Draft Preliminary Land Capability, Salinity and Contamination Assessment - Ingleside Release Area, Ingleside NSW

For: NSW Department of Planning & Environment

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EXECUTIVE SUMMARY

SMEC Australia Pty Ltd was engaged by NSW Department of Planning & Environment (DP&E) to prepare a Preliminary Land Capability, Salinity and Contamination Assessment for the Ingleside Release Area, Ingleside NSW.

The purpose of undertaking a Preliminary Land Capability, Salinity and Contamination Investigation is to determine any land constraints and the soil and groundwater characteristics of the site for the purposes of supporting significant urban development.

Based on the original scope of works it was planned to undertake intrusive ground investigations across the area to determine the ground conditions and allow detailed slope stability and contamination assessments to be undertaken. Subsequent constraints around site access meant that an intrusive ground investigation was not possible, therefore, SMEC has undertaken a visual Land Capability slope risk analysis of 10 previously delineated set zones within the Ingleside precinct that contain slopes that may potentially pose a risk to property.

Specifically, the Land Capability Assessment included a site inspection to identify slope characteristics, identify current and potential slope failure mechanisms to inform a slope risk assessment and categorise slope mechanisms in accordance with the Landslide Risk Management guidelines by Australian Geomechanics Society (AGS, 2007).

Based on the findings of the risk analysis in the Land Capability Assessment it has been established that the tolerable risk to future development for the identified slope failure mechanisms has not been met, as the risk for the ten sites inspected within the precinct (refer to Appendix F) is classed as moderate. Recommendations to reduce the risk to tolerable levels may include scaling the slope, installation of rock bolts and consideration of development location. These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. The location and proximity of any future development to an identified slope failure mechanism will potentially alter the calculated risk level. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. On this basis it is recommended that for any site development, a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation.

An assessment of the soil landscapes within the subject area identified that the Hawkesbury, Lambert and Oxford Falls soil landscape groups are recognised as having a higher susceptibility to erosion. The subject area is considered to present as a high erosion hazard due to the characteristics of a colluvial and erosional soil landscapes combined with high rainfall intensity which can result in high soil loss conditions. This high erosion hazard implies that significant erosion will occur during development and after land use is established, even with intensive soil conservation measures. Such erosion hazards infer that planning will need to carefully consider the balance between the probability of long term erosion damage and maintenance or repair needed to ensure the viability of the land use. Where practicable, construction programing should aim to minimise the potential for soil loss by condensing the time from the beginning of land disturbance activities to rehabilitation.

In order to determine the potential for land contamination, salinity and other environmental constraints within the subject area, a Preliminary Environmental Site Assessment with limited surface soil sampling was conducted and supported by documentation relating to the subject area to identify potential sources of contamination associated with current and historical land use.

The subject area is entirely underlain by the Hawkesbury Sandstone formation of the Wianamatta Group (*Sydney 1:100 000 Series Geological Sheet)* and comprises a variety of soil landscapes recognised under the *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil landscapes mapped within the subject area include Gymea, Oxford Falls, Hawkesbury, Somersby and Lambert.

This study indicates that the regional groundwater flow direction is expected to generally flow to the north-east in accordance with the general site topography, with localised variations in areas located nearer to water bodies and creek lines. Local groundwater can occur at depths ranging from 10-20 metres below ground level (mbgl) and regional groundwater are likely to be deeper at 100-200 mbgl. Water quality information contained within the bore logs is limited; however, information that is provided identifies salinity characteristics as good, which indicates reasonable water quality and non-saline groundwater conditions are likely. The limited soil samples collected and analysed for salinity also indicate a 'Non-saline' classification for soils.

Acid sulfate soils are not considered to present a risk within the subject area, given the mapped soils units and elevation of the subject area (ie generally >100m above sea level).

As the future land use is likely to consist of various types of residential use within some commercial/industrial use, this study has adopted the residential criteria for Health Investigation Levels (HILs). Due to site access constraints within the subject area, limited surface soil sampling was conducted at assessable locations within the subject area only. All samples were analysed for a broad suite of analytes including, Metals (8), BTEX, TPH, OCC and OPP Pesticides, PCBs and PAHs. No soil sample obtained from within the subject area exceeded the adopted site assessment criteria for contaminated land.

While no soil sample exceeded the adopted site assessment criteria, due to the limited nature of the investigation the potential remains for contamination to be present within the subject area. The sources of contamination are likely to be related to the following identified activities or Areas of Environmental Concern (AECs) within the subject area:

- The use of uncontrolled fill material and quarry activities.
- Commercial and industrial facilities.
- Small farm holdings, market gardens and nurseries.
- Hazardous materials within existing buildings and site structures.
- Septic effluent systems.
- Potential fly tipping of waste in unoccupied lands.

On-Site Effluent Assessment

SMEC undertook an On-Site Effluent Assessment for the Ingleside Release Area (2015). The assessment found that the soil landscapes within the Wirreanda Valley and Bayview Heights areas present a number of soil related environmental constraints for on-site effluent systems. Soil depths of less than 0.6 metres to bedrock may not have enough capacity to filter nutrients and pathogens. Shallow soils often have a highly variable depth, and incur a risk of effluent resurfacing near the land application area. Any decisions about the on-site management of sewage should consider these impacts. It is recommended that individual lots may be required to undertake a specific site evaluation at the development application stage which may eliminate areas not suitable for on-site sewage management.

Further investigations will be required as part of future development applications together with additional work during the construction phase. Specific investigations would include but not necessarily be limited to:

- Detailed environmental investigation (comprising subsurface sampling and laboratory testing) in the nominated AECs, primarily in those areas which lie within the proposed “development footprint”. The purpose of this work would be to quantify the level of contamination (if any) and delineate contaminated areas in order to facilitate the preparation of remediation action plans (RAP).
- Additional hazardous building material assessments should be undertaken of all buildings in the subject area that are to be demolished/renovated.
- Additional investigation should be undertaken in development areas which are to be excavated deeper than three metres or into rock at shallower depth, where direct sampling and testing of salinity has not been carried out.
- Installation of groundwater bores well in advance of construction and monitoring/sampling/analysis before, during and after construction, to monitor and assess changes in groundwater quality, electrical conductivity and level as a result of the development. The bores would be strategically located on a catchment basis near creek lines.
- Detailed geotechnical investigations on a stage-by-stage basis for determination of pavement thickness designs and lot classifications.

Overall SMEC sees no substantive reason with respect to Land Capability, Salinity and Contamination, why the subject area could not be developed from an urban development perspective subject to recommendations associated with additional investigations and implementation of appropriate mitigation measures.

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1 INTRODUCTION

SMEC Australia Pty Ltd (SMEC) was engaged by NSW Department of Planning & Environment (DP&E) to prepare a Land Capability, Salinity and Contamination Assessment for the Ingleside Release Area, Ingleside NSW. This report is a technical paper developed to inform the precinct planning process for Ingleside. The precinct planning is being developed as a partnership between the Department of Planning and Environment, Pittwater Council and Urban Growth NSW.

The Ingleside precinct occupies approximately 700 hectares within Pittwater Council Local Government Area (LGA) and is located approximately 20 km north-east of the Sydney CBD.

The location of the Ingleside precinct (subject area) is presented in Figure 1.

It is understood that the subject area will accommodate a mixture of land uses including environmental living, low and medium density dwellings (and a range of other land uses) in the future, in order to meet the strategic planning requirements of the NSW State Government.

1.1 Objectives

The key objectives of the Land Capability, Salinity and Contamination Assessment for the subject area were to:

- Identify and map soil landscapes within the subject area and the limitations of the land.
- Undertake limited salinity and contamination soil sampling and analysis.
- Assess and provide recommendations for slope stability across the precinct.
- Identify any potential areas of concern from a contamination perspective.
- Map the suitability of land for urban development.
- Provide recommendations for any additional investigations to be undertaken prior to commencing urban development in the precinct.

1.2 Scope of works

The scope of works undertaken for the Land Capability, Salinity and Contamination assessments is provided in the following sections:

1.2.1 Land Capability

Based on the original scope of works it was planned to undertake intrusive ground investigations across the area to determine the ground conditions and allow detailed slope stability assessments to be undertaken. Subsequent constraints around site access meant that an intrusive ground investigation was not possible, therefore, SMEC has undertaken a visual slope risk analysis of 10 previously delineated set zones within the Ingleside Precinct and supported by the slope risk assessment technical paper (Ingleside Precincts Slope Risk Assessment Report, SMEC 2014) located in Appendix F.

Specifically, the revised scope of works for the Land Capability assessment comprised:

- Site inspection of the ten sites to identify slope characteristics as visible from the road side or clearly identifiable public land.

- Identify current and potential slope failure mechanisms to inform a slope risk assessment.
- Categorise slope mechanisms in accordance with the Landslide Risk Management guidelines dated March 2007 by Australian Geomechanics Society (AGS, 2007).
- Conduct a risk estimation of identified slope mechanisms (i.e. comparative analysis of likelihood of a slope failure versus consequence of the failure).
- Evaluation of the estimated (assessed) risk by comparing against acceptance criteria.

1.2.2 Soil Salinity Assessment

The scope of works for the salinity assessment comprised the following:

- A review of available preliminary soil information to determine soil conditions and salinity potential within the subject area.
- Collection and laboratory analysis surface soil samples (including QAQC) from accessible locations within the subject area.
- Laboratory analysis of soil samples for Electrical Conductivity (EC), pH, sulfate and chloride.

1.2.3 Site Contamination Assessment

In order to determine the potential for land contamination and particular environmental constraints in the subject area, a Phase 1 Preliminary Environmental Site Assessment (PESA) with limited surface soil sampling was conducted.

The scope of works for the ESA comprised the following:

- Review of available documentation relating to the subject area to identify potential sources of contamination associated with current and historical land use; including:
  - Current and historical aerial photographs.
  - Soil, acid sulfate soils, geological and hydrogeological maps and information.
  - Groundwater borehole database search.
  - Environment Protection Authority (EPA) regulatory database searches.
- A detailed desktop assessment of the subject area to evaluate the risks of contamination within the subject area and identify locations where contamination may pose a potential risk to human health or the environment.
- A general site inspection of the subject area.
- Limited surface soil sampling at accessible locations within the subject area.
- Identify areas where further investigation may be required to characterise the nature and extent of any potential contamination.
- Preparation of a Draft Land Capability, Salinity and Contamination Assessment report presenting information gained during the above tasks.
- Preparation of Final Land Capability, Salinity and Contamination Assessment report including consideration of comments from relevant stakeholders.

1.3 Limitations

This report has been prepared for NSW Department of Planning and Environment. The findings of this report are based on the scope of works defined in **Section 1.2**. SMEC

performed the works in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession.

The purpose of this report is to provide a preliminary assessment of Land Capability, Salinity and Contamination characteristics of the Ingleside release area. This report does not provide a complete assessment of the defined subject area or the surrounding area.

The absence of any identified hazardous materials within the subject area should not be interpreted as a guarantee that such materials do not exist. As this is a preliminary, broad scale Land Capability assessment, it is not intended to be comprehensive.

The findings of the report are based on a review of desktop information, limited soil sampling and visual observations only and are therefore merely indicative of the environmental condition.

No warranty, expressed or implied, is made as to the information and professional advice included in this report. This document has been prepared in good faith and no responsibility can be accepted for inaccuracies contained in any information provided third parties.

The report shall only be used for the purposes stated in the signed contract and shall not be relied upon by any party other than the NSW Department of Planning and Environment for the Ingleside Release Area project.

2 LAND CAPABILITY ASSESSMENT

2.1 Site Location and Description

For the purposes of assessment and reporting, the subject area comprises the following sub-precincts:

- Wirreanda Valley
- North Ingleside
- Bayview Heights
- South Ingleside.

Collectively, the sub-precincts are generally bordered by the following:

- West - Wirrianda Creek and the Ku-ring-gai Chase National Park.
- North - Ku-ring-gai Chase National Park and the suburb of Church Point.
- East – Warriewood Escarpment, Katandra Bushland Sanctuary and the suburb of Mona Vale.
- South - Garrigal National Park and the suburb of Elanora Heights.

It is understood that the subject area adopted by DP&E for the Ingleside precinct will accommodate a mixture of land uses including environmental living, low and medium density dwellings (and a range of other land uses) in the future, in order to meet the strategic planning requirements of the NSW State Government.

2.2 Land Use

The subject area contains a number of existing land uses including recreational, private residential, commercial/industrial, schools, hobby farms and nursery related uses.

Private use of the land includes large residential blocks, commercial/industrial activities (including nursery and various commercial uses), schools, recreational camps and various other uses.

Approximately one third of the subject area is owned by the NSW State Government agencies. Key public landowners within the subject area are listed below:

- Department of Education and Communities.
- Department of Planning and Environment.
- Department of Primary Industries – Lands.
- Roads and Maritime Services.
- Sydney Water.
- Pittwater Council.

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KU-RING-GAI CHASE NATIONAL PARK

KU RING GAI CHASE

KU-RING-GAI CHASE National Park

AKUNA BAY

COAL AND CANDLE DR

MCCARRS CREEK RD

DUFFYS FOREST

WARRINGAH COUNCIL

TERREY HILLS

MONA VALE RD

FOREST WY

SAINT IVES CHASE

GARIGAL National Park

BELROSE

WAKEHURST PWY

Ingleside Release Area

INGLESIDE

CLAREVILLE

BARRENJOEY RD

SCOTLAND ISLAND

BILGOLA

PITTWATER RD

CHURCH POINT

NEWPORT

BAYVIEW

MONA VALE RD

PITTWATER COUNCIL

WARRIEWOOD

PITTWATER RD

ELANORA HEIGHTS

NORTH NARRABEEN

NARRABEEN

HORNSBY

MONA VALE

SYDNEY

BANKSTOWN

N

0 500 1,000 1,500 2,000 2,500 3,000 m

Fig. 1: Ingleside Release Area - Subregional Context

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2.3 Topography and Hydrology

The landscape of the subject area generally consists of relatively steep areas close to the Warriewood/Ingleside Escarpment, through to lower lying areas around the centre of the precinct (Powder Works Road, McLean Street etc.). Mona Vale Road dissects the subject area and generally follows the ridge line through the subject area. Elevations throughout the subject area generally range from a high of 200 m above sea level near the Baha'i Temple to low of 80 m above sea level in the area around Emmaus Road. In general, the subject area north of Mona Vale Road falls towards the north and north-east while the subject area south of Mona Vale Road falls towards the south-east.

Further discussion on the topography within the subject area is provided in the geotechnical / slope risk assessment report (Appendix F).

There are two creek lines located within the subject area north of Mona Vale Road. Wirreanda Creek follows the western edge of the subject area and flows to the north before discharging into McCarrs Creek, while Cicada Glen Creek flows to the north from Chiltern Road before also discharging into McCarrs Creek.

There are three creek lines located within the subject area south of Mona Vale Road. Mullet Creek (and its tributaries) flow to the south-east from King Road and Hyman Eizenberg Drive. Fern Creek and Narrabeen Creek begin at the Warriewood Escarpment and flow towards the south-east. All creek lines to the south of Mona Vale Road discharge into Narrabeen Lakes.

Figure 2, Appendix A identifies the creek lines and topography in relation to the subject area.

2.4 Soils

The subject area comprises a variety of soil landscapes recognised under the *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil landscapes mapped within the subject area include Gymea, Oxford Falls, Hawkesbury, Somersby and Lambert.

Descriptions and characteristics of the various soil landscapes identified within the subject area are provided in Table 1 below. Figure 3, Appendix A identifies the locations of the various soil landscape groups mapped throughout the subject area.

Table 1 Soils descriptions under the Soil Landscapes of the Sydney 1:100 000 Sheet

Soil Type	Landscape	Soils
Somersby	Gently undulating to rolling rises on deeply weathered Hawkesbury Sandstone plateau. Local relief to 40 m, slopes <15%. Rock outcrop is absent. Crests are broad and convex, valleys are narrow and concave. Extensively cleared, low eucalypt open-woodland and scrubland.	Moderately deep to deep (100-300 cm) Red Earths (Gn2.14) and Yellow Earths (Gn 2.24, Gn2.21) overlying laterite gravels and clays on crests and upper slopes; Yellow Earths (Gn2.21, Gn2.24) and Earthy Sands (Uc5.11, Uc5.22) on mid slopes; Grey Earths (Gn2.81), Leached Sands (Uc2.23) and Siliceous Sands (Uc1.22) on lower slopes and drainage lines; Gleyed Podzolic Soils (Dg3.82, Dg4.51) in low lying poorly drained areas.
Oxford Falls	Hanging valleys on Hawkesbury Sandstone. Local relief <80 m, slopes <15%. Occasional broad benches and broken scarps. Valley floors are relatively wide, gently inclined and often poorly drained. Low eucalypt woodland, scrub heathland and sedgeland.	Moderately deep to deep (50 >150 cm) Earthy Sands (Ue5.23),Yellow Earths (Gn2.84, Gn2.94), Siliceous Sands (Ue 1.21) on slopes; deep (>200 cm) Leached Sands (Uc 2.12), Podzols (Uc2.32, Uc2.36) and Grey Earths (Gn2.81) on valley floors.
Hawkesbury	Lugged, rolling to very steep hills on Hawkesbury Sandstone. Local relief 40-200m, slopes >25% Rock outcrop >50%. Narrow crests and ridges, narrow incised valleys, steep sideslopes with rocky benches, broken scarps and boulders. Mostly uncleared eucalypt open-woodland (dry sclerophyll forest) and tall open-forest (wet sclerophyll forest).	Shallow (>50 cm), discontinuous Lithosols, Siliceous Sands (Ucl.21) associated with rock outcrop; Earthy Sands (Uc5.11, Uc5.23), Yellow Earths (Gn2.24) and some Yellow Podzolic Soils (Dy4.11) on inside of benches and along joints and fractures; localised Yellow and Red Podzolic Soils (Dy4.11, Dy5.21, Dr5.11, Dr5.21) associated with shale lenses; Siliceous Sands (Uc1.2) and secondary Yellow Earths (Gn2.41) along drainage lines.
Gymea	Undulating to rolling rises and low hills on Hawkesbury Sandstone. Local relief 20-80m, slopes 10-25%. Rock outcrop <25%. Broad convex crests, moderately inclined side slopes with wide benches, localised rock outcrop on low broken scarps. Extensively cleared open-forest (dry sclerophyll forest) and eucalypt woodland.	Shallow to moderately deep (30-100 cm) Yellow Earths (Gn2.24) and Earthy Sands (Uc5.11, Uc5.23) on crests and inside of benches; shallow (<20 cm) Siliceous Sands (Ucl.21) on leading edges of benches; localized Gleyed Podzolic Soils (Dg4.21) and Yellow Podzolic Soils (Dy4.11, Dy5.11, Dy5.4V on shale lenses; shallow to moderately deep (<100 cm) Silkeous Sands (Ucl.1.2) and Leached Sands (Uc2.21) along drainage lines.
Lambert	Undulating to rolling low hills on Hawkesbury Sandstone. Local relief 20-120m, slopes <20%. Rock outcrop >50%. Broad ridges, gently to moderately inclined	Shallow(<50 cm), discontinuous Earthy Sands (Uc5.11, Uc5.22) and Yellow Earths (Gn2.2) on crests and inside of benches; shallow (<20 cm) Siliceous Sands/Lithosols (Uc1,2) on

Soil Type	Landscape	Soils
	slopes, wide rock benches with low broken scarps, small hanging valleys and areas of poor drainage. Open and closed-heathland, scrub and occasional low eucalypt open woodland.	leading edges; shallow to moderately deep (<150 cm) Leached Sands (Uc2.21), Grey Earths (Gn2.81) and Gleyed Podzolic Soils (Dg4.21) in poorly drained areas; localised Yellow Podzolic Soils (Dy4.1, Dy5.2) associated with shale lenses.

2.5 Geology

The *Sydney 1:100 000 Series Geological Sheet* indicates that the subject area is entirely underlain by the Hawkesbury Sandstone formation (mapping unit Rh) of the Wianamatta Group from the Triassic Period.

The Hawkesbury Sandstone formation typically comprises medium to coarse-grained quartz sandstone with very minor shale and laminate lenses. Figure 4, Appendix A identifies the mapped geology throughout the subject area.

2.6 Hydrogeology

SMEC completed a search of the Department of Water and Energy Online Database to identify groundwater bores within the subject area. The search indicated that there are 50 registered boreholes in the subject area.

Regional groundwater is expected to generally flow to the north-east in accordance with the general site topography with localised variations in areas located nearer to water bodies and creek lines.

Water quality information contained within the bore logs is limited; however, the information that is available identifies salinity characteristics as good to fresh which indicates reasonable water quality and non-saline groundwater conditions. This is anticipated given the geology of the subject area.

The recorded bore depths range from 5.3 mbgl in GW014179 to 210 mbgl in GW104265. Recorded historical standing water levels within the bores range from 14 mbgl in GW101503 to 105 mbgl in GW105671. The recorded bore depths and water levels indicate that there is likely more than one aquifer within the subject area.

The locations of existing groundwater boreholes within the subject area can be seen in Figure 5, Appendix A. Appendix B presents the works summary records from the groundwater database search for each groundwater bores identified within the subject area.

2.7 Slope Risk and Stability

The Land Capability assessment included a site inspection of the 10 previously delineated set zones within the Ingleside precinct (see Figure 2), that contain slopes that may potentially pose a risk to property, to identify slope characteristics, and identify current and potential slope failure mechanisms to inform a slope risk assessment and categorise slope mechanisms in accordance with the Landslide Risk Management guidelines dated March 2007 by Australian Geomechanics Society (AGS, 2007).

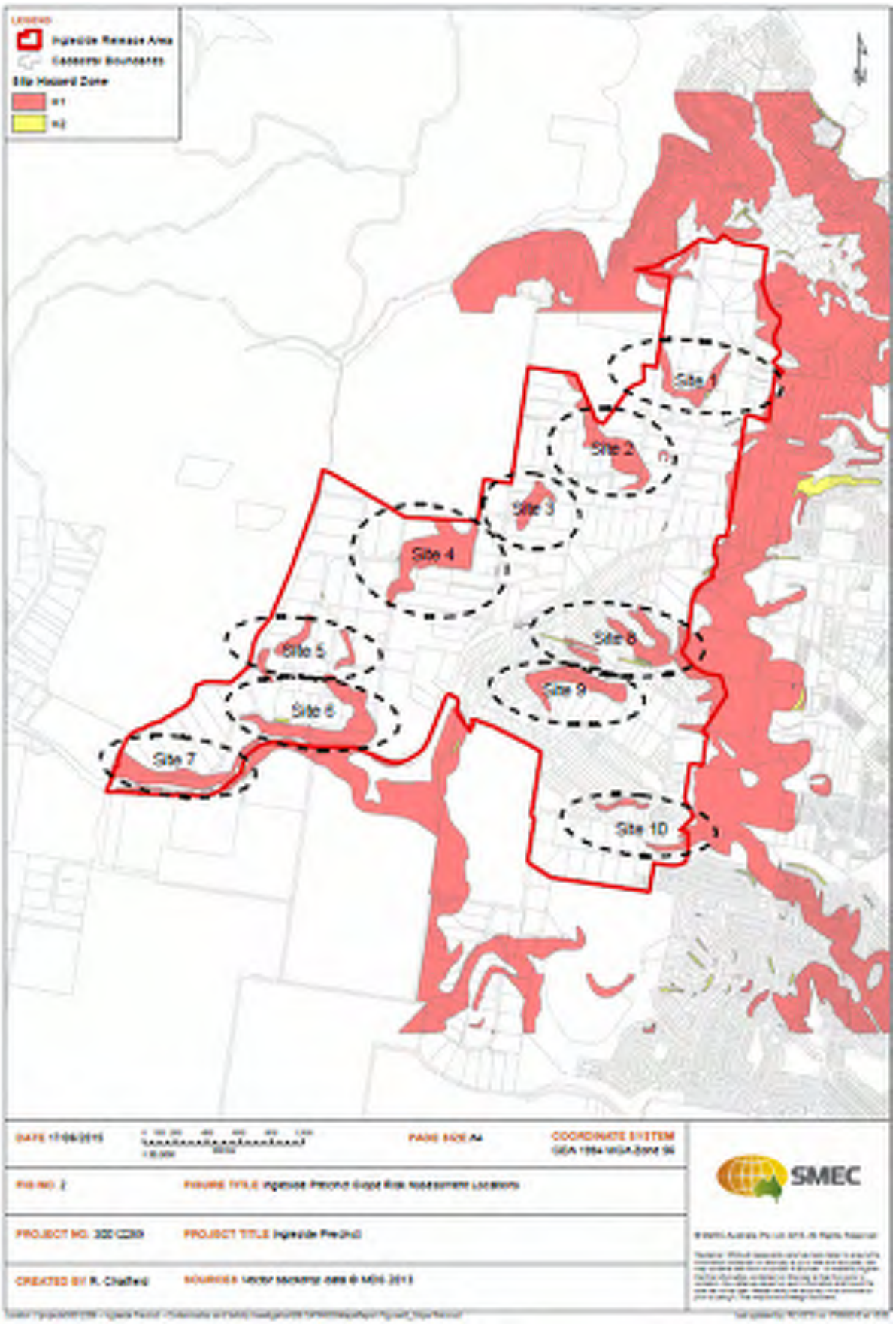

Figure 2. Site map for risk locations assessed

The methodology of assessing the risks at the site comprised the following steps:

- Site inspection involving a geological and geomorphologic appraisal
- Hazard identification
- Risk estimation.

The site inspections comprised site observations and recording of surface features including geomorphological characteristics, evident failure mechanisms, erosion and indications of slope instability.

Slope characterisation was undertaken for each precipice in order to:

- Identify whether the slope has current or potential slope instability issues
- Classify the types of slope instability, if relevant
- Assess the physical extent of the areas affected by instability being considered, including the location, areal extent and volume involved
- Assess the likely initiating event(s), the physical characteristics of the materials involved, and the failure mechanics
- Estimate the resulting anticipated travel distance and velocity of movement
- Identify if risks from a possible slope hazards to existing or future property are acceptable.

As access to private properties was not possible, SMEC has undertaken a visual slope risk analysis in line with AGS (2007) guidelines, which are included in Appendix F. These slope risk analyses involved the inspection of the slope characteristics at 10 sites (Figure 1, Appendix F). Inspections were undertaken from accessible areas, generally either from the roadside or clearly identifiable public land.

The data collected during the site visit by a senior geotechnical engineer has enabled the definition and characterisation of slope instability mechanisms at the 10 sites. Three main mechanisms were identified. These are listed below:

- Mechanism 1: Block falls up to 1 m from precipices up to 2 m in height
- Mechanism 2: Block falls up to 1 m from precipices up to 5 m in height
- Mechanism 3: Block falls up to 2 m from overhangs

SMEC considered three future uses for any land development and made assumptions with regards to the temporal probability for these uses (detailed in Appendix F Section 4.3.4). The three land uses considered are:

- Residential areas
- Roads
- Recreational areas

A risk assessment was undertaken for each of the slope instability mechanisms. For risk to property, the assessment was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure.

The findings of the slope risk analysis identified the risk level as ‘moderate’. On this basis, the tolerable risk to property for the identified failure mechanisms has not been met. Recommendations to reduce risk to acceptable levels may include scaling the slope, installation of rock bolts and due consideration of the developments location.

Risk analyses were based on high level observations. The analyses are conservative because comprehensive and detailed geological mapping of the site was not possible. Accordingly there may be other active or potential slope mechanisms that were not identified. On this basis it is recommended that for any site development, a location-specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation.

2.8 Erosional and Sedimentation Characteristics

The erosion hazard is dependent on a combination of climate, landform, soil, land use and land management factors. The qualitative categories are of erosion hazard are 'low', 'moderate', 'high', 'very high' and 'extreme'.

The subject area has typical geomorphic characteristics of a colluvial (loose, unconsolidated sediments) and erosional (wearing away) soil landscapes. Generally, erosional landscapes are the source of soil materials deposited in a receiving colluvial landscape. Colluvium generally accumulates as gently sloping aprons or fans, either at the base of or within gullies and hollows on hill slopes down gradient.

Soil erosion hazards refer to the susceptibility of a parcel of land to the prevailing components of erosion. The 'Soil Loss Class' is a measure of erosional hazard that underpins the erosional control aspects of the *Managing Urban Stormwater: Soils and Construction* document (Landcom, 2004) listed for each soil landscape in Table 2.

Following assignment of a soil loss class, soil erodibility is assessed. Soil erodibility is a measure of the susceptibility of individual soil particle to detach and transport by rainfall and runoff. The K-factor range for soil landscapes within the subject area is 0.025 to 0.046. In general, the Hawkesbury, Lambert and Oxford Falls soil landscape groups are recognised as having a higher susceptibility to erosion than the other soil landscapes groups within the subject area.

Rainfall erosivity is another factor determining the soil loss class. Rainfall erosivity is a measure of the ability of rainfall to cause erosion. It is the product of two components: total energy and 30 minute intensity for each storm. In NSW it varies from 750 in western parts of the state to over 10,000 in on part of the north coast. The R-factor for Ingleside is 4000. Slopes exceeding 7% are considered high erosional risk in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004).

The annual rainfall distribution for Sydney area is seasonably variable. Given categorisation of the subject area as a high erosion risk, scheduling of construction activities during February and March (up to six months of the year in areas with higher soil loss classes) would require special measures in addition to best management practise is applied all year round.

High erosion hazard implies that significant erosion could occur during development of the particular land use and that appropriate erosion control measures would be needed to minimise long-term erosion risk. Control of short term erosion could be provided by simple soil conservation measures but long-term erosion control would involve intensive measures.

Very high erosion hazard implies that significant erosion could occur during development and after land use is established, even with intensive soil conservation measures. This category of erosion hazard infers that planning will need to carefully consider the balance between the probability of long term erosion damage and maintenance or repair needed to ensure the ongoing viability of the land use.

Where practicable, construction programing should aim to minimise the potential for soil loss by condensing the time from the beginning of land disturbance activities to rehabilitation to less than six months, subject to a detailed risk assessment. Further, on lands with a very high erosion hazard:

(i) Attempt to confine specific land disturbance to those times of the year when the rainfall erosivity is low; or

(ii) Show specific measures within Site Environmental Management Plans to address the high erosion hazard.

Erosion mitigation aims to reduce the severity of erosion should it occur. Erosion mitigation is a general term used to embrace all those activities, aimed at the control of soil erosion and the reduction of its impact on all forms of land use.

Table 2: Urban development limitations.

Soil Type	Limitations
Somersby	Localised permanently high water tables, areas of laterite and stony soil, very low soil fertility, highly permeable soil and slightly reactive Soil Loss 58 t/ha for topsoil and 162 t/ha for subsoil
Oxford Falls	Very high soil erosion hazard, perched water tables and swamps, highly permeable soil, very low to low soil fertility, localised rock outcrop. Moderately reactive Soil Loss 91 t/ha for topsoil and 131 t/ha for subsoil
Hawkesbury	Extreme soil erosion hazard, mass movement (rock fall) hazard, steep slopes, rock outcrop, shallow, stony, highly permeable soil, low soil fertility. Slightly reactive Soil Loss 109 t/ha for topsoil and 394 t/ha for subsoil
Gymea	Localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil, very low soil fertility. Slightly reactive Soil Loss - 19 t/ha for topsoil and 464 t/ha for subsoil
Lambert	Very high soil erosion hazard, rock outcrop, seasonally perched water tables, shallow, highly permeable soil, very low soil fertility. Slightly reactive Soil Loss 17 t/ha for topsoil and 197 t/ha for subsoil

2.9 On-site Sewage Management

SMEC undertook an On-Site Effluent Assessment for the Ingleside Release Area (2015). The assessment found that the soil landscapes within the Wirreanda Valley and Bayview Heights areas present a number of soil-related environmental constraints. Soil depths of less than 0.6 metres to bedrock may not have enough capacity to filter nutrients and pathogens. Shallow soil often has a highly variable depth, and incurs a risk of effluent surfacing near the

land application area. Any decisions about the on-site management of sewage should consider these issues.

Soil landscapes in the broader subject area can be typically <0.5 metres in the Hawkesbury, Gymea and Lambert soil profile and can present wide sandstone benches on side slopes and with associated rock outcrops. These soil landscapes are characterised by low water holding capacity, low to very low cation exchange capacity (CEC), and low nutrient status. They can be seasonally waterlogged with connected seepage areas and may also seasonally feed into hillside wetlands. Soil depths to bedrock can marginally increase in the Somersby and Oxford Falls soil landscapes with ranges of 0.5–1.0 m.

It is important that on-site sewage management issues are addressed as early as possible in the planning and development process as existing and proposed on-site sewage management within the subject area has potential to impact on the natural and managed parts of the water cycle through pollution of ground and surface waters with pathogens and nutrients. Moderate soil limitations can sometimes be overcome by appropriate selection, design, and sizing of on-site systems, or by modifying the site.

Ideally, the assessment proceeds from a broad evaluation and desktop analysis to more detailed subdivision survey work. It is recommended that individual lots may be required to undertake a specific site evaluation at the development application stage which may eliminate areas not suitable for on-site sewage management.

2.10 Salinity

The *Soil Landscapes of the Sydney 1:100 000 Sheet*, (Table 4.3 Soil Limitations for Each Soil Material) identifies that there is no known occurrence of salinity within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area.

Further discussion on the salinity characteristics of the subject area is provided in Section 3 of this report.

2.11 Acid Sulfate Soil Risk

Acid sulfate soils (ASS) are acidic soil horizons (layers) resulting from the aeration of soil materials rich in iron sulfides. ASS generally occur within the following environments:

- Marine or estuarine sediments deposited during the Holocene period.
- Soils environments <5 metres above sea level.
- Marine or estuarine settings/environments.

The *Soil Landscapes of the Sydney 1:100 000 Sheet*, (Table 4.3 Soil Limitations for Each Soil Material) identifies that there is no known occurrence of ASS within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area.

Given the mapped soils units and elevation of the subject area (generally >100 m above sea level) ASS are not considered to present a risk within the subject area.

Figure 3, Appendix A identifies the areas within the vicinity of the subject area where ASS are known to occur.

3 SALINITY ASSESSMENT

In order to determine the potential for salinity within the subject area, surface soils were collected and analysed during the site inspection within the subject area. Sampling locations were identified on a subjective basis. It is noted that sampling activities were conducted prior to the revision of the subject area. As such only samples obtained from within the revised subject area are discussed in the following sections.

3.1 Assessment Criteria

Soil salinity is commonly assessed with respect to EC of a 1:5 soil:water extract (EC 1:5). This value can be converted to ECe (electrical conductivity of a saturated extract) by multiplication by a factor dependent on soil texture ranging from 6 for shale to 17 for sand.

Hazelton and Murphy (2007) classify soil salinity on the basis of ECe and describe the following salinity classes for assessing soil salinity:

- 'Non saline': <2 mS/cm
- 'Slightly saline': 2-4 mS/cm
- 'Moderately saline': 4-8 mS/cm
- 'Very saline': 8-16 mS/cm
- 'Highly saline': >16 mS/cm

The adopted soil salinity assessment criteria are presented in Table D3, Appendix D.

3.2 Subject area Investigation and Methodology

The principal question of the investigation is to assess the potential risks posed by soil salinity with the subject area. All sampling design plans and fieldwork were undertaken by suitably qualified, trained and experienced personnel in general accordance with the Department of Land and Water Conservation, *Site Investigations for Urban Salinity*, Sydney, 2002.

Due to constraints around site access within the subject area, limited surface soil sampling was conducted at assessable public locations within the subject area only. Samples obtained were analysed for EC, pH, sulfate and chloride.

All surface soil samples were collected using a stainless steel trowel. The sample was then transferred directly from the trowel in to laboratory supplied sample jars. New disposable nitrile gloves were worn for the collection of each sample and the trowel was decontaminated with a phosphate free detergent (Decon 90) between each sample location.

3.3 Site Assessment

Visual evidence of soil salinity was not observed throughout the subject area during the limited field investigations.

All soil samples collected and analysed were surface or near-surface soil samples obtained from approximately 0.0-0.2m.

The field texture of the soil samples collected ranged from orange brown clayey sands to dark grey silty clays.

The locations of the salinity soil samples collected within the subject area are presented in Figure 8, Appendix A.

3.4 Quality Control and Quality Assurance (QAQC)

All fieldwork was performed by suitably qualified subcontractors in accordance with SMEC's standard operating procedures.

All samples were collected directly into laboratory supplied sample jars. To avoid potential cross-contamination a clean pair of nitrile gloves was worn prior to the collection of each sample. All equipment that came into contact with multiple sample locations was decontaminated with Decon 90 and rinsed prior to use at each location.

All sample jars were filled with sample directly from a stainless steel trowel and immediately placed in an ice-filled esky to keep the samples below a temperature of approximately 4^{o}C.

A chain of custody form was completed with the sample names, sampling date and required analyses. The Chain of Custody (COC) form and the samples were then sent in a sealed esky to the NATA accredited laboratory ALS for analysis within the prescribed analyte holding times.

Analytical methods complied with NEPM and NSW EPA requirements.

The laboratory reports and certificates and COC information are provided in Appendix E.

A total of 72 soil samples were collected from within the subject area and analysed for salinity by the primary laboratory. Two intra–laboratory blind duplicate soil samples S15/2 (S15/1) and S283 (S283/2) was also analysed ALS.

In general all Relative Percent Differences (RPD's) for replicate samples S283/2 and S15/1 were within the recognised quality control interval of ±50%. Some exceptions were noted (moisture, sulfate, chloride), however, it is considered that the exceptions are reflective of the heterogeneous nature of the surface material sampled.

It is therefore considered that the field duplicate/laboratory QA/QC is adequate for the purposes of this investigation.

RPD results for salinity analysis are presented in Table D4, Appendix D.

3.5 Salinity Analytical Results

Laboratory EC results were converted to ECe values using a soil class factor of 8.6 (based on the average soil type encountered).

The reported EC results range from 6 µS/cm (0.006 mS/cm) to 214 µS/cm (0.214 mS/cm). The converted ECe results ranged from 0.1 mS/cm to 1.8 mS/cm.

Based on the assessment criteria detailed in section 5.1, the results indicate that all soil samples analysed were <2 mS/cm and therefore can be classified as being Non-saline.

Table D3, Appendix D presents soil analytical results for salinity analysis with comparison to the adopted salinity classes presented in Section 5.1.

3.6 Discussion Of Results

Analytical results for soil samples collected and analysed for salinity from within the subject area indicate that all soil samples can be classified as being Non-saline.

The reported analytical results confirm desktop information which identified that there is no known occurrence of salinity within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area (*Soil Landscapes of the Sydney 1:100 000 Sheet,* Table 4.3 Soil Limitations for Each Soil Material).

Based on the information presented above, a salinity management plan is not considered necessary and no further assessment of soil salinity within the subject area is required.

4 CONTAMINATION ASSESSMENT

4.1 Site History Review

In order to determine the potential for land contamination and particular environmental constraints in the subject area, a Stage 1 Preliminary Environmental Site Assessment (PESA) was conducted for the subject area. This included an appraisal of the potential for site contamination that may have resulted from past and present land uses to determine Areas of Environmental Concern (AEC).

In addition to the PESA a limited surface soil sampling program was also conducted at immediately assessable locations within the subject area. It is noted that sampling activates were conducted prior to the revision of the subject area. As such only samples obtained from within the revised subject area are discussed in the following sections.

The methodology for the site history assessment of the subject area consisted of the following:

- Review of past and present aerial photographs obtained from the NSW Department of Lands. Aerial Photographs from 1930, 1947, 1965, 1978, 1991, and 2014 were reviewed to determine potential past/present contaminating activities.
- Database search of registered groundwater bores within the subject area via the NSW Natural Resource Atlas online resource.
- Identification of the subject area, including location of surrounding infrastructure, area, boundaries, and a review of the physical site setting including regional and local geology, hydrology and hydrogeology.
- Database search of EPA contaminated land record and public record for licences, applications and notices.
- Database search of EPA environment protection licences, applications, notices, audit or pollution studies and reduction programs.
- A desktop review of information relevant to the history of sites within the subject area to determine past and present land uses.
- A site inspection on 16 July 2014 by a SMEC environmental scientist to visually assess present and past potentially contaminating activities, current landforms and site condition.

Aerial imagery dated between 1930 and 2012 was reviewed to assess major changes to land use within the subject area.

Table 3 lists the historical aerial photographs that were obtained and the review observations.

Appendix C presents the aerial images summarised within Table 3.

Table 3 Summary of Historical Aerial Photograph Information

Year	Site Description and Surrounding Area	Potential (AEC)
6 March1930 Sydney Survey Run 1 - 12 B/W Scale 1:22,000	Minimal development appears to have occurred within the release area prior to the 1930s. The main exceptions occur within the south and south-east of the subject area where a number of roads and small farm/agricultural developments are visible. A parcel of cleared land (square in appearance) is visible within the north-eastern portion of the subject area. The cleared area appears to be in the general vicinity of the present day location of Bayview Heights Estate.	Areas developed as small farm/agricultural holdings within the South and South-eastern portion of the subject area. Cleared area towards north-eastern tip of the subject area.
Jan 1947 Broken Bay, Runs 39 and 40 B/W Scale 1:12,000	Other than the development of additional farm/agricultural type developments within the south and south- west of the subject area; there is little change in comparison to the 1930 image. The cleared area towards north-eastern tip (visible in the 1930 image) is no longer visible in the 1947 image.	Areas developed as small farm holdings / market gardens / nurseries within the South and South-eastern portion of the subject area.
23 September 1965 Cumberland Run 12E and 13E B/W Scale 1:2,200	The southern portion of the release area has been further developed. More lots appear to have been developed for agricultural type activities. Many of the plots (particularly within the center and south-eastern sections of the subject area) contain long rectangular greenhouse/shed type structures assumed to be related to farming or nursery operations. The golf course (Monash Country Club) has also been developed within the southern section of the release area. There are a few additional developed lots within the northern and central portions of the release area, that from appearance are assumed to be small farm/agricultural developments and a large area of scaring/cleared land is visible within the northern tip which is presumed to be the development of the Bayview Heights Estate. Some development has occurred within the north-western section of the subject area. Several roads have been developed since 1947 and there is evidence of land clearance activities, however the nature of the land use is difficult to determine. Construction of the Baha'i Temple is visible within the image.	Areas developed as small farm holdings / market gardens / nurseries within the North, Central, South and South-eastern portions of the subject area.

Year	Site Description and Surrounding Area	Potential (AEC)
29 March 1978 Cumberland Run 7 and 8 B/W Scale 1:16,000	Other than the development of some additional farming/agricultural plots and rural properties throughout the subject area; there appears to be little obvious change in comparison to the 1965 image.	Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area.
14 August 1991 Sydney Run 5 Colour Scale 1:25,000	Obvious changes from the 1978 image include: - Development of light industrial activities (Sophie Ave, etc.). - Scarring/land clearance evident (potential quarry locations) east and west of Wirreanda Rd North, Bungendore St, Addison Rd, on the northern side of Powder Works Rd near Wilson Ave (present day Council works depot) and on the northern side of Lane Cove Rd at the intersection with View Rd - Construction of water tower on Wattle Rd.	Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area. Lots developed for light industrial activates throughout the subject area (Sophie Ave, etc.). Potential quarry locations and fill materials.
2012 Bing Maps Colour Scale Unknown	Other than the development of some additional rural properties throughout the release area; there appears to be little obvious major change in comparison to the 1991 image.	Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area. Lots developed for light industrial activates throughout the subject area (Sophie Ave, etc.) Potential quarry or former quarry locations.

