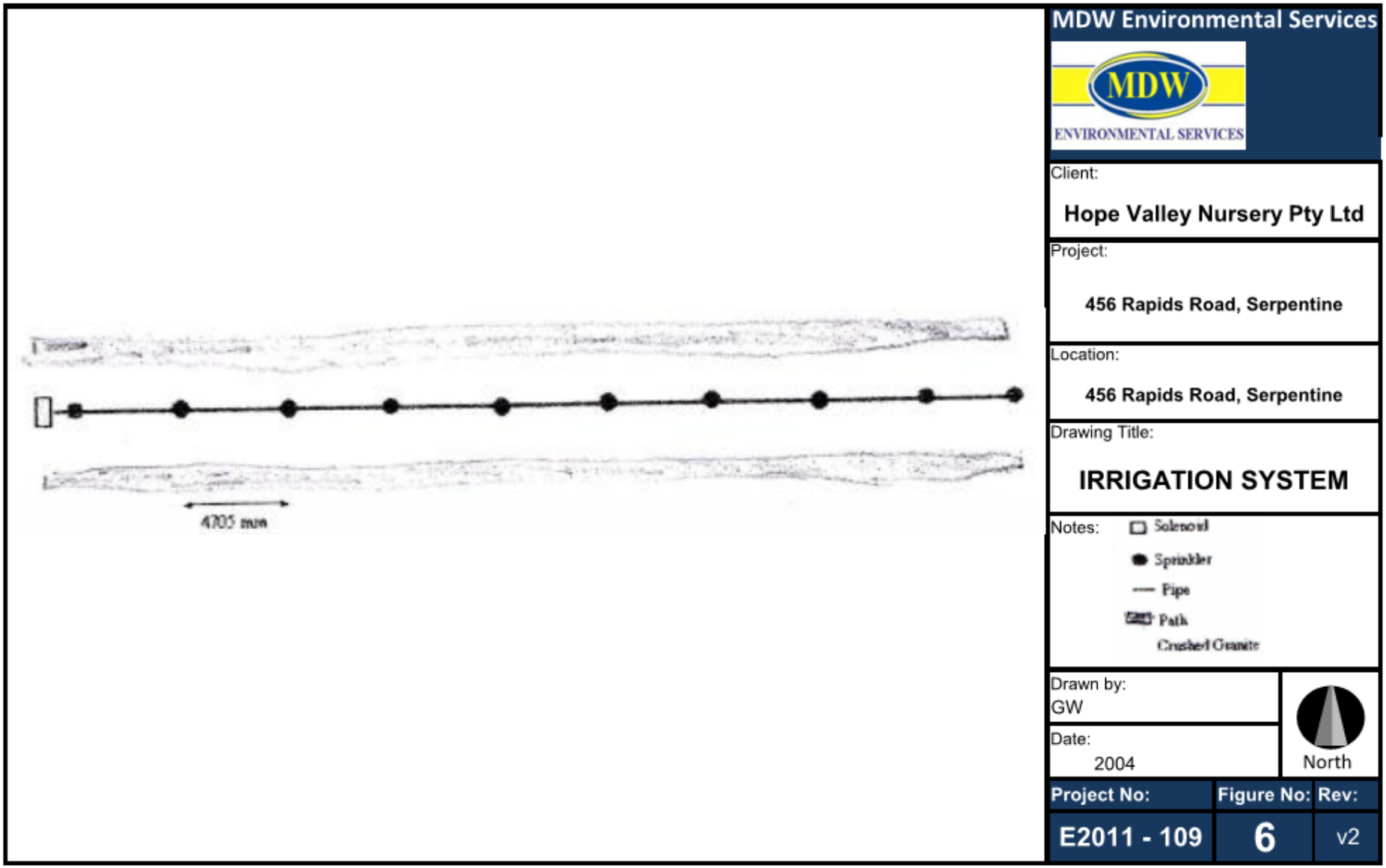



**Figure 6:** Irrigation System

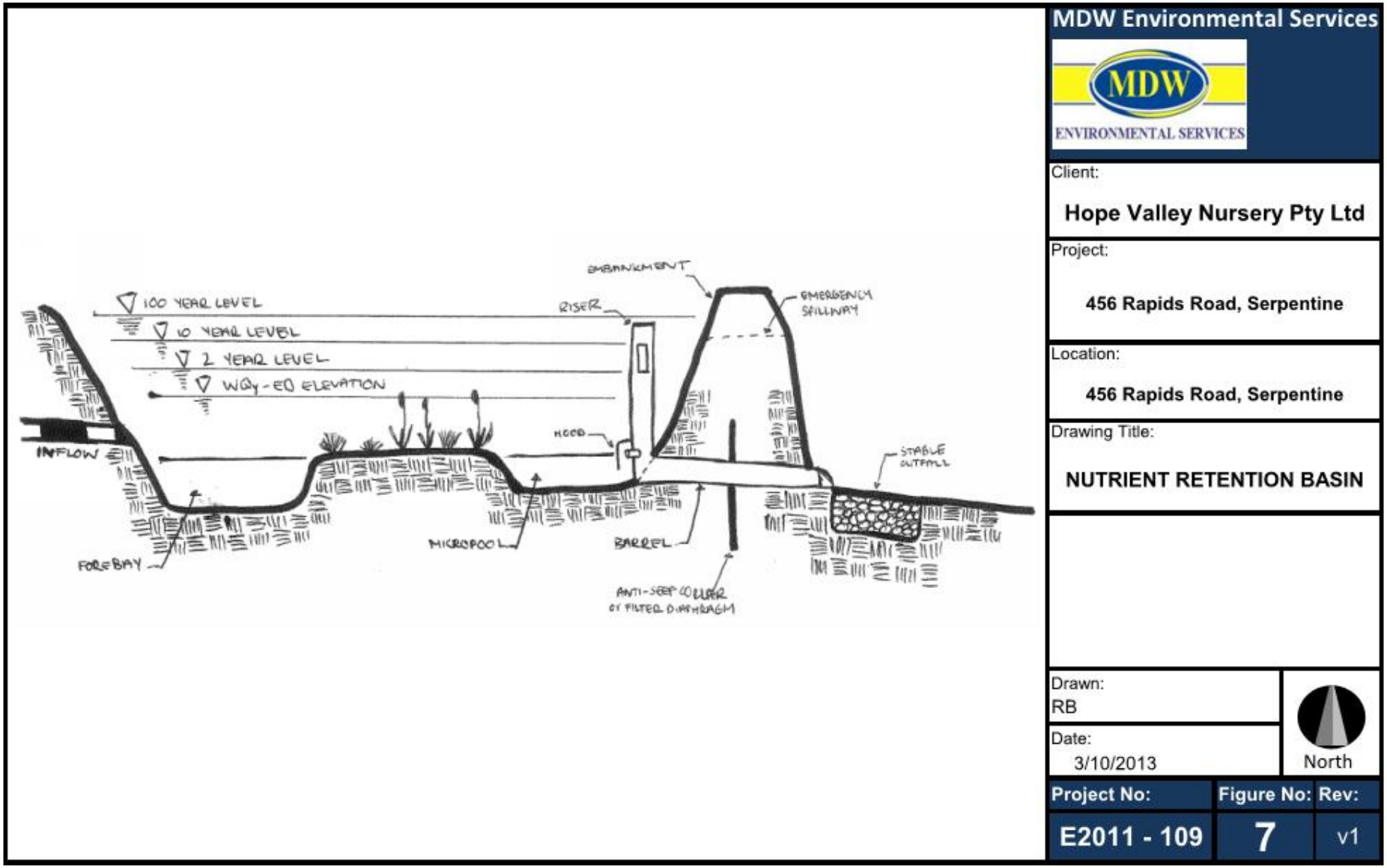



**Figure 7:** Nutrient Retention Basin

## 7.2 Nutrient Application

The wholesale nursery will be used to grow annual, flowering plants. They will be grown in pots of varying sizes filled with imported soil mixes (Table 3). Slow release fertilisers will be added prior to planting (Table 4). All production areas will have the ability to be fertilised through a fertigation system in conjunction with the irrigation system. Typical nutrient analysis of the fertigation water is presented in Table 5. Fertigation will be completed on a crop needs basis. This will affect the quantity, duration and frequency of application, as it will be different for each crop. The method of application will be consistent for all crops. There will be no broad scale application of fertilisers by mechanical spreading as all potted plants have slow release fertiliser pre-applied at an optimum rate. This generally supplies all nutrients required during the growing period.

Leaching of fertilisers to the groundwater will be controlled by the covering of a compacted limestone roadbase over the production areas, and the subsequent collection of all surface runoff in a nutrient retention basin.

**Table 3:** Typical analysis of the soil mixes which will be used, prior to fertiliser addition

| Soil Type | "Potted Colour Mix" | "New Generation Mix" |
|---|---|---|
| **pH** | 5.8 | 5.9 |
| **Electrical Conductivity** | 0.52 dS/m | 1.00 dS/m |
| **Phosphorus** | 20 ppm | <1 ppm |
| **Nitrogen (NH4)** | 33 ppm | 26 ppm |
| **Nitrogen (NO3)** | 69 ppm | 94 ppm |
| **Potassium** | 62 ppm | 60 ppm |
| **Sulphur** | 11 ppm | 48 ppm |
| **Calcium** | 55 ppm | 130 ppm |
| **Sodium** | 24 ppm | 36 ppm |
| **Iron** | 34 ppm | 38 ppm |
| **Zinc** | 0.94 ppm | 0.77 ppm |
| **Copper** | 0.75 ppm | 2.5 ppm |
| **Manganese** | 4.2 ppm | 6.8 ppm |
| **Boron** | 0.02 ppm | <0.01 ppm |
| **Chloride** | 14 ppm | 70 ppm |

**Table 4:** The type of fertiliser and constituents used in potting soil

| Fertiliser | Nutricote No. 4 Yellow | Nutricote No. 7 Orange | IBDU | Flow Trace | Nutricote Grey | Apex 17 | Apex 23 | Osmocote Iron |
|---|---|---|---|---|---|---|---|---|
| **N-NO3** | 7 | 7.5 | - | - | 8.9 | 3.5 | 1 | - |
| **N-NH4** | 7 | 5.5 | - | - | 7.1 | 3.9 | 3.3 | - |
| **N-Urea** | | - | - | - | - | 9.6 | 18.7 | - |
| **Total N** | 14 | 13 | 31 | - | 16 | 17 | 23 | - |
| **P-H2O Soluble** | 5.2 | 1.3 | - | - | 2.1 | - | - | - |
| **P-Citrate Soluble** | 6.1 | 5.7 | - | - | 3.1 | - | - | - |
| **Total P** | 6.1 | 5.7 | - | - | 4.4 | 17 | 6 | - |
| **Potassium** | 11.6 | 9.1 | - | - | 8.3 | 17 | 12 | - |
| **Calcium** | 0.5 | 2.8 | - | - | 0.45 | - | 1 | - |
| **Sulphur** | 0.5 | - | - | - | 1.4 | 1.4 | 1 | 17 |
| **Magnesium** | - | - | - | - | - | - | 0.5 | - |
| **Copper** | - | - | - | 0.75 | - | - | 0.05 | - |
| **Iron** | - | - | - | 24 | - | - | 1.5 | 28 |
| **Manganese** | - | - | - | 0.5 | - | - | 0.05 | - |
| **Molybdenum** | - | - | - | 0.04 | - | - | 0.0005 | - |
| **Zinc** | - | - | - | 0.2 | - | - | 0.05 | - |
| **Boron** | - | - | - | 0.033 | - | - | - | - |

**Table 5:** Fertilisers used in the Fertigation System

| Fertiliser | Ammonium Nitrate | Epsom Salts |
|---|---|---|
| **N-NO3** | 17 | - |
| **N-NH4** | 17 | - |
| **Total N** | 34 | - |
| **MgSO4** | | 99.9 |
| **Cadmium** | | >0.000001 |
| **Mercury** | | >0.0000002 |
| **Lead** | | >0.00001 |

# 8 DRAINAGE AND CONTAMINANT LEACHING CONTROLS

The site will be graded to collect drainage from production areas and surface runoff from roads through the site. The collected water will channelled into a retention basin where it will then be collected in a pump-out station for reuse. Contaminant leaching to the groundwater will be controlled by the impermeable lining of the production areas and the subsequent collection of all surface runoff in a nutrient retention basin.

# 9 SURFACE WATER PROTECTION

The damplands on and adjacent to this site may be impacted if the quality and quantity of surface water runoff is altered. To minimise impact on these wetlands, surface water runoff from the production areas will be collected into a nutrient retention basin. The basin is designed so as to enable biological removal of excess nutrients that may be present in runoff waters through the use of vegetative scavenging and chemical fixation using soil amendments.

# 10 GROUNDWATER PROTECTION

In order to protect the groundwater, all production areas will be built on an impermeable limestone pad to prevent infiltration through the soil into the groundwater. This will have the effect of lowering the water table and groundwater evaporation will also be reduced via the filling of low-lying areas. The net effect on lateral flow is predicted to small. Filling of low lying areas will also mean that water-logging is unlikely to occur (CDM Smith, July 2013).

# 11 VEGETATION MANAGEMENT

In order to develop the wholesale nursery 5.462 ha of the property will need to be cleared of existing vegetation. In addition, an assessment of the property to provide foraging and breeding habitat for Black-Cockatoos' was undertaken by Terrestrial Ecosystems (2012). The assessment concluded that the project area contained five fauna habitat types: groves of Jarrah or Marri; Banksia woodland; Allocasaurina woodland; pasture; and wetlands (Figure 8).

To offset this loss the property owners have committed to the rehabilitation of three areas (Figure 9) that have been degraded by over-grazing activity over many years. These three areas (16.35 ha in total) are adjacent to groves of mature jarrah and marri trees and currently have a limited understorey. These areas will be revegetated as per the Rehabilitation and Revegetation Management Plan (Nuts about Natives, 2103) developed for the Site. In addition, as per the offset provided for in the SEWPAC approval, each of these areas will be fenced to exclude stock and sufficient young marri and jarrah will be planted in these areas to ensure that after five years there are an additional 50 marri and 50 jarrah trees growing. These areas will be fenced and the trees planted before the wholesale nursery becomes operational and the fence will remain in place (Terrestrial Ecosystems, 2012).

When clearing the vegetation, care will be taken to ensure that all machinery will be cleaned prior to entering the site. This will prevent *Phytophthora* sp and other plant diseases from infecting the remaining vegetation and the nursery site.

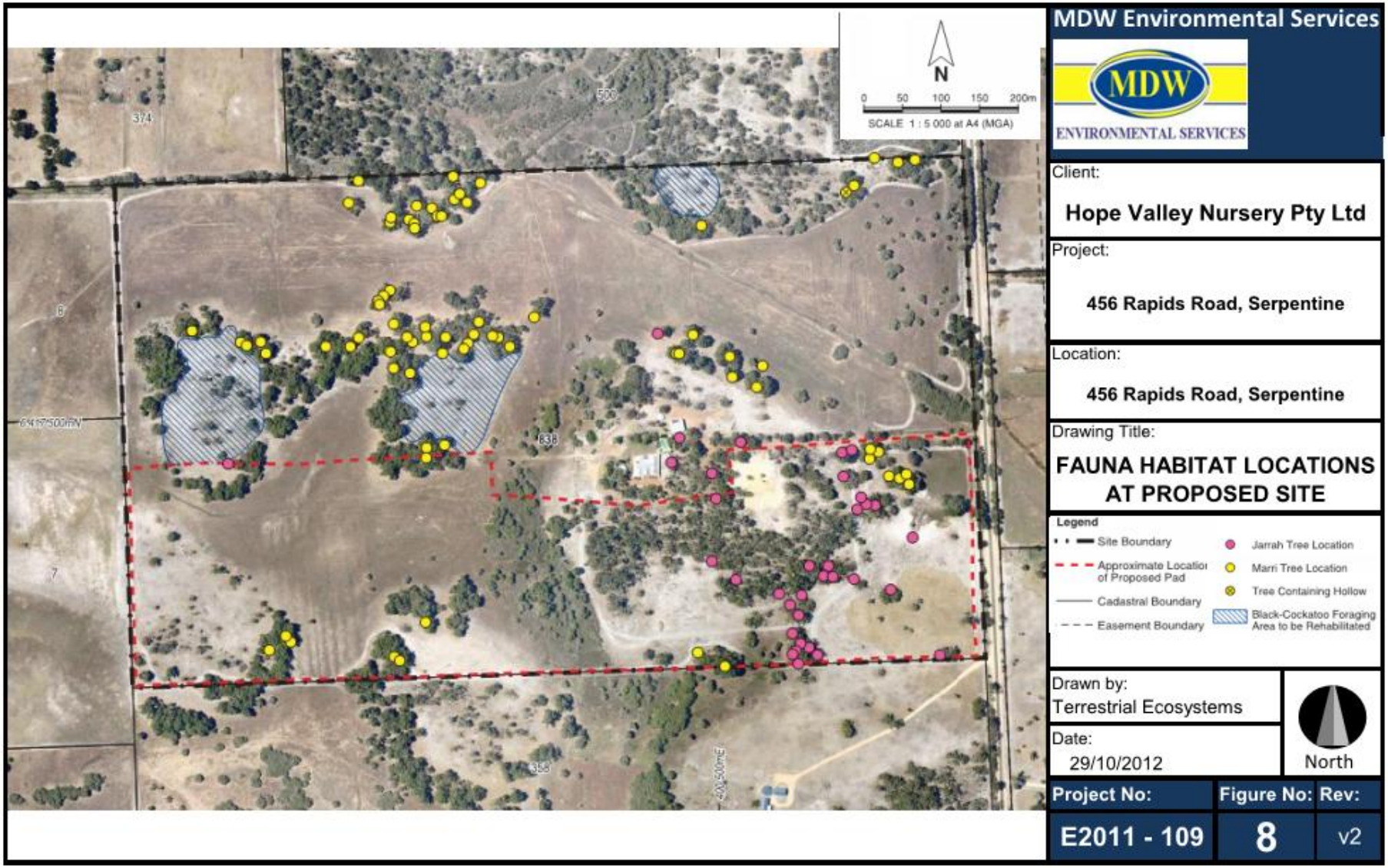



**Figure 8:** Fauna Habitat Locations at Proposed Site

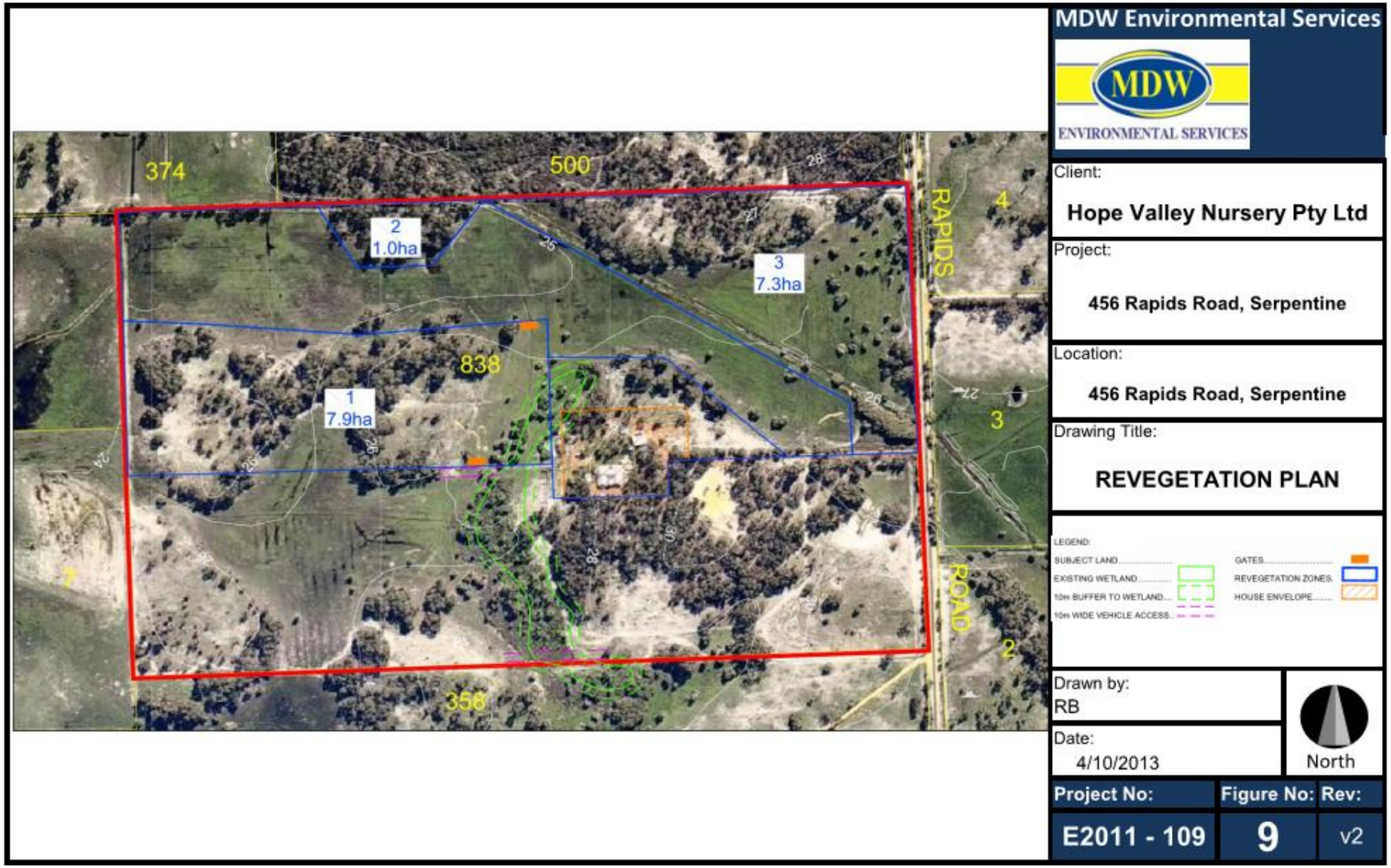



**Figure 9:** Revegetation Plan

# 12 PESTICIDE STORAGE AND USE

As per AS2507.1998 – Storage and handling of pesticides, an emergency spill kit will be located in the chemical storage facility on the Site. The facility will be constructed using best management practices guidelines for the storage and handling of horticultural chemicals. The facility will have a bunded concrete floor to ensure spills are contained within the facility. All chemicals will be stored in locked cages within the facility. It will be insulated and have roof top ventilation to maintain an even temperature.

All drainage from the facility will be collected in a waste chemical evaporation pit, which will have sealed concrete liners and organic material to breakdown residual chemicals from the rinsate. A clear plastic roof, to increase solarisation and evaporation, will be installed on top of the pit.

The commonly used chemicals that will be stored in the chemical storage facility are listed in Table 6 below.

The MSDS for each product was reviewed and information relevant to aquatic biota listed for comparison between products. Ecotoxicity effects on rainbow trout (*Oncorhynchus mykiss*), water flea (*Daphnia magna*) and the algae *Desmodesmus subspicatus* and Pseudokirchneriella subcapitata are listed in the table. Where warning regarding the impact of the product on the aquatic environment were detailed this is also included in the table.

**Table 6:** Commonly uses chemicals

| Product Manufacturer | Active Ingredient | Environmental Hazard |
|---|---|---|
| Axe Insecticide<br>Crop Care | 500 g/L Permethrin | Permethrin ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 0.0025 mg/l.<br>LC50 (48hr) for daphnia is 0.0006 mg/l.<br>Prevent product or washings from entering drains, waterways or sewers. |
| Baycor 300<br>Fungicide spray<br>Bayer | 300 g/L Bitertanol | Baycor 300 ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 8.31 mg/L.<br>EC50 (72hr) for green alga *(D. subspicatus)* is 5.75 mg/L.<br>Toxic to aquatic organisms and may cause long term adverse effects in the aquatic environment. It has a low toxicity to bees and earthworms. Do not contaminate streams, rivers or waterways with the product or used containers. |
| Belt 480 SC<br>Insecticide<br>Bayer | 480 g/L Flubendiamide | Flubendiamide Ecotoxicity effects:<br>LC50 (96hr) Rainbow trout is > 250 mg/l.<br>EC50 (48hr) Daphnia is 0.0065 mg/l.<br>IC50 (72hr) (P. subcapitata) is > 0.07 mg/l.<br>Do not allow to get into surface water, drains and ground water. If the product contaminates rivers and lakes or drains inform respective authorities. |

| Product Manufacturer | Active Ingredient | Environmental Hazard |
|---|---|---|
| Confidor 200 SC<br>Insecticide<br>Bayer | 200 g/L Imidacloprid | Imidacloprid Ecotoxicity effects:<br>LC50 (96hr) Rainbow trout is 211 mg/L.<br>EC50 (48hr) Daphnia is 85 mg/l.<br>IC50 (72hr) (P. subcapitata) is 100 mg/l.<br>Imidacloprid is toxic to certain aquatic species. Do not contaminate streams, rivers or waterways with the product or used containers. |
| Dimethoate<br>Systemic Insecticide<br>Nufarm | 400 g/L Dimethoate | Dimethoate Ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 6.2 mg/l.<br>EC50 (48hr) for Daphnia is 3.3 mg/l.<br>Do not contaminate streams, rivers or waterways with the product or used containers. |
| Folicur 430 SC<br>Fungicide<br>Bayer | 430 g/L Tebuconazole | Tebuconazole Ecotoxicity effects:<br>LC50 (96hr) Rainbow trout is 19.9 mg/L.<br>EC50 (48hr) Daphnia is 31.9 mg/l.<br>IC50 (72hr) (P. subcapitata) is 15.2 mg/l.<br>Do not allow to get into surface water, drains and ground water. If the product contaminates rivers and lakes or drains inform respective authorities. |
| Kocide BlueXtra<br>Fungicide<br>Multicrop | 350g/kg Copper | Ecotoxicity effects of Copper:<br>LC50 (96hr) Rainbow trout is 4.79 mg/l.<br>ErC50 (72hr) *P. subcapitata* is 18.03mg/l.<br>EC50 (48hr) is Daphnia is 1.61mg/l.<br>Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not contaminate ponds, waterways, or ditches with chemical or used container. |
| Mancozeb 750 DF<br>Fungicide<br>Titian Ag | 750 g/kg Mancozeb | Mancozeb ecotoxicity effects :<br>LC50 (96hr) Rainbow trout is 2.2 mg/l.<br>Moderately to highly toxic to fish and aquatic organisms. |
| Payback<br>Plant growth regulator<br>Crop Care | 250 g/L Paclobutrazol | Paclobutrazol ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 27.8 mg/l.<br>LC50 (48hr) for daphnia is 33.2 mg/l.<br>Prevent product or washings from entering drains, waterways or sewers. Use earthen bunds or absorbent bunding to prevent spreading of spillage. |
| Redye<br>Marker dye<br>Crop Care | 150 g/L Rhodamine B | Rhodamine B ecotoxicity effects:<br>LC50 (96hr) for fish of 10 – 100 mg/L.<br>Prevent product or washings from entering drains, waterways or sewers. Use earthen bunds or absorbent bunding to prevent spreading of spillage. |

| Product Manufacturer | Active Ingredient | Environmental Hazard |
|---|---|---|
| Roundup Power MAX<br>Herbicide<br>Nufarm | 540 g/L Glyphosate | Glyphosate Ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 3.13 mg/L.<br>EC50 (48hr) for Daphnia is 8.0 mg/L.<br>EC50 (120hr) for *S. capricornutum* is 0.124 mg/L.<br>Do not contaminate dams, waterways or sewers with this product. Harmful to fish and other aquatic life, mainly due to the surfactant. |
| Rovral<br>Liquid Seed Dressing Fungicide<br>Bayer | 250g/L Iprodione | Iprodione Ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 4.1 mg/L.<br>EC50 (48hr) for Daphnia is 0.25 mg/L.<br>EC50 (120hr) for *S. capricornutum* is 15.3 mg/L.<br>This product is very toxic to aquatic organisms, and may cause long-term adverse effects in the aquatic environment. Do not contaminate streams, rivers or waterways with Rovral Liquid Seed Dressing or the used containers. |
| Banrot 400wp<br>Soil Fungicide<br>Scotts | 150 g/kg Etridiazole and<br>250 g/kg Thiophanate-methyl | Etridiazole Ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 2.4 mg/L.<br>EC50 (48hr) for Daphnia is 3.1 mg/L.<br>EC50 (120hr) for algae is 0.072 mg/L.<br>Banrot 400wp is toxic to fish and aquatic invertebrates. Keep out of lakes, streams and ponds. Do not contaminate water sources by cleaning of equipment or disposal of wastes. |
| Sierraron G<br>Herbicide<br>Scotts | 67.5 g/kg Dichlobenil | Dichlobenil Ecotoxicity effects:<br>LC50 (96hr) for rainbow trout is 8.3 mg/L.<br>EC50 (48hr) for *Daphnia magna* is 6.2 mg/L.<br>Dichlobenil is moderately toxic to fish and aquatic invertebrates. Do not allow the product to empty container to enter drains, streams or other waterways. |
| Success<br>Insecticide<br>Yates | 10 g/L Spinosad | Spinosad Ecotoxicity effects:<br>EC50 (48hr) Daphnia is 14 ppm.<br>LC50 (96hr) rainbow trout is 30 mg/L.<br>Harmful to aquatic organisms. Avoid contaminating waterways and fishponds. Do not allow spray to drift onto aquatic environments. |

As the table demonstrates, these chemicals that may be used in the nursery have the potential to impact negatively on the aquatic environment. Consequently the proponents are serious about the storage and handling of these chemicals to ensure that risks are negated to the aquatic environment.

# 13 SITE MONITORING AND REPORTING

## 13.1 Pre-development nutrient and irrigation management program

### 13.1.1 Groundwater Monitoring Sampling

The locations of all groundwater monitoring wells (on site) are shown on Figure 10. Groundwater assessment activities conducted at the site are summarised in Table 7 below.

**Table 7:** Groundwater Assessment Methodology

| Activity | Details |
|---|---|
| **Date of Field Activity** | 21 February, 25 June and 20 August 2013. |
| **Investigation** | A total of six (6) groundwater monitoring wells were sampled (MW1, MW2, MW3, MW4, MW5 and MW6).<br>MDWES installed all six wells. |
| **Rationale for Monitoring Well Locations** | The six wells were positioned to provide good coverage across the proposed nursery site. |
| **Dimensions** | The six wells extend to approximately 5.0mbgl. |
| **Sampling Method** | A Geotech low flow bladder pump, coupled via dedicated tubing to an Insitu Troll 9500™ low flow sampler was used to collect samples; thereby enabling continuous measurement of field parameters. |
| **Samples** | Six groundwater samples were taken within each of the groundwater wells. |
| **Well Gauging** | Monitoring wells were gauged using an electronic water level probe prior to purging in succession. The probe was decontaminated between each measurement. Well field gauging data is contained in Table 8. |
| **Well Purging** | Stabilisation period consisted of at least three consecutive measurements, one to two minutes apart, with the relative difference in values less than pre-determined values. Once stabilisation of the field parameters was reached, samples were collected for laboratory analysis. |
| **Calibration** | A YSI (used to measure water quality) was calibrated and certified. |
| **Decontamination Procedure** | Water monitoring equipment such as the electronic water level probe, were decontaminated with laboratory grade detergent and rinsed with deionised water between wells. Dedicated disposable nitrile gloves were used for each sample. |

| Activity | Details |
|---|---|
| **Analysis** | – pH, Conductivity, Total Dissolved Solids, Suspended Solids, Turbidity<br>– Acidity, Dissolved Metals, Total Recoverable Metals<br>– Total Mercury, Hexavalent Chromium, Ferrous Iron, Sulfide<br>– Biological Oxygen Demand, Major Anions, Nutrients |
| **Laboratory** | Primary samples sent to ALS Environmental (Perth) NATA Accredited. |
| **Sample Preservation** | Samples were placed in laboratory supplied bottles containing appropriate preservatives. Samples were stored on ice (<4$^{o}$C) in an esky while on site and in transit to the laboratory. |

### 13.1.2 Monitoring Well Construction

All monitoring wells were installed using a Geoprobe with 8" hollow flight auger drilled to a depth of approximately 4 to 5 metres below ground level (mbgl). Prior to removal of the auger casing 50 mm PVC casing (screwed together) was placed centrally in the void to the surface or with a stick up (where practicable). As the auger casing was removed the void was packed with annular gravel to approximately 1.5 mbgl (groundwater), a bentonite seal was placed above the gravel pack up to the surface, with a concrete seal at the surface. A steel, locked, monument cover was inserted in the concrete seal and the above ground stick of casing within the cover sealed with a locked cap (enviro-cap). Monitoring wells were developed immediately after construction until visually clean water was discharged. Soil auger spoil was spread next to the monitoring wells and purged groundwater was released on to the ground.

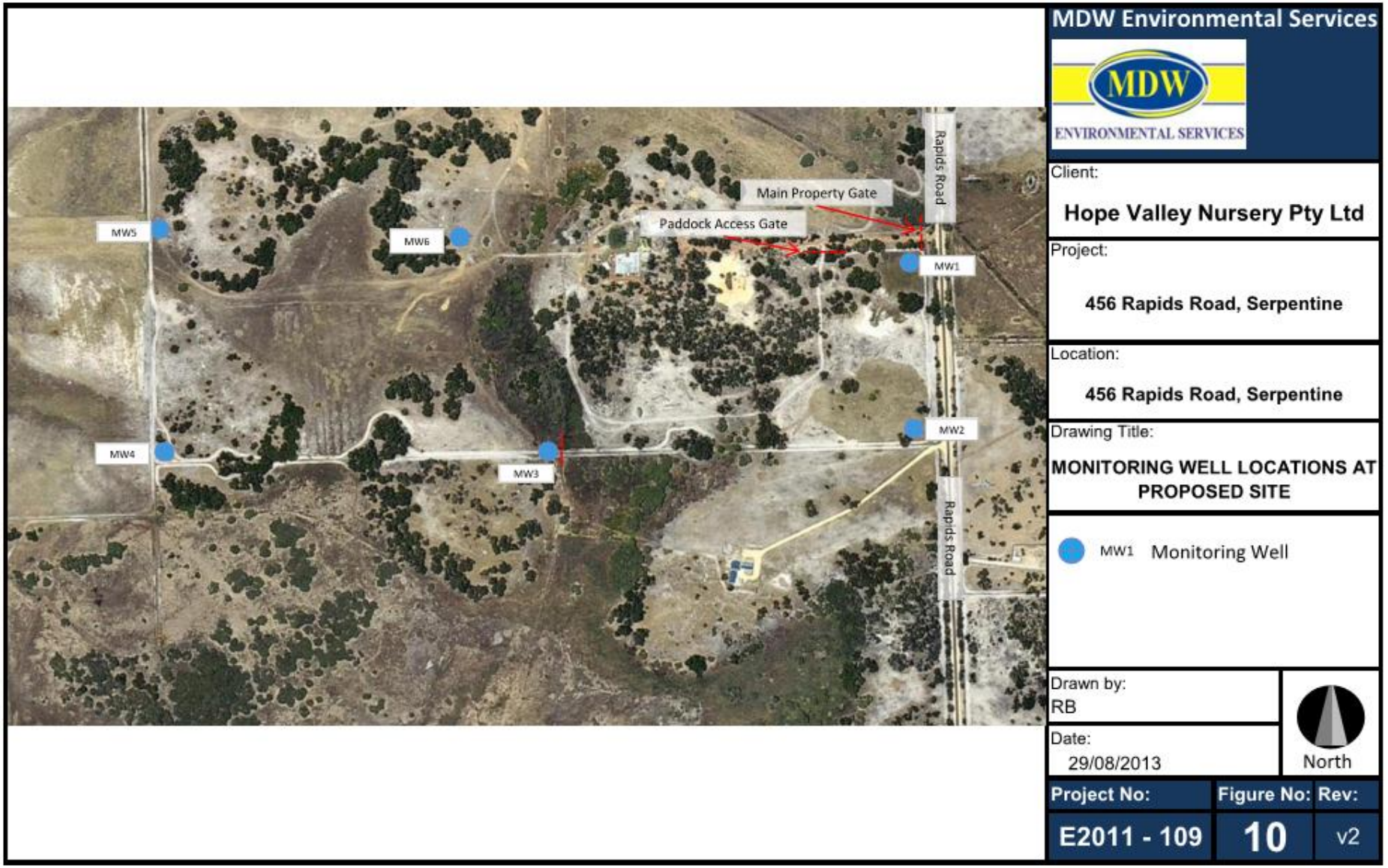



**Figure 10:** Monitoring well locations at proposed site

# 14 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The following Quality Assurance/Quality Control (QA/QC) program was implemented throughout the investigation to ensure the accuracy and precision of the data obtained. QC measures the effectiveness of the procedures of the QA program.

## 14.1 Quality Assurance

All procedures including staff selection, sampling methodologies, equipment, analysis methods and data transfer were based on:

- Australian Standards AS-4482.1-2005 and AS-4482.2-1999: Guides to the Sampling and Investigation of Potentially Contaminated Soil; and
- Australian/New Zealand Standard AS/NZS 5667.1:1998. Water Quality-Sampling.

Particularly, the following actions applied:

- Samples were collected by a trained, experienced field technician.
- Samples were collected by the same person, ensuring that techniques used were consistent across the sampling program.

### 14.1.1 Groundwater Sampling Procedure

Groundwater sample collection was undertaken using “low-flow” or “micro-purge” sampling techniques. For low-flow sampling, the pump was fitted with a disposable low-density polyethylene bladder and tubing for each bore. The tubing was connected to a 400 mL-capacity flow cell with a field water quality meter attached to measure parameters as water passes through the flow cell. Field water quality meter measurements pH ($^{+}$/-0.1 unit), redox potential ($^{+}$/-10 mV), electrical conductivity (EC) ($^{+}$/-3%), temperature ($^{+}$/-0.2°C) and dissolved oxygen (DO) ($^{+}$/-10%) were taken until the measurements (with groundwater not being drawn down) were stabilised between successive readings.

Successive groundwater chemistry measurements were taken at intervals determined by the pumping rate and the time taken for complete refilling of the flow cell. After parameter stabilisation it was considered that groundwater entering the bore was representative of water from the aquifer.

The standing water level within the bore was constantly monitored during purging to ensure minimal drawdown (<10 cm). The purpose of this was to check that purged groundwater had not solely been removed from the water column within the bore, but from the aquifer itself; in order to facilitate this, a pump rate of less than 100 mL/minute was maintained in order to minimise the potential for drawdown. If drawdown exceeded 10 cm, the purge rate was reduced until drawdown stabilised, and the time between successive parameter readings increased appropriately. The inlet for the low flow groundwater pump was placed as close as practical to the groundwater surface.

All groundwater samples were subject to the following procedures:

- Samples were collected using clean disposable nitrile gloves replaced between each sample location.
- Dedicated tubing was used for each well and the pump and low flow cell were decontaminated between wells.
- Samples were collected within an eight hour period into new, laboratory supplied sample bottles. Preservatives (if required) were provided by the laboratory in the appropriate sample bottle.
- Samples were filled to the top to ensure no headspace remained.
- All samples were marked in the field using permanent marker with a label showing sample location, date and job number.
- Samples were immediately placed on ice within an esky for transport to the laboratory.

### 14.1.2 Decontamination of Sampling Equipment

All sampling and drilling equipment were decontaminated prior to use and between each sample location. Decontamination was done using the following procedure:

- Equipment washed in water.
- Equipment thoroughly scrubbed in water with Decon 90.
- Equipment rinsed in tap water.
- Equipment rinsed in DI water.

## 14.2 Quality Control

To ensure the quality of the sampling method and laboratory analysis several quality control (QC) samples were collected. The laboratory used for analysis of the groundwater samples was ALS Environmental, a laboratory with NATA accreditation for all analyses undertaken.

