Attachment 11 Casuarina South Local Water Management Strategy

Casuarina South Precinct Residential Development - Lots 110, 111, 108 and 114 Lugg Place

EPBC Act Referral Form

316 Property Developments Pty Ltd and 316 Property Group Pty Ltd

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PENTIUM WATER

LOCAL WATER MANAGEMENT STRATEGY

Casuarina South Precinct Local Structure Plan

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Executive Summary

Planning background and current land use

This Local Water Management Strategy (LWMS) has been prepared to support the Casuarina South Precinct Local Structure Plan (LSP) (BDG, 2026). The site is currently zoned 'Urban' under the Metropolitan Region Scheme and 'Residential' under the City of Kwinana's Local Planning Scheme No. 2 (DPLH, 1992). The area is generally semi-rural and bush to the north and east, and suburban residential to the south and west.

Existing environment

The site is typical of the Swan Coastal Plain, being warm and dry during summer and cooler and wetter during winter. The site is gently undulating and generally slopes from east to west towards Kwinana Freeway. Natural surface levels range from 17-30 mAHD along the eastern boundary to 11-16 mAHD along the western boundary.

The site is located on the low-lying Swan Coastal Plain. Regional geological mapping indicates that the surficial geology across much of the site consists of Bassendean Sand overlying the Guildford formation in the centre of the site. The site is generally classified as having moderate to low risk (Class 2) of Acid Sulphate Soils occurring less than 3 m from the surface. The remaining area consists of small pockets of high to moderate risk (Class 1) located within the wetland areas.

There are no known contaminated sites, aboriginal heritage sites, bush forever sites, Public Drinking Water Source Areas or wellhead protection zones within the LSP.

Groundwater

Pre-development groundwater level and quality monitoring on site was conducted by SLR Consulting between October 2022 and October 2024. Groundwater level monitoring was undertaken on Lot 123 east of site between 2007 and 2011, and on Lot 9000 north of site in 2019, 2022 and 2025.

The estimated 20-year AAMGL was estimated at 15.5 mAHD at the north-eastern corner and 11 mAHD at the north-west and south-west corners of site. Groundwater was found to be moderately acidic and fresh, with numerous exceedances of non-potable use guidelines for aluminium, iron, sulphate, sodium, chloride and ammonia. The MGL was estimated at approximately 0.3 m above the AAMGL, corrected to the recent wet winter of 2025.

Hydrology and wetlands

The site is located in the Serpentine River catchment area. The major surface water features are semi-permanent surface water expressions located in the western margins of the site that discharge via artificial open drains. The site drains generally east to west following the topography, with minimal runoff on account of the highly permeable Bassendean Sands.

The Department of Biodiversity, Conservation and Attractions' (DBCA) mapping of Geomorphic Wetlands of the Swan Coastal Plain indicates that a significant portion of the site consists of palusplain wetlands (DBCA, 2025). In 2023, SLR was engaged by the landowners to assess the existing wetlands through a wetland reclassification process, which resulted in the re-classification of two of the wetlands from Resource Enhancement Wetlands to Multiple Use Wetlands, and one of the wetlands from a Resource Enhancement Wetland to a Conservation Category Wetland (CCW) (SLR, 2023b).

The CCW areas in the north-western corner and centre of site are classified as Environmentally Sensitive Areas (ESA) (DWER, 2021). A recent DBCA investigation (DBCA, 2024) identified the presence of an Organic Mound Spring (Tumulus Spring) Threatened Ecological Community (TEC) within the north-western CCW.

Water source planning

Potable water will be accessed via a connection to Water Corporations Integrated Water Supply Scheme. It is likely that a DN250 water main extension would be required to extend north through site from Mortimer Road.

A groundwater licence request was submitted in June 2025 for an allocation of 89,750 kL per year. Obtaining this additional allocation would secure the water licences to support the irrigation requirement and some additional irrigated areas. DWER are currently assessing this request under DWER reference number DWERVT18248 (application 073426).

Stormwater management

The site will effectively manage stormwater quantity and quality generated from small, minor and major events, incorporating best practice WSUD principles. The drainage objectives are based on the Stormwater management manual for Western Australia (DoW, 2004-2007), Decision process for stormwater management in Western Australia (DWER, 2017) and the Jandakot drainage and water management plan (JDWMP) (DoW, 2009).

The drainage strategy comprises stormwater being infiltrated as close to source as possible (e.g. soakwells within lots or infiltration areas within road reserves) or entering bio-retention areas within road reserves and POS. Bio-retention basins in POS and swales in road reserve areas are required to retain, treat, and infiltrate road reserve runoff generated from the first 15 mm of rainfall, with larger events being allowed to overflow to detention basins and wetlands. The bio-retention areas are designed to ensure post-development water quality does not exceed pre-development and are located outside wetlands and their buffers. The detention basins and wetlands are designed to ensure post-development stormwater flows do not exceed that outlined in the JDWMP.

The drainage design involves a ~ 65 ha stormwater catchment draining west towards the wetland basins adjacent the Kwinana Freeway, prior to discharging to Peel Sub Drains. The stormwater catchment for the Casuarina South LSP is comprised of various land uses including road reserves, residential lots, commercial lots, school, district open space and public open space areas. All sub-catchments are drained via pit-and-pipe drainage systems which collect and convey development runoff to bio-retention basins. The pit-and-pipe network is complemented by bio-retention swales in the road reserve in sub-catchments with boulevard roads. External catchments reporting to site include portions of the Kwinana Freeway and the Casuarina Central Precinct to the north, and a substantial rural-residential and bushland are to the east.

Stormwater modelling for the Casuarina South LSP shows the 15 mm event is attenuated in bioretention basins and swales at depths of 0.3 to 0.5 m, and the 1% AEP event is attenuated in detention basins and wetlands at depths of 1 to 1.2 m. The modelling demonstrates that the downstream discharge requirements of the JDWMP at the Kwinana Freeway and Mortimer Road culverts are met.

Groundwater management

Groundwater levels will be managed by the installation of a subsoil drainage system to be placed beneath road reserves and POS areas. The level at which subsoil drains are installed, the Controlled Groundwater Level (CGL), will be set according to *Water resource considerations when controlling groundwater levels in urban development* (DoW, 2013). Fill will be imported to provide clearance from the CGL to roads and building pads where required.

The subsoil drainage system for the LSP will discharge into either existing wetlands throughout the site or modified / new drainage channels which will be created as part of the flood detention system within the large flood corridors. Ultimately the subsoil discharge will be to the Peel Sub Drains to the west and south of the site. Subsoil drainage water quality will be managed by treating the 15 mm stormwater event prior to infiltration, and by discharging into bioretention areas where possible.

Future monitoring requirements

Post-development groundwater and surface water monitoring is proposed for three years and will include pre-development locations as best possible. The sampling program includes quarterly monitoring of water levels and nutrients and an annual sample of metals and pathogens. Monthly monitoring of water levels is proposed during winter and spring.

Trigger values have been established based on pre-development monitoring results obtained from the SLR monitoring program between October 2022 and 2024. Trigger values have been calculated at 20% above the mean pre-development results as well as comparing to ANZG

guidelines (ANZG, 2018) for wetlands and lowland rivers in the south-west of Australia. The post-development monitoring results will be compared to these trigger values.

Additional pre-development surface water and groundwater monitoring is proposed to better characterise the seasonal water behaviour in the low-lying western margins of site, with a particular focus on existing wetlands and the Tumulus Organic Mound Spring in the north-west corner. The scope of this monitoring will be confirmed with the City, DWER and DBCA.

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1. Introduction

1.1. Background

This Local Water Management Strategy (LWMS) has been prepared to support the Casuarina South Precinct Local Structure Plan (LSP) (BDG, 2026) which comprises of 65 ha of the south-west Casuarina region, approximately 31 km south of Perth CBD. It is bounded by Lot 9000 Orton Road and Lot 39 Landgren Road to the north, Lot 123 Mortimer Road to the east, Mortimer Road to the south and Kwinana Freeway to the west. The area is generally semi-rural and bush to the north and east, and suburban residential to the south and west. The LSP area consists of the following lots, herein referred to as "the site."

- Lots 101, 122, 2001 Mortimer Road
- Lots 1001, 1002, 103, 104, 105, 106, 115, 116, 117, 118, 121 Nicolas Drive
- Lots 107, 108, 109, 110, 111, 112, 113, 114 Lugg Place

The site location is shown in Figure 1. The LSP is included in Appendix A.

1.2. Planning context

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Residential' under the City of Kwinana's Local Planning Scheme (LPS) No. 2 (DPLH, 1992).

The Jandakot Structure Plan (JSP) (WAPC, 2007) provides guidance for local structure plans and subdivision applications based on the MRS zoning, with a particular focus on the protection of the Jandakot Mound groundwater resource. The Jandakot Drainage and Water Management Plan (JDWMP) (DoW, 2009) was developed for the JSP, to inform key surface water and groundwater management measures to be implemented subdivision and development. Subdivision applications are then guided by Local Water Management Strategies (LWMS') and Urban Water Management Plans (UWMPs), which detail the size, levels and functions of water management infrastructure.

The LPS identifies the existing wetlands on-site as 'Areas for Landscape Protection;' however, they have recently been re-classified (see section 3.9). Studies by SLR (SLR, 2023b) (SLR, 2025) document the re-classification process undertaken with DBCA for three wetlands on-site. The re-classification process resulted in a change from Resource Enhancement to Multiple Use for two wetlands, and from Resource Enhancement to Conservation Category for one wetland (refer Figure 6). This deems two of the previous mapped wetland areas suitable for residential development, and one wetland area unsuitable, in-line with the 'Urban' zoning under the MRS and 'Residential' zoning under the LPS.

The site is in Development Contribution Areas (DCA) 3 and 10 under the LPS. DCA 3 'Casuarina – Standard Infrastructure' requires the developer to financially contribute to road upgrades (including Mortimer Road along the southern boundary), drainage upgrades (including the Peel Sub O Drain at the western boundary), public open space (POS) and other community infrastructure. DCA 10 'Casuarina/Anketell Community Infrastructure' requires the developer to financially contribute towards district and local community infrastructure.

1.3. Key documents and previous studies

A number of investigations have been completed and relied upon to prepare this LWMS including:

- Jandakot drainage and water management plan – Peel main drain catchment (DoW, 2009)
- Casuarina South LSP – Biological Survey (SLR, 2023a)
- Casuarina South – Wetland Verification and Reclassification Assessment (SLR, 2023b)
- Site drainage inspection – Casuarina South LSP (Pentium Water, 2024)

- Casuarina South Groundwater Monitoring Report from October 2022 - October 2024 (SLR, 2024)
- Site wetland investigation – Casuarina Central Precinct (DBCA, 2024)
- Casuarina Wetlands Technical Memorandum (SLR, 2025)

Figure 1: Site location plan

2. Water management principles and objectives

The following principles and objectives have been adapted from the *Better Urban Water Management* (WAPC, 2008), Jandakot drainage and water management plan – Peel main drain catchment (DoW, 2009) (the 'JDWMP'), and Decision process for stormwater management in Western Australia (DWER, 2017).

Table 1: LWMS principles and objectives

Key element	Principles	Objectives
Water conservation	▪ No potable water should be used outside of homes and buildings with the use of water to be as efficient as possible.	▪ Meet the *State Water Plan* (Government of WA, 2007) water consumption target of 100 kL/person/yr, including not more than 40-60 kL/person/yr scheme water. ▪ Irrigation of public spaces to be by groundwater or an alternate water supply scheme.
Water quantity	▪ Maintain the pre-development hydrologic regime of the receiving environment. ▪ At source retention of small storm events (15mm). ▪ Protection of people and property by the safe conveyance of excessive run-off from extreme events.	▪ Maintain predevelopment flows into important wetlands and water dependent ecosytems. ▪ Design stormwater management systems to provide serviceability, amenity and road safety during minor rainfall events. ▪ Meet the 10% and 1% annual exceedance probability (AEP) post-development flood regime (flood level, peak flow rates and storage volumes) outlined in the JDWMP. ▪ Safely convey run-off from extreme events up to the 1% AEP event and ensure that the flood channel capacity of the receiving waterway is not exceeded by retaining or detaining the run-off from storm events where appropriate. ▪ Protect people and property from flooding by constructing building habitable floor levels with a minimum of 0.5 m above the 1% AEP flood level. ▪ Minor roads remain passable in the 10% AEP event.
Water quality	▪ Maintain surface water quality at pre-development levels and, if possible, improve the quality of the water leaving the development area to maintain and restore ecological systems in the sub-catchment in which the development is located.	▪ Manage – retain/detain and treat (if required) – stormwater run-off from constructed impervious surfaces generated by the first 15 mm of rainfall at source as much as practical.
Groundwater management	▪ Protect buildings and other infrastructure by providing adequate separation from maximum groundwater levels. ▪ Maintain groundwater quality at pre-development levels and, if possible, improve the quality of water leaving the development area to maintain and restore ecological systems in the sub-catchment in which the development is located.	▪ Set the Controlled Groundwater Level (CGL) according to Department of Water and Environmental Regulation (DWER) guidelines and at a level to protect groundwater dependent ecosystems and infrastructure. The conceptual design at local structure plan scale is provided in section 7.3. ▪ Subsoil drainage to be laid at or above the CGL, which has been set at the 2025 maximum groundwater level (MGL). ▪ Nutrient export from the site will not be increased.

3. Existing environment

3.1. Existing and historical use

The site is located in Casuarina, within the City of Kwinana, covering an area of approximately 65 hectares. Historically the site has been used for grazing and rural residential.

Table 2 is a summary of the main current land uses and structures associated with the site.

Table 2: Site land uses

Lot/site number	Industry/Land use	Structures and/or sensitive receptors
Lots 101, 2001 Mortimer Road	Pastoral, power transmission easement	▪ Sheep feedlots ▪ Containment infrastructure for contaminated stormwater/wastewater ▪ Workshops ▪ Office and breakout areas ▪ Residence ▪ Powerline corridor
Lot 122 Mortimer Road Lots 1001, 1002, 103, 104, 105, 106, 115, 116, 117, 118, 121 Nicolas Drive Lots 107, 108, 109, 110, 111, 112, 113, 114 Lugg Place	Rural residential	▪ Residences

3.2. Climate and rainfall

The site is typical of the Swan Coastal Plain, being warm and dry during summer and cooler and wetter during winter.

Climate statistics for the site were obtained from the Jandakot weather station (Station 09172) which is located 17 km north-east of the site. The average annual rainfall extracted from Jandakot weather station is 790 mm whilst the long-term mean minimum temperature for Jandakot Aero Weather Station ranges from 11˚C (June) to 20.0˚C (January) (1989 to 2024) and the long-term mean maximum temperature ranges from 25.6˚C (June) to 46.6˚C (February) (Bureau of Meteorology, 2025).

The Jandakot Aero weather station recorded 757 mm of rainfall in the last 12 months prior to the survey (January 2024 to December 2024), which is 32.1 mm below the long-term average of 790 mm (Bureau of Meteorology, 2025). This decrease in rainfall is consistent with the declining trend in the south-west of Western Australia region where rainfall has dropped by 20% in some areas (DPIRD, 2025).

Table 3: Monthly rainfall and temperature averages

Statistic (mm/mth)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max Temp (°C)	34.4	35.0	32.5	28.4	25.0	21.2	19.1	21.1	22.4	26.3	30.6	32.8
Min Temp (°C)	28.2	29.3	27.7	23.1	20.5	17.1	16.5	17.0	18.0	19.9	23.5	23.8
Rainfall (mm)	14.7	17.1	16.8	40.9	103.9	151.1	174	128.4	82.1	46.3	26.9	9.8

3.3. Topography

The site is gently undulating and generally slopes from east to west towards Kwinana Freeway. Natural surface levels range from 17-30 mAHD along the eastern boundary to 11-16 mAHD along the western boundary. The site is at the headwaters of the Peel Sub O and Sub N2 Drains running west and south from site, respectively. Surface water drainage is from east to west, with the northern portion (approximately three-quarters) of site reporting to the Peel Sub O Drain, and the southern quarter reporting to the Peel Sub N2 Drain.

Figure 2 shows the Peel Sub Drain locations and the existing topography of the site and surrounds with 1 m elevation contours. The contours were generated from a 5 m LiDAR grid from Geoscience Australia (GA, 2015).

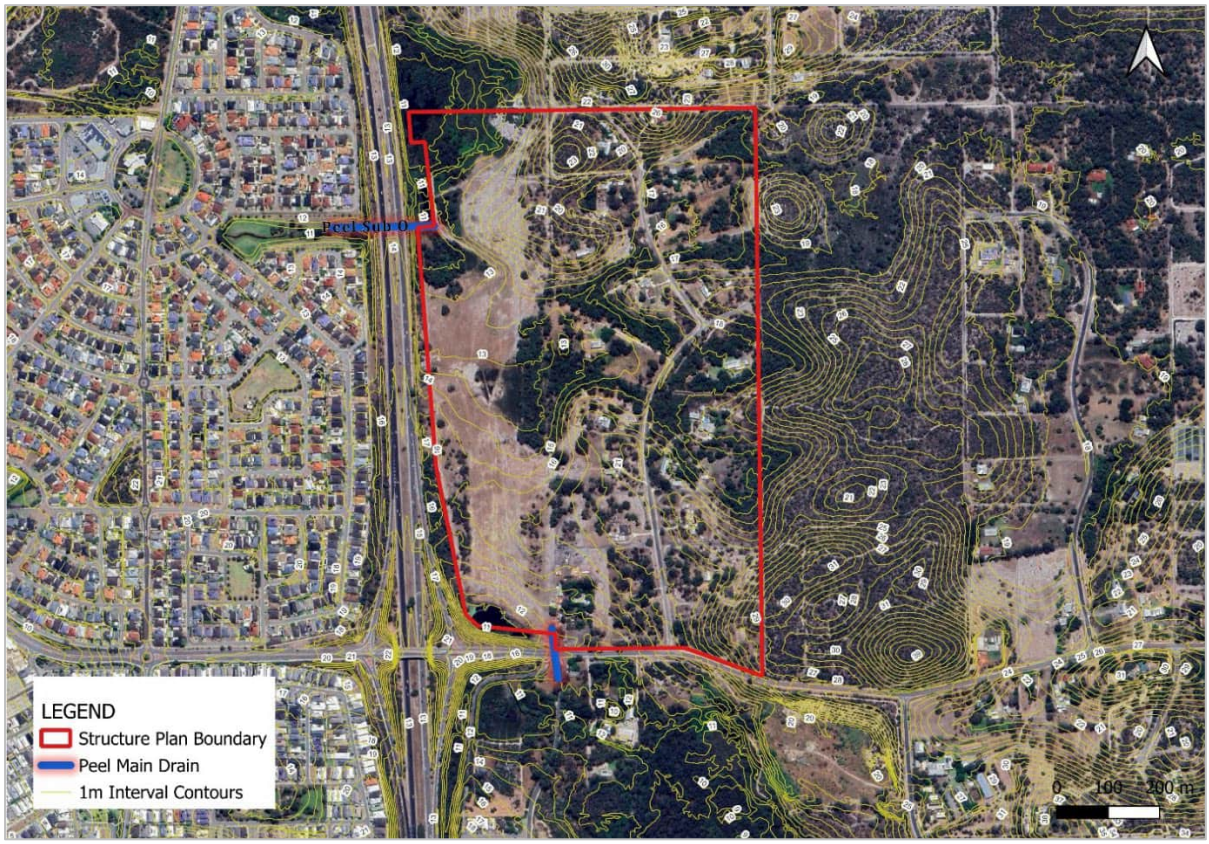


Figure 2: Existing topography

3.4. Geology

3.4.1. Regional Mapping

The site is located on the low-lying Swan Coastal Plain. Regional geological mapping indicates that the surficial geology across much of the site consists of Bassendean Sand overlying the Guildford formation in the centre of the site. The Guildford formation (Qrw) is described as alluvial sand and clay with shallow-marine estuarine lenses and local conglomerate (Davidson, 1995). The northern and southern part of the site is mapped as part of the Bassendean Sand formation (Qpb), described as basal conglomerate overlain by dune quartz sand with heavy mineral concentrations (Davidson, 1995). Regional surficial geology mapping is shown in Figure 3.