An online search of the EPA Contaminated Land Records Database (http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx) was conducted on 24 June 2014. No notice records or management notices were identified for any site within the subject area. In addition, no records were held in relation to the land within a one kilometre radius of the subject area as at the search date.

An online search of the EPA Protection of the Environment Operations Act public register (http://www.epa.nsw.gov.au/prpoeoapp) was conducted on 24 June 2014. No environment protection licences, applications, notices, audits or pollution studies and reduction programs were identified for any site within the subject area. In addition, no environment protection licences, applications, notices, audits or pollution studies and reduction programs were identified for any site within a one kilometre radius of the subject area as at the search date.

No historical environmental reports were reviewed by SMEC in relation to the subject area for this report.

4.2 Site Inspection

A SMEC environmental scientist conducted a visual site inspection on 16 July 2014. Due to site access limitations, the site inspection consisted of observations from public roads and visual inspection to determine potential AEC and to field check desktop information.

The purpose of the visual site inspection was to gather non-invasive data to support the conceptual understanding of the spatial extent of historic and contemporary activities within the subject area.

The site inspection was undertaken to try to identify, locate and map the following surface features where they existed within the subject area:

- Disturbed ground possibly in the form of trenches or mounds.
- Illegal waste disposal, including domestic rubbish and building rubble (including asbestos fragments and sheets).
- Unnatural changes in vegetation (including evidence of cleared ground or vegetation potentially impacted by contamination).
- Potential environmental receivers.

4.3 Risk Assessment of AECs

A level of low, medium or high risk from a contamination perspective has been assigned based on qualitative judgment from observations made during the site inspection, information obtained during the desk top review and the extent of the proposed works for the proposed rezoning. Table 4 summarises the risk criteria developed to assess the AECs.

Table 4: Summary of Risk Criteria for AECs

Risk	AEC Risk Assessment Criteria
Low	Low potential of residual soil and/or groundwater contamination to exist within the extent concept proposal footprint. Low probability of engaging any potential contaminated land associated with identified AEC due to extent of proposed works.
Medium	Medium potential of residual soil and/or groundwater contamination to exist within the extent concept proposal footprint. Contaminated soil and / or groundwater associated with identified AEC may be engaged due to the extent of the proposed works.
High	High potential of some level of residual soil and/or groundwater contamination to exist within the extent concept proposal footprint. Contaminated soil and / or groundwater associated with identified AEC are likely to be engaged due to the extent of the proposed works. Further investigations recommended.

It should be noted that while the risk ranking system categorises the various AECs as 'high' to 'low' risk, this does not indicate that contamination has or has not occurred. Rather, it highlights the need that further assessment may be required. Further data would give greater confidence on these risk levels.

4.4 Potential AEC Within Subject area

Given the general history of land use within the subject area it is expected that any identified contamination would likely to be limited to relatively localised areas.

Table 5 presents the general high level AEC, potential impacts, risk rating and contaminants of concern within the subject area from a contamination perspective.

Figure 7, Appendix A identifies the AEC within the subject area from a contamination perspective.

Table 5 Potential AEC within Subject area

AEC	Potential High Level Impacts	Risk	Potential Contaminants of Concern
Uncontrolled Fill Material	Potential impacts to soil (and groundwater). The potential exists that contaminated heterogeneous fill material may have been used either within subsurface strata (i.e. used as backfill for lots to level sites) or stockpiled on lots within the subject area.	Medium	Metals (8) arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn), PAHs, Total Petroleum Hydrocarbons (TPH), Benzene, toluene, ethylbenzene and xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs) Polychlorinated biphenyls (PCB), Organochlorine and Organophosphorous Pesticides (OCP& OPP), and asbestos
Industrial facilities and Vehicle/Equipment Maintenance	Potential impacts to soil (and groundwater). The potential for petroleum hydrocarbon impacts exists as a result of vehicle / equipment maintenance activities being conducted within the subject area particularly on commercial / industrial lots within the subject area.	Medium	Metals – lead (Pb), solvents, Volatile Organic Hydrocarbons (VOC), PAHs, TPH, BTEX
Small farm holdings / market gardens and nurseries	Potential soil (and groundwater) impacts - The potential exists that OCC and OPP pesticides and herbicides may have been used particularly on small farm holdings / market garden and nursery lots within the subject area.	High	OCP & OPP Pesticides
Existing Buildings and Site Structures	Potential soil impacts - The potential exists that older site structures throughout the subject area may contain a variety of contaminated materials including PCBs within electrical fittings, lead based paints, Synthetic Mineral Fibers (SMF) and Asbestos based products.	High (for structures built prior to 1986)	PCBs, Lead (paint), Synthetic Mineral Fibers (SMF) and Asbestos
Septic effluent	Potential soil (and groundwater) impacts –	Medium	Fecal coliforms, Various

AEC	Potential High Level Impacts	Risk	Potential Contaminants of Concern
systems	The potential exists that Septic effluent systems will be located throughout the subject area. Potential impacts relate to fecal coliforms and the use of domestic cleaning products.		metals
Fly Tipping	Potential soil impacts - The potential exists for illegal dumping on road verges and lots throughout the subject area.	Low	Metals, PAHs, TPH, BTEX, PCB, OCP, OPP and asbestos

4.5 Potential Receptors of Concern and Pathways

Based on the information available, the potential receptors include:

- Residents (existing and future), workers and general public with the subject area.
- Transient users of areas around the subject area.
- Construction workers involved in potential redevelopment of the subject area.
- Flora and fauna in areas within and around the subject area.
- Aquatic ecosystems of Wirreanda, Cicada Glen and McCarrs Creek(s) to the north and Mullet (and its tributaries), Fern, Narrabeen Creek(s) and Narrabeen Lakes to the south-east.

Based on the information available, the potential pathways include:

- Direct contact with contaminated soil and potentially groundwater.
- Ingestion or inhalation of soils and dust.
- Inhalation of vapours from soils and potentially groundwater.

4.6 Persistence in the Environment

The potential contaminants of concern identified which have a relatively high degree of persistence in the environment are:

- Asbestos.
- Lead.
- Agricultural pesticides
- VOCs
- Some PAHs.
- Longer chain hydrocarbons (ie >C29).

4.7 Assessment Criteria

Assessment criteria for the soil analytical results are discussed below. Evaluation against assessment criteria is used to identify levels of contamination that may pose ecological or health risks to existing and future users of the site.

It is noted that a new, amended National Environment Protection (Assessment of Site Contamination) Measure (NEPM) has been approved by all Australian States and Territories. The NEPM was first published in 1999 and updated in 2013 by the National Environment Protection Council (NEPC), and provides national standards for a variety of environmental issues, including the assessment of site contamination in Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater.

NEPM (2013) has undertaken the development of health-based screening levels (HSLs) for petroleum hydrocarbons to address consistent human health risk in Australian conditions. The HSLs were derived through the consideration of health effects only, with particular emphasis on the vapour exposure pathway. HSLs have been derived for petroleum hydrocarbons for different land uses, media, soil types and depths to contamination.

The management limits (MLs) for TPH fractions in soil (NEPM 2013), are more conservative than the HSLs and therefore SMEC has adopted these as screening levels for TPH fractions for this investigation.

Analytical results are also compared with the NEPM (2013) provisional phytotoxicity-based ecological investigation levels (EILs) to determine potential risks to current and future ecological receptors at the site for select analytes (As, DDT, Pb, naphthalene, Cr, Cu, Ni, Zn).

The NEPM (2013) EIL values rely on site-specific inputs and calculations, and were derived specifically for sandy loam soils or soils of a closely similar texture with a pH in the range of 6 to 8. They are intended for assessment screening purpose only.

Ecological screening levels (ESLs) are relevant in terms of petroleum impacted soils where ecological receptors are present. The ESLs presented in Table 1B(6) of the NEPM (2013) are compared against various land uses for fine or coarse soil textures.

For the purpose of this investigation TPH fractions will be compared to fine soil texture for Urban Residential/Public Open Space and Commercial/Industrial land use.

As the future land-use is likely to be predominantly various residential within some commercial/industrial, the adopted assessment criteria for assessing the soil contaminants have been sourced from:

- NEPM (2013) HILs for Residential (A, B, C) and Commercial/Industrial (HIL D) for organic and inorganic chemicals.
- NEPM (2013) ESLs and MLs for TPH.
- NEPM (2013) EILs.
- For analytes in which there are no listed criteria, the laboratory Limits of Reporting (LOR) will be taken as screening level for this investigation.
- Where more than one value is listed for any particular analyte the most conservative value has been used as a screening level.

The adopted soil assessment criteria for the site are summarised in Table D1, Appendix D.

4.8 Subject Area Investigation and Methodology

The principal question of the investigation is to assess the risks posed by potential contamination for the proposed land use of the subject area for urban development.

SMEC undertook the works in accordance with a site specific Job Safety and Environmental Analysis (JSEA) Plan. The aim of the plan was to manage the potential risks to human health and safety associated with fieldwork activities.

All fieldwork was undertaken by suitably qualified, trained and experienced personnel.

Due to limitations around site access within the subject area limited surface soil sampling was conducted at assessable locations within the subject area only. All samples obtained were analysed for a broad suit of analytes including, metals (8), BTEX, TPH, OCC and OPP pesticides, PCBs and PAHs.

The locations of the contamination soil samples collected within the subject area are presented in Figure 8, Appendix A.

All surface soil samples were collected using a stainless steel trowel. The sample was then transferred directly from the trowel in to laboratory supplied sample jars. New disposable nitrile gloves were worn for the collection of each sample and the trowel was decontaminated with Decon 90 between each sample location.

4.9 Quality Control and Quality Assurance (QAQC)

All fieldwork was performed by suitably qualified subcontractors in accordance with SMEC's standard operating procedures.

All samples were collected directly into laboratory supplied sample jars. To avoid potential cross-contamination a clean pair of nitrile gloves was worn prior to the collection of each sample. All equipment that came into contact with multiple sample locations was decontaminated with Decon 90 and rinsed prior to use at each location.

All sample jars were filled with sample directly from a stainless steel trowel and immediately placed in an ice-filled esky to keep the samples below a temperature of approximately 4^{o}C.

A chain of custody form was completed with the sample names, sampling date and required analyses. The Chain of Custody (COC) form and the samples were then sent in a sealed esky to the NATA accredited laboratory ALS for analysis within the prescribed analyte holding times.

Analytical methods complied with NEPM and NSW EPA requirements.

The laboratory reports and certificates and Chain of Custody (COC) information are provided in Appendix E.

A total of 12 soil samples were collected from within the subject area and analysed for contaminants of concern by the primary laboratory. Two intra–laboratory blind duplicate soil samples S15/2 (S15/1) and S283 (S283/2) was also analysed ALS.

In general all Relative Percent Differences (RPD's) for replicate samples S283/2 and S15/1 were within the recognised quality control interval of ±50%. Some exceptions were noted for some metals analytes and TPH fractions, however, it is considered that the exceptions are reflective of the heterogeneous nature of the surface material sampled.

It is therefore considered that the field duplicate/laboratory QA/QC is adequate for the purposes of this investigation.

RDP results for contamination analysis are presented in Table D2, Appendix D.

4.10 Contamination Analytical Results

All soil samples were surface soil samples obtained from approximately 0.0 -0.2m. The soil samples ranged from orange brown clayey sand to dark grey clayey silty sand. Soil analytical results obtained from the subject area were compared to the adopted site criteria.

Results indicate the following for soils respective to the criteria:

- No soil sample obtained from within the subject area exceeded the adopted site assessment criteria.

Other soil analytical results indicated that:

- Metals (8) concentrations were below the site assessment criteria for all samples analysed.
- Concentrations of PAH analytes, TPH and BTEX were generally either below their LOR or below the adopted site criteria in all samples analysed. The only exceptions were:
    - PAHs (sum of total 1.3 mg/kg), TRH C_{10}-C_{40} (210 mg/kg) and TPH C_{29}-C_{36} (100 mg/kg) were detected at levels either equal to or marginally above the LOR (but below site assessment criteria in sample S164. The sample was obtained from an undeveloped bush lot. The minor levels of PAH and hydrocarbons detected are probably reflective of residual oils from eucalyptus vegetation and combusted organics associated with bush fire ash likely to be in the area; and
    - OC Pesticides (DDE 0.13 mg/kg) were detected at levels marginally above the LOR (but below site assessment criteria in sample S38. It is noted sample S38 was obtained from within the vicinity of Powder Works Nursery located on Wilson Avenue.
- Remaining, OCP, OPP, PCB and phenol concentrations were below their LOR or below the adopted site criteria in all samples analysed.

Table D1, Appendix D presents soil analytical results for contamination analysis with comparison to the adopted site assessment criteria.

4.11 Summary of Contaminated Lands

Land contamination is most often the result of past land uses. It can arise from activities that took place on or adjacent to a site and be the result of improper chemical handling or disposal practices, or accidental spillages or leakages of chemicals during transport or storage. Activities not directly related to a site may also cause contamination; for example, from diffuse sources such as polluted groundwater migrating under a site or dust settling out from industrial emissions. All construction activities prior to 1986 have the potential for asbestos-containing materials (ACM) to be present.

Due to the high level nature of this investigation it is recommended that the contamination status of individual sites should be assessed at as part of any future development application (DA) process. This may require further assessment of soil and groundwater conditions.

The findings of the preliminary soil contamination survey indicate soil qualities within the survey area are low risk for contamination. Localised contamination issues are likely to be associated with landfilling associated with cut and fill building pads, quarrying activities, construction equipment handling yards, and agricultural activities like nursery and market gardens where buildings are likely to contain asbestos sheeting in their construction. It is likely that underground utilities contain asbestos materials within service conduits and communications pits.

There is the potential for contaminated land to be disturbed by construction activities associated with ground engaging activities required for the proposed development of the subject area.

Potential environmental impacts associated with the proposal in relation to contaminated land management include:

- Increasing waste amounts from improper practices such as poor fill management.
- Contaminated or hazardous waste not being correctly disposed of.
- Adverse effects on human health (construction personnel, travelling public or nearby communities).
- Release of contaminants to underlying soils.
- Release of contaminants to groundwater.
- Movement of contaminated sediments into waterways.
- Adverse effects on flora and fauna.

Given the expected depth of groundwater in the vicinity of the subject area, it is considered unlikely that groundwater would be directly intercepted. During development, groundwater quality may be affected if recharge water caries pollutants generated from the proposal construction work. Sources of potential pollution could include nutrient rich water generated from nurseries, on-site sewage management systems, drainage from contaminated soil stockpiles or from spills of fuels, oil or other chemicals used in historical land uses.

5 CONCLUSIONS AND RECOMMENDATIONS

The following sections summarise the conclusions of the land capability, salinity and contamination assessment and the recommendations arising from the investigation.

5.1 Land Capability Assessment

The Land Capability Assessment included a site inspection at slope risk analysis of 10 previously delineated set zones within the Ingleside precinct to identify slope characteristics, identify current and potential slope failure mechanisms to inform a slope risk assessment and categorise slope mechanisms in accordance with the Landslide Risk Management guidelines by Australian Geomechanics Society (AGS, 2007). Appendix F outlines the risk analysis framework.

Based on the findings of the risk analysis it has been established that the tolerable risk to future development for the identified slope failure mechanisms has not been met, as the risk for the ten sites inspected within the precinct is classed as moderate. The report presenting the slope risk analysis undertaken within the precinct is contained in Appendix F. Recommendations to reduce the risk to tolerable levels may include; scaling the slope, installation of rock bolts and consideration of development location. These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. The location and proximity of any future development to an identified slope failure mechanism will potentially alter the calculated risk level.

On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation.

The subject area is considered to present as a high erosion hazard due to the typical characteristics of a colluvial and erosional soil landscapes combined with high rainfall intensity which can generate high soil loss. This high erosional hazard implies that significant erosion will occur during development and after land use is established, even with intensive soil conservation measures. Erosion hazards will need to be considered at the development application stage. Where practicable, construction programing should aim to minimise the potential for soil loss by condensing the time from the beginning of land disturbance activities to rehabilitation. This study indicates that the regional groundwater flow direction is expected to generally flow to the north-east in accordance with the general site topography with localised variations in areas located nearer to water bodies and creek lines. Local groundwater can occur at depths ranging from 10-20 mgbl and regional groundwater are likely to be deeper at 100-200 mbgl. Water quality information contained within the bore logs is limited; however, information that is provided identifies salinity characteristics as good, which indicates reasonable water quality and non-saline groundwater conditions are likely. The limited soil samples collected and analysed for salinity also indicate a ‘Non-saline’ classification for soils.

5.2 On-Site Sewage Assessment

SMEC undertook an On-Site Effluent Assessment for the Ingleside Release Area (2015). The assessment found that the soil landscapes within the Wirreanda Valley and Bayview Heights areas present a number of soil related environmental constraints for on-site effluent systems. Soil depths of less than 0.6 metres to bedrock may not have enough capacity to filter nutrients and pathogens. Shallow soils often have a highly variable depth, and incur a

risk of effluent resurfacing near the land application area. Any decisions about the on-site management of sewage should consider these impacts. It is recommended that individual lots may be required to undertake a specific site evaluation at the development application stage which may eliminate areas not suitable for on-site sewage management.

5.3 Salinity Assessment

With regard to the salinity investigation, the following is concluded:

- There is no known occurrence of salinity within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area.
- All soil samples obtained and analysed from the subject area were <2 mS/cm and therefore classified as being non-saline.

Based on the information presented above, a salinity management plan is not considered necessary and no further assessment of soil salinity within the subject area is required.

5.4 Contamination Assessment

With regard to the contamination investigation, the following is concluded:

- The subject area contains a number of existing land uses including recreational, private residential, commercial/industrial, schools, hobby farms and nursery related uses.
- The subject area comprises 5 soil landscapes: Gymea, Oxford Falls, Hawkesbury, Somersby, Lambert.
- There is no known occurrence of acid sulfate soils within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area. Given the mapped soils units and elevation of the subject area (generally >100m above sea level) ASS are not considered to present a risk within the subject area.
- No soil sample obtained from within the subject area exceeded the adopted site assessment criteria.
- OC pesticides (DDE 0.13 mg/kg) were detected at levels marginally above the LOR (but below site assessment criteria) in sample S38. The sample was obtained from within the vicinity of Powder Works Nursery located on Wilson Avenue.
- PAHs (sum of total 1.3 mg/kg), TRH C10-C40 (210 mg/kg) and TPH C29-C36 (100 mg/kg) were detected at levels either equal to or marginally above the LOR (but below site assessment criteria) in sample S164. The sample was obtained from an undeveloped bush lot. It is assumed that the minor levels PAH and hydrocarbons detected are probably reflective of vehicle emissions within the area.
- Potential high level AEC, from a contamination perspective, that could exist throughout the subject area include:
  - The use of uncontrolled fill material.
  - Industrial facilities and vehicle / equipment maintenance.
  - Small farm holdings / market gardens and nurseries.
  - Existing buildings and site structures.
  - Septic effluent systems.
  - Fly tipping.

- Given the general history of land use within the subject area it is expected that any identified contamination would likely to be limited to relatively localised areas.

With regard to the contamination investigation, the following is recommended:

- The contamination status of each site should be further assessed as part of any future DA process. This may require further assessment of soil and groundwater conditions.
- A Remediation Action Plan should be developed to manage potential sources of contamination should they be identified during additional investigation stages.

6 REFERENCES

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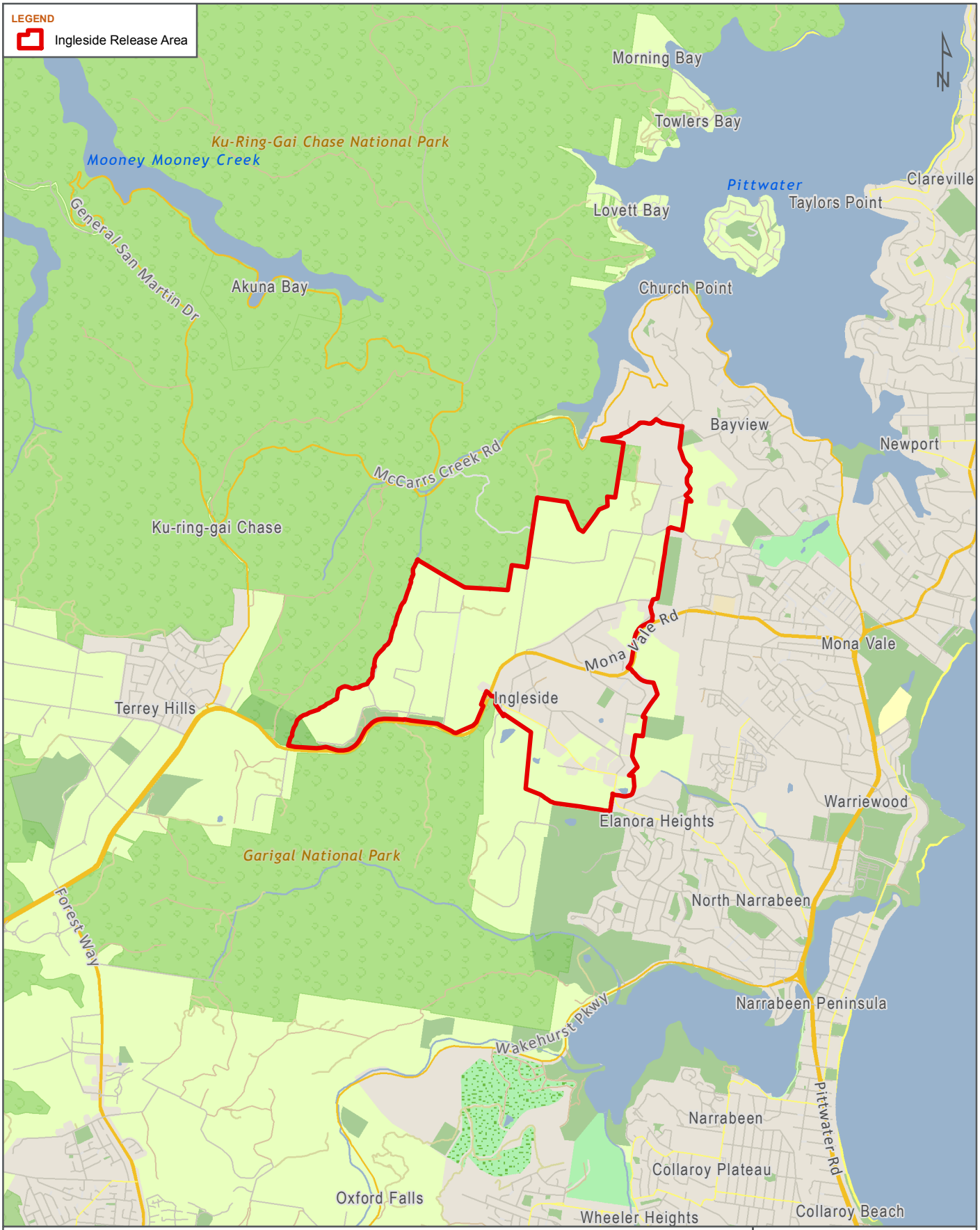
APPENDIX A – FIGURES



DATE 04/08/2014

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 1

FIGURE TITLE Site location

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\1_Site_location.mxd

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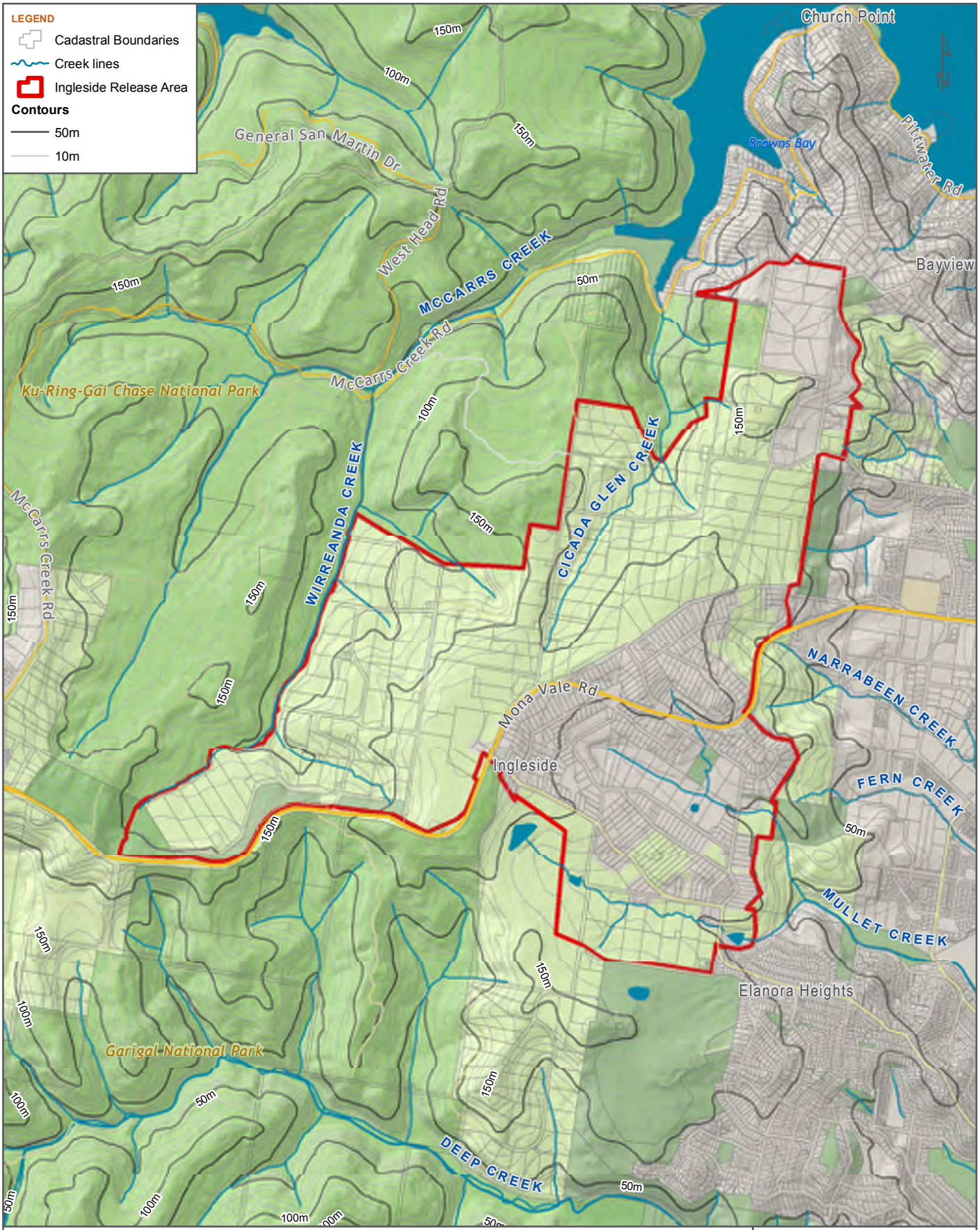

DATE 05/08/2014

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 2

FIGURE TITLE Topography and Creek lines

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC

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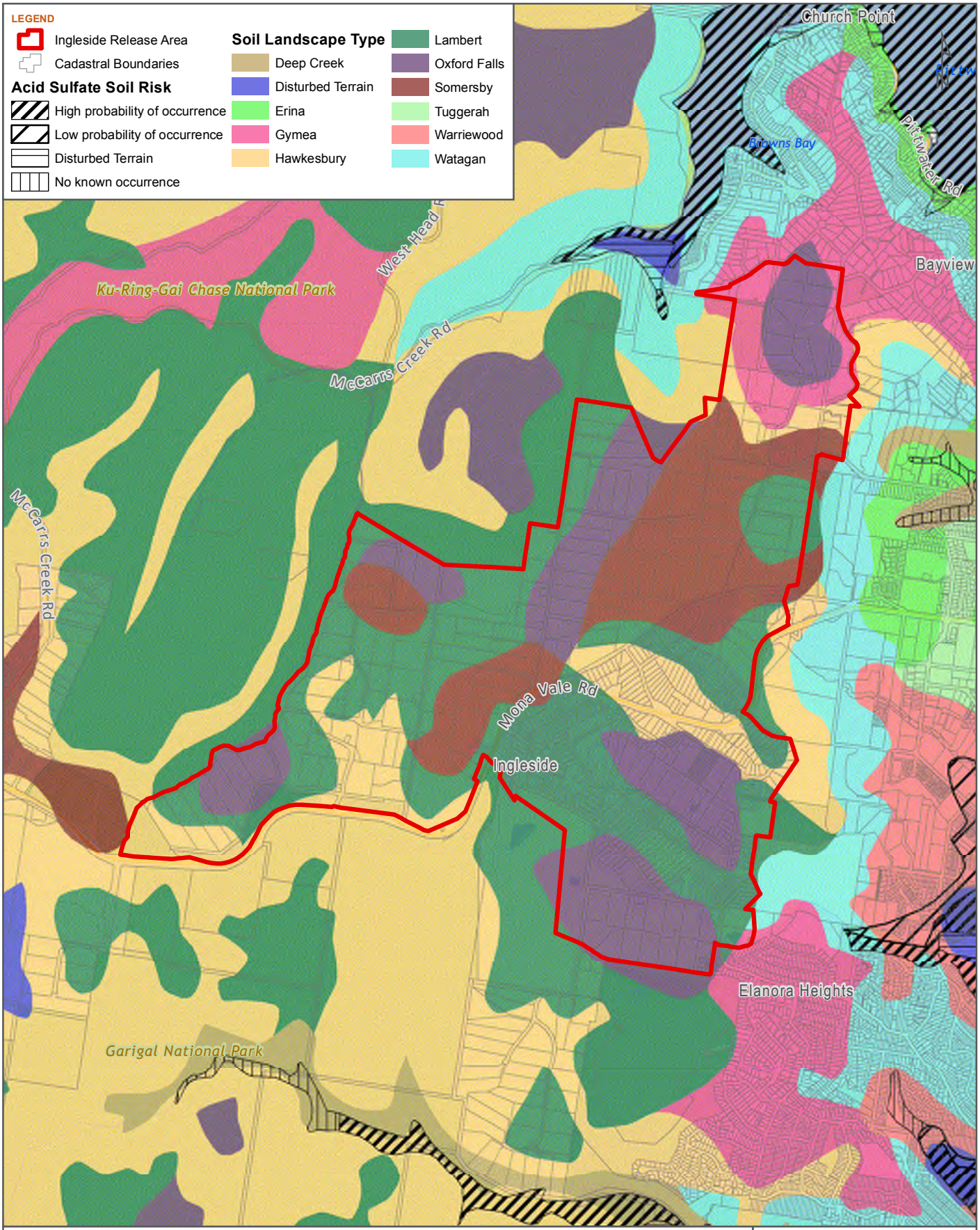
Last updated by: RC10721 on 5/08/2014 at 15:01



DATE 04/08/2014

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 3

FIGURE TITLE Soil Landscapes/Acid Sulfate Soil

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

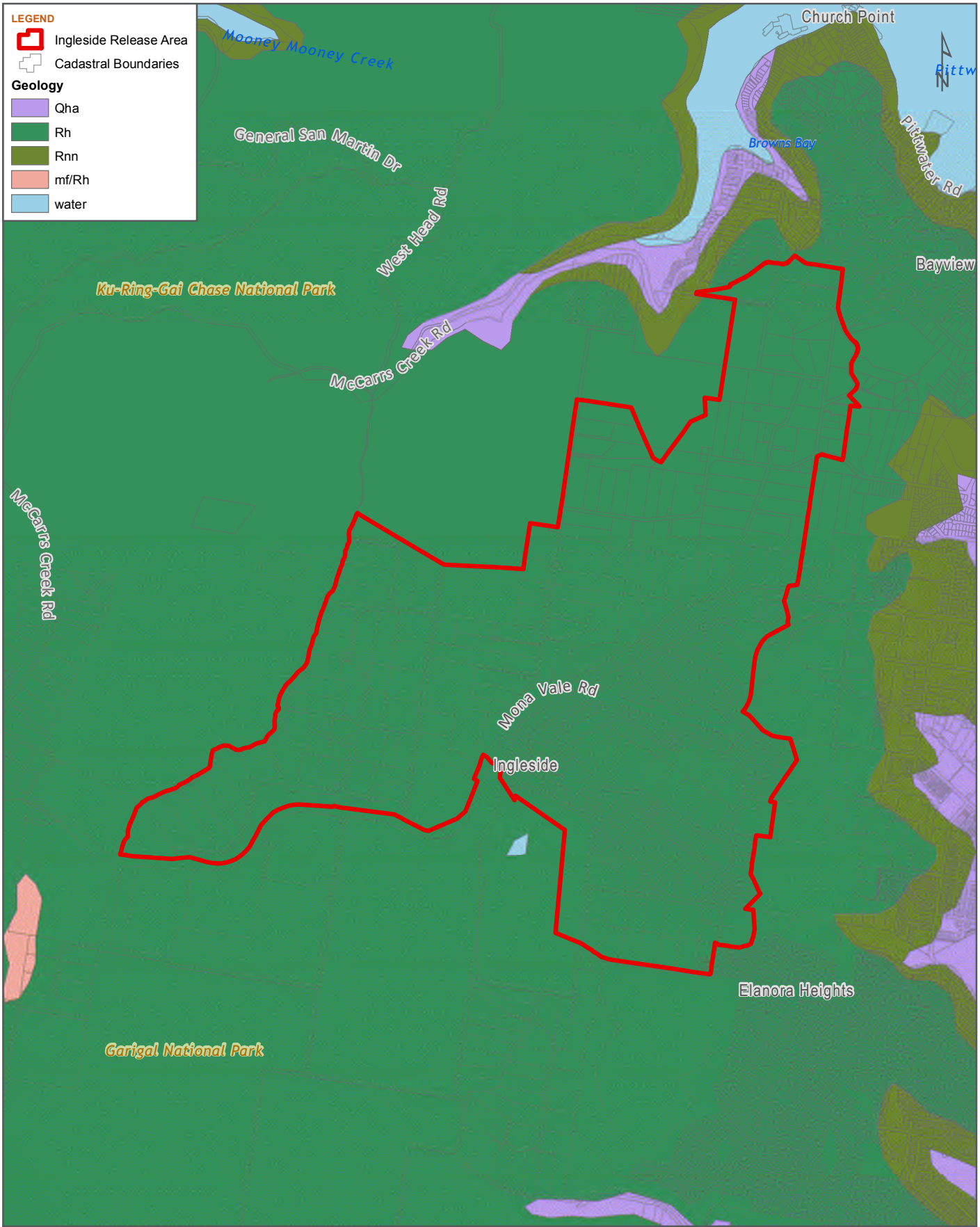
CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\3_Soil Landscapes_Acid Sulfate Soil.mxd

Last updated by: RC10721 on 4/08/2014 at 12:32



DATE 04/08/2014

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Metres
1:30,000

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 4

FIGURE TITLE Geology

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC

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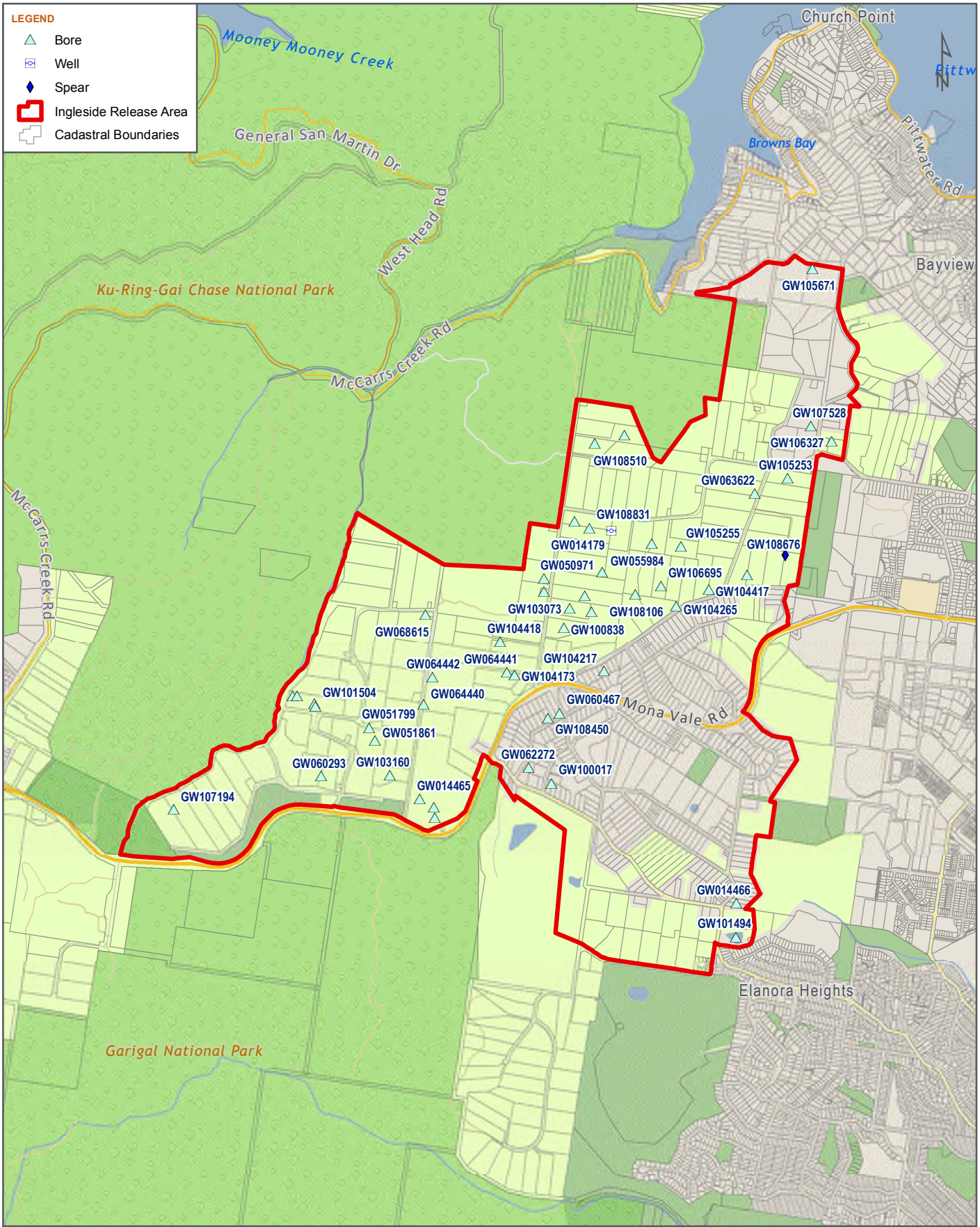

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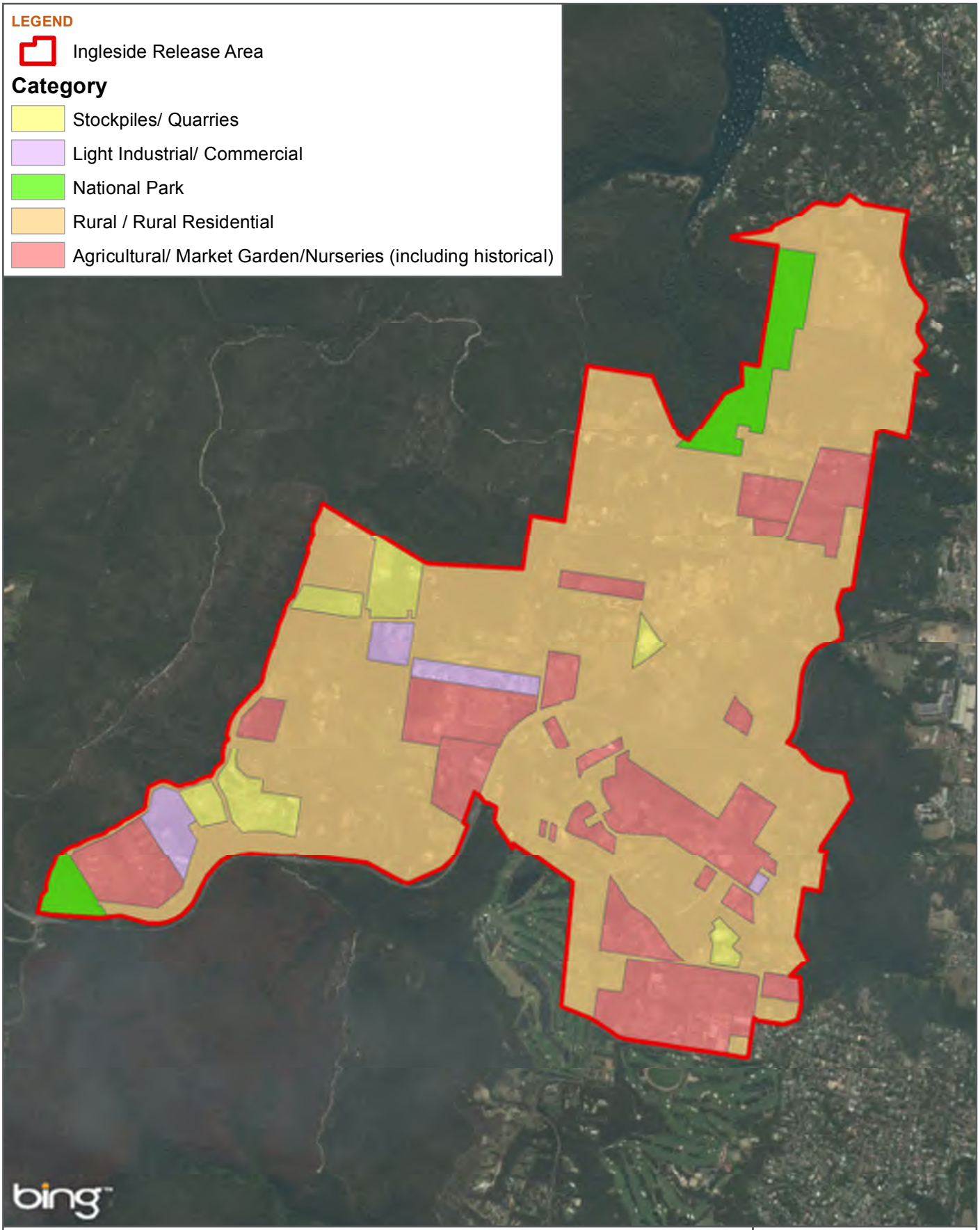
FIG NO. 5	**FIGURE TITLE** Groundwater bores		
PROJECT NO. 30012289	**PROJECT TITLE** Ingleside Precinct		
CREATED BY R. Chatfield	**SOURCES** Vector backdrop data © MDS 2013		



DATE 21/10/2014

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Metres
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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 7

FIGURE TITLE Areas of Environmental Concern (AEC)

PROPOSAL NO.