The laboratory conducts internal quality control analysis as part of their QA/QC Procedures. These are:

- At least 10% of samples are split into internal laboratory duplicate samples. These samples are homogenised prior to splitting into sub samples;
- At least 5% of samples are run with Matrix Spikes of known additions.
- Laboratory Control Samples (LCS) are run at the required rate (minimum 1 LCS per batch of samples). The LCS results are reported in the laboratory certificates named ‘Interpretive Quality Control Report’ and the ‘Quality Control Report’.

Chain of Custody forms (CoC), laboratory sample receipt notification (SRN), laboratory certificates of analysis (COA), quality control report (QC) and interpretive quality control report (QCI) are provided in Appendix C (February), D (June) and E (August).

# 15 ASSESSMENT CRITERIA

Laboratory analyses of groundwater samples undertaken onsite are presented in Table 8 through to Table 13. To assess the groundwater quality at the Site, water quality results were compared against the criteria outlined within the DER's *Contaminated Site Management Series - Assessment Levels for Soil, Sediment and Water* (DEC, 2010). Laboratory results were compared against the following criteria:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC 2000) as reproduced in the DER's *Contaminated Site Management Series - Assessment Levels for Soil, Sediment and Water* (DEC 2010):
    - Freshwater Ecosystems
    - Long-term Irrigation Water
- Department of Health *Contaminated Sites Reporting Guideline for Chemicals in Groundwater*, (DoH 2006):
    - Domestic Non-Potable groundwater use
- DER Trigger Values

# 16 RESULTS

## 16.1 Groundwater Field Results

During the course of the investigation, a total of six groundwater monitoring wells were monitored on the 21 February, 18 June, and 20 August 2013. The wells were gauged, purged and sampled using low flow sampling methodology.

Current groundwater gauging data collected during field activities is presented in Table 8 with interpreted groundwater elevation contours and groundwater flow direction presented on Figure 11. Field groundwater quality parameters are presented in Table 9. Field data sheets of water quality measurements from February, June and August are presented in Appendix B.

## 16.2 Groundwater Quality Parameters

Groundwater quality parameters presented in Table 9 and summarised below.

- pH measurements ranged between 4.30 (MW6) and 5.89 (MW4) indicating mildly acidic conditions.
- Electrical conductivity (EC) measurements range between 133.4µS/cm (MW5) and 369.4µS/cm (MW2).
- Dissolved oxygen (DO) concentrations ranged between 0mg/L (MW3) and 5.90mg/L (MW4), with a mean of 3.21mg/L indicating aerobic conditions.
- Temperature measurements ranged between 15.5ºC (MW5) and 19.1ºC (MW2).
- Reduction/oxidation (redox) potential (Eh) ranged between 71.9mV (MW3) and 236.7mV (MW2) indicating oxidising conditions.

Groundwater quality parameters were used to determine the likelihood of the occurrence of natural attenuation processes (i.e. indicators of biodegradation) within groundwater beneath the site, of which is discussed in detail in Section 12.

## 16.3 Groundwater Levels

The depth to groundwater was measured monthly from February to September. Table 8 summarises a compilation of depth to groundwater from the top of casing. The water table depth value (RL AHD) for each monitoring well is estimated, based on the contour and feature survey conducted in August 2012 (Appendix F).

**Table 8:** Groundwater Levels

| SAMPLE LOCATION | | MW1 | | | | MW2 | | | | MW3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Standpipe (m): | 0.66 | Ground (RL mAHD): | 26.70 | Standpipe (m): | 0.63 | Ground (RL mAHD): | 31.00 | Standpipe (m): | 0.62 | Ground (RL mAHD): | 26.60 |
| Date | Day | Water Level (mm TOC) | Water Level Change (mm) | Water Level (mbgl) | Water Level (RL mAHD) | Water Level (mm TOC) | Water Level Change (mm) | Water Level (mbgl) | Water Level (RL mAHD) | Water Level (mm TOC) | Water Level Change (mm) | Water Level (mbgl) | Water Level (RL mAHD) |
| **Trigger Level** | | | | | | | | | | | | | |
| 20/2/13 | Wed | -2065 | -2065 | -1.41 | 25.30 | -4510 | -4510 | -3.88 | 27.12 | -1750 | -1750 | -1.13 | 25.47 |
| 21/3/13 | Thu | -2173 | -108 | -1.51 | 25.19 | -4685 | -175 | -4.06 | 26.95 | -1812 | -62 | -1.19 | 25.41 |
| 23/4/13 | Tue | -2170 | 3 | -1.51 | 25.19 | -4810 | -125 | -4.18 | 26.82 | -1915 | -103 | -1.30 | 25.31 |
| 21/5/13 | Tue | -1680 | 490 | -1.02 | 25.68 | -4710 | 100 | -4.08 | 26.92 | -1480 | 435 | -0.86 | 25.74 |
| 18/6/13 | Tue | -1370 | 310 | -0.71 | 25.99 | -4631 | 79 | -4.00 | 27.00 | -1473 | 7 | -0.85 | 25.75 |
| 20/8/13 | Wed | -830 | 540 | -0.17 | 26.53 | -3790 | 841 | -3.16 | 27.84 | -820 | 653 | -0.20 | 26.40 |
| 27/9/13 | Fri | -521 | 309 | 0.14 | 26.84 | -3336 | 454 | -2.71 | 28.29 | -672 | 148 | -0.05 | 26.55 |

| SAMPLE LOCATION | | MW4 | | | | MW5 | | | | MW6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Standpipe (m): | 0.60 | Ground (RL mAHD): | 25.75 | Standpipe (m): | 0.62 | Ground (RL mAHD): | 25.00 | Standpipe (m): | 0.69 | Ground (RL mAHD): | 26.25 |
| Date | Day | Water Level (mm TOC) | Water Level Change (mm) | Water Level (mbgl) | Water Level (RL mAHD) | Water Level (mm TOC) | Water Level Change (mm) | Water Level (mbgl) | Water Level (RL mAHD) | Water Level (mm TOC) | Water Level Change (mm) | Water Level (mbgl) | Water Level (RL mAHD) |
| **Trigger Level** | | | | | | | | | | | | | |
| 20/2/13 | Wed | -2000 | -2000 | -1.34 | 24.41 | -1690 | -1690 | -1.06 | 23.94 | -1880 | -1880 | -1.26 | 24.99 |
| 21/3/13 | Thu | -2076 | -76 | -1.42 | 24.33 | -1686 | 4 | -1.06 | 23.94 | -1933 | -53 | -1.31 | 24.94 |
| 23/4/13 | Tue | -2176 | -100 | -1.52 | 24.23 | -1810 | -124 | -1.18 | 23.82 | -2045 | -112 | -1.43 | 24.83 |
| 21/5/13 | Tue | -1738 | 438 | -1.08 | 24.67 | -1255 | 555 | -0.63 | 24.38 | -1643 | 402 | -1.02 | 25.23 |
| 18/6/13 | Tue | -1731 | 7 | -1.07 | 24.68 | -1293 | -38 | -0.66 | 24.34 | -1652 | -9 | -1.03 | 25.22 |
| 20/8/13 | Wed | -1140 | 591 | -0.48 | 25.27 | -730 | 563 | -0.10 | 24.90 | -1031 | 621 | -0.41 | 25.84 |
| 27/9/13 | Fri | -993 | 147 | -0.33 | 25.42 | -650 | 80 | -0.02 | 24.98 | -963 | 68 | -0.34 | 25.91 |

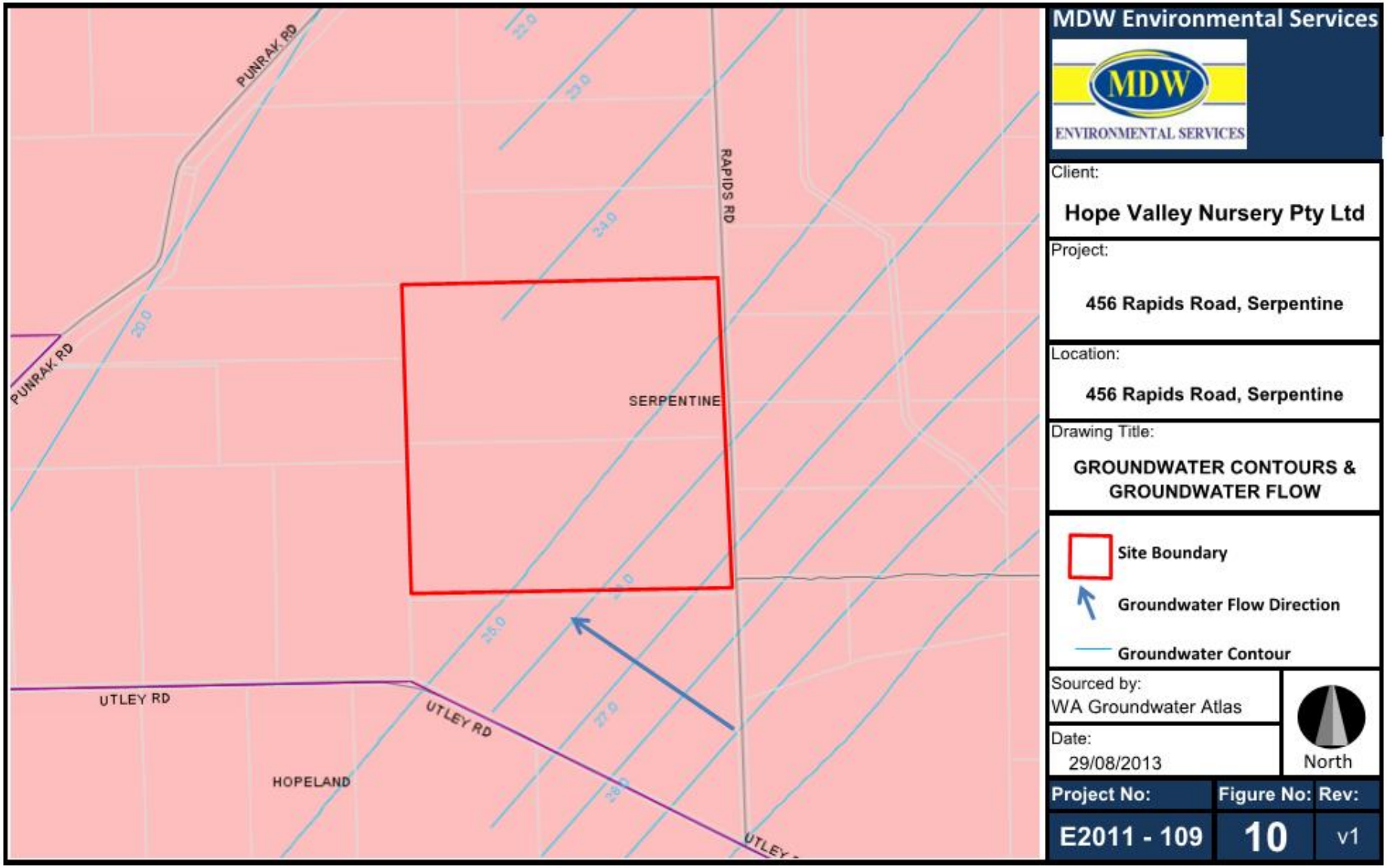



**Figure 11:** Groundwater contours and groundwater flow

**Table 9:** Field Groundwater Parameters

| SAMPLE LOCATION | | MW1 | | | | | | | MW2 | | | | | | | MW3 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Day | pH (pH units) | EC (µS/cm) | DO (mg/L O2) | Temp (°C) | Redox (mV) | TTA (mg/L CaCO3) | TALK (mg/L CaCO3) | pH (pH units) | EC (µS/cm) | DO (mg/L O2) | Temp (°C) | Redox (mV) | TTA (mg/L CaCO3) | TALK (mg/L CaCO3) | pH (pH units) | EC (µS/cm) | DO (mg/L O2) | Temp (°C) | Redox (mV) | TTA (mg/L CaCO3) | TALK (mg/L CaCO3) |
| **Freshwater Ecosystems** | | **6.5-8.5** | **1500** | | | | | | **6.5-8.5** | **1500** | | | | | | **6.5-8.5** | **1500** | | | | | |
| **DEC Trigger Values** | | **<6** | | | | | **40** | **<30** | **<6** | | | | | **40** | **<30** | **<6** | | | | | **40** | **<30** |
| 20/2/13 | Wed | 5.70 | 416.0 | 5.75 | 21.1 | 150.7 | 25 | 15 | 5.40 | 177.1 | 3.80 | 21.6 | 127.2 | 14 | 15 | 5.38 | 463.5 | 4.01 | 24.4 | -18.0 | 81 | 15 |
| 18/6/13 | Tue | 5.77 | 407.0 | 1.13 | 20.9 | 171.7 | 15 | 30 | 5.48 | 158.1 | 2.92 | 21.7 | 220.6 | 17 | 30 | 5.11 | 505.0 | 0.37 | 18.9 | -21.1 | 34 | 30 |
| 20/8/13 | Tues | 5.44 | 349.9 | 5.10 | 18.6 | 187.2 | 30 | 30 | 5.64 | 146.5 | 2.50 | 19.1 | 236.7 | 10 | 24 | 4.45 | 327.9 | 0.00 | 15.8 | 71.9 | 40 | 30 |

| SAMPLE LOCATION | | MW4 | | | | | | | MW5 | | | | | | | MW6 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Day | pH (pH units) | EC (µS/cm) | DO (mg/L O2) | Temp (°C) | Redox (mV) | TTA (mg/L CaCO3) | TALK (mg/L CaCO3) | pH (pH units) | EC (µS/cm) | DO (mg/L O2) | Temp (°C) | Redox (mV) | TTA (mg/L CaCO3) | TALK (mg/L CaCO3) | pH (pH units) | EC (µS/cm) | DO (mg/L O2) | Temp (°C) | Redox (mV) | TTA (mg/L CaCO3) | TALK (mg/L CaCO3) |
| **Freshwater Ecosystems** | | **6.5-8.5** | **1500** | | | | | | **6.5-8.5** | **1500** | | | | | | **6.5-8.5** | **1500** | | | | | |
| **DEC Trigger Values** | | **<6** | | | | | **40** | **<30** | **<6** | | | | | **40** | **<30** | **<6** | | | | | **40** | **<30** |
| 20/2/13 | Wed | 6.34 | 806.0 | 5.50 | 25.8 | -33.5 | 28 | 45 | 6.63 | 748.0 | 5.93 | 27.1 | -61.2 | 38 | 24 | 5.57 | 8.5 | 0.07 | 24.8 | 0.8 | 32 | 27 |
| 18/6/13 | Tue | 6.38 | 404.0 | 5.02 | 18.3 | -23.4 | 35 | 63 | 6.45 | 396.1 | 1.97 | 18.6 | -44.2 | 60 | 30 | 5.61 | 948.0 | 0.06 | 19.3 | -37.5 | 31 | 30 |
| 20/8/13 | Tues | 5.89 | 243.4 | 5.90 | 15.7 | 82.6 | 30 | 45 | 5.52 | 133.4 | 4.70 | 15.5 | 107.3 | 30 | 15 | 4.30 | 396.4 | 1.10 | 16.3 | 92.8 | 30 | 36 |

## 16.4 Groundwater Analytical Results

Sampling has been undertaken on three occasions; February, June and August 2013. Samples were collected from the six groundwater bores and labelled as MW1, MW2, MW3, MW4, MW5 and MW6.

The groundwater samples collected from the wells were transported to the laboratory where they were analysed for the following parameters:

- pH
- Electrical conductivity
- Total dissolved solids
- Suspended solids
- Turbidity
- Total alkalinity
- Acidity
- $SO_4^{2-}$
- $Cl^-$
- Dissolved metals: Al, As, Cd, Cr, Mn, Ni, Se, Zn, Fe.
- Total metals: Al, As, Cd, Cr, Cu, Pb, Mn, Mo, Ni, Se, Ag, Zn, Fe.
- Total recoverable mercury
- Dissolved Hexavalent Chromium
- Ferrous Iron
- Nutrients: Ammonia, Nitrite, Nitrate, Nitrite + Nitrate, Total Kjeldahl Nitrogen, Total nitrogen, total phosphorus, Reactive Phosphorus and Sulfide
- Biological Oxygen Demand.

## 16.5 Groundwater Parameters

February Results

In February, the pH of the groundwater samples at the six sites ranged from 5.63 to 6.94, with two sites MW2 and MW3, exceeding the freshwater investigation levels. The electrical conductivity in the samples ranged from 184 to 812 uS/cm, the lowest value from site MW2, exceeding the freshwater investigation levels. Total dissolved solids, suspended solids and turbidity varied between the groundwater monitoring sites, with no obvious patterns. The turbidity exceeded the freshwater ecosystem investigation level in five of the six samples; MW2 was with the guideline range.

Total alkalinity ranged from 5 to 98 mg/l and acidity from 9 to 58 mg/l. The groundwater sample from MW6 contained 552 mg/l of sulphate, while the others ranged from 10 to 85 mg/l. The chloride concentration in the groundwater samples ranged from 24 to 229 mg/l. The Biological Oxygen Demand from the samples was <2 mg/L at four sites and 5 mg/L at MW4 and MW5.

June Results

The pH of the groundwater samples in June at the six sites ranged from 5.19 to 6.48, and all were more acidic than the freshwater ecosystem investigation levels. The groundwater from MW2, MW3 and MW6 were also more acidic than the Long-term Irrigation water levels of 6.0-8.5. The electrical conductivity in the samples ranged from 162 to 1040 uS/cm, the lowest value from was from site MW2, which again exceeded the freshwater investigation levels. The turbidity exceeded the freshwater ecosystem investigation level in all of the six samples.

Total alkalinity ranged from 3 to 58 mg/l and acidity from 14 to 43 mg/l. The groundwater results for sulphate were within the range of 5 to 74 mg/l. The chloride concentration in the groundwater samples ranged from 24 to 229 mg/l. The Biological Oxygen Demand results were <2 mg/L to 8 mg/L.

August Results

In August, the pH of the groundwater samples at the six monitoring locations ranged from 4.51 to 6.46 with three locations (MW3, MW5 and MW6) below the DER trigger level. pH levels for MW1, MW2 and MW4 were outside of the Freshwater Ecosystems trigger levels. The electrical conductivity in the samples ranged from 152 to 500µs/cm all samples being within guideline levels. No exceedances occurred at any monitoring locations for total dissolved solids, suspended solids and turbidity.

Total alkalinity ranged from <1 (below LOR) to 27 mg/L with MW1, MW2, MW4 and MW5 below the DER trigger value. Total acidity ranged from 6 to 47 mg/L. Sulfate levels within groundwater samples ranged from 11 to 36 mg/L and chloride levels ranged between 17 to 119 mg/L. The Biological Oxygen Demand results were <2 to 11 mg/L.

## 16.6 Major Anions and Cations

In all monitoring wells the Alkalinity : Sulfate ratio exceeded the DER trigger values for generally all sampling dates except in MW1 during the February monitoring. The Sulfate : Chloride ratio has generally remained the increased or remained relatively stable in all wells over the sampling period.

## 16.7 Metals

The following dissolved metals exceedances were detected:

- Dissolved aluminium exceeded the following assessment criteria at the associated locations:
    - MW1, MW2, MW5 and MW6 exceeded the Freshwater Ecosystems assessment criteria;
    - MW4 exceeded the Freshwater Ecosystems and DER trigger levels; and
    - MW3 exceeded the Freshwater Ecosystems, DER and Domestic Non-potable trigger levels.
- Dissolved manganese exceeded the Long-term Irrigation trigger level in MW5.
- Dissolved nickel exceeded the Freshwater Ecosystems trigger level in MW3 and MW4.
- Dissolved zinc exceeded the Freshwater Ecosystems trigger level in MW1, MW2, MW3, MW5 and MW6.
- Dissolved iron exceeded the following assessment criteria at the associated locations:
    - MW1 exceeded the Long-term Irrigation trigger level;
    - MW3, MW4 and MW6 exceeded the Long-term Irrigation and Freshwater Ecosystems trigger levels;
    - MW4 exceeded the Long-term Irrigation, Freshwater Ecosystems and Domestic Non-potable trigger levels.

The following total metals exceedances were detected:

- Total aluminium exceeded the following assessment criteria at the associated locations:
    - MW2 and MW5 exceeded the Freshwater Ecosystems trigger level;
    - MW6 exceeded the Freshwater Ecosystems and Domestic Non-potable trigger levels;
    - MW1, MW3 and MW4 exceeded all assessment criteria.
- Total copper exceeded the Freshwater Ecosystems assessment criteria in MW1, MW3, MW4, MW5 and MW6.
- Total lead copper exceeded the Freshwater Ecosystems assessment criteria in MW1, MW3, MW4 and MW6.
- Total manganese exceeded the Long-term irrigation trigger level in MW4 and MW5.
- Total zinc exceeded the Freshwater Ecosystems trigger level in MW1, MW3, MW4, MW5 and MW6.

- Total iron exceeded the following assessment criteria at the associated locations:
    - MW2, MW3, and MW6 exceeded the Freshwater Ecosystems trigger level;
    - MW1, MW4 and MW5 exceeded the Freshwater Ecosystems and Domestic Non-potable assessment criteria
- Total mercury exceeded the Freshwater Ecosystems trigger level in MW4.

## 16.8 Nutrients

Total Nitrogen exceeded the Freshwater Ecosystems assessment criteria at MW3 and MW5. Total Nitrogen levels exceeded the Freshwater Ecosystems and Long-term Irrigation trigger levels in MW2, MW4 and MW6.

Total Phosphorus exceeded the Freshwater Ecosystems assessment criteria in MW1 and MW6.

## 16.9 Historical Data

Laboratory analyses of samples collected for the three sampling periods are tabulated for each monitoring well to identify changes in groundwater quality (Table 8 to Table 13). The following points are comparisons of current results (August 2013) previous historical data (February and June 2013).

- Laboratory results of MW1 indicate an increase in dissolved ferrous iron, total aluminium, total copper, total lead, total manganese total iron and total phosphorus. Decreases in levels were observed in total dissolved solids, turbidity, total acidity, chloride, dissolved aluminium, dissolved manganese, dissolved nickel, dissolved zinc, dissolved iron, total chromium, and ammonia.
- MW2 laboratory results indicate that pH total alkalinity, biological oxygen demand, chloride, total aluminium and total iron have increased from previous monitoring periods. Total dissolved solids, suspended solids, acidity, dissolved aluminium, dissolved iron, nitrate and total nitrogen have decreased from previous monitoring events.
- Results for MW3 indicate that suspended solids, sulphide, dissolved aluminium, dissolved arsenic, dissolved cadmium, dissolved chromium, dissolved nickel, dissolved zinc, dissolved iron, dissolved ferrous iron, total aluminium, total copper, total iron, kjeldhal nitrogen and total nitrogen have increased from historical levels. pH, electrical conductivity turbidity, BOD, sulfate, chloride, total arsenic, total lead, ammonia, and total phosphorus have decreased.
- Laboratory results for MW4 indicate that an increase in total dissolved solids, turbidity, dissolved aluminium, dissolved chromium, dissolved nickel, dissolved zinc, total aluminium, total chromium, total iron and total mercury were observed when compared to previous sampling events. Decreases in analytes were observed for pH, electrical conductivity, suspended solids, total alkalinity, acidity, sulfate, chloride, dissolved manganese, dissolved iron,

dissolved ferrous iron, total arsenic, total manganese, ammonia, and total phosphorus.

- Results for MW5 indicate that dissolved aluminium, dissolved zinc, nitrate and reactive phosphorus have increased when compared to previous reporting periods. Analytes that have decreased when compared to previous reporting periods are pH, electrical conductivity, total dissolved solids, suspended solids, turbidity, total alkalinity, acidity, BOD, sulfate, chloride, dissolved manganese, dissolved iron, dissolved ferrous iron, total aluminium, total arsenic, total chromium, total copper, total manganese, total molybdenum, total zinc, total iron, ammonia, kjeldhal nitrogen, total nitrogen, and total phosphorus.
- Laboratory results for MW6 indicate that there has been an increase in suspended solids, turbidity, dissolved aluminium, dissolved arsenic, dissolved chromium, dissolved zinc, total aluminium, total arsenic, total chromium, total copper, total manganese, total zinc, nitrate, kjeldhal nitrogen, total nitrogen, total phosphorus and reactive phosphorus in comparison to previous sampling periods. Electrical conductivity, total dissolved solids, total alkalinity, sulfate, chloride, dissolved manganese, dissolved nickel, dissolved iron, ferrous iron, total iron and ammonia have decreased.

**Table 10:** HVNMW1 Laboratory Results

| Analyte grouping/Analyte | Units | Freshwater Ecosystems | Domestic Non-potable | Long Term Irrigation | DEC Trigger Values | 21/02/2013 HVNMW1-01 | 18/06/2013 HVN MW1 02 | 20/08/2013 HVNMW1 03 |
|---|---|---|---|---|---|---|---|---|
| pH Value | pH Unit | 6.5-8.5 | | 6.0-8.5 | <5[3] / <6[4] | 6.49 | 6.13 | 6.13 |
| Electrical Conductivity | µS/cm | 1500 | | | | 432 | 434 | 440 |
| Total Dissolved Solids | mg/L | | | | | 1340 | 3260 | 685 |
| Suspended Solids | mg/L | | | | | 3750 | 2570 | 2530 |
| Turbidity | NTU | | | | | 8810 | 3100 | 1690 |
| Total Alkalinity $CaCO_3$ | mg/L | | | | <30[4] | 12 | 12 | 12 |
| Acidity as $CaCO_3$ | mg/L | | | | 40[4] | 20 | 17 | 10 |
| BOD | mg/L | | | | | <2 | 4 | <2 |
| Sulfate as $SO_4^{2-}$ | mg/L | | 5000 | | | <20 | 34 | 36 |
| Sulfide | mg/L | 0.001 | | | | <0.1 | <0.1 | <0.1 |
| Alkalinity : Sulfate | ratio | | | | <5[3] | 0.00 | 0.35 | 0.33 |
| Chloride | mg/L | | | | | 24 | 102 | 97 |
| Sulfate : Chloride | ratio | | | | 0.5[3] | 0.00 | 0.33 | 0.37 |
| **Dissolved Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | 1.0[3] | 3.37 | 0.53 | 0.14 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.002 | 0.001 | 0.002 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | 0.005 | 0.002 | <0.001 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.01 | 0.026 | 0.012 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | 0.003 | 0.006 | 0.001 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.021 | 0.032 | 0.017 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 0.84 | 0.37 | 0.3 |
| Ferrous Iron | mg/L | | | | | 0.46 | 0.27 | 0.32 |
| Chromium VI | mg/L | 0.001 | 0.5 | | | <0.01 | <0.01 | <0.01 |
| **Total Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | | 46.9 | 12.8 | 15 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.012 | 0.006 | 0.006 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | 0.199 | 0.05 | 0.038 |
| Copper | mg/L | 0.0014 | 20 | 0.2 | | 0.065 | 0.017 | 0.02 |
| Lead | mg/L | 0.0034 | 0.1 | 2 | | 0.117 | 0.032 | 0.035 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.021 | 0.022 | 0.044 |
| Molybdenum | mg/L | | 0.5 | 0.01 | | 0.004 | 0.002 | 0.002 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | 0.01 | 0.002 | 0.002 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Silver | mg/L | 0.00005 | 1 | | | <0.001 | <0.001 | <0.001 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.083 | 0.021 | 0.028 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 6.43 | 3.62 | 4.93 |
| Mercury | mg/L | 0.00006 | 0.01 | | | <0.0001 | 0.0003 | 0.0002 |
| **Nutrients** | | | | | | | | |
| Ammonia as N | mg/L | 0.9 | 5 | | | 0.04 | 0.04 | 0.02 |
| Nitrite as N | mg/L | | 30 | | | <0.01 | <0.01 | <0.01 |
| Nitrate as N | mg/L | | 500 | | | 1.55 | 0.01 | <0.01 |
| Kjeldhal Nitrogen | mg/L | | | | | 1 | 0.2 | 0.2 |
| Total Nitrogen | mg/L | 1.0 [1] | | 5 | | 2.6 | 0.2 | 0.2 |
| Total Phosphorus | mg/L | 0.1 [1] | | 0.05 | | 0.61 | 0.1 | 0.18 |
| Reactive Phosphorus | mg/L | | | | | 0.15 | <0.01 | <0.01 |

NOTES:
1. SRT Healthy Rivers Action Plan Long Term Targets
2. pH > 6 / pH < 6
3. ASS disturbance indicators
4. Effluent treatment triggers

**Table 11:** HVNMW2 Laboratory Results

| Analyte grouping/Analyte | Units | Freshwater Ecosystems | Domestic Non-potable | Long Term Irrigation | DEC Trigger Values | 21/02/2013 HVNMW2-01 | 18/06/2013 HVN MW2 02 | 20/08/2013 HVNMW2 03 |
|---|---|---|---|---|---|---|---|---|
| pH Value | pH Unit | 6.5-8.5 | | 6.0-8.5 | <5[3] / <6[4] | 6.26 | 5.83 | 6.46 |
| Electrical Conductivity | µS/cm | 1500 | | | | 184 | 162 | 159 |
| Total Dissolved Solids | mg/L | | | | | 1540 | 129 | 116 |
| Suspended Solids | mg/L | | | | | 31 | 574 | 72 |
| Turbidity | NTU | | | | | 36.1 | 197 | 56.8 |
| Total Alkalinity $CaCO_3$ | mg/L | | | | <30[4] | 5 | 2 | 10 |
| Acidity as $CaCO_3$ | mg/L | | | | 40[4] | 9 | 14 | 6 |
| BOD | mg/L | | | | | <2 | <2 | 6 |
| Sulfate as $SO_4^{2-}$ | mg/L | | 5000 | | | 10 | 5 | 11 |
| Sulfide | mg/L | 0.001 | | | | <0.1 | <0.1 | <0.1 |
| Alkalinity : Sulfate | ratio | | | | <5[3] | 0.50 | 0.40 | 0.91 |
| Chloride | mg/L | | | | | 28 | 16 | 17 |
| Sulfate : Chloride | ratio | | | | 0.5[3] | 0.36 | 0.31 | 0.65 |
| **Dissolved Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | 1.0[3] | 0.04 | 0.46 | 0.33 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | <0.001 | <0.001 | <0.001 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | <0.001 | <0.001 | <0.001 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.007 | 0.008 | 0.007 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | <0.001 | 0.001 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.006 | 0.008 | 0.009 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | <0.05 | 0.14 | 0.07 |
| Ferrous Iron | mg/L | | | | | <0.05 | 0.06 | <0.05 |
| Chromium VI | mg/L | 0.001 | 0.5 | | | <0.01 | <0.01 | <0.01 |
| **Total Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | | 1.83 | 1.19 | 1.35 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | <0.001 | <0.001 | <0.001 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | <0.001 | <0.001 | <0.001 |
| Copper | mg/L | 0.0014 | 20 | 0.2 | | <0.001 | <0.001 | 0.001 |
| Lead | mg/L | 0.0034 | 0.1 | 2 | | <0.001 | <0.001 | <0.001 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.007 | 0.005 | 0.006 |
| Molybdenum | mg/L | | 0.5 | 0.01 | | <0.001 | <0.001 | 0.001 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | <0.001 | <0.001 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Silver | mg/L | 0.00005 | 1 | | | <0.001 | <0.001 | <0.001 |
| Zinc | mg/L | 0.008 | 30 | 2 | | <0.005 | <0.005 | <0.005 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 0.27 | 0.18 | 0.36 |
| Mercury | mg/L | 0.00006 | 0.01 | | | <0.0001 | <0.0001 | <0.0001 |
| **Nutrients** | | | | | | | | |
| Ammonia as N | mg/L | 0.9 | 5 | | | 0.04 | 0.04 | 0.02 |
| Nitrite as N | mg/L | | 30 | | | 0.03 | <0.01 | <0.01 |
| Nitrate as N | mg/L | | 500 | | | 8.19 | 8.82 | 7.81 |
| Kjeldhal Nitrogen | mg/L | | | | | <0.5 | 1.4 | <0.5 |
| Total Nitrogen | mg/L | 1.0 [1] | | 5 | | 8.2 | 10.2 | 7.8 |
| Total Phosphorus | mg/L | 0.1 [1] | | 0.05 | | <0.05 | <0.05 | <0.05 |
| Reactive Phosphorus | mg/L | | | | | <0.01 | <0.01 | <0.01 |

NOTES:
1. SRT Healthy Rivers Action Plan Long Term Targets
2. pH > 6 / pH < 6
3. ASS disturbance indicators
4. Effluent treatment triggers

**Table 12:** HVNMW3 Laboratory Results

| Analyte grouping/Analyte | Units | Freshwater Ecosystems | Domestic Non-potable | Long Term Irrigation | DEC Trigger Values | 21/02/2013 HVNMW3-01 | 18/06/2013 HVN MW3 02 | 20/08/2013 HVNMW3 03 |
|---|---|---|---|---|---|---|---|---|
| pH Value | pH Unit | 6.5-8.5 | | 6.0-8.5 | <5[3] / <6[4] | 5.63 | 5.19 | 4.58 |
| Electrical Conductivity | µS/cm | 1500 | | | | 449 | 532 | 435 |
| Total Dissolved Solids | mg/L | | | | | 1950 | 818 | 820 |
| Suspended Solids | mg/L | | | | | 3300 | 310 | 620 |
| Turbidity | NTU | | | | | 7480 | 2870 | 1860 |
| Total Alkalinity $CaCO_3$ | mg/L | | | | <30[4] | 9 | 3 | <1 |
| Acidity as $CaCO_3$ | mg/L | | | | 40[4] | 49 | 43 | 47 |
| BOD | mg/L | | | | | 2 | 2 | <2 |
| Sulfate as $SO_4^{2-}$ | mg/L | | 5000 | | | 33 | 40 | 18 |
| Sulfide | mg/L | 0.001 | | | | <0.1 | <0.1 | 0.2 |
| Alkalinity : Sulfate | ratio | | | | <5[3] | 0.27 | 0.08 | 0.06 |
| Chloride | mg/L | | | | | 122 | 145 | 107 |
| Sulfate : Chloride | ratio | | | | 0.5[3] | 0.27 | 0.28 | 0.17 |
| **Dissolved Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | 1.0[3] | 0.89 | 1.62 | 2.84 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.005 | 0.002 | 0.005 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | 0.0002 |
| Chromium | mg/L | | | 0.1 | | 0.002 | 0.002 | 0.009 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.007 | 0.025 | 0.026 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | 0.002 | 0.019 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.008 | 30 | 2 | | <0.005 | 0.015 | 0.079 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 0.38 | 0.46 | 1.02 |
| Ferrous Iron | mg/L | | | | | 0.32 | 0.61 | 0.88 |
| Chromium VI | mg/L | 0.001 | 0.5 | | | <0.01 | <0.01 | <0.01 |
| **Total Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | | 89.8 | 11.7 | 12.9 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.016 | 0.009 | 0.006 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | 0.0003 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | 0.057 | 0.01 | 0.01 |
| Copper | mg/L | 0.0014 | 20 | 0.2 | | 0.006 | 0.004 | 0.007 |
| Lead | mg/L | 0.0034 | 0.1 | 2 | | 0.176 | 0.048 | 0.02 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.012 | 0.014 | 0.015 |
| Molybdenum | mg/L | | 0.5 | 0.01 | | <0.001 | <0.001 | <0.001 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | 0.031 | 0.005 | 0.004 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Silver | mg/L | 0.00005 | 1 | | | <0.001 | <0.001 | <0.001 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.008 | 0.01 | 0.016 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 3.12 | 1.03 | 1.29 |
| Mercury | mg/L | 0.00006 | 0.01 | | | 0.0001 | 0.0001 | <0.0001 |
| **Nutrients** | | | | | | | | |
| Ammonia as N | mg/L | 0.9 | 5 | | | 0.52 | 0.38 | 0.12 |
| Nitrite as N | mg/L | | 30 | | | <0.01 | <0.01 | <0.01 |
| Nitrate as N | mg/L | | 500 | | | <0.01 | <0.01 | <0.05 |
| Kjeldhal Nitrogen | mg/L | | | | | 4.4 | 1.7 | 3.2 |
| Total Nitrogen | mg/L | 1.0 [1] | | 5 | | 4.4 | 1.7 | 3.2 |
| Total Phosphorus | mg/L | 0.1 [1] | | 0.05 | | 0.48 | 0.14 | 0.1 |
| Reactive Phosphorus | mg/L | | | | | <0.01 | 0.02 | 0.03 |

NOTES:
1. SRT Healthy Rivers Action Plan Long Term Targets
2. pH > 6 / pH < 6
3. ASS disturbance indicators
4. Effluent treatment triggers

**Table 13:** HVNMW4 Laboratory Results

| Analyte grouping/Analyte | Units | Freshwater Ecosystems | Domestic Non-potable | Long Term Irrigation | DEC Trigger Values | 21/02/2013 HVNMW4-01 | 18/06/2013 HVN MW4 02 | 20/08/2013 HVNMW4 03 |
|---|---|---|---|---|---|---|---|---|
| pH Value | pH Unit | 6.5-8.5 | | 6.0-8.5 | <5[3] / <6[4] | 6.74 | 6.37 | 6.19 |
| Electrical Conductivity | µS/cm | 1500 | | | | 704 | 550 | 300 |
| Total Dissolved Solids | mg/L | | | | | 1690 | 676 | 1200 |
| Suspended Solids | mg/L | | | | | 7500 | 300 | 152 |
| Turbidity | NTU | | | | | 2090 | 656 | 1390 |
| Total Alkalinity $CaCO_3$ | mg/L | | | | <30[4] | 98 | 58 | 27 |
| Acidity as $CaCO_3$ | mg/L | | | | 40[4] | 58 | 37 | 21 |
| BOD | mg/L | | | | | 5 | 2 | 3 |
| Sulfate as $SO_4^{2-}$ | mg/L | | 5000 | | | 59 | 37 | 29 |
| Sulfide | mg/L | 0.001 | | | | <0.1 | <0.1 | <0.1 |
| Alkalinity : Sulfate | ratio | | | | <5[3] | 1.66 | 1.57 | 0.93 |
| Chloride | mg/L | | | | | 136 | 118 | 50 |
| Sulfate : Chloride | ratio | | | | 0.5[3] | 0.43 | 0.31 | 0.58 |
| **Dissolved Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | 1.0[3] | 0.05 | 0.31 | 1.12 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.004 | 0.003 | 0.002 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | 0.0001 |
| Chromium | mg/L | | | 0.1 | | <0.001 | <0.001 | 0.023 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.505 | 0.51 | 0.154 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | 0.003 | 0.044 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.01 | 0.034 | 0.05 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 0.82 | 7.37 | 2 |
| Ferrous Iron | mg/L | | | | | 0.09 | 5 | 1.36 |
| Chromium VI | mg/L | 0.001 | 0.5 | | | <0.01 | <0.01 | <0.01 |
| **Total Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | | 59.2 | 4.06 | 8.99 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.026 | 0.009 | 0.005 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | 0.001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | 0.08 | 0.005 | 0.008 |
| Copper | mg/L | 0.0014 | 20 | 0.2 | | 0.053 | 0.004 | 0.004 |
| Lead | mg/L | 0.0034 | 0.1 | 2 | | 0.061 | 0.004 | 0.004 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 3.34 | 0.649 | 0.317 |
| Molybdenum | mg/L | | 0.5 | 0.01 | | 0.001 | <0.001 | <0.001 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | 0.011 | 0.001 | 0.001 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Silver | mg/L | 0.00005 | 1 | | | <0.001 | <0.001 | <0.001 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.315 | 0.024 | 0.023 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 510 | 35 | 39.9 |
| Mercury | mg/L | 0.00006 | 0.01 | | | 0.0003 | <0.0001 | 0.0001 |
| **Nutrients** | | | | | | | | |
| Ammonia as N | mg/L | 0.9 | 5 | | | 1.49 | 0.42 | 0.19 |
| Nitrite as N | mg/L | | 30 | | | <0.01 | <0.01 | <0.01 |
| Nitrate as N | mg/L | | 500 | | | <0.01 | 3.11 | 3.12 |
| Kjeldhal Nitrogen | mg/L | | | | | 15.2 | 2.3 | 2.3 |
| Total Nitrogen | mg/L | 1.0 [1] | | 5 | | 15.2 | 5.4 | 5.4 |
| Total Phosphorus | mg/L | 0.1 [1] | | 0.05 | | 1.05 | 0.09 | 0.05 |
| Reactive Phosphorus | mg/L | | | | | <0.01 | <0.01 | <0.01 |