Figure 3: Local surface geology

3.4.2. Site investigations

Whilst there is yet to be a geotechnical investigation undertaken across site, groundwater monitoring bores installed as part of the groundwater assessment on-site, the wetland assessment on the neighbouring Lot 123 and the groundwater assessment on the neighbouring Lot 9000 provide some insight into the underlying soil profile.

The bore logs in the lower-lying north-western area of site indicate Guildford Clay to around 4 m depth, comprising grey-black fine- to medium-grained sandy clay of low to high plasticity (SLR, 2024). The bore logs on Lot 123 east of site indicate Bassendean Sand to 4 m depth, comprising grey-white medium- to coarse-grained sand in the upper 1 m, and coarse yellow-brown sand below (Bioscience, 2011). The bore logs on Lot 9000 north of site indicate Bassendean Sand to around 6 m depth, with a peat layer encountered at 3-8 m depth near the wetland in the west and a coffee rock layer encountered at 4-6 m depth in the higher eastern area.

The SLR and western Urban Resources bore logs are associated with lower-lying peaty wetland areas. The lithology outside these areas (majority of site) is expected to reflect a deeper upper portion of Bassendean Sand due to the significantly higher elevations.

The bore logs are included in Appendix B, and a map of locations is included in Figure 9 in section 3.12.4 below.

A geotechnical investigation is yet to be undertaken on-site due to fragmented land ownership and is therefore proposed at Urban Water Management Plan (UWMP) stage to inform detailed design.

3.5. Acid sulphate soils

The site is generally classified as Class 2 (orange), having moderate to low risk of Acid Sulphate Soils (ASS) occurring less than 3 m from the surface. The remaining area consists

of small pockets of Class 1 (red) located within the wetland areas of the northeast, southwest and the central pockets of the site. A Class 1 risk indicates ASS could be occurring within 3 metres of the natural soil surface which could be disturbed by development activities such as earthworks, dewatering or soil drainage (DWER, 2017).

A detailed ASS investigation will be undertaken and in the event that any ASS is encountered an Acid Sulphate Soil Management Plan will be prepared and implemented as part of the subdivision process.

Figure 4 shows the distribution of potential ASS across the site.

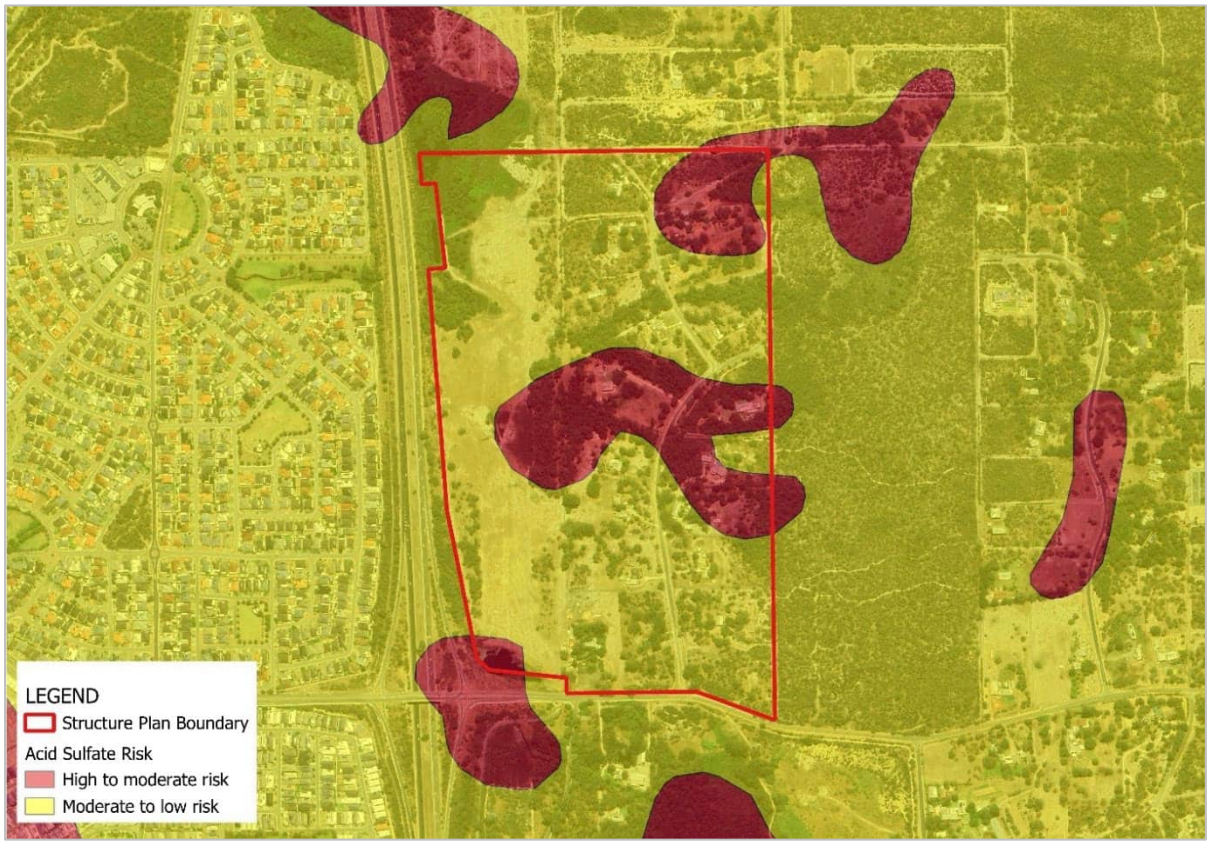


Figure 4: Acid sulphate soils risk

3.6. Contaminated Sites

A review of the DWER Contaminated Sites Register did not identify any known contaminated site under Section 11 of the Act within the Site or in the immediate surrounds (DWER, 2023).

3.7. Aboriginal Heritage

A search of the Department of Planning Land and Heritage, Aboriginal Heritage (DPLH, 2025) Inquiry system found no registered aboriginal heritage sites within the site boundaries. The nearest aboriginal heritage listed site (ID: 38661) is 1.2 km directly north of the site's northern boundary.

A search of the EPBC Protected Matters Search Tool identified no Commonwealth listed heritage sites within 1 km of the site.

3.8. Bush Forever Sites

A search of the Department of Plannings Lands and Heritage Bush Forever mapping did not identify any Bush Forever sites within the site (DPLH, 2019).

3.9. Wetlands

3.9.1. Previous DBCA wetland mapping

The Department of Biodiversity, Conservation and Attractions' (DBCA) mapping of Geomorphic Wetlands of the Swan Coastal Plain indicates that a significant portion of the site consists of palusplain wetlands of varying classification (DBCA, 2025). The wetland types are recorded as Basin Damplands and Basin Sumplands, which are characterised by seasonal waterlogging and inundation respectively. The mapped wetlands on-site are shown in Figure 5 below.

There are two mapped Multiple Use Wetlands (MUW) on-site at the western boundary and in the south-western corner (UFIs 15974, 13966, 15976, 15977, 15982, 15799). MUWs are typically wetlands with few remaining important ecological attributes and functions and do not generally pose a constraint to developments.

The site also contains two Resource Enhancement Wetlands (REW) located in the centre (wetland 1) and in the north-eastern corner (wetland 2) of site (UFIs 15978, 13969, 6690); see Table 4 and Figure 5 below. REWs are typically wetlands that have been partly modified but will support ecological attributes and values. The EPA advises that reasonable measures are taken to minimise potential impacts on REWs and their appropriate buffers (WRC 2001; EPA 2008).

Part of one Conservation Category wetland (CCW) is mapped in the north-western corner of the site (UFIs 15972, 15973); see Figure 5 below. CCWs are wetlands which support a high level of ecological attributes and functions and are therefore protected with no development or clearing allowed within wetland boundaries or buffers.

DWER mapping indicates the wetland areas in the north-western corner (wetland 1) and centre (wetland 2) of site are classified as Environmentally Sensitive Areas (ESA) (DWER, 2021).

3.9.2. Current wetland classification

In 2023, SLR undertook a wetland assessment to reclassify the previous DBCA wetland classifications (SLR, 2023b). The wetland assessment report discussed the environmental values and physical signatures evident of the wetlands on-site, which resulted in the re-classification of two of the wetlands from REWs to MUWs. The details of the recommended classification and footprint are listed in Table 4 and are shown in Figure 6.

Upon further consultation with DBCA, the LSP was adjusted to allow for the reclassification of the wetland in the centre of site (wetland 2) from an REW to a CCW, on account of its clear wetland signatures (water regime, vegetation species, etc.) and areas of high ecological value vegetation in good condition. The wetland boundaries proposed under the LSP are shown in Figure 6.

Table 4: Previous DBCA wetland classification and current SLR classification

Wetland ID	Previous DBCA Management Classification	Wetland Area (ha)	Current SLR Classification	Wetland Area (ha)
1	REW	REW = 9.06	REW & MU	REW = 3.33 MU = 5.73
2	REW	REW = 4.22	REW & MU	REW = 2.35 MU = 1.87
3	CCW	CCW = 5.57	CCW	CCW = 4.97

REW: Resource Enhancement Wetland (REW), MUW: Multiple Use Wetland, CCW: Conservation Category Wetland

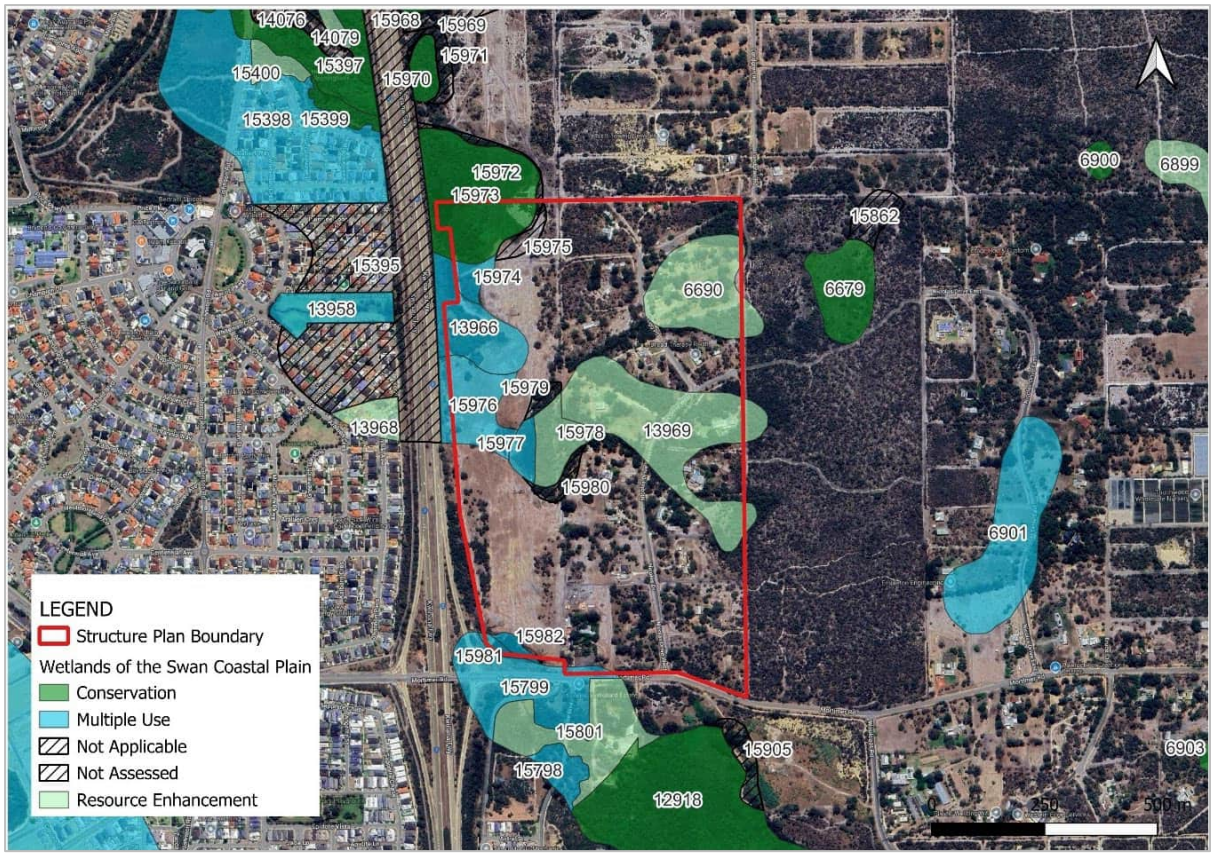


Figure 5: Previous DBCA wetland classification

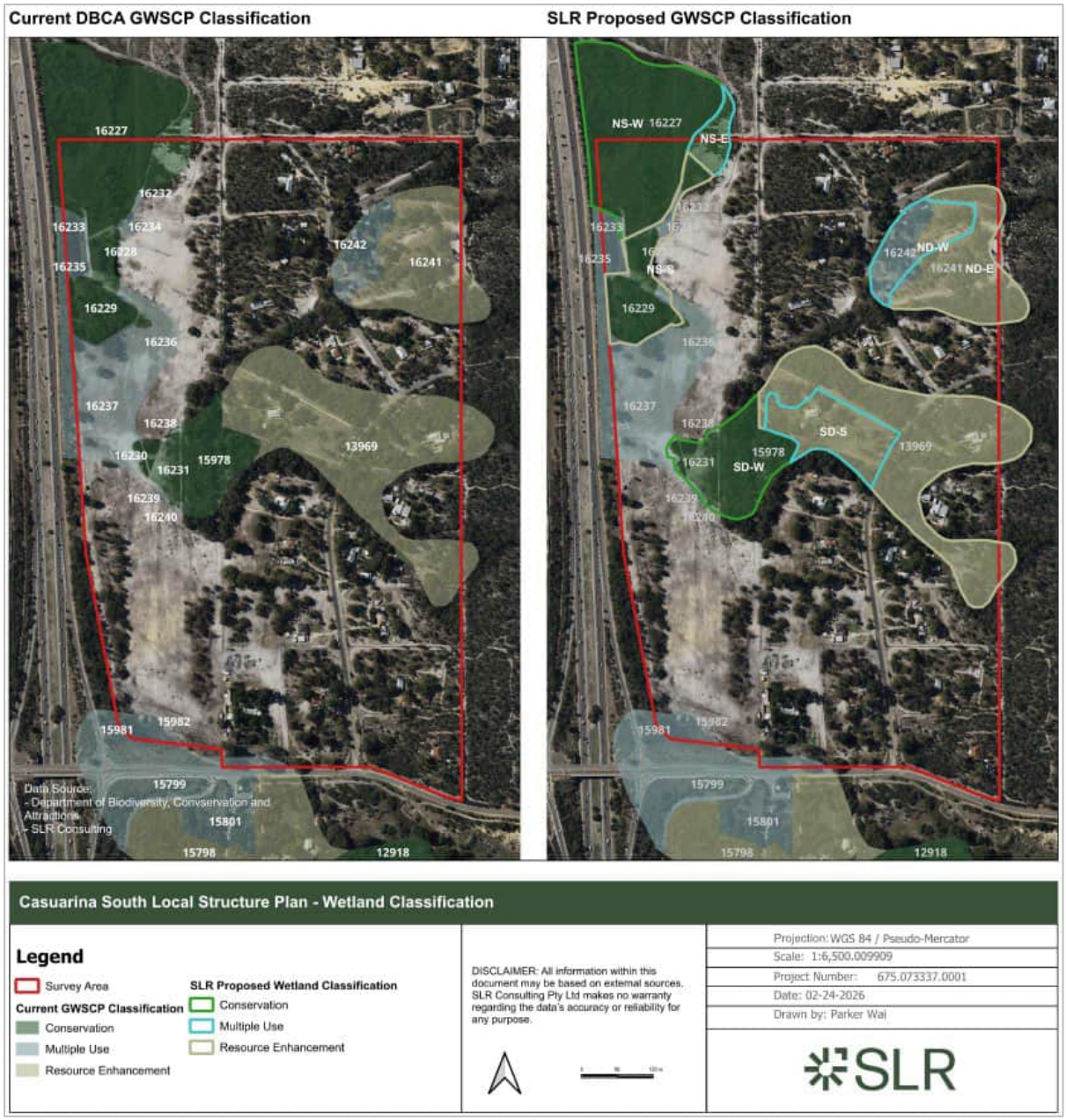


Figure 6: Previous DBCA and current SLR wetland classification (SLR, 2026)

3.9.3. Tumulus Organic Mound Spring

A recent DBCA investigation (DBCA, 2024) identified the presence of a Tumulus Organic Mound Spring (TOMS) Threatened Ecological Community (TEC) within the north-west CCW (Wetland 1). The TOMS is an ecosystem dependent on particular soil-water-vegetation conditions, being a continuous expression of groundwater, a surface mound of peat, and moisture-adapted plant species. A 0.99 ha area of TOMS is mapped on-site, as shown in Figure 7 below.

The TOMS is characterised by the following key attributes (SLR, 2026):

- Continuous, year-round supply of groundwater, typically under pressure from an underground spring
- Peat layer at surface, becoming increasingly elevated (i.e. mounding) at the water source
- Vegetation species adapted to year-round moist or wet conditions, with their continuous growth causing the ongoing formation of peat

There are few known occurrences of TOMS' in WA, with significant variance between. The occurrence of the TOMS on-site is not fully understood and further investigations are required to define its function and dependencies, to ensure that it can be adequately protected during construction and post-development (refer section 7.5.2 for detail).