PROPOSAL TITLE Ingleside Land Capability Assessment

CREATED BY T. Rajkumar

SOURCES Vector backdrop data © MDS 2013
Bing Maps Aerial: © 2014 DigitalGlobe © 2014 GeoEye Earthstar Geographics SIO © 2014 Microsoft Corporation

SMEC

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\8_AEC.mxd

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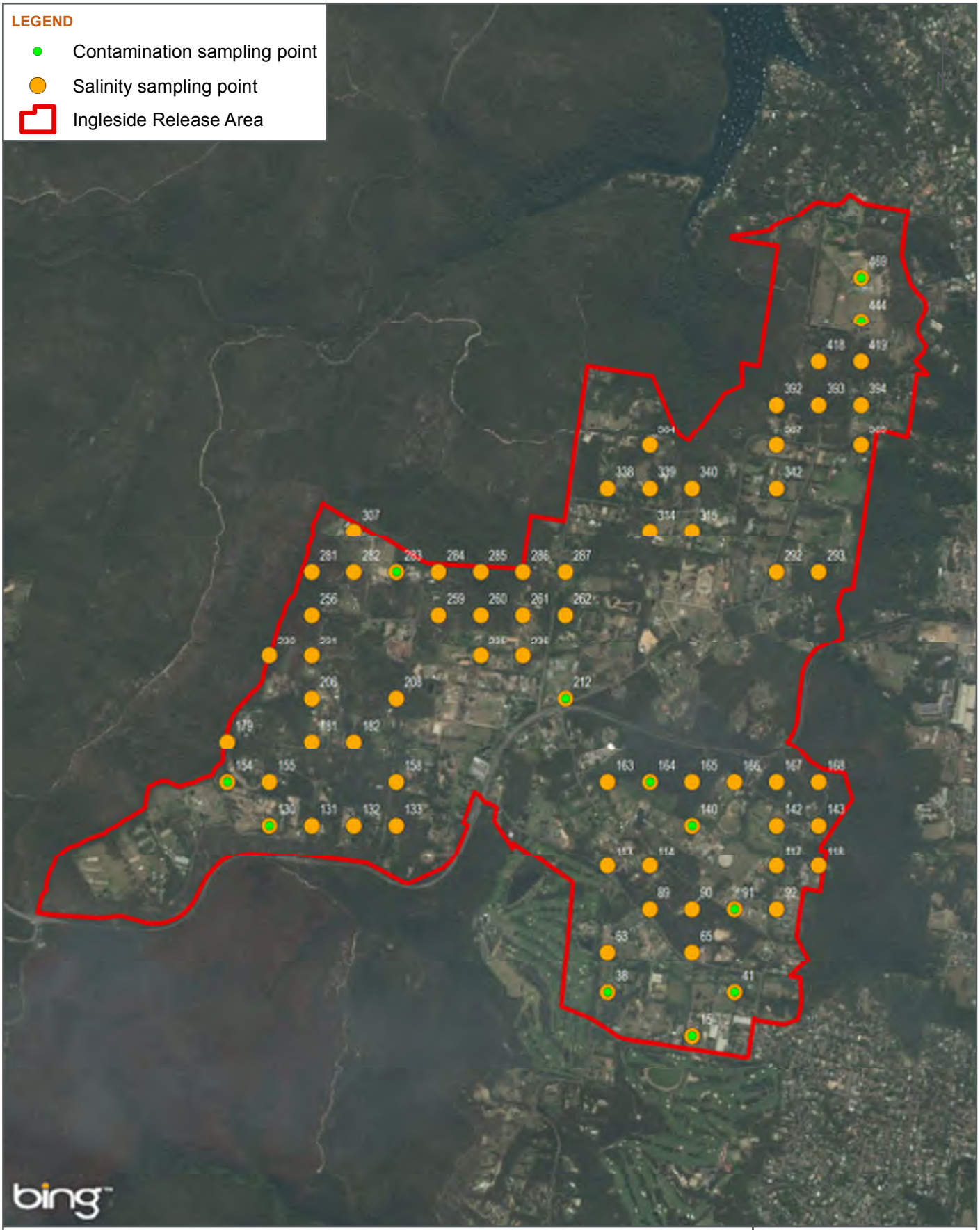

DATE 20/10/2014

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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 8

FIGURE TITLE Sample location plan

PROPOSAL NO.

PROPOSAL TITLE Ingleside Land Capability Assessment

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013
© 2014 DigitalGlobe © 2014 GeoEye Earthstar Geographics SIO © 2014 Microsoft Corporation

SMEC

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\9_Samples.mxd

Last updated by: RC10721 on 20/10/2014 at 14:05

APPENDIX B – GROUNDWATER DATABASE SEARCH

NSW OFFICE OF WATER
Work Summary

GW014179

Converted From HYDSYS

Licence : 10BL007801
Licence Status Active

Work Type : Well
Work Status : Supply Obtained
Construct. Method : (Unknown)
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	GENERAL USE
FARMING	

Commenced Date :
Completion Date : 01-Jan-1959
Final Depth : 5.30 m
Drilled Depth : 5.30 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : 603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	202
	Licensed : CUMBERLAND	NARRABEEN	202

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6272942
Easting : 339549
Latitude (S) : 33° 40' 17"
Longitude (E) : 151° 16' 9"

GS Map : 0055B3
MGA Zone : 56
Coordinate Source : GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Brick	0.00	0.20	1346			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.22	0.22	Loam Sandy	Loam	
0.22	5.33	5.11	Sandstone	Sandstone	

Remarks

***** End of GW014179 *****

NSW OFFICE OF WATER
Work Summary

GW014464

Converted From HYDSYS

Licence :10BL009510

Licence Status Cancelled

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	**Intended Purpose(s)**
DOMESTIC	IRRIGATION
ORCHARDS (GROUNDWATER)	

Commenced Date : **Final Depth :** 33.50 m
Completion Date :01-Aug-1960 **Drilled Depth :** 33.50 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	**County**	**Parish**	**Portion/Lot DP**
	Form A :CUMBERLAND	NARRABEEN	69
	Licensed :CUMBERLAND	NARRABEEN	7 25951

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6271365 **Latitude (S) :**33° 41' 7"
Easting :338534 **Longitude (E) :**151° 15' 29"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	-0.10	12.00	152			(Unknown)
1	1	Opening	Perforations	0.00		152		1	Mechanically Slotted; SL: 0mm; A: 0mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
6.00	6.00	0.00	Unconsolidated	3.00		0.03			(Unknown)
30.40	30.40	0.00	Consolidated	3.00		0.10			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	12.19	12.19	Soil Clay Water Supply	Soil	
12.19	33.52	21.33	Sandstone Water Supply	Sandstone	

Remarks

MONA VALE RD INGLESIDE

***** End of GW014464 *****

NSW OFFICE OF WATER
Work Summary

GW014465

Converted From HYDSYS

Licence : 10BL011016
Licence Status Active

Work Type : Bore open thru rock
Work Status : (Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	GENERAL USE
FARMING	

Commenced Date :
Completion Date : 01-Nov-1960
Final Depth : 39.00 m
Drilled Depth : 39.00 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : 603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	69
	Licensed : CUMBERLAND	NARRABEEN	C 25951

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6271412
Easting : 338454

Latitude (S) : 33° 41' 6"
Longitude (E) : 151° 15' 26"

GS Map : 0055B3
MGA Zone : 56
Coordinate Source : GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Asbestos Cement	0.00	0.90	152			Cemented

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	30.48	30.48	Sandstone	Sandstone	
30.48	39.01	8.53	Mudstone	Mudstone	

Remarks

LOT 7 MONA VALE RD INGLESIDE

***** End of GW014465 *****

NSW OFFICE OF WATER
Work Summary

GW014466

Converted From HYDSYS

Licence : 10BL010502
Licence Status Active
Authorised Purpose(s) DOMESTIC
Intended Purpose(s) DOMESTIC

Work Type : Bore open thru rock
Work Status : (Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Commenced Date :
Completion Date : 01-May-1960
Final Depth : 35.30 m
Drilled Depth : 35.40 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - GREEN ACRES
GWMA : 603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	63
	Licensed : CUMBERLAND	NARRABEEN	PT 63

Region : 10 - SYDNEY SOUTH COAST
River Basin : 213 - SYDNEY COAST - GEORGES RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6270818
Easting : 340259
Latitude (S) : 33° 41' 26"
Longitude (E) : 151° 16' 36"

GS Map : 0055B3
MGA Zone : 56
Coordinate Source : GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Asbestos Cement	0.00	1.50	152			Cemented

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
21.30	21.30	0.00	Consolidated	16.40		0.01			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.21	1.21	Soil	Soil	
1.21	35.35	34.14	Sandstone Water Supply	Sandstone	

Remarks

INGLESIDE RD NTH NARRABEEN

***** End of GW014466 *****

NSW OFFICE OF WATER
Work Summary

GW047779

Converted From HYDSYS

Licence :10BL110873

Licence Status Active

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Rotary Air
Owner Type : Private

Authorised Purpose(s)	**Intended Purpose(s)**
DOMESTIC	IRRIGATION
INDUSTRIAL	

Commenced Date : **Final Depth :** 67.00 m
Completion Date :01-Oct-1979 **Drilled Depth :** 67.00 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 0-500 ppm
Yield :

Site Details

Site Chosen By	**County**	**Parish**	**Portion/Lot DP**
	Form A :CUMBERLAND	NARRABEEN	169
	Licensed :CUMBERLAND	NARRABEEN	169 752046

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :
Grid Zone : **Scale :**

Elevation :
Elevation Source :(Unknown)

Northing :6271958 **Latitude (S) :**33° 40' 48"
Easting :337854 **Longitude (E) :**151° 15' 3"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing P.V.C.	0.00	18.00	150			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
33.60	35.00	1.40	Consolidated	16.50		2.00			0-500 ppm

Drillers Log

From (m)	To (m)	Thickness(m	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	Soil	Soil	
1.00	9.00	8.00	Clay Soft Shale	Clay	
1.00	9.00	8.00	Sandstone	Sandstone	
9.00	33.60	24.60	Sandstone	Sandstone	
33.60	35.00	1.40	Water Supply	(Unknown)	
35.00	67.00	32.00	Sandstone	Sandstone	

Remarks

***** End of GW047779 *****

NSW OFFICE OF WATER
Work Summary

GW050971

Converted From HYDSYS

Licence : 10BL109711

Licence Status Active

Work Type : Bore open thru rock
Work Status : Supply Obtained
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	DOMESTIC

Commenced Date :
Completion Date : 01-Apr-1979
Final Depth : 17.00 m
Drilled Depth : 17.00 m

Contractor Name :
Driller : 1435 ISELT, John Hans
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	L8 DP30325 (87)
	Licensed : CUMBERLAND	NARRABEEN	8 30325

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6272670 **Latitude (S) :** 33° 40' 25"
Easting : 339162 **Longitude (E) :** 151° 15' 54"

GS Map : 0055B3 **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Welded Steel	-0.20	1.40	165			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
10.90	11.00	0.10	Consolidated	5.80		0.06			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.40	0.40	Topsoil Sandy	Topsoil	
0.40	0.80	0.40	Clay Shale	Clay	
0.80	10.90	10.10	Sandstone Yellow	Sandstone	
0.80	10.90	10.10	Ironstone Bands	Ironstone	
10.90	11.00	0.10	Sandstone Yellow Open Water Supply	Sandstone	
11.00	13.60	2.60	Sandstone Yellow	Sandstone	
13.60	17.00	3.40	Sandstone Grey	Sandstone	

Remarks

***** End of GW050971 *****

NSW OFFICE OF WATER
Work Summary

GW051799

Converted From HYDSYS

Licence :10BL113896 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	NOT KNOWN
Work Status : Supply Obtained		
Construct. Method : Cable Tool		
Owner Type : Private		

Commenced Date : **Final Depth :** 27.50 m
Completion Date :01-Jan-1981 **Drilled Depth :** 27.50 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** 0-500 ppm
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :CUMBERLAND	NARRABEEN	179
	Licensed :CUMBERLAND	NARRABEEN	179

Region :10 - SYDNEY SOUTH COAST **CMA Map :**9130-1S MONA VALE
River Basin :212 - HAWKESBURY RIVER **Grid Zone :**56/1 **Scale :**1:25,000
Area / District :

Elevation : **Northing :**6271820 **Latitude (S) :**33° 40' 52"
Elevation Source :(Unknown) **Easting :**338166 **Longitude (E) :**151° 15' 15"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Welded Steel	0.30	3.00	162			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.00	9.50	0.50	Consolidated						(Unknown)
11.00	11.50	0.50	Unconsolidated						(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	9.00	9.00	Sandstone Multicoloured	Sandstone	
9.00	11.00	2.00	Sandstone Water Bearing	Sandstone	
11.00	27.50	16.50	Sand Silty Water Bearing	Sand	

Remarks

***** End of GW051799 *****

NSW OFFICE OF WATER
Work Summary

GW051861

Converted From HYDSYS

Licence : 10BL113891
Licence Status Active
Authorised Purpose(s) DOMESTIC
Intended Purpose(s) DOMESTIC

Work Type : Bore
Work Status : Supply Obtained
Construct. Method : Cable Tool
Owner Type : Private

Commenced Date :
Completion Date : 01-Jan-1981
Final Depth : 42.00 m
Drilled Depth : 42.00 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	L52 (179)
	Licensed : CUMBERLAND	NARRABEEN	L52 (179)

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6271745
Easting : 338199
Latitude (S) : 33° 40' 55"
Longitude (E) : 151° 15' 16"

GS Map : 0055B3
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	0.30	1.00	152			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.00	19.00	1.00	Unconsolidated	9.40					(Unknown)
38.00	39.00	1.00	Unconsolidated	27.50					(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	18.00	18.00	Sandstone Coloured	Sandstone	
18.00	38.00	20.00	Sand Silty Water Bearing	Sand	
38.00	40.00	2.00	Sand Water Bearing	Sand	
40.00	42.00	2.00	Sand Silty	Sand	

Remarks

***** End of GW051861 *****

NSW OFFICE OF WATER
Work Summary

GW055934

Converted From HYDSYS

Licence :10BL121705 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock	DOMESTIC	DOMESTIC

Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Commenced Date : **Final Depth :** 60.00 m
Completion Date :01-Dec-1981 **Drilled Depth :** 60.00 m

Contractor Name :
Driller :1441 BARRETT, Roy Max
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** Good
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :CUMBERLAND	NARRABEEN	L16 (87)
	Licensed :CUMBERLAND	NARRABEEN	L16 (P+ Port 87)

Region :10 - SYDNEY SOUTH COAST **CMA Map :**9130-1S MONA VALE
River Basin :213 - SYDNEY COAST - GEORGES RIVER **Grid Zone :**56/1 **Scale :**1:25,000
Area / District :

Elevation : **Northing :**6272692 **Latitude (S) :**33° 40' 25"
Elevation Source :(Unknown) **Easting :**340320 **Longitude (E) :**151° 16' 39"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	0.00	3.00	200			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
15.00	60.00	45.00	Consolidated	6.00		0.18			Good

Drillers Log

From (m)	To (m)	Thickness(m	Drillers Description	Geological Material	Comments
0.00	34.00	34.00	Sandstone Water Supply	Sandstone	
0.00	34.00	34.00	Clay Seams Water Supply	Clay	
34.00	60.00	26.00	Sandstone White Water Supply	Sandstone	

Remarks

***** End of GW055934 *****

NSW OFFICE OF WATER
Work Summary

GW055984

Converted From HYDSYS

Licence :10BL121849

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status :(Unknown)	STOCK	STOCK
Construct. Method : Cable Tool		
Owner Type : Private		

Commenced Date : **Final Depth :** 53.00 m
Completion Date :01-Dec-1981 **Drilled Depth :** 53.00 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :CUMBERLAND	NARRABEEN	203
	Licensed :CUMBERLAND	NARRABEEN	203

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6272867 **Latitude (S) :**33° 40' 19"
Easting :339776 **Longitude (E) :**151° 16' 18"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing (Unknown)	-0.30	1.70	152			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.00	19.00	1.00	(Unknown)						(Unknown)
26.00	27.00	1.00	(Unknown)						(Unknown)
48.00	49.00	1.00	(Unknown)						(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	16.00	16.00	Sandstone	Sandstone	
16.00	18.00	2.00	Ironstone	Ironstone	
18.00	28.00	10.00	Sandstone Shaley Water Bearing	Sandstone	
28.00	30.00	2.00	Ironstone	Ironstone	
30.00	44.00	14.00	Sand Silty	Sand	
44.00	45.00	1.00	Ironstone	Ironstone	
45.00	53.00	8.00	Sand Silty Water Bearing	Sand	

Remarks

***** End of GW055984 *****

NSW OFFICE OF WATER
Work Summary

GW057745

Converted From HYDSYS

Licence :10BL123454

Licence Status Lapsed

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)
DOMESTIC
IRRIGATION
STOCK

Intended Purpose(s)
IRRIGATION

Commenced Date :
Completion Date :01-Sep-1982

Final Depth : 150.00 m
Drilled Depth : 150.00 m

Contractor Name :
Driller :1435 ISELT, John Hans
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 0-500 ppm
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	CUMBERLAND	NARRABEEN	L10 DP25951 (69)
Licensed :	CUMBERLAND	NARRABEEN	10 25951

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6271306 **Latitude (S) :**33° 41' 9"
Easting :338540 **Longitude (E) :**151° 15' 29"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Galvinised Steel	-0.30	6.20	168			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	6.20	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
24.80	25.00	0.20	Consolidated	25.00		0.03			Fresh
145.10	146.00	0.90	Consolidated	32.00		0.27			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.60	0.60	Topsoil	Topsoil	
0.60	0.90	0.30	Gravel Sandy	Gravel	
0.90	12.10	11.20	Sandstone Yellow Silty	Sandstone	
12.10	13.90	1.80	Sandstone Silty	Sandstone	
13.90	24.80	10.90	Sandstone Yellow Silty	Sandstone	
24.80	25.00	0.20	Sandstone Yellow Silty Open	Sandstone	
25.00	37.10	12.10	Sandstone Red Silty	Sandstone	
37.10	49.00	11.90	Sandstone Yellow Silty	Sandstone	
49.00	52.20	3.20	Sandstone Grey	Sandstone	
52.20	135.30	83.10	Sandstone Yellow	Sandstone	
135.30	138.50	3.20	Clay Sandy	Clay	
138.50	145.10	6.60	Sandstone Yellow	Sandstone	
145.10	146.00	0.90	Sandstone Yellow Open Water Supply	Sandstone	
146.00	150.00	4.00	Sandstone	Sandstone	

Remarks

***** End of GW057745 *****

NSW OFFICE OF WATER
Work Summary

GW059821

Converted From HYDSYS

Licence : 10BL151475

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock	DOMESTIC	DOMESTIC
Work Status : (Unknown)	STOCK	STOCK
Construct. Method : Rotary		
Owner Type : Private		

Commenced Date : 01-Feb-1993 **Final Depth :** 116.00 m
Completion Date : 03-Feb-1993 **Drilled Depth :** 116.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - SMITH
GWMA : -
GW Zone : -

Standing Water Level : 14.50 m
Salinity : 140.00 mg/L Fresh
Yield : 1.30 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	169
	Licensed : CUMBERLAND	NARRABEEN	169 752046

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-4S HORNSBY
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6272001 **Latitude (S) :** 33° 40' 46"
Easting : 337729 **Longitude (E) :** 151° 14' 58"

GS Map : 0055A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	42.00	116.00	152			Down Hole Hammer
1	1	Casing	PVC Class 9	-0.50	4.70	160			
1	1	Casing	Pressure Cemented Casing	0.00	4.70	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
83.00	107.50	24.50		14.50		1.30	116.00		140.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
42.00	60.00	18.00	SANDSTONE/GREY F.G.		
60.00	61.00	1.00	SANDSTONE/BED SHALE		
61.00	61.20	0.20	FRACTURED		
61.20	68.00	6.80	SANDSTONE GREY F.G.		
68.00	83.00	15.00	SANDSTONE GREY SMALL FRACT./BED SHALES		
83.00	107.00	24.00	SANDSTONE COURSE OPEN GRAIN W.B.		
107.00	107.50	0.50	FRACTURED W.D.		
107.50	116.00	8.50	SANDSTONE COURSE OPEN GRAIN W.B.		

Remarks

Previous Lic No: 10BL131472 due to alteration work.

***** End of GW059821 *****

NSW OFFICE OF WATER
Work Summary

GW060293

Converted From HYDSYS

Licence :10BL127611 **Licence Status** Cancelled

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock	IRRIGATION	IRRIGATION

Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Commenced Date : **Final Depth :** 34.00 m
Completion Date :01-Sep-1986 **Drilled Depth :** 34.00 m

Contractor Name :
Driller :1435 ISELT, John Hans
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** Fresh
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :CUMBERLAND	NARRABEEN	L2 DP52208 (139)
	Licensed :CUMBERLAND	NARRABEEN	LT11 DP52208 PT139

Region :10 - SYDNEY SOUTH COAST **CMA Map :**9130-4S HORNSBY
River Basin :212 - HAWKESBURY RIVER **Grid Zone :**56/1 **Scale :**1:25,000
Area / District :

Elevation : **Northing :**6271542 **Latitude (S) :**33° 41' 1"
Elevation Source :(Unknown) **Easting :**337892 **Longitude (E) :**151° 15' 4"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Welded Steel	-0.20	4.40	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
29.20	30.30	1.10	Consolidated	18.00		1.10			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.40	1.40	Soil Sandy	Soil	
1.40	3.60	2.20	Sandstone Yellow	Sandstone	
1.40	3.60	2.20	Clay Layer	Clay	
3.60	29.20	25.60	Sandstone Grey	Sandstone	
29.20	30.30	1.10	Sandstone Grey Coarse Water Supply	Sandstone	
30.30	34.00	3.70	Sandstone Grey	Sandstone	

Remarks

***** End of GW060293 *****

NSW OFFICE OF WATER
Work Summary

GW060467

Converted From HYDSYS

Licence :10BL122807

Licence Status Active

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method :(Unknown)
Owner Type : Private

Authorised Purpose(s)
DOMESTIC
IRRIGATION
STOCK

Intended Purpose(s)
IRRIGATION

Commenced Date :
Completion Date :01-Jan-1982

Final Depth : 130.10 m
Drilled Depth : 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	CUMBERLAND	NARRABEEN	L14 DP12115 (81)
Licensed :	CUMBERLAND	NARRABEEN	15 12115

Region :10 - SYDNEY SOUTH COAST
River Basin :213 - SYDNEY COAST - GEORGES RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6271903 **Latitude (S) :**33° 40' 50"
Easting :339251 **Longitude (E) :**151° 15' 57"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Asbestos Cement	0.00	9.10	152			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW060467 *****

NSW OFFICE OF WATER
Work Summary

GW061466

Converted From HYDSYS

Licence :10BL133892 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC

Work Status :(Unknown)
Construct. Method :(Unknown)
Owner Type : Private

Commenced Date : **Final Depth :** 76.20 m
Completion Date :01-Jan-1983 **Drilled Depth :** 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** (Unknown)
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :CUMBERLAND	NARRABEEN	61
	Licensed :CUMBERLAND	NARRABEEN	3

Region :10 - SYDNEY SOUTH COAST **CMA Map :**9130-1S MONA VALE
River Basin :212 - HAWKESBURY RIVER **Grid Zone :**56/1 **Scale :**1:25,000
Area / District :

Elevation : **Northing :**6272709 **Latitude (S) :**33° 40' 24"
Elevation Source :(Unknown) **Easting :**339495 **Longitude (E) :**151° 16' 7"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	0.00	152			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW061466 *****

NSW OFFICE OF WATER
Work Summary

GW062272

Converted From HYDSYS

Licence :10BL143759

Licence Status Active

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method :(Unknown)
Owner Type : Private

Authorised Purpose(s)	**Intended Purpose(s)**
DOMESTIC	IRRIGATION
STOCK	

Commenced Date :
Completion Date :

Final Depth : 114.00 m
Drilled Depth : 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	**County**	**Parish**	**Portion/Lot DP**
	Form A :CUMBERLAND	NARRABEEN	81
	Licensed :CUMBERLAND	NARRABEEN	PT81

Region :10 - SYDNEY SOUTH COAST
River Basin :213 - SYDNEY COAST - GEORGES RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6271592 **Latitude (S) :**33° 41' 0"
Easting :339076 **Longitude (E) :**151° 15' 50"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing (Unknown)	0.00	0.00	150			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW062272 *****

NSW OFFICE OF WATER
Work Summary

GW063622

Converted From HYDSYS

Licence :10BL135164
Licence Status Active
Authorised Purpose(s) DOMESTIC
Intended Purpose(s) DOMESTIC
Work Type : Bore
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Commenced Date :
Completion Date :01-Sep-1986
Final Depth : 46.00 m
Drilled Depth : 46.00 m

Contractor Name :
Driller :1435 ISELT, John Hans
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -
Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	CUMBERLAND	NARRABEEN	L2 DP30325 (87)
Licensed :	CUMBERLAND	NARRABEEN	2 30325

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :
CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)
Northing :6273154 **Latitude (S) :**33° 40' 10"
Easting :340363 **Longitude (E) :**151° 16' 41"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Steel	-0.30	6.20	168			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	6.20	168			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.30	22.60	0.30	Consolidated	20.00		0.10			Fresh
37.20	37.80	0.60	Consolidated	9.00		0.30			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.80	0.80	Soil Sandy	Soil	
0.80	1.60	0.80	Clay Sandy Gravel	Clay	
1.60	2.90	1.30	Shale	Shale	
2.90	46.00	43.10	Sandstone Yellow	Sandstone	

Remarks

***** End of GW063622 *****

NSW OFFICE OF WATER
Work Summary

GW064440

Converted From HYDSYS

Licence :10BL138571

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status :(Unknown)	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type : Private		

Commenced Date : **Final Depth :** 150.00 m
Completion Date :01-Nov-1988 **Drilled Depth :** 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :CUMBERLAND	NARRABEEN	L1 DP213794 (83)
	Licensed :CUMBERLAND	NARRABEEN	LT1 DP213794

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6271952 **Latitude (S) :**33° 40' 48"
Easting :338477 **Longitude (E) :**151° 15' 27"

GS Map :0055B3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Steel	0.00	33.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
84.00	90.00	6.00	Consolidated			0.20			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

PUMP TEST DATA SUSPECT

***** End of GW064440 *****

NSW OFFICE OF WATER
Work Summary

GW064441

Licence : 10BL160105
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	INDUSTRIAL	INDUSTRIAL
Work Status : Supply Obtained	RECREATION (GROUNDWATER)	RECREATION (GROUNDWATER)
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : 23-Aug-1990 **Final Depth :** 150.00 m
Completion Date : 18-Sep-1990 **Drilled Depth :** 150.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1466 FERGUSON, Gary
Assistant Driller's Name :

Property : - HAMAZKAINE **Standing Water Level :** 31.90 m
GWMA : - **Salinity :** Good
GW Zone : - **Yield :** 1.25 L/s Cumulative

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	1//808703
	Licensed : CUMBERLAND	NARRABEEN	1 808703

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272134 **Latitude (S) :** 33° 40' 43"
Elevation Source : **Easting :** 338950 **Longitude (E) :** 151° 15' 46"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole Hole	0.00	150.00	152			Down Hole Hammer
1	1	Casing Steel	-0.50	6.50	168.3	158.7		C: .5-6.5m; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
84.00	86.00	2.00				0.02	86.00		
120.00	150.00	30.00				1.23	150.00		

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	6.00	6.00	SANDSTONE	Sandstone	
6.00	9.00	3.00	SANDSTONE /FINE CLAY	Sandstone	
9.00	21.00	12.00	BROWN SANDSTONE,SILT AND CLAY	Sandstone	
21.00	24.00	3.00	BLACK SANDSTONE,SILT AND CLAY	Sandstone	
24.00	48.00	24.00	RED SANDSTONE,IRON AND CLAY	Sandstone	
48.00	87.00	39.00	PINK SANDSTONE, SILT AND CLAY	Sandstone	
87.00	96.00	9.00	RED SANDSTONE,IRON AND CLAY	Sandstone	
96.00	99.00	3.00	DARK GREY SHALE AND CLAY	Shale	
99.00	117.00	18.00	PALE PINK SANDSTONE AND CLAY	Sandstone	
117.00	150.00	33.00	WHITE SANDSTONE AND CLAY	Sandstone	

Remarks

PREVIOUS LIC NO: 10BL141627

***** End of GW064441 *****

NSW OFFICE OF WATER
Work Summary

GW064442

Converted From HYDSYS

Licence : 10BL160104
Licence Status Active

Work Type : Bore
Work Status : Supply Obtained
Construct. Method : Rotary Air
Owner Type : Private

	Authorised Purpose(s)	Intended Purpose(s)
	INDUSTRIAL	INDUSTRIAL
	RECREATION (GROUNDWATER)	RECREATION (GROUNDWATER)

Commenced Date :
Completion Date : 01-Nov-1988
Final Depth : 115.00 m
Drilled Depth : 115.00 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - HAMAZKAINE
GWMA : -
GW Zone : -

Standing Water Level : 45.00 m
Salinity : Good
Yield : 0.30 L/s

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	CUMBERLAND	NARRABEEN	LT 1 DP 808703
Licensed :	CUMBERLAND	NARRABEEN	1 808703

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6272107
Easting : 338526
Latitude (S) : 33° 40' 43"
Longitude (E) : 151° 15' 29"

GS Map : 0055B3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing P.V.C.	0.00	13.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
90.00	115.00	25.00	(Unknown)	45.00		0.30			Good

Drillers Log

From (m)	To (m)	Thickness(m	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	Gravel	Gravel	
3.00	100.00	97.00	Sandstone Water Supply	Sandstone	
100.00	115.00	15.00	Shale Water Supply	Shale	

Remarks

PREVIOUS LIC NO: 10BL138709

***** End of GW064442 *****

NSW OFFICE OF WATER
Work Summary

GW068615

Licence : 10BL141903
Licence Status Active
Authorised Purpose(s) DOMESTIC
Intended Purpose(s)

Work Type : Bore
Work Status : (Unknown)
Construct. Method : Rotary
Owner Type :

Commenced Date : 10-Feb-1981 **Final Depth :** 125.00 m
Completion Date : 17-Feb-1981 **Drilled Depth :** 125.00 m

Contractor Name : SLADE DRILLING
Driller : SLADE, W.E.
Assistant Driller's Name :

Property : - WILLCOCKS
GWMA : -
GW Zone : -

Standing Water Level : 15.50 m
Salinity :
Yield : 0.45 L/s

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	CUMBERLAND	NARRABEEN	174//752046
Licensed :	CUMBERLAND	NARRABEEN	174 752046

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing : 6272464
Easting : 338486
Latitude (S) : 33° 40' 32"
Longitude (E) : 151° 15' 28"

GS Map :
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	125.00	155			Rotary
1	1	Casing	P.V.C.	0.00	12.00	155			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
5.00	6.00	1.00				0.06	9.00		
91.00	93.00	2.00				0.16	94.00		
99.00	100.00	1.00		0.00		0.08	101.00		
114.00	116.00	2.00		15.50		0.15	125.00		

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	SOIL		
2.00	27.00	25.00	SOFT MUDSTONE AND SHALE		
27.00	107.00	80.00	HARD SANDSTONE		
107.00	109.00	2.00	SHALE		
109.00	125.00	16.00	SANDSTONE		

Remarks

***** End of GW068615 *****

NSW OFFICE OF WATER
Work Summary

GW100017

Licence : 10BL153221
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	IRRIGATION	IRRIGATION
Construct. Method : Other	STOCK	STOCK
Owner Type :		

Commenced Date : **Final Depth :** 151.00 m
Completion Date : 23-Oct-1993 **Drilled Depth :** 151.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - SANTA MULE
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 200.00 mg/L
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARELLAN	38 12115
	Licensed : CUMBERLAND	NARRABEEN	38 12115

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing : 6271502
Easting : 339206
Latitude (S) : 33° 41' 3"
Longitude (E) : 151° 15' 55"

GS Map :
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	6.00	203			Rotary Air
1		Hole	Hole	6.00	151.00	156			Rotary Air
1	1	Casing	Steel	-0.50	6.50				C: 0-6m; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
12.50	13.00	0.50					6.00		150.00
60.00	80.00	20.00				0.25	6.00		200.00
99.00	104.00	5.00				0.05	6.00		200.00
139.00	150.00	11.00		62.00		0.10	6.00		

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	OVERBURDEN & FILLING		
2.00	3.50	1.50	ORANGE MED. GRAIN S.S.		
3.50	3.80	0.30	WHITE CLAY BAND		
3.80	5.00	1.20	ORANGE & WHITE MED. GRAIN S.S.		
5.00	41.00	36.00	WHITE S.S. & BED CLAY		
41.00	41.20	0.20	SMALL CAVITY		
41.20	50.00	8.80	WHITE S.S. & BED SHALE		
50.00	51.00	1.00	WHITE S.S. & BED SHALE		
51.00	51.50	0.50	SHALE BANDS		
51.50	60.00	8.50	WHITE S.S. & BED SHALE		
60.00	80.00	20.00	WHITE OPEN S.S. & WATER BEARING		
80.00	99.00	19.00	WHITE/ORANGE S.S. CLAY IN MATRIX		
99.00	99.20	0.20	SMALL CAVITY		
99.20	104.00	4.80	WHITE S.S. & BED SHALE		
104.00	112.00	8.00	WHITE GREY S.S. MED. GRAIN		
112.00	115.00	3.00	WHITE S.S. & BED SHALE		
115.00	132.00	17.00	WHITE L.G.S.S. WITH SMALL FRACTURED		
132.00	137.00	5.00	WHITE S.S. OPEN WATER BEARING		
137.00	139.00	2.00	WHITE S.S. & BED SHALE		
139.00	151.00	12.00	WHITE S.S. MED. GRAIN		
151.00	151.00	0.00	E.O.H.		

Remarks

***** End of GW100017 *****

NSW OFFICE OF WATER
Work Summary

GW100648

Licence : 10BL157628
Licence Status Active

Authorised Purpose(s)	**Intended Purpose(s)**
DOMESTIC	DOMESTIC
	STOCK

Work Type : Bore
Work Status : (Unknown)
Construct. Method : Rot. Rev. Circ. Air
Owner Type :

Commenced Date :
Completion Date : 13-May-1996
Final Depth : 120.00 m
Drilled Depth : 120.00 m

Contractor Name : J.H. ISELT
Driller : 1435 ISELT, John Hans
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By	**County**	**Parish**	**Portion/Lot DP**
Driller	**Form A :** CUMBERLAND	NARRABEEN	2//595804
	Licensed : CUMBERLAND	NARRABEEN	2 595804

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing : 6273489
Easting : 339622
Latitude (S) : 33° 39' 59"
Longitude (E) : 151° 16' 13"

GS Map :
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type		From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	120.00	150			Rotary
1	1	Casing	P.V.C.	-0.30	3.00	160			C: 0-3m; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
59.50	59.70	0.20		30.00	120.00	0.12	120.00	1.00	Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	Topsoil		
0.30	1.50	1.20	Sandstone Yellow		
1.50	3.50	2.00	Sandstone White		
3.50	59.50	56.00	Sandstone Yellow		
59.50	59.70	0.20	Sandstone Yellow (W.B.)		
59.70	65.00	5.30	Sandstone Yellow		
65.00	120.00	55.00	Shale		

Remarks

***** End of GW100648 *****

NSW OFFICE OF WATER
Work Summary

GW100838

Licence : 10BL157556
Licence Status Active
Authorised Purpose(s) DOMESTIC
Intended Purpose(s) DOMESTIC, STOCK

Work Type : Bore
Work Status : (Unknown)
Construct. Method : Rotary
Owner Type :

Commenced Date :
Completion Date : 27-Mar-1996
Final Depth : 90.50 m
Drilled Depth : 90.50 m

Contractor Name : INTERTECH DRILLING
Driller : 1648 AULD, Richard
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 100.00 mg/L
Yield :

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	13//803203
		Licensed : CUMBERLAND	NARRABEEN	13 803203

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing : 6272390
Easting : 339276
Latitude (S) : 33° 40' 35"
Longitude (E) : 151° 15' 58"

GS Map :
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	1.30	210			Rotary
1		Hole	Hole	1.30	10.80	210			Rotary
1		Hole	Hole	10.80	90.50	158			Rotary
1	1	Casing	Steel	-1.00	11.00	168.3	158.7		C: -.1-10.8m; Welded; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.50	40.50	5.00				0.10	42.50	0.25	80.00
60.30	65.80	5.50				0.40	66.50	0.25	80.00
78.00	78.70	0.70				0.20	78.50	0.25	100.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.80	0.80	SANDY LOAM		
0.80	1.30	0.50	GREY CLAY		
1.30	26.50	25.20	SANDSTONE BROWN/GREY BANDS CLAY MATRIX		
26.50	27.40	0.90	GREY CLAY		
27.40	28.50	1.10	IRON STONE		
28.50	29.50	1.00	SANDSTONE, GREY, QUARTZ MATRIX		
29.50	30.00	0.50	IRONSTONE		
30.00	30.60	0.60	GREY MUDSTONE		
30.60	35.50	4.90	SANDSTONE; LT GREY, CLAY MATRIX		
35.50	40.50	5.00	SANDSTONE, BWN, QUARTZ MAT		
40.50	49.70	9.20	SANDSTONE; LT GREY, CLAY MATRIX		
49.70	51.10	1.40	IRONSTONE		
51.10	59.20	8.10	SANDSTONE; LT. GREY, COARSE GRAIN		
59.20	60.30	1.10	IRONSTONE		
60.30	65.80	5.50	SANDSTONE LT.GREY, PEBBLY QUARTZ MATRIX		
65.80	71.50	5.70	SANDSTONE LT. GREY C.G.		
71.50	71.90	0.40	GREY MUDSTONE		
71.90	78.70	6.80	SANDSTONE, LT. BWN, NARROW QUARTZ BANDS		
78.70	80.90	2.20	IRONSTONE		
80.90	82.30	1.40	SANDSTONE LT GREY, QUARTZ MATRIX		
82.30	86.40	4.10	SANDSTONE; LT GREY C.G.		
86.40	90.50	4.10	BANDED SANDSTONE - IRONSTONE, SOFT & FRACTURED		

Remarks

***** End of GW100838 *****

NSW OFFICE OF WATER
Work Summary

GW101494

Licence : 10BL158124
Licence Status Cancelled
Authorised Purpose(s) RECREATION (GROUNDWATER)
Intended Purpose(s) IRRIGATION
Work Type : Bore
Work Status : (Unknown)
Construct. Method : Rotary
Owner Type :

Commenced Date :
Completion Date : 29-Aug-1997
Final Depth : 140.00 m
Drilled Depth : 140.00 m

Contractor Name : B.B. DRILLING
Driller : 1649 BARRETT, Michael Gerard
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -
Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	2//525908
	Licensed : CUMBERLAND	NARRABEEN	2 525908

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :
CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :
Northing : 6270626
Easting : 340256
Latitude (S) : 33° 41' 32"
Longitude (E) : 151° 16' 35"

GS Map :
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	140.00	150			Percussion
1	1	Casing	Steel	0.00	3.00	150			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
14.90	120.00	105.10		14.90	110.00	0.20	140.00	8.00	Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	60.00	60.00	SANDSTONE, DARK GREY		
60.00	120.00	60.00	SANDSTONE, WHITE		
120.00	140.00	20.00	SHALE, DARK GREY		

Remarks

Form A Remarks:
COMMENT IN COMPLETION DETAILS. "OPEN HOLE"

***** End of GW101494 *****

NSW OFFICE OF WATER
Work Summary

GW101503

Licence : 10BL158708 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	INDUSTRIAL	INDUSTRIAL

Work Status : Supply Obtained
Construct. Method : Cable Tool
Owner Type : Private

Commenced Date : **Final Depth :** 46.00 m
Completion Date : 08-Feb-1984 **Drilled Depth :** 46.00 m

Contractor Name : J.H. ISELT
Driller : 986 ISELT, John Hans
Assistant Driller's Name :

Property : - SMITH **Standing Water Level :** 14.00 m
GWMA : - **Salinity :** Fresh
GW Zone : - **Yield :** 1.25 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	169 752046
	Licensed : CUMBERLAND	NARRABEEN	169 752046

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272001 **Latitude (S) :** 33° 40' 46"
Elevation Source : **Easting :** 337755 **Longitude (E) :** 151° 14' 59"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	46.00	152			Percussion
1	1	Casing	P.V.C.	-0.50	4.70				C: 0-4.7m; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
12.10	12.40	0.30		8.00	16.00	0.19	16.00		Fresh
30.80	31.30	0.50		14.00	17.00	1.25	46.00		Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.10	2.10	SANDY GRAVEL	Gravel	
2.10	8.50	6.40	YELLOW SANDSTONE	Sandstone	
8.50	9.30	0.80	GREY SANDSTONE	Sandstone	
9.30	12.10	2.80	YELLOW SANDSTONE	Sandstone	
12.10	12.40	0.30	GREY SANDSTONE(OPEN AND W.B.)	Sandstone	
12.40	30.30	17.90	GREY SANDSTONE	Sandstone	
30.30	30.80	0.50	SHALE	Shale	
30.80	31.30	0.50	GREY SANDSTONE(COARSE OPEN & W.B.	Sandstone	
31.30	36.40	5.10	GREY SANDSTONE	Sandstone	
36.40	36.70	0.30	SHALE	Shale	
36.70	46.00	9.30	GREY SANDSTONE	Sandstone	

Remarks

Form A Remarks:
13 STAGE GRUNDFOR SUBMERSIBLE 415 VOLT 3 PHASE 1 1/2 INCH DIAMETER DELIVERY PUMP

***** End of GW101503 *****

NSW OFFICE OF WATER
Work Summary

GW101504

Licence : 10BL158707
Licence Status Active
Authorised Purpose(s) INDUSTRIAL
Intended Purpose(s) INDUSTRIAL
Work Type : Bore
Work Status : Supply Obtained
Construct. Method : Rotary
Owner Type : Private

Commenced Date :
Completion Date : 09-Feb-1993
Final Depth : 48.00 m
Drilled Depth : 48.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - SMITH
GWMA : -
GW Zone : -
Standing Water Level :
Salinity : 180.00 mg/L
Yield : 1.60 L/s

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	CUMBERLAND	NARRABEEN	LT 169 DP 752046
Licensed :	CUMBERLAND	NARRABEEN	169 752046

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :
CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :
Northing : 6271942
Easting : 337859
Latitude (S) : 33° 40' 48"
Longitude (E) : 151° 15' 3"