NOTES:
1. SRT Healthy Rivers Action Plan Long Term Targets
2. pH > 6 / pH < 6
3. ASS disturbance indicators
4. Effluent treatment triggers

**Table 14:** HVNMW5 Laboratory Results

| Analyte grouping/Analyte | Units | Freshwater Ecosystems | Domestic Non-potable | Long Term Irrigation | DEC Trigger Values | 21/02/2013 HVNMW5-01 | 18/06/2013 HVN MW5 02 | 20/08/2013 HVNMW5 03 |
|---|---|---|---|---|---|---|---|---|
| pH Value | pH Unit | 6.5-8.5 | | 6.0-8.5 | <5[3] / <6[4] | 6.94 | 6.48 | 5.99 |
| Electrical Conductivity | µS/cm | 1500 | | | | 592 | 451 | 157 |
| Total Dissolved Solids | mg/L | | | | | 350 | 336 | 139 |
| Suspended Solids | mg/L | | | | | 500 | 1160 | 38 |
| Turbidity | NTU | | | | | 1810 | 1920 | 46.8 |
| Total Alkalinity $CaCO_3$ | mg/L | | | | <30[4] | 58 | 50 | 10 |
| Acidity as $CaCO_3$ | mg/L | | | | 404 | 29 | 42 | 20 |
| BOD | mg/L | | | | | 3 | 5 | 2 |
| Sulfate as $SO_4^{2-}$ | mg/L | | 5000 | | | 86 | 74 | 22 |
| Sulfide | mg/L | 0.001 | | | | <0.1 | <0.1 | <0.1 |
| Alkalinity : Sulfate | ratio | | | | <5[3] | 0.67 | 0.68 | 0.45 |
| Chloride | mg/L | | | | | 85 | 60 | 28 |
| Sulfate : Chloride | ratio | | | | 0.53 | 1.01 | 1.23 | 0.79 |
| **Dissolved Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | 1.03 | 0.01 | 0.02 | 0.26 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | <0.001 | <0.001 | 0.001 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | <0.001 | <0.001 | 0.001 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 1.68 | 1.85 | 0.296 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | 0.001 | 0.002 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.006 | 0.006 | 0.014 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 3.34 | 12.3 | 3.52 |
| Ferrous Iron | mg/L | | | | | 3.03 | 13.1 | 2.4 |
| Chromium VI | mg/L | 0.001 | 0.5 | | | <0.01 | <0.01 | <0.01 |
| **Total Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | | 1.14 | 5.71 | 0.4 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.008 | 0.011 | 0.002 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | 0.014 | 0.191 | 0.002 |
| Copper | mg/L | 0.0014 | 20 | 0.2 | | 0.006 | 0.06 | 0.004 |
| Lead | mg/L | 0.0034 | 0.1 | 2 | | 0.001 | 0.009 | <0.001 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 1.72 | 1.9 | 0.308 |
| Molybdenum | mg/L | | 0.5 | 0.01 | | 0.007 | 0.016 | 0.002 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | 0.003 | 0.002 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Silver | mg/L | 0.00005 | 1 | | | <0.001 | <0.001 | <0.001 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.006 | 0.042 | 0.013 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 34.5 | 68.6 | 4.42 |
| Mercury | mg/L | 0.00006 | 0.01 | | | <0.0001 | <0.0001 | <0.0001 |
| **Nutrients** | | | | | | | | |
| Ammonia as N | mg/L | 0.9 | 5 | | | 1.03 | 0.73 | 0.08 |
| Nitrite as N | mg/L | | 30 | | | 0.01 | <0.01 | <0.01 |
| Nitrate as N | mg/L | | 500 | | | 0.01 | 0.3 | 1 |
| Kjeldhal Nitrogen | mg/L | | | | | 1.8 | 2 | 1.4 |
| Total Nitrogen | mg/L | 1.0 [1] | | 5 | | 1.8 | 2.3 | 2.4 |
| Total Phosphorus | mg/L | 0.1 [1] | | 0.05 | | 0.02 | 0.07 | 0.04 |
| Reactive Phosphorus | mg/L | | | | | <0.01 | <0.01 | 0.02 |

NOTES:
1. SRT Healthy Rivers Action Plan Long Term Targets
2. pH > 6 / pH < 6
3. ASS disturbance indicators
4. Effluent treatment triggers

**Table 15:** HVNMW6 Laboratory Results

| Analyte grouping/Analyte | Units | Freshwater Ecosystems | Domestic Non-potable | Long Term Irrigation | DEC Trigger Values | 21/02/2013 HVNMW6-01 | 18/06/2013 HVN MW6 02 | 20/08/2013 HVNMW6 03 |
|---|---|---|---|---|---|---|---|---|
| pH Value | pH Unit | 6.5-8.5 | | 6.0-8.5 | <5[3] / <6[4] | 6.23 | 5.7 | 4.51 |
| Electrical Conductivity | µS/cm | 1500 | | | | 812 | 1040 | 500 |
| Total Dissolved Solids | mg/L | | | | | 402 | 840 | 518 |
| Suspended Solids | mg/L | | | | | 1600 | 36 | 136 |
| Turbidity | NTU | | | | | 5270 | 441 | 505 |
| Total Alkalinity $CaCO_3$ | mg/L | | | | <30[4] | 21 | 12 | <1 |
| Acidity as $CaCO_3$ | mg/L | | | | 40[4] | 23 | 38 | 36 |
| BOD | mg/L | | | | | <2 | 8 | <2 |
| Sulfate as $SO_4^{2-}$ | mg/L | | 5000 | | | 552 | 55 | 17 |
| Sulfide | mg/L | 0.001 | | | | <0.1 | <0.1 | <0.1 |
| Alkalinity : Sulfate | ratio | | | | <5[3] | 0.04 | 0.22 | 0.06 |
| Chloride | mg/L | | | | | 229 | 307 | 119 |
| Sulfate : Chloride | ratio | | | | 0.5[3] | 2.41 | 0.18 | 0.14 |
| **Dissolved Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | 1.0[3] | 0.37 | 0.35 | 0.68 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.005 | 0.003 | 0.008 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | <0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | <0.001 | <0.001 | 0.004 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.003 | 0.057 | 0.012 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | <0.001 | 0.002 | <0.001 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.008 | 30 | 2 | | <0.005 | 0.021 | 0.034 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 0.92 | 1.84 | 0.62 |
| Ferrous Iron | mg/L | | | | | 0.86 | 1.97 | 0.66 |
| Chromium VI | mg/L | 0.001 | 0.5 | | | <0.01 | <0.01 | <0.01 |
| **Total Metals** | | | | | | | | |
| Aluminium | mg/L | 0.055 | 2 | 5 | | 17.5 | 3.51 | 4.41 |
| Arsenic | mg/L | 0.013 | 0.07 | 0.1 | | 0.006 | 0.004 | 0.008 |
| Cadmium | mg/L | 0.0002 | 0.02 | 0.01 | | <0.0001 | 0.0001 | <0.0001 |
| Chromium | mg/L | | | 0.1 | | 0.006 | 0.002 | 0.007 |
| Copper | mg/L | 0.0014 | 20 | 0.2 | | 0.009 | 0.005 | 0.033 |
| Lead | mg/L | 0.0034 | 0.1 | 2 | | 0.052 | 0.007 | 0.007 |
| Manganese | mg/L | 1.9 | 5 | 0.2 | | 0.004 | 0.01 | 0.014 |
| Molybdenum | mg/L | | 0.5 | 0.01 | | <0.001 | <0.001 | <0.001 |
| Nickel | mg/L | 0.011 | 0.2 | 0.2 | | 0.006 | 0.002 | 0.002 |
| Selenium | mg/L | 0.005 | 0.1 | 0.02 | | <0.01 | <0.01 | <0.01 |
| Silver | mg/L | 0.00005 | 1 | | | <0.001 | <0.001 | <0.001 |
| Zinc | mg/L | 0.008 | 30 | 2 | | 0.049 | 0.018 | 0.023 |
| Iron | mg/L | 0.3 | 3 | 0.2 | | 1.51 | 1.69 | 0.8 |
| Mercury | mg/L | 0.00006 | 0.01 | | | 0.0002 | <0.0001 | <0.0001 |
| **Nutrients** | | | | | | | | |
| Ammonia as N | mg/L | 0.9 | 5 | | | 0.21 | 0.3 | 0.16 |
| Nitrite as N | mg/L | | 30 | | | <0.01 | <0.01 | <0.01 |
| Nitrate as N | mg/L | | 500 | | | 0.21 | 1.91 | 5.98 |
| Kjeldhal Nitrogen | mg/L | | | | | 1.8 | 2.1 | 2.8 |
| Total Nitrogen | mg/L | 1.0 [1] | | 5 | | 2 | 4 | 8.8 |
| Total Phosphorus | mg/L | 0.1 [1] | | 0.05 | | 0.33 | 0.29 | 0.52 |
| Reactive Phosphorus | mg/L | | | | | 0.22 | 0.27 | 0.57 |

NOTES:
1. SRT Healthy Rivers Action Plan Long Term Targets
2. pH > 6 / pH < 6
3. ASS disturbance indicators
4. Effluent treatment triggers

## 16.10 Summary

The pH of the ground water samples at the six sites ranged from 4.51 to 6.46 with, exceedances outside the Freshwater Ecosystems trigger levels, Long-term irrigation levels and below the DER trigger level. Electrical conductivity in the samples ranged from 157 to 500 uS/cm, the lowest value from all sampling occasions was from site MW2 yet within all assessment criteria. Total dissolved solids, suspended solids and turbidity varied between the groundwater monitoring sites, with no obvious patterns.

As the site is classified as moderate to low risk in the Acid Sulphate Soil Risk Map, Swan Coastal Plain (DEC-001) (25.01.2010 15:16:09) an analysis of possible issues was undertaken with the water quality data. In a report produced by the Department of Environment (2004) several criteria were identified to assist in determining if they may be acid sulfate soil issues. The report states that:

*"Chemical indicators that **may** indicate that groundwater at the water table is be affected by the oxidation of sulfides include:*

- *A sulphate/chloride mg L-1 ratio greater than 0.5 (Mulvey, 1993);*
- *An alkalinity/sulphate mg L-1 ratio of less 5 (Swedish EPA, 2002);*
- *A pH of less than 5;*
- *A soluble aluminium concentration greater than 1 mg L-1."*

In Table 14 the sulfate : choride ratios were calculated for the monitoring well locations and compared. Groundwater samples from Sites MW2, MW4 and MW5 exceeded the indicator ratio. The alkalinity : sulfate ratios at Sites MW1 to MW6 were all <5 indicating that oxidation may be occurring. The pH of the groundwater samples from MW3 and MW6 were the only ones below 5 while the soluble aluminium concentration in the groundwater was >1 mg/L within MW1 in February, MW3 for June and August and MW4 in August.

**Table 16:** Acid Sulfate Soil Disturbance Indicators

| Analyte | Acidity Indicators | Location | 21.2.2013 Ratio | 18.6.2013 Ratio | 20.08.2013 Ratio |
|---|---|---|---|---|---|
| Sulfate/Chloride Ratio | > 0.5 | MW1 | 0 | 0.3 | 0.37 |
| | | MW2 | 0.4 | 0.3 | **0.65** |
| | | MW3 | 0.3 | 0.2 | 0.17 |
| | | MW4 | 0.4 | 0.3 | **0.58** |
| | | MW5 | **1.0** | **1.2** | **0.79** |
| | | MW6 | **2.4** | 0.1 | 0.14 |
| Alkalinity/Sulfate Ratio | < 5.0 | MW1 | 0 | **0.3** | **0.33** |
| | | MW2 | **0.5** | **0.4** | **0.91** |
| | | MW3 | **0.3** | **0.1** | **0.06** |
| | | MW4 | **1.7** | **1.5** | **0.93** |
| | | MW5 | **0.7** | **0.6** | **0.45** |
| | | MW6 | **0.0** | **0.2** | **0.06** |

The issues concerning the concentration of chloride in irrigation waters relate to the risk of foliar injury to crops (ANZECC, 2000). The concentration of chloride recommended to prevent foliar injury depends upon the sensitivity of the plant and can range from <175 mg/l for sensitive plants to >700 mg/l for tolerant plants. The water samples from the groundwater ranged from the sensitive to moderately sensitive, which would be of suitable use for a wholesale nursery.

Metalloid results could be considered higher than expected for background waters within this locality, however, elevated levels of suspended solids within majority of the samples could have contributed to artificially increasing the results. Dissolved metals analysed are significantly lower than the total metals results and are more indicative of the quality of water that would be abstracted for use on site.

Although nutrient levels in all monitoring wells were slightly elevated above ANZECC criteria, surface waters are not located in the immediate vicinity of the site and downstream receptors are likely to be more significantly impacted upon by land uses.

The main points to be aware of from the results are:

1. pH results indicate that the groundwater may need to by adjusted prior to use.
2. The groundwater may be affected by the oxidation of sulphides and needs to be monitored further.

3. The elevated metal concentrations in the groundwater in conjunction with the potential acid sulphate soil risk, requires monitoring of the groundwater to keep a check of possible problems.
4. As nutrient concentrations are already elevated above guideline concentrations, it will be important to make sure that all runoff water from the nursery is captured and treated to reduce nutrient concentrations prior to infiltration into the ground.

# 17 CONTINGENCY PLANS

The contingency plans for the site include the chemical storage facility and chemical rinsing's breakdown facility. This system has been designed to effectively contain and treat all chemical spill and clean-up operations.

The establishment of vehicle tracks and the design of the production areas will minimise the impact of erosion and other such storm damage. To prevent disruptions from electricity failure, a backup diesel-powered generator and uninterruptible power supply units will be installed on all water treatment and chemical injection controllers.

Through the use of the nutrient retention basin and responsible fertiliser management practices all nutrients will be contained on site. In the event that nutrient leaching to the groundwater is highlighted through the water-monitoring program, a nutrient minimisation and captivation program will be initiated. The design of this program will ensure that the nutrient source is located and the problem remedied.

# 18 REFERENCES

ANZECC 2000. Australian and New Zealand Environment and Conservation Council, Australian Water Quality Guidelines.

CDM Smith 2013. Hydrological modelling of land clearing on Rapids Road, Serpentine.

Department of Environment and Conservation 2013. Preliminary Assessment Report – Application to clear native vegetation under the *Environmental Protection Act 1986.*

Department of Environment and Conservation 2010. Contaminated Sites Management Series - Assessment Levels for Soil, Sediment, and Water, Feb 2010.

Department of Environment 2004. Acid Sulfate Soils Guideline Series – Guidance for groundwater management in urban areas on acid sulphate soils.

Department of Health 2006 *Contaminated Sites Reporting Guideline for Chemicals in Groundwater*

Department of Water 2010. Water quality protection note 33 – Nutrient and irrigation management plans.

Department of Water 2012. Water Technical Series Lower Serpentine hydrological studies – conceptual model Report no. 45.

Department of Water 2013. Rights in Water and Irrigation Act 1914 advice for clearing permit application CPS 5441/1. Department of Water, Western Australia.

Environmental Protection Authority (2008). Guidance Statement 33 – Environmental Guidance of Planning and Development.

Mark Lund (2013) Advice on Damp land at 456 Rapids Road, Serpentine.

Nuts about Natives (2012) – Flora and Vegetation Survey of 456 Rapids Road, Serpentine

Terrestrial Ecosystems (2012a) – Black Cockatoo Assessment of 456 Rapids Road, Serpentine

Terrestrial Ecosystems (2012b) – Referral of proposed action, 456 Rapids Road, Serpentine Western Australia.

Standards Australia. 2005. AS 4482.1-2005. Guide to the Sampling and Investigation of Potentially Contaminated Soil. Part I: Non-volatile and semi-volatile compounds. Standards Australia, NSW.

Standards Australia/Standards New Zealand. 1998. AS/NZS 5667.1:1998. Water Quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of sample. Standards Australia and Standards New Zealand, Homebush NSW and Wellington NZ.

SEWPAC, 2012. Decision on referral. Wholesale Nursery, 456 Rapids Road, Serpentine, WA

Vaune and Graeme Hall (2012) Nutrient and Irrigation Management Plan: Northern Portion Lot 25 (Lot 607) Holmes Rd Oakford.

# Appendix A – Hydrological modelling of land clearing on Rapids Road, Serpentine (CDM Smith 2013)

MDW Environmental Services

# Hydrological modelling of land clearing on Rapids Road, Serpentine: REVISED

CDM Smith

MDW Environmental Services

# Hydrological modelling of land clearing on Rapids Road, Serpentine: REVISED

23 July 2013

CDM Smith Australia Pty Ltd
ABN 88 152 082 936
11/300 Rokeby Road
Subiaco, Perth
WA 6008
Tel: +61 8 9381 8855
Fax: +61 8 9381 8822

# Table of Contents



# List of Figures



# List of Tables

# Appendices

Appendix A - Disclaimer and Limitations

# Document History and Status

| Revision | Date Issued | Reviewed By | Approved By | Date Approved | Revision Type |
|---|---|---|---|---|---|
| REVA | 03 July 2013 | Andrew Brooker | | | Draft |
| REVB | 04 July 2013 | Lynn Reid | Lynn Reid | 04 July 2013 | Draft |
| REV0 | 12 July 2013 | | Lynn Reid | 12 July 2013 | Final |
| REV1 | 23 July 2013 | Lynn Reid | Lynn Reid | 23 July 2013 | Revision 1 |
| | | | | | |
| | | | | | |

# Distribution of Copies

| Version | Date Issued | Quantity | Electronic | Issued To |
|---|---|---|---|---|
| REVB DRAFT | 04 July 2013 | 1 | 1 | Greg Watts |
| REV0 FINAL | 12 July 2013 | 1 | 1 | Greg Watts |
| REV1 REVISION | 23 July 2013 | 1 | 1 | Greg Watts |
| | | | | |
| | | | | |

| | |
|---|---|
| **Printed:** | 23 July 2013 |
| **Last Saved:** | 23 July 2013 02:48 PM |
| **File Name:** | PGW130026_RapidsRoadHydrology_Rev1_20130723.docx |
| **Author:** | Isabelle Dionne, Lynn Reid, Evan O'Brien, Andrew Brooker |
| **Project Manager:** | Lynn Reid |
| **Client:** | MDW Environmental Services |
| **Document Title:** | Hydrological modelling of land clearing on Rapids Road, Serpentine: REVISED |
| **Document Version:** | Final |
| **Project Number:** | PGW130026.01 |

# Executive Summary

CDM Smith Australia Pty (CDM Smith) has been commissioned by MDW Environmental Services (MDW) to prepare a hydrologic study of the proposed development of a nursery at 456 Rapids Road in Serpentine, Western Australia. The nursery would sit on an impermeable pad which would cover less than a third of the site. This revised report considers that an area of native vegetation and a wetland on the southern portion of the site will not be cleared. All water used in the nursery operations would be captured and treated.

The WA Department of Environment and Conservation (DEC) has expressed concerns about the impact of the proposed nursery to flora, fauna, and the hydrological regime. In the context of hydrology, the DEC was particularly concerned about decreased surface water discharge to a wetland on the adjacent northern property. CDM Smith has performed a study to understand existing water movement and how the construction of the nursery will cause hydrological changes to surface and groundwater. This revised report also addresses changes to the retained southern wetland.

The study site has surface soils of Bassendean Sand and Guildford Clay. Recharge to groundwater occurs through freely draining sandy soils in the Surficial Aquifer. Much of the site is classified as a geomorphic Dampland wetland of Resource Enhancement status.

Rainfall in Serpentine exceeds evapotranspiration. The ratio of rainfall to runoff would be quite low, with most rainfall events generating little or no runoff, particularly in the warmer months.

Topographic analysis of ground elevations determined that the site contains three subcatchments, which primarily drain to the west and northwest. The proposed development will decrease the area of the subcatchment draining to the northern wetland by 16%, and the area draining to the southern wetland by 33%.

Hydrologic modelling was performed to estimate the impact on surface water flows. The magnitude of extreme flows to the northern wetland was determined with XP-RAFTS, a runoff-routing model. The change in total volume to the wetland was determined with AWBM, a daily water balance model.

The overall impact on the volume and discharge rate of surface water flows is relatively minor, due to the high rates of infiltration and low annual rainfall. This conclusion is reflected in both the design rainfall approach and the AWBM approach. The northern wetland will receive approximately 16% less volume of water and 10% lower peak discharge. The southern wetland will receive approximately 31% less volume of water and 28% lower peak discharge, but will retain all runoff in the post-development design.

Groundwater flow will not be significantly impacted at the site due to low recharge and lateral rates of flow. Development is likely to increase depth to water and is unlikely to result in water-logging. Nitrogen concentrations in groundwater and surface water are unlikely to change significantly due to the proposed development.

The hydrologic study points out that care is needed in the design of the nursery site to avoid waterlogging outside the nursery and provide for sufficient capture of high rainfall events.

# Section 1 Introduction and Purpose

Mr Graeme Hall and Mrs Vaune Hall have applied to the Western Australia Department of Environment and Conservation (DEC) for permission to develop a wholesale nursery within Lot 838 on Rapids Road, Serpentine, Western Australia. This development proposes to clear approximately 17 hectares of native vegetation and adjust land surface levels. The owners have engaged MDW Environmental Services (MDW) to assist with the application process. The DEC has identified several potential environmental impacts, including vegetation, wildlife, land use, hydrologic, and hydrogeological concerns. An initial response by MDW, including hydrologic modeling, was provided to DEC in July 2013. This revised report includes an alternative development proposal which retains a native wetland on the southern section of the lot.

CDM Smith Australia Pty (CDM Smith) has been commissioned by MDW to develop hydrological and hydrogeological models to assist with the regulatory requirements at the site. The modelling has been developed to meet the following objectives:

- Understand existing hydrological conditions on the lot to quantify the water supply to adjacent wetland and lots.
- Predict hydrological changes from the construction of a wholesale nursery on the nearby wetland and lots.
- Estimate and predict water discharge and nitrogen loading to groundwater from operational activities.

This report provides information about the potential impacts to surface water and groundwater as a result of the construction of the nursery using the revised development layout.

# Section 2 Data Analysis

## 2.1 Proposed development

The proposed commercial development will extend across approximately 17 hectares of land at the site, and be located on a nearly flat graded impermeable pad at 27.3 m AHD. Excluded from the cleared area is a native wetland plus a buffer zone in the central southern portion of the site. Clean fill will be added to the pad, and pot plants grown on top. The plants will be watered and fed with a nitrate-free but phosphorus-containing fertiliser. After development, all rainfall onto the pad and water used within the facility will be retained onsite, treated, and reused. Figure 2-5 shows the development layout, with a shaded area illustrating the development zone. This development will excise the southern wetland as indicated on the map.

## 2.2 Topography

Detailed contours derived from a topographic survey have been supplied by MDW. Land surface elevations vary between 24 and 32 m AHD across the site (see Figure 2-5). The lot is generally flat with a slight grading toward the west, although sandy rises create higher areas on the lot. A few elevation contours outside of the lot boundary were provided by MDW but are not extensive. For the area outside lot boundaries, digital elevation data (DEM 1 second/30 m derived from SRTM; Geoscience Australia, 2011) was also available. When this smoothed data was compared to the detailed survey, the elevation and profile were considerably different and this DEM data source was discounted. No other detailed topography is available outside of the property boundaries.

## 2.3 Geology and soils

DEC commissioned a flora and vegetation survey by Nuts about Natives (DEC, 2013a) and a site assessment by the office of the Commissioner of Soil and Land Conservation. The survey identified soil types within the study area which may support ecological communities.

The surface geology in the study area is primarily associated with the Bassendean Sand. As indicated in Marillier et al. (2012) the sand sequence in likely to be relatively thin at this location. Bassendean Sands (Qb) will be underlain by the Guildford formation (Qg). A quaternary sand sequence (Qn) is the lowermost superficial aquifer unit. Figure 2-1 shows a stratigraphic cross-section (from Marillier, 2012). In this cross-section, Rapids Rd would lay between bore T460 and T470. Surface soils mapping shows that in some areas in the north of the study area are Pinjarra soils associated with the Guildford clay. Underlying the Superficial Aquifer is the Wanneroo Member (Kwlw) of the Leederville formation, which forms part of the Leederville Aquifer.

The Bassendean Sand is a pale grey to white and occasionally brown, moderately sorted, fine- to medium-grained quartz sand with traces of heavy minerals. The Guildford Clay is described as pale grey, blue, but mostly brown silty and slightly sandy clay. The Quaternary sand is described as consisting of pale grey to grey-brown, fine- to very-coarse-grained, very poorly sorted, subrounded to rounded quartz and abundant feldspar.

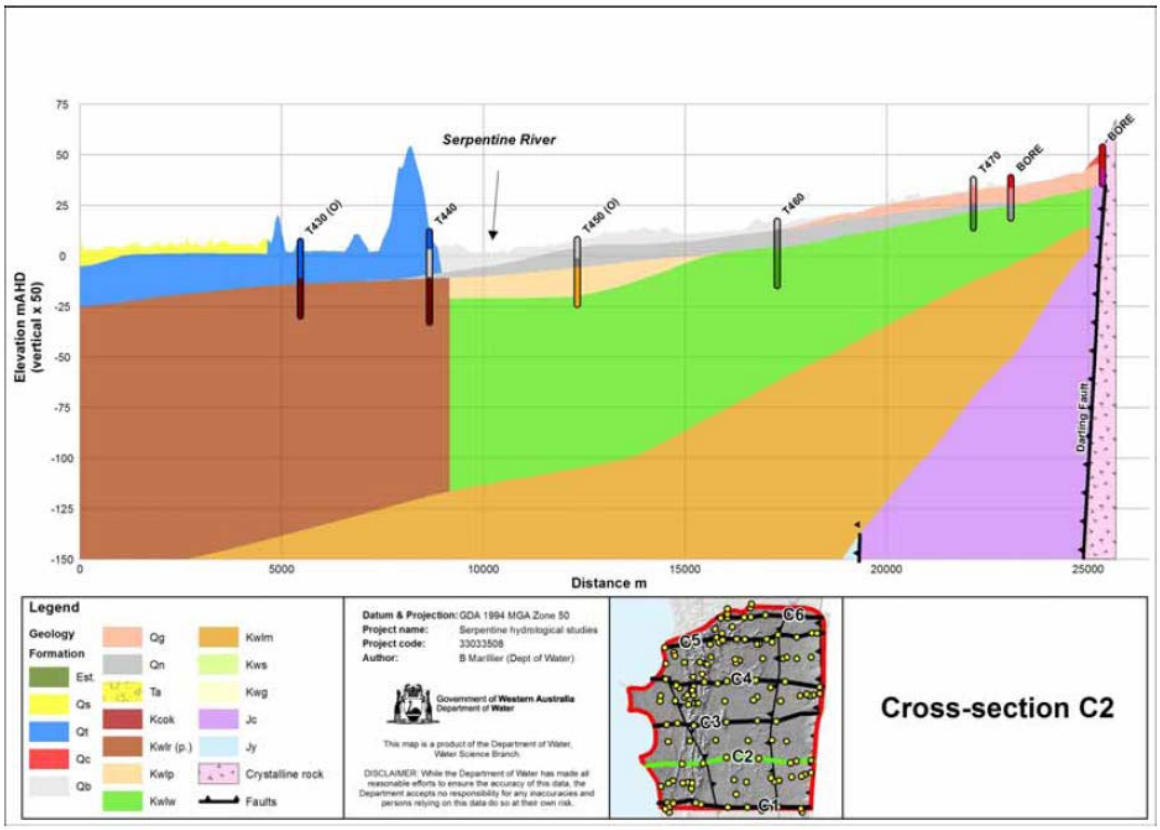



**Figure 2-1 Cross section near study site (from Marillier et al. 2012).**

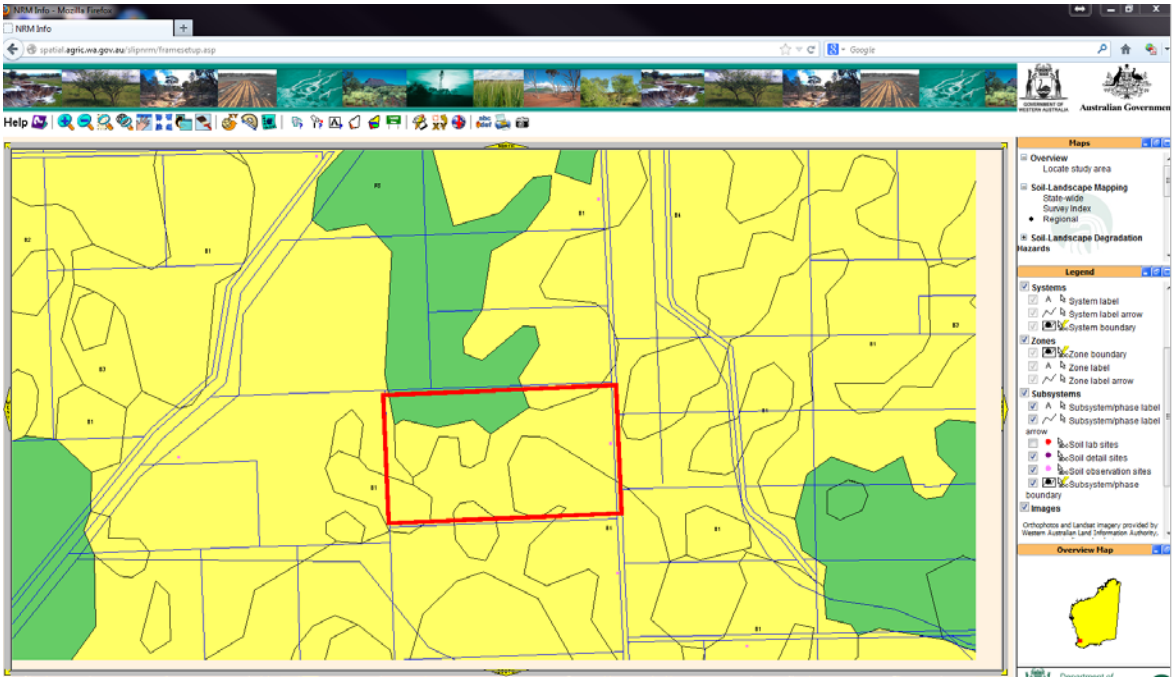



**Figure 2-2 Soil types at site: Bassendean Soil (yellow), Pinjarra Soil (green) (from SLIP NRM, 2013).**

## 2.4 Wetlands

The study area contains geomorphic wetlands designated Resource Enhancement (DEC, 2013b) and is considered a Dampland. This assessment was confirmed by site visits commissioned by MDW (Lund, 2013). A wetland situated in the next property north of the lot is also a source of concern from the DEC as it may support important ecological communities.

The survey by Lund (2013) indicated that the wetlands on 456 Rapids Road are disconnected from wetlands to the north of the property by surface drains. However, as the on-site wetlands are in relatively good condition, the proposed nursery development will maintain the wetlands and a 10 m buffer around the dampland area containing native vegetation in relatively good condition (see Figure 2-5).

## 2.5 Rainfall data

The climate in Serpentine is characterised by hot dry summers and cool wet winters. The Bureau of Meteorology data for the region (Site 9039) indicates that 84% of the rainfall falls during the winter months of May to October. Average annual rainfall is 919 mm, with pan evaporation exceeding rainfall with an average of 1675 mm. As such, the ratio of rainfall to runoff would be quite low, with most rainfall events generating little or no runoff, particularly in the warmer months.

Figure 2-3 illustrates rainfall and pan evaporation distribution over the year (Marillier et al., 2012).

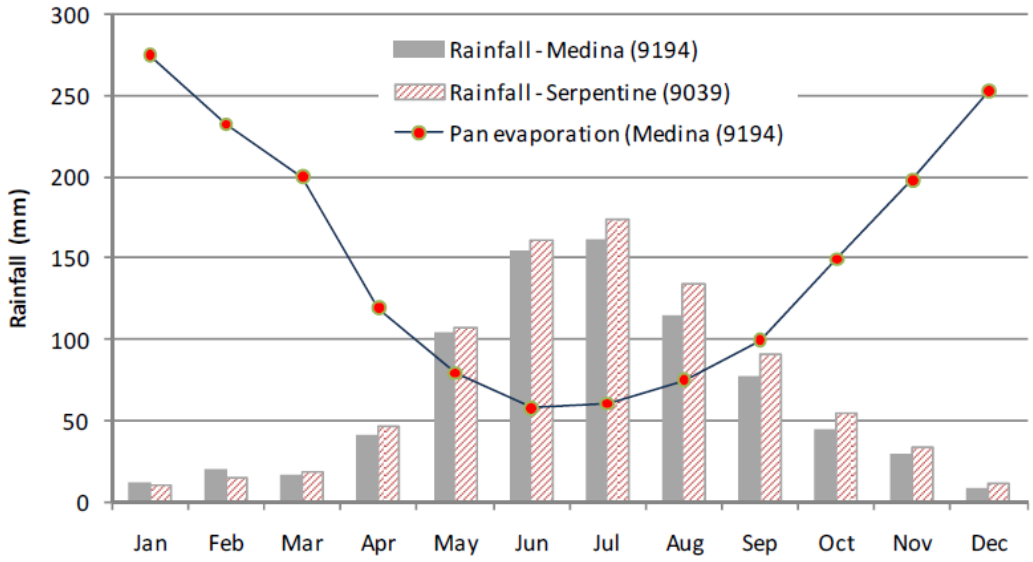



**Figure 2-3 Monthly average rainfall and pan evaporation (from Marillier et al., 2012).**

To analyse the changes in total volume reporting to the wetlands within the lot and north of the lot, a daily water balance is required. The water balance is informed by the most recent 14 months of recorded daily rainfall and daily evaporation data from the Serpentine station and nearby Karnet station, respectively. The total rainfall over this period was 870 mm. These data are implemented in the Australian Water Balance Model (AWBM), and the results discussed in detail in Section 3.

To predict the changes in the magnitude of extreme flows to the wetland, the Design Rainfall procedure is adopted. Using this method, an estimate of rainfall is obtained which has a specified

probability of occurring in any given year. In this case, the assessment focuses on the 50 year and 100 year Average Recurrence Interval (ARI) events; that is, probabilistic estimates of rainfall that has a one-in-fifty and one-in-one hundred chance of occurring in any given year.

An Intensity-Frequency-Duration (IFD) table of design rainfall was created for the Serpentine area by using the online tool at the Bureau of Meteorology website (BOM, 2013). The temporal characteristics of design rainfall were taken from the Engineers Australia publication "Australian Rainfall and Runoff" (Pilgrim, 2001). The IFD data and the temporal patterns are used in the RAFTS runoff routing model, which is discussed in detail in Section 3.

## 2.6 Pre- and post-development subcatchments

This area of Serpentine is mostly agricultural and contains a system of drains. One of these drains crosses Rapids Road and Lot 858 to discharge in a wetland situated north of the property. A drain situated on the lot north of the proposed development lot also discharges into this wetland. Two surface water WIN sites (Atlas, DoW) are situated on each of these drains but do not have continuous recorded flow data.

Subcatchments on the lot have been delineated from the topography and are presented on Figure 2-4. As mentioned in Section 2.2, no elevation data was available outside of the lot boundary except from a few contour lines. The lot boundary was therefore assumed primarily to form the boundary for the subcatchments. In the largest subcatchment it was possible to confidently include a portion of the adjacent southern lot into the contributing area, as the SRTM data and visual inspection of aerial photographs provided supporting evidence.

- Subcatchment 1 is located on the southern part of the lot and drains towards the northwest. A portion of the drainage area comes from the adjacent southern lot. This subcatchment contains the southern wetland.
- Subcatchment 2 is situated on the eastern portion of the lot. Runoff drains in a northwesterly direction via a drain towards the northern wetland.
- Subcatchment 3 is the smallest catchment and also discharges in a northwesterly direction with eventual drainage north across the property boundary.

Figure 2-5 presents the post-development layout and subcatchments.

- Subcatchment 1 will be divided in two. Part A will still drain towards the west; however Part B becomes isolated by the nursery fill pad. It is proposed that Part B will be principally self-contained with runoff collecting in the southern wetland. When water levels within the southern wetland reach approximately 0.25m in depth, additional runoff will be directed to Subcatchment 2 by an engineered controlled level drain. This occasional connection between the two subcatchments is not modelled in this report; Subcatchment 1B will be modelled as a water sink.
- Subcatchment 2 will lose 3.27 ha to the nursery. This catchment drains into the northern wetland via a drain. Grading will be performed in this subcatchment to prevent ponding in the lower area close to the nursery and also in the higher areas to prevent runoff from entering the nursery.
- Subcatchment 3 will be 1.02 ha bigger after the development. Grading will be performed on this subcatchment to prevent ponding in the lower areas close to the nursery.