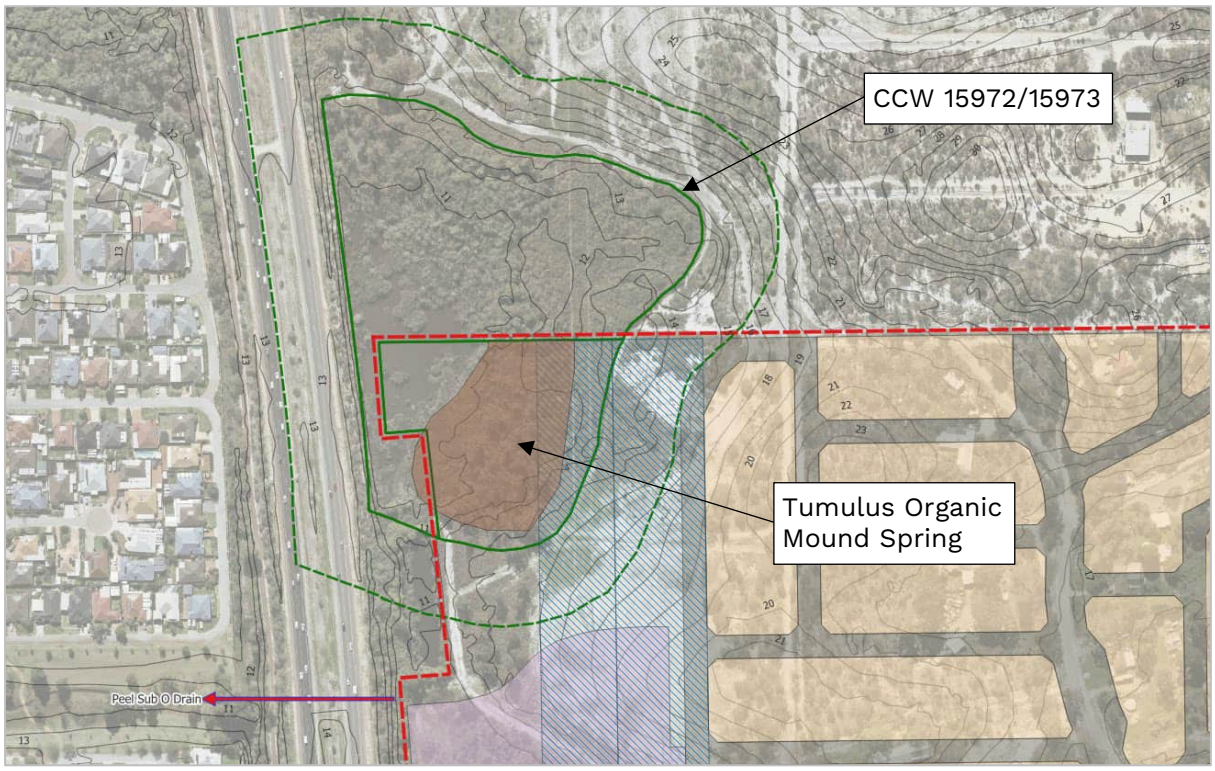


Figure 7: Tumulus Organic Mound Spring mapped on-site (DBCA, 2024)

3.10. Public Drinking Water Source Areas

There are no Public Drinking Water Source Areas (PDWSAs) or wellhead protection zones within the site boundaries. The nearest PDWSA's are a Priority 1 and Priority 2 area within the Jandakot Underground Water Pollution Control Area, approximately 1.2 km north-east of the site, as shown in Figure 8.

Figure 8: Public Drinking Water Source Areas and Wellhead Protection Zones

3.11. Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are classes or areas of native vegetation where the exemptions for clearing vegetation under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) do not apply. ESAs ensure that clearing within these areas is assessed under the clearing permit process.

The site contains two mapped ESAs according to the DWER Environmentally Sensitive Areas Map Viewer (DWER, 2021). The ESAs are associated with the CCW in the north-western corner of site, and the MUW/REW (now a CCW) in the centre of site. A Tumulus Springs Threatened Ecological Community (TEC) was identified within the ESA associated with the CCW in the north-western corner (DBCA, 2024).

3.12. Groundwater

3.12.1. Regional Hydrogeology

Groundwater resource mapping available from the DWER Water Register (DWER, 2025) shows the site is located in the Jandakot Mound groundwater management area, and underlain by the following aquifers:

- Perth Superficial (unconfined)
- Leederville Aquifer (confined)

3.12.1.1. Superficial Aquifer

Groundwater flow direction is generally to the south-west towards the coast. Much of the Jandakot mound is underlain by Bassendean Sand which has an estimated aquifer transmissivity of 200 to 1,000m^2/d, saturated thickness of 40 m and a low salinity of 0 –

500 mg/L (Davidson, 1995). Regionally the Superficial Aquifer is fresh, with salinity ranging between 250-500 mg/L. High nutrient concentrations are known to occur in areas where the Superficial Aquifer has been heavily fertilised (DoW, 2010).

3.12.1.2. Leederville Aquifer

Sitting beneath the Superficial Aquifer is the Leederville Aquifer which is estimated to be 200 – 300 m thick (Davidson, 1995). There are no boreholes in the area that have depths beyond 70 m so the exact depth of the Leederville in this area is unknown.

Sitting between the Superficial and Leederville Aquifers is the Osborne Formation which includes the confining beds of the Kardinya Shale and the permeable Henley Sandstone. The Henley Sandstone formation is included in the Leederville Aquifer (Davidson and Yu, 2008).

The Leederville Aquifer is made up of the Pinjar Member, Wanneroo Member and Mariginup Member and is a major drinking water resource with groundwater salinity beneath the Jandakot Mound typically < 500 mg/L ('fresh').

3.12.2. Regional Groundwater Levels

The Perth Groundwater Map (DWER, 2022), which provides an indication of regional groundwater levels, shows the historical Maximum Groundwater Level (MGL) at the site to range between 11 mAHD and 14 mAHD in the southwest and northeast corners, respectively.

There are no DWER bores located within the bounds of the site, however, there are 3 DWER bores positioned roughly 2 km to the north-east (AWRC 61410107), south (AWRC 61410095), and north-west (AWRC 61410082), of the site. These bores are screened in the Superficial and Leederville Aquifers and have groundwater levels available from 1975 to 2025.

3.12.3. Local Hydrogeology

The surficial geology across the majority of the site consists of sands of the Bassendean Formation occurring in a shallow dune system, with sands and clays of the Guildford Formation in the centre, north-western corner and south-western corner of site. Bore installation logs on-site and on Lot 123 to the east indicate variability in the vertical distribution of sands and clays across site.

3.12.4. Site Groundwater Levels

Pre-development groundwater level monitoring at Lot 2001 on-site was conducted by SLR Consulting between October 2022 and October 2024. This monitoring regime involved the measurement of monthly groundwater levels and field parameters and periodic water quality sampling of six monitoring bores across the western portion of the site. The monitoring report prepared by SLR is provided in Appendix C.

Groundwater levels measured between October 2022 and October 2024 ranged from a minimum elevation of 9.1 mAHD in MB21 at the western boundary to a maximum of 13.1 mAHD in MB6 near the centre of site. The depth to water relative to existing surface ranged from 0.1 mbgl to 4.4 mbgl.

Surface water levels measured by SLR during the high groundwater period were considered to be representative of groundwater levels (see section 3.13.4), so were used in the groundwater level assessment.

Groundwater level monitoring was undertaken on Lot 123 east of site between 2007 and 2011, as part of a wetland assessment (Bioscience, 2011). The groundwater elevation at the Lot 123 wetland varied from minimum elevation 14.9 mAHD at MMB1 to maximum elevation 16.8 mAHD at MMB5. The minimum depth to groundwater was recorded at 1.5 mbgl at MMB4.

Groundwater level monitoring was undertaken on Lot 9000 north of site by Urban Resources in 2019, 2022 and 2025, as part of the pre-development monitoring regime for the Casuarina Central precinct (Urban Resources, 2026). The groundwater elevation on Lot 9000 varied

from minimum elevation 11.5 mAHD in the south-west to maximum elevation 15 mAHD in the north-east. The minimum depth to groundwater was recorded at 0.5 mbgl.

The SLR, Bioscience and Urban Resources monitoring data were all used in the groundwater level assessment.

The average annual maximum groundwater level (AAMGL) across the Casuarina LSP site was estimated over a 20-year period using the SLR, Bioscience and Urban Resources monitoring data, correlated with the long-range datasets of the DWER bores. The AAMGL was estimated at 15.5 mAHD at the north-eastern corner and 11 mAHD at the north-west and south-west corners of site. The AAMGL ranges from around 15 mbgl in the south-east to 0.5 m above ground in the west.

The maximum groundwater level (MGL) on-site was estimated using the aforementioned dataset corrected to the peak 2025 groundwater level. The DWER bore data indicates the 2025 peak was the highest or second-highest of the last 20 years, thus representative of recent MGL. The MGL was estimated at around 0.3 m higher than AAMGL.

The monitoring locations, estimated 20-year AAMGL contours and 2025 MGL contours are shown in Figure 9 and Figure 10 below.

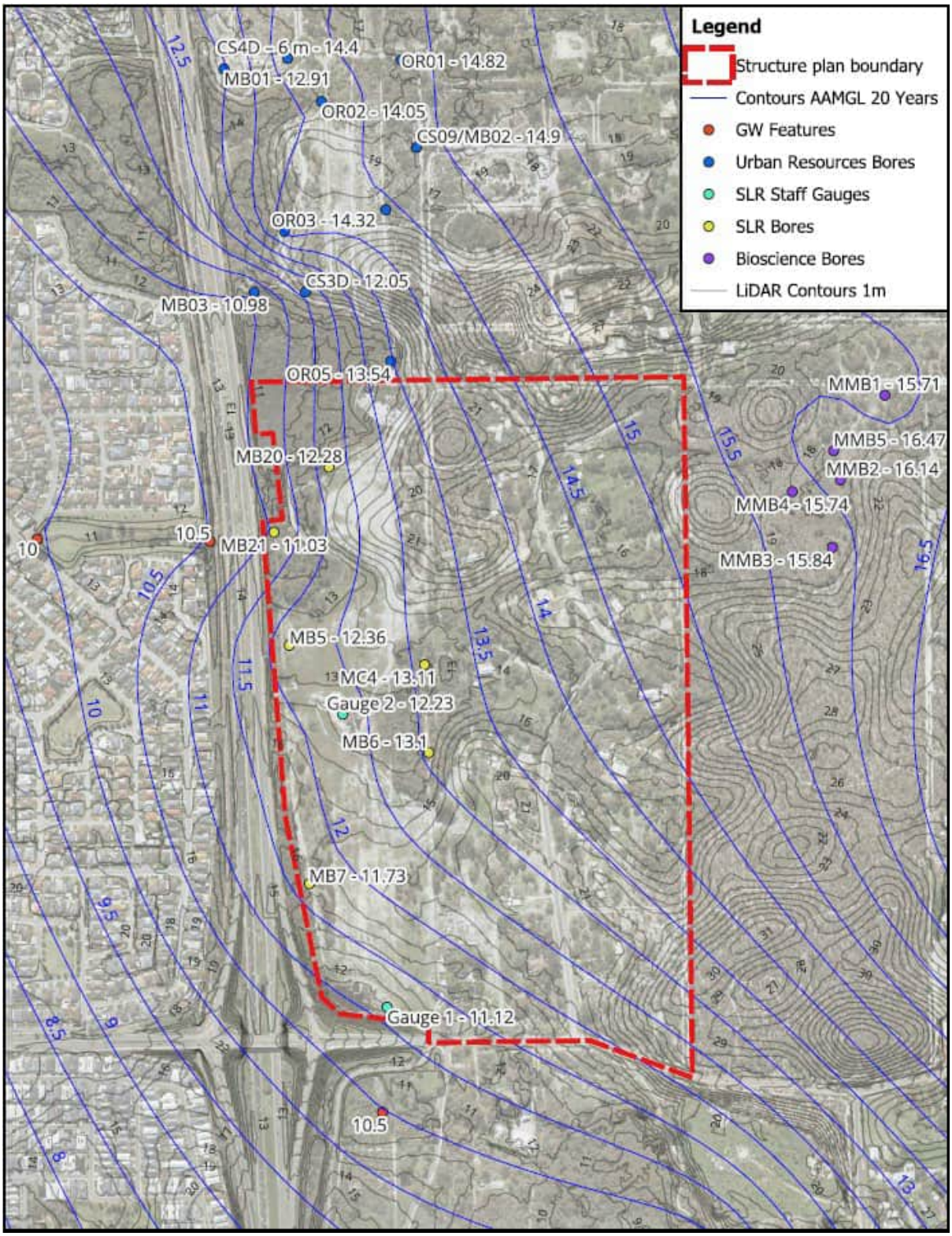


Figure 9: Estimated AAMGL elevation contours

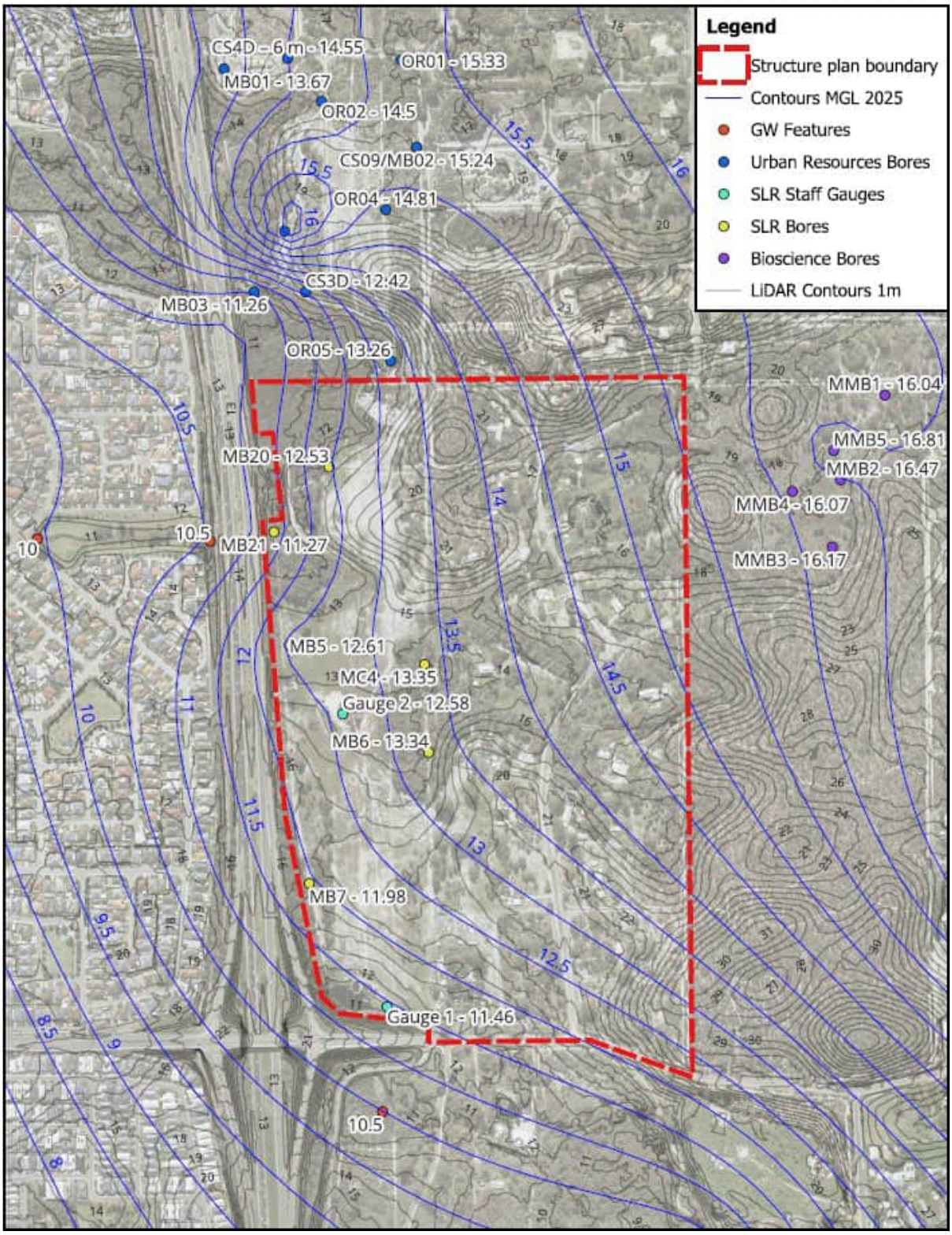


Figure 10: Estimated MGL elevation contours

3.12.5. Groundwater quality

Groundwater quality was sampled regularly by SLR between October 2022 and October 2024. Tabulated groundwater analytical results are available in Appendix C. The monitoring results recorded to date have been summarised below, with the following conclusions made.

- The pH of groundwater ranged from 4.14 to 5.77 pH units indicating moderate acidic conditions. MC4 and MB5 recorded the lowest pH with all recordings less than pH 5.
- Bore MC4 recorded higher electrical conductivity (EC) compared to the other bores (2,432 to 3,468 µS/cm, mean EC 2916.54 µS/cm). The mean EC for all bores except MC4 was less than 1000 µS/cm indicating generally fresh water beneath the site.
- The concentration of aluminium and iron exceeded the NPUG guidelines (0.2 mg/L) at all locations at some time during the monitoring period. Other analytes that exceeded the assessment criteria were sulphate, sodium, chloride and ammonia-N with MC4 recording the most exceedances.
- All GWQ results including exceedances were considered typical of the predevelopment groundwater quality for the area.

The groundwater quality data is summarised in Table 5 below and represents the average across bores.

Table 5: Groundwater quality at SLR monitoring locations

Parameter	Mean	Min	Max
EC (µs/cm)	793	7.70	3468
pH	5.07	4.14	5.77
DO (mg/L)	1.00	0.06	7.37
ORP (mV)	-38.36	-241.40	218.50
TSS (mg/L)	145	<5	1,000
TN (mg/L)	3.3	0.7	16
TKN (mg/L)	1.9	<0.2	16
Ammonia (mg/L)	0.23	<0.02	1.20
Phosphate (mg/L)	0.05	<0.01	0.22
TP (mg/L)	0.32	<0.01	7

3.13. Surface Hydrology

The site is located in the Serpentine River catchment area, which is a sub-catchment of the Lower Serpentine.