GS Map :
MGA Zone : 56
Coordinate Source : GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	40.00	152			Down Hole Hammer
1	1	Casing	Steel	-0.60	9.60				C: 0-9.6m; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.00	35.30	0.30		24.00		1.60	48.00		180.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	TOPSOIL AND CLAY	Topsoil	
3.00	9.00	6.00	CLAY AND SANDSTONE	Clay	
9.00	24.00	15.00	SANDSTONE,F.G.GREY. SMALL AMT CLAY	Sandstone	
24.00	36.00	12.00	SANDSTONE AND QUARTZ. LOT OF CLAY	Sandstone	
36.00	36.30	0.30	FRACTURE W.B. W.B 1.5 L/PS	Invalid Code	
36.30	48.00	11.70	SANDSTONE AND QURTZ. OPEN GRAIN	Sandstone	

Remarks

***** End of GW101504 *****

NSW OFFICE OF WATER
Work Summary

GW101751

Licence : 10BL158944 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type :		

Commenced Date : **Final Depth :** 132.00 m
Completion Date : 01-Feb-1999 **Drilled Depth :** 132.00 m

Contractor Name : INTERTECH
Driller : 1736 MILGATE, Dean John
Assistant Driller's Name :

Property : - N/A **Standing Water Level :** 36.00 m
GWMA : - **Salinity :** 102.00 mg/L
GW Zone : - **Yield :** 1.80 L/s

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	1//596295
		Licensed : CUMBERLAND	NARRABEEN	1 596295

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272483 **Latitude (S) :** 33° 40' 32"
Elevation Source : **Easting :** 339433 **Longitude (E) :** 151° 16' 5"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	210			Rotary Air
1		Hole	Hole	5.60	132.00	159			Rotary Air
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: 0-5.6m; Driven into Hole
1	1	Casing	PVC Class 9	-0.40	53.60	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Vertical	46.00	49.00	140			PVC Class 9; Sawn; SL: 100mm; A: 4mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
46.00	49.00	3.00				0.10	54.00	0.25	90.00
74.50	75.00	0.50				0.60	78.00	0.25	96.00
112.50	113.00	0.50				0.30	114.00	0.25	109.00
123.00	123.50	0.50				0.80	132.00	0.50	102.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	Fill	Fill	
2.00	6.50	4.50	Grey Sandstone M.G.	Sandstone	
6.50	7.00	0.50	Grey Clay	Clay	
7.00	18.00	11.00	Weathered Sandstone	Sandstone	
18.00	24.00	6.00	Sandstone and Quartz	Sandstone	
24.00	25.00	1.00	Grey Clay	Clay	
25.00	40.00	15.00	Grey Sandstone M.G.	Sandstone	
40.00	40.50	0.50	Grey Clay	Clay	
40.50	45.00	4.50	Grey Sandstone M.G.	Sandstone	
45.00	46.00	1.00	Grey Clay	Clay	
46.00	49.00	3.00	Sandstone and Quartz, Fractured	Sandstone	
49.00	51.00	2.00	Ironstone	Ironstone	
51.00	60.00	9.00	Sandstone and Quartz	Sandstone	
60.00	74.50	14.50	Grey Sandstone M.G.	Sandstone	
74.50	75.00	0.50	Sandstone and Quartz, Fractured	Sandstone	
75.00	90.00	15.00	White Sandstone M.G.	Sandstone	
90.00	92.00	2.00	Ironstone	Ironstone	
92.00	112.50	20.50	White Sandstone M.G.	Sandstone	
112.50	113.00	0.50	Sandstone and Quartz, Fractured	Sandstone	
113.00	123.00	10.00	White Sandstone M.G.	Sandstone	
123.00	123.50	0.50	Sandstone and Quartz, Fractured	Sandstone	
123.50	132.00	8.50	Grey Sandstone M.G.	Sandstone	

Remarks

***** End of GW101751 *****

NSW OFFICE OF WATER
Work Summary

GW103073

Licence : 10BL159597 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type :		

Commenced Date : **Final Depth :** 150.00 m
Completion Date : 29-Mar-2000 **Drilled Depth :** 150.00 m

Contractor Name : INTERTECH
Driller : 1737 READY, Mark Edward
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** 140.00 mg/L
GW Zone : - **Yield :**

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	255//752046
		Licensed : CUMBERLAND	NARRABEEN	232

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272593 **Latitude (S) :** 33° 40' 28"
Elevation Source : **Easting :** 339163 **Longitude (E) :** 151° 15' 54"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	210			Down Hole Hammer
1		Hole	Hole	5.60	150.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: -.1-5.6m; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
81.00	82.00	1.00		43.00		0.50	84.00	1.00	140.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	SANDY LOAM	Loam	
0.50	3.50	3.00	YELLOW SANDSTONE M.G.	Sandstone	
3.50	16.00	12.50	WHITE SANDSTONE M.G.	Sandstone	
16.00	16.20	0.20	IRONSTONE	Ironstone	
16.20	24.00	7.80	YELLOW SANDSTONE WITH IRON	Sandstone	
24.00	30.00	6.00	WHITE SANDSTONE M.G	Sandstone	
30.00	46.00	16.00	LT GREY SANDSTONE M.G.	Sandstone	
46.00	46.50	0.50	IRONSTONE	Ironstone	
46.50	59.00	12.50	YELLOW SANDSTONE M.G.	Sandstone	
59.00	62.00	3.00	WHITE SANDSTONE M.G.	Sandstone	
62.00	73.00	11.00	LT GREY SANDSTONE M.G.	Sandstone	
73.00	73.50	0.50	IRONSTONE	Ironstone	
73.50	82.00	8.50	LT GREY SANDSTONE/QUARTZ BANDS	Sandstone	
82.00	82.30	0.30	IRONSTONE	Ironstone	
82.30	85.00	2.70	PINK TO WHITE SANDSTONE M.G.	Sandstone	
85.00	135.00	50.00	LT GREY SANDSTONE M.G.	Sandstone	
135.00	150.00	15.00	LT TO DARK GREY SANDSTONE M.G.	Sandstone	

Remarks

***** End of GW103073 *****

NSW OFFICE OF WATER
Work Summary

GW103160

Licence : 10BL159765 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type :		

Commenced Date : **Final Depth :** 120.50 m
Completion Date : 03-Aug-2000 **Drilled Depth :** 120.50 m

Contractor Name : INTERTECH
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** 145.00 mg/L
GW Zone : - **Yield :**

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	1831//812302
		Licensed : CUMBERLAND	NARRABEEN	1831 812302

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6271548 **Latitude (S) :** 33° 41' 1"
Elevation Source : **Easting :** 338282 **Longitude (E) :** 151° 15' 19"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	9.00	205			Rotary Air
1		Hole	Hole	9.00	11.50	210			Down Hole Hammer
1		Hole	Hole	11.50	120.50	155			Down Hole Hammer
1	1	Casing	Steel	-0.40	11.60	168.3	158.7		C: -.1-11.6m; Welded; Driven into Hole
1	1	Casing	P.V.C.	-0.40	17.50	140			Suspended in Clamps
1	1	Opening	Slots - Vertical	15.50	17.50	140			PVC Class 9; Sawn; SL: .1mm; A: 4mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
15.00	18.00	3.00				0.30	18.00	0.25	153.00
105.00	107.00	2.00				0.05	108.00	0.25	145.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	9.00	9.00	FILL	Fill	
9.00	14.00	5.00	SANDSTONE GREY	Sandstone	
14.00	15.00	1.00	SANDSTONE / CLAY	Sandstone	
15.00	18.00	3.00	SANDSTONE / QUARTZ	Sandstone	
18.00	20.00	2.00	QUARTZ	Quartz	
20.00	22.00	2.00	SANDSTONE/ QUARTZ	Sandstone	
22.00	32.00	10.00	SANDSTONE GREY	Sandstone	
32.00	38.00	6.00	SANDSTONE QUARTZ	Sandstone	
38.00	40.00	2.00	SANDSTONE GREY	Sandstone	
40.00	41.00	1.00	SANDSTONE / SHALE	Sandstone	
41.00	42.50	1.50	SANDSTONE GREY	Sandstone	
42.50	43.00	0.50	QUARTZ	Quartz	
43.00	45.00	2.00	SANDSTONE QUARTZ	Sandstone	
45.00	52.00	7.00	SANDSTONE GREY	Sandstone	
52.00	54.50	2.50	SILTSTONE FRACTURED	Siltstone	
54.50	59.00	4.50	SANDSTONE GREY AND WHITE	Sandstone	
59.00	61.00	2.00	SANDSTONE QUARTZ	Sandstone	
61.00	66.00	5.00	SANDSTONE GREY	Sandstone	
66.00	67.00	1.00	HARD SHALE	Shale	
67.00	77.00	10.00	SANDSTONE GREY	Sandstone	
77.00	78.00	1.00	SANDSTONE QUARTZ	Sandstone	
78.00	93.50	15.50	SANDSTONE GREY	Sandstone	
93.50	105.00	11.50	SANDSTONE WHITE	Sandstone	
105.00	107.00	2.00	SANDSTONE QUARTZ	Sandstone	
107.00	112.50	5.50	SANDSTONE GREY	Sandstone	
112.50	113.00	0.50	SANDSTONE QUARTZ	Sandstone	
113.00	120.50	7.50	SANDSTONE GREY	Sandstone	

Remarks

***** End of GW103160 *****

NSW OFFICE OF WATER
Work Summary

GW103538

Licence : 10BL159951 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type :		

Commenced Date : **Final Depth :** 132.00 m
Completion Date : 17-Jan-2001 **Drilled Depth :** 132.00 m

Contractor Name : INTERTECH
Driller : 1737 READY, Mark Edward
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** 139.00 mg/L
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	2//596295
	Licensed : CUMBERLAND	NARRABEEN	2 596295

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272500 **Latitude (S) :** 33° 40' 31"
Elevation Source : **Easting :** 339309 **Longitude (E) :** 151° 15' 60"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	210			Down Hole Hammer
1		Hole	Hole	5.60	132.00	156.5			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: 3-5.6m; Driven into Hole
1	1	Casing	PVC Class 9	-0.40	47.60	140			Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
54.00	55.00	1.00				0.10	60.00	25.00	150.00
88.00	89.00	1.00				0.10	90.00	25.00	150.00
112.00	113.00	1.00				0.40	114.00	25.00	140.00
115.00	117.00	2.00		32.00		0.10	120.00	50.00	139.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	OVERBURDEN	Overburden	
0.50	2.00	1.50	WEATHERED SANDSTONE	Sandstone	
2.00	14.00	12.00	WHITE TO PINK SANDSTONE M.G.	Sandstone	
14.00	19.00	5.00	YELLOW SANDSTONE M.G.	Sandstone	
19.00	19.20	0.20	IRONSTONE	Ironstone	
19.20	20.00	0.80	GREY SANDSTONE M.G.	Sandstone	
20.00	20.40	0.40	WHITE CLAY	Clay	
20.40	21.00	0.60	WHITE SANDSTONE M.G.	Sandstone	
21.00	21.50	0.50	WHITE CLAY	Clay	
21.50	26.00	4.50	IRONSTONE	Ironstone	
26.00	37.00	11.00	WHITE SANDSTONE M.G.	Sandstone	
37.00	37.50	0.50	IRONSTONE	Ironstone	
37.50	39.00	1.50	GREY CLAYSTONE	Clay	
39.00	57.00	18.00	WHITE SANDSTONE M.G.	Sandstone	
57.00	78.00	21.00	LT GREY SANDSTONE	Sandstone	
78.00	90.00	12.00	WHITE TO RED SANDSTONE M.G.	Sandstone	
90.00	99.00	9.00	LT GREY SANDSTONE M.G.	Sandstone	
99.00	99.20	0.20	IRONSTONE	Ironstone	
99.20	102.00	2.80	WHITE TO GREY SANDSTONE M.G.	Sandstone	
102.00	111.00	9.00	LY GREY SANDSTONE M.G.	Sandstone	
111.00	113.00	2.00	DK GREY SANDSTONE M.G.	Dacite(Tonalite)	
113.00	115.00	2.00	WHITE SANDSTONE QUARTZ	Sandstone	
115.00	115.30	0.30	IRONSTONE	Ironstone	
115.30	117.00	1.70	LT GREY SANDSTONE + QUARTZ	Sandstone	
117.00	125.00	8.00	DK GREY SANDSTONE M.G.	Dacite(Tonalite)	
125.00	132.00	7.00	LT GREY SANDSTONE M.G.	Sandstone	

Remarks

***** End of GW103538 *****

NSW OFFICE OF WATER
Work Summary

GW104173

Licence : 10BL160499 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status :	STOCK	STOCK
Construct. Method : Rotary		
Owner Type :		

Commenced Date : **Final Depth :** 150.50 m
Completion Date : 01-Mar-2002 **Drilled Depth :** 150.50 m

Contractor Name : INTERTECH DRILLING
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - N/A **Standing Water Level :**
GWMA : - **Salinity :** 134.00 mg/L
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	LT D DP 33150
	Licensed : CUMBERLAND	NARRABEEN	D 33150

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272118 **Latitude (S) :** 33° 40' 43"
Elevation Source : **Easting :** 338993 **Longitude (E) :** 151° 15' 47"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type		From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	150.50	158			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	89.50	140	130		Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
86.30	90.00	3.70				0.30	90.50	0.25	97.00
94.00	100.00	6.00				0.30	102.50	0.25	106.00
142.00	142.50	0.50				0.90	144.50	0.25	120.00
143.50	144.00	0.50		50.00		1.10	150.50	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	SAND AND ROCKS	Sand	
2.00	4.00	2.00	PINK SANDSTONE	Sandstone	
4.00	27.00	23.00	SANDSTONE LIGHT BROWN	Sandstone	
27.00	28.50	1.50	IRONSTONE AND QUARTZ	Ironstone Gravel	
28.50	30.00	1.50	CLAYSTONE DARK GREY	Claystone	
30.00	44.00	14.00	SANDSTONE LIGHT GREY	Sandstone	
44.00	44.30	0.30	CLAY, CREAM	Clay	
44.30	45.50	1.20	IRONSTONE , QUARTZ	Ironstone Gravel	
45.50	47.00	1.50	CLAYSTONE DARK GREY	Claystone	
47.00	56.50	9.50	SANDSTONE LIGHT GREY	Sandstone	
56.50	58.00	1.50	CLAY STIFF, GREY	Clay	
58.00	61.00	3.00	IRONSTONE AND QUARTZ	Ironstone Gravel	
61.00	62.00	1.00	IRONSTONE, BANDS OF CLAY	Ironstone	
62.00	85.00	23.00	SANDSTONE LIGHT GREY	Sandstone	
85.00	86.00	1.00	SANDSTONE QUARTZ	Sandstone	
86.00	86.30	0.30	IRONSTONE	Ironstone	
86.30	90.00	3.70	SANDSTONE , QUARTZ	Sandstone	
90.00	94.00	4.00	IRONSTONE, SANDSTONE	Ironstone	
94.00	100.00	6.00	SANDSTONE , QUARTZ	Sandstone	
100.00	105.50	5.50	SANDSTONE LIGHT GREY	Sandstone	
105.50	110.00	4.50	SANDSTONE D/G. FRACT.	Sandstone	
110.00	142.00	32.00	SANDSTONE GREY	Sandstone	
142.00	142.50	0.50	FINE QUARTZ	Quartz	
142.50	143.50	1.00	SANDSTONE GREY	Sandstone	
143.50	144.00	0.50	SANDSTONE QUARTZ, FRACT.	Sandstone	
144.00	150.50	6.50	SANDSTONE GREY	Sandstone	

Remarks

***** End of GW104173 *****

NSW OFFICE OF WATER
Work Summary

GW104217

Licence : 10BL160567
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary		
Owner Type : Private		

Commenced Date : **Final Depth :** 150.00 m
Completion Date : 05-Mar-2002 **Drilled Depth :** 150.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - SACCO
GWMA : -
GW Zone : -

Standing Water Level : 58.00 m
Salinity : 134.00 mg/L
Yield : 0.20 L/s

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	LT 26 DP 12115
		Licensed : CUMBERLAND	NARRABEEN	26 12115

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :

Northing : 6272141
Easting : 339505
Latitude (S) : 33° 40' 43"
Longitude (E) : 151° 16' 7"

GS Map :
MGA Zone : 56
Coordinate Source : Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	150.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	89.50	140	130		Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
60.50	61.00	0.50				0.10			120.00
94.00	101.50	7.50				0.30			128.00
116.00	117.00	1.00				0.30			134.00
132.00	133.00	1.00		58.00		0.20			134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.50	1.50	SANDS AND LARGE ROCKS	Sandstone	
1.50	3.00	1.50	SANDSTONE RED	Sandstone	
3.00	21.00	18.00	SANDSTONE LIGHT BROWN	Sandstone	
21.00	21.50	0.50	CLAY DARK BROWN	Clay	
21.50	29.00	7.50	SANDSTONE LIGHT BROWN	Sandstone	
29.00	30.50	1.50	SHALE	Shale	
30.50	45.00	14.50	SANDSTONE LIGHT GREY	Sandstone	
45.00	45.50	0.50	SHALE	Shale	
45.50	50.00	4.50	SANDSTONE GREY	Sandstone	
50.00	55.00	5.00	IRONSTONE/QUARTZ	Ironstone	
55.00	60.50	5.50	SANDSTONE GREY	Sandstone	
60.50	61.00	0.50	QUARTZ	Invalid Code	
61.00	75.00	14.00	SANDSTONE L/G	Sandstone	
75.00	76.50	1.50	IRONSTONE	Ironstone	
76.50	79.00	2.50	SANDSTONE QUARTZ	Sandstone	
79.00	79.50	0.50	IRONSTONE FRACTURED	Ironstone Gravel	
79.50	89.00	9.50	SANDSTONE QUARTZ	Sandstone	
89.00	93.50	4.50	SANDSTONE FRACTURED	Sandstone	
93.50	94.00	0.50	CLAY/QUARTZ	Clay	
94.00	101.50	7.50	SANDSTONE/QUARTZ	Sandstone	
101.50	102.00	0.50	IRONSTONE	Ironstone	
102.00	107.00	5.00	SANDSTONE GREY	Sandstone	
107.00	107.30	0.30	CLAY	Clay	
107.30	116.00	8.70	SANDSTONE GREY	Sandstone	
116.00	117.00	1.00	SAND/QUARTZ FINE	Sand	
117.00	132.00	15.00	SANDSTONE L/G	Sandstone	
132.00	133.00	1.00	SANDSTONE QUARTZ	Sandstone	
133.00	150.00	17.00	SANDSTONE GREY	Sandstone	

Remarks

***** End of GW104217 *****

NSW OFFICE OF WATER
Work Summary

GW104265

Licence : 10BL160616 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary		
Owner Type : Private		

Commenced Date : **Final Depth :** 210.00 m
Completion Date : 18-Apr-2002 **Drilled Depth :** 210.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - N/A **Standing Water Level :** 43.00 m
GWMA : - **Salinity :** 134.00 mg/L
GW Zone : - **Yield :** 0.10 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	LT 71 DP 752046
	Licensed : CUMBERLAND	NARRABEEN	71 752046

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272512 **Latitude (S) :** 33° 40' 31"
Elevation Source : **Easting :** 339916 **Longitude (E) :** 151° 16' 23"

GS Map : **MGA Zone :** 56 **Coordinate Source :** Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	210.00	160			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	59.50	140	130		Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
48.00	50.00	2.00				0.10	54.00	0.25	120.00
80.00	84.00	4.00				0.10	84.00	0.25	126.00
101.50	102.00	0.50				0.10	102.00	0.25	132.00
111.00	112.00	1.00				0.10	114.00	0.25	134.00
143.00	146.00	3.00		43.00		0.10	210.00	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	SAND	Sand	
1.00	8.00	7.00	SANDSTONE SOFT	Sandstone	
8.00	26.00	18.00	SANDSTONE/IRONSTONE	Sandstone	
26.00	28.00	2.00	CLAYSTONE	Claystone	
28.00	32.00	4.00	SILTSTONE	Siltstone	
32.00	37.00	5.00	SANDSTONE/IRONSTONE	Sandstone	
37.00	42.00	5.00	SANDSTONE GREY	Sandstone	
42.00	48.00	6.00	SILTSTONE	Siltstone	
48.00	50.00	2.00	IRONSTONE AND QUARTZ	Ironstone Gravel	
50.00	54.00	4.00	SANSDSTONE GREY	Sand	
54.00	58.00	4.00	IRONSTONE AND QUARTZ	Ironstone Gravel	
58.00	65.00	7.00	SANDSTONE GREY	Sandstone	
65.00	80.00	15.00	SANDSTONE WITH IRONSTONE BANDS	Sandstone	
80.00	84.00	4.00	SANDSTONE/QUARTZ	Sandstone	
84.00	101.50	17.50	SANDSTONE GREY	Sandstone	
101.50	102.00	0.50	SANDSTONE/QUARTZ	Sandstone	
102.00	104.00	2.00	SANDSTONE FRACTURED	Sandstone	
104.00	111.00	7.00	SANDSTONE GREY	Sandstone	
111.00	112.00	1.00	SANDSTONE QUARTZ	Sandstone	
112.00	143.00	31.00	SANDSTONE GREY	Sandstone	
143.00	146.00	3.00	SANDSTONE DARK GREY FRACT.	Sandstone	
146.00	166.00	20.00	SANDSTONE GREY	Sandstone	
166.00	170.00	4.00	SANDSTONE DARK GREY	Sandstone	
170.00	198.00	28.00	SANDSTONE GREY	Sandstone	
198.00	202.00	4.00	SANDSTONE DARK GREY	Sandstone	
202.00	205.00	3.00	SANDSTONE DARK GREY	Sandstone	
205.00	210.00	5.00	SANDSTONE DARK GREY	Sandstone	

Remarks

***** End of GW104265 *****

NSW OFFICE OF WATER
Work Summary

GW104417

Licence : 10BL160790
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary		
Owner Type : Private		

Commenced Date : **Final Depth :** 180.00 m
Completion Date : 23-Aug-1982 **Drilled Depth :** 180.00 m

Contractor Name : unknown
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level : 33.00 m
Salinity : 134.00 mg/L
Yield : 0.20 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	LT 8 DP 30325
	Licensed : CUMBERLAND	NARRABEEN	8 30325

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :
CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :
Northing : 6272609
Easting : 340101
Latitude (S) : 33° 40' 28"
Longitude (E) : 151° 16' 31"

GS Map :
MGA Zone : 56
Coordinate Source : Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	180.00	159			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	47.50	140			Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
45.00	48.00	3.00				0.10	48.00	0.25	134.00
67.00	70.00	3.00				0.20	72.00	0.25	134.00
71.50	72.50	1.00				0.30	78.00	0.25	134.00
133.00	135.00	2.00		33.00		0.20	138.00	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	TOPSOIL	Topsoil	
1.00	10.00	9.00	SANDSTONE LIGHT BROWN	Sandstone	
10.00	14.00	4.00	SHALE	Shale	
14.00	32.00	18.00	SANDST0NE LIGHT BROWN	Sandstone	
32.00	32.50	0.50	CLAY WHITE	Clay	
32.50	35.00	2.50	SANDSTONE WHITE	Sandstone	
35.00	35.50	0.50	CLAY	Sandstone	
35.50	39.00	3.50	SANDSTONE WHITE	Sandstone	
39.00	44.70	5.70	SANDSTONE GREY	Sandstone	
44.70	45.00	0.30	CLAY WHITE	Clay	
45.00	48.00	3.00	SANDSTONE QUARTZ	Sandstone	
48.00	67.00	19.00	SANDSTONE GREY	Sandstone	
67.00	70.00	3.00	SANDSTONE QUARTZ	Sandstone	
70.00	71.50	1.50	SANDSTONE GREY	Sandstone	
71.50	72.50	1.00	IRONSTONE QUARTZ	Ironstone Gravel	
72.50	74.00	1.50	SANDSTONE QUARTZ	Sandstone	
74.00	75.50	1.50	SANDSTONE QUARTZ FRACTURED	Sandstone	
75.50	95.00	19.50	SANDSTONE GREY	Sandstone	
95.00	95.30	0.30	CLAY WHITE	Clay	
95.30	111.00	15.70	SANDSTONE GREY	Sandstone	
111.00	112.00	1.00	SANDSTONE DARK GREY	Sandstone	
112.00	133.00	21.00	SANDSTONE GREY	Sandstone	
133.00	135.00	2.00	SANDSTONE D/G FRACTURED	Sandstone	
135.00	180.00	45.00	SANDSTONE GREY	Sandstone	

Remarks

***** End of GW104417 *****

NSW OFFICE OF WATER
Work Summary

GW104418

Licence : 10BL160792 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary		
Owner Type : Private		

Commenced Date : **Final Depth :** 180.00 m
Completion Date : 21-Aug-2002 **Drilled Depth :** 180.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - N/A **Standing Water Level :** 71.00 m
GWMA : - **Salinity :** 134.00 mg/L
GW Zone : - **Yield :** 0.30 L/s

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	LT B DP 403166
		Licensed : CUMBERLAND	NARRABEEN	B 403166

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272310 **Latitude (S) :** 33° 40' 37"
Elevation Source : **Easting :** 338914 **Longitude (E) :** 151° 15' 44"

GS Map : **MGA Zone :** 56 **Coordinate Source :** Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type		From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	180.00	157			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	71.50	140			Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
86.50	94.00	7.50				0.25	96.00	0.25	134.00
114.00	114.50	0.50		71.00		0.05	120.00	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	TOPSOIL	Topsoil	
0.50	17.00	16.50	SANDSTONE LIGHT BROWN	Sandstone	
17.00	22.00	5.00	SANDSTONE GREY	Sandstone	
22.00	23.00	1.00	SHALE	Shale	
23.00	28.00	5.00	SANDSTONE GREY	Sandstone	
28.00	28.30	0.30	CLAY	Clay	
28.30	29.00	0.70	IRONSTONE	Ironstone	
29.00	30.00	1.00	SANDSTONE QUARTZ	Sandstone	
30.00	35.00	5.00	SANDSTONE LIGHT BROWN SOFT	Sandstone	
35.00	43.00	8.00	SANDSTONE WHITE	Sandstone	
43.00	45.00	2.00	IRONSTONE FRACTURED	Ironstone Gravel	
45.00	57.00	12.00	SANDSTONE GREY	Sandstone	
57.00	60.00	3.00	SHALE SOFT	Shale	
60.00	68.00	8.00	SANDSTONE GREY	Sandstone	
68.00	69.00	1.00	IRONSTONE	Ironstone	
69.00	86.50	17.50	SANDSTONE GREY	Sandstone	
86.50	93.00	6.50	SANDSTONE FINE QUARTZ	Sandstone	
93.00	94.00	1.00	FINE QUARTZ SOFT	Invalid Code	
94.00	98.00	4.00	SANDSTONE FINE QUARTZ	Sandstone	
98.00	114.00	16.00	SANDSTONE GREY	Sandstone	
114.00	114.50	0.50	SANDSTONE QUARTZ	Sandstone	
114.50	180.00	65.50	SANDSTONE GREY	Sandstone	

Remarks

***** End of GW104418 *****

NSW OFFICE OF WATER
Work Summary

GW105253

Licence : 10BL162186 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type :		

Commenced Date : **Final Depth :** 192.50 m
Completion Date : 16-Oct-2003 **Drilled Depth :** 192.50 m

Contractor Name : INTERTECH DRILLING
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - MARFLEET **Standing Water Level :** 87.00 m
GWMA : - **Salinity :** 206.00 mg/L
GW Zone : - **Yield :** 0.10 L/s

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	9 30325
		Licensed : CUMBERLAND	NARRABEEN	9 30325

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 212 - HAWKESBURY RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : 0.00 **Northing :** 6273242 **Latitude (S) :** 33° 40' 8"
Elevation Source : (Unknown) **Easting :** 340553 **Longitude (E) :** 151° 16' 49"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	205			Down Hole Hammer
1		Hole	Hole	5.60	102.50	159			Down Hole Hammer
1		Hole	Hole	102.50	192.50	154			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: 0-5.6m; Driven into Hole
1	1	Casing	PVC Class 9	-0.40	24.00	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Diagonal	24.00	30.00	140			PVC Class 9; SL: .1mm; A: 4mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
26.50	27.50	1.00				0.20	30.50	0.25	125.00
127.00	128.00	1.00				0.10	132.50	0.25	142.00
151.00	151.30	0.30				0.10	156.50	0.25	220.00
184.50	185.50	1.00		87.00		0.10	186.50	0.50	240.00

Drillers Log

From (m)	To (m)	Thickness(m	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	TOPSOIL	Topsoil	
0.20	6.20	6.00	SANDSTONE LT GREY M/G	Sandstone	
6.20	6.50	0.30	CLAY WHITE	Clay	
6.50	24.50	18.00	SANDSTONE GREY BROWN/IRONSTONE	Sandstone	
24.50	42.50	18.00	SANDSTONE F.W.GREY BROWN M/G	Sandstone	
42.50	56.50	14.00	SANDSTONE BROWN/IRONSTONE	Sandstone	
56.50	57.50	1.00	F. SANDSTONE BROWN/IRONSTONE	Invalid Code	
57.50	127.70	70.20	SANDSTONE GREY/DARK GREY M.G	Sandstone	
127.70	128.00	0.30	F.W. SANDSTONE GREY	Invalid Code	
128.00	137.00	9.00	SANDSTONE GREY M/G	Sandstone	
137.00	147.50	10.50	SANDSTONE DARK GREY	Sandstone	
147.50	175.00	27.50	SANDSTONE GREY/DARK GREY M.G	Sandstone	
175.00	186.50	11.50	F. SANDSTONE GREY W.	Invalid Code	
186.50	188.00	1.50	SANDSTONE GREY/DARK GREY	Sandstone	
188.00	190.50	2.50	RED SHALE	Invalid Code	
190.50	192.50	2.00	SANDSTONE GREY	Sandstone	

Remarks

***** End of GW105253 *****

NSW OFFICE OF WATER
Work Summary

GW105255

Licence : 10BL600322 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary		
Owner Type :		

Commenced Date : **Final Depth :** 114.00 m
Completion Date : 16-Oct-2003 **Drilled Depth :** 114.00 m

Contractor Name : ULTRA DRIILING
Driller : 1423 DODD, Alan Marcus
Assistant Driller's Name :

Property : - FARAH **Standing Water Level :** 44.00 m
GWMA : - **Salinity :** 96.00 mg/L
GW Zone : - **Yield :** 1.00 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	264 752046
	Licensed : CUMBERLAND	NARRABEEN	264 752046

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 213 - SYDNEY COAST - GEORGES RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : 0.00 **Northing :** 6272855 **Latitude (S) :** 33° 40' 20"
Elevation Source : (Unknown) **Easting :** 339944 **Longitude (E) :** 151° 16' 25"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	36.00	170			Down Hole Hammer
1		Hole	Hole	36.00	114.00	130			Down Hole Hammer
1	1	Casing	Steel	0.30	2.00	160			Driven into Hole
1	1	Casing	PVC Class 9	0.30	36.00	140			Glued; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
66.00	67.00	1.00			68.00	0.60	68.00	1.00	100.00
72.00	73.00	1.00		44.00	75.00	1.00	75.00	1.50	96.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	CLAY	Clay	
2.00	22.00	20.00	BROKEN SANDSTONE	Invalid Code	
22.00	30.00	8.00	SHALE	Shale	
30.00	76.00	46.00	WHITE SANDSTONE	Invalid Code	
76.00	83.00	7.00	SANDSTONE/SHALE	Sandstone	
83.00	114.00	31.00	WHITE SANDSTONE	Invalid Code	

Remarks

Previous Lic No:10BL162212

***** End of GW105255 *****

NSW OFFICE OF WATER
Work Summary

GW105671

Licence : 10BL162365 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
	DOMESTIC	DOMESTIC

Work Type : Bore
Work Status : Supply Obtained
Construct. Method : Down Hole Hammer
Owner Type : Private

Commenced Date : **Final Depth :** 180.00 m
Completion Date : 22-Oct-2003 **Drilled Depth :** 180.00 m

Contractor Name : Ultradrilling
Driller : 1600 DODD, Bradley Alan
Assistant Driller's Name :

Property : - BIRD
GWMA : -
GW Zone : -

Standing Water Level : 105.00 m
Salinity : 110.00 mg/L
Yield : 105.00 L/s cumulative

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	2//618622
	Licensed : CUMBERLAND	NARRABEEN	2 618622

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :

CMA Map : 9130-1S MONA VALE
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation : 0.00
Elevation Source : (Unknown)

Northing : 6274438 **Latitude (S) :** 33° 39' 29"
Easting : 340693 **Longitude (E) :** 151° 16' 55"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	72.00	174			Down Hole Hammer
1		Hole	Hole	72.00	180.00	140			Down Hole Hammer
1	1	Casing	Steel	0.30	1.00	168			Glued; Driven into Hole
1	1	Casing	PVC Class 9	0.30	72.00	140			Glued; Driven into Hole; Open End

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
162.00	163.00	1.00			164.00	0.40		1.00	110.00
174.00	175.00	1.00		105.00	180.00	0.60		2.00	110.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	soil, dirt	Soil	
1.00	3.00	2.00	clay	Clay	
3.00	66.00	63.00	sandstone, soft yellow	Sandstone	
66.00	150.00	84.00	sandstone, shale	Sandstone	
150.00	174.00	24.00	shale	Shale	
174.00	180.00	6.00	shale, red	Shale	

Remarks

updated from original form A

***** End of GW105671 *****

NSW OFFICE OF WATER
Work Summary

GW106327

Licence : 10BL163449 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 180.00 m
Completion Date : 07-Jul-2004 **Drilled Depth :** 180.00 m

Contractor Name : INTERTECH
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - HAUGH **Standing Water Level :** 49.50 m
GWMA : - **Salinity :** 198.00 mg/L
GW Zone : - **Yield :** 0.40 L/s cumualtive

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	82//875079
		Licensed : CUMBERLAND	NARRABEEN	82 875079

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 212 - HAWKESBURY RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : 0.00 **Northing :** 6273453 **Latitude (S) :** 33° 40' 1"
Elevation Source : (Unknown) **Easting :** 340803 **Longitude (E) :** 151° 16' 58"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	206			Down Hole Hammer
1		Hole	Hole	5.50	72.00	159			Down Hole Hammer
1		Hole	Hole	72.00	180.00	155			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		Screwed and Glued; Suspended in Clamps
1	1	Casing	PVC Class 9	-0.50	11.00	140			Screwed and Glued; Driven into Hole; Open End
1	1	Opening	Slots - Diagonal	11.00	21.50	140			PVC Class 9; Sawn; SL: .1mm; A: 3mm; Screwed and Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
11.30	11.50	0.20				0.10			149.00
18.30	21.10	2.80				0.10			201.00
52.00	55.00	3.00		49.50		0.01			198.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	sand, silty	Sand	
3.00	11.30	8.30	sandstone, light grey	Sandstone	
11.30	11.50	0.20	sandstone, fractured	Sandstone	
11.50	15.00	3.50	sandstone, light brown	Sandstone	
15.00	15.20	0.20	sandstone, fractured	Sandstone	
15.20	17.50	2.30	sandstone, light brown	Sandstone	
17.50	18.30	0.80	sandstone, very soft	Sandstone	
18.30	21.00	2.70	sandstone, quartz	Sandstone	
21.00	21.10	0.10	sandstone, fracture	Sandstone	
21.10	21.70	0.60	sandstone, grey	Sandstone	
21.70	22.20	0.50	clay, white	Clay	
22.20	33.00	10.80	sandstone, ironstone bands	Sandstone	
33.00	40.00	7.00	sandstone, grey	Sandstone	
40.00	40.20	0.20	clay, white	Clay	
40.20	52.00	11.80	sandstone, grey	Sandstone	
52.00	55.00	3.00	sandstone, dark grey	Sandstone	
55.00	93.50	38.50	sandstone, grey	Sandstone	
93.50	93.70	0.20	sandstone, fracture	Sandstone	
93.70	153.50	59.80	sandstone, grey	Sandstone	
153.50	159.00	5.50	silt, stone	Silt	
159.00	164.00	5.00	sandstone, grey	Sandstone	
164.00	165.50	1.50	silt, stone, grey	Silt	
165.50	178.00	12.50	silt, stone red	Silt	
178.00	180.00	2.00	silt stone, grey	Silt	

Remarks

updated from original form A

***** End of GW106327 *****

NSW OFFICE OF WATER
Work Summary

GW106695

Licence : 10BL164232 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 120.00 m
Completion Date : 23-Nov-2004 **Drilled Depth :** 120.00 m

Contractor Name : INTERTECH
Driller : 1783 CRUMP, William
Assistant Driller's Name :

Property : - DAWE **Standing Water Level :** 38.00 m
GWMA : - **Salinity :** 132.00 mg/L
GW Zone : - **Yield :** 0.90 L/s cumulative

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	6//1044346
		Licensed : CUMBERLAND	NARRABEEN	6 1044346

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 213 - SYDNEY COAST - GEORGES RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : **Northing :** 6272628 **Latitude (S) :** 33° 40' 27"
Elevation Source : **Easting :** 339830 **Longitude (E) :** 151° 16' 20"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	208			Down Hole Hammer
1		Hole	Hole	5.50	120.00	156			Down Hole Hammer
1	1	Casing	PVC Class 9	-42.00	53.00				Screwed and Glued
1	1	Casing	Steel	-0.40	5.60	156	146.4		Driven into Hole; Open End
1	1	Casing	PVC Class 9	-0.40	30.00	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Diagonal	30.00	42.00	140			PVC Class 9; Sawn; SL: .1mm; A: 3mm; Screwed and Glued
1	1	Opening	Slots - Diagonal	53.00	59.60	140			PVC Class 9; Sawn; SL: .1mm; A: 3mm; Screwed and Glued
1		Annulus	Concrete	-0.10	5.50	208	168		

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
31.00	35.00	4.00				0.20			145.00
53.00	54.00	1.00				0.20			144.00
67.00	70.00	3.00		38.00		0.20			140.00
72.00	86.00	14.00				0.30			132.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	fill, sandstone, rocker clay	Fill	
2.00	4.00	2.00	sandstone, very soft	Sandstone	
4.00	20.00	16.00	sandstone, light brown	Sandstone	
20.00	26.00	6.00	sandstone, quartz bands	Sandstone	
26.00	27.00	1.00	clay, soft	Clay	
27.00	31.00	4.00	sandstone, light brown	Sandstone	
31.00	35.00	4.00	sandstone, quartz soft	Sandstone	
35.00	41.00	6.00	ironstone, sandstone,	Ironstone	
41.00	41.30	0.30	clay	Clay	
41.30	41.60	0.30	quartz, course	Quartz	
41.60	44.00	2.40	clay	Clay	
44.00	49.00	5.00	siltstone	Siltstone	
49.00	53.00	4.00	sandstone, grey	Sandstone	
53.00	54.00	1.00	sandstone, fractured	Sandstone	
54.00	57.00	3.00	sandstone, quartz	Sandstone	
57.00	67.00	10.00	sandstone, grey	Sandstone	
67.00	67.50	0.50	quartz, course	Quartz	
67.50	70.00	2.50	sandstone, grey	Sandstone	
70.00	72.00	2.00	ironstone	Ironstone	
72.00	86.00	14.00	sandstone, fractured quartz	Sandstone	
86.00	90.00	4.00	sandstone, grey	Sandstone	
90.00	94.00	4.00	sandstone, ironstone, fractured quartz	Sandstone	
94.00	95.00	1.00	clay, sandstone, soft	Clay	
95.00	102.00	7.00	sandstone, quartz bands	Sandstone	
102.00	120.00	18.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

***** End of GW106695 *****

NSW OFFICE OF WATER
Work Summary

GW107194

Licence : 10BL163459 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary - Percussion (Down Hole Hammer)		
Owner Type : Private		

Commenced Date : **Final Depth :** 192.00 m
Completion Date : 28-Sep-2004 **Drilled Depth :** 192.00 m

Contractor Name : CENTRAL WEST WATER DRILLING
Driller : 1812 REYNOLDS, Christopher Howard R
Assistant Driller's Name :

Property : - SWIFT **Standing Water Level :** 18.00 m
GWMA : - **Salinity :**
GW Zone : - **Yield :** 0.40 L/s cumulative

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	137 752046
	Licensed : CUMBERLAND	NARRABEEN	137 752046

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6271355 **Latitude (S) :** 33° 41' 7"
Elevation Source : **Easting :** 337051 **Longitude (E) :** 151° 14' 31"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	192.00	200			Rotary - Percussion (Down Hole Hammer)
1	1	Casing	PVC Class 9	-0.40	192.00	164	163.8		Riveted and Glued; Driven into Hole; Open End; S: 170~192m
1	1	Opening	Slots - Vertical	0.00	0.00	164			PVC Class 9; Casing - Hand Sawn Slot; SL: 200mm; A: 2mm; Riveted and Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
74.00	170.00	96.00		18.00		0.40		2.00	

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	tospsoil	Topsoil	
3.00	4.00	1.00	clay, sandy	Clay	
4.00	20.00	16.00	sandstone	Sandstone	
20.00	22.00	2.00	shales, grey	Shale	
22.00	52.00	30.00	sandstone	Sandstone	
52.00	56.00	4.00	clays	Claystone	
56.00	170.00	114.00	sandstone	Sandstone	
170.00	192.00	22.00	shales, grey	Shale	

Remarks

updated from original form A

***** End of GW107194 *****

NSW OFFICE OF WATER
Work Summary

GW107518

Licence : 10BL164091 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained		
Construct. Method : (Unknown)		
Owner Type : Private		

Commenced Date : **Final Depth :** 120.00 m
Completion Date : 01-Jul-2005 **Drilled Depth :** 120.00 m

Contractor Name : unknown
Driller : 400 UNKNOWN, Unkown
Assistant Driller's Name :

Property : - CHOULARTON **Standing Water Level :**
GWMA : - **Salinity :**
GW Zone : - **Yield :** 500 L/day

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	208//752046
	Licensed : CUMBERLAND	NARRABEEN	208 752046

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 213 - SYDNEY COAST - GEORGES RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : **Northing :** 6272572 **Latitude (S) :** 33° 40' 29"
Elevation Source : **Easting :** 339395 **Longitude (E) :** 151° 16' 3"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details

(No Construction Details Found)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

Type of casing PVC, diameter of casing 150mm updated from AG form

***** End of GW107518 *****

NSW OFFICE OF WATER
Work Summary

GW107528

Licence : 10BL165517 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 180.30 m
Completion Date : 28-Sep-2005 **Drilled Depth :** 180.30 m

Contractor Name : INTERTECH
Driller : 1950 WYATT, Brett Roy
Assistant Driller's Name :

Property : - MORRIS **Standing Water Level :** 83.60 m
GWMA : - **Salinity :** 390.00 mg/L
GW Zone : - **Yield :** 0.60 L/s cumulative

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	156//752046
	Licensed : CUMBERLAND	NARRABEEN	156 752046

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 213 - SYDNEY COAST - GEORGES RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : **Northing :** 6273541 **Latitude (S) :** 33° 39' 58"
Elevation Source : **Easting :** 340683 **Longitude (E) :** 151° 16' 54"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	202			Down Hole Hammer
1		Hole	Hole	5.60	102.30	165			Down Hole Hammer
1		Hole	Hole	102.30	180.30	159			Down Hole Hammer
1	1	Casing	Steel	-0.20	5.80	165	155.4		Driven into Hole
1	1	Casing	PVC Class 9	-0.20	59.80	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Diagonal	17.80	23.80	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	29.80	41.80	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	47.80	53.80	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1		Annulus	Concrete	0.00	5.80	165			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
19.80	20.30	0.50				0.08			132.00
35.70	50.90	15.20		17.00		0.13			155.00
130.50	131.20	0.70				0.10			225.00
156.00	166.00	10.00		83.60		0.30			390.00