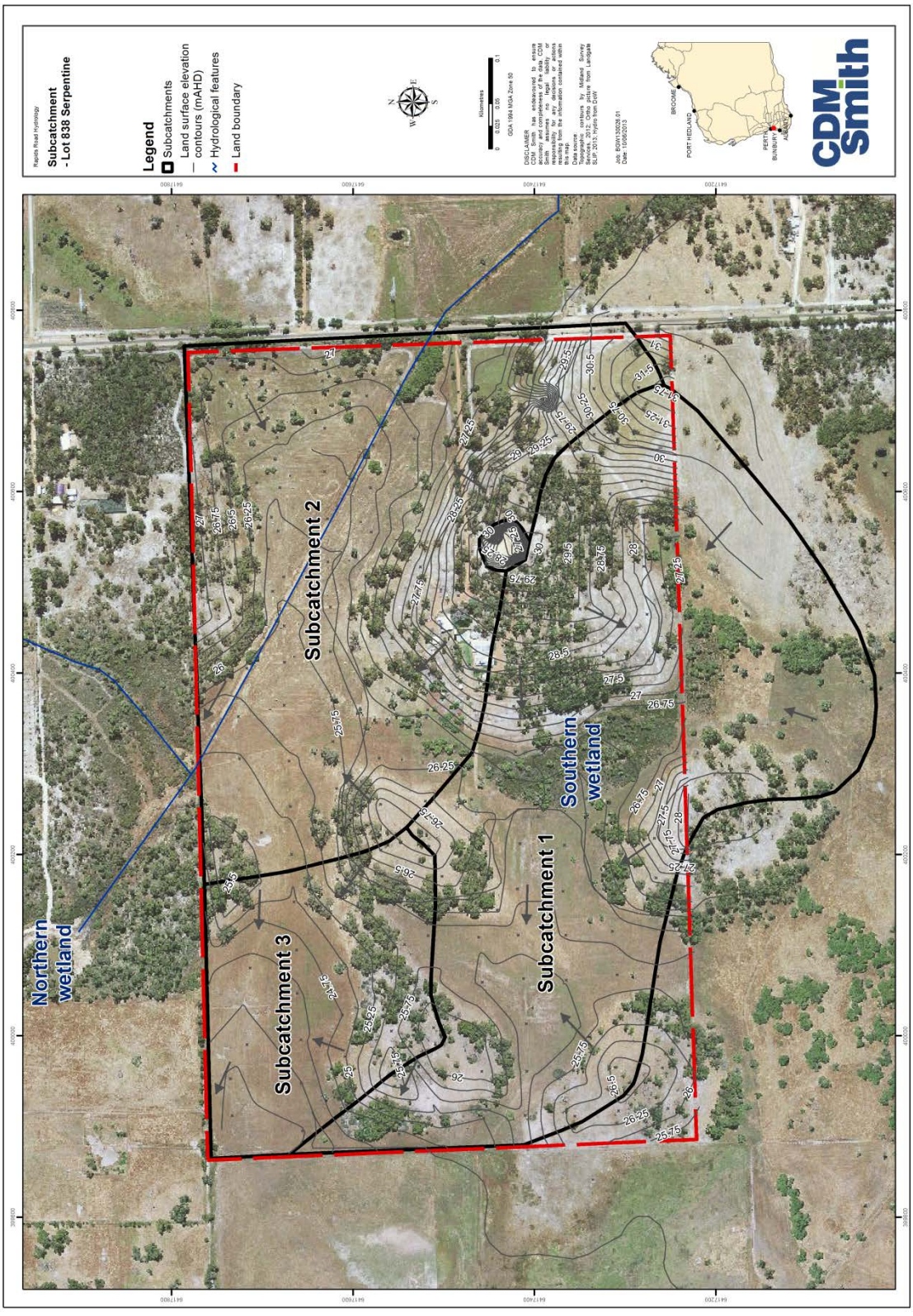



**Figure 2-4 : Pre-development subcatchments.**

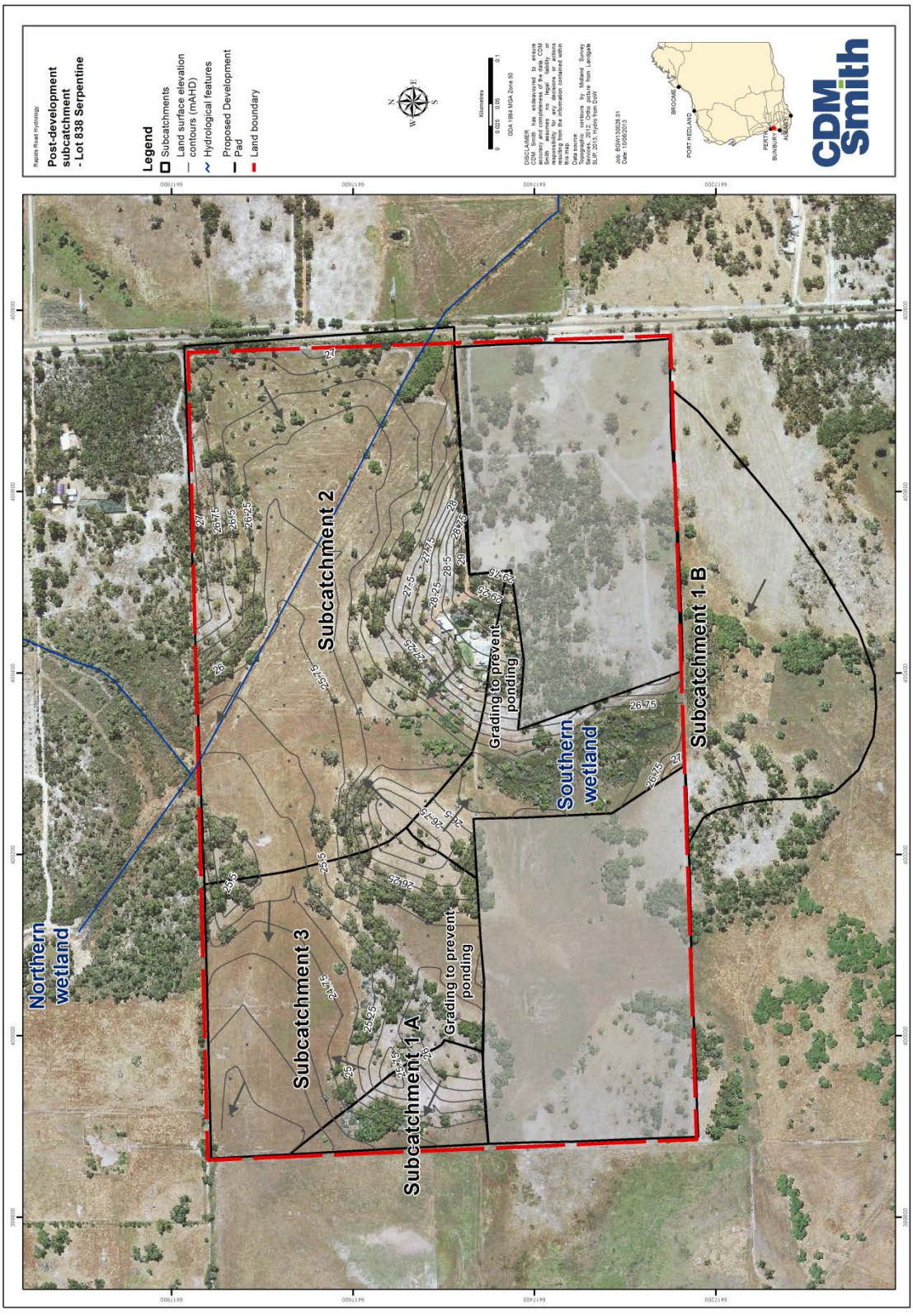



**Figure 2-5 : Post-development subcatchments.**

# Section 3 Surface Water

The objective of this hydrologic analysis is to quantify the likely change in runoff to the wetlands as a result of the proposed development. It is important to understand that the total area offsite draining into the northern wetland is large, and the contribution of Subcatchment 2 on Lot 838 represents a small fraction of the overall drainage to this wetland. The southern wetland receives runoff from approximately two-thirds of the original catchment.

Hydrologic modelling was performed with two methodologies. The magnitude of extreme flows to the wetlands was determined with a runoff-routing model. The change in total volume to the wetlands was determined with a daily water balance model.

## 3.1 Runoff Routing

### 3.1.1 XP-RAFTS model

Surface runoff can be estimated for rainfall events using topographic data, vegetation, soil type, land use and the existing channel network. For this project, the hydrologic model XP-RAFTS (XP solutions, 2013) was used to evaluate the likely magnitude of surface runoff. The model utilises Laurenson's non-linear routing method to derive an estimate of the runoff hydrograph from a given rainfall event. This runoff-routing model has been shown to provide good replication of observed catchment response and for this reason is in widespread use across Australia.

Runoff is determined by the difference between rainfall and losses. Losses come generally from infiltration into the soil. The remaining precipitation, referred to as 'rainfall excess,' is available to the surface water system as runoff.

Several different conceptualisations exist to represent rainfall losses. For this model we have adopted the Initial-Continuing model. It is comprised of an Initial Loss parameter (specified in millimetres), which represents the depth of rainfall that infiltrates before runoff occurs, and a Continuing Loss parameter (specified in millimetres per hour), which is representative of the ongoing infiltration rate that occurs after the Initial Loss. Although conceptually quite simple, it is an effective way to account for rainfall losses, and is appropriate for our case where the absence of site-specific data precludes the use of a physically based model, such as the Green-Ampt equation.

The infiltration rate is not specific to a particular soil and will depend on other parameters such as the surface condition, surface roughness and site management (Moore, 2001). In Section 2.3, the soil on the lot is described as sandy soil with sparse vegetation; however no data are available to against which to calibrate the model. Based on the sandy soil properties and the cleared lot, loss rates representative of the region have been assumed and are presented in Table 3-1.

**Table 3-1 Initial and Continuous Loss parameter for hydrological modelling.**

| Land type | Initial Loss (mm) | Continuous Loss (mm/hr) |
|---|---|---|
| Sandy soil with sparse vegetation | 20 | 5 |

The RAFTS model consists of one 'node' for each of the sub-catchments under consideration. Sub-catchment areas and slopes were measured in GIS, with slopes (on an equal area basis) found to be generally quite flat, in the range of 0.4% to 0.8%. A Manning's roughness of 0.04 was adopted,

based on the advice of Chow (1959), whereby it is listed as a representative value for grassed areas with scattered small brush.

Multi-storm analysis was conducted to determine storm duration that produced the largest peak discharge (the critical duration) for each of the subcatchments. Results are shown below in Table 3-2 for the pre-development case.

**Table 3-2: XP-RAFTS Peak Runoff: Pre-development case.**

| Subcatchment | Area (ha) | Peak Runoff Rate ($m^3/s$) | |
|---|---|---|---|
| | | 50 year ARI | 100 year ARI |
| 1 | 24.98 | 0.46 | 0.57 |
| 2 | 20.60 | 0.41 | 0.52 |
| 3 | 7.12 | 0.17 | 0.20 |

### 3.1.2 Rational Method model

In the absence of any gauged data, we can gain some degree of confidence in the pre-development results by comparing peak runoff rates from XP-RAFTS to those calculated using the Rational Method (Dooge, 1959). A Rational Method analysis was carried out for the Pre-development Case subcatchments, following the regional method for Western Australia (Pilgrim, 2001). Results for the 100 year ARI design rainfall event are shown in Table 3-3 below:

**Table 3-3: Comparison of XP-RAFTS and Rational Method.**

| Subcatchment | Area (ha) | 100 year ARI Peak Runoff Rate ($m^3/s$) | | |
|---|---|---|---|---|
| | | XP-RAFTS (1) | Rational Method (2) | % Change (1) : (2) |
| 1 | 24.98 | 0.57 | 0.52 | 8.8% |
| 2 | 20.60 | 0.52 | 0.45 | 13.5% |
| 3 | 7.12 | 0.20 | 0.17 | 15% |

The comparison shows that the peak runoff rates estimated by the two different methods differ by between 9 and 15 percent. This can be considered a good agreement on ungauged catchments, and gives confidence that the model results are of the correct magnitude.

### 3.1.3 XPRAFTS Post-development results

The XP-RAFTS model described above was then run for the post-development case. Results are shown in Table 3-4 for the 50 year and 100 year ARI design rainfall events.

**Table 3-4: XP-RAFTS Peak Runoff: Post-development case.**

| Subcatchment | Area (ha) | Peak Runoff Rate ($m^3/s$) | |
|---|---|---|---|
| | | 50 year ARI | 100 year ARI |
| 1A | 1.53 | 0.07 | 0.10 |
| 1B | 10.37 | 0.32 | 0.41 |
| 2 | 17.33 | 0.36 | 0.47 |
| 3 | 8.14 | 0.18 | 0.22 |

Of most interest is the comparison of the pre- and post-development cases for Subcatchment 2, where the northern wetland is situated. Table 3-5 presents this comparison for the peak discharge of the 100 year ARI. Results show that the decrease in area of approximately 16% for Subcatchment 2 results in a peak discharge decrease of less than 10%, likely due to the non-linear nature of catchment response to rainfall. From this we can conclude that the change in peak runoff to the northern wetland as a result of extreme rainfall events is unlikely to be greatly altered by the proposed development.

**Table 3-5: Comparison of XP-RAFTS Peak Runoff for pre-development and post-development. Asterisk indicates subcatchments with considerably altered drainage pattern.**

| Subcatchment | 100 year ARI Peak Runoff Rate ($m^3/s$) | | |
|---|---|---|---|
| | Pre-development (1) | Post-development (2) | % Change (1) : (2) |
| 1→1B* | 0.57 | 0.41 | 28% |
| 2 | 0.52 | 0.47 | 9.6% |

The southern wetland is contained in the middle of the in the pre-development Subcatchment 1, whereas all of post-development Subcatchment 1B drains into this sink. Hence results shown in Table 3-5 for Subcatchment 1→1B represent different drainage patterns across the pre- and post-development subcatchments. The pre- to post-development peak runoff for the southern wetland has decreased by 28% due to a decrease in drainage area contributing to the wetland of approximately 33%.

## 3.2 AWBM model

For typical smaller magnitude, more common rainfall events in the Serpentine region, the bulk of precipitation is lost in to the soil with little or no overland flow produced as a result. In this case, the Design Rainfall method is not a particularly appropriate method for estimating flows, as it is likely to show zero runoff from, say, the 1 year ARI rainfall event due to the fixed nature of the assumed rainfall loss model. In reality, rainfall losses are a function of antecedent soil moisture – a fact that is of greater importance for the smaller ARI events – and several small rainfall events in succession may produce observable runoff.

To account for this, an Australian Water Balance Model (AWBM, see Boughton, 2010) was created, through which recent historic rainfall could be routed to gain an idea of the volume of water reporting to the wetland. The AWBM uses three conceptual surface stores to simulate partial areas of runoff. At each timestep, rainfall is added to and evaporation subtracted from each store. If the value of moisture in the store exceeds the capacity of the store, excess moisture becomes runoff which is then split into a surface runoff component and a baseflow component. Figure 3-1 illustrates the conceptualisation.

An AWBM model requires the following parameters:

**Average Surface Storage Capacity (S) –** The key parameter determining the amount of runoff. It is disaggregated into a set of capacities and partial areas using a fixed pattern, as per the work of Boughton (2004).
**Base Flow Index (BFI)** – The proportion of the rainfall excess that reports to the baseflow store.
**Base Flow Recession Constant (Kb)** – One minus the proportion of the baseflow store that is discharged per day.

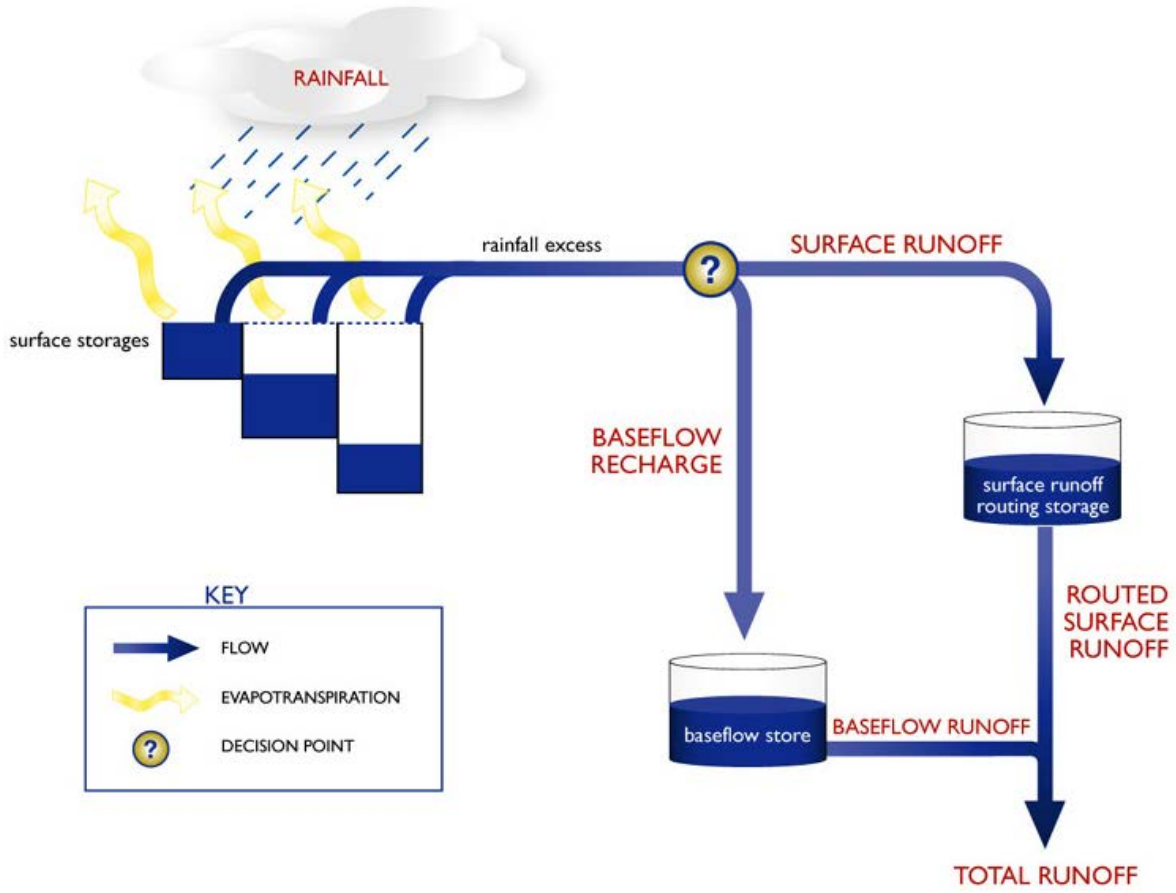



**Figure 3-1: AWBM conceptualisation**

For this study, in the absence of calibration data an average set of parameter values is adopted based on studies conducted in ten Western Australian catchments (Boughton, 2010), as shown in Table 3-6.

**Table 3-6: Adopted AWBM parameters.**

| Parameter | Value |
|---|---|
| Surface Storage Capacity | 410 mm |
| Base Flow Index | 0.56 |
| Baseflow Recession Constant | 0.956 |

The model simulated the likely runoff that would arise from 14 months of observed rainfall data, from May 2012 to July 2013, for both Subcatchments 1B and 2. Figure 3-2 presents the simulated runoff for this period to the northern wetland in blue and the southern wetland in red. Most of the runoff occurs during the winter months when the rainfall is higher and the evaporation rate is lower. Over this simulation period, monthly average winter rainfalls are lower than long term trends at site 9039 (see Figure 2-3). During the summer months, a higher evaporation rate produces almost no runoff towards the wetland. This model does not take into account recharge to groundwater.

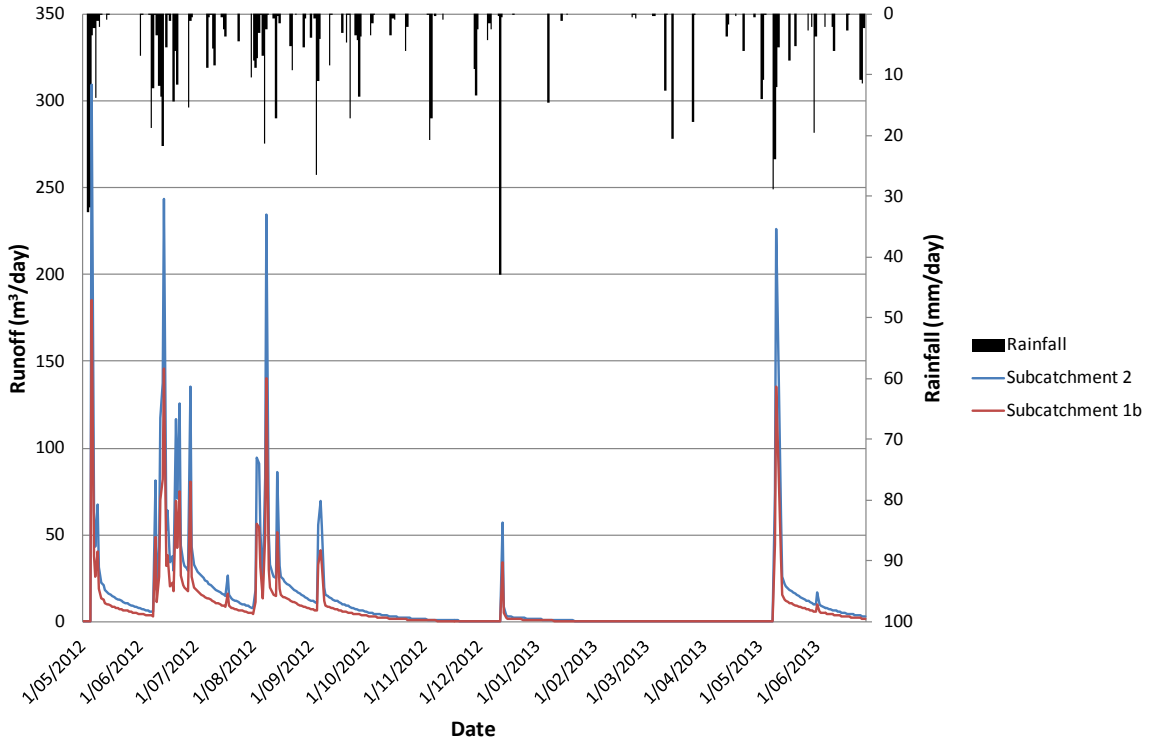



**Figure 3-2: AWBM results: Post-development runoff to wetlands**

To evaluate the change in volume of water to the northern wetland, runoff was integrated over the simulation period of 14 months. Volumes of water to Subcatchment 1/1B and Subcatchment 2 in both the current state and the future post-development state are presented in Table 3-7 below.

**Table 3-7: AWBM results: Comparison of surface runoff to wetlands. Asterisk indicates subcatchments with considerably altered drainage pattern.**

| Subcatchment | Surface Runoff (m³) | | |
|---|---|---|---|
| | Pre-development (1) | Post-development (2) | % Change (1) : (2) |
| 1→1B* | 5032 | 3479 | 31% |
| 2 | 6910 | 5813 | 16% |

As expected, the change in surface runoff to the northern wetland from Subcatchment 2 was found to be approximately equal to the change in contributing catchment area, with decreases both by 16%. However, in both cases the total surface runoff represented only around 3% of the incident rainfall to the catchment (total observed rainfall of 870 mm), suggesting the majority of precipitation is either lost as evaporation or contributes to groundwater recharge. Alteration to the surface runoff regime by the proposed development is neither particularly large, nor is it likely the dominant factor with respect to inflows on a water balance of the wetland.

Likewise, the decrease in surface runoff to the post-development Subcatchment 1B and the southern wetland is similar to the change in contributing catchment area. The portion of Subcatchment 1 'upstream' of the southern wetland will be decreased by approximately 33% by the nursery development, while surface runoff decreases 31% over the 14 months of simulation. Despite this decrease, the self-contained nature of the post-development southern wetland will ensure that maximum runoff is retained in this dampland.

# Section 4 Groundwater

## 4.1 Conceptual hydrogeological model

Watertable contours from regional bores measured in May 2003 (DoW, 2013b) show that the groundwater flow is in a North-Westerly direction , on lot 838, approximately 24 m. Season variations in Groundwater levels of 2-3 m are indicted from nearby bores with the seasonal minimum occurring around May.

Six monitoring bores have been installed into the Superficial Aquifer at the site by MDW. Although the bores are not yet surveyed, depth to water shortly after installation ranges from 0.5 to 5.5 m below ground. The shallowest water table is measured in the northwestern corner of the proposed development, and the deepest in the northeastern corner.

As described in Marillier (2012) the low hydraulic gradient and shallow watertable indicate that the water balance will have high vertical fluxes (e.g. recharge from rainfall and evapotranspiration) and small lateral fluxes (e.g. horizontal groundwater flow). Across most of the study area, recharge to the superficial groundwater is through free draining sandy soils. In areas where the watertable reaches the surface there will be a component of rejected recharge; that is, water that would have recharged the aquifer but instead runs off as surface flow. Most of the water flux in the Superficial Aquifer is expected to be vertical via recharge and evaporative losses, with lateral movement consisting of a much smaller portion.

Discharge to underlying aquifers occurs where a negative (downward) head gradient exists and no confining layer is present. Marillier (2012) indicates that the vertical head gradient in the study area is low. This, and the presence of semi-confining Guildford clay underlying the area, means that it is unlikely that significant downward discharge to the Leederville aquifer occurs.

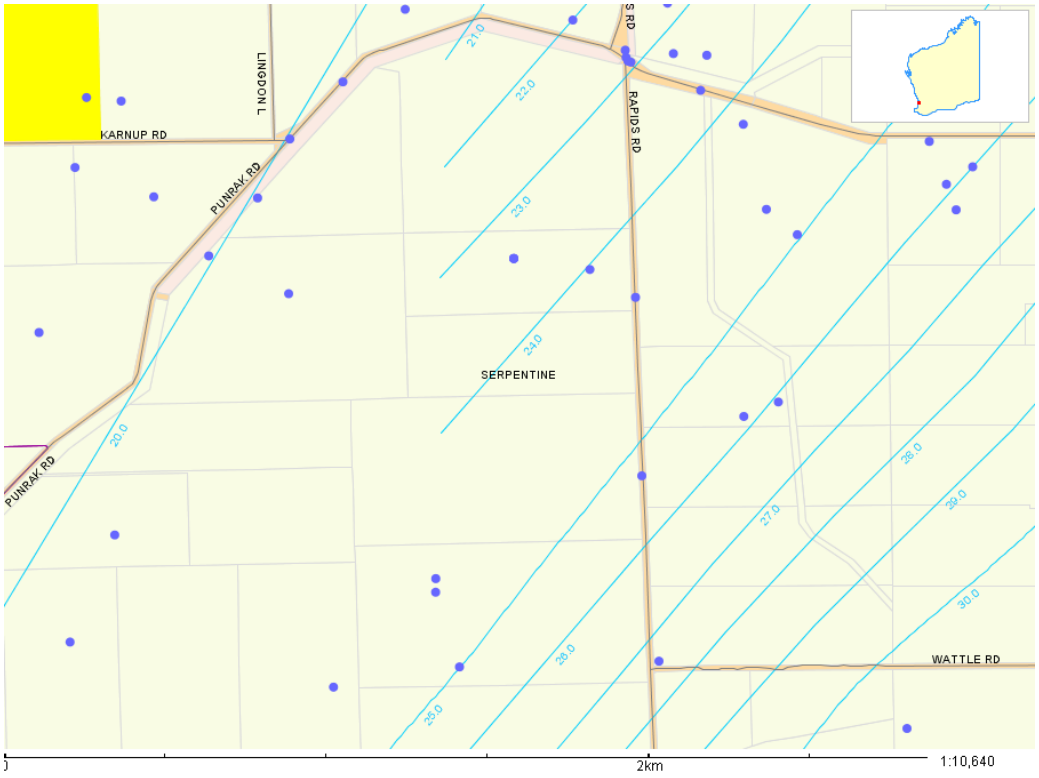



**Figure 4-1: Groundwater contours at May 2003 (from DoW 2013b).**

## 4.2 Groundwater impacts

The nursery site will be lined with impermeable materials, thereby reducing the rainfall recharge under the nursery pad to near zero. This will have the effect of lowering the water table. Groundwater evaporation also will be reduced via the filling of low-lying areas. Given the current dynamic regime of interacting groundwater with the landsurface, the net effect on lateral flow is likely to be small. Filling of low lying areas will mean that water-logging is unlikely as a result.

Groundwater sampling of the six wells installed by MDW (ALS Group, 2013) indicates groundwater is acidic (pH between 5.18 and 6.94), moderate in total dissolved solids (TDS between 350 and 1950 mg/L), with total nitrate as N between below detection of 0.01 to 8.19 mg/L, and total phosphorus as P between below detection of 0.05 to 1.05 mg/L. Values of nitrate as $NO_3$ ion would be measured up to 36 mg/L, with an average value from the six wells of 7.3 mg/L. This average value is in line with that reported by Yerstener (2010) and below the drinking water limit of 50 mg/L.

Removal of vegetation in the nursery development, and hence removal of the uptake of nitrogen by vegetation, will have the effect of increasing nitrogen levels in groundwater. Some sources estimate that nitrogen uptake from plants can contribute 1 to 34% of total nitrate loss in the nutrient cycle (Kadlec & Wallace, 2009). The internal drainage to the southern wetlands, and retention of the native vegetation, will help mitigate the changes caused under the nursery development pad. However, as the groundwater recharge will be nil under the pads, no significant increase of nitrate concentrations in groundwater is expected.

Note that no direct input of nutrients to the groundwater or surface water directly from the horticultural operation is expected. Hence groundwater or surface water eutrophication from the development is unlikely.

# Section 5 Conclusions and Recommendations

Review of data and hydrologic modelling lead to conclusions on the impact of the proposed nursery on surface and groundwater at the Rapids Road site.

- Most subcatchments at the site drain to the west and do not impact wetlands to the north of the property. One wetland exists in the southern portion of the development. The proposed development will decrease the area contributing to the northern wetland (Subcatchment 2) by approximately 16%. The area contributing to the southern wetland (Subcatchment 1B) will decrease by approximately 33%.
- The overall impact on the volume and discharge rate of surface water flows is relatively minor, due to the high rates of infiltration and low annual rainfall. This conclusion is reflected in both the design rainfall approach and the AWBM approach. The northern wetland will receive approximately 16% less volume of water and 10% lower peak discharge. The southern wetland will receive approximately 31% less volume of water and 28% lower peak discharge, but will retain all normal runoff post-development.
- Groundwater flow will not be significantly impacted at the site due to low recharge and lateral rates of flow. Development is likely to increase depth to water and unlikely to result in water-logging.
- Nitrogen loading to groundwater would increase slightly due to clearing but the impermeable nature of site operations means that nitrogen concentrations are unlikely to change significantly.

This study has highlighted a few issues which should be addressed in the nursery design.

- Consideration should be given to the grading of the site, the localised areas of fill, and the perimeter table drains to ensure that they are adequately sized to allow for free drainage away from the pads. Detailed analysis here was beyond the scope of this report.
- Runoff originating from the nursery fill pad area is proposed to be captured and treated as appropriate to the relevant standards. This report makes no comment as to the exact nature by which these goals will be achieved. Capture and storage of extreme rainfall events should be included in the treatment design.

# References


ALS Group (2013). Certificate of Analysis Work Order EP1301307 for Hope Valley Nusery [sic] Serpentine. 28 February 2013.

BOM (2013). Intensity Frequency Duration IFS data system, Bureau of Meteorology, Australian Government, http://www.bom.gov.au/water/designRainfalls/ifd/index.shtml.

Boughton, W (2004). The Australian water balance model, *Environmental Modelling & Software*, **19**(10), pp. 943—946.

Boughton, W (2010). Rainfall-runoff modelling with the AWBM, EA Books, Crows Nest, NSW.

Chow, VT (1959), Open-Channel Hydraulics, Part 1. Basic Principles, McGraw Hill Books, New York.

DEC (2013a) Letter to Mr Gregory Watts, MDW Environmental Services re *Application to clear native vegetation under the Environmental Protection Act 1986, reference CPS 5441/1*, Department of Environment and Conservation, 2 May 2013.

DEC (2013b). Geomorphic Wetlands Swan Coastal Plain dataset, Department of Environment and Conservation Western Australia, http://www.dec.wa.gov.au/management-and-protection/wetlands/wetlands-mapping/geomorphic-wetlands-swan-coastal-plain-dataset.html, sighted 12 June 2013.

Dooge, JCI (1959). A general theory of the unit hydrograph, *Journal of Geophysical Research,* **64**(2), pp. 241—256.

DoW (2013a) Geographic Data Atlas, http://www.water.wa.gov.au/Tools/Maps+and+atlases/Geographic+data+atlas/default.aspx#1, Department of Water, Government of Western Australia, sighted 12 June 2013.

DoW (2013b). Perth Groundwater Atlas, Department of Water, Government of Western Australia, http://www.water.wa.gov.au/idelve/gwa/, sighted 12 June 2013.

Geoscience Australia (2013). National Elevation Data Framework Portal, http://nedf.ga.gov.au/geoportal/catalog/main/home.page.

Kadlec, R and Wallace, S (2009). Treatment wetlands (2nd ed.), Taylor and Francis Group, Boca Raton, Florida.

Lund (2013). Advice on Dampland at 456 Rapids Rd, Serpentine. Letter from Associate Professor Mark Lund to Mobile Dewatering Environmental Services, 18 June 2013.

Marillier, B, P Kretschmer, J Hall & B Quinton, (2012), *Lower Serpentine hydrological studies – conceptual model report,* Water Science Technical Series, report no. 45, Department of Water, Western Australia.

Moore, G, (2001). Soilguide, A handbook for understanding and managing agricultural soils. Agriculture Western Australia Bulletin No. 4343.

Pilgrim, D (2001). Australian Rainfall and Runoff: Volume One: A Guide to Flood Estimation, Institution of Engineers, Barton, ACT.

SLIP NRM (2013). Information products for Natural Resource Management, Soil-Landscape mapping, http://spatial.agric.wa.gov.au/slip/products_viewNRM.asp, sighted 18 June 2013.

XP Solutions (2013). XP rafts, Urban & rural runoff routing application, Belconnen ACT, http://www.xpsolutions.com/wp-content/uploads/docs/xprafts-tech-desc.pdf

Yerstener, C (2010). Hydrogeochemical assessment of the Superficial aquifer, Department of Water Hydrogeological record series Report no. HG37, August 2010.

# Appendix A - Disclaimer and Limitations

This report has been prepared by CDM Smith Australia Pty Ltd (CDM Smith) for the sole benefit of the MDW Environmental Services for the sole purpose of determining developmental impacts on hydrology and hydrogeology at Rapids Road in Serpentine Western Australia.

This report should not be used or relied upon for any other purpose without CDM Smith's prior written consent. CDM Smith, nor any officer or employee of CDM Smith, accepts no responsibility or liability in any way whatsoever for the use or reliance of this report for any purpose other than that for which it has been prepared.

Except with CDM Smith's prior written consent, this report may not be:

(a) released to any other party, whether in whole or in part (other than to Department of Natural Resources and Mines officers, employees and advisers);

(b) used or relied upon by any other party; or

(c) filed with any Governmental agency or other person or quoted or referred to in any public document.

CDM Smith, nor any officer or employee of CDM Smith, accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

The information on which this report is based has been provided by MDW Environmental Services and third parties. CDM Smith (including its officer and employee):

(a) has relied upon and presumed the accuracy of this information;

(b) has not verified the accuracy or reliability of this information (other than as expressly stated in this report);

(c) has not made any independent investigations or enquiries in respect of those matters of which it has no actual knowledge at the time of giving this report to the Department of Natural Resources and Mines; and

(d) makes no warranty or guarantee, expressed or implied, as to the accuracy or reliability of this information.

In recognition of the limited use to be made MDW Environmental Services of this report, the Department of Natural Resources and Mines agrees that, to the maximum extent permitted by law, CDM Smith (including its officer and employee) shall not be liable for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by MDW Environmental Services or any third party as a result of or in connection with the information, findings, opinions, estimates, recommendations and conclusions provided in the course of this report.

If further information becomes available, or additional assumptions need to be made, CDM Smith reserves its right to amend this report.

MDW
ENVIRONMENTAL SERVICES

# Appendix B – Groundwater Field Sheets (February, June, August 2013)

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: HVN Location: SERPENTINE

Well ID: MW1 Date: 21/2/13 Sampler: JM

## Monitoring Well Information

Depth to Water: 2065 (mm TOC) Depth to Bottom: 0.66 (m)

Standpipe: 7765 (m) Monument Cover ☐ 7765

Lock: ☐ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: YSI TTA Kit: 4

Pump: TWISTER TALK Kit: 4

Dipper: D3

## Sampling

Sample ID: HVNMW1-01 COC No: E2011-109-01

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 9:10 | 6.63 | 419.7 | 0.56 | 22.5 | 48.2 | | |
| 9:15 | 5.76 | 4.14 | 2.48 | 21.3 | 147.7 | | |
| 9:20 | 5.70 | 416 | 5.75 | 21.1 | 150.7 | 0.25 | 0.05 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | | | | |
|---|---|---|---|---|---|
| 1 x 1000mL plastic GREEN | ☑ | 1 x 60mL plastic BLUE | ☑ | **BRING BACK & FILTER INTO: | |
| 1 x 125mL plastic YELLOW | ☑ | 1 x 60mL plastic RED/GREEN | ☑ | 1 x 60mL plastic MAROON | ☑ |
| 1 x 125mL plastic PURPLE | ☐ | 1 x 500mL plastic GREEN** | ☑ | 1 x 60mL plastic RED/GREEN | ☐ |

**Comments**

STRUGGLED TO REVISIT WELL

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: EZ011-109 Client: HVN Location: SERPENTINE

Well ID: MW2 Date: 20 Sampler: JM

## Monitoring Well Information

Depth to Water: 4510 (mm TOC) Depth to Bottom: 7170 (m)

Standpipe: .62 (m) Monument Cover ☐

Lock: ☐ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 451 TTA Kit: 1

Pump: TWISTER TALK Kit: 1

Dipper: D3

## Sampling

Sample ID: HVNMW2-01 COC No: EZ011-109-01

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 9.35 | 5.69 | 177.1 | 1.68 | 22.3 | 166.2 | | |
| 9.40 | 5.51 | 185.1 | 3.81 | 21.6 | 112.3 | | |
| 9.45 | 5.40 | 177.1 | 3.80 | 21.6 | 127.2 | 0.14 | 0.05 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Bottles — ASSESSMENT SUITE 1

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☐ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☐ | 1 x 60mL plastic RED/GREEN ☐ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☐ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic RED/GREEN ☐ |

## Comments

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: EZ011-109 Client: HVN Location: SERPENTINE

Well ID: MW3 Date: 21/2 Sampler: JM

## Monitoring Well Information

Depth to Water: 1750 (mm TOC) Depth to Bottom: 3.97 (m)

Standpipe: 0.59 (m) Monument Cover ☐

Lock: ☐ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 451 TTA Kit: 4

Pump: TWISTER TALK Kit: 4

Dipper: D3

## Sampling

Sample ID: HVNMW3-01 COC No: EZ011-109-01

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 9.55 | 5.26 | 582 | 0.9 | 24.9 | -27.1 | | |
| 10.00 | 5.38 | 463.5 | 4.01 | 24.4 | -18.0 | 0.81 | 0.05 |
| 10.05 | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☐ | 1 x 60mL plastic RED/GREEN ☐ | 1 x 60mL plastic MAROON ☑ |
| 1 x 125mL plastic PURPLE ☑ | 1 x 500mL plastic GREEN** ☑ | 1 x 60mL plastic RED/GREEN ☑ |

**Comments**

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: EZ011-109 Client: HUN Location: SERPENTINE

Well ID: MW4 Date: 21/2 Sampler: JM

## Monitoring Well Information

Depth to Water: 2000 (mm TOC) Depth to Bottom: ~~4.54~~ 4.54 (m)

Standpipe: 0.60 (m) Monument Cover ☐

Lock: ☐ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: YSI TTA Kit: Y

Pump: TWISTED TALK Kit: Y

Dipper: D3

## Sampling

Sample ID: HUNMW4-01 COC No: EZ011-109-01

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 10:15 | 6.31 | 681 | 0.12 | 25.9 | -79.1 | | |
| 10:20 | 6.43 | 766 | 2.84 | 25.9 | -66.1 | | |
| 10:25 | 6.34 | 806 | 5.50 | 25.8 | -33.5 | 0.29 | 0.15 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☑ | 1 x 60mL plastic RED/GREEN ☑ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☑ | 1 x 500mL plastic GREEN** ☑ | 1 x 60mL plastic RED/GREEN ☐ |

**Comments**

STRUGGLED TO REPLENISH WELL

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: HVN Location: SERPENTINE

Well ID: MW5 Date: 21/2 Sampler: JM

## Monitoring Well Information

Depth to Water: 1690 (mm TOC) Depth to Bottom: 3.06 (m)

Standpipe: 0.61 (m) Monument Cover ☐

Lock: ☐ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 451 TTA Kit: 1

Pump: TWISTER TALK Kit: 1

Dipper: D3

## Sampling

Sample ID: HVNMW5-01 COC No: E2011-109-01

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 10.40 | 6.73 | 706 | 0.69 | 27.9 | -78.1 | | |
| 10.45 | 6.63 | 748 | 5.93 | 27.1 | -61.2 | 0.38 | 0.08 |
| 10.50 | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Bottles — ASSESSMENT SUITE 1

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☑ | 1 x 60mL plastic RED/GREEN ☑ | 1 x 60mL plastic MAROON ☑ |
| 1 x 125mL plastic PURPLE ☑ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic RED/GREEN ☐ |

## Comments

WELL DRAINS VERY QUICKLY

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: HVN Location: SERPENTINE

Well ID: MW6 Date: 21/2/13 Sampler: JM

**Monitoring Well Information**

Depth to Water: 1880 (mm TOC) Depth to Bottom: 4.26 (m)