The existing surface water hydrology in relation to the site is shown in Figure 11. The major surface water features are semi-permanent surface water expressions located in the western margins of the site that discharge via artificial open drains (see Section 3.13.2).

The site drains generally east to west following the topography. The highly permeable Bassendean Sands soak up most of the frequent, minor rainfall events; however, in major and high intensity rainfall events the infiltration capacity of the soil is exceeded and water runs off into the wetlands and low-lying depressions located in the north-west, south-west and central portions of the site. In such major events, the site also receives runoff from the semi-rural and bushland area to the east.

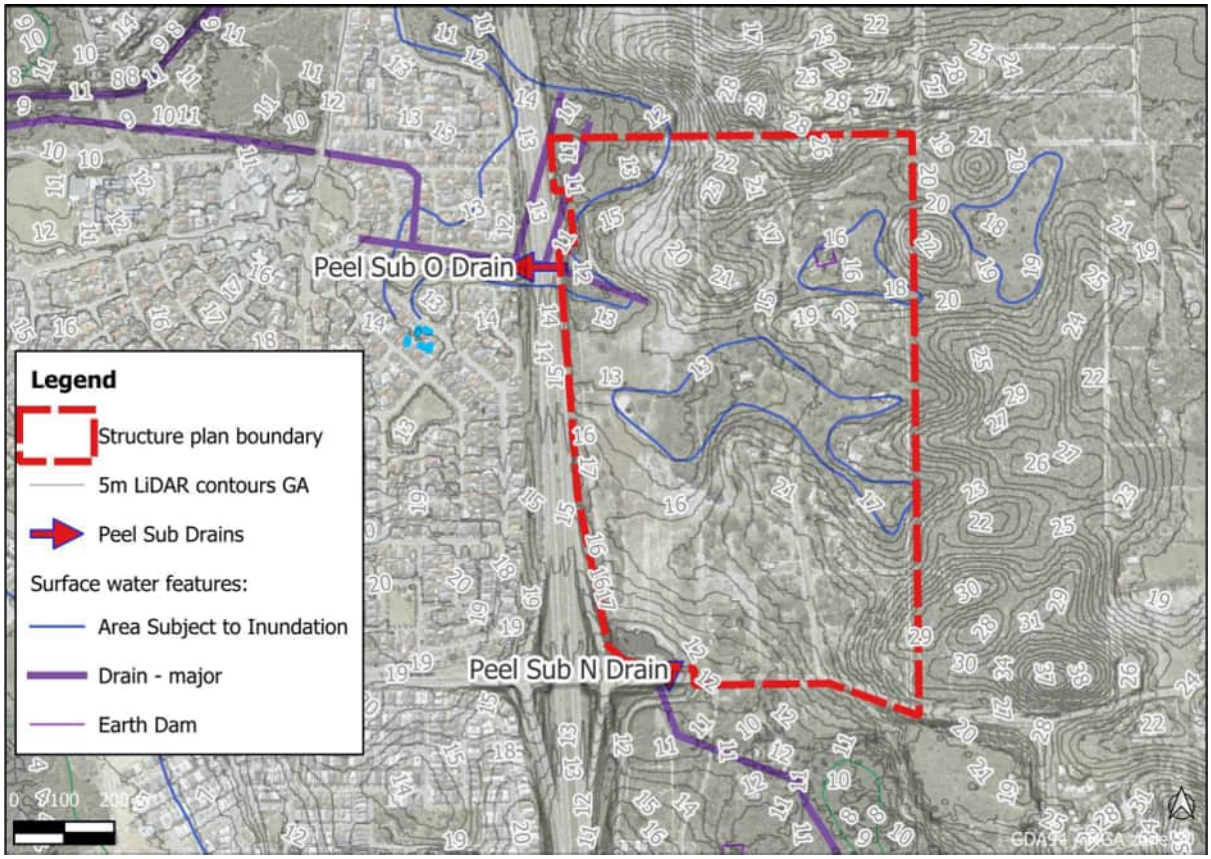


Figure 11: Surface water features

3.13.1. Jandakot drainage and water management plan (DoW, 2009)

The Department of Water (now DWER) published a flood study covering the Casuarina LSP site area in 2008. The Jandakot drainage and water management plan (JDWMP) modelled pre- and post-development flows and outlined an ultimate drainage system for the Peel Main Drain catchment from Bartram Road in the north to Millar Road in the south, based on the existing land use and land use planning at the time. The post development maximum allowable discharge rates and estimated detention storage provisions throughout the Peel Main Drain network were outlined in the JDWMP. The post-development allowable discharge rates and estimated detention storages for the Peel Sub O and N2 Drains at site are summarised in Table 6 and Table 7 below. The sub-catchments and post-development indicative detention storages modelled in the JDWMP are shown in Figure 12 below. The model long-sections for the Peel Sub O and N2 Drains are included in Appendix D.

The detention storages outlined in the JDWMP comprise offline compensating basins along the drain network, as well as relatively small volumes attenuated in wetlands. Advice from DWER (*pers. comm.* J. Sturgess March 2025) confirmed the wetlands can act as compensating basins for major flood events, provided the water quality event (15 mm) is retained and treated outside of wetlands and buffer zones. Hence, the storages shown in Table 7 and Figure 12 can be attenuated in wetlands on-site.

Table 6: Discharge requirements per Jandakot DWMP

Discharge location		Post-development allowable peak discharge	
Drain ID	Culvert size	10% AEP	1% AEP
Peel Sub O	4 x 900 Ø	0.31 m^3/s	0.31 m^3/s
Peel Sub N2	1 x 450 Ø	0.03 m^3/s	0.04 m^3/s

Table 7: Indicative detention storage requirements per Jandakot DWMP

Detention storage location		10% AEP indicative detention storage		1% AEP indicative detention storage	
Sub-catchment ID	Storage ID	Volume	Depth	Volume	Depth
Peel Sub O Drain					
CAT03	Johnson Rd Wetland	3,700 m^3	0 m	4,100 m^3	0 m
	Johnson Rd East CB	3,100 m^3	0.3 m	5,200 m^3	0.5 m
CAT03B	Johnson Rd Nth CB	1,800 m^3	0.4 m	3,300 m^3	0.7 m
CAT04	-	-	-	-	-
CAT04A	Lugg Rd Sth CB	10,000 m^3	0.6 m	17,500 m^3	1.0 m
CAT05A	Lugg Rd Nth CB	6,400 m^3	0.6 m	11,700 m^3	1.0 m
Peel Sub N2 Drain					
CATN7	Wake Way Nth CB	6,000 m^3	0.6 m	10,000 m^3	1.0 m

Note:
Storage depth in wetlands is taken between Low Water Level (LWL) and Top Water Level (TWL).
Johnson Rd Wetland 10% and 1% AEP water levels are shown as equal to base-flow level in the Jandakot DWMP, hence the '0 m depth' shown in the above table.

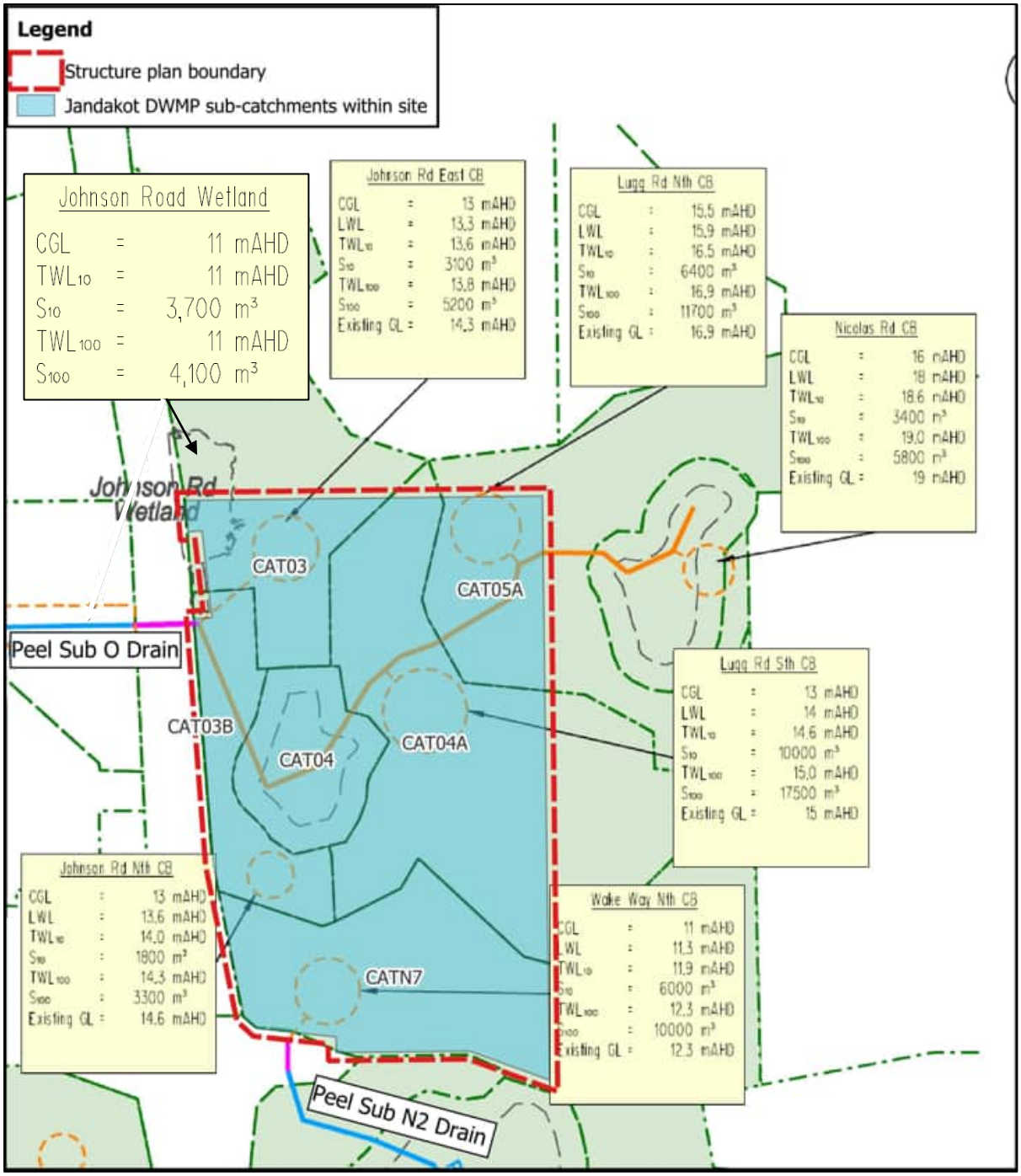


Figure 12: Drainage sub-catchments and indicative detention storages per Jandakot DWMP

3.13.2. Main Roads Western Australia infrastructure

Small areas at the western and southern boundaries of site serve stormwater attenuation functions for the Kwinana Freeway road reserve, operated by Main Roads Western Australia (MR). A pair of detention basins at the north-western corner of site attenuate runoff from the Freeway and are designed to discharge into the site at attenuated rates (design flows were not provided). A small amount of runoff from the eastern embankment of the road reserve discharges directly into site and is attenuated at low points at the western boundary. Most of the Freeway runoff is ultimately conveyed west via the 4 x 900 mm diameter Peel Sub O Drain culverts beneath the Freeway. A small amount of the embankment runoff is ultimately conveyed south via the 450 mm diameter Peel Sub N2 Drain culvert beneath Mortimer Rd.

A site and drainage inspection by Pentium Water in July 2024 verified most of the drainage features shown on the MR as-constructed drawings; although there were some deviations from design evident.

The as-constructed drawings (Main Roads, 2000) show the second detention basin discharging equally north into the Johnson Rd Wetland and south into the quadruple 900 mm diameter culverts beneath the Freeway. However, it was observed on-site (Pentium Water, 2024) that open drains had been cut through the banks of both MR basins (refer Figure 13). The open drain invert levels were lower than the bubble-down pit lid levels, indicating: a) the basins were not attenuating stormwater to their design depth, and; b) the basins were discharging more frequently and greater volumes of stormwater into site and the Freeway culverts.

The as-constructed drawings for the MR detention basins and culverts are included in Appendix E.

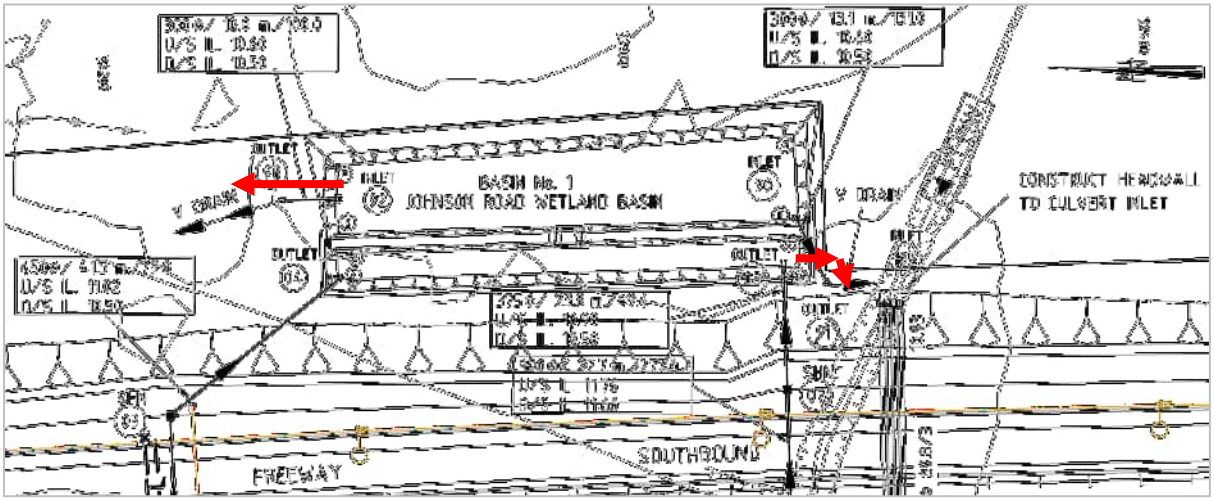


Figure 13: Excerpt from MR as-constructed drainage drawing (Main Roads, 2000). Open drains observed on-site marked up in red.

3.13.3. External catchments

A number of stormwater catchments external to site influence the drainage regime, as shown in Figure 14 below. An approximately 18 ha portion of the Kwinana Freeway drains into site via the basin described in section 3.13.2 (Johnson Rd Wetland Basin). An approximately 16 ha portion of the Casuarina Central LSP area to the north drains into site via the wetland in the north-western corner (Johnson Rd Wetland/Wetland 1). A large approximately 220 ha rural-residential and bushland catchment drains into site at the eastern boundary, and is conveyed west through site via the central wetland (Wetland 2).

The Kwinana Freeway is proposed to be widened in the near future, with an additional lane both northbound and southbound. The concept design is included in Appendix E.

Mortimer Rd at the southern boundary of site is also proposed to be upgraded in the near future. The concept design indicates drainage is fully retained in a proposed basin south of Mortimer Rd. The concept design is included in Appendix E.

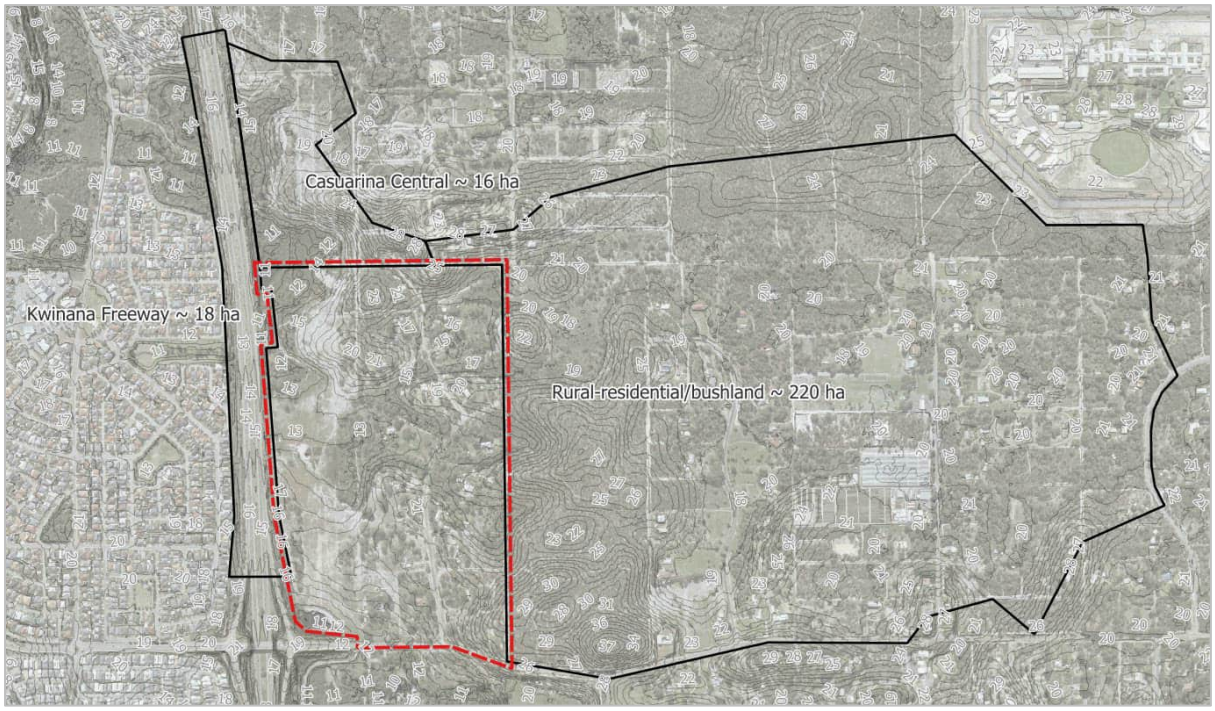


Figure 14: External catchments reporting to site

3.13.4. Surface water levels

A surface water monitoring program was undertaken by SLR from October 2023 to October 2024 and included the monitoring of water levels and water quality at two locations (Gauge 1 and 2) positioned in the south-western and central wetlands, respectively; see Figure 9 and Figure 10 above for monitoring locations.

A summary of the water level measurements is presented in Table 8 below. Tabulated surface water analytical results are available in Appendix C.

Table 8: Surface water level monitoring summary

Site	RL Staff Gauge (m AHD)	Max surface water level (mAHD)
Gauge 1	10.93	11.13
Gauge 2 (wetland)	12.01	12.31

It is noted from the monitoring results that:

- The southern drain location at Gauge 1 had the lowest Max surface water level (SWL) for the monitoring period at 11.13 mAHD. The wetland location (Gauge 2) had a Max SWL of 12.31 mAHD.
- The drains at the northwest and southwest corners of the site are likely to maintain controlled groundwater levels (CGLs) during the high groundwater period. The Max SWL at Gauge 1 (11.13 mAHD) represents the CGL at this location.
- Both gauges were dry in May and July, reflecting the seasonal low groundwater level being below ground at the gauge locations.