Drillers Log

From (m)	To (m)	Thickness(m	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	clay, light brown	Clay	
1.00	2.00	1.00	sandstone, brown weathered	Sandstone	
2.00	2.80	0.80	sandstone & ironstone, brown, water bearing	Sandstone	
2.80	13.60	10.80	sandstone, brown	Sandstone	
13.60	14.40	0.80	shale, grey	Shale	
14.40	19.80	5.40	sandstone, brown, grey pink	Sandstone	
19.80	20.30	0.50	sandstone, pink and quartz, water bearing	Sandstone	
20.30	26.50	6.20	sandstone & ironstone, brown	Sandstone	
26.50	26.90	0.40	clay, light brown	Clay	
26.90	35.70	8.80	sandstone, grey, light brown	Sandstone	
35.70	35.80	0.10	quartz, water bearing	Quartz	
35.80	37.00	1.20	ironstone	Ironstone	
37.00	37.30	0.30	clay, light brown	Clay	
37.30	47.70	10.40	sandstone, pink, grey, brown	Sandstone	
47.70	47.90	0.20	shale, grey	Shale	
47.90	50.80	2.90	sandstone, grey	Sandstone	
50.80	50.90	0.10	sandstone, grey and quartz, water bearing	Sandstone	
50.90	63.50	12.60	sandstone, grey	Sandstone	
63.50	67.80	4.30	shale, black silty	Shale	
67.80	71.70	3.90	sandstone, light grey	Sandstone	
71.70	78.60	6.90	shale, black silty	Shale	
78.60	130.50	51.90	sandstone, grey black shale bands	Sandstone	
130.50	131.20	0.70	sandstone, grey, fractured, water bearing	Sandstone	
131.20	166.00	34.80	sandstone, grey, & grey silty shale, water bearing	Sandstone	
166.00	180.30	14.30	shale, grey silty, red silty shale	Shale	

Remarks

Form A Remarks:

NSW OFFICE OF WATER
Work Summary

GW107528

130.5 - 131.2 very unstable - aire lifted at 132m 0.5lps updated from original form A

***** End of GW107528 *****

NSW OFFICE OF WATER
Work Summary

GW108106

Licence : 10BL600255 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 180.00 m
Completion Date : 15-May-2006 **Drilled Depth :** 180.00 m

Contractor Name : INTERTECH
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - MEDWAY **Standing Water Level :** 50.00 m
GWMA : - **Salinity :**
GW Zone : - **Yield :** 0.70 L/s cumulative

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client	**Form A :** CUMBERLAND	NARRABEEN	8 1044346
	Licensed : CUMBERLAND	NARRABEEN	8 1044346

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272580 **Latitude (S) :** 33° 40' 29"
Elevation Source : **Easting :** 339684 **Longitude (E) :** 151° 16' 14"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	203			Down Hole Hammer
1		Hole	Hole	5.50	120.00	164			Down Hole Hammer
1		Hole	Hole	120.00	180.00	160			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168	158.4		Driven into Hole; Suspended in Clamps; Open End
1	1	Casing	PVC Class 9	-0.50	71.50	140			Screwed and Glued; Suspended in Clamps; Open End
1		Annulus	Concrete	0.00	5.50	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.00	42.00	7.00				0.01			156.00
66.00	66.30	0.30				0.49			130.00
90.50	93.00	2.50				0.10			130.00
130.00	131.50	1.50		50.00		0.10			148.00

Drillers Log

From (m)	To (m)	Thickness(m	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	sand, clay	Sand	
1.00	15.00	14.00	sandstone, weathered	Sandstone	
15.00	15.20	0.20	clay, grey	Clay	
15.20	28.00	12.80	sandstone, weathere d	Sandstone	
28.00	30.00	2.00	ironstone	Ironstone	
30.00	35.00	5.00	shale	Shale	
35.00	42.00	7.00	sandstone, grey quartz	Sandstone	
42.00	44.00	2.00	claym grey	Clay	
44.00	51.50	7.50	sandstone, grey	Sandstone	
51.50	66.00	14.50	sandstone, grey quartz	Sandstone	
66.00	66.30	0.30	quartz, fractured	Quartz	
66.30	88.00	21.70	sandstone, grey quartz	Sandstone	
88.00	88.50	0.50	ironstone	Ironstone	
88.50	90.50	2.00	sandstone, grey	Sandstone	
90.50	93.00	2.50	quartz	Quartz	
93.00	94.50	1.50	sandstone, grey	Sandstone	
94.50	95.00	0.50	clay, grey	Clay	
95.00	100.00	5.00	sandstone, grey	Sandstone	
100.00	103.00	3.00	sandstone, grey clay quartz	Sandstone	
103.00	104.00	1.00	sandstone, grey	Sandstone	
104.00	107.00	3.00	sandstone, grey clay	Sandstone	
107.00	122.00	15.00	sandstone, grey	Sandstone	
122.00	130.00	8.00	sandstone, grey siltstone	Sandstone	
130.00	131.50	1.50	sandstone, grey quartz	Sandstone	
131.50	158.00	26.50	sandstone, grey	Sandstone	
158.00	160.00	2.00	siltstone	Siltstone	
160.00	170.00	10.00	sandstone, grey siltstone	Sandstone	
170.00	180.00	10.00	sandstone, grey		

Remarks

updated from original form A

NSW OFFICE OF WATER
Work Summary

GW108106

***** End of GW108106 *****

NSW OFFICE OF WATER
Work Summary

GW108450

Licence : 10BL601060 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 150.00 m
Completion Date : 19-Jan-2007 **Drilled Depth :** 150.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - SHIELDS **Standing Water Level :** 41.30 m
GWMA : - **Salinity :** 110.00 mg/L
GW Zone : - **Yield :** 0.55 L/s Cumulative

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	86//12115
		Licensed : CUMBERLAND	NARRABEEN	86 12115

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 213 - SYDNEY COAST - GEORGES RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : **Northing :** 6271876 **Latitude (S) :** 33° 40' 51"
Elevation Source : **Easting :** 339185 **Longitude (E) :** 151° 15' 55"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	2.70	203			Down Hole Hammer
1		Hole	Hole	2.70	150.00	161			Down Hole Hammer
1	1	Casing	Steel	-0.30	2.70	168	158.4		Driven into Hole; Suspended in Clamps; Open End
1	1	Casing	PVC Class 9	-0.30	41.70	140			Screwed and Glued; Suspended in Clamps
1		Annulus	Concrete	0.00	2.70	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.50	37.00	1.50				0.02			125.00
73.00	75.00	2.00				0.10			98.00
101.00	103.00	2.00				0.23			92.00
133.00	137.00	4.00		41.30		0.20			110.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	Soil, sandy	Soil	
0.50	22.00	21.50	Sandstone, yellow	Sandstone	
22.00	25.00	3.00	Ironstone	Ironstone	
25.00	35.50	10.50	Sandstone, grey	Sandstone	
35.50	37.00	1.50	Sandstone-Quartz, water bearing	Sandstone	
37.00	38.00	1.00	Clay band	Clay	
38.00	49.00	11.00	Sandstone, grey	Sandstone	
49.00	63.00	14.00	Sandstone-Quartz	Sandstone	
63.00	73.00	10.00	Sandstone, grey	Sandstone	
73.00	75.00	2.00	Sandstone-Quartz, water bearing	Sandstone	
75.00	101.00	26.00	Sandstone, grey	Sandstone	
101.00	103.00	2.00	Sandstone-Quartz, water bearing	Sandstone	
103.00	116.00	13.00	Sandstone, grey	Sandstone	
116.00	117.00	1.00	Siltstone	Siltstone	
117.00	129.00	12.00	Sandstone, grey	Sandstone	
129.00	129.50	0.50	Clay	Clay	
129.50	133.00	3.50	Sandstone, grey	Sandstone	
133.00	137.00	4.00	Sandstone-Quartz, water bearing	Sandstone	
137.00	139.00	2.00	Sandstone-Siltstone	Sandstone	
139.00	148.50	9.50	Sandstone, grey	Sandstone	
148.50	149.00	0.50	Siltstone	Siltstone	
149.00	150.00	1.00	Sandstone, grey	Sandstone	

Remarks

updated from original form A

***** End of GW108450 *****

NSW OFFICE OF WATER
Work Summary

GW108510

Licence : 10BL600637 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 102.00 m
Completion Date : 27-Sep-2006 **Drilled Depth :** 102.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1489 BARDEN, Colin Leslie
Assistant Driller's Name :

Property : - CRAIG PERKINS INVESTMENTS **Standing Water Level :** 32.40 m
GWMA : - **Salinity :** 125.00 mg/L
GW Zone : - **Yield :** 2.40 L/s Cumulative

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	1//598867
		Licensed : CUMBERLAND	NARRABEEN	1 598867

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9130-1S MONA VALE
River Basin : 212 - HAWKESBURY RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : **Northing :** 6273441 **Latitude (S) :** 33° 40' 1"
Elevation Source : **Easting :** 339452 **Longitude (E) :** 151° 16' 6"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	2.60	203			Down Hole Hammer
1		Hole	Hole	2.60	102.00	164			Down Hole Hammer
1	1	Casing	Steel	-0.40	2.60	168	158.4		Driven into Hole; Suspended in Clamps; Open End
1	1	Casing	PVC Class 9	-0.40	17.60	140			Screwed and Glued; Suspended in Clamps
1		Annulus	Concrete	0.00	2.60	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
54.00	58.00	4.00				0.20			115.00
85.50	90.00	4.50		32.40		2.20			125.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.60	0.60	Soil, sandy	Soil	
0.60	2.80	2.20	Sandstone, weathered	Sandstone	
2.80	5.40	2.60	Shale	Shale	
5.40	7.00	1.60	Sandstone, weathered	Sandstone	
7.00	8.00	1.00	Shale	Shale	
8.00	15.00	7.00	Sandstone, grey	Sandstone	
15.00	22.00	7.00	Sandstone, yellow	Sandstone	
22.00	43.00	21.00	Sandstone, grey	Sandstone	
43.00	45.00	2.00	Sandstone, grey Quartz	Sandstone	
45.00	47.00	2.00	Sandstone, grey	Sandstone	
47.00	50.00	3.00	Sandstone, grey Quartz	Sandstone	
50.00	54.00	4.00	Sandstone, grey	Sandstone	
54.00	58.00	4.00	Sandstone, grey Quartz, water bearing	Sandstone	
58.00	67.00	9.00	Sandstone, grey	Sandstone	
67.00	73.00	6.00	Sandstone, grey Quartz	Sandstone	
73.00	85.50	12.50	Sandstone, grey	Sandstone	
85.50	90.00	4.50	Quartz	Quartz	
90.00	102.00	12.00	Sandstone, grey	Sandstone	

Remarks

updated from original form A

***** End of GW108510 *****

NSW OFFICE OF WATER
Work Summary

GW108676

Licence : 10BL601385 **Licence Status** Active

	Authorised Purpose(s)	Intended Purpose(s)
	DOMESTIC	DOMESTIC

Work Type : Spear
Work Status : Abandoned Bore
Construct. Method : Down Hole Hammer
Owner Type : Private

Commenced Date : **Final Depth :** 120.00 m
Completion Date : 01-Mar-2007 **Drilled Depth :** 120.00 m

Contractor Name : Highland Drilling
Driller : 1771 DELAMONT, Brett
Assistant Driller's Name :

Property : - CONGAGLEN **Standing Water Level :**
GWMA : - **Salinity :**
GW Zone : - **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : CUMBERLAND	NARRABEEN	2//579095
	Licensed : CUMBERLAND	NARRABEEN	2 579095

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272803 **Latitude (S) :** 33° 40' 22"
Elevation Source : **Easting :** 340538 **Longitude (E) :** 151° 16' 48"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	0.00	120.00	200			Down Hole Hammer

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	24.00	24.00	sandstone, pink orange	Sandstone	
24.00	72.00	48.00	sandstone, fine grey	Sandstone	
72.00	84.00	12.00	shale	Shale	
84.00	114.00	30.00	sandstone, fine grey	Sandstone	
114.00	120.00	6.00	shale	Shale	

Remarks

Abandoned bore. updated from original form A

***** End of GW108676 *****

NSW OFFICE OF WATER
Work Summary

GW108708

Licence : 10BL601568

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 150.00 m
Completion Date : 19-Apr-2007 **Drilled Depth :** 150.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1997 SHEEHY, Paul
Assistant Driller's Name :

Property : - ADDISON
GWMA : -
GW Zone : -

Standing Water Level : 38.00 m
Salinity : 270.00 mg/L
Yield : 0.85 L/s cumulative

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Client	Driller	**Form A :** CUMBERLAND	NARRABEEN	1//595401
		Licensed : CUMBERLAND	NARRABEEN	1 595401

Region : 10 - SYDNEY SOUTH COAST
River Basin :
Area / District :

CMA Map :
Grid Zone : **Scale :**

Elevation :
Elevation Source :

Northing : 6272996 **Latitude (S) :** 33° 40' 15"
Easting : 339338 **Longitude (E) :** 151° 16' 1"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	203			Down Hole Hammer
1		Hole	Hole	5.60	150.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168			Driven into Hole; Open End
1	1	Casing	PVC Class 9	-0.40	95.60	140			Screwed and Glued; Suspended in Clamps; Open End
1	1	Opening	Slots - Diagonal	72.00	90.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
37.00	42.00	5.00				0.10			121.00
73.00	76.00	3.00				0.10			150.00
108.50	112.00	3.50				0.65			270.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	topsoil	Topsoil	
0.20	21.00	20.80	sandstone, grey	Sandstone	
21.00	21.50	0.50	ironstone	Ironstone	
21.50	31.50	10.00	sandstone, grey	Sandstone	
31.50	34.00	2.50	sandstone, quartz	Sandstone	
34.00	37.00	3.00	sandstone, grey	Sandstone	
37.00	42.00	5.00	sandstone, quartz	Sandstone	
42.00	56.50	14.50	sandstone, grey	Sandstone	
56.50	67.00	10.50	sandstone, quartz	Sandstone	
67.00	73.00	6.00	sandstone, grey	Sandstone	
73.00	76.00	3.00	sandstone, quartz	Sandstone	
76.00	77.00	1.00	sandstone, grey	Sandstone	
77.00	78.50	1.50	siltstone, clay band	Siltstone	
78.50	85.00	6.50	sandstone, grey	Sandstone	
85.00	85.50	0.50	siltstone, clay band	Siltstone	
85.50	94.00	8.50	sandstone, quartz	Sandstone	
94.00	94.50	0.50	clay, quartz band	Clay	
94.50	98.00	3.50	sandstone, quartz	Sandstone	
98.00	108.50	10.50	sandstone, grey	Sandstone	
108.50	112.00	3.50	sandstone, quartz	Sandstone	
112.00	128.50	16.50	sandstone, grey	Sandstone	
128.50	130.00	1.50	siltstone	Siltstone	
130.00	136.00	6.00	sandstone, grey	Sandstone	
136.00	140.00	4.00	siltstone	Siltstone	
140.00	150.00	10.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

***** End of GW108708 *****

NSW OFFICE OF WATER
Work Summary

GW108831

Licence : 10BL601319

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Down Hole Hammer		
Owner Type : Private		

Commenced Date : **Final Depth :** 180.00 m
Completion Date : 17-Apr-2007 **Drilled Depth :** 180.00 m

Contractor Name : INTERTECH DRILLING
Driller : 1997 SHEEHY, Paul
Assistant Driller's Name :

Property : - SCARF **Standing Water Level :** 21.00 m
GWMA : - **Salinity :**
GW Zone : - **Yield :** 0.20 L/s cumulative

Site Details

Site Chosen By			County	Parish	Portion/Lot DP
Client	Driller	**Form A :**	CUMBERLAND	NARRABEEN	2//595401
		Licensed :	CUMBERLAND	NARRABEEN	2 595401

Region : 10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** 6272957 **Latitude (S) :** 33° 40' 16"
Elevation Source : **Easting :** 339422 **Longitude (E) :** 151° 16' 4"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	203			Down Hole Hammer
1		Hole	Hole	5.60	180.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168			Seated on Bottom; Open End
1	1	Casing	PVC Class 9	-0.40	107.60	140			Screwed and Glued; Suspended in Clamps; Open End
1	1	Opening	Slots - Diagonal	20.00	24.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	57.00	60.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	90.00	102.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1		Annulus	Concrete	0.00	5.60	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.00	22.50	0.50				0.05			115.00
89.00	91.00	2.00				0.10			140.00
98.00	98.50	0.50				0.05			151.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	topsoil	Topsoil	
0.50	13.00	12.50	sandstone, yellow	Sandstone	
13.00	13.50	0.50	clay	Clay	
13.50	22.00	8.50	sandstone, yellow	Sandstone	
22.00	22.50	0.50	sandstone, quartz	Sandstone	
22.50	23.00	0.50	clay	Clay	
23.00	43.00	20.00	sandstone, yellow	Sandstone	
43.00	52.50	9.50	sandstone, quartz	Sandstone	
52.50	55.50	3.00	sandstone, grey	Sandstone	
55.50	56.50	1.00	shale, soft	Shale	
56.50	58.50	2.00	sandstone, quartz	Sandstone	
58.50	64.50	6.00	shale, clay band	Shale	
64.50	74.00	9.50	sandstone, grey	Sandstone	
74.00	77.00	3.00	shale, soft	Shale	
77.00	89.00	12.00	sandstone, grey	Sandstone	
89.00	91.00	2.00	sandstone, quartz	Sandstone	
91.00	94.00	3.00	sandstone, grey	Sandstone	
94.00	95.00	1.00	sandstone, clay band	Sandstone	
95.00	98.00	3.00	sandstone, grey	Sandstone	
98.00	98.50	0.50	sandstone, quartz	Sandstone	
98.50	100.50	2.00	sandstone, grey	Sandstone	
100.50	102.00	1.50	sandstone, clay band	Sandstone	
102.00	121.00	19.00	sandstone, grey	Sandstone	
121.00	125.00	4.00	shale	Shale	
125.00	145.00	20.00	sandstone, grey	Sandstone	
145.00	146.00	1.00	shale	Shale	
146.00	180.00	34.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

NSW OFFICE OF WATER
Work Summary

GW108831

***** End of GW108831 *****

APPENDIX C – HISTORICAL AERIAL PHOTOGRAPHS

DATE 26/08/2014

0 100 200 400 600 800 1,000
Metres
1:25,000

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1930

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

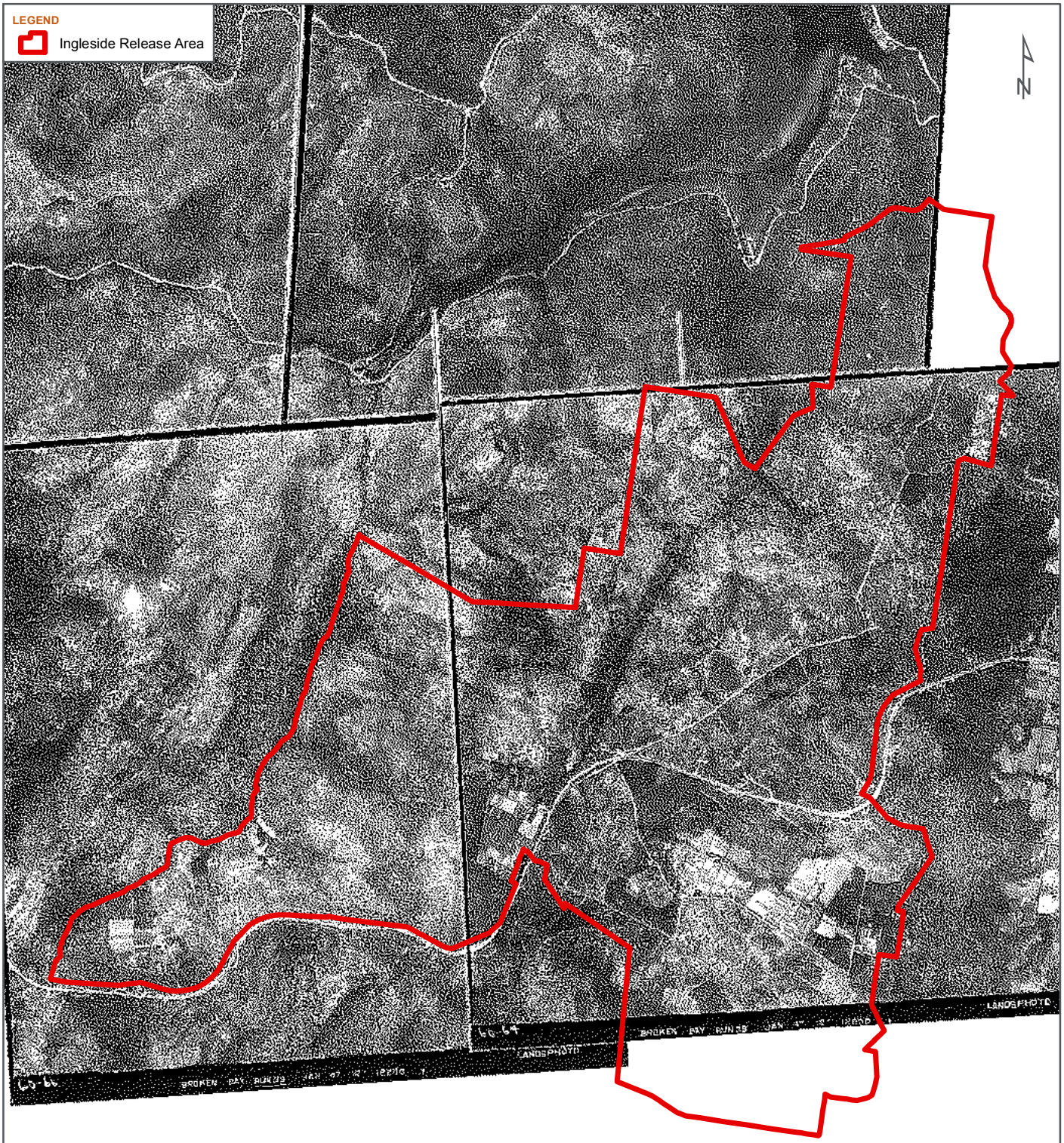
SOURCES Vector backdrop data © MDS 2013

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\A_1930.mxd

Last updated by: RC10721 on 26/08/2014 at 14:52

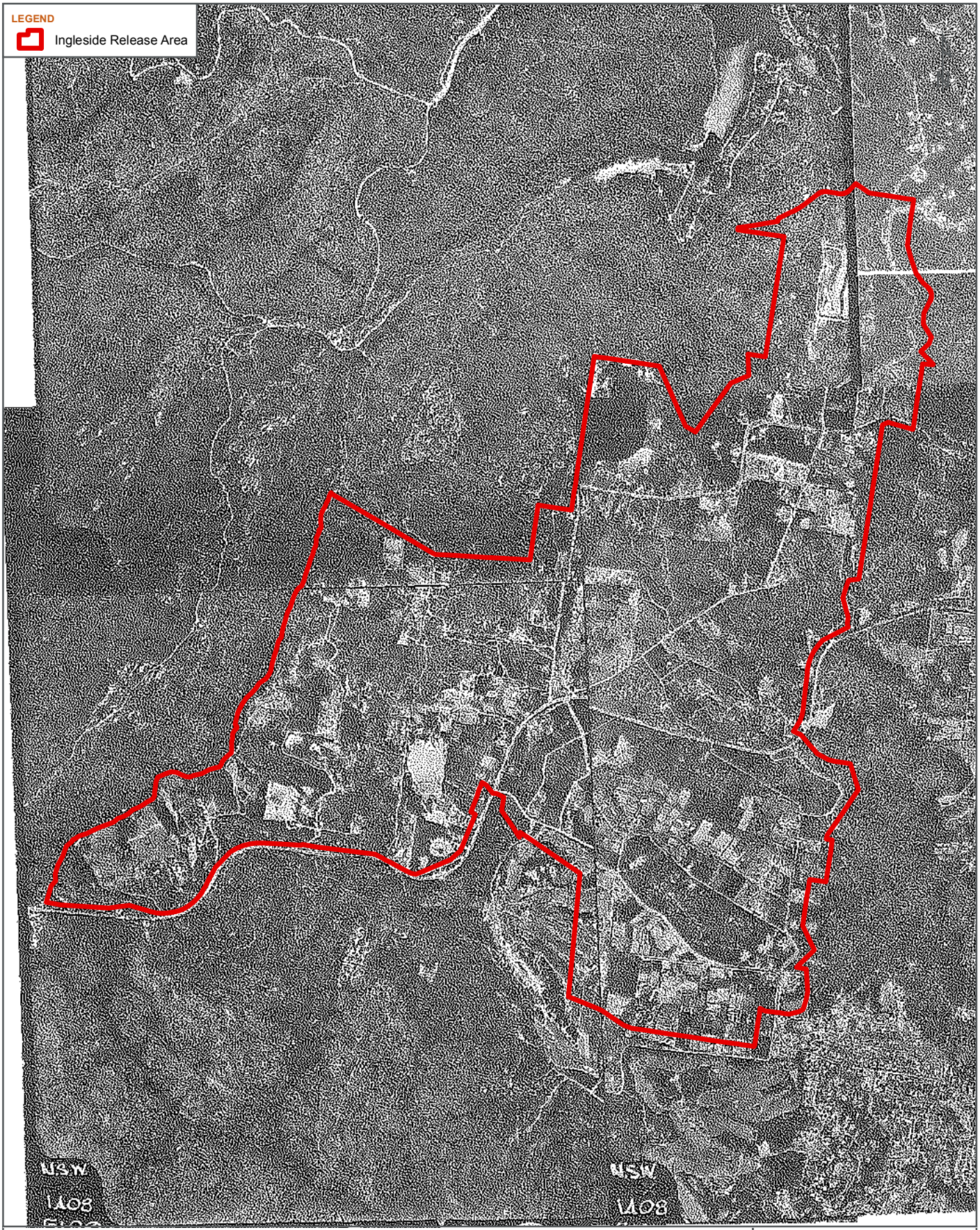
LEGEND

Ingleside Release Area



DATE 26/08/2014	0 100 200 400 600 800 1,000 1:25,000 Metres	**PAGE SIZE** A4	**COORDINATE SYSTEM** GDA 1994 MGA Zone 56
APPENDIX C	**FIGURE TITLE** Aerial - 1947		
PROJECT NO. 30012289	**PROJECT TITLE** Ingleside Precinct		
CREATED BY R. Chatfield	**SOURCES** Vector backdrop data © MDS 2013		

SMEC



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1:25,000

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1965

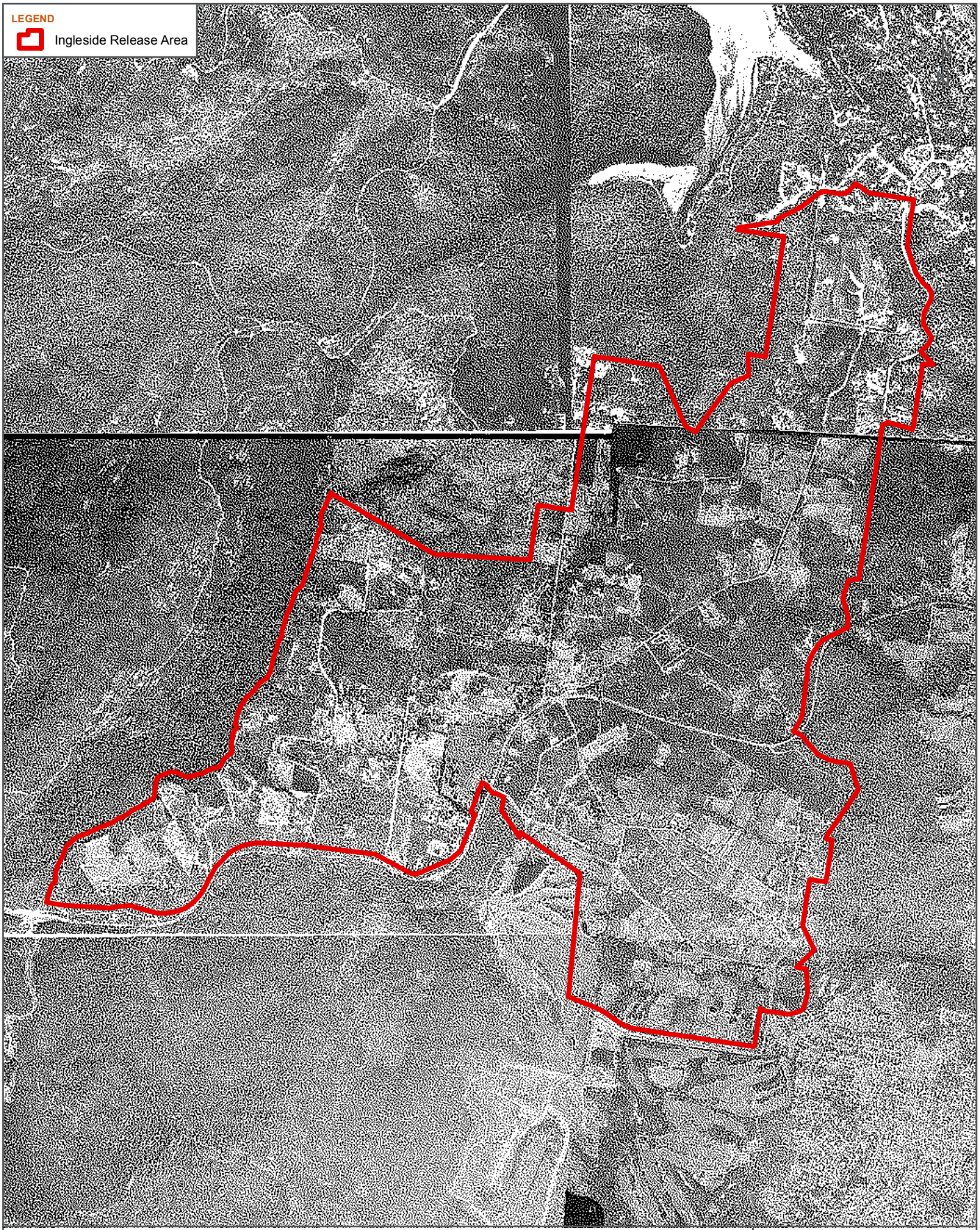
PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC



DATE 28/08/2014

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Metres
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PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1978

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC

DATE 26/08/2014

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Metres
1:25,000

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1991

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\E_1991.mxd

Last updated by: RC10721 on 26/08/2014 at 14:57

DATE 26/08/2014

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Metres
1:25,000

PAGE SIZE A4

COORDINATE SYSTEM GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 2012

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013

SMEC

APPENDIX D – LABORATORY SUMMARY TABLES

Table D1 - Soil Analytical Results (Contamination)

				BTEX								Lead	Metals							Organochlorine (OC) Pesticides																					
				Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene (Total)	Napthalene	Sum of BTEX	Lead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	Nickel	Zinc	4,4-DDE	alpha-BHC	Aldrin	Aldrin + Dieldrin	beta-BHC	Total Chlordane (sum)	Chlordane (trans)	d-BHC	4.4 DDD	4.4 DDT	DDT+DDE+DDD	Dieldrin	Hexachlorobenzene (HCB)	appha-Endosulfan	cis-Chlordane	Endrin aldehyde	Endrin ketone	beta-Endosulfan	Endosulfan sulphate
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR				0.2	0.5	0.5	0.5	0.5	0.5	1	0.2	5	5	1	2	5	0.1	2	5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Health Investigation Levels (NEPM 2013)																																								
NEPM 2013 HIL Residential A												300	100	20		6000	40	400	7400				6		50					240										
NEPM 2013 HIL Residential B												1200	500	150		30000	120	1200	60000				10		90					600										
NEPM 2013 HIL Residential C												600	300	90		17000	80	1200	30000				10		70					400										
NEPM 2013 HIL Residential D												1500	3000	900		240000	730	6000	400000				45		530					3600										
Ecological Screening Level for TPH																																								
NEPM 2013 ESLs for TPH in urban residential and public open space (fine)				65	125	105			45																															
NEPM 2013 ESLs for TPH in commercial/Industrial (fine)				95	185	135			95																															
Management Limits for TPH Fractions in soil (NEPM 2013)																																								
Urban residential/public open space (fine)																																								
Commercial/ Industrial (fine)																																								
Ecological Investigation Levels																																								
NEPM 1999 EIL												600	20	3		100	1	60	200																					
NEPM 2013 ACL in public open space												1100	100		190	230		30	280									180											
Average concentration												21			9	11		3.8	45																					
NEPM EILs (Calculated Value ACL + Average)												1121			199	241		34	325																					
Field_ID	**Sampled_Date**	**SDG**	**Sample_Depth**																																						
S154	6/3/20114	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	36	<5	<1	15	26	<0.1	12	70	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S469	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	6	<5	<1	8	22	<0.1	<2	15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S444	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	6	10	<1	7	6	<0.1	3	13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S212	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	49	<5	<1	9	18	<0.1	6	98	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S38	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	<5	<5	<1	5	<5	<0.1	<2	<5	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S91	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	16	10	<1	21	8	<0.1	3	61	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S140	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	24	<5	<1	14	8	0.1	<2	73	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S164	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	35	<5	<1	18	16	<0.1	16	98	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S41	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	47	<5	<1	6	12	<0.1	<2	50	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S15/1	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	15	<5	<1	6	14	<0.1	2	62	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S15/2 - Field Duplicate	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	33	<5	<1	9	18	<0.1	4	68	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S283	14/03/2014	ES1405891	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	8	<5	<1	<2	<5	<0.1	<2	10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S283/2 - Field Duplicate	14/03/2014	ES1405891	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	<5	<5	<1	4	<5	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S130	14/03/2014	ES1405891	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	10	<5	<1	6	<5	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Statistical Summary																																								
Number of Results				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Number of Detects				0	0	0	0	0	0	0	0	12	2	0	13	10	1	7	11	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Minimum Concentration				<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	<5	<5	<1	<2	<5	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Minimum Detect				ND	ND	ND	ND	ND	ND	ND	ND	6	10	ND	4	6	0.1	2	10	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration				<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	49	10	<1	21	26	0.1	16	98	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Maximum Detect				ND	ND	ND	ND	ND	ND	ND	ND	49	10	ND	21	26	0.1	16	98	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration				0.1	0.25	0.25	0.25	0.25	0.25	0.5	0.1	21	3.6	0.5	9.2	11	0.054	3.8	45	0.033	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.1	0.033	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Median Concentration				0.1	0.25	0.25	0.25	0.25	0.25	0.5	0.1	15.5	2.5	0.5	7.5	10	0.05	1.5	55.5	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Standard Deviation				0	0	0	0	0	0	0	0	16	2.7	0	5.7	7.9	0.013	4.6	36	0.028	0	0	0	0	0	0	0	0	0	0.028	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	6	0	0	4	7	0	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	6	0	0	4	7	0	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NEW NEPM acronyms:
ACLs = Added Contaminant Limits
ESLs = Ecological Screening Level
HSL = Health Screening Levels
EIL = Ecological Investigation Level
NL = Not Limiting
A&B = Low to high density residential
C = Residential / Open Space
D = Commercial / Industrial

Table D1 - Soil Analytical Results (Contamination)

						Organophosphorous (OP) Pesticides																			PCB	PAH/Ph										
	Endrin	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Dichlorvos	Demeton-S-methyl	Monocrotophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl	Total Polychlorinated biphenyls	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(a)pyrene TEQ (zero)	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(k)fluoranthene	Benzo(b)fluoranthene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	0.05	0.05	0.05	0.05	0.2	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Health Investigation Levels (NEPM 2013)																																			
NEPM 2013 HIL Residential A	10		6		300																														
NEPM 2013 HIL Residential B	20		10		500																														
NEPM 2013 HIL Residential C	20		10		400																														
NEPM 2013 HIL Residential D	100		50		2500																														
Ecological Screening Level for TPH																																			
NEPM 2013 ESLs for TPH in urban residential and public open space (fine)																													0.7						
NEPM 2013 ESLs for TPH in commercial/Industrial (fine)																													1.4						
Management Limits for TPH Fractions in soil (NEPM 2013)																																			
Urban residential/public open space (fine)																																			
Commercial/ Industrial (fine)																																			
Ecological Investigation Levels																																			
NEPM 1999 EIL																																			
NEPM 2013 ACL in public open space																																			
Average concentration																																			
NEPM EILs (Calculated Value ACL + Average)																																			
Field_ID	**Sampled_Date**	**SDG**	**Sample_Depth**																																	
S154	6/3/20114	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	0.6	0.7	0.9	1.2	1.5	<0.5	0.9
S469	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S444	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S212	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S38	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S91	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S140	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S164	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S41	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S15/1	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S15/2 - Field Duplicate	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S283	14/03/2014	ES1405891	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S283/2 - Field Duplicate	14/03/2014	ES1405891	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S130	14/03/2014	ES1405891	0-0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
Statistical Summary																																			
Number of Results	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	14	14	0	1
Minimum Concentration	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6	0.7	0.9	0.6	1.2	ND	0.9
Maximum Concentration	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	0.6	0.7	0.9	0.6	1.2	1.5	<0.5	0.9
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6	0.7	0.9	1.2	1.5	ND	0.9
Average Concentration	0.025	0.025	0.025	0.025	0.1	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.05	0.25	0.25	0.25	0.28	0.28	0.3	0.64	1.2	0.25	0.3
Median Concentration	0.025	0.025	0.025	0.025	0.1	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.05	0.25	0.25	0.25	0.25	0.25	0.25	0.6	1.2	0.25	0.25
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.094	0.12	0.17	0.16	0.08	0	0.17
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NEW NEPM acronyms:
ACLs = Added Contaminant Limits
ESLs = Ecological Screening Level
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EIL = Ecological Investigation Level
NL = Not Limiting
A&B = Low to high density residential
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Table D1 - Soil Analytical Results (Contamination)

				PAHs										TRH							TPH				
				Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Sum of PAH	Pyrene	C6-C10 Fraction	C6-C10 Fraction minus BTEX (F1)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (sum)	>C10-C16 Fraction minus Naphthalene (F2)	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	10	10	50	100	100	50	50	10	50	100	100	50
Health Investigation Levels (NEPM 2013)																									
NEPM 2013 HIL Residential A																									
NEPM 2013 HIL Residential B																									
NEPM 2013 HIL Residential C																									
NEPM 2013 HIL Residential D																									
Ecological Screening Level for TPH																									
NEPM 2013 ESLs for TPH in urban residential and public open space (fine)														180		120	1300	5600							
NEPM 2013 ESLs for TPH in commercial/Industrial (fine)														215		170	2500	6600							
Management Limits for TPH Fractions in soil (NEPM 2013)																									
Urban residential/public open space (fine)														800		1000	3500	10000							
Commercial/ Industrial (fine)														800		1000	5000	10000							
Ecological Investigation Levels																									
NEPM 1999 EIL																									
NEPM 2013 ACL in public open space										170															
Average concentration																									
NEPM EILs (Calculated Value ACL + Average)																									
Field_ID	**Sampled_Date**	**SDG**	**Sample_Depth**																						
S154	6/3/20114	ES1405222	0-0.2	0.6	0.6	<0.5	1.3	<0.5	<0.5	<0.5	0.8	6.9	1.4	<10	<10	<50	150	130	280	<50	<10	<50	<100	130	130
S469	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S444	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S212	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S38	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S91	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S140	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S164	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	1.3	0.6	<10	<10	<50	100	110	210	<50	<10	<50	<100	100	100
S41	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S15/1	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S15/2 - Field Duplicate	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	160	100	260	<50	<10	<50	120	110	230
S283	14/03/2014	ES1405891	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S283/2 - Field Duplicate	14/03/2014	ES1405891	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S130	14/03/2014	ES1405891	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
Statistical Summary																									
Number of Results				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Number of Detects				1	1	0	2	0	0	0	1	2	2	0	0	0	3	3	3	0	0	0	1	3	3
Minimum Concentration				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
Minimum Detect				0.6	0.6	ND	0.7	ND	ND	ND	0.8	1.3	0.6	ND	ND	ND	100	100	210	ND	ND	ND	120	100	100
Maximum Concentration				0.6	0.6	<0.5	1.3	<0.5	<0.5	<0.5	0.8	6.9	1.4	<10	<10	<50	160	130	280	<50	<10	<50	120	130	230
Maximum Detect				0.6	0.6	ND	1.3	ND	ND	ND	0.8	6.9	1.4	ND	ND	ND	160	130	280	ND	ND	ND	120	130	230
Average Concentration				0.28	0.28	0.25	0.36	0.25	0.25	0.25	0.29	0.8	0.36	5	5	25	69	64	73	25	5	25	55	64	53
Median Concentration				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	5	5	25	50	50	25	25	5	25	50	50	25
Standard Deviation				0.094	0.094	0	0.3	0	0	0	0.15	1.8	0.31	0	0	0	39	28	97	0	0	0	19	28	61
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NEW NEPM acronyms:
ACLs = Added Contaminant Limits
ESLs = Ecological Screening Level
HSL = Health Screening Levels
EIL = Ecological Investigation Level
NL = Not Limiting
A&B = Low to high density residential
C = Residential / Open Space
D = Commercial / Industrial

	SDG	ES1405222	ES1405222	RPD (%)	ES1405891	ES1405891	RPD (%)
	Field ID	S15/1	S15/2		S283	S283/2	
	Date	6/03/2014	6/03/2014		14/03/2014	14/03/2014	
Group	ChemName	Units	LOR						
BTEX	Benzene	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Ethylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Toluene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Xylene (m & p)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Xylene (o)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Xylene (Total)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Napthalene	mg/kg	1	<1	<1	0	<1	<1	0
	Sum of BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
Lead	Lead	mg/kg	5	15	33	**75**	8	<5	**105**
Metals	Arsenic	mg/kg	5	<5	<5	0	<5	<5	0
	Cadmium	mg/kg	1	<1	<1	0	<1	<1	0
	Chromium (III+VI)	mg/kg	2	6	9	40	<2	4	**120**
	Copper	mg/kg	5	14	18	25	<5	<5	0
	Mercury	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	Nickel	mg/kg	2	2	4	**67**	<2	<2	0
	Zinc	mg/kg	5	62	68	9	10	<5	**120**
Organochlorine (OC) Pesticides	4,4-DDE	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	alpha-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Aldrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Aldrin + Dieldrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	beta-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Total Chlordane (sum)	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Chlordane (trans)	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	d-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	4.4 DDD	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	4.4 DDT	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	DDT+DDE+DDD	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Dieldrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Hexachlorobenzene (HCB)	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	appha-Endosulfan	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	cis-Chlordane	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Endrin aldehyde	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Endrin ketone	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	beta-Endosulfan	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Endosulfan sulphate	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Endrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	g-BHC (Lindane)	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Heptachlor	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Heptachlor epoxide	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Methoxychlor	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
Organophosphorous (OP) Pesticides	Dichlorvos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Demeton-S-methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Monocrotophos	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Dimethoate	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Diazinon	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Chlorpyrifos-methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Parathion-methyl	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Malathion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Fenthion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Chlorpyrifos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Parathion	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
	Pirimphos-ethyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Bromophos-ethyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Fenamiphos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Prothiofos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Ethion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Carbophenothion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Azinphos Methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
PCB	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0
PAH/Phenols	Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a) pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a)pyrene TEQ (zero)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(a)pyrene TEQ (half LOR)	mg/kg	0.5	0.6	0.6	0	0.6	0.6	0
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0
	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Chrysene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Naphthalene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Sum of PAH	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
TRH	C6-C10 Fraction	mg/kg	10	<10	<10	0	<10	<10	0
	C6-C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	0	<10	<10	0
	>C10-C16 Fraction	mg/kg	50	<50	<50	0	<50	<50	0
	>C16-C34 Fraction	mg/kg	100	<100	160	46	<100	<100	0
	>C34-C40 Fraction	mg/kg	100	<100	100	**67**	<100	<100	0
	>C10-C40 Fraction (sum)	mg/kg	50	<50	260	**165**	<50	<50	0
	>C10-C16 Fraction minus Naphthalene (F2)	mg/kg	50	<50	<50	0	<50	<50	0
TPH	C6 - C9	mg/kg	10	<10	<10	0	<10	<10	0
	C10 - C14	mg/kg	50	<50	<50	0	<50	<50	0
	C15 - C28	mg/kg	100	<100	120	**82**	<100	<100	0
	C29-C36	mg/kg	100	<100	110	**75**	<100	<100	0
	+C10 - C36 (Sum of total)	mg/kg	50	<50	230	**161**	<50	<50	0

Note: Where RPD are above 30%, this is attributable to the heterogeneous nature of the materials sampled and not a reflection of the analytical methods used. Therefore, the results are considered to be an acceptable reflection of site conditions.