Standpipe: 0.69 (m) Monument Cover ☐

Lock: ☐ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

**Equipment IDs**

Water Quality Meter: 451 TTA Kit: Y

Pump: TWISTER TALK Kit: Y

Dipper: D3

**Sampling**

Sample ID: HVNMW6-01 COC No: E2011-109-01

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 11.00 | 5.62 | 720 | 0.22 | 25.5 | 61.7 | | |
| 11.05 | 5.62 | 816 | 0.07 | 24.9 | 10.0 | | |
| 11.10 | 5.57 | 8.48 | 0.07 | 24.8 | 0.8 | 0.32 | 0.09 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☐ | 1 x 60mL plastic RED/GREEN ☑ | 1 x 60mL plastic MAROON ☑ |
| 1 x 125mL plastic PURPLE ☑ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic RED/GREEN ☑ |

**Comments**

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: Hope Valley Location: Serpentine

Well ID: MW 1 Date: 18/6/13 Sampler: JC

| Monitoring Well Information | | | |
|---|---|---|---|
| Depth to Water: | 1.370 (mm TOC) | Depth to Bottom: | 7.80 (m) |
| Standpipe: | 0.70 (m) | Monument Cover | ☑ |
| Lock: ☑ None | ☐ Padlock (YL) | ☐ Enviro Cap | ☐ Gatic |

| Equipment IDs | | | |
|---|---|---|---|
| Water Quality Meter: | YSI 3 | TTA Kit: | 3 |
| Pump: | 1 | TALK Kit: | 4 |
| Dipper: | 2 | | |

**Sampling**

Sample ID: HVN MW1 02 COC No: E2011-109-02

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 824 | 5.90 | 408.7 | 2.09 | 20.9 | 162.3 | | |
| 829 | 5.77 | 407.0 | 1.13 | 20.9 | 171.7 | 0.15 | 0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| Bottles | | MW SUITE | | | |
|---|---|---|---|---|---|
| 1 x 1000mL plastic GREEN | ☑ | 1 x 60mL plastic BLUE | ☑ | | |
| 1 x 125mL plastic YELLOW | ☑ | 1 x 500mL plastic GREEN** | ☑ | 1 x 60mL plastic MAROON | ☑ |
| 1 x 125mL plastic PURPLE | ☑ | **BRING BACK & FILTER INTO: | | 1 x 60mL plastic RED/GREEN | ☑ |

**Comments**

MURKY GREY

RAN DRY after ~ 10 mins

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: Hope Valley Location: Serpentine

Well ID: MW 2 Date: 18/6/13 Sampler: JT

## Monitoring Well Information

Depth to Water: 4.630 (mm TOC) Depth to Bottom: 7.24 (m)

Standpipe: 0.70 (m) Monument Cover ☒

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 3 TTA Kit: 3

Pump: 1 TALK Kit: 4

Dipper: 2

## Sampling

Sample ID: HVNMW202 COC No: E2011-109-02

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 844 | 5.66 | 159.7 | 2.09 | 21.7 | 189.5 | | |
| 850 | 5.48 | 158.1 | 2.92 | 21.7 | 220.6 | 0.17 | 0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **MW SUITE**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☐ | 1 x 60mL plastic BLUE ☑ | |
| 1 x 125mL plastic YELLOW ☑ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic MAROON ☑ |
| 1 x 125mL plastic PURPLE ☑ | **BRING BACK & FILTER INTO: | 1 x 60mL plastic RED/GREEN ☑ |

## Comments

Tried to run dry

$O_2$ being drawn in as pumping but did not run dry. (could hear pump in well)

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: H.V. NURSERY Location: SERPENTINE

Well ID: MW3 Date: 18/6/13 Sampler: JT

## Monitoring Well Information

Depth to Water: 1.473 (mm TOC) Depth to Bottom: 4.00 (m)

Standpipe: 0.70 (m) Monument Cover ☑

Lock: ☑ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 3 TTA Kit: 3

Pump: 1 TALK Kit: 4

Dipper: 2

## Sampling

Sample ID: HVN MW3 02 COC No: E2011-109-02

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 903 | 4.80 | 647 | 0.0 | 18.4 | 89.4 | | |
| ~~9~~ 920 | 5.11 | 505 | 0.37 | 18.9 | -21.1 | 0.34 | 01 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **MW SUITE**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☐ | |
| 1 x 125mL plastic YELLOW ☑ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☑ | **BRING BACK & FILTER INTO: | 1 x 60mL plastic RED/GREEN ☑ |

**Comments**

Murky grey
Strong $H_2S$

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: Hope Valley Nurs Location: SERPENTINE

Well ID: MW4 Date: 18/6/13 Sampler: SJ

## Monitoring Well Information

Depth to Water: 1.73 (mm TOC) Depth to Bottom: 4.50 (m)

Standpipe: 0.70 (m) Monument Cover ☑

Lock: ☑ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 3 TTA Kit: 3

Pump: 1 TALK Kit: 4

Dipper: 2

## Sampling

Sample ID: HVN MW402 COC No: E2011-109-02

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 925 | 6.38 | 404 | 5.82 | 18.3 | -23.4 | 0.35 | 0.21 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **MW SUITE**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | |
| 1 x 125mL plastic YELLOW ☑ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☑ | **BRING BACK & FILTER INTO: | 1 x 60mL plastic RED/GREEN ☐ |

**Comments**

Ran dry repeatedly
Sampled after 15 mins
Intermediate results omitted due to running dry

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: MW5 Client: Hope Valley Location: Serpentine

Well ID: EZ0111-109 Date: 18/6/13 Sampler: JT

## Monitoring Well Information

Depth to Water: 1.293 (mm TOC) Depth to Bottom: 3.05 (m)

Standpipe: 0.70 (m) Monument Cover ☐✓

Lock: ☐✓ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 3 TTA Kit: 3

Pump: 1 TALK Kit: 4

Dipper: 2

## Sampling

Sample ID: HVN MW5 0L COC No: EZ11-107-02

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 945 | 6.45 | 396.1 | 1.97 | 18.6 | -44.2 | 0.60 | 0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **MW SUITE**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☐ | 1 x 60mL plastic BLUE ☐ | |
| 1 x 125mL plastic YELLOW ☐ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☐ | **BRING BACK & FILTER INTO: | 1 x 60mL plastic RED/GREEN ☐✓ |

**Comments**

RAN OM after 2 mins & every 30 seconds ~~3 mins~~

Pumped dry 3 times before sampling

fresh $H_2O$

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: HOPE VALLEY Location: SERPENTINE

Well ID: MW6 Date: 18/6/13 Sampler: JT

## Monitoring Well Information

Depth to Water: 1.652 (mm TOC) Depth to Bottom: 4.25 (m)

Standpipe: 0.70 (m) Monument Cover ☑

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 3 TTA Kit: 3

Pump: 1 TALK Kit: 4

Dipper: 2

## Sampling

Sample ID: HVN MW602 COC No: E2011-109-02

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 1000am | 5.51 | 845 | 0.15 | 19.1 | -10.5 | | |
| 1015am | 5.61 | 948 | 0.06 | 19.3 | -37.5 | 0.35 | 0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **MW SUITE**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☐ | 1 x 60mL plastic BLUE ☑ | |
| 1 x 125mL plastic YELLOW ☑ | 1 x 500mL plastic GREEN** ☑ | 1 x 60mL plastic MAROON ☑ |
| 1 x 125mL plastic PURPLE ☑ | **BRING BACK & FILTER INTO: | 1 x 60mL plastic RED/GREEN ☑ |

**Comments**

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: 12011.109 Client: HPV Location: Rapids Rd

Well ID: MW1 Date: 20/5/13 Sampler: JT

## Monitoring Well Information

Depth to Water: 8.30 (mm TOC) Depth to Bottom: _____ (m)

Standpipe: _____ (m) Monument Cover ☑

Lock: ☑ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: TSI (1) TTA Kit: 3

Pump: Twister 1 TALK Kit: 4

Dipper: 3

## Sampling

Sample ID: HPVMW1 03 COC No: 12011.109-03

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 728 | 6.53 | 352.0 | 9.1 | 15.0 | 193.7 | | |
| 734 | 5.46 | 3444 | 5.1 | 18.6 | 187.2 | 0.3 | 0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☐ | 1 x 60mL plastic RED/GREEN ☑ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☐ | 1 x 500mL plastic GREEN** ☐ | 1 x 60mL plastic RED/GREEN ☐ |

**Comments**

Ran dry after 5 - collected next sample

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: ~~AAW~~ E2011-109 Client: KPU Location: Rupicks Rd

Well ID: MW2 Date: 20/8/13 Sampler: JI

## Monitoring Well Information

Depth to Water: 3.79 (mm TOC) Depth to Bottom: _____ (m)

Standpipe: _____ (m) Monument Cover ☒

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: YSI 1 TTA Kit: (3)

Pump: TWISTER 1 TALK Kit: (4)

Dipper: (3)

## Sampling

Sample ID: HV-MW2 03 COC No: E2011-109-003

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 7.49 | 5.54 | 114.1 | 8.7 | 18.3 | 211.8 | | |
| 7.54 | 5.70 | 150.3 | 2.4 | 19.6 | 226.9 | | |
| 7.59 | 5.64 | 146.5 | 2.5 | 19.1 | 236.7 | 0.1 | 0.08 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☒ | 1 x 60mL plastic BLUE ☒ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☒ | 1 x 60mL plastic RED/GREEN ☒ | 1 x 60mL plastic MAROON ☒ |
| 1 x 125mL plastic PURPLE ☒ | 1 x 500mL plastic GREEN** ☒ | 1 x 60mL plastic RED/GREEN ☒ |

**Comments**

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: HPV Location: Rapids Rd

Well ID: MW3 Date: 20/8/13 Sampler: TJ

## Monitoring Well Information

Depth to Water: 820 (mm TOC) Depth to Bottom: _____ (m)

Standpipe: _____ (m) Monument Cover ☑

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: YSI 1 TTA Kit: 3

Pump: TWISTER 1 TALK Kit: 4

Dipper: 3

## Sampling

Sample ID: HVN MW3 03 COC No: E2011-109-03

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 8:09 | 4.51 | 313.2 | 6.8 | 16.3 | 150.7 | | |
| 8:14 | 4.41 | 317.3 | 0 | 15.8 | 128.3 | | |
| 8:19 | 4.45 | 327.9 | 0 | 15.8 | 71.9 | 0.4 | 0.1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Bottles — ASSESSMENT SUITE 1

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☒ | 1 x 60mL plastic BLUE ☒ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☒ | 1 x 60mL plastic RED/GREEN ☒ | 1 x 60mL plastic MAROON ☐ |
| 1 x 125mL plastic PURPLE ☒ | 1 x 500mL plastic GREEN** ☒ | 1 x 60mL plastic RED/GREEN ☒ |

## Comments

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2116-109 Client: HVN Location: Rapids Rd

Well ID: MW4 Date: 20/8/13 Sampler: JT

## Monitoring Well Information

Depth to Water: 1140 (mm TOC) Depth to Bottom: _____ (m)

Standpipe: _____ (m) Monument Cover ☒

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: YSI (1) TTA Kit: 3

Pump: TUSHER (1) TALK Kit: 4

Dipper: (3)

## Sampling

Sample ID: HVNMW4 03 COC No: E2011-109-03

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 9 08 | 6 14 | 324·5 | 4·4 | 17·2 | 102·3 | | |
| 9·13 | 5·90 | 252·0 | 6·3 | 15·7 | 83·9 | | |
| 9·18 | 5·89 | 243·4 | 5·9 | 15·7 | 82·6 | 0·3 | 0·15 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Bottles — ASSESSMENT SUITE 1

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☒ | 1 x 60mL plastic BLUE ☒ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☒ | 1 x 60mL plastic RED/GREEN ☒ | 1 x 60mL plastic MAROON ☒ |
| 1 x 125mL plastic PURPLE ☒ | 1 x 500mL plastic GREEN** ☒ | 1 x 60mL plastic RED/GREEN ☒ |

## Comments

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011.109 Client: HVN Location: Rapids Rd

Well ID: MW5 Date: 20/8/13 Sampler: SJ

## Monitoring Well Information

Depth to Water: 730 (mm TOC) Depth to Bottom: _____ (m)

Standpipe: _____ (m) Monument Cover ☒

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: 451 1 TTA Kit: 7

Pump: TWISTER 1 TALK Kit: 4

Dipper: 3

## Sampling

Sample ID: HVN MW5 03 COC No: E2011-109-03

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 848 | 4.82 | 125.5 | 2.6 | 16.5 | 195.4 | | |
| 853 | 5.22 | 121.8 | 4.8 | 15.3 | 142.8 | | |
| 858 | 5.52 | 133.4 | 4.7 | 15.5 | 107.3 | 0.3 | 0.05 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Bottles** **ASSESSMENT SUITE 1**

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☒ | 1 x 60mL plastic BLUE ☒ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☐ | 1 x 60mL plastic RED/GREEN ☒ | 1 x 60mL plastic MAROON ☒ |
| 1 x 125mL plastic PURPLE ☒ | 1 x 500mL plastic GREEN** ☒ | 1 x 60mL plastic RED/GREEN ☒ |

**Comments**

MDW
ENVIRONMENTAL SERVICES

# Monitoring Well Field Record

Job #: E2011-109 Client: HPV Location: Rapids Rd

Well ID: MW6 Date: 20/8/13 Sampler: JJ

## Monitoring Well Information

Depth to Water: 1081 (mm TOC) Depth to Bottom: _____ (m)

Standpipe: _____ (m) Monument Cover ☑

Lock: ☒ None ☐ Padlock (YL) ☐ Enviro Cap ☐ Gatic

## Equipment IDs

Water Quality Meter: YSI (1) TTA Kit: 3

Pump: Twister (1) TALK Kit: 4

Dipper: (3)

## Sampling

Sample ID: HVN MW 6 03 COC No: E2011-109-03

| Time | pH | EC | DO | Temp | Redox | TTA | TALK |
|---|---|---|---|---|---|---|---|
| 8 28 | 4·28 | 294·4 | 2·4 | 16·5 | 168·1 | | |
| 8·33 | 4·30 | 366·5 | 1·1 | 16·3 | 138·1 | | |
| 8·36 | 4·34 | 396·4 | 1·1 | 16·3 | 92·8 | 0·30 | 0·12 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Bottles — ASSESSMENT SUITE 1

| | | |
|---|---|---|
| 1 x 1000mL plastic GREEN ☑ | 1 x 60mL plastic BLUE ☑ | **BRING BACK & FILTER INTO: |
| 1 x 125mL plastic YELLOW ☑ | 1 x 60mL plastic RED/GREEN ☑ | 1 x 60mL plastic MAROON ☒ |
| 1 x 125mL plastic PURPLE ☑ | 1 x 500mL plastic GREEN** ☑ | 1 x 60mL plastic RED/GREEN ☐ |

## Comments

MDW
ENVIRONMENTAL SERVICES

# Appendix C – February Laboratory Documentation

Site: HOPE VALLEY NURSERY SERPENTINE
Job #: E2011-109
Sampler: JM
CoC #: E2011-109-01
Quote #: EP/784/12
Laboratory: ALS
Date and time delivered: 21/2/13 15:55
Received by: R. SAUNDERS

MDW
ENVIRONMENTAL SERVICES
**Mobile Dewatering Environmental Services**
Unit 1, 22 Elmsfield Road
Midvale WA 6056
P: 08 9250 6960
F: 08 9250 8269
E: info@environmentalservices.com.au

Comments:
COULD YOU PLS FILTER LAB SAMPLES - MW3/MW4/MW6

THANX, JUSTIN

Analysis Detection Limits

ASSESS SUITE 1

Environmental Division
Perth
Work Order
**EP1301307**

Telephone : +61-8-9209 7655

| Sample ID | Lab ID | Type | Sampling Date | Sampling Time | ASSESS SUITE 1 |
|---|---|---|---|---|---|
| HVNMW1-01 | 1 | WATER | 21/2 | 10:00 | ✓ |
| HVNMW2-01 | 2 | | | | ✓ |
| HVNMW3-01 | 3 | | | | ✓ |
| HVNMW4-01 | 4 | | | | ✓ |
| HVNMW5-01 | 5 | | | | ✓ |
| HVNMW6-01 | 6 | | | | ✓ |

Condition of Sample: Cool / Ambient / Warm  Relinquished by: JM

Environmental Division

# SAMPLE RECEIPT NOTIFICATION (SRN)

## Comprehensive Report

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1301307** | | |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | Page | : 1 of 3 |
| Order number | : ---- | | |
| C-O-C number | : E2011-109-01 | Quote number | : EP2012MOBDEW0134 (EP/785/12) |
| Site | : HOPE VALLEY NUSERY<br>SERPENTINE | | |
| Sampler | : J.M. | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |

## Dates

| | | | |
|---|---|---|---|
| Date Samples Received | : 21-FEB-2013 | Issue Date | : 21-FEB-2013 17:58 |
| Client Requested Due Date | : 28-FEB-2013 | Scheduled Reporting Date | : **28-FEB-2013** |

## Delivery Details

| | | | |
|---|---|---|---|
| Mode of Delivery | : Carrier | Temperature | : 13.2 - Ice present |
| No. of coolers/boxes | : 2 Medium Hard Esky | No. of samples received | : 6 |
| Security Seal | : Intact. | No. of samples analysed | : 6 |

## General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **pH analysis should be conducted within 6 hours of sampling.**
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (SamplesPerth@alsenviro.com)
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of Work Order.

## Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

| Method<br>Client sample ID | Sample Container Received | Preferred Sample Container for Analysis |
|---|---|---|
| **EG051G : Ferrous Iron by Discrete Analyser** | | |
| **HVNMW2-01** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |
| **HVNMW3-01** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |
| **HVNMW4-01** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |
| **HVNMW6-01** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |

## Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EA005P pH (PC) | WATER - EA010P Conductivity (PC) | WATER - EA015H Total Dissolved Solids - High Level | WATER - EA025H Suspended Solids (High Level) | WATER - EA045 Turbidity | WATER - ED038 Acidity as CaCO3 | WATER - EG020F Dissolved Metals by ICPMS | WATER - EG020T Total Recoverable Metals by ICPMS |
|---|---|---|---|---|---|---|---|---|---|---|
| EP1301307-001 | 21-FEB-2013 10:00 | HVNMW1-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-002 | 21-FEB-2013 10:00 | HVNMW2-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-003 | 21-FEB-2013 10:00 | HVNMW3-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-004 | 21-FEB-2013 10:00 | HVNMW4-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-005 | 21-FEB-2013 10:00 | HVNMW5-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-006 | 21-FEB-2013 10:00 | HVNMW6-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EG035T Total Mercury by FIMS | WATER - EG050G-F Hexavalent Chromium by Discrete Analyser - Filtered | WATER - EG051G Ferrous Iron by Discrete Analyser | WATER - EK085M Sulfide as S 2- | WATER - EP030 BOD | WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity) | WATER - NT-08A Total Nitrogen + NO2 + NO3 + NH3 + Total P + |
|---|---|---|---|---|---|---|---|---|---|
| EP1301307-001 | 21-FEB-2013 10:00 | HVNMW1-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-002 | 21-FEB-2013 10:00 | HVNMW2-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-003 | 21-FEB-2013 10:00 | HVNMW3-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-004 | 21-FEB-2013 10:00 | HVNMW4-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-005 | 21-FEB-2013 10:00 | HVNMW5-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1301307-006 | 21-FEB-2013 10:00 | HVNMW6-01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

## Requested Deliverables

**ACCOUNTS PAYABLE (WA)**

| | | |
|---|---|---|
| - A4 - AU Tax Invoice ( INV ) | Email | deb@mobiledewatering.com.au |

**INFO**

| | | |
|---|---|---|
| - *AU Certificate of Analysis - NATA ( COA ) | Email | info@environmentalservices.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) ( QCI ) | Email | info@environmentalservices.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA ( QC ) | Email | info@environmentalservices.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT ( SRN ) | Email | info@environmentalservices.com.au |
| - Chain of Custody (CoC) ( COC ) | Email | info@environmentalservices.com.au |
| - EDI Format - ENMRG ( ENMRG ) | Email | info@environmentalservices.com.au |
| - EDI Format - ESDAT ( ESDAT ) | Email | info@environmentalservices.com.au |
| - EDI Format - XTab ( XTAB ) | Email | info@environmentalservices.com.au |

Environmental Division

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1301307** | Page | : 1 of 8 |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Order number | : ---- | | |
| C-O-C number | : E2011-109-01 | Date Samples Received | : 21-FEB-2013 |
| Sampler | : J.M. | Issue Date | : 28-FEB-2013 |
| Site | : HOPE VALLEY NUSERY SERPENTINE | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/785/12 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## *Signatories*

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Benjamin Nicholson | Metals Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Scott James | Laboratory Manager | Perth Inorganics |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EG020: It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.**
- **EG020: Metals LOR for particular sample(s) raised due to high matrix interference**
- **EK061G\EK067G: LOR for sample 'HVNMW2-01' raised due to the high amount of NOx present.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

## Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | HVNMW1-01 | HVNMW2-01 | HVNMW3-01 | HVNMW4-01 | HVNMW5-01 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 |
| | | | | | EP1301307-001 | EP1301307-002 | EP1301307-003 | EP1301307-004 | EP1301307-005 |
| **EA005P: pH by PC Titrator** | | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | | **6.49** | **6.26** | **5.63** | **6.74** | **6.94** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | | **432** | **184** | **449** | **704** | **592** |
| **EA015: Total Dissolved Solids** | | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | | **1340** | **1540** | **1950** | **1690** | **350** |
| **EA025: Suspended Solids** | | | | | | | | | |
| **Suspended Solids (SS)** | ---- | 5 | mg/L | | **3750** | **31** | **3300** | **7500** | **500** |
| **EA045: Turbidity** | | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | | **8810** | **36.1** | **7480** | **2090** | **1810** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | | <1 | <1 | <1 | <1 | <1 |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | | <1 | <1 | <1 | <1 | <1 |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | | **12** | **5** | **9** | **98** | **58** |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | | **12** | **5** | **9** | **98** | **58** |
| **ED038A: Acidity** | | | | | | | | | |
| **Acidity as CaCO3** | ---- | 1 | mg/L | | **20** | **9** | **49** | **58** | **29** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | | <20 | **10** | **33** | **59** | **86** |
| **ED045G: Chloride Discrete analyser** | | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | | **24** | **28** | **122** | **136** | **85** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | | **3.37** | **0.04** | **0.89** | **0.05** | **0.01** |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | | **0.002** | <0.001 | **0.005** | **0.004** | <0.001 |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | | **0.005** | <0.001 | **0.002** | <0.001 | <0.001 |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | | **0.010** | **0.007** | **0.007** | **0.505** | **1.68** |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | | **0.003** | <0.001 | <0.001 | <0.001 | <0.001 |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | | **0.021** | **0.006** | <0.005 | **0.010** | **0.006** |
| **Iron** | 7439-89-6 | 0.05 | mg/L | | **0.84** | <0.05 | **0.38** | **0.82** | **3.34** |
| **EG020T: Total Metals by ICP-MS** | | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | | **46.9** | **1.83** | **89.8** | **59.2** | **1.14** |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | | **0.012** | <0.001 | **0.016** | **0.026** | **0.008** |

## Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | HVNMW1-01 | HVNMW2-01 | HVNMW3-01 | HVNMW4-01 | HVNMW5-01 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 |
| | | | | | EP1301307-001 | EP1301307-002 | EP1301307-003 | EP1301307-004 | EP1301307-005 |
| **EG020T: Total Metals by ICP-MS - Continued** | | | | | | | | | |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | **0.0010** | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | | **0.199** | <0.001 | **0.057** | **0.080** | **0.014** |
| **Copper** | 7440-50-8 | 0.001 | mg/L | | **0.065** | <0.001 | **0.006** | **0.053** | **0.006** |
| **Lead** | 7439-92-1 | 0.001 | mg/L | | **0.117** | <0.001 | **0.176** | **0.061** | **0.001** |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | | **0.021** | **0.007** | **0.012** | **3.34** | **1.72** |
| **Molybdenum** | 7439-98-7 | 0.001 | mg/L | | **0.004** | <0.001 | <0.001 | **0.001** | **0.007** |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | | **0.010** | <0.001 | **0.031** | **0.011** | <0.001 |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Silver** | 7440-22-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | | **0.083** | <0.005 | **0.008** | **0.315** | **0.006** |
| **Iron** | 7439-89-6 | 0.05 | mg/L | | **6.43** | **0.27** | **3.12** | **510** | **34.5** |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| **Mercury** | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | <0.0001 | **0.0001** | **0.0003** | <0.0001 |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| **Hexavalent Chromium** | 18540-29-9 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | | | |
| **Ferrous Iron** | ---- | 0.05 | mg/L | | **0.46** | <0.05 | **0.32** | **0.09** | **3.03** |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| **Ammonia as N** | 7664-41-7 | 0.01 | mg/L | | **0.04** | **0.04** | **0.52** | **1.49** | **1.03** |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| **Nitrite as N** | ---- | 0.01 | mg/L | | <0.01 | **0.03** | <0.01 | <0.01 | **0.01** |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| **Nitrate as N** | 14797-55-8 | 0.01 | mg/L | | **1.55** | **8.19** | <0.01 | <0.01 | **0.01** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| **Nitrite + Nitrate as N** | ---- | 0.01 | mg/L | | **1.55** | **8.22** | <0.01 | <0.01 | **0.02** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| **Total Kjeldahl Nitrogen as N** | ---- | 0.1 | mg/L | | **1.0** | <0.5 | **4.4** | **15.2** | **1.8** |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ **Total Nitrogen as N** | ---- | 0.1 | mg/L | | **2.6** | **8.2** | **4.4** | **15.2** | **1.8** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| **Total Phosphorus as P** | ---- | 0.01 | mg/L | | **0.61** | <0.05 | **0.48** | **1.05** | **0.02** |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| **Reactive Phosphorus as P** | ---- | 0.01 | mg/L | | **0.15** | <0.01 | <0.01 | <0.01 | <0.01 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW1-01 | HVNMW2-01 | HVNMW3-01 | HVNMW4-01 | HVNMW5-01 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 | 21-FEB-2013 10:00 |
| Compound | CAS Number | LOR | Unit | | EP1301307-001 | EP1301307-002 | EP1301307-003 | EP1301307-004 | EP1301307-005 |
| **EK085M: Sulfide as S2-** | | | | | | | | | |
| **Sulfide as S2-** | 18496-25-8 | 0.1 | mg/L | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | <2 | <2 | <2 | **5** | **3** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | HVNMW6-01 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 21-FEB-2013 10:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | EP1301307-006 | ---- | ---- | ---- | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | **6.23** | ---- | ---- | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | **812** | ---- | ---- | ---- | ---- |
| **EA015: Total Dissolved Solids** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | **402** | ---- | ---- | ---- | ---- |
| **EA025: Suspended Solids** | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | **1600** | ---- | ---- | ---- | ---- |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | **5270** | ---- | ---- | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | **21** | ---- | ---- | ---- | ---- |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | **21** | ---- | ---- | ---- | ---- |
| **ED038A: Acidity** | | | | | | | | |
| Acidity as CaCO3 | ---- | 1 | mg/L | **23** | ---- | ---- | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | **552** | ---- | ---- | ---- | ---- |
| **ED045G: Chloride Discrete analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | **229** | ---- | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | **0.37** | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | **0.005** | ---- | ---- | ---- | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | **0.003** | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | **0.92** | ---- | ---- | ---- | ---- |
| **EG020T: Total Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | **17.5** | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | **0.006** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW6-01 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 21-FEB-2013 10:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1301307-006 | ---- | ---- | ---- | ---- |
| **EG020T: Total Metals by ICP-MS - Continued** | | | | | | | | | |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | | **0.006** | ---- | ---- | ---- | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | | **0.009** | ---- | ---- | ---- | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | | **0.052** | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | | **0.004** | ---- | ---- | ---- | ---- |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | | **0.006** | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | | **0.049** | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | | **1.51** | ---- | ---- | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | **0.0002** | ---- | ---- | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | | | |
| Ferrous Iron | ---- | 0.05 | mg/L | | **0.86** | ---- | ---- | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | **0.21** | ---- | ---- | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | ---- | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | **0.21** | ---- | ---- | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | **0.21** | ---- | ---- | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | **1.8** | ---- | ---- | ---- | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | **2.0** | ---- | ---- | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | | **0.33** | ---- | ---- | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| Reactive Phosphorus as P | ---- | 0.01 | mg/L | | **0.22** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW6-01 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 21-FEB-2013 10:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1301307-006 | ---- | ---- | ---- | ---- |
| **EK085M: Sulfide as S2-** | | | | | | | | | |
| **Sulfide as S2-** | 18496-25-8 | 0.1 | mg/L | | <0.1 | ---- | ---- | ---- | ---- |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | <2 | ---- | ---- | ---- | ---- |

Environmental Division

# QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1301307** | Page | : 1 of 12 |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Site | : HOPE VALLEY NUSERY SERPENTINE | | |
| C-O-C number | : E2011-109-01 | Date Samples Received | : 21-FEB-2013 |
| Sampler | : J.M. | Issue Date | : 28-FEB-2013 |
| Order number | : ---- | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/785/12 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## *Signatories*

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Benjamin Nicholson | Metals Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Scott James | Laboratory Manager | Perth Inorganics |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EA005P: pH by PC Titrator (QC Lot: 2746838)** | | | | | | | | | |
| EP1301301-003 | Anonymous | EA005-P: pH Value | ---- | 0.01 | pH Unit | 7.28 | 7.32 | 0.5 | 0% - 20% |
| EP1301310-001 | Anonymous | EA005-P: pH Value | ---- | 0.01 | pH Unit | 7.36 | 7.42 | 0.8 | 0% - 20% |
| **EA010P: Conductivity by PC Titrator (QC Lot: 2746834)** | | | | | | | | | |
| EP1301287-001 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 643 | 641 | 0.3 | 0% - 20% |
| EP1301298-007 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1720 | 1730 | 0.4 | 0% - 20% |
| **EA010P: Conductivity by PC Titrator (QC Lot: 2746839)** | | | | | | | | | |
| EP1301301-003 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 225 | 222 | 1.4 | 0% - 20% |
| EP1301310-001 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1260 | 1300 | 3.1 | 0% - 20% |
| **EA015: Total Dissolved Solids (QC Lot: 2746443)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 1340 | 1130 | 17.1 | 0% - 20% |
| EP1301344-001 | Anonymous | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 2830 | 2800 | 1.1 | 0% - 20% |
| **EA025: Suspended Solids (QC Lot: 2746444)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 3750 | 3800 | 1.3 | 0% - 20% |
| EP1301344-001 | Anonymous | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 60 | 60 | 0.0 | 0% - 50% |
| **EA045: Turbidity (QC Lot: 2743200)** | | | | | | | | | |
| EP1301275-001 | Anonymous | EA045: Turbidity | ---- | 0.1 | NTU | 5.4 | 4.9 | 9.6 | 0% - 20% |
| EP1301310-002 | Anonymous | EA045: Turbidity | ---- | 0.1 | NTU | 1.7 | 2.0 | 17.0 | 0% - 20% |
| **ED037P: Alkalinity by PC Titrator (QC Lot: 2746837)** | | | | | | | | | |
| EP1301301-003 | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 49 | 51 | 4.6 | 0% - 20% |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 49 | 51 | 4.6 | 0% - 20% |
| EP1301310-001 | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 334 | 336 | 0.8 | 0% - 20% |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 334 | 336 | 0.8 | 0% - 20% |
| **ED038A: Acidity (QC Lot: 2748324)** | | | | | | | | | |
| EP1301287-001 | Anonymous | ED038: Acidity as CaCO3 | ---- | 1 | mg/L | 39 | 41 | 4.4 | 0% - 20% |
| EP1301307-006 | HVNMW6-01 | ED038: Acidity as CaCO3 | ---- | 1 | mg/L | 23 | 23 | 0.0 | 0% - 20% |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2742138)** | | | | | | | | | |
| EP1301287-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 88 | 87 | 1.3 | 0% - 20% |
| EP1301310-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 54 | 55 | 2.1 | 0% - 20% |
| **ED045G: Chloride Discrete analyser (QC Lot: 2742137)** | | | | | | | | | |
| EP1301287-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1 | mg/L | 141 | 140 | 0.0 | 0% - 20% |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **ED045G: Chloride Discrete analyser (QC Lot: 2742137) - continued** | | | | | | | | | |
| EP1301310-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1 | mg/L | 194 | 192 | 1.3 | 0% - 20% |
| **EG020F: Dissolved Metals by ICP-MS (QC Lot: 2746484)** | | | | | | | | | |
| EP1301285-008 | Anonymous | EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | 0.042 | 0.043 | 0.0 | No Limit |
| | | EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | <0.05 | 0.0 | No Limit |
| EP1301287-004 | Anonymous | EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | 0.015 | 0.014 | 12.3 | 0% - 20% |
| | | EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | 0.011 | 0.010 | 0.0 | 0% - 20% |
| | | EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | 0.02 | 0.02 | 0.0 | 0% - 20% |
| | | EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | 2.54 | 2.47 | 2.9 | 0% - 20% |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2746474)** | | | | | | | | | |
| EP1301265-001 | Anonymous | EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | 0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | 0.286 | 0.290 | 1.2 | 0% - 20% |
| | | EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | 0.003 | 0.003 | 0.0 | No Limit |
| | | EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | 0.003 | 0.003 | 0.0 | No Limit |
| | | EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | 0.0 | No Limit |
| | | EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | 0.03 | 0.03 | 0.0 | No Limit |
| | | EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | 0.02 | 0.02 | 0.0 | No Limit |
| | | EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | <0.05 | 0.0 | No Limit |
| EP1301288-008 | Anonymous | EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0010 | <0.0010 | 0.0 | 0% - 50% |
| | | EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.010 | <0.010 | 0.0 | 0% - 50% |
| | | EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | 0.031 | 0.028 | 10.7 | 0% - 20% |
| | | EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | 1.07 | 1.04 | 2.8 | 0% - 20% |
| | | EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | 0.044 | 0.043 | 0.0 | 0% - 20% |
| | | EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | 0.633 | 0.613 | 3.3 | 0% - 20% |
| | | EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.010 | <0.010 | 0.0 | 0% - 50% |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2746474) - continued** | | | | | | | | | |
| EP1301288-008 | Anonymous | EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | 0.238 | 0.228 | 4.1 | 0% - 20% |
| | | EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | 0.306 | 0.297 | 2.8 | 0% - 20% |
| | | EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | 70.2 | 67.8 | 3.4 | 0% - 20% |
| | | EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.10 | <0.10 | 0.0 | 0% - 50% |
| | | EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | 10.3 | 9.90 | 3.6 | 0% - 20% |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2746475)** | | | | | | | | | |
| EP1301265-001 | Anonymous | EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | 0.001 | <0.001 | 0.0 | No Limit |
| EP1301288-008 | Anonymous | EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.010 | <0.010 | 0.0 | 0% - 50% |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2746476)** | | | | | | | | | |
| EP1301307-002 | HVNMW2-01 | EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | 0.007 | 0.007 | 0.0 | No Limit |
| | | EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | 0.0 | No Limit |
| | | EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | 1.83 | 1.96 | 7.0 | 0% - 20% |
| | | EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | 0.27 | 0.30 | 8.2 | No Limit |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2746477)** | | | | | | | | | |
| EP1301307-002 | HVNMW2-01 | EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| **EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2746513)** | | | | | | | | | |
| EP1301265-001 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| EP1301307-004 | HVNMW4-01 | EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | 0.0003 | 0.0003 | 0.0 | No Limit |
| **EG050F: Dissolved Hexavalent Chromium (QC Lot: 2745761)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| EP1301348-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EG051G: Ferrous Iron by Discrete Analyser (QC Lot: 2741378)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EG051G: Ferrous Iron | ---- | 0.05 | mg/L | 0.46 | 0.46 | 0.0 | No Limit |
| **EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2741377)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | 0.04 | 0.03 | 36.8 | No Limit |
| **EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2742139)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| EP1301310-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | 0.02 | 0.02 | 0.0 | No Limit |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2741376)** | | | | | | | | | |
| EP1301298-005 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.16 | 0.16 | 0.0 | 0% - 20% |
| EP1301307-004 | HVNMW4-01 | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2748939)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 1.0 | 1.0 | 0.0 | 0% - 20% |
| EP1301310-005 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 3.2 | 3.2 | 0.0 | 0% - 20% |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2748940)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | 0.61 | 0.66 | 8.2 | 0% - 20% |
| EP1301310-005 | Anonymous | EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | 3.91 | 3.98 | 1.7 | 0% - 20% |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 2742136)** | | | | | | | | | |
| EP1301287-001 | Anonymous | EK071G: Reactive Phosphorus as P | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| EP1301310-001 | Anonymous | EK071G: Reactive Phosphorus as P | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK085M: Sulfide as S2- (QC Lot: 2749219)** | | | | | | | | | |
| EP1301287-001 | Anonymous | EK085: Sulfide as S2- | 18496-25-8 | 0.1 | mg/L | <0.1 | <0.1 | 0.0 | No Limit |
| EP1301307-006 | HVNMW6-01 | EK085: Sulfide as S2- | 18496-25-8 | 0.1 | mg/L | <0.1 | <0.1 | 0.0 | No Limit |
| **EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 2742819)** | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | <2 | <2 | 0.0 | No Limit |
| EP1301308-005 | Anonymous | EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | <2 | <2 | 0.0 | No Limit |

## Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

| | | | | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Recovery Limits (%) | |
| Method: Compound | CAS Number | LOR | Unit | Result | Concentration | LCS | Low | High |
| **EA005P: pH by PC Titrator (QCLot: 2746838)** | | | | | | | | |
| EA005-P: pH Value | ---- | 0.01 | pH Unit | ---- | 7.00 pH Unit | 101 | 70 | 130 |
| **EA010P: Conductivity by PC Titrator (QCLot: 2746834)** | | | | | | | | |
| EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | <1 | 24800 µS/cm | 98.5 | 95 | 110 |
| **EA010P: Conductivity by PC Titrator (QCLot: 2746839)** | | | | | | | | |
| EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | <1 | 24800 µS/cm | 97.5 | 95 | 110 |
| **EA015: Total Dissolved Solids (QCLot: 2746443)** | | | | | | | | |
| EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | <10 | 293 mg/L | 111 | 70 | 130 |
| **EA025: Suspended Solids (QCLot: 2746444)** | | | | | | | | |
| EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | <5 | 150 mg/L | 95.6 | 70 | 130 |
| **EA045: Turbidity (QCLot: 2743200)** | | | | | | | | |
| EA045: Turbidity | ---- | 0.1 | NTU | <0.1 | 40 NTU | 105 | 91 | 107 |
| **ED037P: Alkalinity by PC Titrator (QCLot: 2746837)** | | | | | | | | |
| ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | <1 | 200 mg/L | 109 | 87 | 121 |
| **ED038A: Acidity (QCLot: 2748324)** | | | | | | | | |
| ED038: Acidity as CaCO3 | ---- | 1 | mg/L | ---- | 20 mg/L | 102 | 85 | 119 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2742138)** | | | | | | | | |
| ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | <1 | 25 mg/L | 104 | 88 | 121 |
| **ED045G: Chloride Discrete analyser (QCLot: 2742137)** | | | | | | | | |
| ED045G: Chloride | 16887-00-6 | 1 | mg/L | <1 | 1000 mg/L | 92.5 | 84 | 120 |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2746484)** | | | | | | | | |
| EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.50 mg/L | 99.9 | 77 | 113 |
| EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 103 | 89 | 109 |
| EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1000 mg/L | 102 | 89 | 109 |
| EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 91.8 | 88 | 106 |
| EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 92.7 | 87 | 107 |
| EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 91.6 | 87 | 109 |
| EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.10 mg/L | 108 | 93 | 117 |
| EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.100 mg/L | 106 | 89 | 115 |
| EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.50 mg/L | 93.0 | 83 | 109 |