4. Water Servicing

4.1. Potable water supply

Potable water will be accessed via a connection to Water Corporations Integrated Water Supply Scheme.

Based on the available information, it is likely that a DN250 water main extension would be required to extend north through site from Mortimer Road (Peritas, 2025). The extension of this distribution main can likely be staged during the Casuarina South LSP development (subject to Water Corporation approval) and will eventually form a ring feed linking with developments north of site at Orton Road.

Funding of the water main extension is subject to its inclusion within the Water Corporation's Capital Works Program, which must be confirmed with Water Corporation.

4.2. Non-potable water supply

4.2.1. Irrigation Water Requirements

As per the water conservation principle of "No potable water should be used outside of homes and buildings with the use of water to be as efficient as possible" in *Better Urban Water Management* (WAPC, 2008), a non-potable water supply will need to be sourced to service the irrigation requirements of POS within the site.

4.2.1.1. Irrigation Demand

Table 9 below outlines the estimated irrigation water demand for the proposed development. The table estimates the irrigation demand based on the known area of POS, DOS and school site. A landscape concept is provided in Appendix F which illustrates the various landscape treatments being considered across the open space areas.

A groundwater licence application has been lodged for an allocation of 89,750 kL/yr. It is proposed to amend the licence details once the final irrigation demand is known following detailed landscape design of the POS areas.

The landscape concept plan (Appendix F) for the site involves mainly native plant species which will likely only require temporary irrigation for a period of 2 years during the establishment phase. An estimation of the maximum irrigation demand for the LSP area (i.e. during the initial years of plant establishment) is provided below in Table 9.

Table 9: Irrigation water demand

Area	Irrigated area (ha)	Irrigation rate (kL/ha/yr)	Total water demand (kL/yr)
District open space	5.0	7,500	37,500
Public open space	2.7	7,500	20,250
High school, including playing fields	3.2	10,000	32,000
Total irrigation demand	**10.9**	**-**	**89,750**

4.2.1.2. Groundwater licence application

A groundwater licence request was submitted in June 2025 for an allocation of 89,750 kL per year. Securing this water licence will satisfy the irrigation requirement of the LSP. DWER are currently assessing this request (DWER reference DWERVT18248, application 073426). DWER have confirmed progression of the application and are processing information from the project team relating to landscape master planning, lot access and drawpoint locations before formally issuing the licence. Correspondence with DWER is included in Appendix F.

4.2.2. Existing groundwater availability and licences

The site is located within the Serpentine groundwater area. The following aquifers are present in the area:

- Perth – Superficial Swan (Unconfined, Jandakot Mound 2 subarea).
- Perth – Leederville (Confined, Jandakot Mound 2 subarea).
- Perth – Yarragadee North (Confined, Jandakot Mound 2 subarea).

DWER have advised there is approximately 90,000 kL unallocated in the Serpentine, Jandakot Mound 2, Superficial resource (*pers. comm.* C. Slodecki, March 2025).

There are no existing groundwater licences held over the project site. However, there are landholdings nearby to the north with groundwater licences that have excess allocation available for trade. It is acknowledged that these groundwater licences lie within the Serpentine, Jandakot Mound 1, Superficial resource; however, options for trade or sharing of allocation are currently being explored with the CoK and neighbouring landowners.

The POS schedule for the Casuarina Central LSP directly north of site indicates some 11.2 ha of POS requiring irrigation. At the standard irrigation rate of 7,500 kL/ha/year, the irrigation demand for the Casuarina Central LSP amounts to approximately 84,000 kL/year, assuming all unrestricted POS is irrigated. The current licences across the Casuarina Central LSP amount to a total of 126,863 kL/year, some 43,000 kL/year above demand. Figure 15 below shows the POS plan for the Casuarina Central LSP.

The Marri Park Golf Course further north holds a groundwater licence with a significant 432,000 kL/year allocation, with some 192,000 kL/year above demand. At the standard 'playing field' irrigation rate of 10,000 kL/ha/year, the irrigation demand is approximately 240,000 kL/year, assuming irrigated course greens constitute 50% of the total lot area.

Possible trades also exist east of the site with allocations ranging from 3,000 kL/year to 88,910 kL/year. The land use is primarily rural-residential, with few properties appearing to require water for production.

The existing groundwater licences near site are shown in Figure 16 with their details summarised in Table 10.

Figure 15: POS plan for Casuarina Central LSP (TBB, 2021)

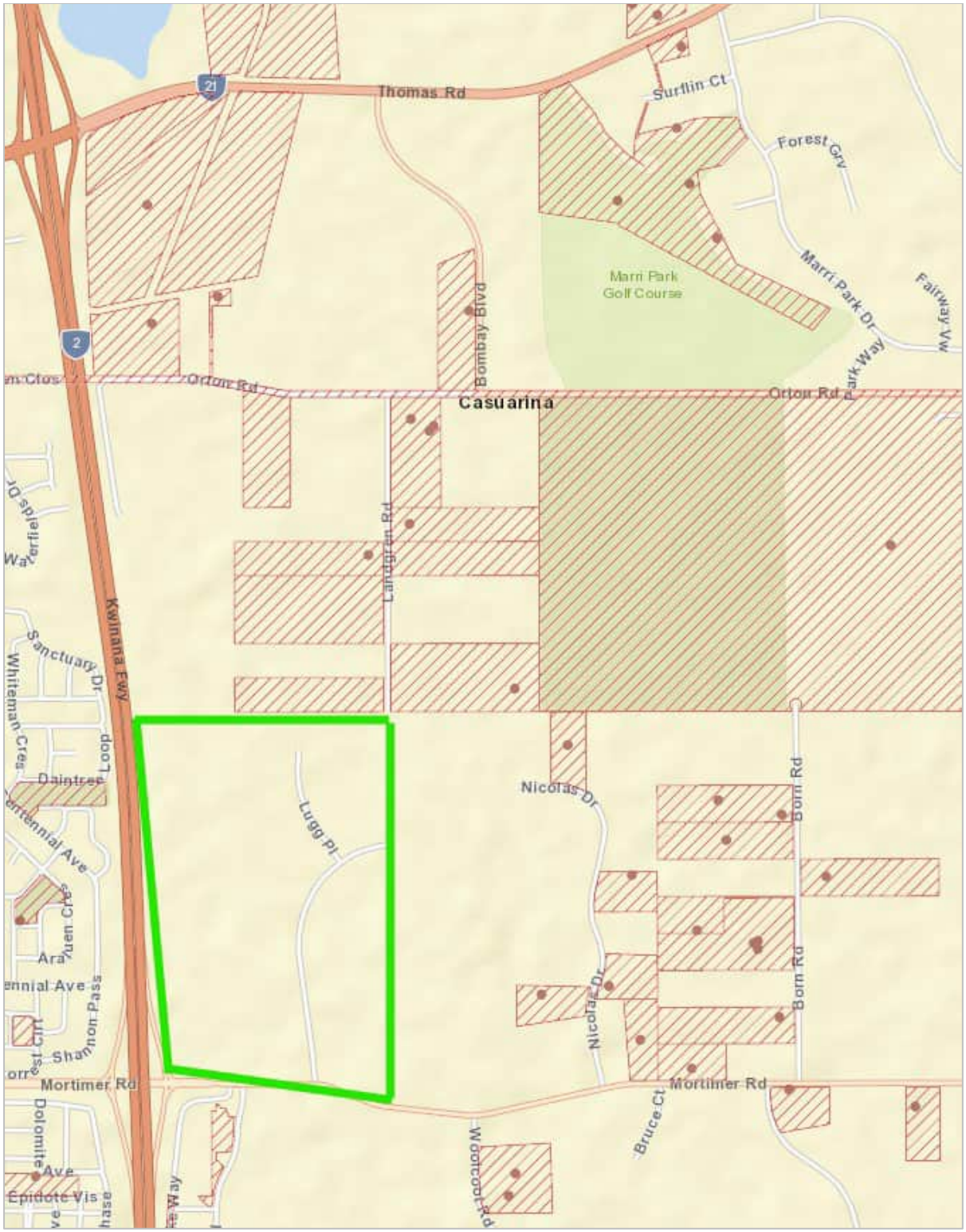


Figure 16: Existing groundwater licences near site (DWER, 2025)

Table 10: Existing groundwater licences near site

Licence no.	Owner	Licence address	Allocation (kL/yr)	Expiry date
East of site (Jandakot Mound 2 Groundwater Subarea)			**209,914**	
203510	Olivia Del Signore	LOT 311 ON PLAN 20944	3,150	23/10/2029
169579	Greve, Hendricus	Lot 303 On Plan 20944 Volume/Folio 2064/641 Lot 303 Nicolas Dr Casuarina	7,000	9/3/2032
180247	Fontana, Stephen	Lot 316 On Plan 20944 Volume/Folio 2064/654 Lot 316 Nicolas Dr Casuarina	8,000	30/4/2035
180761	Gorman, Phillip	Lot 318 On Plan 20944 Volume/Folio 2064/656 Lot 318	4,150	3/7/2025
98584	Vasic, Milan, Vasic, Ethel Christina	320, MORTIMER RD, CASUARINA	3,900	7/5/2030
162166	Palmerston Association Inc	Lot 2 on Diagram 45392; Certificate of Title Volume 1357 folio 968 Lot 2 Woolcoot Road Wellard	10,750	15/2/2031
204613	Lovrenc Levko	LOT 8 ON PLAN 10772	16,550	3/8/2030
207206	Michael D'Ercole	LOT 7 ON PLAN 10772	42,000	7/4/2032
171414	Stoddart, Terry Gordon	LOT 26 ON DEPOSITED PLAN 412364, Volume/Folio 2948/153, Lot 26 BORN RD CASUARINA	10,150	24/3/2030
154332	Archibald, Benjamin Terence	LOT 25 ON PLAN 412364	88,910	9/1/2028
159327	Gabrielle Joan Bauskis	Lot 2 On Plan 10772 Volume/Folio 1369/602 Lot 2 Born Rd Casuarina	3,000	21/9/2025
98051	McGillivray, George Stephen	163, MORTIMER RD, CASUARINA	3,650	26/2/2030
206362	Andrew John Willmer	60 BORN ROAD CASUARINA 6167	3,204	16/9/2031
98380	Konstandis, Vasiliki	LOT 34 ON DIAGRAM 64810, Volume/Folio 1645/136, Lot 34 MORTIMER RD WELLARD	5,500	8/2/2031
North of site (Jandakot Mound 1 Groundwater Subarea)			**575,963**	
48591	Harvey, Maureen Patricia, Harvey, Douglas William	Lot 32 On Plan 8390 Volume/Folio 1411/394 Lot 32 Orton Rd Casuarina	18,000	12/4/2033
108183	Pearson, Steven Arnold	Lot 33 On Plan 8390 Volume/Folio 1308/437 Lot 33 Landgren Rd Casuarina	36,500	26/4/2034
203583	Department of Communities	92 ORTON ROAD CASUARINA 6167; 58 LANDGREN ROAD CASUARINA 6167; LOT 39 LANDGREN ROAD CASUARINA 6167; 46 LANDGREN ROAD CASUARINA 6167; 77 LANDGREN ROAD CASUARINA 6167; 64 LANDGREN ROAD CASUARINA 6167; LOT 38 LANDGREN ROAD CASUARINA 6167; 45 LANDGREN ROAD CASUARINA 6167	72,363	12/11/2029
172055	Muco, Steven Robert	Lot 88 On Plan 41586 Volume/Folio 2616/589 Lot 88 Orton Rd Casuarina	17,100	27/9/2033
62694	Parkroyal Holdings Pty Ltd	112, MARRI PARK DR, CASUARINA; Lot 121 On Plan 20707 Volume/Folio 2042/160 Lot 121 Surflin Ct Casuarina	432,000	20/3/2023

5. Water conservation strategies

Conservation of water through fit-for-purpose use and best management practices is encouraged for efficient water use. Fit-for-purpose describes the use of water that is of a quality suitable for the required use of the water. Fit-for-purpose principles have been utilised in the water conservation strategy for the site.

5.1. Proposed strategy

The State Water Plan (Government of WA, 2007) is a strategic policy and planning framework to meet the state's water demands to the year 2030. While the site is not within Perth, more recently the Waterwise Perth Plan 2 (DWER, 2022) has a number of targets for 2030 with a focus on the current residential water supplied of 91 kL per person per year or less.

Water conservation strategies that will be implemented include:

- No potable water should be used outside the homes and buildings and achieve efficient use of scheme water, where alternative water sources are available.
- Waterwise landscaping techniques.
- Water efficient fixtures and fittings (WELS) installed in households.

5.2. Household water conservation

The Building Code of Australia sets minimum standards of efficiency for water-using fixtures and fittings in homes. These include:

- All tap fittings, except bath outlets, garden taps and toilets must be a minimum 4-star WELS rated.
- All showerheads must be a minimum of 3-star WELS rated.
- An outdoor private swimming pool or spa associated with a Class 1 building must be supplied with a cover or blanket.
- All internal hot water outlets (such as taps, showers and washing machine water supply fittings) must be connected to a hot water system or a recirculating hot water system with pipes installed and insulated in accordance with AS/NS 3500.
- Lot owners will be encouraged to install grey water systems for the irrigation of individual household landscaping.
- Lot owners will be encouraged to install rainwater tanks. Rainwater tanks can be connected to water using fixtures such as toilets, washing machines and external taps to reduce potable water demand as well as assisting in reducing stormwater run-off.

5.3. Waterwise landscaping

While detailed landscaping plans have not been prepared at this stage of the development, broad landscaping principles will be set to ensure waterwise features will be implemented in future designs. This will include but is not limited to:

- Minimising areas of turf to "kick about" recreation areas and active recreational areas
- Amended soil will be applied in POS areas
- Biofiltration areas will be planted with species selected from Vegetation Guidelines for Stormwater biofilters in the south-west of Western Australia (Monash University, 2014)
- Garden beds will be mulched
- Hydrozoning and xeriscaping principles will be implemented where required
- Planting will consist of predominantly endemic native species following consultation with the local government
- Remnant vegetation will be retained as much as possible
- Vegetated swales or living streams will be incorporated where possible as a Water Sensitive Urban Design structure for stormwater conveyance as well as providing ecological linkages
- Efficient use of fertilisers and pesticides.

Water-use efficiency for irrigation of POS will be enhanced through:

- Prioritising irrigation areas
- Best practice turf maintenance
- Optimal irrigation design and management including adjusting irrigation rates in accordance with weather and site-specific requirements.

6. Stormwater management

6.1. Drainage principles and design criteria

Integrated urban water management recognises that the urban water cycle should be managed as a single system and water supply, stormwater, wastewater, flooding, water quality and wetlands is interconnected (WAPC, 2008). The aim of the stormwater management strategy, as per Water Sensitive Urban Design (WSUD) principles, is to:

- Protect natural systems.
- Integrate stormwater treatment into the landscape to maximise the visual and recreational amenity of the development.
- Protect water quality.
- Maintain peak flows to pre-development rates if discharging off site.
- Add value to the development.

The site will effectively manage stormwater quantity and quality generated from small, minor and major events, incorporating best practice WSUD principles. Table 11 summarises the drainage criteria for several objectives based on the Stormwater management manual for Western Australia (DoW, 2004-2007), Decision process for stormwater management in Western Australia (DWER, 2017) and the Jandakot drainage and water management plan (DoW, 2009).

Table 11: Stormwater management design criteria

Event	Objective	Criteria
Small (1 EY)	▪ Manage water quality	▪ Retain/detain, and treat (if required) stormwater run-off from constructed impervious surfaces generated by the first 15 mm of rainfall at-source as much as practical ▪ Size bioretention swales at minimum 2% connected impervious area ▪ As compared with a development that does not actively manage water quality, achieve reductions of 80% of total suspended solids, 60% of total phosphorous, 45% of total nitrogen and 70% of gross pollutants
	▪ Maintain form and hydrology of sensitive receiving environments	▪ Maintain pre-development peak flow rates and total volume runoff from the outlets of the development area for the critical 1 exceedance per year (EY) event ▪ Manage the first 15 mm of runoff outside of wetlands and wetland buffers ▪ Discharge to wetlands via shallow overland flow through wetland buffers (events exceeding 15 mm)
Minor (20% or 10% AEP)	▪ Maintain serviceability of road networks including pedestrian areas, public open space and drainage networks	▪ Provide piped drainage system capacity for the critical 20% AEP event in residential areas and 10% AEP in commercial areas, or maintain appropriate maximum gutter flow widths where overland flow is proposed in place of piped conveyance
Major (1% AEP)	▪ Manage catchment flooding	▪ Maintain the pre-development 1% AEP flood regime by maintaining the floodplain storage volume, flood level and flow rates downstream of the site
	▪ Prevent building and critical infrastructure flooding	▪ Habitable floor levels to be at least 0.3 m above the 1% AEP flood level of the urban drainage system and road reserve ▪ Habitable floor levels at least 0.5 m above the 1% AEP flood level of the regional flood regime (i.e. the wetland basins and flood corridors through the site)

6.2. Drainage Strategy

The drainage strategy comprises stormwater being infiltrated as close to source as possible (e.g. soakwells within lots or infiltration areas within road reserves) or entering bio-retention areas within road reserves and POS. Bio-retention basins in POS and swales in road reserve areas are required to retain, treat, and infiltrate road reserve runoff generated from the first 15 mm of rainfall, with larger events being allowed to overflow to detention basins and wetlands. The bio-retention areas are designed to ensure post-development water quality does not exceed pre-development (refer section 3.12.5). The detention basins and wetlands are designed to ensure post-development stormwater flows do not exceed that outlined in the JDWMP (refer section 3.13.1).

6.2.1. Small event drainage (up to the 1EY / 15 mm event)

Runoff generated from the first 15 mm of rainfall can mobilise substances such as soluble materials, fine dusts and silts, oils, grease and other non-volatile hydrocarbons from constructed impervious surfaces. To prevent water quality impacts in sensitive downstream environments, run off generated from rainfall events up to 15 mm (1 EY) will be managed as close to source, and as high in the catchment, as possible. Capturing and treating small rainfall events will minimise the export of pollutants into CCWs and the Peel Main Drain. This will be achieved by adopting the following strategies:

- Residential and commercial lots will retain and infiltrate the first 15 mm (where possible) using soakwells, tree pits and swales.
- Stormwater runoff from roads for the first 15 mm of rainfall will be discharged to bioretention areas within POS areas or road reserves, some of which are within the powerline easement.