Table D3 - Soil Analytical Results (Salinity)

				Salinity							
				Electrical Conductivity @ 25°C	Electrical Conductivity @ 25°C	Applied soil conversion factor of 8.6 (silty clay)	Calculated ECe	pH	Moisture	Sulfate as SO4	Chloride
				µS/cm	mS/cm	NA	mS/cm	pH Unit	%	mg/kg	mg/kg
LOR				1	1	NA	1	0.1	1	10	10
Non Saline							<2				
Slightly saline							2 - 4				
Moderately saline							4 - 8				
Very saline							8 - 16				
Highly saline							>16				
Field_ID	**Sampled_Date**	**SDG**	**Sample Depth**								
S212	6/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2	-	-	-	-
S262	6/03/2014	ES1405223	0-0.2	16	0.016	8.6	0.1	-	-	-	-
S287	6/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2				
S314	6/03/2014	ES1405223	0-0.2	64	0.064	8.6	0.6	-	-	-	-
S338	6/03/2014	ES1405223	0-0.2	22	0.022	8.6	0.2				
S339	6/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2				
S340	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1				
S315	6/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2	-	-	-	-
S364	6/03/2014	ES1405223	0-0.2	80	0.08	8.6	0.7				
S393	6/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2				
S392	6/03/2014	ES1405223	0-0.2	18	0.018	8.6	0.2				
S394	6/03/2014	ES1405223	0-0.2	45	0.045	8.6	0.4				
S369	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S418	6/03/2014	ES1405223	0-0.2	28	0.028	8.6	0.2				
S469	6/03/2014	ES1405223	0-0.2	77	0.077	8.6	0.7				
S444	6/03/2014	ES1405223	0-0.2	112	0.112	8.6	1.0				
S419	6/03/2014	ES1405223	0-0.2	35	0.035	8.6	0.3				
S367	6/03/2014	ES1405223	0-0.2	17	0.017	8.6	0.1				
S342	6/03/2014	ES1405223	0-0.2	42	0.042	8.6	0.4	-	-	-	-
S293	6/03/2014	ES1405223	0-0.2	22	0.022	8.6	0.2	-	-	-	-
S292	6/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2	-	-	-	-
S133	4/03/2014	ES1405223	0-0.2	64	0.064	8.6	0.6	-	-	-	-
S158	4/03/2014	ES1405223	0-0.2	24	0.024	8.6	0.2	-	-	-	-
S179	4/03/2014	ES1405223	0-0.2	11	0.011	8.6	0.1				
S154	4/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2				
S131	4/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1				
S155	4/03/2014	ES1405223	0-0.2	22	0.022	8.6	0.2				
S181	4/03/2014	ES1405223	0-0.2	29	0.029	8.6	0.2				
S206	4/03/2014	ES1405223	0-0.2	122	0.122	8.6	1.0				
S231	4/03/2014	ES1405223	0-0.2	33	0.033	8.6	0.3				
S281	4/03/2014	ES1405223	0-0.2	21	0.021	8.6	0.2				
S282	4/03/2014	ES1405223	0-0.2	17	0.017	8.6	0.1				
S307	4/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2				
S256	4/03/2014	ES1405223	0-0.2	17	0.017	8.6	0.1				
S230	4/03/2014	ES1405223	0-0.2	27	0.027	8.6	0.2				
S15/1	4/03/2014	ES1405223	0-0.2	80	0.08	8.6	0.7	6.9	12.7	60	20
S15/2 - Field Duplicate	4/03/2014	ES1405223	0-0.2	126	0.126	8.6	1.1	6.3	36.7	210	50
S91	6/03/2014	ES1405223	0-0.2	76	0.076	8.6	0.7	-	-	-	-
S140	6/03/2014	ES1405223	0-0.2	34	0.034	8.6	0.3	-	-	-	-
S164	6/03/2014	ES1405223	0-0.2	45	0.045	8.6	0.4	-	-	-	-
S166	6/03/2014	ES1405223	0-0.2	21	0.021	8.6	0.2	-	-	-	-
S142	6/03/2014	ES1405223	0-0.2	20	0.02	8.6	0.2	-	-	-	-
S41	6/03/2014	ES1405223	0-0.2	31	0.031	8.6	0.3	-	-	-	-
S167	6/03/2014	ES1405223	0-0.2	58	0.058	8.6	0.5	-	-	-	-
S92	6/03/2014	ES1405223	0-0.2	25	0.025	8.6	0.2	-	-	-	-
S163	6/03/2014	ES1405223	0-0.2	8	0.008	8.6	0.1	-	-	-	-
S118	6/03/2014	ES1405223	0-0.2	44	0.044	8.6	0.4	-	-	-	-
S114	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S117	6/03/2014	ES1405223	0-0.2	33	0.033	8.6	0.3	-	-	-	-
S65	6/03/2014	ES1405223	0-0.2	16	0.016	8.6	0.1	-	-	-	-
S63	6/03/2014	ES1405223	0-0.2	33	0.033	8.6	0.3	-	-	-	-
S89	6/03/2014	ES1405223	0-0.2	37	0.037	8.6	0.3	-	-	-	-
S143	6/03/2014	ES1405223	0-0.2	44	0.044	8.6	0.4	-	-	-	-
S165	6/03/2014	ES1405223	0-0.2	214	0.214	8.6	1.8	-	-	-	-
S38	6/03/2014	ES1405223	0-0.2	11	0.011	8.6	0.1	-	-	-	-
S90	6/03/2014	ES1405223	0-0.2	36	0.036	8.6	0.3	-	-	-	-
S113	6/03/2014	ES1405223	0-0.2	96	0.096	8.6	0.8	-	-	-	-
S168	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S284	14/03/2014	ES1405892	0-0.2	33	0.033	8.6	0.3				
285	14/03/2014	ES1405892	0-0.2	21	0.021	8.6	0.2				
286	14/03/2014	ES1405892	0-0.2	18	0.018	8.6	0.2	-	-	-	-
261	14/03/2014	ES1405892	0-0.2	107	0.107	8.6	0.9	-	-	-	-
260	14/03/2014	ES1405892	0-0.2	20	0.02	8.6	0.2				
259	14/03/2014	ES1405892	0-0.2	22	0.022	8.6	0.2				
236	14/03/2014	ES1405892	0-0.2	116	0.116	8.6	1.0	-	-	-	-
235	14/03/2014	ES1405892	0-0.2	30	0.03	8.6	0.3	-	-	-	-
283	14/03/2014	ES1405892	0-0.2	6	0.006	8.6	0.1				
283/2 - Field Duplicate	14/03/2014	ES1405892	0-0.2	7	0.007	8.6	0.1				
208	14/03/2014	ES1405892	0-0.2	19	0.019	8.6	0.2	-	-	-	-
182	14/03/2014	ES1405892	0-0.2	15	0.015	8.6	0.1	-	-	-	-
132	14/03/2014	ES1405892	0-0.2	12	0.012	8.6	0.1				
130	14/03/2014	ES1405892	0-0.2	16	0.016	8.6	0.1	-	-	-	-
Statistical Summary											
Number of Results				72	72	NA	72	2	2	2	2
Number of Detects				72	72	NA	72	2	2	2	2
Minimum Concentration				6	0.006	NA	0.0516	6.3	12.7	60	20
Minimum Detect				6	0.006	NA	0.0516	6.3	12.7	60	20
Maximum Concentration				214	0.214	NA	1.8404	6.9	36.7	210	50
Maximum Detect				214	0.214	NA	1.8404	6.9	36.7	210	50
Average Concentration				38	0.038	NA	0.33	NA	NA	NA	NA
Median Concentration				23	0.023	NA	0.1978	6.6	24.7	135	35
Standard Deviation				36	0.036	NA	0.31	NA	NA	NA	NA
Number of Guideline Exceedances				0	0	NA	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	NA	0	0	0	0	0

* Average Soil Coversion Factor 'Silty Clay' - P. A. and Murphy, B. W, 2007 (Table 5.33)

Table D4 - RPD Results (Salinity)

SDG	ES1405223	ES1405223	RPD (%)	ES1405892	ES1405892	RPD (%)
Field ID	S15/1	S15/2		S283	S283/2	
Date	6/03/2014	6/03/2014		14/03/2014	14/03/2014	

Group	Analyte	Units	LOR						
Salinity	Electrical Conductivity @ 25℃	µS/cm	1	80	126	0	6	7	0
	pH	pH Unit	0.1	6.9	6.3	9	--	--	--
	Moisture	%	1	12.7	36.7	**97**	--	--	--
	Sulfate as SO4	mg/kg	10	60	210	**111**	--	--	--
	Chloride	mg/kg	10	20	50	**86**	--	--	--

Note: Where RPD are above 30%, this is attributable to the heterogeneous nature of the materials sampled and not a reflection of the analytical methods used Therefore, the results are considered to be an acceptable reflection of site conditions.

APPENDIX E – LABORATORY REPORTS

SMEC Aust

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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- ☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: makay@alsglobal.com
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- ☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- ☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- ☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- ☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC Testing

OFFICE: 14/1 Cowpasture Pl.

PROJECT: 15580 / 40030C

PURCHASE ORDER NUMBER: 10818

PROJECT MANAGER:

CONTACT PH:

SAMPLER: J. Kerr

SAMPLER MOBILE: 0409036355

COC emailed to ALS? (YES / NO)

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

☐ Standard TAT (List due date):

☒ Non Standard or urgent TAT (List due date): 19/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: (1) 2 3 4 5 6 7

OF: (1) 2 3 4 5 6 7

RELINQUISHED BY: JK

DATE/TIME:

RECEIVED BY: [illegible]

DATE/TIME: 11/3/14 6:30pm

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comment:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	S-16								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	S154	6/3/14	S	Jar / Ice		—								
2	S469					—								
3	S444					—								
4	S212					—								
5	S38					—								
6	S91					—								
7	S140					—								
8	S164					—								
9	S41					—								
10	S15/1					—								
11	S15/2					—								
				TOTAL										

Environmental Division
Sydney
Work Order
ES1405222
Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic;
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order	: **ES1405222**	Page	: 1 of 15
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 4030C	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 10818		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: J. KERR	Issue Date	: 19-MAR-2014
Site	: ----		
		No. of samples received	: 11
Quote number	: EN/025/13	No. of samples analysed	: 11

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
- Surrogate Control 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*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

- **ALS is not NATA accredited for the analysis of Bifenthrin in soils when performed under ALS Method EP068D**
- **EP068: Pozitive results on sample #S38 confirmed by re-extraction and re-analysis.**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	S154	S469	S444	S212	S38
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
					ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		**26.6**	**9.6**	**12.3**	**20.6**	**11.2**
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	<5	**10**	<5	<5
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		**15**	**8**	**7**	**9**	**5**
Copper	7440-50-8	5	mg/kg		**26**	**22**	**6**	**18**	<5
Lead	7439-92-1	5	mg/kg		**36**	**6**	**6**	**49**	<5
Nickel	7440-02-0	2	mg/kg		**12**	<2	**3**	**6**	<2
Zinc	7440-66-6	5	mg/kg		**70**	**15**	**13**	**98**	<5
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ **Total Chlordane (sum)**	----	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	**0.13**
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	S154	S469	S444	S212	S38
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
					ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP068A: Organochlorine Pesticides (OC) - Continued									
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	----	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	**0.13**
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		**0.8**	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		**1.3**	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		**1.4**	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		**0.6**	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client sample ID	S154	S469	S444	S212	S38
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
					ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	0.5	mg/kg		**0.6**	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		**0.9**	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		**0.7**	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		**0.6**	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		**6.9**	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		**0.9**	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**1.2**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.5**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		**130**	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		**130**	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		**150**	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		**130**	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		**280**	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	S154	S469	S444	S212	S38
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
					ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP080: BTEXN - Continued									
^ **Total Xylenes**	1330-20-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**75.0**	**86.0**	**73.0**	**70.0**	**70.0**
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		**84.2**	**91.0**	**78.2**	**79.5**	**84.6**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		**74.3**	**104**	**85.7**	**55.7**	**110**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**95.4**	**97.9**	**98.1**	**98.3**	**96.2**
2-Chlorophenol-D4	93951-73-6	0.1	%		**87.3**	**91.8**	**90.3**	**93.9**	**92.1**
2.4.6-Tribromophenol	118-79-6	0.1	%		**98.8**	**95.6**	**92.0**	**97.7**	**89.2**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**96.8**	**98.9**	**97.6**	**98.5**	**100**
Anthracene-d10	1719-06-8	0.1	%		**77.4**	**81.6**	**80.1**	**83.6**	**78.4**
4-Terphenyl-d14	1718-51-0	0.1	%		**79.4**	**85.7**	**82.4**	**87.4**	**84.5**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**84.9**	**94.5**	**114**	**97.2**	**91.4**
Toluene-D8	2037-26-5	0.1	%		**77.2**	**87.0**	**89.1**	**91.6**	**84.2**
4-Bromofluorobenzene	460-00-4	0.1	%		**86.0**	**93.1**	**97.6**	**98.2**	**90.6**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S91	S140	S164	S41	S15/1
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit		ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		15.8	15.6	15.0	20.3	14.3
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		10	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		21	14	18	6	6
Copper	7440-50-8	5	mg/kg		8	8	16	12	14
Lead	7439-92-1	5	mg/kg		16	24	35	47	15
Nickel	7440-02-0	2	mg/kg		3	<2	16	<2	2
Zinc	7440-66-6	5	mg/kg		61	73	98	50	62
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S91	S140	S164	S41	S15/1
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit		ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP068A: Organochlorine Pesticides (OC) - Continued									
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	**0.7**	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	**0.6**	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S91	S140	S164	S41	S15/1
				Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit		ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	**1.3**	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	**100**	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	**100**	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	**100**	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	**110**	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	**210**	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID: S91	S140	S164	S41	S15/1
				Client sampling date / time: 06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
				ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP080: BTEXN - Continued								
^ **Total Xylenes**	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**80.0**	**83.0**	**92.0**	**92.0**	**97.0**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	**81.8**	**90.8**	**93.4**	**74.9**	**78.0**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	**84.5**	**102**	**89.6**	**86.9**	**75.4**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	**100**	**95.9**	**98.4**	**93.9**	**93.8**
2-Chlorophenol-D4	93951-73-6	0.1	%	**90.4**	**87.8**	**91.7**	**87.8**	**91.8**
2.4.6-Tribromophenol	118-79-6	0.1	%	**95.8**	**91.1**	**94.9**	**97.7**	**87.6**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**98.2**	**95.4**	**103**	**98.0**	**98.2**
Anthracene-d10	1719-06-8	0.1	%	**81.5**	**79.0**	**76.8**	**79.5**	**81.1**
4-Terphenyl-d14	1718-51-0	0.1	%	**85.5**	**81.1**	**78.5**	**82.1**	**82.9**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**114**	**98.6**	**96.7**	**96.3**	**95.2**
Toluene-D8	2037-26-5	0.1	%	**95.4**	**94.3**	**90.9**	**94.3**	**89.4**
4-Bromofluorobenzene	460-00-4	0.1	%	**103**	**100**	**95.4**	**94.7**	**95.7**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID: S15/2	----	----	----	----
				Client sampling date / time: 06-MAR-2014 15:00	----	----	----	----
				ES1405222-011	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**32.2**	----	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**9**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**18**	----	----	----	----
Lead	7439-92-1	5	mg/kg	**33**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**4**	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**68**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
^ **Total Chlordane (sum)**	----	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID: S15/2	----	----	----	----
				Client sampling date / time: 06-MAR-2014 15:00	----	----	----	----
				ES1405222-011	----	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----
^ **Sum of DDD + DDE + DDT**	----	0.05	mg/kg	<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	----	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	----	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	----	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S15/2	----	----	----	----
			Client sampling date / time	06-MAR-2014 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1405222-011	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg	**120**	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg	**110**	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**230**	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	----	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	**160**	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	**100**	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**260**	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg	<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S15/2	----	----	----	----
			Client sampling date / time	06-MAR-2014 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1405222-011	----	----	----	----
EP080: BTEXN - Continued								
^ **Total Xylenes**	1330-20-7	0.5	mg/kg	<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	----	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**102**	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	**84.1**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	**102**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	**92.2**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	**89.2**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%	**96.6**	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**97.6**	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%	**80.7**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	**84.0**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**92.6**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	**88.0**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**91.6**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

QUALITY CONTROL REPORT

Work Order	: **ES1405222**	Page	: 1 of 14
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 4030C	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: J. KERR	Issue Date	: 19-MAR-2014
Order number	: 10818		
		No. of samples received	: 11
Quote number	: EN/025/13	No. of samples analysed	: 11

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 ir compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney 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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 3335666)									
ES1405222-003	S444	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	12.3	11.6	5.6	0% - 50%
ES1405224-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	19.8	20.0	0.8	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 3341731)									
ES1405194-004	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	225	249	10.1	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	49	56	14.2	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	42	38	9.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	56	51	9.1	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	141	165	16.0	0% - 20%
ES1405199-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	360	306	16.3	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	81	71	13.0	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	45	44	3.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	65	61	6.5	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	282	302	6.8	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 3341733)									
ES1405222-004	S212	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	9	9	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	9	36.4	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	18	18	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	49	49	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	98	85	14.6	0% - 50%
ES1405224-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	25	28	11.8	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3341732)									
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405199-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **SOIL**

				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: 3341734)									
ES1405222-004	S212	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405224-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 3335080)									
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405222-011	S15/2	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3335079)									
ES1405222-001	S154	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES1405222-011	S15/2	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3335079) - continued									
ES1405222-011	S15/2	EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3335079)									
ES1405222-001	S154	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES1405222-011	S15/2	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3335079) - continued									
ES1405222-011	S15/2	EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3335631)									
ES1405194-003	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	0.9	1.0	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	4.1	4.9	18.1	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	2.2	3.0	30.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	1.5	2.1	31.7	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	0.9	1.1	25.9	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	1.0	1.3	22.2	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	0.6	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	10.6	14.0	# 27.6	0% - 20%
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES1405222-003	S444	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3335631) - continued									
ES1405222-003	S444	EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3334827)									
ES1405222-001	S154	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1405222-010	S15/1	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3335630)									
ES1405194-003	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	1040	1000	4.0	0% - 50%
		EP071: C29 - C36 Fraction	----	100	mg/kg	260	260	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	100	100	0.0	No Limit
ES1405222-003	S444	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3334827)									
ES1405222-001	S154	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES1405222-010	S15/1	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3335630)									
ES1405194-003	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	1110	1040	6.4	0% - 50%
		EP071: >C34 - C40 Fraction	----	100	mg/kg	150	130	18.5	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	200	250	24.2	No Limit
ES1405222-003	S444	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 3334827)									
ES1405222-001	S154	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1405222-010	S15/1	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	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: **SOIL**

				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
EG005T: Total Metals by ICP-AES (QCLot: 3341731)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	108	87	129
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	102	80	122
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	100	71	133
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	112	86	128
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	103	81	123
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	108	84	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	94.7	81	133
EG005T: Total Metals by ICP-AES (QCLot: 3341733)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	113	87	129
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	107	80	122
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	102	71	133
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	111	86	128
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	108	81	123
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	111	84	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	104	81	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	77.9	66	112
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341734)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	76.7	66	112
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3335080)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	87.0	57.4	117
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	80.6	71	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	93.8	66	122
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	88.2	69	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	82.6	71	115
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	86.6	65	113
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	87.5	68	116
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	83.8	68	118
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	85.5	68	116
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	86.5	68	120
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	76.4	69	119
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	78.9	67	121
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	80.8	66	118

Sub-Matrix: **SOIL**

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
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079) - continued								
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	82.6	69	117
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	77.4	67	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	84.4	76	120
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	83.8	76	120
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	82.9	57.3	115
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.2	60	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	100	67	127
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	87.3	65	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	106	65	129
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3335079)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	75.0	56	126
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	86.8	64	128
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	103	54	122
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	90.4	64	124
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	75.4	73	117
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	88.4	55	119
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	87.0	69	123
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	87.2	70	120
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	81.8	71	115
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	87.1	68	114
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	87.7	68	122
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	82.1	69	115
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	85.5	68	116
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	85.4	64	120
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	82.7	68	116
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	84.0	70	118
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	84.4	67	123
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	94.0	42	126
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	98.3	80	124
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	96.2	77	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	92.8	79	123
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	107	77	123
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	97.7	79	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	96.5	79	123
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	97.7	79	123
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	95.8	79	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	92.8	73	121
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	94.6	81	123

Sub-Matrix: **SOIL**

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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631) - continued								
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	79.8	70	118
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	82.8	77	123
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	91.4	76	122
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	80.1	71	113
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	78.8	71.7	113
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	77.7	72.4	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	79.3	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3335630)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	90.7	71	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	127	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	101	64	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3334827)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	73.2	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3335630)								
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	87.5	70	130
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	121	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	72.2	63	131
EP080: BTEXN (QCLot: 3334827)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	73.1	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	75.6	62	128
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	70.8	58	118
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	66.6	60	120
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	72.0	60	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	82.0	62	138

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: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005T: Total Metals by ICP-AES (QCLot: 3341731)							
ES1405194-004	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	97.3	70	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG005T: Total Metals by ICP-AES (QCLot: 3341731) - continued							
ES1405194-004	Anonymous	EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70	130
		EG005T: Copper	7440-50-8	125 mg/kg	121	70	130
		EG005T: Lead	7439-92-1	125 mg/kg	105	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	123	70	130
		EG005T: Zinc	7440-66-6	125 mg/kg	122	70	130
EG005T: Total Metals by ICP-AES (QCLot: 3341733)							
ES1405222-004	S212	EG005T: Arsenic	7440-38-2	50 mg/kg	113	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	109	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	112	70	130
		EG005T: Copper	7440-50-8	125 mg/kg	113	70	130
		EG005T: Lead	7439-92-1	125 mg/kg	109	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	105	70	130
		EG005T: Zinc	7440-66-6	125 mg/kg	98.0	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732)							
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	99.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341734)							
ES1405222-004	S212	EG035T: Mercury	7439-97-6	5 mg/kg	93.5	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3335080)							
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	84.0	70	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079)							
ES1405222-001	S154	EP068: gamma-BHC	58-89-9	0.5 mg/kg	98.2	70	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	102	70	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	99.9	70	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	104	70	130
		EP068: Endrin	72-20-8	2 mg/kg	85.4	70	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	81.3	70	130
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3335079)							
ES1405222-001	S154	EP068: Diazinon	333-41-5	0.5 mg/kg	106	70	130
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	74.2	70	130
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	100	70	130
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	102	70	130
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	75.5	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631)							
ES1405194-003	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	94.9	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	71.8	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827) - continued							
ES1405222-001	S154	EP080: C6 - C9 Fraction	----	32.5 mg/kg	80.5	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3335630)							
ES1405194-003	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	89.3	73	137
		EP071: C15 - C28 Fraction	----	3140 mg/kg	83.2	53	131
		EP071: C29 - C36 Fraction	----	2860 mg/kg	68.7	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3334827)							
ES1405222-001	S154	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	75.0	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3335630)							
ES1405194-003	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	114	73	137
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	74.8	53	131
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	53.6	52	132
EP080: BTEXN (QCLot: 3334827)							
ES1405222-001	S154	EP080: Benzene	71-43-2	2.5 mg/kg	72.3	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	78.5	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	78.3	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	74.2	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	79.9	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	77.8	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: **SOIL**

				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
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827)										
ES1405222-001	S154	EP080: C6 - C9 Fraction	----	32.5 mg/kg	80.5	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3334827)										
ES1405222-001	S154	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	75.0	----	70	130	----	----
EP080: BTEXN (QCLot: 3334827)										
ES1405222-001	S154	EP080: Benzene	71-43-2	2.5 mg/kg	72.3	----	70	130	----	----
		EP080: Toluene	108-88-3	2.5 mg/kg	78.5	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	78.3	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	74.2	----	70	130	----	----

Sub-Matrix: **SOIL**

				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
EP080: BTEXN (QCLot: 3334827) - continued										
ES1405222-001	S154	EP080: ortho-Xylene	95-47-6	2.5 mg/kg	79.9	----	70	130	----	----
		EP080: Naphthalene	91-20-3	2.5 mg/kg	77.8	----	70	130	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079)										
ES1405222-001	S154	EP068: gamma-BHC	58-89-9	0.5 mg/kg	98.2	----	70	130	----	----
		EP068: Heptachlor	76-44-8	0.5 mg/kg	102	----	70	130	----	----
		EP068: Aldrin	309-00-2	0.5 mg/kg	99.9	----	70	130	----	----
		EP068: Dieldrin	60-57-1	0.5 mg/kg	104	----	70	130	----	----
		EP068: Endrin	72-20-8	2 mg/kg	85.4	----	70	130	----	----
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	81.3	----	70	130	----	----
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3335079)										
ES1405222-001	S154	EP068: Diazinon	333-41-5	0.5 mg/kg	106	----	70	130	----	----
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	74.2	----	70	130	----	----
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	100	----	70	130	----	----
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	102	----	70	130	----	----
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	75.5	----	70	130	----	----
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3335080)										
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	84.0	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3335630)										
ES1405194-003	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	89.3	----	73	137	----	----
		EP071: C15 - C28 Fraction	----	3140 mg/kg	83.2	----	53	131	----	----
		EP071: C29 - C36 Fraction	----	2860 mg/kg	68.7	----	52	132	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3335630)										
ES1405194-003	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	114	----	73	137	----	----
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	74.8	----	53	131	----	----
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	53.6	----	52	132	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631)										
ES1405194-003	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	94.9	----	70	130	----	----
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	71.8	----	70	130	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3341731)										
ES1405194-004	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	97.3	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	----	70	130	----	----
		EG005T: Copper	7440-50-8	125 mg/kg	121	----	70	130	----	----
		EG005T: Lead	7439-92-1	125 mg/kg	105	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	123	----	70	130	----	----
		EG005T: Zinc	7440-66-6	125 mg/kg	122	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732)										

Sub-Matrix: **SOIL**

				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
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732) - continued										
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	99.9	----	70	130	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3341733)										
ES1405222-004	S212	EG005T: Arsenic	7440-38-2	50 mg/kg	113	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	109	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	112	----	70	130	----	----
		EG005T: Copper	7440-50-8	125 mg/kg	113	----	70	130	----	----
		EG005T: Lead	7439-92-1	125 mg/kg	109	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	105	----	70	130	----	----
		EG005T: Zinc	7440-66-6	125 mg/kg	98.0	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341734)										
ES1405222-004	S212	EG035T: Mercury	7439-97-6	5 mg/kg	93.5	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1405222**	Page	: 1 of 7
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 4030C	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: J. KERR	Issue Date	: 19-MAR-2014
Order number	: 10818		
		No. of samples received	: 11
Quote number	: EN/025/13	No. of samples analysed	: 11

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: **SOIL**

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
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**----**	----	----	**12-MAR-2014**	20-MAR-2014	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**17-MAR-2014**	02-SEP-2014	✓	**17-MAR-2014**	02-SEP-2014	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**17-MAR-2014**	03-APR-2014	✓	**18-MAR-2014**	03-APR-2014	✓
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**12-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	21-APR-2014	✓

Matrix: **SOIL**

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
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**12-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	21-APR-2014	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**12-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	21-APR-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP071)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**13-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	22-APR-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**13-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	22-APR-2014	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**12-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	20-MAR-2014	✓

Matrix: **SOIL**

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
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	**06-MAR-2014**	**12-MAR-2014**	20-MAR-2014	✓	**14-MAR-2014**	20-MAR-2014	✓

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: **SOIL**

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)							
Moisture Content	EA055-103	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	11	**18.2**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	17	**11.8**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	4	35	**11.4**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	4	32	**12.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	35	**5.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	32	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	35	**5.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	32	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	35	**5.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	32	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	**5.3**	**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
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. 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)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (2013) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 501)

Preparation Methods	Method	Matrix	Method Descriptions
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.

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: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	ES1405194-003	Anonymous	**Sum of polycyclic aromatic hydrocarbons**	----	27.6 %	0-20%	**RPD exceeds LOR based limits**
Matrix Spike (MS) Recoveries							
EG005T: Total Metals by ICP-AES	ES1405194-004	Anonymous	**Chromium**	7440-47-3	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 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.

- **No Analysis Holding Time Outliers exist.**

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.**

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

SNEC HAPT.

- ☐ ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
- ☐ BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
- ☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5600 E: gladstone@alsglobal.com
- ☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- ☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
- ☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- ☐ NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
- ☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
- ☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- ☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- ☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- ☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT:	SNEC Testing
OFFICE:	Wetherill Park
PROJECT:	15580
PURCHASE ORDER NUMBER:	10833
PROJECT MANAGER:	N/A
SAMPLER:	J. Lam.
SAMPLER MOBILE:	0409036300
CONTACT PH:	97562166
COC emailed to ALS? (YES / NO)	
EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):	
Email Invoice to (will default to PM if no other addresses are listed):	
COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:	

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

- ☐ Standard TAT (List due date):
- ☐ Non Standard or urgent TAT (List due date): 25/3/14.

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC:	1	2	3	4	5	6	7
OF:	1	2	3	4	5	6	7

FOR LABORATORY USE ONLY (Circle)

- Custody Seal Intact? Yes No N/A
- Free ice / frozen ice bricks present upon receipt? Yes No N/A
- Random Sample Temperature on Receipt: °C
- Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	Dav. J		
DATE/TIME:	DATE/TIME: 19/3 0830	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	S-16	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	S283	14/3/14	S	Jar / IC		✓	
2	S283/2					✓	
3	S130					✓	
				TOTAL			

Environmental Division Sydney Work Order **ES1405891** Telephone : + 61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic;
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order	: **ES1405891**	Page	: 1 of 7
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 10833		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 25-MAR-2014
Site	: ----		
		No. of samples received	: 3
Quote number	: EN/025/13	No. of samples analysed	: 3

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
- Surrogate Control 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*
		Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics

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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

- **ALS is not NATA accredited for the analysis of Bifenthrin in soils when performed under ALS Method EP068D**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S283	S283/2	S130	----	----
			Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405891-001	ES1405891-002	ES1405891-003	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**20.7**	**14.1**	**7.8**	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg	<2	**4**	**6**	----	----
Copper	7440-50-8	5	mg/kg	<5	<5	<5	----	----
Lead	7439-92-1	5	mg/kg	**8**	<5	**10**	----	----
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	----	----
Zinc	7440-66-6	5	mg/kg	**10**	<5	<5	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S283	S283/2	S130	----	----
				Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit		ES1405891-001	ES1405891-002	ES1405891-003	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	S283	S283/2	S130	----	----
				Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit		ES1405891-001	ES1405891-002	ES1405891-003	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	<50	<50	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S283	S283/2	S130	----	----
			Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405891-001	ES1405891-002	ES1405891-003	----	----
EP080: BTEXN - Continued								
^ **Total Xylenes**	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**106**	**94.8**	**86.7**	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	**79.2**	**83.4**	**76.1**	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	**95.9**	**116**	**85.5**	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	**99.7**	**99.3**	**101**	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	**89.6**	**90.5**	**92.8**	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%	**83.8**	**81.3**	**82.5**	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**89.6**	**90.5**	**93.1**	----	----
Anthracene-d10	1719-06-8	0.1	%	**78.6**	**78.7**	**81.4**	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	**79.0**	**81.2**	**82.7**	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**92.4**	**106**	**109**	----	----
Toluene-D8	2037-26-5	0.1	%	**81.2**	**98.2**	**98.8**	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**88.8**	**108**	**106**	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

QUALITY CONTROL REPORT

Work Order	: **ES1405891**	Page	: 1 of 12
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 25-MAR-2014
Order number	: 10833		
		No. of samples received	: 3
Quote number	: EN/025/13	No. of samples analysed	: 3

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 ir compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
		Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics

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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 3350010)									
ES1405883-009	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	11.2	10.2	9.3	0% - 50%
ES1405938-008	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	20.3	18.7	7.9	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 3351439)									
ES1405739-002	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	8	7	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	8	7	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	6	5	21.4	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	15	6	83.7	No Limit
ES1405891-001	S283	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	4	70.5	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	8	9	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	10	9	15.6	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3351440)									
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405891-001	S283	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 3349459)									
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3349458)									
ES1405891-001	S283	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3349458) - continued									
ES1405891-001	S283	EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3349458)									
ES1405891-001	S283	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3347805)									
ES1405601-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	1.0	0.8	18.4	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	1.2	1.1	8.9	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	1.0	0.8	20.6	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	0.6	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	0.7	0.5	20.7	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	0.6	0.6	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3347805) - continued									
ES1405601-001	Anonymous	EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	5.1	3.8	29.2	0% - 50%
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES1405891-003	S130	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3347806)									
ES1405601-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	350	310	10.2	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	220	210	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1405891-003	S130	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3347810)									
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1405883-002	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3347806)									
ES1405601-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	480	440	8.5	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	150	150	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3347806) - continued									
ES1405601-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	50	<50	0.0	No Limit
ES1405891-003	S130	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3347810)									
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES1405883-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080: BTEXN (QC Lot: 3347810)									
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1405883-002	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	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: **SOIL**

				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
EG005T: Total Metals by ICP-AES (QCLot: 3351439)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	112	87	129
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	107	80	122
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	102	71	133
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	113	86	128
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	105	81	123
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	110	84	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	114	81	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3351440)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	90.5	66	112
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	82.0	57.4	117
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	80.4	71	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	94.6	66	122
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	101	69	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	98.7	71	115
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	89.2	65	113
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	88.8	68	116
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	80.9	68	118
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	92.4	68	116
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	105	68	120
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.0	69	119
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	88.4	67	121
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	89.9	66	118
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	69	117
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.7	67	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	92.6	76	120
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	100	76	120
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	89.5	57.3	115
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	87.2	60	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	96.1	67	127
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	88.1	65	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	102	65	129
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458)								

Sub-Matrix: **SOIL**

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
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458) - continued								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	74.0	56	126
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	78.6	64	128
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	78.3	54	122
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	80.9	64	124
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	86.5	73	117
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	91.6	55	119
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	89.3	69	123
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	98.7	70	120
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	90.4	71	115
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	94.3	68	114
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	105	68	122
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	94.9	69	115
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	97.9	68	116
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	89.7	64	120
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	94.5	68	116
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	96.8	70	118
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	90.7	67	123
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	97.1	42	126
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3347805)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	101	80	124
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	95.3	77	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	99.0	79	123
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	97.6	77	123
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	103	79	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	101	79	123
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	98.5	79	123
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	100	79	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	92.0	73	121
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	98.4	81	123
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	88.8	70	118
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	101	77	123
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	90.1	76	122
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	83.5	71	113
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	83.5	71.7	113
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	81.4	72.4	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347806)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	109	71	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	96.0	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	93.6	64	128

Sub-Matrix: **SOIL**

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
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347810)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	83.2	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347806)								
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	94.4	70	130
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	94.7	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	114	63	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347810)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	80.3	68.4	128
EP080: BTEXN (QCLot: 3347810)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	87.5	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	92.2	62	128
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	86.2	58	118
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	83.0	60	120
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	90.3	60	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	85.5	62	138

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: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005T: Total Metals by ICP-AES (QCLot: 3351439)							
ES1405739-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	105	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	105	70	130
		EG005T: Copper	7440-50-8	125 mg/kg	106	70	130
		EG005T: Lead	7439-92-1	125 mg/kg	104	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	97.6	70	130
		EG005T: Zinc	7440-66-6	125 mg/kg	101	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3351440)							
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.4	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459)							
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	91.0	70	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458)							
ES1405891-001	S283						

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458) - continued							
ES1405891-001	S283	EP068: gamma-BHC	58-89-9	0.5 mg/kg	96.3	70	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	95.6	70	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	101	70	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	109	70	130
		EP068: Endrin	72-20-8	2 mg/kg	105	70	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	75.7	70	130
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458)							
ES1405891-001	S283	EP068: Diazinon	333-41-5	0.5 mg/kg	103	70	130
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	76.7	70	130
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	103	70	130
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	107	70	130
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	91.4	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3347805)							
ES1405601-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	91.1	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	84.1	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347806)							
ES1405601-001	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	86.8	73	137
		EP071: C15 - C28 Fraction	----	3140 mg/kg	80.2	53	131
		EP071: C29 - C36 Fraction	----	2860 mg/kg	74.8	52	132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347810)							
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	77.3	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347806)							
ES1405601-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	96.0	73	137
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	71.4	53	131
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	57.4	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347810)							
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.5	70	130
EP080: BTEXN (QCLot: 3347810)							
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	73.4	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	75.8	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	74.0	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	72.3	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	74.8	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	76.6	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: **SOIL**

				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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3347805)										
ES1405601-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	91.1	----	70	130	----	----
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	84.1	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347806)										
ES1405601-001	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	86.8	----	73	137	----	----
		EP071: C15 - C28 Fraction	----	3140 mg/kg	80.2	----	53	131	----	----
		EP071: C29 - C36 Fraction	----	2860 mg/kg	74.8	----	52	132	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347806)										
ES1405601-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	96.0	----	73	137	----	----
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	71.4	----	53	131	----	----
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	57.4	----	52	132	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347810)										
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	77.3	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347810)										
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.5	----	70	130	----	----
EP080: BTEXN (QCLot: 3347810)										
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	73.4	----	70	130	----	----
		EP080: Toluene	108-88-3	2.5 mg/kg	75.8	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	74.0	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	72.3	----	70	130	----	----
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	74.8	----	70	130	----	----
		EP080: Naphthalene	91-20-3	2.5 mg/kg	76.6	----	70	130	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458)										
ES1405891-001	S283	EP068: gamma-BHC	58-89-9	0.5 mg/kg	96.3	----	70	130	----	----
		EP068: Heptachlor	76-44-8	0.5 mg/kg	95.6	----	70	130	----	----
		EP068: Aldrin	309-00-2	0.5 mg/kg	101	----	70	130	----	----
		EP068: Dieldrin	60-57-1	0.5 mg/kg	109	----	70	130	----	----
		EP068: Endrin	72-20-8	2 mg/kg	105	----	70	130	----	----
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	75.7	----	70	130	----	----
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458)										
ES1405891-001	S283	EP068: Diazinon	333-41-5	0.5 mg/kg	103	----	70	130	----	----
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	76.7	----	70	130	----	----
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	103	----	70	130	----	----
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	107	----	70	130	----	----
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	91.4	----	70	130	----	----
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459)										

Sub-Matrix: **SOIL**

				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
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459) - continued										
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	91.0	----	70	130	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3351439)										
ES1405739-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	105	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	105	----	70	130	----	----
		EG005T: Copper	7440-50-8	125 mg/kg	106	----	70	130	----	----
		EG005T: Lead	7439-92-1	125 mg/kg	104	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	97.6	----	70	130	----	----
		EG005T: Zinc	7440-66-6	125 mg/kg	101	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3351440)										
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.4	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1405891**	Page	: 1 of 6
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 25-MAR-2014
Order number	: 10833		
		No. of samples received	: 3
Quote number	: EN/025/13	No. of samples analysed	: 3

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: **SOIL**

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
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
S283, S283/2, S130	**14-MAR-2014**	**----**	----	----	**20-MAR-2014**	28-MAR-2014	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
S283, S283/2, S130	**14-MAR-2014**	**21-MAR-2014**	10-SEP-2014	✓	**24-MAR-2014**	10-SEP-2014	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
S283, S283/2, S130	**14-MAR-2014**	**21-MAR-2014**	11-APR-2014	✓	**24-MAR-2014**	11-APR-2014	✓
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066)							
S283, S283/2, S130	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**21-MAR-2014**	29-APR-2014	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
S283, S283/2, S130	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**21-MAR-2014**	29-APR-2014	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
S283, S283/2, S130	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**21-MAR-2014**	29-APR-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP071)							
S283, S283/2, S130	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**21-MAR-2014**	29-APR-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
S283, S283/2, S130	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**21-MAR-2014**	29-APR-2014	✓

Matrix: **SOIL**

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
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) S283, S130 S283/2,	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**23-MAR-2014**	28-MAR-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP080) S283, S130 S283/2,	**14-MAR-2014**	**20-MAR-2014**	28-MAR-2014	✓	**23-MAR-2014**	28-MAR-2014	✓

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: **SOIL**

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)							
Moisture Content	EA055-103	2	18	**11.1**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	14	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	14	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	17	**11.8**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	18	**11.1**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	18	**11.1**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	18	**5.6**	**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
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. 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)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (2013) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 501)

Preparation Methods	Method	Matrix	Method Descriptions
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.

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.