Sub-Matrix: **WATER**

| Method: Compound | CAS Number | LOR | Unit | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Recovery Limits (%) | |
| | | | | Result | Concentration | LCS | Low | High |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746474)** | | | | | | | | |
| EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 110 | 78 | 116 |
| EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 94.8 | 77 | 109 |
| EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1 mg/L | 96.3 | 78 | 108 |
| EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 93.6 | 80 | 112 |
| EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 96.0 | 79 | 111 |
| EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 89.4 | 81 | 109 |
| EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 94.7 | 80 | 112 |
| EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 95.6 | 86 | 118 |
| EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 94.2 | 80 | 112 |
| EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.1 mg/L | 96.9 | 75 | 107 |
| EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.1 mg/L | 101 | 74 | 108 |
| EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.5 mg/L | 92.5 | 75 | 115 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746475)** | | | | | | | | |
| EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | 0.01 mg/L | 78.8 | 70 | 130 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746476)** | | | | | | | | |
| EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 109 | 78 | 116 |
| EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 97.6 | 77 | 109 |
| EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1 mg/L | 96.2 | 78 | 108 |
| EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 96.9 | 80 | 112 |
| EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 97.8 | 79 | 111 |
| EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 91.0 | 81 | 109 |
| EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 94.9 | 80 | 112 |
| EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 96.9 | 86 | 118 |
| EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 97.1 | 80 | 112 |
| EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.1 mg/L | 97.8 | 75 | 107 |
| EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.1 mg/L | 101 | 74 | 108 |
| EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.5 mg/L | 109 | 75 | 115 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746477)** | | | | | | | | |
| EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | 0.01 mg/L | 75.9 | 70 | 130 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 2746513)** | | | | | | | | |
| EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | 0.0100 mg/L | 101 | 82.3 | 118 |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 2745761)** | | | | | | | | |
| EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 101 | 91 | 115 |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 2741378)** | | | | | | | | |
| EG051G: Ferrous Iron | ---- | 0.05 | mg/L | <0.05 | 2.00 mg/L | 101 | 89 | 113 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2741377)** | | | | | | | | |
| EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | <0.01 | 1 mg/L | 99.8 | 87 | 115 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2742139)** | | | | | | | | |

Sub-Matrix: **WATER**

| Method: Compound | CAS Number | LOR | Unit | Method Blank (MB) Report: Result | Laboratory Control Spike (LCS) Report: Spike Concentration | Spike Recovery (%): LCS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|---|
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2742139) - continued** | | | | | | | | |
| EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 98.0 | 86 | 112 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2741376)** | | | | | | | | |
| EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 105 | 92 | 112 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2748939)** | | | | | | | | |
| EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | <0.1 | 10 mg/L | 89.3 | 74 | 130 |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2748940)** | | | | | | | | |
| EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | <0.01 | 4.42 mg/L | 101 | 70 | 130 |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2742136)** | | | | | | | | |
| EK071G: Reactive Phosphorus as P | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 97.0 | 87 | 115 |
| **EK085M: Sulfide as S2- (QCLot: 2749219)** | | | | | | | | |
| EK085: Sulfide as S2- | 18496-25-8 | 0.10 | mg/L | <0.1 | 0.50 mg/L | 102 | 82 | 116 |
| **EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2742819)** | | | | | | | | |
| EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | <2 | 198 mg/L | 85.8 | 84 | 114 |

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) Report: Spike Concentration | SpikeRecovery(%): MS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2742138)** | | | | | | | |
| EP1301287-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L | 109 | 70 | 130 |
| **ED045G: Chloride Discrete analyser (QCLot: 2742137)** | | | | | | | |
| EP1301287-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 250 mg/L | 123 | 70 | 130 |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2746484)** | | | | | | | |
| EP1301285-009 | Anonymous | EG020A-F: Arsenic | 7440-38-2 | 0.200 mg/L | 118 | 70 | 130 |
| | | EG020A-F: Cadmium | 7440-43-9 | 0.0500 mg/L | 112 | 70 | 130 |
| | | EG020A-F: Chromium | 7440-47-3 | 0.200 mg/L | 97.5 | 70 | 130 |
| | | EG020A-F: Manganese | 7439-96-5 | 0.200 mg/L | 98.4 | 70 | 130 |
| | | EG020A-F: Nickel | 7440-02-0 | 0.200 mg/L | 96.9 | 70 | 130 |
| | | EG020A-F: Zinc | 7440-66-6 | 0.200 mg/L | 119 | 70 | 130 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746474)** | | | | | | | |
| EP1301265-003 | Anonymous | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 108 | 70 | 130 |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 103 | 70 | 130 |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 93.7 | 70 | 130 |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 92.6 | 70 | 130 |

Sub-Matrix: **WATER**

| | | | | Matrix Spike (MS) Report | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spike | SpikeRecovery(%) | Recovery Limits (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | Low | High |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746474) - continued** | | | | | | | |
| EP1301265-003 | Anonymous | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 92.7 | 70 | 130 |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 94.3 | 70 | 130 |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 95.9 | 70 | 130 |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 94.1 | 70 | 130 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746476)** | | | | | | | |
| EP1301307-003 | HVNMW3-01 | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 87.2 | 70 | 130 |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 105 | 70 | 130 |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 77.5 | 70 | 130 |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 110 | 70 | 130 |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 104 | 70 | 130 |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 76.3 | 70 | 130 |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 108 | 70 | 130 |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 114 | 70 | 130 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 2746513)** | | | | | | | |
| EP1301265-003 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0100 mg/L | 105 | 70 | 130 |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 2745761)** | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.5 mg/L | 94.9 | 70 | 130 |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 2741378)** | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EG051G: Ferrous Iron | ---- | 2.5 mg/L | 102 | 70 | 130 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2741377)** | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 95.7 | 70 | 130 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2742139)** | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK057G: Nitrite as N | ---- | 0.6 mg/L | 86.8 | 70 | 130 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2741376)** | | | | | | | |
| EP1301298-005 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | 107 | 70 | 130 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2748939)** | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK061G: Total Kjeldahl Nitrogen as N | ---- | 5.0 mg/L | 96.5 | 70 | 130 |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2748940)** | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK067G: Total Phosphorus as P | ---- | 1 mg/L | 80.6 | 70 | 130 |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2742136)** | | | | | | | |
| EP1301287-001 | Anonymous | EK071G: Reactive Phosphorus as P | ---- | 0.5 mg/L | 100 | 70 | 130 |

## *Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report*

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2741376)** | | | | | | | | | | |
| EP1301298-005 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | 107 | ---- | 70 | 130 | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2741377)** | | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 95.7 | ---- | 70 | 130 | ---- | ---- |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 2741378)** | | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EG051G: Ferrous Iron | ---- | 2.5 mg/L | 102 | ---- | 70 | 130 | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2742136)** | | | | | | | | | | |
| EP1301287-001 | Anonymous | EK071G: Reactive Phosphorus as P | ---- | 0.5 mg/L | 100 | ---- | 70 | 130 | ---- | ---- |
| **ED045G: Chloride Discrete analyser (QCLot: 2742137)** | | | | | | | | | | |
| EP1301287-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 250 mg/L | 123 | ---- | 70 | 130 | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2742138)** | | | | | | | | | | |
| EP1301287-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L | 109 | ---- | 70 | 130 | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2742139)** | | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK057G: Nitrite as N | ---- | 0.6 mg/L | 86.8 | ---- | 70 | 130 | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 2745761)** | | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.5 mg/L | 94.9 | ---- | 70 | 130 | ---- | ---- |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746474)** | | | | | | | | | | |
| EP1301265-003 | Anonymous | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 108 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 103 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 93.7 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 92.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 92.7 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 94.3 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 95.9 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 94.1 | ---- | 70 | 130 | ---- | ---- |
| **EG020T: Total Metals by ICP-MS (QCLot: 2746476)** | | | | | | | | | | |
| EP1301307-003 | HVNMW3-01 | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 87.2 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 105 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 77.5 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 110 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 104 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 76.3 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 108 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 114 | ---- | 70 | 130 | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2746484)** | | | | | | | | | | |
| EP1301285-009 | Anonymous | EG020A-F: Arsenic | 7440-38-2 | 0.200 mg/L | 118 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Cadmium | 7440-43-9 | 0.0500 mg/L | 112 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Chromium | 7440-47-3 | 0.200 mg/L | 97.5 | ---- | 70 | 130 | ---- | ---- |

Sub-Matrix: **WATER**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2746484) - continued** | | | | | | | | | | |
| EP1301285-009 | Anonymous | EG020A-F: Manganese | 7439-96-5 | 0.200 mg/L | 98.4 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Nickel | 7440-02-0 | 0.200 mg/L | 96.9 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Zinc | 7440-66-6 | 0.200 mg/L | 119 | ---- | 70 | 130 | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 2746513)** | | | | | | | | | | |
| EP1301265-003 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0100 mg/L | 105 | ---- | 70 | 130 | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2748939)** | | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK061G: Total Kjeldahl Nitrogen as N | ---- | 5.0 mg/L | 96.5 | ---- | 70 | 130 | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2748940)** | | | | | | | | | | |
| EP1301307-001 | HVNMW1-01 | EK067G: Total Phosphorus as P | ---- | 1 mg/L | 80.6 | ---- | 70 | 130 | ---- | ---- |

Environmental Division

# INTERPRETIVE QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1301307** | Page | : 1 of 12 |
| Client | : MOBILE DEWATERING | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Site | : HOPE VALLEY NUSERY SERPENTINE | | |
| C-O-C number | : E2011-109-01 | Date Samples Received | : 21-FEB-2013 |
| Sampler | : J.M. | Issue Date | : 28-FEB-2013 |
| Order number | : ---- | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/785/12 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

# Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EA005P: pH by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA005-P)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 21-FEB-2013 | ---- | **26-FEB-2013** | 21-FEB-2013 | ✗ |
| **EA010P: Conductivity by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA010-P)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 21-MAR-2013 | ---- | **26-FEB-2013** | 21-MAR-2013 | ✓ |
| **EA015: Total Dissolved Solids** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA015H)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 28-FEB-2013 | ---- | **26-FEB-2013** | 28-FEB-2013 | ✓ |
| **EA025: Suspended Solids** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA025H)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 28-FEB-2013 | ---- | **26-FEB-2013** | 28-FEB-2013 | ✓ |
| **EA045: Turbidity** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA045)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **22-FEB-2013** | 23-FEB-2013 | ✓ |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED037-P)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 07-MAR-2013 | ---- | **26-FEB-2013** | 07-MAR-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **ED038A: Acidity** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED038)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **27-FEB-2013** | 07-MAR-2013 | ✓ |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED041G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 21-MAR-2013 | ---- | **21-FEB-2013** | 21-MAR-2013 | ✓ |
| **ED045G: Chloride Discrete analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED045G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 21-MAR-2013 | ---- | **21-FEB-2013** | 21-MAR-2013 | ✓ |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 20-AUG-2013 | ---- | **27-FEB-2013** | 20-AUG-2013 | ✓ |
| **EG020T: Total Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **26-FEB-2013** | 20-AUG-2013 | ✓ | **26-FEB-2013** | 20-AUG-2013 | ✓ |
| **EG020T: Total Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **26-FEB-2013** | 20-AUG-2013 | ✓ | **26-FEB-2013** | 20-AUG-2013 | ✓ |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **26-FEB-2013** | 21-MAR-2013 | ✓ |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | |
| **Clear Plastic Bottle - NaOH (EG050G-F)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **27-FEB-2013** | 21-MAR-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - HCl - Filtered (EG051G)** | | | | | | | |
| HVNMW1-01, HVNMW5-01 | **21-FEB-2013** | **----** | ---- | ---- | **21-FEB-2013** | 28-FEB-2013 | ✓ |
| **Clear Plastic Bottle - Natural (EG051G)** | | | | | | | |
| HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **21-FEB-2013** | 22-FEB-2013 | ✓ |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK055G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 21-MAR-2013 | ---- | **21-FEB-2013** | 21-MAR-2013 | ✓ |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK057G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 23-FEB-2013 | ---- | **21-FEB-2013** | 23-FEB-2013 | ✓ |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK059G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 21-MAR-2013 | ---- | **21-FEB-2013** | 21-MAR-2013 | ✓ |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK061G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **28-FEB-2013** | 21-MAR-2013 | ✓ | **28-FEB-2013** | 21-MAR-2013 | ✓ |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK067G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **28-FEB-2013** | 21-MAR-2013 | ✓ | **28-FEB-2013** | 21-MAR-2013 | ✓ |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK071G)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **---** | 23-FEB-2013 | ---- | **21-FEB-2013** | 23-FEB-2013 | ✓ |
| **EK085M: Sulfide as S2-** | | | | | | | |
| **Clear Plastic Bottle - Zinc Acetate/NaOH (EK085)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **27-FEB-2013** | 28-FEB-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | |
| **Clear Plastic Bottle - Natural (EP030)** | | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | **21-FEB-2013** | **----** | ---- | ---- | **22-FEB-2013** | 23-FEB-2013 | ✓ |

# Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Duplicates (DUP)** | | | | | | | |
| Acidity as Calcium Carbonate | ED038 | 2 | 10 | **20.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Alkalinity by PC Titrator | ED037-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 1 | 6 | **16.7** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 2 | 11 | **18.2** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 4 | 40 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 17 | **11.8** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 7 | **14.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 2 | 11 | **18.2** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 13 | **15.4** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 15 | **13.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| pH by PC Titrator | EA005-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 2 | 15 | **13.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 2 | 15 | **13.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 2 | 13 | **15.4** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 3 | 25 | **12.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 3 | 25 | **12.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| **Laboratory Control Samples (LCS)** | | | | | | | |
| Acidity as Calcium Carbonate | ED038 | 1 | 10 | **10.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Alkalinity by PC Titrator | ED037-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 6 | 40 | **15.0** | **15.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 17 | **5.9** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 7 | **14.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| pH by PC Titrator | EA005-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Control Samples (LCS) - Continued** | | | | | | | |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 2 | 15 | **13.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 2 | 15 | **13.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 19 | **10.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| **Method Blanks (MB)** | | | | | | | |
| Alkalinity by PC Titrator | ED037-P | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 2 | 40 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 17 | **5.9** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 7 | **14.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 1 | 19 | **5.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| **Matrix Spikes (MS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 6 | **16.7** | **5.0** | ✓ | ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 19 | **5.3** | **5.0** | ✓ | ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 17 | **5.9** | **5.0** | ✓ | ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 7 | **14.3** | **5.0** | ✓ | ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 11 | **9.1** | **5.0** | ✓ | ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 13 | **7.7** | **5.0** | ✓ | ALS QCS3 requirement |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| Matrix Spikes (MS) - Continued | | | | | | | |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 15 | **6.7** | **5.0** | ✓ | ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 19 | **5.3** | **5.0** | ✓ | ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 19 | **5.3** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 19 | **5.3** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 13 | **7.7** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 2 | 25 | **8.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 1 | 19 | **5.3** | **5.0** | ✓ | ALS QCS3 requirement |

## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| pH by PC Titrator | EA005-P | WATER | APHA 21st ed. 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Conductivity by PC Titrator | EA010-P | WATER | APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Dissolved Solids (High Level) | EA015H | WATER | In-House, APHA 21st ed., 2540C A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Suspended Solids (High Level) | EA025H | WATER | In-House, APHA 21st ed., 2540D A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Turbidity | EA045 | WATER | APHA 21st ed., 2130 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Alkalinity by PC Titrator | ED037-P | WATER | APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Acidity as Calcium Carbonate | ED038 | WATER | APHA 21st ed., 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | WATER | APHA 21st ed., 4500-SO4 Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Chloride by Discrete Analyser | ED045G | WATER | APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003 |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Total Metals by ICP-MS - Suite A | EG020A-T | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Total Metals by ICP-MS - Suite B | EG020B-T | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Total Mercury by FIMS | EG035T | WATER | AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | WATER | APHA 21st ed., 3500 Cr-A & B. Samples are 0.45 um filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Ferrous Iron by Discrete Analyser | EG051G | WATER | APHA 21st ed., 3500 Fe-B. A colorimetric determination based on the reaction between phenanthroline and ferrous iron at pH 3.2-3.3 to form an orange-red complex that is measured against a five-point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Ammonia as N by Discrete analyser | EK055G | WATER | APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Nitrite as N by Discrete Analyser | EK057G | WATER | APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Nitrate as N by Discrete Analyser | EK058G | WATER | APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | WATER | APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | WATER | APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Nitrogen as N (TKN + Nox) By Discrete Analyser | EK062G | WATER | APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Phosphorus as P By Discrete Analyser | EK067G | WATER | APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | WATER | APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Sulfide as S2- | EK085 | WATER | APHA 21st ed., 4500-S2- D Sulfide species present in water samples are immediately precipitated when collected in pretreated caustic/zinc acetate preserved sample containers. After the supernatant is discarded, the resultant precipitate is then coloured using methylene blue indicator and measured using UV-VIS detection at 664nm. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Biochemical Oxygen Demand (BOD) | EP030 | WATER | APHA 21st ed., 5210 B The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Digestion for Total Recoverable Metals | EN25 | WATER | USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |

# Summary of Outliers

## Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

### Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

### Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

## Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

| Method | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|
| **Container** / Client Sample ID(s) | Date extracted | Due for extraction | Days overdue | Date analysed | Due for analysis | Days overdue |
| **EA005P: pH by PC Titrator** | | | | | | |
| **Clear Plastic Bottle - Natural** | | | | | | |
| HVNMW1-01, HVNMW2-01, HVNMW3-01, HVNMW4-01, HVNMW5-01, HVNMW6-01 | ---- | ---- | ---- | 26-FEB-2013 | 21-FEB-2013 | **5** |

## Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

MDW
ENVIRONMENTAL SERVICES

# Appendix D – June Laboratory Documentation

0789

Site: HOPE VALLEY NURSERY
Job #: E2011-109
Sampler: JT
CoC #: E2011-109
Quote #: ~~EP1490109~~ EP1785/12
Laboratory: ALS
Date and time delivered: 19/6/13 15:08
Received by: R Saunders


MDW
ENVIRONMENTAL SERVICES
**Mobile Dewatering Environmental Services**
8 Loton Avenue
Midland WA 6056
P: 08 9250 6960
F: 08 9250 8269
E: info@environmentalservices.com.au


Comments:

Analysis Detection Limits

Environmental Division Perth
Work Order
**EP1304590**
Telephone : +61-8-9209 7655

| Sample ID | Lab ID | Type | Sampling Date | Sampling Time | ASSESSMENT (1) SUITE |
|---|---|---|---|---|---|
| HVN MW102 | | W | 18/6 | | / |
| MW202 | | | | | / |
| MW3 | | | | | / |
| MW4 | | | | | / |
| MW5 | | | | | / |
| MW6 | | | | | / |

Condition of Sample: Cool / Ambient / Warm  Relinquished by: JM

Environmental Division

# SAMPLE RECEIPT NOTIFICATION (SRN)

## Comprehensive Report

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1304590** | | |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | Page | : 1 of 3 |
| Order number | : 0789 | | |
| C-O-C number | : E2011-109 | Quote number | : EP2012MOBDEW0134 (EP/785/12) |
| Site | : HOPE VALLEY NURSERY | | |
| Sampler | : JT | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |

### Dates

| | | | |
|---|---|---|---|
| Date Samples Received | : 18-JUN-2013 | Issue Date | : 19-JUN-2013 07:08 |
| Client Requested Due Date | : 25-JUN-2013 | Scheduled Reporting Date | : **25-JUN-2013** |

### Delivery Details

| | | | |
|---|---|---|---|
| Mode of Delivery | : Carrier | Temperature | : 6.2 - Ice present |
| No. of coolers/boxes | : 2 medium hard eskies | No. of samples received | : 6 |
| Security Seal | : Intact. | No. of samples analysed | : 6 |

### General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- **Samples received in appropriately pretreated and preserved containers.**
- **pH analysis should be conducted within 6 hours of sampling.**
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (SamplesPerth@alsenviro.com)
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of Work Order.

## Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

## Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EA005P pH (PC) | WATER - EA010P Conductivity (PC) | WATER - EA015H Total Dissolved Solids - High Level | WATER - EA025H Suspended Solids (High Level) | WATER - EA045 Turbidity | WATER - ED038 Acidity as CaCO3 | WATER - EG020F Dissolved Metals by ICPMS | WATER - EG020T Total Recoverable Metals by ICPMS |
|---|---|---|---|---|---|---|---|---|---|---|
| EP1304590-001 | 18-JUN-2013 15:00 | HVN MW1 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-002 | 18-JUN-2013 15:00 | HVN MW2 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-003 | 18-JUN-2013 15:00 | HVN MW3 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-004 | 18-JUN-2013 15:00 | HVN MW4 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-005 | 18-JUN-2013 15:00 | HVN MW5 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-006 | 18-JUN-2013 15:00 | HVN MW6 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EG035T Total Mercury by FIMS | WATER - EG050G-F Hexavalent Chromium by Discrete Analyser - Filtered | WATER - EG051G Ferrous Iron by Discrete Analyser | WATER - EK085M Sulfide as S 2- | WATER - EP030 BOD | WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity) | WATER - NT-08A Total Nitrogen + NO2 + NO3 + NH3 + Total P + |
|---|---|---|---|---|---|---|---|---|---|
| EP1304590-001 | 18-JUN-2013 15:00 | HVN MW1 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-002 | 18-JUN-2013 15:00 | HVN MW2 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-003 | 18-JUN-2013 15:00 | HVN MW3 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-004 | 18-JUN-2013 15:00 | HVN MW4 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-005 | 18-JUN-2013 15:00 | HVN MW5 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1304590-006 | 18-JUN-2013 15:00 | HVN MW6 02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

## Requested Deliverables

**ACCOUNTS PAYABLE (WA)**

| | | |
|---|---|---|
| - A4 - AU Tax Invoice ( INV ) | Email | deb@mobiledewatering.com.au |

**INFO**

| | | |
|---|---|---|
| - *AU Certificate of Analysis - NATA ( COA ) | Email | info@environmentalservices.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) ( QCI ) | Email | info@environmentalservices.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA ( QC ) | Email | info@environmentalservices.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT ( SRN ) | Email | info@environmentalservices.com.au |
| - Chain of Custody (CoC) ( COC ) | Email | info@environmentalservices.com.au |
| - EDI Format - ENMRG ( ENMRG ) | Email | info@environmentalservices.com.au |
| - EDI Format - ESDAT ( ESDAT ) | Email | info@environmentalservices.com.au |
| - EDI Format - XTab ( XTAB ) | Email | info@environmentalservices.com.au |

Environmental Division

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1304590** | Page | : 1 of 8 |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Order number | : 0789 | | |
| C-O-C number | : E2011-109 | Date Samples Received | : 18-JUN-2013 |
| Sampler | : JT | Issue Date | : 25-JUN-2013 |
| Site | : HOPE VALLEY NURSERY | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/785/12 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## *Signatories*

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Benjamin Nicholson | Metals Chemist | Perth Inorganics |
| Canhuang Ke | Metals Instrument Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EG020:It has been confirmed by re-digestion and re-analysis that total concentration is less than dissolved for sample EP1304590 #3 &6.**

## Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | HVN MW1 02 | HVN MW2 02 | HVN MW3 02 | HVN MW4 02 | HVN MW5 02 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 |
| | | | | | EP1304590-001 | EP1304590-002 | EP1304590-003 | EP1304590-004 | EP1304590-005 |
| **EA005P: pH by PC Titrator** | | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | | **6.13** | **5.83** | **5.19** | **6.37** | **6.48** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | | **434** | **162** | **532** | **550** | **451** |
| **EA015: Total Dissolved Solids** | | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | | **3260** | **129** | **818** | **676** | **336** |
| **EA025: Suspended Solids** | | | | | | | | | |
| **Suspended Solids (SS)** | ---- | 5 | mg/L | | **2570** | **574** | **310** | **300** | **1160** |
| **EA045: Turbidity** | | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | | **3100** | **197** | **2870** | **656** | **1920** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | | <1 | <1 | <1 | <1 | <1 |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | | <1 | <1 | <1 | <1 | <1 |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | | **12** | **2** | **3** | **58** | **50** |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | | **12** | **2** | **3** | **58** | **50** |
| **ED038A: Acidity** | | | | | | | | | |
| **Acidity as CaCO3** | ---- | 1 | mg/L | | **17** | **14** | **43** | **37** | **42** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | | **34** | **5** | **40** | **37** | **74** |
| **ED045G: Chloride Discrete analyser** | | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | | **102** | **16** | **145** | **118** | **60** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | | **0.53** | **0.46** | **1.62** | **0.31** | **0.02** |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | | **0.001** | <0.001 | **0.002** | **0.003** | <0.001 |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | | **0.002** | <0.001 | **0.002** | <0.001 | <0.001 |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | | **0.026** | **0.008** | **0.025** | **0.510** | **1.85** |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | | **0.006** | <0.001 | **0.002** | **0.003** | **0.001** |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | | **0.032** | **0.008** | **0.015** | **0.034** | **0.006** |
| **Iron** | 7439-89-6 | 0.05 | mg/L | | **0.37** | **0.14** | **0.46** | **7.37** | **12.3** |
| **EG020T: Total Metals by ICP-MS** | | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | | **12.8** | **1.19** | **11.7** | **4.06** | **5.71** |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | | **0.006** | <0.001 | **0.009** | **0.009** | **0.011** |

## Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | HVN MW1 02 | HVN MW2 02 | HVN MW3 02 | HVN MW4 02 | HVN MW5 02 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 |
| | | | | | EP1304590-001 | EP1304590-002 | EP1304590-003 | EP1304590-004 | EP1304590-005 |
| **EG020T: Total Metals by ICP-MS - Continued** | | | | | | | | | |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | **0.0003** | <0.0001 | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | | **0.050** | <0.001 | **0.010** | **0.005** | **0.191** |
| **Copper** | 7440-50-8 | 0.001 | mg/L | | **0.017** | <0.001 | **0.004** | **0.004** | **0.060** |
| **Lead** | 7439-92-1 | 0.001 | mg/L | | **0.032** | <0.001 | **0.048** | **0.004** | **0.009** |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | | **0.022** | **0.005** | **0.014** | **0.649** | **1.90** |
| **Molybdenum** | 7439-98-7 | 0.001 | mg/L | | **0.002** | <0.001 | <0.001 | <0.001 | **0.016** |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | | **0.002** | <0.001 | **0.005** | **0.001** | **0.003** |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Silver** | 7440-22-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | | **0.021** | <0.005 | **0.010** | **0.024** | **0.042** |
| **Iron** | 7439-89-6 | 0.05 | mg/L | | **3.62** | **0.18** | **1.03** | **35.0** | **68.6** |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| **Mercury** | 7439-97-6 | 0.0001 | mg/L | | **0.0003** | <0.0001 | **0.0001** | <0.0001 | <0.0001 |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| **Hexavalent Chromium** | 18540-29-9 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | | | |
| **Ferrous Iron** | ---- | 0.05 | mg/L | | **0.27** | **0.06** | **0.61** | **5.00** | **13.1** |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| **Ammonia as N** | 7664-41-7 | 0.01 | mg/L | | **0.04** | **0.04** | **0.38** | **0.42** | **0.73** |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| **Nitrite as N** | ---- | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| **Nitrate as N** | 14797-55-8 | 0.01 | mg/L | | **0.01** | **8.82** | <0.01 | **3.11** | **0.30** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| **Nitrite + Nitrate as N** | ---- | 0.01 | mg/L | | **0.01** | **8.82** | <0.01 | **3.11** | **0.30** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| **Total Kjeldahl Nitrogen as N** | ---- | 0.1 | mg/L | | **0.2** | **1.4** | **1.7** | **2.3** | **2.0** |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ **Total Nitrogen as N** | ---- | 0.1 | mg/L | | **0.2** | **10.2** | **1.7** | **5.4** | **2.3** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| **Total Phosphorus as P** | ---- | 0.01 | mg/L | | **0.10** | <0.05 | **0.14** | **0.09** | **0.07** |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| **Reactive Phosphorus as P** | 14265-44-2 | 0.01 | mg/L | | <0.01 | <0.01 | **0.02** | <0.01 | <0.01 |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVN MW1 02 | HVN MW2 02 | HVN MW3 02 | HVN MW4 02 | HVN MW5 02 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 | 18-JUN-2013 15:00 |
| Compound | CAS Number | LOR | Unit | | EP1304590-001 | EP1304590-002 | EP1304590-003 | EP1304590-004 | EP1304590-005 |
| **EK085M: Sulfide as S2-** | | | | | | | | | |
| **Sulfide as S2-** | 18496-25-8 | 0.1 | mg/L | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | **4** | <2 | **2** | **2** | **5** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | Client sample ID | HVN MW6 02 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 18-JUN-2013 15:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | EP1304590-006 | ---- | ---- | ---- | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | **5.70** | ---- | ---- | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | **1040** | ---- | ---- | ---- | ---- |
| **EA015: Total Dissolved Solids** | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | **840** | ---- | ---- | ---- | ---- |
| **EA025: Suspended Solids** | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | **36** | ---- | ---- | ---- | ---- |
| **EA045: Turbidity** | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | **441** | ---- | ---- | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | **12** | ---- | ---- | ---- | ---- |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | **12** | ---- | ---- | ---- | ---- |
| **ED038A: Acidity** | | | | | | | | |
| Acidity as CaCO3 | ---- | 1 | mg/L | **38** | ---- | ---- | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | **55** | ---- | ---- | ---- | ---- |
| **ED045G: Chloride Discrete analyser** | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | **307** | ---- | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | **0.35** | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | **0.003** | ---- | ---- | ---- | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | **0.057** | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | **0.002** | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | **0.021** | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | **1.84** | ---- | ---- | ---- | ---- |
| **EG020T: Total Metals by ICP-MS** | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | **3.51** | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | **0.004** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVN MW6 02 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 18-JUN-2013 15:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1304590-006 | ---- | ---- | ---- | ---- |
| **EG020T: Total Metals by ICP-MS - Continued** | | | | | | | | | |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | **0.0001** | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | | **0.002** | ---- | ---- | ---- | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | | **0.005** | ---- | ---- | ---- | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | | **0.007** | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | | **0.010** | ---- | ---- | ---- | ---- |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | | **0.002** | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | | **0.018** | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | | **1.69** | ---- | ---- | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | ---- | ---- | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | | | |
| Ferrous Iron | ---- | 0.05 | mg/L | | **1.97** | ---- | ---- | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | **0.30** | ---- | ---- | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | ---- | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | **1.91** | ---- | ---- | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | **1.91** | ---- | ---- | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | **2.1** | ---- | ---- | ---- | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | **4.0** | ---- | ---- | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | | **0.29** | ---- | ---- | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | | **0.27** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVN MW6 02 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 18-JUN-2013 15:00 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1304590-006 | ---- | ---- | ---- | ---- |
| **EK085M: Sulfide as S2-** | | | | | | | | | |
| **Sulfide as S2-** | 18496-25-8 | 0.1 | mg/L | | <0.1 | ---- | ---- | ---- | ---- |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | **8** | ---- | ---- | ---- | ---- |

Environmental Division

# QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1304590** | Page | : 1 of 12 |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Site | : HOPE VALLEY NURSERY | | |
| C-O-C number | : E2011-109 | Date Samples Received | : 18-JUN-2013 |
| Sampler | : JT | Issue Date | : 25-JUN-2013 |
| Order number | : 0789 | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/785/12 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## *Signatories*

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Benjamin Nicholson | Metals Chemist | Perth Inorganics |
| Canhuang Ke | Metals Instrument Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EA005P: pH by PC Titrator (QC Lot: 2924281)** | | | | | | | | | |
| EP1304573-003 | Anonymous | EA005-P: pH Value | ---- | 0.01 | pH Unit | 7.86 | 7.89 | 0.4 | 0% - 20% |
| EP1304590-003 | HVN MW3 02 | EA005-P: pH Value | ---- | 0.01 | pH Unit | 5.19 | 5.14 | 1.0 | 0% - 20% |
| **EA010P: Conductivity by PC Titrator (QC Lot: 2924280)** | | | | | | | | | |
| EP1304573-003 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 65000 | 64700 | 0.4 | 0% - 20% |
| EP1304590-003 | HVN MW3 02 | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 532 | 529 | 0.6 | 0% - 20% |
| **EA015: Total Dissolved Solids (QC Lot: 2928457)** | | | | | | | | | |
| EP1304563-001 | Anonymous | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 1750 | 1720 | 2.1 | 0% - 20% |
| EP1304565-007 | Anonymous | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 1530 | 1480 | 3.0 | 0% - 20% |
| **EA015: Total Dissolved Solids (QC Lot: 2928459)** | | | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 336 | 294 | 13.3 | 0% - 20% |
| EP1304607-013 | Anonymous | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 370 | 368 | 0.7 | 0% - 20% |
| **EA025: Suspended Solids (QC Lot: 2928458)** | | | | | | | | | |
| EP1304563-001 | Anonymous | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 24 | 30 | 22.2 | No Limit |
| EP1304565-007 | Anonymous | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 54 | 54 | 0.0 | 0% - 50% |
| **EA025: Suspended Solids (QC Lot: 2928460)** | | | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 1160 | 1040 | 10.9 | 0% - 20% |
| EP1304607-013 | Anonymous | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 84 | 80 | 4.9 | 0% - 50% |
| **EA045: Turbidity (QC Lot: 2925434)** | | | | | | | | | |
| EP1304590-001 | HVN MW1 02 | EA045: Turbidity | ---- | 0.1 | NTU | 3100 | 3090 | 0.4 | 0% - 20% |
| EP1304594-001 | Anonymous | EA045: Turbidity | ---- | 0.1 | NTU | 2.9 | 2.9 | 0.0 | 0% - 20% |
| **ED037P: Alkalinity by PC Titrator (QC Lot: 2924282)** | | | | | | | | | |
| EP1304573-003 | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 213 | 216 | 1.4 | 0% - 20% |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 213 | 216 | 1.4 | 0% - 20% |
| EP1304590-003 | HVN MW3 02 | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 3 | 2 | 0.0 | No Limit |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 3 | 2 | 0.0 | No Limit |
| **ED038A: Acidity (QC Lot: 2931427)** | | | | | | | | | |
| EP1304590-001 | HVN MW1 02 | ED038: Acidity as CaCO3 | ---- | 1 | mg/L | 17 | 19 | 10.5 | 0% - 50% |
| EP1304593-003 | Anonymous | ED038: Acidity as CaCO3 | ---- | 1 | mg/L | 23 | 23 | 0.0 | 0% - 20% |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2924304)** | | | | | | | | | |
| EP1304564-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 69 | 69 | 0.0 | 0% - 20% |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2924304) - continued** | | | | | | | | | |
| EP1304588-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 16 | 16 | 0.0 | 0% - 50% |
| **ED045G: Chloride Discrete analyser (QC Lot: 2924303)** | | | | | | | | | |
| EP1304564-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1 | mg/L | 107 | 107 | 0.0 | 0% - 20% |
| EP1304588-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1 | mg/L | 172 | 170 | 0.9 | 0% - 20% |
| **EG020F: Dissolved Metals by ICP-MS (QC Lot: 2925407)** | | | | | | | | | |
| EP1304573-003 | Anonymous | EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0010 | <0.0010 | 0.0 | No Limit |
| | | EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.010 | <0.010 | 0.0 | No Limit |
| | | EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.010 | <0.010 | 0.0 | No Limit |
| | | EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | 0.175 | 0.172 | 1.8 | 0% - 50% |
| | | EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | 0.028 | 0.030 | 7.5 | No Limit |
| | | EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | <0.050 | <0.050 | 0.0 | No Limit |
| | | EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.10 | <0.10 | 0.0 | No Limit |
| | | EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.10 | <0.10 | 0.0 | No Limit |
| | | EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | <0.50 | <0.50 | 0.0 | No Limit |
| EP1304590-004 | HVN MW4 02 | EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | 0.003 | 0.002 | 0.0 | No Limit |
| | | EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | 0.510 | 0.515 | 1.0 | 0% - 20% |
| | | EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | 0.003 | 0.003 | 0.0 | No Limit |
| | | EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | 0.034 | 0.034 | 0.0 | No Limit |
| | | EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | 0.31 | 0.30 | 0.0 | 0% - 20% |
| | | EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | 7.37 | 7.62 | 3.3 | 0% - 20% |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2925414)** | | | | | | | | | |
| EP1304590-001 | HVN MW1 02 | EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | 0.006 | 0.006 | 0.0 | No Limit |
| | | EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | 0.050 | 0.052 | 4.7 | 0% - 20% |
| | | EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | 0.017 | 0.018 | 0.0 | 0% - 50% |
| | | EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | 0.032 | 0.031 | 0.0 | 0% - 20% |
| | | EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | 0.022 | 0.022 | 0.0 | 0% - 20% |
| | | EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | 0.002 | 0.002 | 0.0 | No Limit |
| | | EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | 0.002 | 0.002 | 0.0 | No Limit |
| | | EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | 0.021 | 0.017 | 20.0 | No Limit |
| | | EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | 12.8 | 13.6 | 6.7 | 0% - 20% |
| | | EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | 3.62 | 3.83 | 5.6 | 0% - 20% |
| **EG020T: Total Metals by ICP-MS (QC Lot: 2925415)** | | | | | | | | | |
| EP1304590-001 | HVN MW1 02 | EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| **EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2926793)** | | | | | | | | | |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2926793) - continued** | | | | | | | | | |
| EP1304553-001 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| EP1304590-002 | HVN MW2 02 | EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| **EG050F: Dissolved Hexavalent Chromium (QC Lot: 2925232)** | | | | | | | | | |
| EP1304552-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| EP1304590-005 | HVN MW5 02 | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EG051G: Ferrous Iron by Discrete Analyser (QC Lot: 2924311)** | | | | | | | | | |
| EP1304561-004 | Anonymous | EG051G: Ferrous Iron | ---- | 0.05 | mg/L | 1.82 | 1.81 | 0.6 | 0% - 20% |
| EP1304593-002 | Anonymous | EG051G: Ferrous Iron | ---- | 0.05 | mg/L | 9.90 | 9.90 | 0.0 | 0% - 20% |
| **EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2924274)** | | | | | | | | | |
| EP1304578-001 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | 0.41 | 0.41 | 0.0 | 0% - 20% |
| EP1304588-001 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | 0.01 | 0.01 | 0.0 | No Limit |
| **EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2924276)** | | | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | 0.73 | 0.73 | 0.0 | 0% - 20% |
| EP1304601-003 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | 0.04 | 0.03 | 28.6 | No Limit |
| **EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2924299)** | | | | | | | | | |
| EP1304564-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | 0.05 | 0.06 | 0.0 | No Limit |
| EP1304588-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2924305)** | | | | | | | | | |
| EP1304596-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | 0.07 | 0.08 | 13.9 | No Limit |
| EP1304602-004 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2924273)** | | | | | | | | | |
| EP1304578-001 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 15.6 | 15.8 | 1.1 | 0% - 20% |
| EP1304588-001 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.10 | 0.10 | 0.0 | 0% - 50% |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2924275)** | | | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.30 | 0.28 | 6.9 | 0% - 20% |
| EP1304601-003 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 0.26 | 0.26 | 0.0 | 0% - 20% |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2928716)** | | | | | | | | | |
| EP1304563-001 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 140 | 137 | 2.4 | 0% - 20% |
| EP1304590-003 | HVN MW3 02 | EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 1.7 | 1.5 | 8.8 | 0% - 50% |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2928717)** | | | | | | | | | |
| EP1304563-001 | Anonymous | EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | 19.8 | 18.7 | 5.7 | 0% - 20% |
| EP1304590-003 | HVN MW3 02 | EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | 0.14 | 0.11 | 24.8 | 0% - 50% |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 2924300)** | | | | | | | | | |
| EP1304564-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | 0.03 | 0.04 | 0.0 | No Limit |
| EP1304588-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK085M: Sulfide as S2- (QC Lot: 2934673)** | | | | | | | | | |
| EP1304590-001 | HVN MW1 02 | EK085: Sulfide as S2- | 18496-25-8 | 0.1 | mg/L | <0.1 | <0.1 | 0.0 | No Limit |
| EP1304593-003 | Anonymous | EK085: Sulfide as S2- | 18496-25-8 | 0.1 | mg/L | <0.1 | <0.1 | 0.0 | No Limit |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 2927175)** | | | | | | | | | |
| EP1304590-001 | HVN MW1 02 | EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | 4 | <2 | 57.1 | No Limit |
| EP1304611-004 | Anonymous | EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | 13 | 12 | 0.0 | No Limit |

## Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

| | | | | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Recovery Limits (%) | |
| Method: Compound | CAS Number | LOR | Unit | Result | Concentration | LCS | Low | High |
| **EA005P: pH by PC Titrator (QCLot: 2924281)** | | | | | | | | |
| EA005-P: pH Value | ---- | 0.01 | pH Unit | ---- | 7.00 pH Unit | 100 | 70 | 130 |
| **EA010P: Conductivity by PC Titrator (QCLot: 2924280)** | | | | | | | | |
| EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | <1 | 24800 µS/cm | 94.8 | 90 | 110 |
| **EA015: Total Dissolved Solids (QCLot: 2928457)** | | | | | | | | |
| EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | <10 | 293 mg/L | 91.6 | 70 | 130 |
| **EA015: Total Dissolved Solids (QCLot: 2928459)** | | | | | | | | |
| EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | <10 | 293 mg/L | 122 | 70 | 130 |
| **EA025: Suspended Solids (QCLot: 2928458)** | | | | | | | | |
| EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | <5 | 150 mg/L | 97.7 | 70 | 130 |
| **EA025: Suspended Solids (QCLot: 2928460)** | | | | | | | | |
| EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | <5 | 150 mg/L | 116 | 70 | 130 |
| **EA045: Turbidity (QCLot: 2925434)** | | | | | | | | |
| EA045: Turbidity | ---- | 0.1 | NTU | <0.1 | 40 NTU | 97.2 | 91 | 107 |
| **ED037P: Alkalinity by PC Titrator (QCLot: 2924282)** | | | | | | | | |
| ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | <1 | 200 mg/L | 116 | 87 | 121 |
| **ED038A: Acidity (QCLot: 2931427)** | | | | | | | | |
| ED038: Acidity as CaCO3 | ---- | 1 | mg/L | ---- | 20 mg/L | 111 | 85 | 119 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2924304)** | | | | | | | | |
| ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | <1 | 25 mg/L | 105 | 88 | 121 |
| **ED045G: Chloride Discrete analyser (QCLot: 2924303)** | | | | | | | | |
| ED045G: Chloride | 16887-00-6 | 1 | mg/L | <1 | 1000 mg/L | 98.2 | 84 | 120 |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2925407)** | | | | | | | | |
| EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.50 mg/L | 90.3 | 77 | 113 |
| EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 90.1 | 89 | 109 |
| EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1000 mg/L | 89.1 | 89 | 109 |
| EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 93.9 | 88 | 106 |
| EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 98.0 | 87 | 107 |
| EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 100 | 87 | 109 |
| EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.10 mg/L | 100 | 93 | 117 |

Sub-Matrix: **WATER**

| Method: Compound | CAS Number | LOR | Unit | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Recovery Limits (%) | |
| | | | | Result | Concentration | LCS | Low | High |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2925407) - continued** | | | | | | | | |
| EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.100 mg/L | 96.2 | 89 | 115 |
| EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.50 mg/L | 96.6 | 83 | 109 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2925414)** | | | | | | | | |
| EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 95.3 | 78 | 116 |
| EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 95.5 | 77 | 109 |
| EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1 mg/L | 95.8 | 78 | 108 |
| EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 95.8 | 80 | 112 |
| EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 95.4 | 79 | 111 |
| EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 99.6 | 81 | 109 |
| EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 95.1 | 80 | 112 |
| EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 105 | 86 | 118 |
| EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 96.7 | 80 | 112 |
| EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.1 mg/L | 94.3 | 75 | 107 |
| EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.1 mg/L | 90.2 | 74 | 108 |
| EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.5 mg/L | 95.5 | 75 | 115 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2925415)** | | | | | | | | |
| EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | 0.01 mg/L | 99.5 | 70 | 130 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 2926793)** | | | | | | | | |
| EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | 0.0100 mg/L | 101 | 82.3 | 118 |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 2925232)** | | | | | | | | |
| EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 102 | 91 | 115 |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 2924311)** | | | | | | | | |
| EG051G: Ferrous Iron | ---- | 0.05 | mg/L | <0.05 | 2.00 mg/L | 102 | 89 | 113 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2924274)** | | | | | | | | |
| EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | <0.01 | 1 mg/L | 90.0 | 87 | 115 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2924276)** | | | | | | | | |
| EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | <0.01 | 1 mg/L | 91.7 | 87 | 115 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2924299)** | | | | | | | | |
| EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 100 | 86 | 112 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2924305)** | | | | | | | | |
| EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 98.2 | 86 | 112 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2924273)** | | | | | | | | |
| EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 93.0 | 92 | 112 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2924275)** | | | | | | | | |
| EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 97.8 | 92 | 112 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2928716)** | | | | | | | | |
| EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | <0.1 | 10 mg/L | 91.2 | 74 | 130 |

Sub-Matrix: **WATER**

| Method: Compound | CAS Number | LOR | Unit | Method Blank (MB) Report: Result | Laboratory Control Spike (LCS) Report: Spike Concentration | Spike Recovery (%): LCS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|---|
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2928717)** | | | | | | | | |
| EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | <0.01 | 4.42 mg/L | 104 | 70 | 130 |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2924300)** | | | | | | | | |
| EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 95.4 | 87 | 115 |
| **EK085M: Sulfide as S2- (QCLot: 2934673)** | | | | | | | | |
| EK085: Sulfide as S2- | 18496-25-8 | 0.10 | mg/L | <0.1 | 0.50 mg/L | 97.8 | 82 | 116 |
| **EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2927175)** | | | | | | | | |
| EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | <2 | 198 mg/L | 87.2 | 84 | 114 |

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) Report: Spike Concentration | SpikeRecovery(%): MS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2924304)** | | | | | | | |
| EP1304564-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L | 92.1 | 70 | 130 |
| **ED045G: Chloride Discrete analyser (QCLot: 2924303)** | | | | | | | |
| EP1304564-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1000 mg/L | 96.9 | 70 | 130 |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2925407)** | | | | | | | |
| EP1304588-001 | Anonymous | EG020A-F: Arsenic | 7440-38-2 | 0.200 mg/L | 97.0 | 70 | 130 |
| | | EG020A-F: Cadmium | 7440-43-9 | 0.0500 mg/L | 100 | 70 | 130 |
| | | EG020A-F: Chromium | 7440-47-3 | 0.200 mg/L | 86.9 | 70 | 130 |
| | | EG020A-F: Manganese | 7439-96-5 | 0.200 mg/L | 93.6 | 70 | 130 |
| | | EG020A-F: Nickel | 7440-02-0 | 0.200 mg/L | 95.4 | 70 | 130 |
| | | EG020A-F: Zinc | 7440-66-6 | 0.200 mg/L | 106 | 70 | 130 |
| **EG020T: Total Metals by ICP-MS (QCLot: 2925414)** | | | | | | | |
| EP1304590-002 | HVN MW2 02 | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 96.9 | 70 | 130 |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 98.6 | 70 | 130 |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 95.7 | 70 | 130 |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 99.4 | 70 | 130 |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 102 | 70 | 130 |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 98.3 | 70 | 130 |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 96.6 | 70 | 130 |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 95.0 | 70 | 130 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 2926793)** | | | | | | | |
| EP1304556-002 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0100 mg/L | 97.8 | 70 | 130 |

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) Report: Spike Concentration | Matrix Spike (MS) Report: SpikeRecovery(%) MS | Matrix Spike (MS) Report: Recovery Limits (%) Low | Matrix Spike (MS) Report: Recovery Limits (%) High |
|---|---|---|---|---|---|---|---|
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 2925232)** | | | | | | | |
| EP1304552-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.5 mg/L | 98.8 | 70 | 130 |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 2924311)** | | | | | | | |
| EP1304561-004 | Anonymous | EG051G: Ferrous Iron | ---- | 2.5 mg/L | 99.6 | 70 | 130 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2924274)** | | | | | | | |
| EP1304578-001 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 89.0 | 70 | 130 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2924276)** | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 82.0 | 70 | 130 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2924299)** | | | | | | | |
| EP1304564-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.5 mg/L | 110 | 70 | 130 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2924305)** | | | | | | | |
| EP1304596-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.5 mg/L | 110 | 70 | 130 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2924273)** | | | | | | | |
| EP1304578-001 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | # Not Determined | 70 | 130 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2924275)** | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | 90.0 | 70 | 130 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2928716)** | | | | | | | |
| EP1304563-001 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 5.0 mg/L | # Not Determined | 70 | 130 |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2928717)** | | | | | | | |
| EP1304563-001 | Anonymous | EK067G: Total Phosphorus as P | ---- | 1 mg/L | # Not Determined | 70 | 130 |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2924300)** | | | | | | | |
| EP1304564-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.5 mg/L | 103 | 70 | 130 |

## *Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report*

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report: Spike Concentration | Spike Recovery (%) MS | Spike Recovery (%) MSD | Recovery Limits (%) Low | Recovery Limits (%) High | RPDs (%) Value | RPDs (%) Control Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2924273)** | | | | | | | | | | |
| EP1304578-001 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | # Not Determined | ---- | 70 | 130 | ---- | ---- |

Sub-Matrix: **WATER**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2924274)** | | | | | | | | | | |
| EP1304578-001 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 89.0 | ---- | 70 | 130 | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2924275)** | | | | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | 90.0 | ---- | 70 | 130 | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 2924276)** | | | | | | | | | | |
| EP1304590-005 | HVN MW5 02 | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 82.0 | ---- | 70 | 130 | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2924299)** | | | | | | | | | | |
| EP1304564-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.5 mg/L | 110 | ---- | 70 | 130 | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2924300)** | | | | | | | | | | |
| EP1304564-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.5 mg/L | 103 | ---- | 70 | 130 | ---- | ---- |
| **ED045G: Chloride Discrete analyser (QCLot: 2924303)** | | | | | | | | | | |
| EP1304564-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1000 mg/L | 96.9 | ---- | 70 | 130 | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2924304)** | | | | | | | | | | |
| EP1304564-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L | 92.1 | ---- | 70 | 130 | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 2924305)** | | | | | | | | | | |
| EP1304596-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.5 mg/L | 110 | ---- | 70 | 130 | ---- | ---- |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 2924311)** | | | | | | | | | | |
| EP1304561-004 | Anonymous | EG051G: Ferrous Iron | ---- | 2.5 mg/L | 99.6 | ---- | 70 | 130 | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 2925232)** | | | | | | | | | | |
| EP1304552-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.5 mg/L | 98.8 | ---- | 70 | 130 | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 2925407)** | | | | | | | | | | |
| EP1304588-001 | Anonymous | EG020A-F: Arsenic | 7440-38-2 | 0.200 mg/L | 97.0 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Cadmium | 7440-43-9 | 0.0500 mg/L | 100 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Chromium | 7440-47-3 | 0.200 mg/L | 86.9 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Manganese | 7439-96-5 | 0.200 mg/L | 93.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Nickel | 7440-02-0 | 0.200 mg/L | 95.4 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Zinc | 7440-66-6 | 0.200 mg/L | 106 | ---- | 70 | 130 | ---- | ---- |
| **EG020T: Total Metals by ICP-MS (QCLot: 2925414)** | | | | | | | | | | |
| EP1304590-002 | HVN MW2 02 | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 96.9 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 98.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 95.7 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 99.4 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 102 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 98.3 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 96.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 95.0 | ---- | 70 | 130 | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 2926793)** | | | | | | | | | | |
| EP1304556-002 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0100 mg/L | 97.8 | ---- | 70 | 130 | ---- | ---- |

Sub-Matrix: **WATER**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2928716)** | | | | | | | | | | |
| EP1304563-001 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 5.0 mg/L | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2928717)** | | | | | | | | | | |
| EP1304563-001 | Anonymous | EK067G: Total Phosphorus as P | ---- | 1 mg/L | # Not Determined | ---- | 70 | 130 | ---- | ---- |

Environmental Division

# INTERPRETIVE QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1304590** | Page | : 1 of 12 |
| Client | : MOBILE DEWATERING | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Lauren Ockwell |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : lauren.ockwell@alsenviro.com |
| Telephone | : +61 08 9250 4995 | Telephone | : 08 9209 7606 |
| Facsimile | : ---- | Facsimile | : 08 9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Site | : HOPE VALLEY NURSERY | | |
| C-O-C number | : E2011-109 | Date Samples Received | : 18-JUN-2013 |
| Sampler | : JT | Issue Date | : 25-JUN-2013 |
| Order number | : 0789 | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/785/12 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

# Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EA005P: pH by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA005-P)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | --- | 18-JUN-2013 | ---- | **19-JUN-2013** | 18-JUN-2013 | × |
| **EA010P: Conductivity by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA010-P)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | --- | 16-JUL-2013 | ---- | **19-JUN-2013** | 16-JUL-2013 | ✓ |
| **EA015: Total Dissolved Solids** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA015H)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | --- | 25-JUN-2013 | ---- | **21-JUN-2013** | 25-JUN-2013 | ✓ |
| **EA025: Suspended Solids** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA025H)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | --- | 25-JUN-2013 | ---- | **21-JUN-2013** | 25-JUN-2013 | ✓ |
| **EA045: Turbidity** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA045)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **19-JUN-2013** | 20-JUN-2013 | ✓ |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED037-P)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | --- | 02-JUL-2013 | ---- | **19-JUN-2013** | 02-JUL-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **ED038A: Acidity** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED038)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **24-JUN-2013** | 02-JUL-2013 | ✓ |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED041G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 16-JUL-2013 | ---- | **18-JUN-2013** | 16-JUL-2013 | ✓ |
| **ED045G: Chloride Discrete analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED045G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 16-JUL-2013 | ---- | **18-JUN-2013** | 16-JUL-2013 | ✓ |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 15-DEC-2013 | ---- | **20-JUN-2013** | 15-DEC-2013 | ✓ |
| **EG020T: Total Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **20-JUN-2013** | 15-DEC-2013 | ✓ | **20-JUN-2013** | 15-DEC-2013 | ✓ |
| **EG020T: Total Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **20-JUN-2013** | 15-DEC-2013 | ✓ | **20-JUN-2013** | 15-DEC-2013 | ✓ |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **21-JUN-2013** | 16-JUL-2013 | ✓ |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | |
| **Clear Plastic Bottle - NaOH (EG050G-F)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **24-JUN-2013** | 16-JUL-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - HCl - Filtered (EG051G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **18-JUN-2013** | 25-JUN-2013 | ✓ |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK055G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 16-JUL-2013 | ---- | **18-JUN-2013** | 16-JUL-2013 | ✓ |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK057G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 20-JUN-2013 | ---- | **18-JUN-2013** | 20-JUN-2013 | ✓ |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK059G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 16-JUL-2013 | ---- | **18-JUN-2013** | 16-JUL-2013 | ✓ |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK061G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **21-JUN-2013** | 16-JUL-2013 | ✓ | **21-JUN-2013** | 16-JUL-2013 | ✓ |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK067G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **21-JUN-2013** | 16-JUL-2013 | ✓ | **21-JUN-2013** | 16-JUL-2013 | ✓ |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK071G)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **---** | 20-JUN-2013 | ---- | **18-JUN-2013** | 20-JUN-2013 | ✓ |
| **EK085M: Sulfide as S2-** | | | | | | | |
| **Clear Plastic Bottle - Zinc Acetate/NaOH (EK085)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **25-JUN-2013** | 25-JUN-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | |
| **Clear Plastic Bottle - Natural (EP030)** | | | | | | | |
| HVN MW1 02, HVN MW2 02, HVN MW3 02, HVN MW4 02, HVN MW5 02, HVN MW6 02 | **18-JUN-2013** | **----** | ---- | ---- | **20-JUN-2013** | 20-JUN-2013 | ✓ |

# Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Duplicates (DUP)** | | | | | | | |
| Acidity as Calcium Carbonate | ED038 | 2 | 12 | **16.7** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Alkalinity by PC Titrator | ED037-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 4 | 39 | **10.3** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 2 | 18 | **11.1** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 2 | 11 | **18.2** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 2 | 17 | **11.8** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 4 | 36 | **11.1** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 4 | 40 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| pH by PC Titrator | EA005-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 4 | 32 | **12.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 4 | 32 | **12.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 2 | 16 | **12.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 6 | **16.7** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 1 | 6 | **16.7** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 2 | 12 | **16.7** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| **Laboratory Control Samples (LCS)** | | | | | | | |
| Acidity as Calcium Carbonate | ED038 | 1 | 12 | **8.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Alkalinity by PC Titrator | ED037-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 2 | 39 | **5.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 18 | **5.6** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 17 | **5.9** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 36 | **5.6** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 40 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| pH by PC Titrator | EA005-P | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Control Samples (LCS) - Continued** | | | | | | | |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 4 | 32 | **12.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 4 | 32 | **12.5** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 16 | **6.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 1 | 12 | **8.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| **Method Blanks (MB)** | | | | | | | |
| Alkalinity by PC Titrator | ED037-P | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 2 | 39 | **5.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 18 | **5.6** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 17 | **5.9** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 36 | **5.6** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 40 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 2 | 32 | **6.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 2 | 32 | **6.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 16 | **6.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 1 | 12 | **8.3** | **5.0** | ✓ | NEPM 1999 Schedule B(3) and ALS QCS3 requirement |
| **Matrix Spikes (MS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 2 | 39 | **5.1** | **5.0** | ✓ | ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 20 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 20 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 11 | **9.1** | **5.0** | ✓ | ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 17 | **5.9** | **5.0** | ✓ | ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 36 | **5.6** | **5.0** | ✓ | ALS QCS3 requirement |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| Matrix Spikes (MS) - Continued | | | | | | | |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 40 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 20 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 20 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 16 | **6.3** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 6 | **16.7** | **5.0** | ✓ | ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 1 | 20 | **5.0** | **5.0** | ✓ | ALS QCS3 requirement |

## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| pH by PC Titrator | EA005-P | WATER | APHA 21st ed. 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Conductivity by PC Titrator | EA010-P | WATER | APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Dissolved Solids (High Level) | EA015H | WATER | In-House, APHA 21st ed., 2540C A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Suspended Solids (High Level) | EA025H | WATER | In-House, APHA 21st ed., 2540D A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Turbidity | EA045 | WATER | APHA 21st ed., 2130 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Alkalinity by PC Titrator | ED037-P | WATER | APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Acidity as Calcium Carbonate | ED038 | WATER | APHA 21st ed., 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | WATER | APHA 21st ed., 4500-SO4 Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Chloride by Discrete Analyser | ED045G | WATER | APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003 |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Total Metals by ICP-MS - Suite A | EG020A-T | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Total Metals by ICP-MS - Suite B | EG020B-T | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Total Mercury by FIMS | EG035T | WATER | AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | WATER | APHA 21st ed., 3500 Cr-A & B. Samples are 0.45 um filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Ferrous Iron by Discrete Analyser | EG051G | WATER | APHA 21st ed., 3500 Fe-B. A colorimetric determination based on the reaction between phenanthroline and ferrous iron at pH 3.2-3.3 to form an orange-red complex that is measured against a five-point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Ammonia as N by Discrete analyser | EK055G | WATER | APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Nitrite as N by Discrete Analyser | EK057G | WATER | APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Nitrate as N by Discrete Analyser | EK058G | WATER | APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | WATER | APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | WATER | APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Nitrogen as N (TKN + Nox) By Discrete Analyser | EK062G | WATER | APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Total Phosphorus as P By Discrete Analyser | EK067G | WATER | APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | WATER | APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Sulfide as S2- | EK085 | WATER | APHA 21st ed., 4500-S2- D Sulfide species present in water samples are immediately precipitated when collected in pretreated caustic/zinc acetate preserved sample containers. After the supernatant is discarded, the resultant precipitate is then coloured using methylene blue indicator and measured using UV-VIS detection at 664nm. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |
| Biochemical Oxygen Demand (BOD) | EP030 | WATER | APHA 21st ed., 5210 B The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Digestion for Total Recoverable Metals | EN25 | WATER | USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) |

# Summary of Outliers

## Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

### Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

| Compound Group Name | Laboratory Sample ID | Client Sample ID | Analyte | CAS Number | Data | Limits | Comment |
|---|---|---|---|---|---|---|---|
| **Matrix Spike (MS) Recoveries** | | | | | | | |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar | EP1304578-001 | Anonymous | **Nitrite + Nitrate as N** | ---- | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser | EP1304563-001 | Anonymous | **Total Kjeldahl Nitrogen as N** | ---- | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EK067G: Total Phosphorus as P by Discrete Analyser | EP1304563-001 | Anonymous | **Total Phosphorus as P** | ---- | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

### Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

## Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

| Method / Container / Client Sample ID(s) | | Extraction / Preparation: Date extracted | Extraction / Preparation: Due for extraction | Extraction / Preparation: Days overdue | Analysis: Date analysed | Analysis: Due for analysis | Analysis: Days overdue |
|---|---|---|---|---|---|---|---|
| **EA005P: pH by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural** | | | | | | | |
| HVN MW1 02, | HVN MW2 02, | ---- | ---- | ---- | 19-JUN-2013 | 18-JUN-2013 | **1** |
| HVN MW3 02, | HVN MW4 02, | | | | | | |
| HVN MW5 02, | HVN MW6 02 | | | | | | |

## Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

MDW
ENVIRONMENTAL SERVICES

# Appendix E – August Laboratory Documentation

0874

Site: HOPE VALLEY NURSERY
Job #: E2011-109
Sampler: JT
CoC #: E2011-109-03
Quote #: EP/667/13
Laboratory: ALS
Date and time delivered: 20/8/13 1622
Received by: M Westmill


MDW
ENVIRONMENTAL SERVICES
**Mobile Dewatering Environmental Services**
8 Loton Avenue
Midland WA 6056
P: 08 9250 6960
F: 08 9250 8269
E: info@environmentalservices.com.au


Comments:
PLS FILTER HVN MW5 & 6 03 for DISSOLVED METALS & $Fe^{+2}$

PLS FILTER HVN MW4 03 for DISSOLVED $Fe^{+2}$

Analysis Detection Limits

ASSESSMENT 1 SITE

| Sample ID | Lab ID | Type | Sampling Date | Sampling Time |
|---|---|---|---|---|
| HVN MW1 03 | | W | 20/8 | 0730 |
| 2 | | | | 0750 |
| 3 | | | | 0815 |
| 4 | | | | 0840 |
| 5 | | | | 0900 |
| 6 | | | | 0930 |

Environmental Division
Perth
Work Order
**EP1306367**
Telephone : +61-8-9209 7655

Condition of Sample: Cool / Ambient / Warm  Relinquished by:

Environmental Division

# SAMPLE RECEIPT NOTIFICATION (SRN)

## Comprehensive Report

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1306367** | | |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Scott James |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : perth.enviro.services@alsglobal.com |
| Telephone | : +61 08 9250 4995 | Telephone | : +61-8-9209 7655 |
| Facsimile | : ---- | Facsimile | : +61-8-9209 7600 |
| Project | : E2011-109 | Page | : 1 of 3 |
| Order number | : ---- | | |
| C-O-C number | : E2011-109-03 | Quote number | : EP2013MOBDEW0138 (EP/667/13) |
| Site | : HOPEVALLEY NURSERY | | |
| Sampler | : J.T. | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |

### Dates

| | | | |
|---|---|---|---|
| Date Samples Received | : 20-AUG-2013 | Issue Date | : 20-AUG-2013 19:46 |
| Client Requested Due Date | : 27-AUG-2013 | Scheduled Reporting Date | : **27-AUG-2013** |

### Delivery Details

| | | | |
|---|---|---|---|
| Mode of Delivery | : Carrier | Temperature | : 3.1 - Ice present |
| No. of coolers/boxes | : 1 Medium Hard Esky | No. of samples received | : 6 |
| Security Seal | : Intact. | No. of samples analysed | : 6 |

### General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.
- Please see scanned COC for sample discrepencies: extra samples , samples not received etc.
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **pH analysis should be conducted within 6 hours of sampling.**
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (SamplesPerth@alsenviro.com)
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of Work Order.

## Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

| Method<br>Client sample ID | Sample Container Received | Preferred Sample Container for Analysis |
|---|---|---|
| **EG051G : Ferrous Iron by Discrete Analyser** | | |
| **HVNMW4 03** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |
| **HVNMW5 03** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |
| **HVNMW6 03** | - Clear Plastic Bottle - Natural | - Clear Plastic Bottle - HCl - Filtered |

## Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EA005P pH (PC) | WATER - EA010P Conductivity (PC) | WATER - EA015H Total Dissolved Solids - High Level | WATER - EA025H Suspended Solids (High Level) | WATER - EA045 Turbidity | WATER - ED038 Acidity as CaCO3 | WATER - EG020F Dissolved Metals by ICPMS | WATER - EG020T Total Recoverable Metals by ICPMS |
|---|---|---|---|---|---|---|---|---|---|---|
| EP1306367-001 | 20-AUG-2013 07:30 | HVNMW1 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-002 | 20-AUG-2013 07:50 | HVNMW2 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-003 | 20-AUG-2013 08:15 | HVNMW3 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-004 | 20-AUG-2013 08:40 | HVNMW4 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-005 | 20-AUG-2013 09:00 | HVNMW5 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-006 | 20-AUG-2013 09:30 | HVNMW6 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EG035T Total Mercury by FIMS | WATER - EG050G-F Hexavalent Chromium by Discrete Analyser - Filtered | WATER - EG051G Ferrous Iron by Discrete Analyser | WATER - EK085M Sulfide as S 2- | WATER - EP030 BOD | WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity) | WATER - NT-08A Total Nitrogen + NO2 + NO3 + NH3 + Total P + |
|---|---|---|---|---|---|---|---|---|---|
| EP1306367-001 | 20-AUG-2013 07:30 | HVNMW1 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-002 | 20-AUG-2013 07:50 | HVNMW2 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-003 | 20-AUG-2013 08:15 | HVNMW3 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-004 | 20-AUG-2013 08:40 | HVNMW4 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-005 | 20-AUG-2013 09:00 | HVNMW5 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EP1306367-006 | 20-AUG-2013 09:30 | HVNMW6 03 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

## Requested Deliverables

**ACCOUNTS PAYABLE (WA)**

| | | |
|---|---|---|
| - A4 - AU Tax Invoice ( INV ) | Email | deb@mobiledewatering.com.au |

**INFO**

| | | |
|---|---|---|
| - *AU Certificate of Analysis - NATA ( COA ) | Email | info@environmentalservices.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) ( QCI ) | Email | info@environmentalservices.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA ( QC ) | Email | info@environmentalservices.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT ( SRN ) | Email | info@environmentalservices.com.au |
| - Chain of Custody (CoC) ( COC ) | Email | info@environmentalservices.com.au |
| - EDI Format - ENMRG ( ENMRG ) | Email | info@environmentalservices.com.au |
| - EDI Format - ESDAT ( ESDAT ) | Email | info@environmentalservices.com.au |
| - EDI Format - XTab ( XTAB ) | Email | info@environmentalservices.com.au |

Environmental Division

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1306367** | Page | : 1 of 8 |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Scott James |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : perth.enviro.services@alsglobal.com |
| Telephone | : +61 08 9250 4995 | Telephone | : +61-8-9209 7655 |
| Facsimile | : ---- | Facsimile | : +61-8-9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Order number | : ---- | | |
| C-O-C number | : E2011-109-03 | Date Samples Received | : 20-AUG-2013 |
| Sampler | : J.T. | Issue Date | : 27-AUG-2013 |
| Site | : HOPEVALLEY NURSERY | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/667/13 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## *Signatories*

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Benjamin Nicholson | Metals Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Efua Wilson | ICP-CHEMIST | Perth Inorganics |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EG020:It has been confirmed by re-digestion and re-analysis that some total analyte concentration is less than dissolved**
- **EK058G/EK059G: LOR raised for sample 'HVNMW3 03' due to possible sample matrix interference.**
- **EK061G/EK067G: LOR raised on various samples due to possible sample matrix interference.**
- **It has been noted that Reactive Phosphorus (EK071G) is greater than Total Phosphorus (EK067G) for sample 'HVNMW6 03', however this difference is within the limits of experimental variation.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

## Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | HVNMW1 03 | HVNMW2 03 | HVNMW3 03 | HVNMW4 03 | HVNMW5 03 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-AUG-2013 07:30 | 20-AUG-2013 07:50 | 20-AUG-2013 08:15 | 20-AUG-2013 08:40 | 20-AUG-2013 09:00 |
| | | | | | EP1306367-001 | EP1306367-002 | EP1306367-003 | EP1306367-004 | EP1306367-005 |
| **EA005P: pH by PC Titrator** | | | | | | | | | |
| **pH Value** | ---- | 0.01 | pH Unit | | **6.13** | **6.46** | **4.58** | **6.19** | **5.99** |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | | |
| **Electrical Conductivity @ 25°C** | ---- | 1 | µS/cm | | **440** | **159** | **435** | **300** | **157** |
| **EA015: Total Dissolved Solids** | | | | | | | | | |
| **Total Dissolved Solids @180°C** | ---- | 10 | mg/L | | **685** | **116** | **820** | **1200** | **139** |
| **EA025: Suspended Solids** | | | | | | | | | |
| **Suspended Solids (SS)** | ---- | 5 | mg/L | | **2530** | **72** | **620** | **152** | **38** |
| **EA045: Turbidity** | | | | | | | | | |
| **Turbidity** | ---- | 0.1 | NTU | | **1690** | **56.8** | **1860** | **1390** | **46.8** |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | | |
| **Hydroxide Alkalinity as CaCO3** | DMO-210-001 | 1 | mg/L | | <1 | <1 | <1 | <1 | <1 |
| **Carbonate Alkalinity as CaCO3** | 3812-32-6 | 1 | mg/L | | <1 | <1 | <1 | <1 | <1 |
| **Bicarbonate Alkalinity as CaCO3** | 71-52-3 | 1 | mg/L | | **12** | **10** | <1 | **27** | **10** |
| **Total Alkalinity as CaCO3** | ---- | 1 | mg/L | | **12** | **10** | <1 | **27** | **10** |
| **ED038A: Acidity** | | | | | | | | | |
| **Acidity as CaCO3** | ---- | 1 | mg/L | | **10** | **6** | **47** | **21** | **20** |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| **Sulfate as SO4 - Turbidimetric** | 14808-79-8 | 1 | mg/L | | **36** | **11** | **18** | **29** | **22** |
| **ED045G: Chloride Discrete analyser** | | | | | | | | | |
| **Chloride** | 16887-00-6 | 1 | mg/L | | **97** | **17** | **107** | **50** | **28** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | | **0.14** | **0.33** | **2.84** | **1.12** | **0.26** |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | | **0.002** | <0.001 | **0.005** | **0.002** | **0.001** |
| **Cadmium** | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | **0.0002** | **0.0001** | <0.0001 |
| **Chromium** | 7440-47-3 | 0.001 | mg/L | | <0.001 | <0.001 | **0.009** | **0.023** | **0.001** |
| **Manganese** | 7439-96-5 | 0.001 | mg/L | | **0.012** | **0.007** | **0.026** | **0.154** | **0.296** |
| **Nickel** | 7440-02-0 | 0.001 | mg/L | | **0.001** | **0.001** | **0.019** | **0.044** | **0.002** |
| **Selenium** | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Zinc** | 7440-66-6 | 0.005 | mg/L | | **0.017** | **0.009** | **0.079** | **0.050** | **0.014** |
| **Iron** | 7439-89-6 | 0.05 | mg/L | | **0.30** | **0.07** | **1.02** | **2.00** | **3.52** |
| **EG020T: Total Metals by ICP-MS** | | | | | | | | | |
| **Aluminium** | 7429-90-5 | 0.01 | mg/L | | **15.0** | **1.35** | **12.9** | **8.99** | **0.40** |
| **Arsenic** | 7440-38-2 | 0.001 | mg/L | | **0.006** | <0.001 | **0.006** | **0.005** | **0.002** |

## Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | HVNMW1 03 | HVNMW2 03 | HVNMW3 03 | HVNMW4 03 | HVNMW5 03 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-AUG-2013 07:30 | 20-AUG-2013 07:50 | 20-AUG-2013 08:15 | 20-AUG-2013 08:40 | 20-AUG-2013 09:00 |
| | | | | | EP1306367-001 | EP1306367-002 | EP1306367-003 | EP1306367-004 | EP1306367-005 |
| **EG020T: Total Metals by ICP-MS - Continued** | | | | | | | | | |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | | **0.038** | <0.001 | **0.010** | **0.008** | **0.002** |
| Copper | 7440-50-8 | 0.001 | mg/L | | **0.020** | **0.001** | **0.007** | **0.004** | **0.004** |
| Lead | 7439-92-1 | 0.001 | mg/L | | **0.035** | <0.001 | **0.020** | **0.004** | <0.001 |
| Manganese | 7439-96-5 | 0.001 | mg/L | | **0.044** | **0.006** | **0.015** | **0.317** | **0.308** |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | | **0.002** | **0.001** | <0.001 | <0.001 | **0.002** |
| Nickel | 7440-02-0 | 0.001 | mg/L | | **0.002** | <0.001 | **0.004** | **0.001** | **0.002** |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | | **0.028** | <0.005 | **0.016** | **0.023** | **0.013** |
| Iron | 7439-89-6 | 0.05 | mg/L | | **4.93** | **0.36** | **1.29** | **39.9** | **4.42** |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | **0.0002** | <0.0001 | <0.0001 | **0.0001** | <0.0001 |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | | | |
| Ferrous Iron | ---- | 0.05 | mg/L | | **0.32** | <0.05 | **0.88** | **1.36** | **2.40** |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | **0.02** | **0.02** | **0.12** | **0.19** | **0.08** |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | ---- | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | <0.01 | **7.81** | <0.05 | **3.12** | **1.00** |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | <0.01 | **7.81** | <0.05 | **3.12** | **1.00** |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | **0.2** | <0.5 | **3.2** | **2.3** | **1.4** |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | **0.2** | **7.8** | **3.2** | **5.4** | **2.4** |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | | **0.18** | <0.05 | **0.10** | **0.05** | **0.04** |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | | <0.01 | <0.01 | **0.03** | <0.01 | **0.02** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW1 03 | HVNMW2 03 | HVNMW3 03 | HVNMW4 03 | HVNMW5 03 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-AUG-2013 07:30 | 20-AUG-2013 07:50 | 20-AUG-2013 08:15 | 20-AUG-2013 08:40 | 20-AUG-2013 09:00 |
| Compound | CAS Number | LOR | Unit | | EP1306367-001 | EP1306367-002 | EP1306367-003 | EP1306367-004 | EP1306367-005 |
| **EK085M: Sulfide as S2-** | | | | | | | | | |
| **Sulfide as S2-** | 18496-25-8 | 0.1 | mg/L | | <0.1 | <0.1 | **0.2** | <0.1 | <0.1 |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | <2 | **6** | <2 | **3** | **2** |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW6 03 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-AUG-2013 09:30 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1306367-006 | ---- | ---- | ---- | ---- |
| **EA005P: pH by PC Titrator** | | | | | | | | | |
| pH Value | ---- | 0.01 | pH Unit | | **4.51** | ---- | ---- | ---- | ---- |
| **EA010P: Conductivity by PC Titrator** | | | | | | | | | |
| Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | | **500** | ---- | ---- | ---- | ---- |
| **EA015: Total Dissolved Solids** | | | | | | | | | |
| Total Dissolved Solids @180°C | ---- | 10 | mg/L | | **518** | ---- | ---- | ---- | ---- |
| **EA025: Suspended Solids** | | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | | **136** | ---- | ---- | ---- | ---- |
| **EA045: Turbidity** | | | | | | | | | |
| Turbidity | ---- | 0.1 | NTU | | **505** | ---- | ---- | ---- | ---- |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | | | |
| Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | | <1 | ---- | ---- | ---- | ---- |
| Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | | <1 | ---- | ---- | ---- | ---- |
| Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | | <1 | ---- | ---- | ---- | ---- |
| Total Alkalinity as CaCO3 | ---- | 1 | mg/L | | <1 | ---- | ---- | ---- | ---- |
| **ED038A: Acidity** | | | | | | | | | |
| Acidity as CaCO3 | ---- | 1 | mg/L | | **36** | ---- | ---- | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | **17** | ---- | ---- | ---- | ---- |
| **ED045G: Chloride Discrete analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | **119** | ---- | ---- | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | **0.68** | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | | **0.008** | ---- | ---- | ---- | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | | **0.004** | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | | **0.012** | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | | **0.034** | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | | **0.62** | ---- | ---- | ---- | ---- |
| **EG020T: Total Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | **4.41** | ---- | ---- | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | | **0.008** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW6 03 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-AUG-2013 09:30 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1306367-006 | ---- | ---- | ---- | ---- |
| **EG020T: Total Metals by ICP-MS - Continued** | | | | | | | | | |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | ---- | ---- | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | | **0.007** | ---- | ---- | ---- | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | | **0.033** | ---- | ---- | ---- | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | | **0.007** | ---- | ---- | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | | **0.014** | ---- | ---- | ---- | ---- |
| Molybdenum | 7439-98-7 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | | **0.002** | ---- | ---- | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | ---- | ---- | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | | **0.023** | ---- | ---- | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | | **0.80** | ---- | ---- | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | ---- | ---- | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | | | |
| Ferrous Iron | ---- | 0.05 | mg/L | | **0.66** | ---- | ---- | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | **0.16** | ---- | ---- | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | ---- | 0.01 | mg/L | | <0.01 | ---- | ---- | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | **5.98** | ---- | ---- | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | **5.98** | ---- | ---- | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | **2.8** | ---- | ---- | ---- | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | **8.8** | ---- | ---- | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | | **0.52** | ---- | ---- | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | | | |
| Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | | **0.57** | ---- | ---- | ---- | ---- |

## Analytical Results

| Sub-Matrix: WATER (Matrix: WATER) | | | | Client sample ID | HVNMW6 03 | ---- | ---- | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-AUG-2013 09:30 | ---- | ---- | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EP1306367-006 | ---- | ---- | ---- | ---- |
| **EK085M: Sulfide as S2-** | | | | | | | | | |
| **Sulfide as S2-** | 18496-25-8 | 0.1 | mg/L | | <0.1 | ---- | ---- | ---- | ---- |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | <2 | ---- | ---- | ---- | ---- |

Environmental Division

# QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1306367** | Page | : 1 of 11 |
| Client | : **MOBILE DEWATERING** | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Scott James |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : perth.enviro.services@alsglobal.com |
| Telephone | : +61 08 9250 4995 | Telephone | : +61-8-9209 7655 |
| Facsimile | : ---- | Facsimile | : +61-8-9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Site | : HOPEVALLEY NURSERY | | |
| C-O-C number | : E2011-109-03 | Date Samples Received | : 20-AUG-2013 |
| Sampler | : J.T. | Issue Date | : 27-AUG-2013 |
| Order number | : ---- | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/667/13 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## *Signatories*