6.2.1.1. Lot drainage

Runoff from constructed impervious areas on lots (e.g. roof, driveway, paving) generated by the first 15 mm of rainfall will be retained within lots, per CoK requirements. This on-lot retention will be achieved via infiltration in soakwells or other appropriate measures (e.g. rain gardens, rainwater tanks plumbed into appliances and/or irrigation for water reuse).

It is anticipated that the earthworks strategy across the site will comprise cut-to-fill of permeable site sands to achieve minimum 2 m clearance between finished lot levels and AAMGL. This will create lots with Class A geotechnical classification and suitable conditions for on-site stormwater disposal.

6.2.1.2. Road reserve

Road runoff from constructed impervious surfaces of road reserve (e.g. pavement, footpath, crossover) generated by the first 15 mm of rainfall will be retained and treated within appropriately sized bioretention areas. These bioretention areas may be in the form of roadside or median swales, rain gardens, or tree pits, or swales and basins within POS areas or flood corridors. Bioretention areas will include littoral planting and amended soils to provide stormwater quality treatment. Plant species to be used within stormwater management areas will be selected from the Vegetation Guidelines for Stormwater Biofilters in the South-west of Western Australia (Monash University 2014) and in liaison with CoK.

6.2.2. Minor event drainage (20% AEP)

The objective for the minor (20% AEP / 5 year ARI) rainfall events is to maintain serviceability of roads and pedestrian areas. To meet these criteria the following strategies are proposed:

- Lot runoff that exceeds the capacity of soak wells will overflow via driveways or front of lots into the road drainage network
- Runoff generated from roads in excess of small event treatment (i.e. 15 mm pits, swales, bio-retention basins) will be conveyed primarily by the road network to flood storage areas within POS and wetlands.

- In commercial areas, stormwater flow in excess of the small event treatment (i.e. pits, swales) will be conveyed primarily by the road pipe network to flood storage areas within POS and wetlands.

6.2.3. Major drainage system

Stormwater management for the major (i.e. up to 1% AEP) rainfall events is typically focused on providing safe conveyance of flows to protect people and property as well as providing adequate flood detention storage so as not to impact flow rates, flow volumes and flood levels downstream of the development.

The major drainage system is designed to manage rainfall events greater than the 20% AEP for the residential area and 10% for the commercial area, and up to the 1% AEP event. The system is also designed to manage flows discharging to site from external catchments. Key points of the major drainage system strategy as follows:

- Flows exceeding the capacity of the pipe and swale network in the road reserve are conveyed overland via the road gutters to flood storage areas in POS.
- Flood volumes exceeding the pit, swale and bio-retention area capacity (i.e. 15 mm event) overflow into major event flood storages in POS areas and wetlands.
- Adequate flood detention volume is provided within basins and wetlands in POS to achieve required discharge rates at downstream Water Corporation culverts beneath the Freeway and Mortimer Rd.
- Discharge from flood storage areas is controlled with an attenuated pit and pipe outlet.

6.3. Drainage Design

The conceptual drainage design comprises 15 mm event storages on lots, within road reserves and POS areas, overtopping into flood storage basins and wetlands. The required post-development stormwater discharge rates are achieved through the flood detention provided in basins and wetlands, and controlled pit-and-pipe outlets which throttle flows. The proposed development and drainage infrastructure have been designed to achieve the objectives outlined in section 6.1 above, in-line with the drainage strategy outlined in section 6.2 above. A summary of stormwater management requirements is provided in Table 12 below.

Table 12: Summary of stormwater management requirements

Aspect	Objective	Conceptual design and LWMS considerations
Earthworks / fill strategy and groundwater control*	▪ Site earthworks to achieve freeboard to flood levels and groundwater separation	▪ Cut-to fill earthworks (ie. re-use of site-won material) where possible and fill importation to provide lots with 0.5m separation to design flood levels through corridors and 2 m from AAMGL ▪ Subsoil drainage system to provide a controlled groundwater level ▪ Earthworks and fill strategy to consider intended lot geotechnical classification and lot-scale stormwater management approach
Lot-scale drainage	▪ Retain stormwater on-lot up to 15 mm event ▪ Manage lot runoff in downstream drainage areas beyond 15 mm event	▪ Use of soakwells or alternative WSUD measures to contain stormwater on lots ▪ No lot connections to road drainage system per City of Kwinana requirements
Road reserve / estate-scale drainage	▪ Manage road runoff as close to source as practical ▪ Treat first 15 mm of runoff from constructed impervious surfaces	▪ At-source treatment approaches (e.g. road reserve-scale systems such as tree pits, median swales and rain gardens) where feasible ▪ Overland flow to / through vegetated areas to be encouraged (i.e. where possible via flush kerbing or kerb openings etc)

Aspect	Objective	Conceptual design and LWMS considerations
	▪ Maintain trafficability of road networks and pedestrian areas	▪ Piped drainage where required to maintain road trafficability in the 20% AEP event ▪ End-of-pipe treatment areas / basins where required to capture and treat the first 15 mm of runoff from constructed impervious surfaces
Major event / flood management	▪ Peak 1% AEP event discharge from LSP to be controlled in-line with Jandakot DWMP	▪ Detention basins and wetlands with attenuated outlets to throttle stormwater discharge ▪ Further modelling and design at UWMP stage to demonstrate flood management criteria are met

An overview of the Casuarina South LSP drainage design is shown in Figure 20 below, with the storages summarised in Table 17. The main features of the stormwater drainage system are described in the following sub-sections 6.3.1, 6.3.2 and 6.3.3, and a comparison with the Jandakot DWMP is included in section 6.3.4. The post-development modelling undertaken by Pentium Water is described in section 0 below, which includes the model set-up, catchment land-use breakdown, and infiltration and loss assumptions.

6.3.1. Catchments

The drainage design involves a ~ 65 ha stormwater catchment draining west towards the wetland basins adjacent the Kwinana Freeway, prior to discharging to Peel Sub Drains (see Figure 17). The stormwater catchment for the Casuarina South LSP is comprised of various land uses including road reserves, residential lots, commercial lots, school, district open space (DOS) and public open space (POS) areas. All sub-catchments are drained via pit-and-pipe drainage systems which collect and convey development runoff to bio-retention basins. The pit-and-pipe network is complemented by bio-retention swales in the road reserve in sub-catchments with boulevard roads.

The site is split into six sub-catchments (refer Figure 20). The northern four are attenuated in the wetlands in the centre and north-west corner and in major events discharge west into the Peel Sub O Drain via the quadruple 900 mm diameter culvert beneath the Freeway. The southern catchment is attenuated in the south-western corner of site and discharges south into the Peel Sub N2 Drain via the 450 mm diameter culvert beneath Mortimer Rd. The eastern catchment is drained to a retention basin and is fully infiltrated.

The external catchments influencing drainage on-site are outlined in section 3.13.3 above. They have been factored into the drainage strategy (see section 6.2.3 above), the drainage design (see following sub-sections 6.3.1.1, 6.3.1.2 and 6.3.1.3) and modelling (refer section 0).

6.3.1.1. Catchment 1

Stormwater runoff and intercepted groundwater from Catchment 1 drain via the road network into Bio-basin 1, sized for the 15 mm event, where it is treated and infiltrated. The water infiltrated in Bio-basin 1 discharges to Wetland 1 via subsoil drainage to maintain base-flow.

In stormwater events exceeding the 15 mm, Bio-basin 1 overtops into Wetland 1 via distributed overland flow through the wetland buffer. External catchments from the Kwinana Fwy (~ 18 ha) and Casuarina Central LSP (~ 16 ha) also discharge to Wetland 1. Wetland 1 provides stormwater detention up to the major 1% AEP event for Catchment 1, the Freeway catchment and the Casuarina Central LSP catchment. Wetland 1 discharges via an attenuated outlet to a conveyance swale and ultimately the Peel Sub O Drain.

6.3.1.2. Catchment 2

Catchment 2 is split into two sub-catchments: 2N and 2S. In both sub-catchments, stormwater runoff and intercepted groundwater drain via the road network into their respective Bio-basins 2N and 2S, sized for the 15 mm event, where it is treated and infiltrated. In Catchment 2N, road runoff is first routed through boulevard swales, which provide treatment and infiltration in sub-15 mm events. The boulevard swales offset the sizing of Bio-basin 2N. The water infiltrated in Bio-basins 2N and 2S discharge to Wetland 2 via subsoil drainage to maintain base-flow.

In stormwater events exceeding the 15 mm, Bio-basins 2N and 2S overtop into Wetland 2 via distributed overland flow through the wetland buffer. The external catchment from the semi-rural/bushland area (~ 220 ha) east of site also discharges to Wetland 1, via Basin 3 and the POS swales. Wetland 2 provides stormwater detention up to the 1% AEP event for Catchment 2N and 2S and the external catchment to the east. Wetland 2 discharges via an attenuated outlet to a conveyance swale and ultimately the Peel Sub O Drain.

6.3.1.3. Catchment 3

Stormwater runoff and intercepted groundwater from Catchment 3 drain via the road network into Bio-basin 3, sized for the 15 mm event, where it is treated and infiltrated.

In stormwater events exceeding the 15 mm, Bio-basin 3 surcharges the bio-retention area into the upper tier of the drainage basin. In major events, the basin receives runoff from the external semi-rural/bushland catchment to the east. Basin 3 provides detention for the 1 EY event for Catchment 3; however, discharges west in major events due to the relatively large inflow from the external catchment. Basin 3 discharges via an attenuated outlet to the POS swales and Wetland 2, and ultimately to the Peel Sub O Drain.

6.3.1.4. Catchment 4

Stormwater runoff and intercepted groundwater from Catchment 4 drain via the road network into Bio-basin 4, sized for the 15 mm event, where it is treated and infiltrated. In the eastern portion of Catchment 4, road runoff is first routed through boulevard swales, which provide treatment and infiltration for sub-15 mm events. The swales offset the sizing of Bio-basin 4. The water infiltrated in Bio-basin 4 discharges to Wetland Basin 4 via subsoil drainage to maintain base-flow.

In stormwater events exceeding the 15 mm, Bio-basin 4 overtops into the lower-lying Wetland basin 4. Wetland basin 4 provides detention storage for the 1% AEP event for Catchment 4, and discharges south via an attenuated outlet into the Peel Sub N2 Drain.

6.3.1.5. Catchment 5

Stormwater runoff and intercepted groundwater from Catchment 5 drain via the road network into Basin 5, sized for the 1% AEP event, where it is fully infiltrated without discharge. Road runoff is first routed through boulevard swales, which provide treatment and infiltration for the 15 mm event.

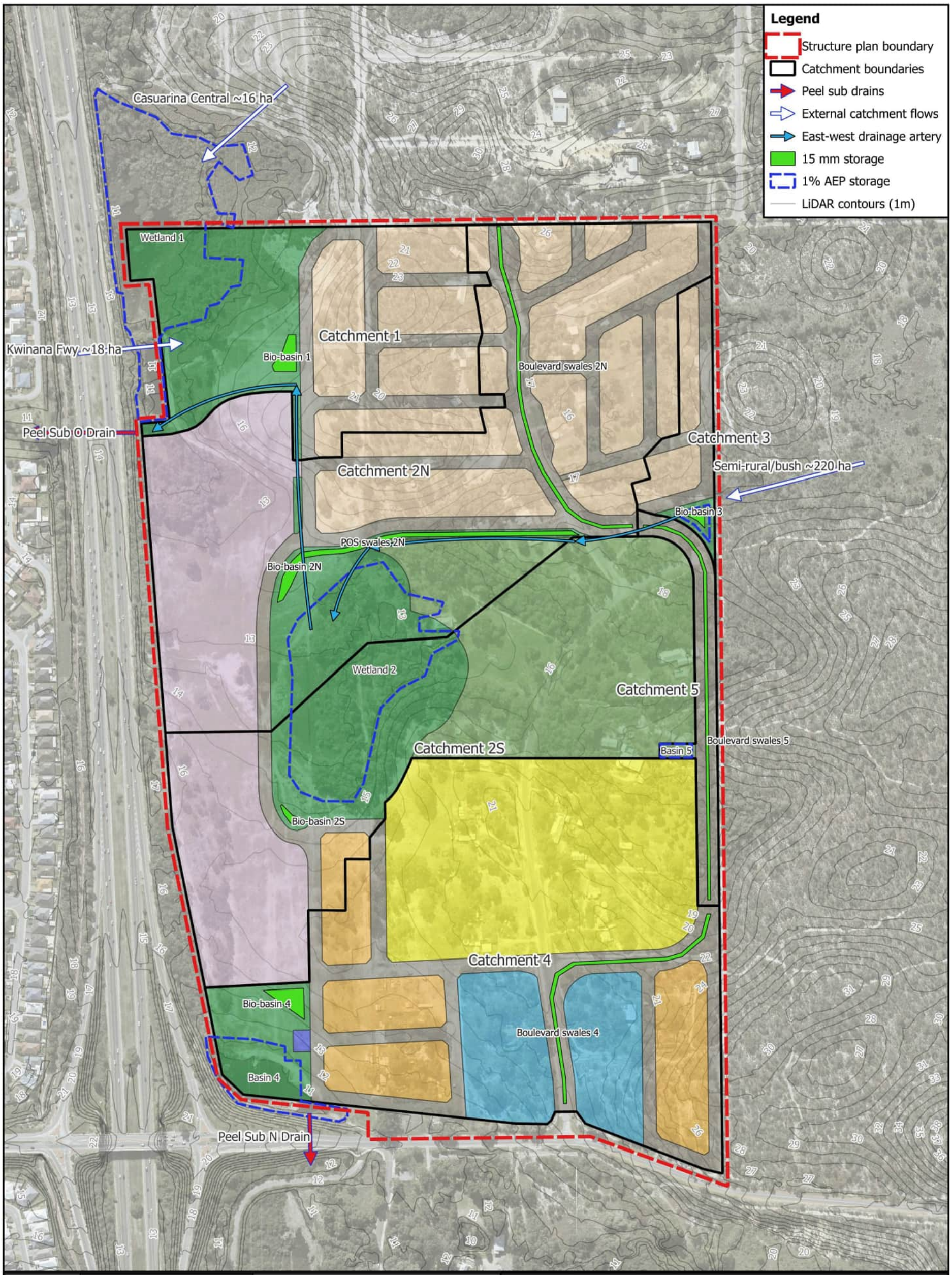


Figure 17: Stormwater management concept plan

Table 13: Storage sizing details

Storage element	Design storm	Storage depth (m)	Batter slopes	Base area (m^2)	TWL area (m^2)	Volume (m^3)
Catchment 1						
Bio-basin 1	1 EY – 1 hr	0.35	1:4	600	726	232
Wetland 1 (Johnson Rd Wetland/POS 1)	1% AEP	0.60*	Existing surface	0	33,028	19,173
Catchment 2						
Boulevard swales 2N	< 1 EY	0.4	1:4	152	636	180
POS swales 2N	< 1 EY	0.4	1:4	200	591	191
Bio-basin 2N	1 EY – 1 hr	0.31	1:4	300	404	108
Bio-basin 2S	1 EY – 1 hr	0.32	1:4	150	205	56
Wetland 2 (Central Wetland/POS 2)	1% AEP	0.89*	Existing surface	10,000	26,715	17,447
Catchment 3						
Bio-basin 3	1 EY – 1 hr	0.31	1:4	180	285	72
Basin 3 (POS 3)	< 10% AEP	1.11	1:6	180	662	438
Catchment 4						
Boulevard swales 4	< 1EY	0.4	1:4	136	523	113
Bio-basin 4	1 EY – 1 hr	0.33	1:4	700	919	275
Wetland basin 4 (POS 4)	1% AEP	0.96*	Existing surface	3,000	7,942	6,664
Catchment 5						
Boulevard swales 5	1 EY – 1 hr	0.4	1:4	176	589	106
Basin 5	1% AEP	0.95	1:6	50	366	174

Note:
- Storage depths shown for wetlands 1, 2 and 4 comprise the stormwater depth between CGL and TWL
- Wetlands 1, 2 and 4 were modelled with 0.6 m, 0.1 m, and 0.2 m of standing water at CGL, respectively
- TWL area and Volume shown for Wetlands 1, 2 and 4 is the total inclusive of standing water at CGL
- Boulevard and POS swale storages are estimates only

6.3.2. Minor Drainage

6.3.2.1. Bio-basins

The bio-retention basins 1, 2N, 2S, 3 and 4 have been designed to treat and infiltrate the first 15 mm event for their respective catchments. The bed levels are set at minimum 0.5 m above peak groundwater level, and the top water levels are around 0.3 m deep. Bio-basins in the lower-lying western portion of site will be underlain by subsoil drainage set to CGL to ensure effective infiltration year-round.

Bio-basins will be underlain by bio-filtration media and planted with nutrient-stripping vegetation. Erosion controls will be installed at bio-basin inlets and outlets, comprising rock rip-rap and dense planting.

Bio-basins will discharge to wetland buffers via shallow overland swales, as point discharge is not allowed by DWER within wetlands or their buffers. The shallow bio-basin discharge swales will be densely planted to dissipate flow and prevent erosion.

6.3.2.2. Boulevard swales

Boulevard swales 2N, 4 and 5 have been designed to pre-treat as much runoff in the 15 mm event as possible in their respective sub-catchments, before discharging to their respective bio-basins. The boulevard swales offset the sizing of downstream bio-basins.

The swales are designed within a 4 m corridor (i.e. median strip or verge) and with 0.5 m base width and embankments at 1 in 4. They are designed with a check weir at every 0.3 m drop in elevation to achieve effective treatment depth, volume and infiltration area along their length.

The boulevard swales will receive inflows via piped inlets as well as direct runoff from adjacent road surfaces. The boulevard swales will be linked together with bubble-down and bubble-up pits. Bubble-down pits are set to top water level 0.3 m depth at the downstream end of each swale to allow minimum 0.1 m freeboard to adjacent road level. Bubble-up pits are set to 0.1 m above swale invert level at the upstream end to encourage flow to move downstream.

The boulevard swales will be underlain with bio-filtration media and planted with nutrient-stripping vegetation. Erosion controls will be installed at swale inlets and outlets, comprising rock rip-rap and dense planting.

6.3.2.3. POS swale

The POS swale has been designed to treat as much runoff as possible in the 15 mm event, and to convey boulevard swale 2N overflow to the Bio-basin 2N downstream. The POS swale offsets the sizing of the downstream Bio-basin 2N.

The POS swale is designed within a 10 m POS/road reserve corridor and with 1.0 m base width and embankments at 1 in 4. The POS swale is designed with a check weir at every 0.3 m drop in elevation, to achieve effective treatment depth, volume and infiltration area along its length.