- **No Analysis Holding Time Outliers exist.**

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.**

CHAIN OF CUSTODY

ALS Environmental

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PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)	
OFFICE: 14/1 COWPASTURE PLACE	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☑ Non Standard or urgent TAT (List due date): 19/3/14	Custody Seal Intact?	Yes / No / N/A
PROJECT: 19580 / 4030C 10920	ALS QUOTE NO.:	Free ice / coolant present upon receipt?	Yes / No / N/A
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166	Cooling Method:	
SAMPLER: J.E / D.L	SAMPLER MOBILE: 02 9756 2166 0409036350		
COC emailed to ALS? NO	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au	RELINQUISHED BY: J.E	RECEIVED BY: Leigh	RELINQUISHED BY: / RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au	DATE/TIME: 6/3/14	DATE/TIME: 11/3/14 6:30pm	DATE/TIME: / DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOIL (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	S212	6/3/14	S	Jar / Ice		✓								
2	S262					✓								
3	S287					✓								
4	S314					✓								
5	S335					✓								
6	S339					✓								
7	S340					✓								
8	S315					✓								
9	S369					✓								
10	S393					✓								
11	S392					✓								
12	S396					✓								
					TOTAL									

Environmental Division
Sydney
Work Order
ES1405223

Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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ORANGE 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

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CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): ☑ Non Standard or urgent TAT (List due date): 7/3/14 - 19/3/14
OFFICE: 14/1 COWPASTURE PLACE	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
PROJECT: 9580/4030C 10920	ALS QUOTE NO.:
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle): COC: 1 2 3 4 5 6 7; OF: 1 2 3 4 5 6 7
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166
SAMPLER: JW / D.L.	SAMPLER MOBILE: 02 9756 2166
COC emailed to ALS? NO	EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au	
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au	

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen coolants present? Yes No N/A
Random Sample Temperature on Receipt: °C
Other Comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/3/14 6:30pm	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	S393	6/3/14	S	Jar	1	1							
14	S392					1							
15	S394					1							
16	S369					1							
17	S418					1							
18	S469					1							
19	S499					1							
20	S419					1							
21	S367					1							
22	S391					1							
23	S293					1							
24	S292					1							
					TOTAL								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
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☑ SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
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WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: 14/1 COWPASTURE PLACE	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☑ Non Standard or urgent TAT (List due date): 9/3/14		
PROJECT: 14580 / 4030C	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	
ORDER NUMBER: 10920		COC: 1 2 (3) 4 5 6 7	
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166	OF: 1 2 3 4 5 (6) 7	
SAMPLER: JK / D.L	SAMPLER MOBILE: 02 9756 2166	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? NO	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au		DATE/TIME:	DATE/TIME: 11/03/14 2:30pm
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au			

RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	S133	4/3/14	S	Var / Ice		1								
26	S158					1								
27	S179					1								
28	S154					1								
29	S131					1								
30	S155					1								
31	S181					1								
32	S206					1								
33	S231					1								
34	S281					1								
35	S282					1								
36	S307					1								
					TOTAL									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: 14/1 COWPASTURE PLACE	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☒ Non Standard or urgent TAT (List due date): 19/3/14.		Custody seal intact? Yes / No / N/A
PROJECT: 19580 / 40300	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Cooling Agent present upon receipt? Yes / No / N/A
ORDER NUMBER: 10920		COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166	OF: 1 2 3 4 5 6 7	Cooling Comments:
SAMPLER: JH / D.L.	SAMPLER MOBILE: 02 9756 2166		
COC emailed to ALS? NO	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au			
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/03/14 6:30pm	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EA	EH	504	DJ					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
37	S256		S	Jar / IQ.		1								
38	S230					1								
39	S15/1					1	1	1	1					
40	S15/2					1	1	1	1					
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

- ☐ ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
- ☐ BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
- ☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5600 E: gladstone@alsglobal.com
- ☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- ☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
- ☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- ☐ NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
- ☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
- ☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- ☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- ☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- ☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC Testing Services

OFFICE: 14/1 Cowpasture Pl. WP

PROJECT: 19580/4030C

PURCHASE ORDER NUMBER: 10920

PROJECT MANAGER: U/A

CONTACT PH: 9862166

SAMPLER: JK /DL.

SAMPLER MOBILE:

COC emailed to ALS? (YES / NO)

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

☐ Standard TAT (List due date):

☒ Non Standard or urgent TAT (List due date): 19/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 (5) 6 7

OF: 1 2 3 4 5 (6) 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	Kelton		
DATE/TIME:	DATE/TIME: 11/03/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC.									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
41	S91	6/3/14	S	Jar /ZQ.		1									
42	S140					1									
43	S169					1									
44	S166					1									
45	S142					1									
46	S91					1									
47	S167					1									
48	S92					1									
49	S163					1									
				TOTAL											

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

- ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
- BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
- GLADSTONE 48 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5500 E: gladstone@alsglobal.com
- MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
- MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
- NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
- PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC Testing Services

OFFICE: 4/1 Cowpasture Pl. W.P.

PROJECT: 19580/4030s

PURCHASE ORDER NUMBER: 10920

PROJECT MANAGER: D/A. CONTACT PH: 97562166

SAMPLER: J.L./D.L SAMPLER MOBILE:

COC emailed to ALS? (YES / NO) EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

- ☐ Standard TAT (List due date):
- ☑ Non Standard or urgent TAT (List due date): 07/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt °C

Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/3/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
50	S118	6/3/14	S	Jar / Jar		1								
51	[redacted] S114					1								
52	S117					1								
53	S65					1								
54	S63					1								
55	S89					1								
56	S143					1								
57	S165					1								
58	S38					1								
59	S90					1								
60	S113					1								
61	[redacted] S168					1								
					TOTAL									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☑SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT:	SMEC TESTING SERVICES
OFFICE:	14/1 COWPASTURE PLACE
PROJECT:	1980/4000
ORDER NUMBER:	10920
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166
SAMPLER: J.k / D.L	SAMPLER MOBILE: ~~02 9756 2166~~ 0409036330
COC emailed to ALS? NO	EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):	enquiries@smectesting.com.au
Email Invoice to (will default to PM if no other addresses are listed):	accounts@smectesting.com.au

TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date): ☑ Non Standard or urgent TAT (List due date): 19/3/14
(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle): COC: (1) 2 3 4 5 6 7 — OF: 1 2 3 4 5 (6) 7

FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt; Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
J.k	Leigh		
DATE/TIME: 11/3/14	DATE/TIME: 11/3/14 6:30pm	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE: LAB ID	SAMPLE DETAILS MATRIX: SOLID(S) WATER(W): SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION: TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required): EC								Additional Information: Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	S212	6/3/14	S	Jar/Bag		✓								
2	S262					✓								
3	S287					✓								
4	S314					✓								
5	S338					✓								
6	S339					✓								
7	S340					✓								
8	S315					✓								
9	S369					✓								
10	S393					✓								
11	S392					✓								
12	S394					✓								
				TOTAL										

Environmental Division
Sydney
Work Order
ES1405223

Telephone : + 61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
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PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☑ SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

JK

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
OFFICE: 14/1 COWPASTURE PLACE	☐ Standard TAT (List due date):
PROJECT: 19580/4030C	☑ Non Standard or urgent TAT (List due date): ~~D/3/10~~ 19/3/14
ORDER NUMBER: 10920	ALS QUOTE NO.:
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166
SAMPLER: JK / D.L.	SAMPLER MOBILE: 02 9756 2166
COC emailed to ALS? NO	EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au	
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au	

COC SEQUENCE NUMBER (Circle)
COC: 1 (2) 3 4 5 6 7
OF: 1 2 3 4 5 (6) 7 — 2

FOR LABORATORY USE ONLY (Circle)

RELINQUISHED BY:	RECEIVED BY: Hirsh	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/03/14 6:20pm	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	(EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	S393 → #10 (Same as)	6/3/14	S	Jar / IQ.		1								
14	S392 → #11					1								
15	S394 #12					1								
16	S368					1								
17	S418					1								
18	S469					1								
19	S444					1								
20	S419					1								
21	S367 "					1								
22	S342					1								
23	S293					1								
24	S292					1								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

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ALS Laboratory: please tick →

- ☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
- ☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
- ☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
- ☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- ☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
- ☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- ☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
- ☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
- ☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
- ☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
- ☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
- ☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): ☑ Non Standard or urgent TAT (List due date): 19/3/14	FOR LABORATORY USE ONLY (Circle)
OFFICE: 14/1 COWPASTURE PLACE		COC SEQUENCE NUMBER (Circle)	Custody Seal Intact? Yes No N/A
PROJECT: 14580 / 40800	ALS QUOTE NO.:	COC: 1 2 (3) 4 5 6 7	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: 10920		OF: 1 2 3 4 5 (6) 7	Random Sample Temperature on Receipt:
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166		Other comment:

SAMPLER: J.L / D.L	SAMPLER MOBILE: 02 9756 2166	RELINQUISHED BY:	RECEIVED BY: [signature]	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? NO	EDD FORMAT (or default):				
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au		DATE/TIME:	DATE/TIME: 11/03/14 @ 3:30pm	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au					

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	S133	4/3/14	S	Jar / Ice		1									
26	S158					1									
27	S179					1									
28	S154					1									
29	S131					1									
30	S155					1									
31	S181					1									
32	S206					1									
33	S231					1									
34	S281					1									
35	S282					1									
36	S307					1									
				TOTAL											

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

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☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
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☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC TESTING SERVICES

OFFICE: 14/1 COWPASTURE PLACE

PROJECT: 19580 / 4030C

ORDER NUMBER: 10920

PROJECT MANAGER: N/A

CONTACT PH: 02 9756 2166

SAMPLER: JL / D.L.

SAMPLER MOBILE: 02 9756 2166

COC emailed to ALS? NO

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au

Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

☐ Standard TAT (List due date):

☒ Non Standard or urgent TAT (List due date): 19/3/14.

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt:

Other comment:

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY: [signature]

DATE/TIME: 11/03/14 6:30pm

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC	pH	SO4	Cl					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
37	S256		S	Jar / IQ.		–								
38	S230					–								
39	S15/1					–	–	–	–					
40	S15/2					–	–	–	–					
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Environmental

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- ☐ ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
- ☐ BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
- ☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4978 5800 E: gladstone@alsglobal.com
- ☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- ☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
- ☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- ☐ NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
- ☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
- ☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- ☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- ☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- ☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC Testing Services

OFFICE: 14/1 Cowpasture Pl, W.P.

PROJECT: 19500/4030C

PURCHASE ORDER NUMBER: 10920

PROJECT MANAGER: U/A

CONTACT PH: 9 8621 66

SAMPLER: JK /DL.

SAMPLER MOBILE:

COC emailed to ALS? (YES / NO)

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

☐ Standard TAT (List due date):

☑ Non Standard or urgent TAT (List due date): 19/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 (5) 6 7

OF: 1 2 3 4 5 (6) 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comment:

RELINQUISHED BY:	RECEIVED BY: Kelsey	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/03/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC.								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
41	S91	6/3/14	S	Jar / Jq.										
42	S140					1								
43	S169					1								
44	S166					1								
45	S142					1								
46	S41					1								
47	S167					1								
48	S92					1								
49	S163					1								
						1								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic;
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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- ☐ ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
- ☐ BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
- ☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5600 E: gladstone@alsglobal.com
- ☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- ☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
- ☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- ☐ NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
- ☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
- ☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- ☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- ☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- ☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: SMEC Testing Services
OFFICE: 14/1 Cowpasture Pl, W.P.
PROJECT: 19580/4030S
PURCHASE ORDER NUMBER: 10920
PROJECT MANAGER: V/A.
CONTACT PH: 97562166
SAMPLER: Jde / D.L
SAMPLER MOBILE:
COC emailed to ALS? (YES / NO)
EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):
COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
☐ Standard TAT (List due date):
☑ Non Standard or urgent TAT (List due date): 17/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 (6) 7
OF: 1 2 3 4 5 (6) 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	[illegible]		
DATE/TIME:	DATE/TIME: 11/3/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE: LAB ID	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W): SAMPLE ID	DATE/ TIME	MATRIX	CONTAINER INFORMATION: TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required): EC								Additional Information: Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
50	S118	6/3/14	S	Jar / JQ.		—								
51	~~[illegible]~~ S114					—								
52	S117					—								
53	S65					—								
54	S63					—								
55	S89					—								
56	S143					—								
57	S165					—								
58	S38					—								
59	S90					—								
60	S113					—								
61	~~[illegible]~~ S168					—								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic;
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

190314

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ADELAIDE 21 Burma Road Pooraka SA 5095 · BRISBANE 32 Shand Street Stafford QLD 4053 · GLADSTONE 46 Callemondah Drive Clinton QLD 4680 · MACKAY 78 Harbour Road Mackay QLD 4740 · MELBOURNE 2-4 Westall Road Springvale VIC 3171 · MUDGEE 27 Sydney Road Mudgee NSW 2850 · NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 · NOWRA 4/13 Geary Place North Nowra NSW 2541 · PERTH 10 Hod Way Malaga WA 6090 · ☑ SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 · TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 · WOLLONGONG 99 Kenny Street Wollongong NSW 2500

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Standard TAT (List due date): ☑ Non Standard or urgent TAT (List due date): 19/3/14
OFFICE: 14/1 COWPASTURE PLACE	ALS QUOTE NO.:
PROJECT: 1980/ 40300	COC SEQUENCE NUMBER (Circle) COC: (1) 2 3 4 5 6 7 OF: 1 2 3 4 5 (6) 7
ORDER NUMBER: 10920	
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166
SAMPLER: J.K / D.L	SAMPLER MOBILE: ~~02 9756 2166~~ 0409036330
COC emailed to ALS? NO	EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au	
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au	

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
J.K	Leifeng		
DATE/TIME: 11/3/14	DATE/TIME: 11/3/14 6:30pm	DATE/TIME:	DATE/TIME:

FOR LABORATORY USE ONLY (Circle)

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	S212	6/3/14	S	Jar / 1Q		/	
2	S262					/	
3	S287					/	
4	S314					/	
5	S338					/	
6	S339					/	
7	S340					/	
8	S315					/	
9	S369					/	
10	S393					/	
11	S392					/	
12	S394					/	
				TOTAL			

Environmental Division
Sydney
Work Order
ES1405223
Telephone : + 61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5630 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
ORANGE 1/13 Geary Place North Orange NSW 2800 Ph: 02 6393 8788 E: orange@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: SMEC TESTING SERVICES	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: 14/1 COWPASTURE PLACE		☑ Non Standard or urgent TAT (List due date): 7/3/14	Custody Seal Intact? Yes / No / N/A
PROJECT: 19580/40300 10920	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Preservation Seal Intact? Yes / No / N/A
ORDER NUMBER:			Receipt Temperature on Receipt:
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166		Other comments:
SAMPLER: JK / D.L.	SAMPLER MOBILE: 02 9756 2165		
COC emailed to ALS? NO	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au			
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/3/14 6:30pm	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
10	S393 Same as #10	6/3/14	S	Jar ICE		1								
11	S392 → #11					1								
12	S394 → #12					1								
13	S369					1								
17	S418					1								
18	S469					1								
19	S499					1								
20	S419					1								
21	S367					1								
22	S391					1								
23	S293					1								
24	S292					1								
				TOTAL										

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ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☑ SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC TESTING SERVICES		TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): ☑ Non Standard or urgent TAT (List due date): 9/3/10
OFFICE: 14/1 COWPASTURE PLACE			FOR LABORATORY USE ONLY (Circle)
PROJECT: 14580 / 4030C		ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)
ORDER NUMBER: 10920			COC: 1 2 (3) 4 5 6 7
PROJECT MANAGER: N/A	CONTACT PH: 02 9756 2166		OF: 1 2 3 4 5 (6) 7
SAMPLER: JK / D.L	SAMPLER MOBILE: 02 9756 2166	RELINQUISHED BY:	RECEIVED BY: Fatah
COC emailed to ALS? NO	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 11/03/14 6:30pm
Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au		DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	S131	4/3/14	S	Jar / Ice		1								
26	S158					1								
27	S179					1								
28	S154					1								
29	S131					1								
30	S155					1								
31	S181					1								
32	S206					1								
33	S231					1								
34	S281					1								
35	S282					1								
36	S307					1								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC TESTING SERVICES

OFFICE: 14/1 COWPASTURE PLACE

PROJECT: 19580 / 4030C

ORDER NUMBER: 10920

PROJECT MANAGER: N/A

CONTACT PH: 02 9756 2166

SAMPLER: JW / D.C.

SAMPLER MOBILE: 02 9756 2166

COC emailed to ALS? NO

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au

Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

☐ Standard TAT (List due date):

☒ Non Standard or urgent TAT (List due date): 19/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7 (4 circled)

OF: 1 2 3 4 5 6 7 (5 circled)

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt:

Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	Tehseh		
DATE/TIME:	DATE/TIME: 11/03/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX: SOLID(S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC	pH	Sog	U					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
37	S256		S	Jar / IQ.		1								
38	S230					1								
39	S15/1					1	1	1	1					
40	S15/2					1	1	1	1					
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5600 E: gladstone@alsglobal.com
☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐ NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4756 0600 E: townsville.environmental@alsenviro.com
☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC Testing Services
OFFICE: 14/1 Cowpasture Pl, W.P.
PROJECT: 19580/4030C
PURCHASE ORDER NUMBER: 10920
PROJECT MANAGER: L/A
CONTACT PH: 9762166
SAMPLER: JK /DL. SAMPLER MOBILE:
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):
COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
☐ Standard TAT (List due date):
☑ Non Standard or urgent TAT (List due date): 19/3/14

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 (5) 6 7
OF: 1 2 3 4 5 (6) 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY: Kelson	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/03/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC.								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
41	SG1	6/3/14	S	Jar/SQ.		—								
42	S140					—								
43	S169					—								
44	S166					—								
45	S142					—								
46	S41					—								
47	S167					—								
48	S92					—								
49	S163					—								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic;
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
BRIDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4969 9433 E: samples.newcastle@alsenviro.com
KOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: SMEC Testing Services
OFFICE: 14/1 Compactus Pl, Wp.
PROJECT: 19580/40805
PURCHASE ORDER NUMBER: 10920
PROJECT MANAGER: D/A.
CONTACT PH: 9756 2166
SAMPLER: J.K / D.L
SAMPLER MOBILE:
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):
COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
☐ Standard TAT (List due date):
☑ Non Standard or urgent TAT (List due date): 07/2/14
ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present Upon receipt? Yes No N/A
Random Sample Temperature on Receipt °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 11/2/14 6:30pm	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
50	J118	6/2/14	S	Jar / Jar		1								
51	[redacted] J114					1								
52	J117					1								
53	J65					1								
54	J63					1								
55	J89					1								
56	J143					1								
57	J165					1								
58	J38					1								
59	J90					1								
60	J113					1								
61	[redacted] J168					1								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1405223**	Page	: 1 of 14
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Client Services
Address	:	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 40300	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 10920		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: JK/DL	Issue Date	: 19-MAR-2014
Site	: ----		
		No. of samples received	: 58
Quote number	: EN/025/13	No. of samples analysed	: 58

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*
		Sydney Inorganics
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S212	S262	S287	S314	S338
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-001	ES1405223-002	ES1405223-003	ES1405223-004	ES1405223-005
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**23**	**16**	**19**	**64**	**22**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S339	S340	S315	S364	S393
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-006	ES1405223-007	ES1405223-008	ES1405223-009	ES1405223-010
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**19**	**15**	**19**	**80**	**23**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S392	S394	S369	S418	S469
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-011	ES1405223-012	ES1405223-016	ES1405223-017	ES1405223-018
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**18**	**45**	**15**	**28**	**77**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S444	S419	S367	S342	S293
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-019	ES1405223-020	ES1405223-021	ES1405223-022	ES1405223-023
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**112**	**35**	**17**	**42**	**22**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S292	S133	S158	S179	S154
			Client sampling date / time	06-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-024	ES1405223-025	ES1405223-026	ES1405223-027	ES1405223-028
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**23**	**64**	**24**	**11**	**19**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S131	S155	S181	S206	S231
			Client sampling date / time	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-029	ES1405223-030	ES1405223-031	ES1405223-032	ES1405223-033
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**15**	**22**	**29**	**122**	**33**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S281	S282	S307	S256	S230
			Client sampling date / time	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-034	ES1405223-035	ES1405223-036	ES1405223-037	ES1405223-038
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**21**	**17**	**23**	**17**	**27**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S15/1	S15/2	S91	S140	S164
			Client sampling date / time	04-MAR-2014 15:00	04-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-039	ES1405223-040	ES1405223-041	ES1405223-042	ES1405223-043
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.9	6.3	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	80	126	76	34	45
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	12.7	36.7	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	60	210	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	20	50	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S166	S142	S41	S167	S92
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-044	ES1405223-045	ES1405223-046	ES1405223-047	ES1405223-048
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**21**	**20**	**31**	**58**	**25**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S163	S118	S114	S117	S65
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-049	ES1405223-050	ES1405223-051	ES1405223-052	ES1405223-053
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**8**	**44**	**15**	**33**	**16**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S63	S89	S143	S165	S38
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-054	ES1405223-055	ES1405223-056	ES1405223-057	ES1405223-058
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	33	37	44	214	11

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S90	S113	S168	----	----
			Client sampling date / time	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405223-059	ES1405223-060	ES1405223-061	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**36**	**96**	**15**	----	----

QUALITY CONTROL REPORT

Work Order	: **ES1405223**	Page	: 1 of 4
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Client Services
Address	:	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 40300	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: JK/DL	Issue Date	: 19-MAR-2014
Order number	: 10920		
		No. of samples received	: 58
Quote number	: EN/025/13	No. of samples analysed	: 58

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 ir compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
		Sydney Inorganics
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney 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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002 : pH (Soils) (QC Lot: 3334853)									
ES1405172-004	Anonymous	EA002: pH Value	----	0.1	pH Unit	4.3	4.2	0.0	0% - 20%
ES1405240-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.3	6.3	0.0	0% - 20%
EA010: Conductivity (QC Lot: 3334845)									
ES1405223-001	S212	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	23	19	18.3	0% - 20%
ES1405223-011	S392	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	18	18	0.0	0% - 50%
EA010: Conductivity (QC Lot: 3334846)									
ES1405223-024	S292	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	23	23	0.0	0% - 20%
ES1405223-034	S281	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	21	21	0.0	0% - 20%
EA010: Conductivity (QC Lot: 3334847)									
ES1405223-046	S41	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	31	30	0.0	0% - 20%
ES1405223-056	S143	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	44	44	0.0	0% - 20%
EA010: Conductivity (QC Lot: 3334849)									
ES1405032-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	504	533	5.6	0% - 20%
ES1405172-004	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	34	36	7.1	0% - 20%
EA055: Moisture Content (QC Lot: 3336930)									
ES1405067-034	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	19.6	20.1	2.4	0% - 20%
ES1405194-006	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	9.0	8.2	9.3	No Limit
ED040S: Soluble Major Anions (QC Lot: 3334852)									
ES1405172-004	Anonymous	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	50	40	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3334851)									
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	10	mg/kg	25200	25300	0.5	0% - 20%

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: **SOIL**

				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
EA010: Conductivity (QCLot: 3334845)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.6	70	130
EA010: Conductivity (QCLot: 3334846)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	97.9	70	130
EA010: Conductivity (QCLot: 3334847)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	96.6	70	130
EA010: Conductivity (QCLot: 3334849)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.6	70	130
ED040S: Soluble Major Anions (QCLot: 3334852)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	750 mg/kg	103	84	112
ED045G: Chloride by Discrete Analyser (QCLot: 3334851)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	99.0	79	125

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: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride by Discrete Analyser (QCLot: 3334851)							
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	1250 mg/kg	# Not Determined	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: **SOIL**

				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
ED045G: Chloride by Discrete Analyser (QCLot: 3334851)										
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	1250 mg/kg	# Not Determined	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1405223**	Page	: 1 of 7
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Client Services
Address	:	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 40300	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: JK/DL	Issue Date	: 19-MAR-2014
Order number	: 10920		
		No. of samples received	: 58
Quote number	: EN/025/13	No. of samples analysed	: 58

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: **SOIL**

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
EA002 : pH (Soils)							
Soil Glass Jar - Unpreserved (EA002)							
S15/1, S15/2	**04-MAR-2014**	**12-MAR-2014**	11-MAR-2014	×	**12-MAR-2014**	12-MAR-2014	✓
EA010: Conductivity							
Soil Glass Jar - Unpreserved (EA010)							
S15/1, S15/2	**04-MAR-2014**	**12-MAR-2014**	11-MAR-2014	×	**12-MAR-2014**	09-APR-2014	✓
Soil Glass Jar - Unpreserved (EA010)							
S133, S158, S179, S154, S131, S155, S181, S206, S231, S281, S282, S307, S256, S230	**04-MAR-2014**	**12-MAR-2014**	11-MAR-2014	×	**13-MAR-2014**	09-APR-2014	✓
Soil Glass Jar - Unpreserved (EA010)							

Matrix: **SOIL**

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
EA010: Conductivity - Continued								
S212,	S262,	**06-MAR-2014**	**12-MAR-2014**	13-MAR-2014	✓	**13-MAR-2014**	09-APR-2014	✓
S287,	S314,							
S338,	S339,							
S340,	S315,							
S364,	S393,							
S392,	S394,							
S369,	S418,							
S469,	S444,							
S419,	S367,							
S342,	S293,							
S292,	S91,							
S140,	S164,							
S166,	S142,							
S41,	S167,							
S92,	S163,							
S118,	S114,							
S117,	S65,							
S63,	S89,							
S143,	S165,							
S38,	S90,							
S113,	S168							
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103)								
S15/1,	S15/2	**04-MAR-2014**	**----**	----	----	**13-MAR-2014**	18-MAR-2014	✓
ED040S : Soluble Sulfate by ICPAES								
Soil Glass Jar - Unpreserved (ED040S)								
S15/1,	S15/2	**04-MAR-2014**	**12-MAR-2014**	01-APR-2014	✓	**12-MAR-2014**	09-APR-2014	✓
ED045G: Chloride Discrete analyser								
Soil Glass Jar - Unpreserved (ED045G)								
S15/1,	S15/2	**04-MAR-2014**	**12-MAR-2014**	01-APR-2014	✓	**12-MAR-2014**	09-APR-2014	✓

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: **SOIL**

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)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	**16.7**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	8	69	**11.6**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	2	12	**16.7**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	6	**33.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	4	69	**5.8**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	**10.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	4	69	**5.8**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	**10.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	**16.7**	**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 (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 104)
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Major Anions - Soluble	ED040S	SOIL	In-house. Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	APHA 21st edition 4500-Cl- E. 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. Analysis is performed on a 1:5 soil / water leachate.

Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

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: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED045G: Chloride by Discrete Analyser	ES1405072-001	Anonymous	**Chloride**	16887-00-6	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: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils)							
Soil Glass Jar - Unpreserved							
S15/1,	S15/2	12-MAR-2014	11-MAR-2014	**1**	----	----	----
EA010: Conductivity							
Soil Glass Jar - Unpreserved							
S15/1,	S15/2	12-MAR-2014	11-MAR-2014	**1**	----	----	----
Soil Glass Jar - Unpreserved							
S133,	S158,	12-MAR-2014	11-MAR-2014	**1**	----	----	----
S179,	S154,						
S131,	S155,						
S181,	S206,						
S231,	S281,						
S282,	S307,						
S256,	S230						

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.**

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 6600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: SMEC Testing.
OFFICE: Lethbridge Park.
PROJECT: 19580
PURCHASE ORDER NUMBER: 10841
PROJECT MANAGER: N/A.
SAMPLER: JH
SAMPLER MOBILE: 0409163553
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):
COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
☐ Standard TAT (List due date):
☑ Non Standard or urgent TAT (List due date): 25/3/14.

ALS QUOTE NO.:
CONTACT PH: 95062166

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Frgs Ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: 14/3 0830	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	5284	14/3/14	S	Tub / Jar.			
2	285						
3	286						
4	261						
5	260						
6	259						
7	236						
8	235						
9	234						
10	258						
11	282						
12	208						
				TOTAL			

Environmental Division
Sydney
Work Order
ES1405892
Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved bag.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

- ☐ ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
- ☐ BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
- ☐ GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 5900 E: gladstone@alsglobal.com
- ☐ MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
- ☐ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
- ☐ MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
- ☐ NEWCASTLE 5 Rosegum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
- ☐ NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
- ☐ PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
- ☐ SYDNEY 277 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
- ☐ TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
- ☐ WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT:	SMEC Testing.
OFFICE:	Wetherill Park.
PROJECT:	19580
PURCHASE ORDER NUMBER:	10841
PROJECT MANAGER:	N/A.
CONTACT PH:	97862160
SAMPLER:	Jh
SAMPLER MOBILE:	0404051515
COC emailed to ALS? (YES / NO)	
EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):	
Email Invoice to (will default to PM if no other addresses are listed):	
COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:	

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

- ☐ Standard TAT (List due date):
- ☒ Non Standard or urgent TAT (List due date): 20/3/19.

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 (2) 3 4 5 6 7

OF: 1 (2) 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
- Custody Seal Intact? Yes No N/A
- Free ice / frozen ice bricks present upon receipt? Yes No N/A
- Random Sample Temperature on Receipt: °C
- Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
	Daniel		
DATE/TIME:	DATE/TIME: 19/3 0830	DATE/TIME:	DATE/TIME:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EC								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	182	14/3/19	S	Jar / Ice		1								
14	132	|	|	|		|								
15	130	|	|	|		|								
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CERTIFICATE OF ANALYSIS

Work Order	: **ES1405892**	Page	: 1 of 5
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 10841		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 24-MAR-2014
Site	: ----		
		No. of samples received	: 14
Quote number	: EN/025/13	No. of samples analysed	: 14

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*
Ankit Joshi	Inorganic Chemist	Sydney 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	S284	285	286	261	260
			Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405892-001	ES1405892-002	ES1405892-003	ES1405892-004	ES1405892-005
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**33**	**21**	**18**	**107**	**20**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	259	236	235	283	283/2
			Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405892-006	ES1405892-007	ES1405892-008	ES1405892-010	ES1405892-011
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**22**	**116**	**30**	**6**	**7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	208	182	132	130	----
			Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----
Compound	CAS Number	LOR	Unit	ES1405892-012	ES1405892-013	ES1405892-014	ES1405892-015	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**19**	**15**	**12**	**16**	----

QUALITY CONTROL REPORT

Work Order	: **ES1405892**	Page	: 1 of 4
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 24-MAR-2014
Order number	: 10841		
		No. of samples received	: 14
Quote number	: EN/025/13	No. of samples analysed	: 14

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

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Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney 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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA010: Conductivity (QC Lot: 3351327)									
ES1405892-001	S284	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	33	33	0.0	0% - 20%
ES1405892-012	208	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	19	20	5.4	0% - 20%

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: **SOIL**

				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
EA010: Conductivity (QCLot: 3351327)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	101	70	130

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.

- **No Matrix Spike (MS) Results are required to be reported.**

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.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1405892**	Page	: 1 of 5
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
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Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 24-MAR-2014
Order number	: 10841		
		No. of samples received	: 14
Quote number	: EN/025/13	No. of samples analysed	: 14

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: **SOIL**

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
EA010: Conductivity							
Soil Glass Jar - Unpreserved (EA010)							
S284, 285, 286, 261, 260, 259, 236, 235, 283, 283/2, 208, 182, 132, 130	**14-MAR-2014**	**21-MAR-2014**	21-MAR-2014	✓	**21-MAR-2014**	18-APR-2014	✓

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: **SOIL**

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)							
Electrical Conductivity (1:5)	EA010	2	14	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	14	**7.1**	**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
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 104)

Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

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.

- **No Analysis Holding Time Outliers exist.**

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.**

APPENDIX F – GEOTECHNICAL REPORT

Ingleside Precinct

Slope Risk Assessment Report

Prepared for: Department of Planning and Environment
Date: 1 September, 2015

DOCUMENT CONTROL

Title	Ingleside Precinct Slope Risk Assessment Report		
Prepared for	Department of Planning and Environment		
Project Ref	30012289		
	Name	**Position**	**Date**
Originator	Ben Morris	Senior Geotechnical Engineer	15/08/2014
Review	Simon Baldock	Senior Engineering Geologist	
Approval	Daniel Saunders	Project Manager Senior Environmental Scientist	

Details of Revisions

Rev	Date	Description	WVR Number
DRAFT	15/08/2014	Draft Report	
FINAL	01/09/2015	Final Report	001

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EXECUTIVE SUMMARY

Ingleside Release Area (Ingleside Precinct) is located within the Pittwater Local Government Area and is approximately 700 hectares in size.

The Minister for Planning and Pittwater Council have agreed to undertake a Precinct Planning Process for the Ingleside Precinct to confirm development potential and to establish planning controls to enable development consistent with that potential.

As part of this process the Department of Planning and Environment wish to identify areas where slopes pose a risk to future development within the Ingleside Precinct.

SMEC has undertaken an inspection of the site where current and potential failure mechanisms were identified. A slope risk analysis of the failure mechanisms has been carried out in line with Australian Geomechanics Society method *"A National Landslide Risk Management Guideline for Australia (2007)"*.

Previous work undertaken had delineated set zones within the Ingleside Precinct that contain slopes that may potentially pose a risk to future development; these can be grouped into ten sites.

Three main slope instability mechanisms were identified. A risk analysis was undertaken for each of the slope instability mechanisms based on three future land uses. The risk analysis framework can be found in Appendix C.

For the risk to property, the analysis was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure. SMEC also undertook an estimation of the risk to life in accordance with the AGS (2007). This approach is primarily based on a quantitative approach.

Based on the findings of the risk analysis it has been established that the tolerable risk to future development for the identified slope failure mechanisms has not been met, as the risk for the ten sites inspected within the precinct is classed as moderate.

The assessed risk for loss of life considering the assumed temporal probabilities are within an acceptable risk level for all three conceptualised mechanisms.

The risk levels determined should be considered where the instability mechanisms are present where development occurs within the subject area and implementation of treatment options should be considered as part of any application.

Recommendations to reduce the risk to tolerable levels may include; scaling the slope, installation of rock bolts and consideration of development location.

These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation. For any development that is undertaken on slopes it is recommended that the advice presented in Appendix B "Examples of good and poor hillside construction" is followed.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Project Background

Ingleside Release Area (Ingleside Precinct) is located within the Pittwater Local Government Area and is approximately 700 hectares in size.

The majority of the Ingleside precinct is zoned RU2 Rural Landscape under the Pittwater LEP 2014. A mix of public and private land ownership exists in the Precinct. Approximately one third of the area is in State Government ownership.

The Minister for Planning and Pittwater Council have agreed to undertake a Precinct Planning Process for the Ingleside Precinct to confirm development potential and to establish planning controls to enable development consistent with that potential.

As part of this planning process a land capability, salinity and contamination assessment is required. As part of the land capability assessment slope stability assessments across the site are required; identifying areas which are, or are likely to be, prone to stability problems.

This report details the findings of SMEC's slope stability assessments undertaken for the Ingleside Precinct.

1.2 Scope of Works

Based on the original scope of works it was planned to undertake intrusive ground investigations across the area to determine the ground conditions and allow detailed slope stability assessments to be undertaken. Subsequent issues with gaining access to private property has meant that an intrusive ground investigation was not possible, therefore, SMEC have undertaken a visual slope risk analysis.

Previous work undertaken had delineated set zones within the Ingleside Precinct that contain slopes that may potentially pose a risk to property. These can be grouped into ten sites as shown on Figure 1.

The scope of work was to undertake an inspection of the ten sites to identify current and potential failure mechanisms; to inform a slope risk assessment of the categorised slope mechanisms in accordance with the Landslide Risk Management guidelines dated March 2007 by Australian Geomechanics Society (AGS, 2007).

Specifically, this role included:

- Site inspection of the slope characteristics as visible from the road side or clearly identifiable public land;
- Risk estimation (comparative analysis of likelihood of a slope failure versus consequence of the failure).
- Evaluation of the estimated (assessed) risk by comparing against acceptance criteria.

2. SITE DESCRIPTION AND GEOLOGY

2.1 Site Description

The Ingleside Precinct area is bounded by Gilwinga Drive to the north, Minkara Road and Ingleside Road to the east, Wilga Street to the south and Wirreanda Road to the west. The area is intersected in an east-west direction by Mona Vale Road.

The topography of the area consists of undulating hillsides with some steepened precipices and valleys that make up the upper reaches of the Pittwater Plateau. Based on site observations undertaken during a site visit on 6th August 2014 and GIS extracted information (Figure 3) much of the area comprises of slopes with a slope angle of less than 20°. There are some isolated areas where slopes have an angle of up to 30° and a very minor component with slope angles between 30° and 40°. A few vertical precipices were observed, up to 5m in height, some containing overhangs.

Land use across the site comprised urban sized residential blocks; large rural residential blocks; rural acreages with farming; light industrial blocks; quarries and Crown Land.

Table 1 below provides a summary of the topography, land use, and identified slope characteristics within each of the ten previously identified sites.

Appendix A presents a plan with comments and collation of photographs for each of the ten sites.

Table 1 – Summary of Site Characteristics

Site	Land Use	Topography and Slope Characteristics
1	Undeveloped land	Undulating terrain with precipices along the eastern and southern extents (Walter Road and Cicada Glen Road). Sandstone precipices up to 5m high with minor overhangs.
2	Undeveloped land and large rural residential blocks	Gently dipping valley (up to 30°) north of Cicada Glen Road between resuidential blocks. Some sandstone precipices up to 2m high.
3	Large rural residential blocks	Private property frontage restricted visibility of slope characteristics, however, it is considered to be similar to Site 2 above.
4	Large rural residential blocks, open farming areas	Gently graded slopes (up to 20°) and some minor sandstone precipices up to 2m in height adjacent to Addison Road.
5 and 6	Undeveloped land, large rural residential blocks, commercial blocks, quarry	Slopes up to 30° with sandstone precipices up to 3m in height between Mona Vale Road and Wirreanda Road, loose sandstone blocks up to 1.5m in size on upper slope adjacent to Mona Vale Road (remnants of cutting Mona Vale Road).
7	Undeveloped land	Gently graded slope from Mona Vale Road to Wirreanda Road in the order of 15°, sandstone precipices up to 2m high.

8	Undeveloped land and urban size residential blocks	Generally undulating slopes 15° to 35°, sandstone precipices up to 4m in height adjacent to Mona Vale Road, with overhangs .
9	Light industrial blocks	Unable to access or view portions of land likley to contain slopes. Considered to be similar to Site 7 above.
10	Large rural residential blocks, open farming areas	Gently graded land sloping at an angle of up to 10° towards creek crossing Powder Works Road.

2.2 Regional Geology and Material Description

The 1:250,000 Geological Series map S1 56-5 for Sydney indicates that the Pittwater Plateau is underlain by near-horizontally bedded sequence of sedimentary rocks of Triassic Age. The ridges, which make up the majority of the Ingleside Precinct are formed by Hawkesbury Sandstone, medium to coarse grained quartzose sandstone, very minor shale and laminite lenses, reasonably distinct bedding and well developed, typically widely spaced near-vertical joints. The slopes surrounding the plateau are underlain by an interbedded sequence of laminite, siltstone, shale and sandstone of the Narrabeen Formation. On the slopes these rocks are overlain by talus which has fallen from the sandstone uphill and by clayey colluvium derived by the weathering process of the sandstone and siltstone rock units. (MacGregor et al, 2007)

An extract of the geological map for the area is presented as Figure 2.

3. INSPECTION AND RISK ASSESSMENT METHODOLOGY

3.1 General

The Australian Geomechanics Society sub-committee first developed and published, 'Landslide Risk Assessment Procedures' in Australian Geomechanics, Volume 35, Number 1 dated March 2000. The intention of this system of slope risk classification was to establish terminology, define the general framework, provide guidance on risk analysis methods and provide sufficient information on tolerable and acceptable risks for loss of life.

Since then, several published papers have progressed the understanding of the landslide risk framework for these assessments and the procedures have subsequently been adjusted. The updated benchmark guidelines on Landslide Risk Management (LRM) are presented in the Australian Geomechanics publication, Volume 42, Number 1, dated March 2007. This issue presents a series of LRM guidelines and further understanding on the application of the risk assessments for the recommended use by all practitioners nationwide.

This investigation was undertaken in accordance with the LRM guidelines dated March 2007.

The methodology of assessing the risks at the site comprised the following steps:

- Site inspection involving a geological and geomorphologic appraisal;
- Hazard identification; and
- Risk Estimation.

3.2 Site Inspection

The site inspection involved a walkover of the ten respective sites within the Ingleside Precinct that have been previously identified as containing slopes which may potentially pose a risk to future development. The site visit was undertaken on 6th August 2014 by a senior geotechnical engineer and included a walkover survey of the areas by accessing clearly identifiable public land and road reserves. Many of the sites were entirely bounded by private property and therefore identifiable slope features was restricted to that visible from the road.

The site inspections comprised site observations and recording of surface features including geomorphological characteristics, evident failure mechanisms, erosion and indications of slope instability.

Slope characterisation was undertaken for each precipice in order to:

- identify if the slope has current or potential slope instability issues;
- classify the types of slope instability, if applicable;
- assess the physical extent of the areas affected by instability being considered, including the location, areal extent and volume involved;
- assess the likely initiating event(s), the physical characteristics of the materials involved, and the failure mechanics;
- estimate the resulting anticipated travel distance and velocity of movement; and

- identify if risk from a possible slope hazards to existing or future property are acceptable.

3.3 Hazard Identification

A landslide is defined as “the movement of a mass of rock, debris or earth down a slope”. Apart from ground subsidence and collapse, this definition is open to the movement of material types including rock, earth and debris downslope. The causes of landslides can be complex. However, two common factors include the occurrence of a failure of part of the soil or rock material on a slope and the resulting movement is driven by gravity. The actual motion of a landslide is subdivided into the five kinematically distinctive types of material movement including fall, topple, slide, spread, and flow. Table 2 shows the major types of landslides (AGS, 2007).

Table 2 – Major Types of Landslides

Type of Movement	Type of Material		
	Bedrock	Engineering Soils	
		Predominantly Coarse	Predominantly Fine
Falls	Rock fall	Debris fall	Earth fall
Topples	Rock topple	Debris topple	Earth topple
Rotational slide	Rock slide	Debris slide	Earth slide
Translational slide			Earth spread
Lateral spread	Rock spread	Debris spread	Earth flow
Flows	Rock flow (deep creep)	Debris flow (soil creep)	Earth flow (soil creep)
Complex	Combination of two or more principle types of movement		

The more common landslides occurring along plateaus and the surrounding slopes include falling or toppling rocks and rotational earth or debris slides.

Rock falls generally result from the under-cutting of the precipice by erosional processes, including scour from surface flows and direct rainfall. Rock topple mechanisms occur in a similar fashion to rock falls, however, the inherent jointing structure within the bedrock and root jacking may be additional factors for the instability of a precipice.

Rotational landslides typically develop in moderate to steep slopes where earth or debris becomes inundated by water and downward movement occurs. They are semi-circular in shape and exhibit a back tilted upper section and a disrupted toe section. Translational slides are similar to rotational slides but may feature downward movement of weak material along a more competent planar surface.

The frequency of landslides is generally complex and typically dependent on the inter-relationship between the factors influencing the stability of the slope. Some of the common factors affecting the stability of slopes within plateau landscapes include land development, vegetation removal and changes in drainage. Some of the potential failure triggers that may affect the stability of slopes include:

- undercutting of erosion;
- prolonged rainfall with water percolating into rock mass defects causing washout of fines and reduction of rock mass strength;
- earthquakes.

One or a combination of these conditions could result in a landslide failure event

3.4 Risk Estimation

A risk assessment was undertaken for each of the categorised slope hazards. The risk assessment and management process adopted for this study in general complies with AGS (2007a). Definition of the terms used in this report with respect to the slope risk assessment and management is as per AGS (2007b).