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Benjamin Nicholson | Metals Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Chas Tucker | Inorganic Chemist | Perth Inorganics |
| Efua Wilson | ICP-CHEMIST | Perth Inorganics |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | LOR | Unit | Original Result | Duplicate Result | RPD (%) | Recovery Limits (%) |
| **EA005P: pH by PC Titrator (QC Lot: 3022038)** | | | | | | | | | |
| EP1306326-001 | Anonymous | EA005-P: pH Value | ---- | 0.01 | pH Unit | 5.98 | 5.96 | 0.3 | 0% - 20% |
| EP1306339-008 | Anonymous | EA005-P: pH Value | ---- | 0.01 | pH Unit | 6.87 | 6.86 | 0.1 | 0% - 20% |
| **EA005P: pH by PC Titrator (QC Lot: 3022041)** | | | | | | | | | |
| EP1306367-002 | HVNMW2 03 | EA005-P: pH Value | ---- | 0.01 | pH Unit | 6.46 | 6.24 | 3.5 | 0% - 20% |
| **EA010P: Conductivity by PC Titrator (QC Lot: 3022037)** | | | | | | | | | |
| EP1306326-001 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 1760 | 1760 | 0.0 | 0% - 20% |
| EP1306339-008 | Anonymous | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 413 | 410 | 0.5 | 0% - 20% |
| **EA010P: Conductivity by PC Titrator (QC Lot: 3022040)** | | | | | | | | | |
| EP1306367-002 | HVNMW2 03 | EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | 159 | 154 | 2.7 | 0% - 20% |
| **EA015: Total Dissolved Solids (QC Lot: 3024207)** | | | | | | | | | |
| EP1306367-001 | HVNMW1 03 | EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | 685 | 663 | 3.3 | 0% - 20% |
| **EA025: Suspended Solids (QC Lot: 3024208)** | | | | | | | | | |
| EP1306367-001 | HVNMW1 03 | EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | 2530 | 2570 | 1.3 | 0% - 20% |
| **EA045: Turbidity (QC Lot: 3022474)** | | | | | | | | | |
| EP1306325-001 | Anonymous | EA045: Turbidity | ---- | 0.1 | NTU | 3.1 | 3.1 | 0.0 | 0% - 20% |
| EP1306339-006 | Anonymous | EA045: Turbidity | ---- | 0.1 | NTU | 602 | 601 | 0.2 | 0% - 20% |
| **EA045: Turbidity (QC Lot: 3022475)** | | | | | | | | | |
| EP1306367-006 | HVNMW6 03 | EA045: Turbidity | ---- | 0.1 | NTU | 505 | 504 | 0.2 | 0% - 20% |
| EP1306370-008 | Anonymous | EA045: Turbidity | ---- | 0.1 | NTU | 20.0 | 19.7 | 1.5 | 0% - 20% |
| **ED037P: Alkalinity by PC Titrator (QC Lot: 3022036)** | | | | | | | | | |
| EP1306326-001 | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 54 | 55 | 2.1 | 0% - 20% |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 54 | 55 | 2.1 | 0% - 20% |
| EP1306339-008 | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 113 | 113 | 0.0 | 0% - 20% |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 113 | 113 | 0.0 | 0% - 20% |
| **ED037P: Alkalinity by PC Titrator (QC Lot: 3022039)** | | | | | | | | | |
| EP1306367-002 | HVNMW2 03 | ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | <1 | 0.0 | No Limit |
| | | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | 10 | 7 | 40.8 | 0% - 50% |
| | | ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | 10 | 7 | 40.8 | 0% - 50% |
| **ED038A: Acidity (QC Lot: 3021983)** | | | | | | | | | |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **ED038A: Acidity (QC Lot: 3021983) - continued** | | | | | | | | | |
| EP1306304-001 | Anonymous | ED038: Acidity as CaCO3 | ---- | 1 | mg/L | 6 | 7 | 15.4 | No Limit |
| EP1306367-002 | HVNMW2 03 | ED038: Acidity as CaCO3 | ---- | 1 | mg/L | 6 | 8 | 28.6 | No Limit |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3021386)** | | | | | | | | | |
| EP1306362-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | 16 | 16 | 0.0 | 0% - 50% |
| **ED045G: Chloride Discrete analyser (QC Lot: 3021383)** | | | | | | | | | |
| EP1306362-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1 | mg/L | 292 | 295 | 1.1 | 0% - 20% |
| **EG020F: Dissolved Metals by ICP-MS (QC Lot: 3026523)** | | | | | | | | | |
| EP1306367-001 | HVNMW1 03 | EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | 0.002 | 0.002 | 0.0 | No Limit |
| | | EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | 0.012 | 0.012 | 0.0 | 0% - 50% |
| | | EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | 0.001 | 0.001 | 0.0 | No Limit |
| | | EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | 0.017 | 0.017 | 0.0 | No Limit |
| | | EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | 0.14 | 0.14 | 0.0 | 0% - 50% |
| | | EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | 0.30 | 0.30 | 0.0 | No Limit |
| EP1306370-005 | Anonymous | EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | 0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | 0.030 | 0.030 | 0.0 | 0% - 20% |
| | | EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | 0.009 | 0.009 | 0.0 | No Limit |
| | | EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | 5.49 | 5.91 | 7.4 | 0% - 20% |
| **EG020T: Total Metals by ICP-MS (QC Lot: 3026511)** | | | | | | | | | |
| EP1306355-001 | Anonymous | EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | 0.001 | 0.001 | 0.0 | No Limit |
| | | EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | 0.936 | 0.948 | 1.2 | 0% - 20% |
| | | EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | 0.012 | 0.012 | 0.0 | 0% - 50% |
| | | EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | 0.002 | 0.001 | 0.0 | No Limit |
| | | EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | 0.106 | 0.106 | 0.0 | 0% - 20% |
| | | EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | 0.14 | 0.14 | 0.0 | No Limit |
| EP1306374-001 | Anonymous | EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | <0.0001 | 0.0 | No Limit |
| | | EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EG020T: Total Metals by ICP-MS (QC Lot: 3026511) - continued** | | | | | | | | | |
| EP1306374-001 | Anonymous | EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | 0.002 | 0.002 | 0.0 | No Limit |
| | | EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | 0.002 | 0.001 | 0.0 | No Limit |
| | | EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| | | EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | 0.004 | 0.004 | 0.0 | No Limit |
| | | EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | 0.003 | 0.003 | 0.0 | No Limit |
| | | EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | <0.005 | 0.0 | No Limit |
| | | EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| | | EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | 0.08 | 0.08 | 0.0 | No Limit |
| **EG020T: Total Metals by ICP-MS (QC Lot: 3026512)** | | | | | | | | | |
| EP1306355-001 | Anonymous | EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | <0.001 | 0.0 | No Limit |
| **EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3024696)** | | | | | | | | | |
| EP1306280-001 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0100 | <0.0100 | 0.0 | No Limit |
| EP1306367-006 | HVNMW6 03 | EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | 0.0001 | 0.0 | No Limit |
| **EG050F: Dissolved Hexavalent Chromium (QC Lot: 3023208)** | | | | | | | | | |
| EP1306304-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| EP1306367-002 | HVNMW2 03 | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EG051G: Ferrous Iron by Discrete Analyser (QC Lot: 3023100)** | | | | | | | | | |
| EP1306336-018 | Anonymous | EG051G: Ferrous Iron | ---- | 0.05 | mg/L | 0.17 | 0.17 | 0.0 | No Limit |
| EP1306367-002 | HVNMW2 03 | EG051G: Ferrous Iron | ---- | 0.05 | mg/L | <0.05 | <0.05 | 0.0 | No Limit |
| **EK055G: Ammonia as N by Discrete Analyser (QC Lot: 3023549)** | | | | | | | | | |
| EP1306366-021 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | 1.84 | 1.85 | 0.5 | 0% - 20% |
| **EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3021378)** | | | | | | | | | |
| EP1306337-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | 0.01 | 0.01 | 0.0 | No Limit |
| EP1306339-008 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3021387)** | | | | | | | | | |
| EP1306362-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3023548)** | | | | | | | | | |
| EP1306366-021 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.05 | <0.05 | 0.0 | No Limit |
| EP1306359-020 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | 3.97 | 3.92 | 1.3 | 0% - 20% |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3026727)** | | | | | | | | | |
| EP1306351-001 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 0.5 | 0.5 | 0.0 | No Limit |
| EP1306367-004 | HVNMW4 03 | EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | 2.3 | 2.3 | 0.0 | 0% - 50% |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3026728)** | | | | | | | | | |
| EP1306351-001 | Anonymous | EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | 0.26 | 0.25 | 0.0 | 0% - 20% |
| EP1306367-004 | HVNMW4 03 | EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | 0.05 | <0.02 | 79.2 | No Limit |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 3021384)** | | | | | | | | | |

Sub-Matrix: **WATER**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Laboratory sample ID* | *Client sample ID* | *Method: Compound* | *CAS Number* | *LOR* | *Unit* | *Original Result* | *Duplicate Result* | *RPD (%)* | *Recovery Limits (%)* |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 3021384) - continued** | | | | | | | | | |
| EP1306362-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | 0.02 | 0.02 | 0.0 | No Limit |
| EP1306369-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | <0.01 | <0.01 | 0.0 | No Limit |
| **EK085M: Sulfide as S2- (QC Lot: 3028642)** | | | | | | | | | |
| EP1306367-001 | HVNMW1 03 | EK085: Sulfide as S2- | 18496-25-8 | 0.1 | mg/L | <0.1 | <0.1 | 0.0 | No Limit |
| **EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 3024826)** | | | | | | | | | |
| EP1306311-014 | Anonymous | EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | 880 | 960 | 8.7 | 0% - 20% |
| EP1306367-006 | HVNMW6 03 | EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | <2 | 5 | 91.9 | No Limit |

## Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

| | | | | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Recovery Limits (%) | |
| Method: Compound | CAS Number | LOR | Unit | Result | Concentration | LCS | Low | High |
| **EA005P: pH by PC Titrator (QCLot: 3022038)** | | | | | | | | |
| EA005-P: pH Value | ---- | 0.01 | pH Unit | ---- | 7.00 pH Unit | 100 | 98.5 | 101.5 |
| **EA005P: pH by PC Titrator (QCLot: 3022041)** | | | | | | | | |
| EA005-P: pH Value | ---- | 0.01 | pH Unit | ---- | 7.00 pH Unit | 100 | 98.5 | 101.5 |
| **EA010P: Conductivity by PC Titrator (QCLot: 3022037)** | | | | | | | | |
| EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | <1 | 24800 µS/cm | 96.3 | 95 | 105 |
| **EA010P: Conductivity by PC Titrator (QCLot: 3022040)** | | | | | | | | |
| EA010-P: Electrical Conductivity @ 25°C | ---- | 1 | µS/cm | <1 | 24800 µS/cm | 97.9 | 95 | 105 |
| **EA015: Total Dissolved Solids (QCLot: 3024207)** | | | | | | | | |
| EA015H: Total Dissolved Solids @180°C | ---- | 10 | mg/L | <10 | 293 mg/L | 102 | 83 | 130 |
| **EA025: Suspended Solids (QCLot: 3024208)** | | | | | | | | |
| EA025H: Suspended Solids (SS) | ---- | 5 | mg/L | <5 | 150 mg/L | 99.8 | 70 | 130 |
| **EA045: Turbidity (QCLot: 3022474)** | | | | | | | | |
| EA045: Turbidity | ---- | 0.1 | NTU | <0.1 | 40 NTU | 98.8 | 91 | 107 |
| **EA045: Turbidity (QCLot: 3022475)** | | | | | | | | |
| EA045: Turbidity | ---- | 0.1 | NTU | <0.1 | 40 NTU | 98.8 | 91 | 107 |
| **ED037P: Alkalinity by PC Titrator (QCLot: 3022036)** | | | | | | | | |
| ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | <1 | 200 mg/L | 102 | 87 | 121 |
| **ED037P: Alkalinity by PC Titrator (QCLot: 3022039)** | | | | | | | | |
| ED037-P: Hydroxide Alkalinity as CaCO3 | DMO-210-001 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Carbonate Alkalinity as CaCO3 | 3812-32-6 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3 | 1 | mg/L | <1 | ---- | ---- | ---- | ---- |
| ED037-P: Total Alkalinity as CaCO3 | ---- | 1 | mg/L | <1 | 200 mg/L | 104 | 87 | 121 |
| **ED038A: Acidity (QCLot: 3021983)** | | | | | | | | |
| ED038: Acidity as CaCO3 | ---- | 1 | mg/L | ---- | 20 mg/L | 100 | 85 | 119 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3021386)** | | | | | | | | |
| ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | <1 | 25 mg/L | 94.4 | 88 | 121 |
| **ED045G: Chloride Discrete analyser (QCLot: 3021383)** | | | | | | | | |
| ED045G: Chloride | 16887-00-6 | 1 | mg/L | <1 | 1000 mg/L | 96.0 | 84 | 120 |

Sub-Matrix: **WATER**

| Method: Compound | CAS Number | LOR | Unit | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Recovery Limits (%) | |
| | | | | Result | Concentration | LCS | Low | High |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 3026523)** | | | | | | | | |
| EG020A-F: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.50 mg/L | 101 | 77 | 113 |
| EG020A-F: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 95.4 | 89 | 109 |
| EG020A-F: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1000 mg/L | 94.6 | 89 | 109 |
| EG020A-F: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 93.8 | 88 | 106 |
| EG020A-F: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 94.8 | 87 | 107 |
| EG020A-F: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.100 mg/L | 93.3 | 87 | 109 |
| EG020A-F: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.10 mg/L | 102 | 93 | 117 |
| EG020A-F: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.100 mg/L | 97.2 | 89 | 115 |
| EG020A-F: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.50 mg/L | 91.9 | 83 | 109 |
| **EG020T: Total Metals by ICP-MS (QCLot: 3026511)** | | | | | | | | |
| EG020A-T: Aluminium | 7429-90-5 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 105 | 78 | 116 |
| EG020A-T: Arsenic | 7440-38-2 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 90.7 | 77 | 109 |
| EG020A-T: Cadmium | 7440-43-9 | 0.0001 | mg/L | <0.0001 | 0.1 mg/L | 91.5 | 78 | 108 |
| EG020A-T: Chromium | 7440-47-3 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 97.4 | 80 | 112 |
| EG020A-T: Copper | 7440-50-8 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 94.1 | 79 | 111 |
| EG020A-T: Lead | 7439-92-1 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 96.4 | 81 | 109 |
| EG020A-T: Manganese | 7439-96-5 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 97.9 | 80 | 112 |
| EG020A-T: Molybdenum | 7439-98-7 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 107 | 86 | 118 |
| EG020A-T: Nickel | 7440-02-0 | 0.001 | mg/L | <0.001 | 0.1 mg/L | 96.2 | 80 | 112 |
| EG020A-T: Selenium | 7782-49-2 | 0.01 | mg/L | <0.01 | 0.1 mg/L | 91.7 | 75 | 107 |
| EG020A-T: Zinc | 7440-66-6 | 0.005 | mg/L | <0.005 | 0.1 mg/L | 88.4 | 74 | 108 |
| EG020A-T: Iron | 7439-89-6 | 0.05 | mg/L | <0.05 | 0.5 mg/L | 97.5 | 75 | 115 |
| **EG020T: Total Metals by ICP-MS (QCLot: 3026512)** | | | | | | | | |
| EG020B-T: Silver | 7440-22-4 | 0.001 | mg/L | <0.001 | 0.01 mg/L | 93.5 | 70 | 130 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3024696)** | | | | | | | | |
| EG035T: Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | 0.0100 mg/L | 100 | 82.3 | 118 |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 3023208)** | | | | | | | | |
| EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 100 | 91 | 115 |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3023100)** | | | | | | | | |
| EG051G: Ferrous Iron | ---- | 0.05 | mg/L | <0.05 | 2.00 mg/L | 102 | 89 | 113 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 3023549)** | | | | | | | | |
| EK055G: Ammonia as N | 7664-41-7 | 0.01 | mg/L | <0.01 | 1 mg/L | 98.0 | 87 | 115 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 3021378)** | | | | | | | | |
| EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 99.7 | 86 | 112 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 3021387)** | | | | | | | | |
| EK057G: Nitrite as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 98.6 | 86 | 112 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3023548)** | | | | | | | | |
| EK059G: Nitrite + Nitrate as N | ---- | 0.01 | mg/L | <0.01 | 0.5 mg/L | 98.0 | 92 | 112 |

Sub-Matrix: **WATER**

| Method: Compound | CAS Number | LOR | Unit | Method Blank (MB) Report: Result | Laboratory Control Spike (LCS) Report: Spike Concentration | Spike Recovery (%): LCS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|---|
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3026727)** | | | | | | | | |
| EK061G: Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | <0.1 | 10 mg/L | 93.5 | 74 | 130 |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3026728)** | | | | | | | | |
| EK067G: Total Phosphorus as P | ---- | 0.01 | mg/L | <0.01 | 4.42 mg/L | 98.9 | 70 | 130 |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3021384)** | | | | | | | | |
| EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.01 | mg/L | <0.01 | 0.5 mg/L | 104 | 87 | 115 |
| **EK085M: Sulfide as S2- (QCLot: 3028642)** | | | | | | | | |
| EK085: Sulfide as S2- | 18496-25-8 | 0.10 | mg/L | <0.1 | 0.50 mg/L | 96.2 | 82 | 116 |
| **EP030: Biochemical Oxygen Demand (BOD) (QCLot: 3024826)** | | | | | | | | |
| EP030: Biochemical Oxygen Demand | ---- | 2 | mg/L | <2 | 198 mg/L | 84.6 | 84 | 114 |

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) Report: Spike Concentration | SpikeRecovery(%): MS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3021386)** | | | | | | | |
| EP1306362-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L | 100 | 70 | 130 |
| **ED045G: Chloride Discrete analyser (QCLot: 3021383)** | | | | | | | |
| EP1306362-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1000 mg/L | 93.1 | 70 | 130 |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 3026523)** | | | | | | | |
| EP1306367-002 | HVNMW2 03 | EG020A-F: Arsenic | 7440-38-2 | 0.200 mg/L | 93.1 | 70 | 130 |
| | | EG020A-F: Cadmium | 7440-43-9 | 0.0500 mg/L | 102 | 70 | 130 |
| | | EG020A-F: Chromium | 7440-47-3 | 0.200 mg/L | 87.3 | 70 | 130 |
| | | EG020A-F: Manganese | 7439-96-5 | 0.200 mg/L | 91.0 | 70 | 130 |
| | | EG020A-F: Nickel | 7440-02-0 | 0.200 mg/L | 87.6 | 70 | 130 |
| | | EG020A-F: Zinc | 7440-66-6 | 0.200 mg/L | 96.6 | 70 | 130 |
| **EG020T: Total Metals by ICP-MS (QCLot: 3026511)** | | | | | | | |
| EP1306367-001 | HVNMW1 03 | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 90.4 | 70 | 130 |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 95.6 | 70 | 130 |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 78.8 | 70 | 130 |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 93.7 | 70 | 130 |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 96.0 | 70 | 130 |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 81.0 | 70 | 130 |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 93.2 | 70 | 130 |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 89.1 | 70 | 130 |

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) Report: Spike Concentration | SpikeRecovery(%): MS | Recovery Limits (%): Low | Recovery Limits (%): High |
|---|---|---|---|---|---|---|---|
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3024696)** | | | | | | | |
| EP1306311-001 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0100 mg/L | 100 | 70 | 130 |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 3023208)** | | | | | | | |
| EP1306304-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.5 mg/L | 93.5 | 70 | 130 |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3023100)** | | | | | | | |
| EP1306336-018 | Anonymous | EG051G: Ferrous Iron | ---- | 2.5 mg/L | 100 | 70 | 130 |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 3023549)** | | | | | | | |
| EP1306366-021 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 103 | 70 | 130 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 3021378)** | | | | | | | |
| EP1306337-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.6 mg/L | 83.4 | 70 | 130 |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 3021387)** | | | | | | | |
| EP1306362-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.6 mg/L | 84.6 | 70 | 130 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3023548)** | | | | | | | |
| EP1306366-021 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | 89.0 | 70 | 130 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3026727)** | | | | | | | |
| EP1306351-001 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 5.0 mg/L | 89.3 | 70 | 130 |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3026728)** | | | | | | | |
| EP1306351-001 | Anonymous | EK067G: Total Phosphorus as P | ---- | 1 mg/L | 80.2 | 70 | 130 |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3021384)** | | | | | | | |
| EP1306362-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.5 mg/L | 106 | 70 | 130 |

## *Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report*

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report: Spike Concentration | Spike Recovery (%): MS | Spike Recovery (%): MSD | Recovery Limits (%): Low | Recovery Limits (%): High | RPDs (%): Value | RPDs (%): Control Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 3021378)** | | | | | | | | | | |
| EP1306337-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.6 mg/L | 83.4 | ---- | 70 | 130 | ---- | ---- |
| **ED045G: Chloride Discrete analyser (QCLot: 3021383)** | | | | | | | | | | |
| EP1306362-001 | Anonymous | ED045G: Chloride | 16887-00-6 | 1000 mg/L | 93.1 | ---- | 70 | 130 | ---- | ---- |
| **EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3021384)** | | | | | | | | | | |
| EP1306362-001 | Anonymous | EK071G: Reactive Phosphorus as P | 14265-44-2 | 0.5 mg/L | 106 | ---- | 70 | 130 | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3021386)** | | | | | | | | | | |
| EP1306362-001 | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 100 mg/L | 100 | ---- | 70 | 130 | ---- | ---- |

Sub-Matrix: **WATER**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EK057G: Nitrite as N by Discrete Analyser (QCLot: 3021387)** | | | | | | | | | | |
| EP1306362-001 | Anonymous | EK057G: Nitrite as N | ---- | 0.6 mg/L | 84.6 | ---- | 70 | 130 | ---- | ---- |
| **EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3023100)** | | | | | | | | | | |
| EP1306336-018 | Anonymous | EG051G: Ferrous Iron | ---- | 2.5 mg/L | 100 | ---- | 70 | 130 | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium (QCLot: 3023208)** | | | | | | | | | | |
| EP1306304-001 | Anonymous | EG050G-F: Hexavalent Chromium | 18540-29-9 | 0.5 mg/L | 93.5 | ---- | 70 | 130 | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3023548)** | | | | | | | | | | |
| EP1306366-021 | Anonymous | EK059G: Nitrite + Nitrate as N | ---- | 0.5 mg/L | 89.0 | ---- | 70 | 130 | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser (QCLot: 3023549)** | | | | | | | | | | |
| EP1306366-021 | Anonymous | EK055G: Ammonia as N | 7664-41-7 | 1.00 mg/L | 103 | ---- | 70 | 130 | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3024696)** | | | | | | | | | | |
| EP1306311-001 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.0100 mg/L | 100 | ---- | 70 | 130 | ---- | ---- |
| **EG020T: Total Metals by ICP-MS (QCLot: 3026511)** | | | | | | | | | | |
| EP1306367-001 | HVNMW1 03 | EG020A-T: Arsenic | 7440-38-2 | 1.00 mg/L | 90.4 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Cadmium | 7440-43-9 | 0.25 mg/L | 95.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Chromium | 7440-47-3 | 1.00 mg/L | 78.8 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Copper | 7440-50-8 | 1.00 mg/L | 93.7 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Lead | 7439-92-1 | 1.00 mg/L | 96.0 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Manganese | 7439-96-5 | 1.00 mg/L | 81.0 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Nickel | 7440-02-0 | 1.00 mg/L | 93.2 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-T: Zinc | 7440-66-6 | 1.00 mg/L | 89.1 | ---- | 70 | 130 | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS (QCLot: 3026523)** | | | | | | | | | | |
| EP1306367-002 | HVNMW2 03 | EG020A-F: Arsenic | 7440-38-2 | 0.200 mg/L | 93.1 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Cadmium | 7440-43-9 | 0.0500 mg/L | 102 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Chromium | 7440-47-3 | 0.200 mg/L | 87.3 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Manganese | 7439-96-5 | 0.200 mg/L | 91.0 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Nickel | 7440-02-0 | 0.200 mg/L | 87.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020A-F: Zinc | 7440-66-6 | 0.200 mg/L | 96.6 | ---- | 70 | 130 | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3026727)** | | | | | | | | | | |
| EP1306351-001 | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ---- | 5.0 mg/L | 89.3 | ---- | 70 | 130 | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3026728)** | | | | | | | | | | |
| EP1306351-001 | Anonymous | EK067G: Total Phosphorus as P | ---- | 1 mg/L | 80.2 | ---- | 70 | 130 | ---- | ---- |

Environmental Division

# INTERPRETIVE QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **EP1306367** | Page | : 1 of 12 |
| Client | : MOBILE DEWATERING | Laboratory | : Environmental Division Perth |
| Contact | : INFO | Contact | : Scott James |
| Address | : PO BOX 239<br>MIDLAND WA, AUSTRALIA 6939 | Address | : 10 Hod Way Malaga WA Australia 6090 |
| E-mail | : info@environmentalservices.com.au | E-mail | : perth.enviro.services@alsglobal.com |
| Telephone | : +61 08 9250 4995 | Telephone | : +61-8-9209 7655 |
| Facsimile | : ---- | Facsimile | : +61-8-9209 7600 |
| Project | : E2011-109 | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Site | : HOPEVALLEY NURSERY | | |
| C-O-C number | : E2011-109-03 | Date Samples Received | : 20-AUG-2013 |
| Sampler | : J.T. | Issue Date | : 27-AUG-2013 |
| Order number | : ---- | | |
| | | No. of samples received | : 6 |
| Quote number | : EP/667/13 | No. of samples analysed | : 6 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

# Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EA005P: pH by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA005-P)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 20-AUG-2013 | ---- | **21-AUG-2013** | 20-AUG-2013 | × |
| **EA010P: Conductivity by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA010-P)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 17-SEP-2013 | ---- | **21-AUG-2013** | 17-SEP-2013 | ✓ |
| **EA015: Total Dissolved Solids** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA015H)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 27-AUG-2013 | ---- | **22-AUG-2013** | 27-AUG-2013 | ✓ |
| **EA025: Suspended Solids** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA025H)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 27-AUG-2013 | ---- | **22-AUG-2013** | 27-AUG-2013 | ✓ |
| **EA045: Turbidity** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA045)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **21-AUG-2013** | 22-AUG-2013 | ✓ |
| **ED037P: Alkalinity by PC Titrator** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED037-P)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 03-SEP-2013 | ---- | **21-AUG-2013** | 03-SEP-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **ED038A: Acidity** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED038)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **21-AUG-2013** | 03-SEP-2013 | ✓ |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED041G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 17-SEP-2013 | ---- | **20-AUG-2013** | 17-SEP-2013 | ✓ |
| **ED045G: Chloride Discrete analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED045G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 17-SEP-2013 | ---- | **20-AUG-2013** | 17-SEP-2013 | ✓ |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 16-FEB-2014 | ---- | **23-AUG-2013** | 16-FEB-2014 | ✓ |
| **EG020T: Total Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **23-AUG-2013** | 16-FEB-2014 | ✓ | **23-AUG-2013** | 16-FEB-2014 | ✓ |
| **EG020T: Total Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **23-AUG-2013** | 16-FEB-2014 | ✓ | **23-AUG-2013** | 16-FEB-2014 | ✓ |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | |
| **Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **22-AUG-2013** | 17-SEP-2013 | ✓ |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | |
| **Clear Plastic Bottle - NaOH (EG050G-F)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **22-AUG-2013** | 17-SEP-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EG051G: Ferrous Iron by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - HCl - Filtered (EG051G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03 | **20-AUG-2013** | **----** | ---- | ---- | **20-AUG-2013** | 27-AUG-2013 | ✓ |
| **Clear Plastic Bottle - Natural (EG051G)** | | | | | | | |
| HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **20-AUG-2013** | 21-AUG-2013 | ✓ |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK055G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 17-SEP-2013 | ---- | **20-AUG-2013** | 17-SEP-2013 | ✓ |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK057G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 22-AUG-2013 | ---- | **20-AUG-2013** | 22-AUG-2013 | ✓ |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK059G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 17-SEP-2013 | ---- | **20-AUG-2013** | 17-SEP-2013 | ✓ |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK061G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **26-AUG-2013** | 17-SEP-2013 | ✓ | **26-AUG-2013** | 17-SEP-2013 | ✓ |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulphuric Acid (EK067G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **26-AUG-2013** | 17-SEP-2013 | ✓ | **26-AUG-2013** | 17-SEP-2013 | ✓ |
| **EK071G: Reactive Phosphorus as P by discrete analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK071G)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **---** | 22-AUG-2013 | ---- | **20-AUG-2013** | 22-AUG-2013 | ✓ |
| **EK085M: Sulfide as S2-** | | | | | | | |
| **Clear Plastic Bottle - Zinc Acetate/NaOH (EK085)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **26-AUG-2013** | 27-AUG-2013 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | |
| **Clear Plastic Bottle - Natural (EP030)** | | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | **20-AUG-2013** | **----** | ---- | ---- | **22-AUG-2013** | 22-AUG-2013 | ✓ |

# Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Duplicates (DUP)** | | | | | | | |
| Acidity as Calcium Carbonate | ED038 | 2 | 14 | **14.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Alkalinity by PC Titrator | ED037-P | 3 | 25 | **12.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 1 | 10 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 10 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 3 | 25 | **12.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 2 | 16 | **12.5** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 2 | 14 | **14.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 13 | **15.4** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 3 | 20 | **15.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| pH by PC Titrator | EA005-P | 3 | 30 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 2 | 11 | **18.2** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 8 | **12.5** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 6 | **16.7** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 1 | 8 | **12.5** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 1 | 8 | **12.5** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 2 | 13 | **15.4** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 2 | 13 | **15.4** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 1 | 7 | **14.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 4 | 40 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| **Laboratory Control Samples (LCS)** | | | | | | | |
| Acidity as Calcium Carbonate | ED038 | 1 | 14 | **7.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Alkalinity by PC Titrator | ED037-P | 4 | 25 | **16.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 1 | 10 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 2 | 10 | **20.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 16 | **6.3** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 14 | **7.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 20 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| pH by PC Titrator | EA005-P | 4 | 30 | **13.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Control Samples (LCS) - Continued** | | | | | | | |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 8 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 2 | 8 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 2 | 8 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 1 | 7 | **14.3** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 20 | **10.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 2 | 40 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| **Method Blanks (MB)** | | | | | | | |
| Alkalinity by PC Titrator | ED037-P | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ammonia as N by Discrete analyser | EK055G | 1 | 10 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 10 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Conductivity by PC Titrator | EA010-P | 2 | 25 | **8.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 16 | **6.3** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 14 | **7.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 20 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 8 | **12.5** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfide as S2- | EK085 | 1 | 6 | **16.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Suspended Solids (High Level) | EA025H | 1 | 8 | **12.5** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Dissolved Solids (High Level) | EA015H | 1 | 8 | **12.5** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite B | EG020B-T | 1 | 7 | **14.3** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Turbidity | EA045 | 2 | 40 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| **Matrix Spikes (MS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 10 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Chloride by Discrete Analyser | ED045G | 1 | 10 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Ferrous Iron by Discrete Analyser | EG051G | 1 | 16 | **6.3** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 14 | **7.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| Matrix Spikes (MS) - Continued | | | | | | | |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 20 | **10.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | 1 | 11 | **9.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 8 | **12.5** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS | EG035T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals by ICP-MS - Suite A | EG020A-T | 1 | 13 | **7.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Phosphorus as P By Discrete Analyser | EK067G | 1 | 20 | **5.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |

## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| pH by PC Titrator | EA005-P | WATER | APHA 21st ed. 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Conductivity by PC Titrator | EA010-P | WATER | APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Total Dissolved Solids (High Level) | EA015H | WATER | In-House, APHA 21st ed., 2540C A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Suspended Solids (High Level) | EA025H | WATER | In-House, APHA 21st ed., 2540D A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Turbidity | EA045 | WATER | APHA 21st ed., 2130 B. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Alkalinity by PC Titrator | ED037-P | WATER | APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Acidity as Calcium Carbonate | ED038 | WATER | APHA 21st ed., 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | WATER | APHA 21st ed., 4500-SO4 Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Chloride by Discrete Analyser | ED045G | WATER | APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003 |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Total Metals by ICP-MS - Suite A | EG020A-T | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Total Metals by ICP-MS - Suite B | EG020B-T | WATER | (APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Total Mercury by FIMS | EG035T | WATER | AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | WATER | APHA 21st ed., 3500 Cr-A & B. Samples are 0.45 um filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Ferrous Iron by Discrete Analyser | EG051G | WATER | APHA 21st ed., 3500 Fe-B. A colorimetric determination based on the reaction between phenanthroline and ferrous iron at pH 3.2-3.3 to form an orange-red complex that is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Ammonia as N by Discrete analyser | EK055G | WATER | APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Nitrite as N by Discrete Analyser | EK057G | WATER | APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Nitrate as N by Discrete Analyser | EK058G | WATER | APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | WATER | APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | WATER | APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Total Nitrogen as N (TKN + Nox) By Discrete Analyser | EK062G | WATER | APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Total Phosphorus as P By Discrete Analyser | EK067G | WATER | APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Reactive Phosphorus as P-By Discrete Analyser | EK071G | WATER | APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Sulfide as S2- | EK085 | WATER | APHA 21st ed., 4500-S2- D Sulfide species present in water samples are immediately precipitated when collected in pretreated caustic/zinc acetate preserved sample containers. After the supernatant is discarded, the resultant precipitate is then coloured using methylene blue indicator and measured using UV-VIS detection at 664nm. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |
| Biochemical Oxygen Demand (BOD) | EP030 | WATER | APHA 21st ed., 5210 B The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Digestion for Total Recoverable Metals | EN25 | WATER | USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3) (Appdx. 2) |

# Summary of Outliers

## Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

### Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

### Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

## Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

| Method | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|
| **Container** / Client Sample ID(s) | Date extracted | Due for extraction | Days overdue | Date analysed | Due for analysis | Days overdue |
| **EA005P: pH by PC Titrator** | | | | | | |
| **Clear Plastic Bottle - Natural** | | | | | | |
| HVNMW1 03, HVNMW2 03, HVNMW3 03, HVNMW4 03, HVNMW5 03, HVNMW6 03 | ---- | ---- | ---- | 21-AUG-2013 | 20-AUG-2013 | **1** |

## Outliers : Frequency of Quality Control Samples

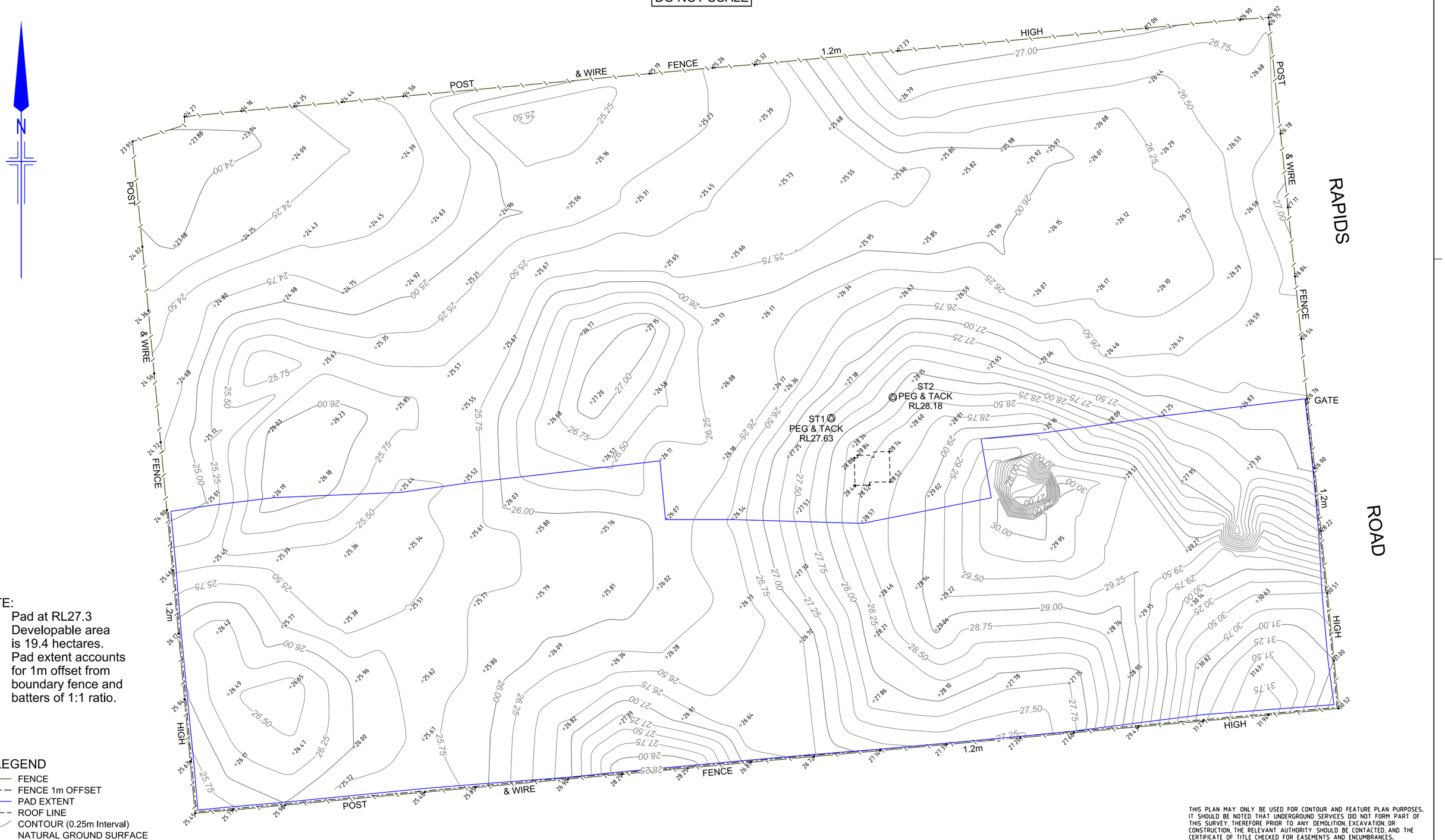
The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

MDW
ENVIRONMENTAL SERVICES

# Appendix F – Contour and Feature Survey (Midland Survey Services)

DO NOT SCALE




NOTE:
1. Pad at RL27.3
2. Developable area is 19.4 hectares.
3. Pad extent accounts for 1m offset from boundary fence and batters of 1:1 ratio.

LEGEND
- FENCE
- FENCE 1m OFFSET
- PAD EXTENT
- ROOF LINE
- CONTOUR (0.25m Interval)
- NATURAL GROUND SURFACE

THIS PLAN MAY ONLY BE USED FOR CONTOUR AND FEATURE PLAN PURPOSES. IT SHOULD BE NOTED THAT UNDERGROUND SERVICES DID NOT FORM PART OF THIS SURVEY. THEREFORE PRIOR TO ANY DEMOLITION, EXCAVATION, OR CONSTRUCTION, THE RELEVANT AUTHORITY SHOULD BE CONTACTED, AND THE CERTIFICATE OF TITLE CHECKED FOR EASEMENTS AND ENCUMBRANCES.

| No. | Date | REVISION | Drawn | Surveyor | Approved |
|---|---|---|---|---|---|
| 0 | 04/09/12 | APPROVED & ISSUED TO CLIENT | CLM | RD | NK |



Freshwater Bay Investments Pty Ltd trading as
MIDLAND SURVEY SERVICES
ACN 105 274 226 ABN 92 105 274 226
LAND AND ENGINEERING SURVEYORS
3 Victoria Street Midland Western Australia 6056
Telephone : (08) 9374 7777 Fax : (08) 9374 7799
Email : survey@midlandsurveys.com.au
Website : www.midlandsurveys.com.au
ISO 9001 FS 520793

40 20 0 20 40 60 80

| | | |
|---|---|---|
| SCALE 1:2000 | | METRES |
| SURVEYED | R.DINSMORE | 08/08/12 |
| DRAWN | C.MILBORN | 04/09/12 |
| CHECKED | M.NISSEN | 04/09/12 |
| APPROVED | N.KITSCHA | |

# MDW ENVIRONMENTAL SERVICES

## CONTOUR & FEATURE SURVEY

LOT 838 RAPIDS ROAD, SERPENTINE

GRID ARBITRARY
DATUM ARBITRARY
FB
LB

DRAWING NUMBER 11511-D001

REV 0 SIZE A2

PS:11511-01

X:_6000\C1235\11511\CAD\11511-D001.dgn 11:54:13 AM 4/09/2012

CLIENT No : C1235