The POS swale will receive inflows via piped inlets as well as direct runoff from adjacent road surfaces. The excess flow from boulevard swale 2N will discharge into the upstream end of the POS swale via a bubble-up pit set 0.1 m above POS swale invert level.

The POS swale will be underlain with bio-filtration media and planted with nutrient-stripping vegetation. Erosion controls will be installed at swale inlets and outlets, comprising rock rip-rap and dense planting.

Refer to section 6.3.3.6 for the POS swale major drainage function.

6.3.3. Major Drainage

6.3.3.1. Wetland 1

Wetland 1 has been designed according to the existing topography, with bed level at 10.4 mAHD and controlled/high groundwater level at AAMGL 11.0 mAHD. The water levels in the wetland will be allowed to drop below ground in summer.

The modelling and design show Wetland 1 to have sufficient storage in the 1% AEP event of 19,173 m^3, at a maximum water depth of 1.20 m (~ 4,000 m3 and 0.6 m of which constitutes standing water). This exceeds the indicative storage of 12,600 m3; however, is within the 0.7 m storage depth shown in the JDWMP.

Wetland 1 discharges through an attenuated outlet of 375 mm diameter set 0.3 m above the controlled groundwater level at invert level 11.3 mAHD. A smaller pipe at CGL 11.0 mAHD will be installed to maintain maximum groundwater levels in the wetland. Both groundwater and stormwater discharge to the Kwinana Freeway culverts downstream.

6.3.3.2. Wetland 2

Wetland 2 has been designed according to the existing topography, with bed level at 13.0 mAHD and controlled groundwater level at AAMGL 13.1 mAHD. The wetland water levels will be allowed to drop below ground in summer.

The modelling shows Wetland 2 to have sufficient storage of 17,447 m3 in the 1% AEP event, at a maximum depth of 0.99 m (~ 1,000 m3 and 0.1 m of which constitutes standing water). This is within the indicative 29,200 m3 and 1.0 m depth shown in the JDWMP.

Wetland 2 is a critical component of the precinct's drainage infrastructure, serving approximately half of the LSP catchment area. The wetland is located at a regional low point, which will be trapped by the proposed road on its western boundary. Thus, it's discharge arrangement is pivotal in both groundwater and flood management for the LSP.

Wetland 2 discharges via an attenuated outlet of 450 mm diameter set at CGL 13.1 mAHD, to the arterial drain downstream (refer section 6.3.3.6). The arterial drain is set to CGL along its length and ultimately discharges to the Peel Sub O Drain at the Freeway culverts.

6.3.3.3. Basin 3

Basin 3 has been designed with bed level at 18.5 mAHD, and operates as a dry basin due to its 4 m clearance to AAMGL 14.5 mAHD. The volumetric capacity of Basin 3 has been maximised within the POS 3 footprint.

The modelling shows Basin 3 has sufficient capacity for the 1 EY event; however, surcharges in the 10% AEP due to inflow from the external catchment to the east (which is assumed to be throttled to allowable flows per the JDWMP). Basin 3 has a modelled storage of 438 m^3 at top water level.

Basin 3 discharges via a 450 mm diameter outlet at invert level 19.2 mAHD to the POS swale downstream. This connection is crucial for safe conveyance of external flows in major events through the LSP.

6.3.3.4. Wetland basin 4

Wetland basin 4 has been designed as a wet basin comprising the upstream/tail end of the mapped Mortimer Rd Wetland south of site. The basin bed level is at 11.0 mAHD according to existing topography, and controlled/high groundwater level is at AAMGL 11.2 mAHD. The upper tier of the basin requires shaping to achieve the required infiltration area, detention volume and depth, as the existing topography is too constraining. The wetland basin water level will be allowed to drop below ground in summer.

The modelling shows Wetland basin 4 has sufficient storage of 6,664 m^3 in the 1% AEP event at a maximum depth of 1.16 m (~ 500 m^3 and 0.2 m of which constitutes standing water). This is within the 10,000 m^3 and 1.0 m depth of storage shown in the JDWMP.

Wetland basin 4 discharges via an attenuated outlet of 180 mm diameter set 0.5 m above the CGL at invert level 11.7 mAHD, to the Peel Sub N2 Drain at the Mortimer Rd culvert. A smaller pipe at CGL 11.2 mAHD will be installed to maintain maximum groundwater levels in the wetland basin.

6.3.3.5. Basin 5

Basin 5 has been designed with bed level at 16.0 mAHD, and operates as a dry basin due to its 1.5 m clearance to AAMGL 14.5 mAHD. The volumetric capacity of Basin 5 has been maximised within the POS footprint to reduce the impost on the DOS.

The modelling shows Basin 5 has sufficient capacity of 187 m^3 to fully infiltrate the 1% AEP event without discharge.

6.3.3.6. East-west drainage artery

The east-west drainage artery allows major flood flows to safely drain through the LSP area. The artery runs from POS 3 through Wetland 2 to the Kwinana Freeway culverts. The POS swale constitutes the drainage artery between POS 3 and Wetland 2 (refer section 6.3.2.3 above). Between Wetland 2 and the Freeway culverts, the artery is comprised of a pit-and-pipe system due to the significant depth from design levels.

In the major 10% and 1% AEP events, the external semi-rural catchment east of site discharges into POS basin 3. Once the basin capacity is exceeded, flows overtop and discharge into the upstream end of the POS swale. Site catchment 2N discharges into the swale around 100 m downstream of here. The POS swale conveys these flows to Wetland 2 for detention. The maximum depth of flow along the swale in the 1% AEP event is around 0.7 m depth, which allows minimum 0.3 m freeboard to the adjacent road. The POS swale will form a seasonal watercourse and will be planted with dense vegetation to stabilise embankments and to improve water quality.

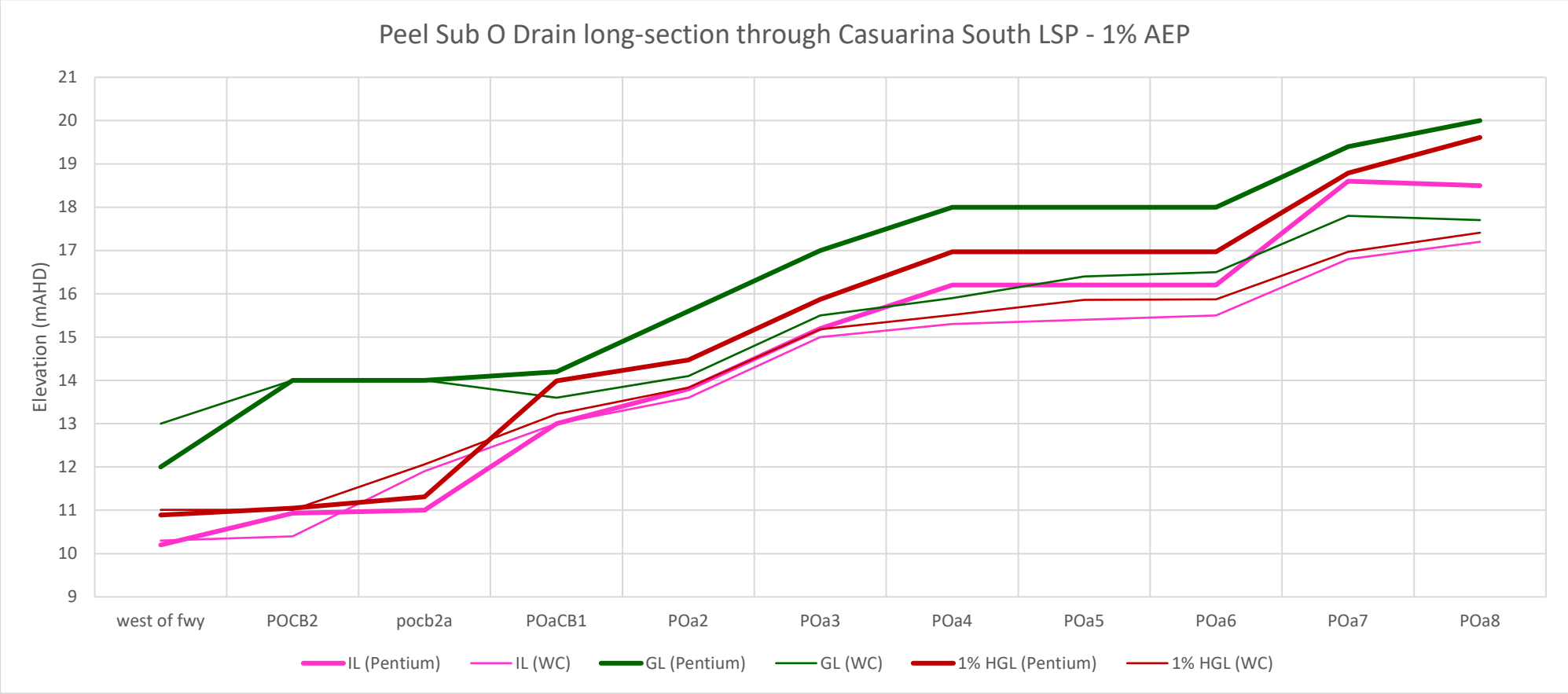
Between Wetland 2 and the Freeway culverts, the east-west drainage artery also controls groundwater levels. This reach of the artery will be a pit-and-pipe system consisting of both a solid 450 mm diameter pipe (to convey upstream flows from Wetland 2) and a slotted 150 mm diameter pipe (to intercept groundwater). The slotted pipe invert level is set to MGL to intercept rising groundwater and will lie at a constant grade no flatter than 1:500. As Wetland 2 is effectively a trapped regional low point, the solid pipe is critical in allowing it to drain in high groundwater season and following stormwater events. The CGL control pipes and stormwater discharge pipes from both Wetlands 1 and 2 will discharge into the pits along this reach of the artery.

6.3.4. Comparison to JDWMP

The post-development stormwater model provides an estimate of the flood water levels and required storage volumes based on the site catchment and land use breakdown. A comparison of the key detention and discharge parameters with the Jandakot DWMP is provided in Table 14 below. A comparison of the modelled flood water levels along the Peel Sub O Drain through site is provided in Figure 18 and Figure 19 below.

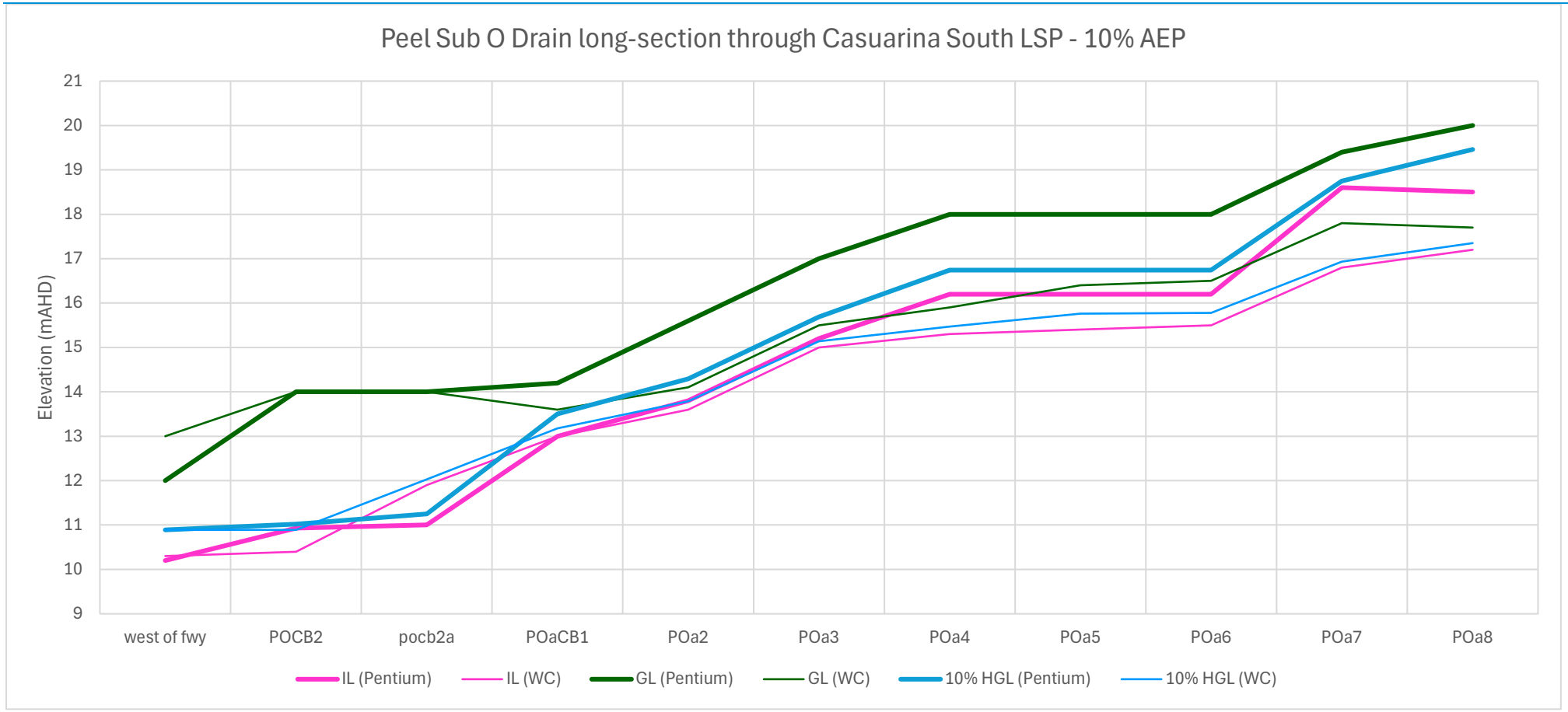
Table 14: Casuarina South LSP and Jandakot DWMP stormwater design comparison

Design parameter	Design AEP	Jandakot DWMP (DoW, 2009)	Casuarina South LWMS (Pentium Water, 2026)
Discharge			
Discharge to Peel Sub O Drain (Kwinana Fwy culverts)	10%	0.31 m^3/s	0.14 m^3/s
	1%	0.31 m^3/s	0.24 m^3/s
Discharge to Peel Sub N Drain (Mortimer Rd culvert)	10%	0.03 m^3/s	0.00 m^3/s
	1%	0.04 m^3/s	0.04 m^3/s
Detention volume			
Peel Sub O Drain	10%	25,000 m^3	16,050 m^3
	1%	41,800 m^3	36,866 m^3
Peel Sub N Drain	10%	6,000 m^3	2,891 m^3
	1%	10,000 m^3	6,301 m^3
Detention depth			
Peel Sub O drain	10%	0.3-0.7 m	0.26-0.96 m
	1%	0.5-1.0 m	0.59-1.11 m
Peel Sub N Drain	10%	0.6 m	0.53 m
	1%	1.0 m	0.98 m



	Location	west of fwy	POCB2	pocb2a	POaCB1	POa2	POa3	POa4	POa5	POa6	POa7	POa8
Pentium model:	Ground level (mAHD)	12	14	14	14.2	15.6	17	18	18	18	19.4	20
	Invert level (mAHD)	10.2	10.93	11	13	13.8	15.2	16.2	16.2	16.2	18.6	18.5
Water Corp model:	Ground level (mAHD)	13	14	14	13.6	14.1	15.5	15.9	16.4	16.5	17.8	17.7
	Invert level (mAHD)	10.3	10.4	11.9	13	13.6	15	15.3	15.4	15.5	16.8	17.2
1% AEP HGL (mAHD)	Pentium	10.89	11.05	11.31	13.99	14.47	15.87	16.97	16.97	16.97	18.79	19.61
	Water Corp	11.01	11.01	12.06	13.22	13.83	15.18	15.51	15.86	15.87	16.97	17.41
1% AEP flow (m3/s)	Pentium	0.239	0.239	0.239	0.162	0.545	0.535	0.522	0.522	0.522	0.187	0.188
	Water Corp	0.31	0.31	0.31	0.22	0.23	0.19	0.19	0.19	0.19	0.15	0.15

Figure 18: Peel Sub O Drain long-section – 1% AEP



	Location	west of fwy	POCB2	pocb2a	POaCB1	POa2	POa3	POa4	POa5	POa6	POa7	POa8
Pentium model:	Ground level (mAHD)	12	14	14	14.2	15.6	17	18	18	18	19.4	20
	Invert level (mAHD)	10.2	10.93	11	13	13.8	15.2	16.2	16.2	16.2	18.6	18.5
Water Corp model:	Ground level (mAHD)	13	14	14	13.6	14.1	15.5	15.9	16.4	16.5	17.8	17.7
	Invert level (mAHD)	10.3	10.4	11.9	13	13.6	15	15.3	15.4	15.5	16.8	17.2
10% AEP HGL (mAHD)	Pentium	10.89	11.02	11.25	13.5	14.29	15.69	16.74	16.74	16.74	18.75	19.46
	Water Corp	10.89	10.89	12.03	13.18	13.79	15.14	15.47	15.76	15.78	16.93	17.35
10% AEP Flow (m3/s)	Pentium	0.137	0.137	0.137	0.131	0.299	0.305	0.323	0.323	0.323	0.11	0.112
	Water Corp	0.31	0.31	0.31	0.16	0.16	0.12	0.12	0.12	0.12	0.09	0.09

Figure 19: Peel Sub O Drain long-section – 10% AEP

It is noted that in general the Pentium modelled water levels are higher than the water Corporation water levels. This is primarily due to the difference in flood route (the drain has been shifted south in the Pentium model to suit the LSP layout) and post-development earthworks levels, as well as the increased flows along the drain due to development runoff, particularly in the middle and upper reaches upstream of Wetland 2 (POaCB1). Given the proposed development levels achieve sufficient clearance to Pentium modelled water levels, this is not considered to be a risk to the development.

The modelled water levels at the upstream boundary indicate there may be additional surface water ponding in the Bush Forever Lot 123 area east of site around CCW 6679. The connection of the external catchment to the development drainage system will be refined at subdivision stage if required.

6.3.5. Stormwater modelling

Pentium Water have undertaken drainage modelling over the Casuarina South LSP contributing catchment to demonstrate the site can adequately manage post-development stormwater and groundwater conditions. The modelling shows the site has sufficient capacity to achieve the allowable discharge rates outlined in the JDWMP and provides comparable detention storage.

The catchment was modelled in 1d using XPSWMM hydraulic modelling software. The ultimate post-development scenario was modelled based on the engineer's earthworks drawings (Peritas, 2026), with basins, basin connections, key culverts and spillways included in the model. The land uses proposed under the Local Structure Plan (BDG, 2026) were applied across the site area. The catchment was modelled as fully developed; although the future staging arrangement is uncertain. Temporary drainage arrangements will be determined at subdivision/Urban Water Management Plan (UWMP) stage.