3.4.1 Risk to Property

For risk to property, the assessment was primarily based on a qualitative approach. The assessment process for each hazard involved the following:

- Risk estimation (comparative analysis of likelihood of a slope failure versus consequence of the failure).
- Evaluation of the estimated (assessed) risk by comparing against acceptance criteria.

Risk management and control strategies are recommended where the estimated risk is beyond the acceptable/tolerable limit.

The qualitative terminology for use in assessing risk to property is presented in Appendix C.

3.4.2 Risk to Life

In accordance with the AGS 2007c Landslide Risk Management Guidelines for loss of life, the risk assessment was primarily based on a quantitative approach. The individual risk for loss of life can be calculated from:

$$R(LoL) = P(H) \times P(S:H) \times P(T:S) \times V(D:T)$$

Where:

- R (LoL) is the risk (annual probability of loss of life (death) of an individual).
- P (H) is the annual probability of the landslide.
- P (S:H) is the probability of spatial impact of the landslide impacting a building (location) taking into account the travel distance and travel direction of a given event.

- P (T:S) is the temporal spatial probability (e.g. of the building or location being occupied by the individual) given the spatial impact and allowing for the possibility of evacuation given there is warning of the landslide occurrence.
- V (D:T) is the vulnerability of the individual (probability of loss of life of the individual given the impact).

Risk management and control strategies are recommended where the estimated risk is beyond the acceptable/tolerable limit.

4. RISK ASSESSMENT

4.1 General

The benchmark guidelines on Landslide Risk Management (LRM) are presented in the Australian Geomechanics publication, Volume 42, Number 1, dated March 2007. As noted in Section 3.1, this document presents a series of LRM guidelines and further understanding on the application of the risk assessments recommended for use by all practitioners nationwide. This investigation was undertaken in accordance with the LRM guidelines dated March 2007.

4.2 Risk Acceptance Criteria

The risk acceptance criteria consider the occurrence of the potential hazards identified and evaluate the risks against a Tolerable Risk Criteria.

The AGS 2007 guidelines indicate that the regulator, with assistance from the practitioner where required, is the appropriate authority to set the standards for tolerable risks relating to perceived safety in relation to other risks and government policy. The importance of the implementation of levels of the tolerable risk should not be understated due to the wide ranging implications, both in terms of the relative risks or safety to the community and the potential economic impact on the community.

For property loss, the tolerable risk criterion may be determined by the importance level of infrastructure. The importance level is directly related to societal requirements during or immediately after extreme events. The AGS provided recommendation for tolerable risk level to property is the "low" risk level. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required. Otherwise the "very low" risk level is acceptable.

For tolerable risk related to loss of life, the following risk levels are as recommended by AGS. For the purpose of this risk assessment the site may be broadly defined as a new development. The AGS risk threshold provided in Table 3 for new developments suggests the 'Tolerable Loss of Life for the person most at risk' is $1x10^{-5}$ per annum.

Table 3 – AGS Suggested Tolerable Risk (AGS, 2007).

Situation	Suggested tolerable loss of life risk for the person most at risk
Existing Slope (1) / Existing Development (2)	$1x10^{-4}$/annum or 0.01%
New Constructed Slope (3) / New Development (4) / Existing Landslide (5)	$1x10^{-5}$/annum or 0.001%

Notes:

1. "Existing Slopes" in this context are slopes that are not part of a recognisable landslide and have demonstrated non-failure performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.

2. "Existing Development" includes existing structures, and slopes that have been modified by cut and fill, that are not located on or part of a recognisable landslide and have demonstrated non-failure

performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.

3. “New Constructed Slope” includes any change to existing slopes by cut or fill or changes to existing slopes by new stabilisation works (including replacement of existing retaining walls or replacement of existing stabilisation measures, such as rock bolts or catch fences).

4. “New Development” includes any new structure or change to an existing slope or structure. Where changes to an existing structure or slope result in any cut or fill of less than 1.0m vertical height from the toe to the crest and this change does not increase the risk, then the Existing Slope / Existing Structure criterion may be adopted. Where changes to an existing structure do not increase the building footprint or do not result in an overall change in footing loads, then the Existing Development criterion may be adopted.

5. “Existing Landslides” have been considered likely to require remedial works and hence would become a New Constructed Slope and acquire the lower risk. Even where remedial works are not required per se, it would be a reasonable expectation of the public for a known landslide to be assessed against the lower risk category as a matter of “public safety”.

4.3 Risk Assessments

As noted in Section 3.2, these risk assessments were based on high level observations made during a limited site visit by a senior geotechnical engineer. The assessments are conservative because comprehensive and detailed geological mapping of the site was not possible under the prescribed scope of work and the limitations of being able to access all areas of the sites. Any future detailed evaluations of particular sites may change the quantification of the hazard risk.

The data collected for this report has enabled the definition and characterisation of slope instability hazards.

4.3.1 Hazard Mechanisms

Photographs showing various site locations where representative slope mechanisms were identified are provided in Appendix A.

During the site inspection the following slope failure mechanisms were identified and conceptualised. For each of these failure mechanisms a risk assessment was carried out.

4.3.1.1 Mechanism 1 (M1): Block Falls up to 1m from Precipices up to 2m in Height

Mobilisation of block falls to 1m are considered to arise from the precipices with jointed sandstone units up to 2m in height and influenced by exposure conditions to wind and rain.

4.3.1.2 Mechanism 2 (M2): Block Falls up to 1m from Precipices up to 5m in Height

Mobilisation of block falls to 1m are considered to arise from the precipices with jointed sandstone units up to 5m in height and influenced by exposure conditions to wind and rain.

4.3.1.3 Mechanism 3 (M3): Block Falls up to 2m from Overhangs

Mobilisation of block falls from overhangs are considered to arise from the precipices with major overhangs and influenced by exposure to wind and rain.

4.3.2 Understanding Failure Modes and Triggering Factors

In view of the site observations, measurements and experience, a conceptual understanding of the failure mechanisms and contributing factors was developed to comprehend its vulnerability and associated risks. The main points describing this phenomenon and triggering factors are summarised below;

- The slopes are directly exposed to weathering processes, wind, rain and atmospheric exposure. This causes the rock mass and joints in the rock to be weakened and blocks are loosened.
- The largely absent sub-vertical joint sets lead to the mechanisms being more stable than would be in a highly fractures and frequently jointed rock mass.

4.3.3 Assets at Risk

As this risk assessment is a high level assessment for future development it is considered that the assets at risk would be newly constructed dwellings or other buildings, roads or areas of congregation of persons such as parks and other recreation areas.

4.3.4 Temporal Probability

The following assumptions have been made with respect to temporal probability. Alteration of these assumptions will inevitably alter the magnitude of risk.

Table 4 – Adopted Temporal Probability

Aspect of Assessment	Assumed Temporal Probability P(T:S)
Residential Areas	It is assumed that people would be present below the slope within residential areas on an average of 30mins/day. This would include being in an area of vulnerability to the mechanism and may include being inside the dwelling.
Roads	For the suburban roads it is assumed that the temporary probability would be 0.001*.
Recreational Areas	It is assumed that people would be present below the slope within recreational areas on an average of 30mins/day.

Notes: *Allocation of temporal probability is based on the Temporal Probability Rating Definitions adopted by RMS for Slope Risk Analysis, Table 11 RMS Guide to Slope Risk Analysis Version 4 (RMS 2011).

With regards to the above temporal probabilities, common usage has been assumed. Allowance for more frequent presence for specific situations, such as persons seeking refuge in adverse weather conditions, has not been considered and therefore re-assessment of the specific land use at the slope is to be undertaken prior to application of these probabilities.

4.3.5 Assessed Risk

Table 5 and 6 below show the assessed risk to property and the risk of loss of life associated with conceptualised failure mechanisms.

Table 5 – Summary of Risk Assessment – Risk to Property

		M1: Block Falls (1.0m) from Precipices up to 2m in Height	M2: Block Falls (1.0m) from Precipices up to 5m in Height	M3: Block Falls (up to 2m) from Overhangs
Probability P(H)	Descriptor	Likely	Possible	Possible
	Level	B	C	C
	Rate	0.01	0.001	0.001
Consequence to Building	Level	Minor	Minor	Medium
	Descriptor	4	4	3
Risk To Property		**Moderate**	**Moderate**	**Moderate**

Table 6 – Summary of Risk Assessment - Level of Risk for Loss of Life

		M1: Block Falls (1.0m) from Precipices up to 2m in Height	M2: Block Falls (1.0m) from Precipices up to 5m in Height	M3: Block Falls (up to 2m) from Overhangs
Probability P(H)		0.01	0.001	0.001
Probability of Spatial Impact ($P_{S:H}$)		0.02 (1.0m block on 50m long section of slope)	0.02 (1.0m block on 50m long section of slope)	0.04 (2.0m length failure over 25m section of slope)
Vulnerability of an Individual ($P_{D:T}$)		1.0 (person killed) 0.1 (person injured)		
Probability of Temporal Impact ($P_{T:S}$)	Residential Areas	0.021		
	Roads	0.001		
	Recreational Areas	0.021		
Risk (loss of life)	Residential Areas	Death 4.2×10^{-6} Injury 4.2×10^{-7}	Death 4.2×10^{-7} Injury 4.2×10^{-8}	Death 8.4×10^{-7} Injury 8.4×10^{-8}
	Roads	Death 2.0×10^{-7} Injury 2.0×10^{-8}	Death 2.0×10^{-8} Injury 2.0×10^{-9}	Death 4.0×10^{-8} Injury 4.0×10^{-9}
	Recreational Areas	Death 4.2×10^{-6} Injury 4.2×10^{-7}	Death 4.2×10^{-7} Injury 4.2×10^{-8}	Death 8.4×10^{-7} Injury 8.4×10^{-8}

According to the AGS suggested tolerable levels for loss of property for the above conceptualised mechanisms do not yield acceptable levels. Noted implications in the AGS guideline is that for risk to loss of property of "moderate" levels "may be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable."

Based on the AGS suggested tolerable levels for loss of life outlined in Table 3 and considering the assumed temporal probability an acceptable risk level is obtained for all conceptualised mechanisms.

5. DISCUSSION AND RECOMMENDATIONS

As previously stated the original scope of works allowed for intrusive ground investigations to be undertaken across the Ingleside Precinct to determine ground conditions for slope stability assessments.

As access to private property was not possible, SMEC, have undertaken a visual slope risk analysis in line with AGS (2007) guidelines. These slope risk analysis involved the inspection of the slope characteristics at ten sites from accessible areas, generally either from the roadside or clearly identifiable public land.

The data collected during the site visit by a senior geotechnical engineer has enabled the definition and characterisation of slope instability mechanisms at the ten sites. Three main mechanisms were identified. These are listed below:

- Mechanism 1: Block Falls up to 1m from precipices up to 2m in Height
- Mechanism 2: Block Falls up to 1m from precipices up to 5m in Height
- Mechanism 3: Block Falls up to 2m from overhangs

SMEC considered three future uses for any land development and made assumptions with regards to the temporal probability for these uses (detailed in Section 4.3.4). The three land uses considered are:

- Residential Areas
- Roads
- Recreational Areas

A risk assessment was undertaken for each of the slope instability mechanisms. For risk to property, the assessment was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure.

In addition to the risk to property SMEC also undertook an estimation of the risk to life in accordance with the AGS (2007). This approach is primarily based on a quantitative approach.

Based on the findings of the risk assessment, as presented in Section 4.3.5, it has been established that the tolerable risk to future development for the identified failure mechanisms has not been met as the risk is classed as moderate.

It is noted that in the AGS guidelines that for risk to loss of property of "moderate" levels "may be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable."

The assessed risk for loss of life considering the assumed temporal probabilities are within an acceptable risk level for all three conceptualised mechanisms.

The risk levels determined should be considered where the instability mechanisms are present within the subject area and implementation of treatment options should be considered as part of any application.

A summary of stabilisation recommendations for reducing the risk levels is presented in Table 7 below.

Table 7 – Summary of Stabilisation Recommendations

Recommendation	Description
Scaling	Removal of rock blocks/mass can be coupled with site earthworks process
Rock Bolts	Rock bolts are frequently used for stabilisation applications of potentially unstable rock blocks due to their relative low cost and fast installation process
Appropriateness of Building	Location of proposed buildings, and suitability of building to withstand a dislodged block may be considered to accept a high level of risk or to derive a tolerable risk level

As noted in Section 3.2, these risk assessments were based on high level observations made during a limited site visit by a senior geotechnical engineer. The assessments are conservative because comprehensive and detailed geological mapping of the site was not possible under the prescribed scope of work and the limitations of being able to access all areas of the sites.

It should be noted that due to the high level nature of the site inspection there may be other active or potential slope mechanisms that were not identified and conceptualised. Any future detailed evaluations of particular sites may change the quantification of the hazard risk.

On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation. For any development that is undertaken on slopes it is recommended that the advice presented in Appendix B “Examples of good and poor hillside construction” is followed.

6. CONCLUSIONS

SMEC have undertaken a site visit and a subsequent slope risk analysis in line with AGS (2007) guidelines for ten sites within the Ingleside Precinct.

Three main slope instability mechanisms were identified. A risk analysis was undertaken for each of the slope instability mechanisms based on three future land uses.

For the risk to property, the analysis was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure. SMEC also undertook an estimation of the risk to life in accordance with the AGS (2007). This approach is primarily based on a quantitative approach.

Based on the findings of the risk analysis it has been established that the tolerable risk to property for the identified failure mechanisms has not been met, as the risk is classed as moderate.

The assessed risk for loss of life considering the assumed temporal probabilities are within an acceptable risk level for all three conceptualised mechanisms.

AGS guidelines state that for risk to loss of property "moderate" levels "may be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable."

The risk levels determined should be considered where the instability mechanisms are present where development occurs within the subject area and implementation of treatment options should be considered as part of any future application. Recommendations to reduce the risk to tolerable levels may include; scaling the slope, installation of rock bolts and consideration of development location.

These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. In addition no details on proposed future development were available. The location and proximity of any future development to an identified slope failure mechanism will potentially alter the calculated risk level.

On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation. For any development that is undertaken on slopes it is recommended that the advice presented in Appendix B “Examples of good and poor hillside construction” is followed.

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- AGS (2007b). “Commentary on guideline for landslide susceptibility, hazard and risk zoning for land use planning”, Australian Geomechanics, Vol 42, No. 1, March 2007.
- AGS (2007c). “Practice note guidelines for landslide risk management”, Australian Geomechanics, Vol 42, No. 1, March 2007.
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- AGS (2007e). “Australian GeoGuides for slope management and maintenance”, Australian Geomechanics, Vol 42, No. 1, March 2007.
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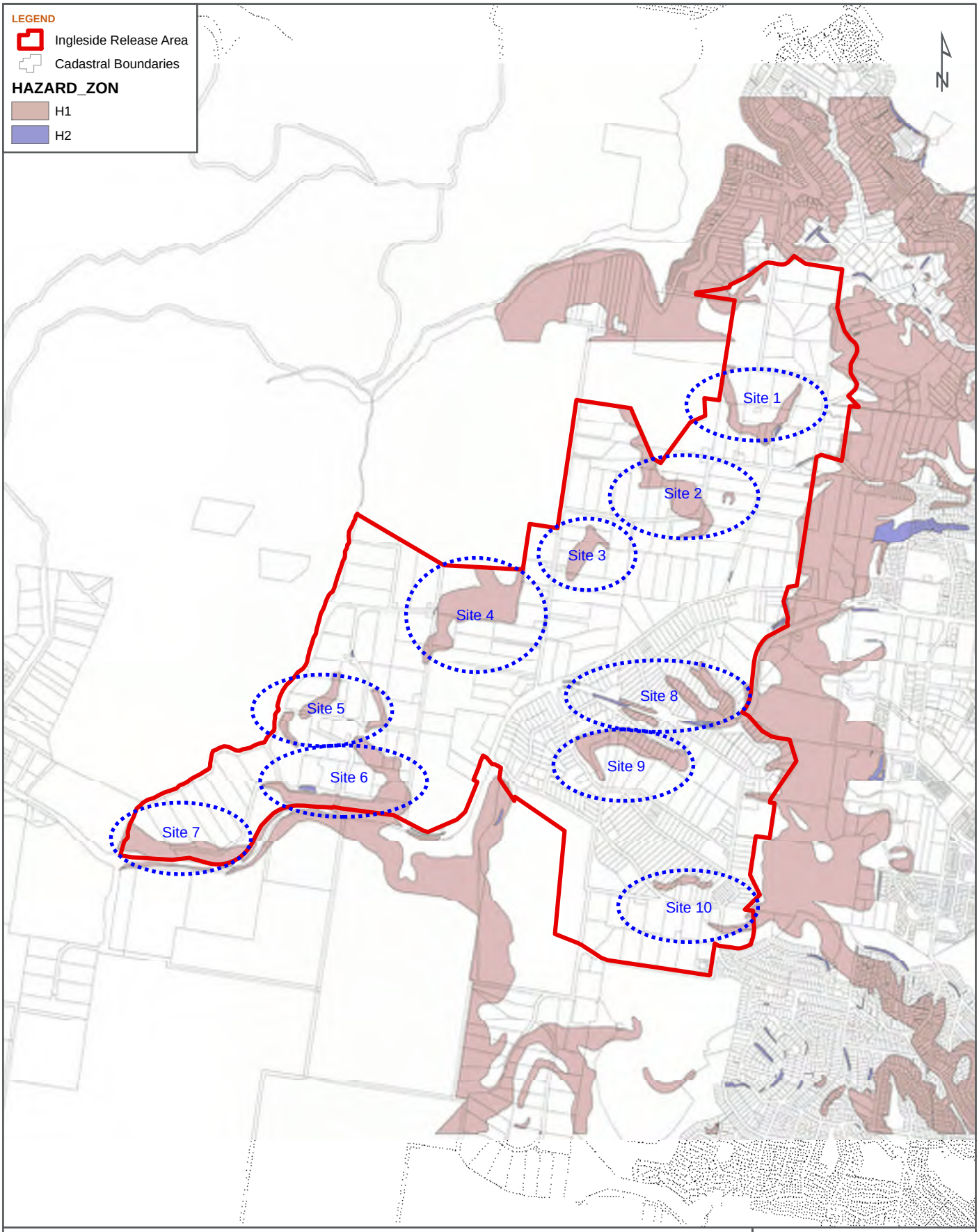
- MacGregor et al (2007). "Assessment of Landslide Likelihood in the Pttwater Local Government Area", Australian Geomechanics, Vol 42, No. 1, March 2007.
- RMS (2011). "RMS Guide to Slope Risk Analysis", 2011.

FIGURES



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COORDINATE SYSTEM
GDA 1994 MGA Zone 56

FIG NO. 1

FIGURE TITLE Ingleside Precinct Site Locations

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct Slope Risk Assessments

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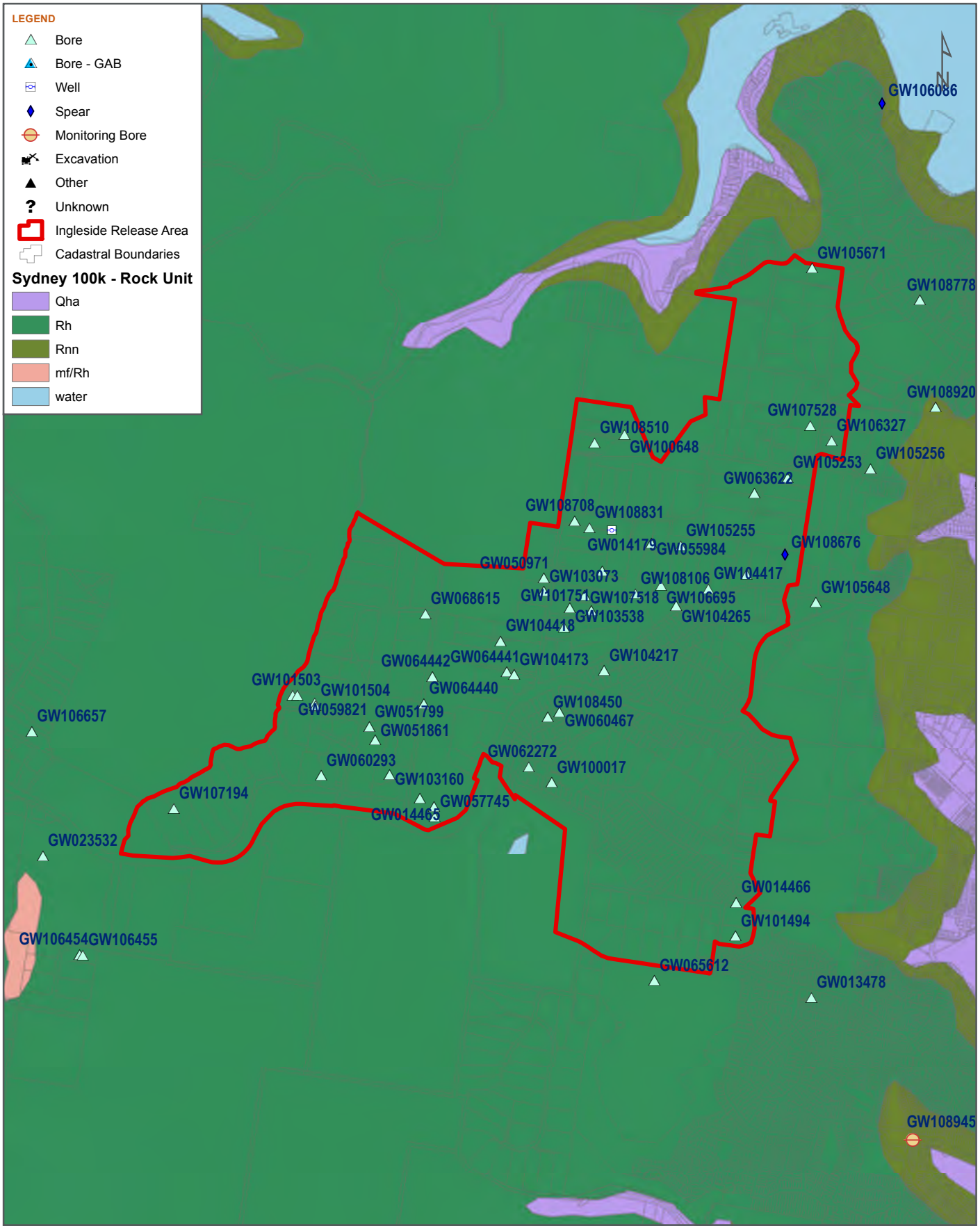
Location:

Last updated by: DS11642 on 13/02/2014 at 16:18



DATE 15/08/2014		**PAGE SIZE** A4	**COORDINATE SYSTEM** GDA 1994 MGA Zone 56
FIG NO. 2	**FIGURE TITLE** Ingleside Precinct Geology Map		
PROJECT NO. 30012289	**PROJECT TITLE** Ingleside Precinct Slope Risk Assessment		
CREATED BY R. Chatfield	**SOURCES** Vector backdrop data © MDS 2013		

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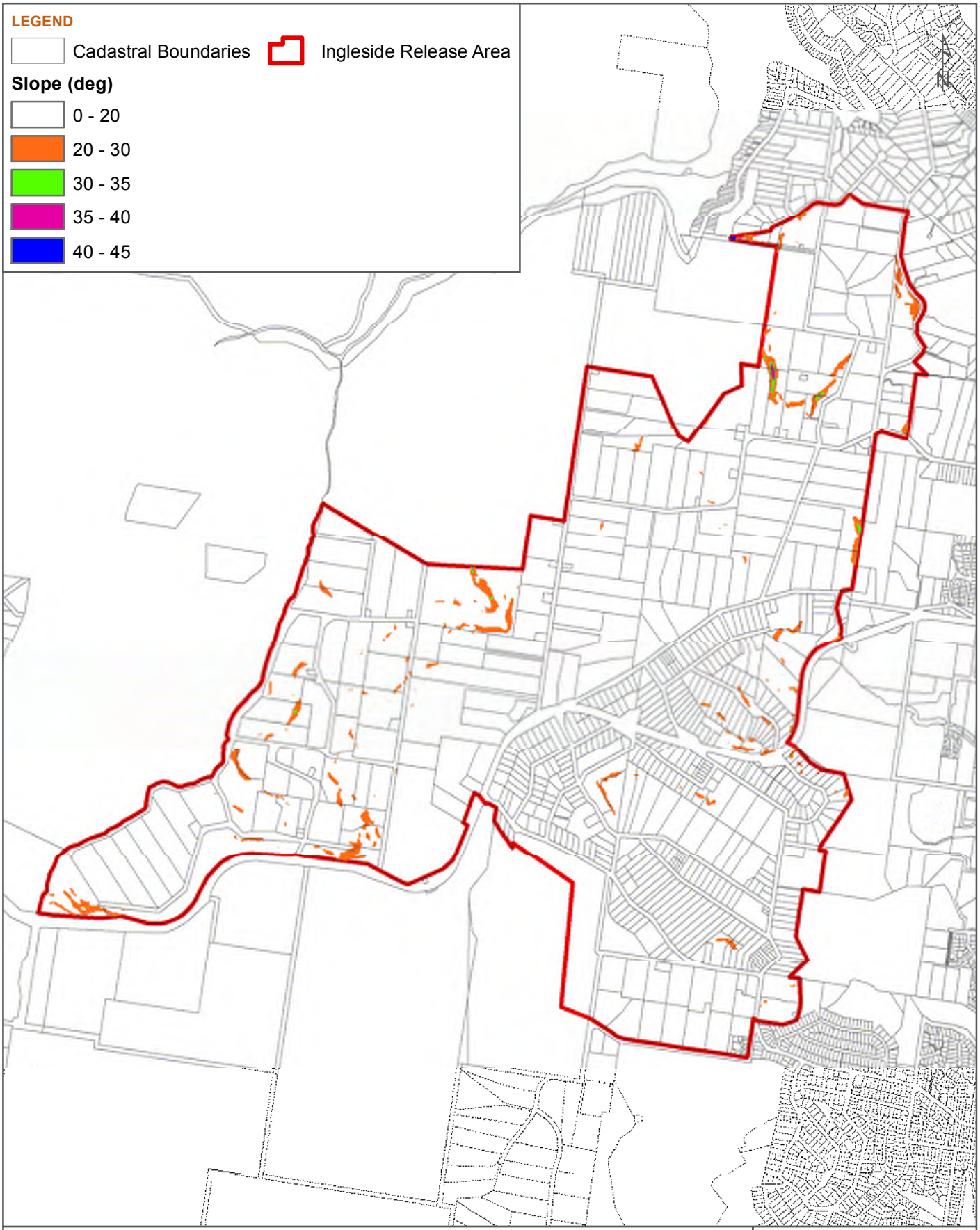

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COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 3

FIGURE TITLE Ingleside Precinct Terrain Map

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct Slope Risk Assessments

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APPENDIX A: PHOTOGRAPHS AND NOTES

Figure 1: Site 1

Figure 2: Site 1

Figure 3: Site 1

Figure 4: Site 1

Figure 5: Site 2

Figure 6: Site 2

Figure 7: Site 2

Figure 8: Site 2

Figure 9: Site 2

Figure 10: Site 3

Figure 11: Site 3

Figure 12: Site 4

Figure 13: Site 4

Figure 14: Site 4

Figure 15: Site 6

Figure 16: Site 6

Figure 17: Site 6

Figure 18: Site 6

Figure 19: Site 6

Figure 20: Site 6

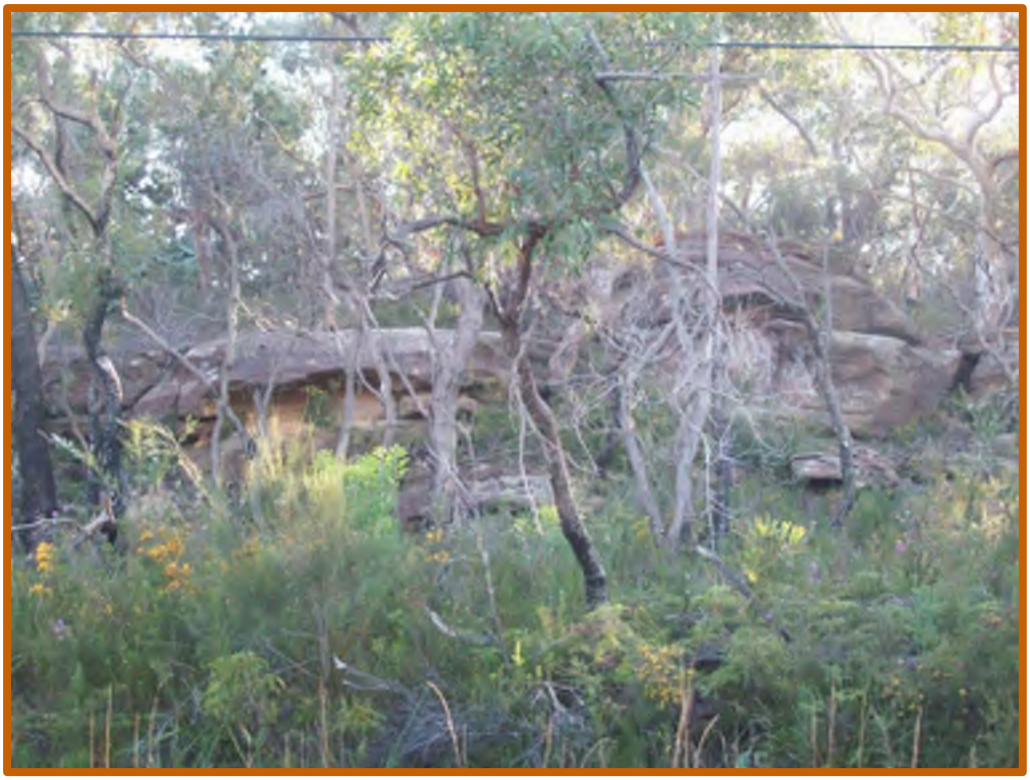


Figure 21: Site 6

Figure 22: Site 7

Figure 23: Site 7

Figure 24: Site 8

Figure 25: Site 8

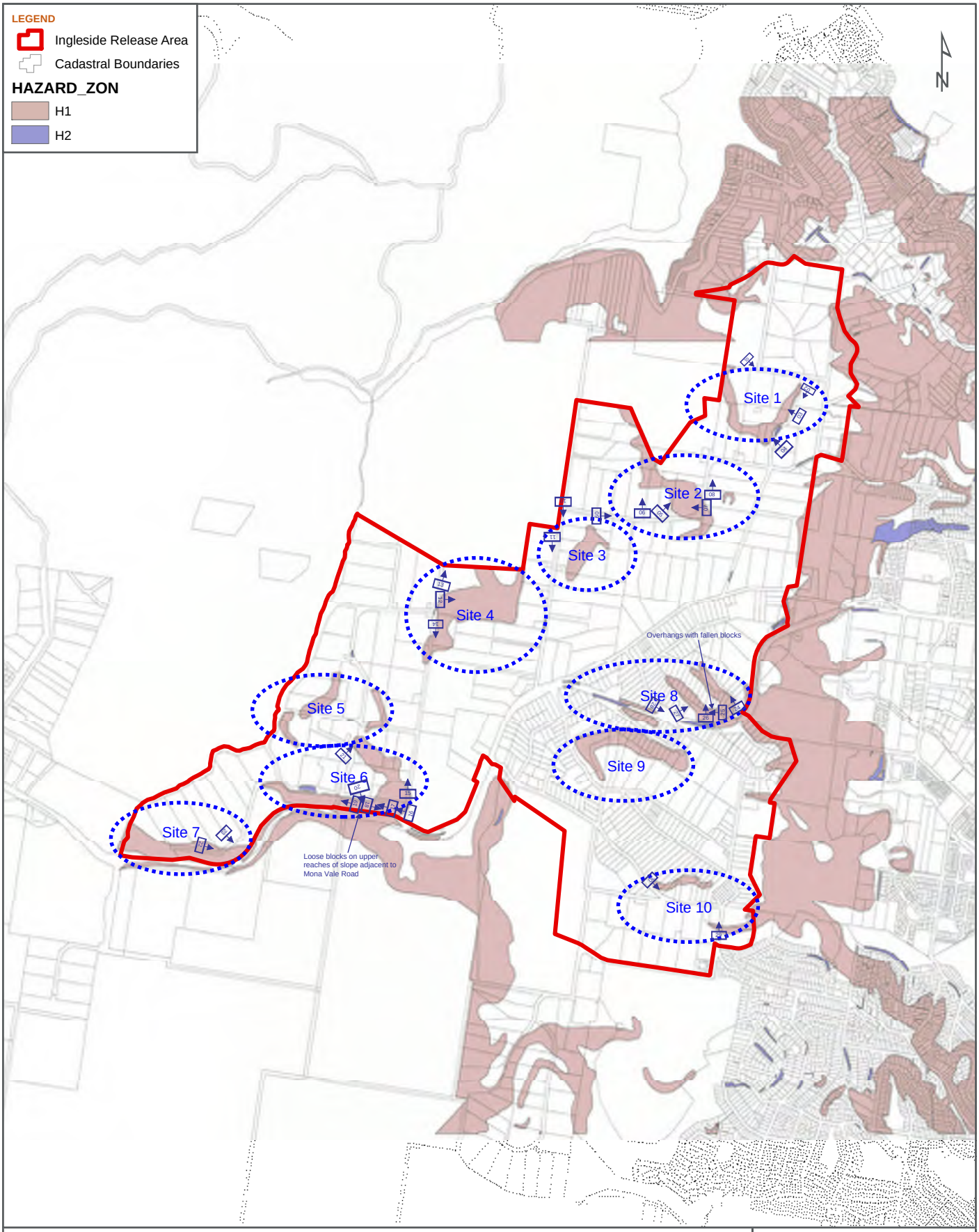
Figure 26: Site 8

Figure 27: Site 8

Figure 28: Site 8

Figure 29: Site 10

Figure 30: Site 10



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COORDINATE SYSTEM GDA 1994 MGA Zone 56

FIG NO. 2

FIGURE TITLE Ingleside Release Area Geology

PROPOSAL NO.

PROPOSAL TITLE Ingleside Land Capability Assessment

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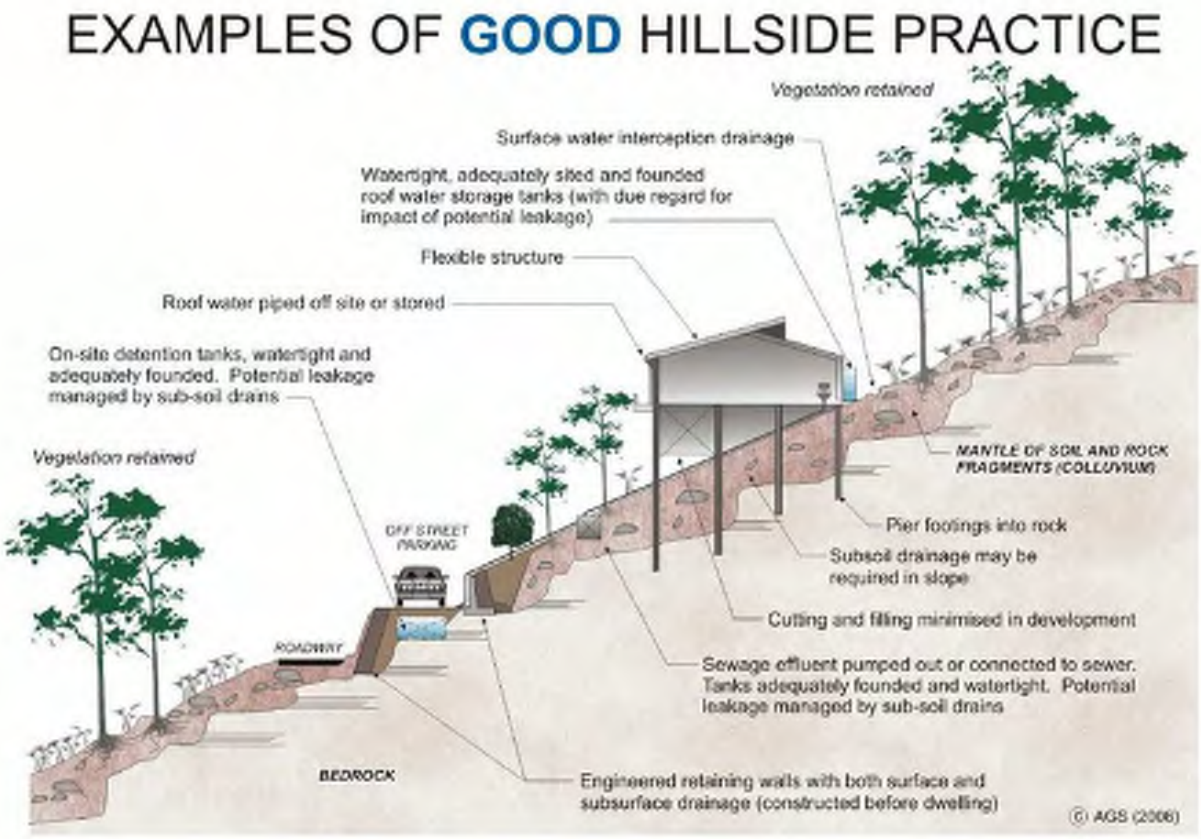
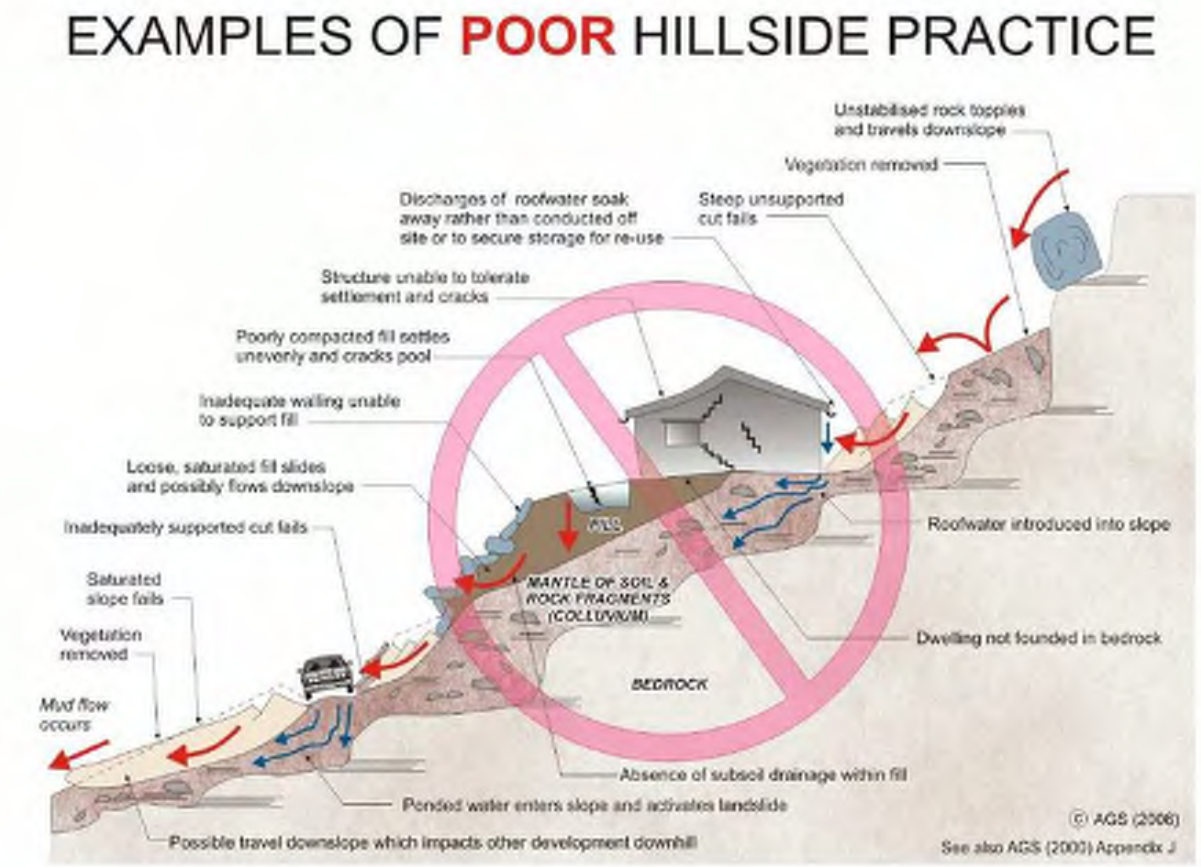
SMEC

Location:

Last updated by: DS11642 on 13/02/2014 at 16:18

APPENDIX B: EXAMPLES OF HILLSIDE PRACTICE


EXAMPLES OF GOOD HILLSIDE PRACTICE
Vegetation retained
Surface water interception drainage
Watertight, adequately sited and founded roof water storage tanks (with due regard for impact of potential leakage)
Flexible structure
Roof water piped off site or stored
On-site detention tanks, watertight and adequately founded. Potential leakage managed by sub-soil drains
Vegetation retained
MANTLE OF SOIL AND ROCK FRAGMENTS (COLLUVIUM)
OFF STREET PARKING
Pier footings into rock
Subsoil drainage may be required in slope
Cutting and filling minimised in development
ROADWAY
Sewage effluent pumped out or connected to sewer. Tanks adequately founded and watertight. Potential leakage managed by sub-soil drains
BEDROCK
Engineered retaining walls with both surface and subsurface drainage (constructed before dwelling)
© AGS (2006)


EXAMPLES OF POOR HILLSIDE PRACTICE
Unstabilised rock topples and travels downslope
Vegetation removed
Discharges of roofwater soak away rather than conducted off site or to secure storage for re-use
Steep unsupported cut fails
Structure unable to tolerate settlement and cracks
Poorly compacted fill settles unevenly and cracks pool
Inadequate walling unable to support fill
Loose, saturated fill slides and possibly flows downslope
Inadequately supported cut fails
Roofwater introduced into slope
Saturated slope fails
MANTLE OF SOIL & ROCK FRAGMENTS (COLLUVIUM)
Vegetation removed
Dwelling not founded in bedrock
BEDROCK
Mud flow occurs
Absence of subsoil drainage within fill
Ponded water enters slope and activates landslide
Possible travel downslope which impacts other development downhill
© AGS (2006)
See also AGS (2000) Appendix J

APPENDIX C: RISK TO PROPERTY TERMINOLOGY

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	**1: CATASTROPHIC 200%**	**2: MAJOR 60%**	**3: MEDIUM 20%**	**4: MINOR 5%**	**5: INSIGNIFICANT 0.5%**
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or **L** (5)
B - LIKELY	10^{-2}	VH	VH	H	M	**L**
C - POSSIBLE	10^{-3}	VH	H	M	M	**VL**
D - UNLIKELY	10^{-4}	H	M	**L**	**L**	**VL**
E - RARE	10^{-5}	M	**L**	**L**	**VL**	**VL**
F - BARELY CREDIBLE	10^{-6}	**L**	**VL**	**VL**	**VL**	**VL**

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		**Example Implications** (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.