Post-development catchments were modelled according to the catchment sizes and land use breakdowns provided in Table 17. The bio-retention swales and basins in the drier upstream areas were modelled as storage nodes with high infiltration, as their bed levels are sufficiently elevated from groundwater and/or they are proposed to be underlain by subsoil drainage. The wetland basins in POS areas 1, 2 and 4 were modelled as storage nodes with minimal infiltration assuming high groundwater/shallow inundation conditions.

The catchment land use breakdown applied in the drainage model is provided in Table 17 below. The infiltration rates applied to the storage elements are shown in Table 15 below. The losses applied to the respective land uses are summarised in Table 16 below. The engineering drawings are included in Appendix G. The LSP is included in Appendix A.

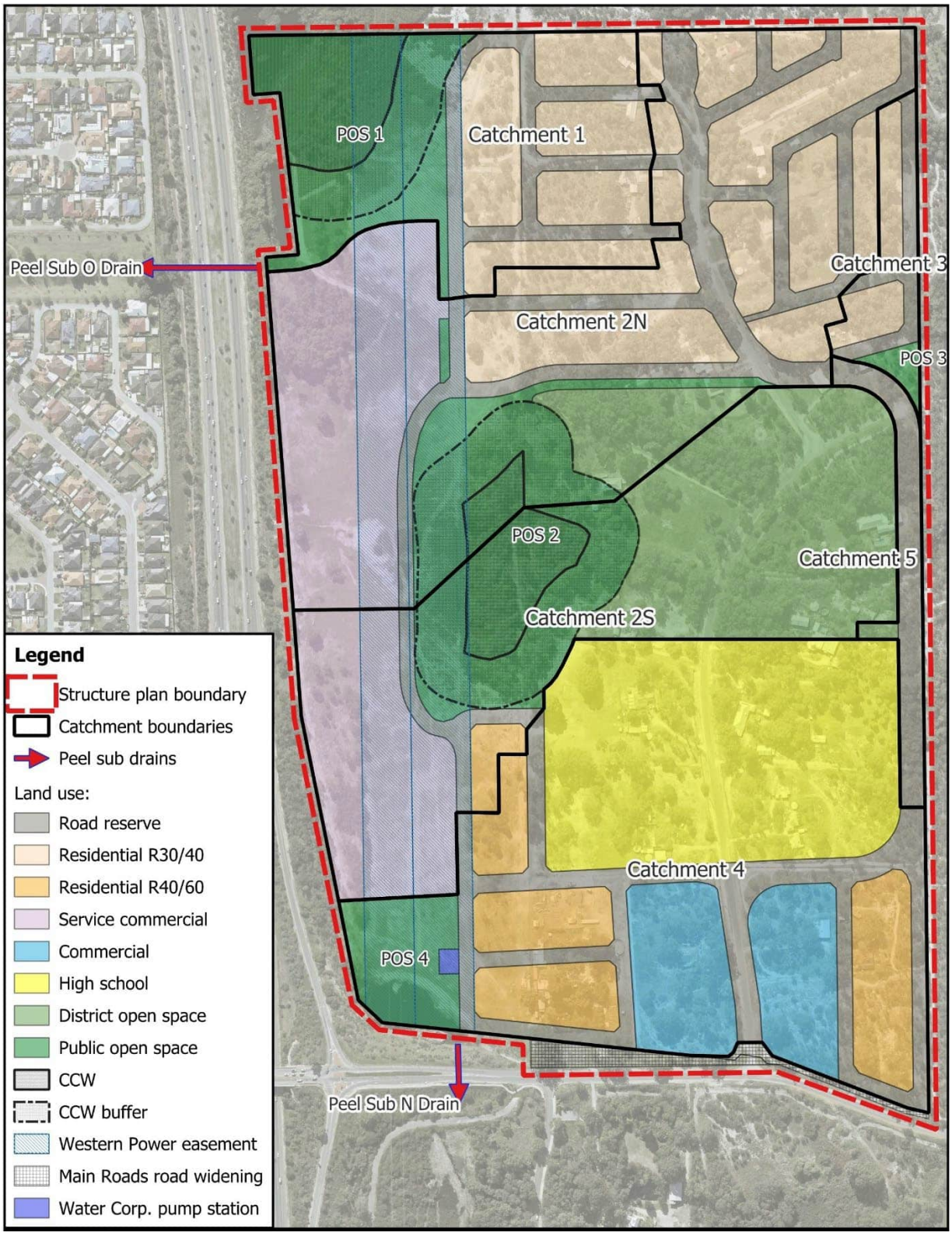


Figure 20: Proposed site sub-catchments and land uses

Table 15: Modelled infiltration rates of storage elements

Storage element	Infiltration rate (m/day)
Catchment 1	
Bio-basin 1	2
Wetland 1 (Johnson Rd Wetland/POS 1)	0.05
Catchment 2	
Boulevard swales 2N	2
POS swales 2N	2
Bio-basin 2N	2
Bio-basin 2S	2
Wetland 2 (Central Wetland/POS 2)	0.2
Catchment 3	
Bio-basin 3	2
Basin 3 (POS 3)	2
Catchment 4	
Boulevard swales 4	2
Bio-basin 4	2
Wetland basin 4 (POS 4)	0.5
Catchment 5	
Boulevard swales 5	2
Basin 5	2

Table 16: Modelled loss parameters according to land use

Land use	Initial loss	Continuing loss
Road reserve	5 mm	20%
Residential lots - unconnected	13 mm	8 mm/hr
Service commercial	22 mm	20%
Commercial	22 mm	20%
High school	22 mm	80%
District open space	20 mm	3 mm/hr
Public open space	20 mm	3 mm/hr
External catchments		
Rural-residential/bushland	30 mm	6 mm/hr
Freeway verge	30 mm	6 mm/hr

Continuing losses for road reserves, connected lots and commercial areas were applied as a proportion of rainfall.

The drainage conveyance network was modelled simplistically due to the concept level of detail in the engineering drawings. This is considered appropriate given the primary purpose of the model was to adequately size the stormwater treatment and detention infrastructure throughout the LSP, to ensure the JDWMP discharge requirements were met. The model network was designed to convey all runoff through bio-retention areas and basin and wetland storages and to prevent flood loss from the model. The model network is summarised as follows and shown in Figure 21 below.

- Runoff from the various land use areas within each sub-catchment is routed directly to a manhole node downstream
- The manhole node is routed directly to the downstream manhole or bio-retention swale/basin storage node via a conduit link
- Bio-retention swale/basin storage nodes are modelled with stage-storage relationships achieving 1 EY – 1 hr event storage volume across approximately 0.3 m depth according to the engineering drawings and infiltration rates as above
- 'Boulevard swales' are assumed to run for 80% of the road length for boulevard roads, with base width 0.5 m, 1:4 batters, 0.3 m depth
- 'POS swales' are assumed to run for 80% of the road length adjacent POS/DOS, with base width 1 m, 1:4 batters, 0.3 m depth
- Overflow from bio-retention swales/basins is routed downstream via a weir and conduit link set at basin TWL, to represent a bubble-down pit and buried pipe
- The POS swale along the northern DOS boundary (between Basin 3 and Wetland 2) is modelled as open channel links
- The wetland basins 1, 2 and 4 outlets were modelled as conduit links sized to attenuate discharge to allowable limits per the JDWMP
- The Freeway culverts are modelled as 4 x 900 mm diameter pipes, and the Mortimer Rd culvert as a 450 mm diameter pipe per the JDWMP long-sections and MRWA as-constructed drawings
- The Freeway and Mortimer Rd culverts are modelled with the downstream node as an outfall with tailwater level at the 10% AEP hydraulic grade line (HGL)

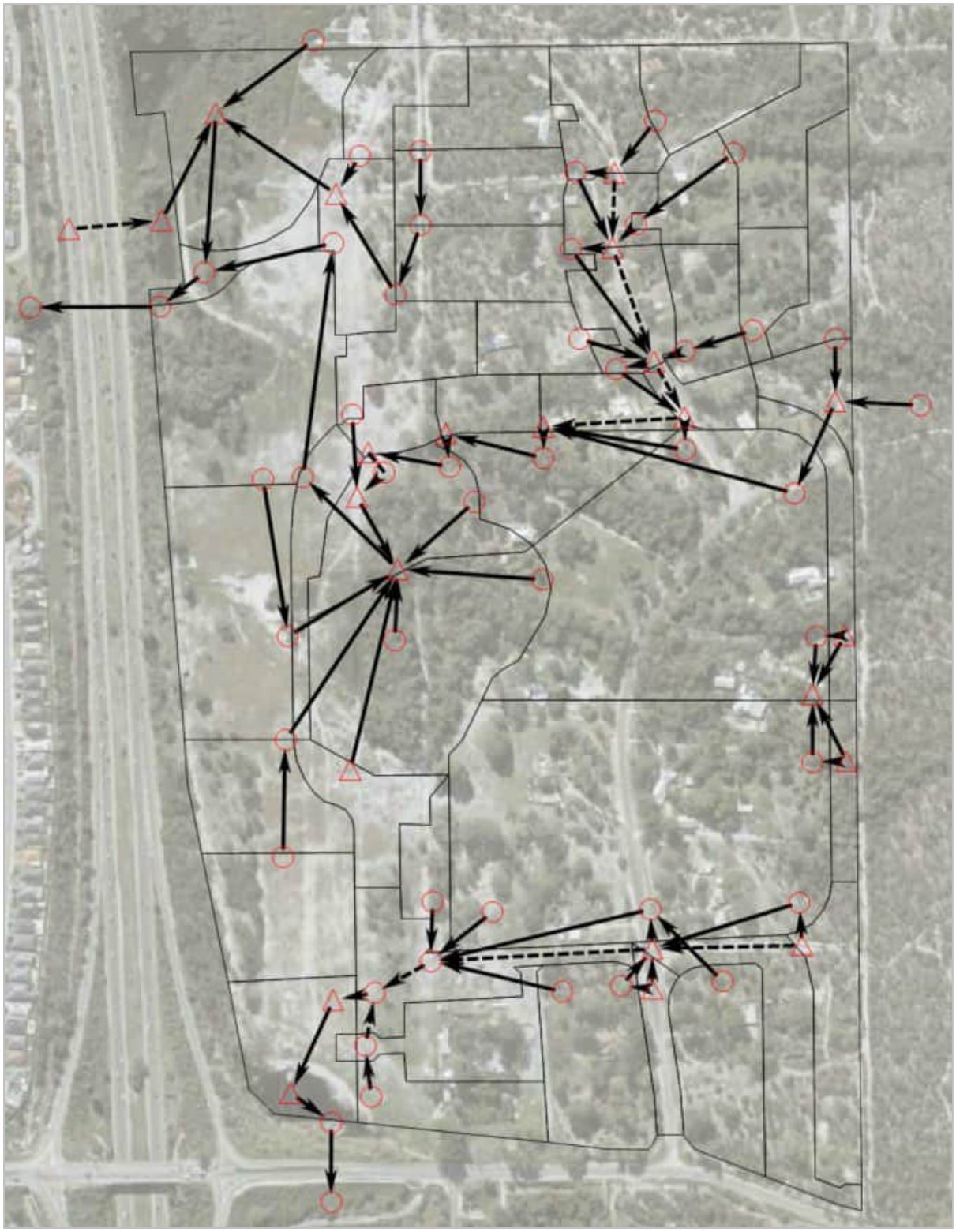


Figure 21: XPSWMM model network

Storm durations of 1, 3, 6, 12 and 24 hours were modelled for the 1 EY, 10% AEP and 1% AEP events. The median temporal pattern of the critical duration event was taken as the design storm, based on detention volume and peak flow. The design storms are listed below.

- 1 EY – 1 hour – temporal pattern 9
- 10% AEP – 6 hour duration – temporal pattern 4
- 1% AEP – 12 hour duration – temporal pattern 1

The model hydraulic long-sections for the 1 EY, 10% AEP and 1% AEP design storms are included in Appendix H.

Table 17 provides the breakdown of land uses within the Casuarina South LSP area and Table 13 provides the basin sizing details. The stormwater catchments delineated from the LSP and engineering design are shown in Figure 20 in section 6.3.1 above. A comparison of the discharge requirements and indicative detention storages of the JDWMP (DoW, 2009) and that provided in the current design (Pentium Water, 2026) is provided in Table 14 in section 6.3.4 below.

Table 17: Catchment land use breakdown

Land use	Sub-catchment						Total
	1	2N	2S	3	4	5	
Road reserve (ha)	1.51	4.04	0.50	0.60	3.67	1.22	11.54
Residential lots – unconnected (ha)	3.50	6.66	0.34	0.75	3.49	-	14.74
Service commercial (ha)	-	5.16	3.60	-	-	-	8.76
Commercial (ha)	-	-	-	-	3.25	-	3.25
High school (ha)	-	-	-	-	8.00	-	8.00
District open space (ha)	-	1.30	6.34	-	-	-	7.64
Public open space (ha)	3.69	2.66	3.24	0.19	1.35	-	11.13
Total (ha)	**8.70**	**19.82**	**14.01**	**1.54**	**19.76**	**1.22**	**65.06**

6.3.6. External catchments

The external stormwater catchments influencing the drainage regime on-site are described in section 3.13.3 and shown in Figure 14 above. Their incorporation into the Casuarina South drainage modelling is summarised as follows. Refer to Table 15 and Table 16 for infiltration and loss parameters applied to respective land uses.

- Kwinana Freeway catchment: 7 ha road reserve, 11 ha Freeway verge
- Casuarina Central: 2 ha road reserve, 4 ha residential lots – unconnected, 9 ha POS
- Semi-rural/bushland east: 110 ha rural-residential/bushland

The Freeway catchment incorporates the additional lanes proposed in the near future. The Freeway catchment is routed through the Johnson Rd Wetland Basin, sized according to the drawings in Appendix E. However, the basin discharge connection to Wetland 1 is via a trapezoidal drain at upstream invert level 10.9 mAHD, estimated per site observations (i.e. lower than design overflow level) (Pentium Water, 2024).

The Casuarina Central catchment is based on the JDWMP sub-catchment boundary overlaid on the Casuarina Central LSP (DoW, 2009) (TBB, 2021).

The semi-rural/bushland catchment east of site has been halved to allow for better matching of design stormwater event hydrographs. This assumes stormwater detention upstream in the catchment, which is considered likely given topography and soil type. The peak flow emanating from the catchment matches the 0.15 m^3/s in the 1% AEP and 0.09 m^3/s in the 10% AEP modelled in the JDWMP (DoW, 2009).

6.4. Vegetation

Vegetation will be included in all suitable stormwater management areas to help prevent erosion, maintain soil infiltration, restrict water flows and remove particulate and soluble pollutants, particularly nitrogen. The plants will mainly be associated with bio-retention areas and will be appropriately selected based on their intended function, using native vegetation as much as possible. The plant species to be used within stormwater management areas will be identified within future UWMPs.

6.5. Non-structural controls

Non-structural controls will be used to provide additional stormwater quality management and will include establishing operation and maintenance activities and controlling land use and management. The following non-structural controls will be implemented (via management plans to be prepared as part of subsequent approval stages) to improve stormwater quality and reduce contamination.

6.5.1. Nutrient control and landscaping

Design guidelines and a landscaping policy will be implemented to control POS landscaping designs and practices. It is expected that these measures will provide improvement of stormwater quality through ensuring:

- Appropriate native plant species are continually used
- Bioretention areas to contain an amended soil with a minimum PRI of 10
- POS and bioretention areas to be maintained
- Recommended fertiliser, pesticide and irrigation regimes are followed.

6.5.2. Waste and construction management

Waste management plans will include provisions for stormwater protection through:

- “At source” management of litter, sediment and organic material such as regular street sweeping
- Prompt removal of litter when discovered
- Discouraging waste dumping in drains and drainage swale through restricted access (i.e. bollards around POS) and signage
- Providing sufficient public facilities for rubbish disposal

All development construction projects, including road and infrastructure construction, will be subject to sediment and erosion control measures.

7. Groundwater management

The main principles of groundwater management are to protect underlying groundwater resources by minimising the export of nutrients through maintaining or improving the quality of groundwater leaving the site and to protect infrastructure from groundwater inundation.

7.1. Overview and objectives

As discussed in section 3.12.4, the western margins of the site are underlain by shallow groundwater, particularly in the south-western corner. Groundwater levels are expected to rise due to increased infiltration associated with urban development, unless otherwise controlled. This groundwater level rise is proposed to be managed by the installation of a subsoil drainage system to be placed beneath road reserves and POS areas. Fill will be imported to provide clearance from the controlled groundwater level to roads and building pads where required.

The site will utilise the unconfined aquifer as a means of stormwater disposal. Groundwater will be controlled with a system of subsoil drains located within road reserves and beneath POS areas. The level at which subsoil drains are installed, the Controlled Groundwater Level (CGL), will be set according to *Water resource considerations when controlling groundwater levels in urban development* (DoW, 2013). As specified in DoW (2013), the CGL will be set with consideration of:

- A free-flowing drainage outlet
- Infrastructure protection
- Groundwater quality and treatment of subsoil drainage discharge
- Protection of water dependent ecosystems (WDEs)
- Catchment and nearby land use constraints.

Appropriate controlled groundwater levels have been established across the LSP in accordance with the Specification Separation Distances for Groundwater Controlled Urban Development (IPWEA, 2016) as well as DoW (2013).

Regarding groundwater quality management, the first 15 mm of rainfall run-off on impervious areas will be treated prior to infiltration in line with best practice.

7.2. Free-flowing drainage outlet

DoW (2013) specifies that subsoil drainage discharge to stormwater systems should be at least 0.1 m above the stormwater pipe or the winter/wet season level for back-flooded stormwater systems (clearance not specified for discharge to natural drainage features other than ensuring WDE protection and a free-flowing outlet). The subsoil drainage system for the LSP will therefore discharge into either existing wetlands throughout the site or modified / new drainage channels which will be created as part of the flood detention system within the large flood corridors. Ultimately the subsoil discharge will be to the Peel Main Drain along the western boundary of the site.

The subsoil drains will grade back from the discharge locations at a typical grade of 1 in 500, which is considered appropriate in terms of installation feasibility. The subsoil outlets may be inundated for a short period during large storm events which is typical for design of subsoil drainage systems in the Perth region. However, this temporary inundation of the subsoil outlets is considered acceptable as the unsaturated zone soil (i.e., fill) across the development will have sufficient storage to compensate for this short-term rise in the hydraulic grade line.

7.3. Infrastructure protection

Setting of earthworks levels and installation of subsoil drains will be the primary mechanism for protecting infrastructure from groundwater rise. Subsoil drains are proposed to be

installed at MGL in areas of shallow groundwater (i.e. the low-lying areas around wetlands generally in the western half of the LSP). A conceptual subsoil layout is presented in Figure 22 below.

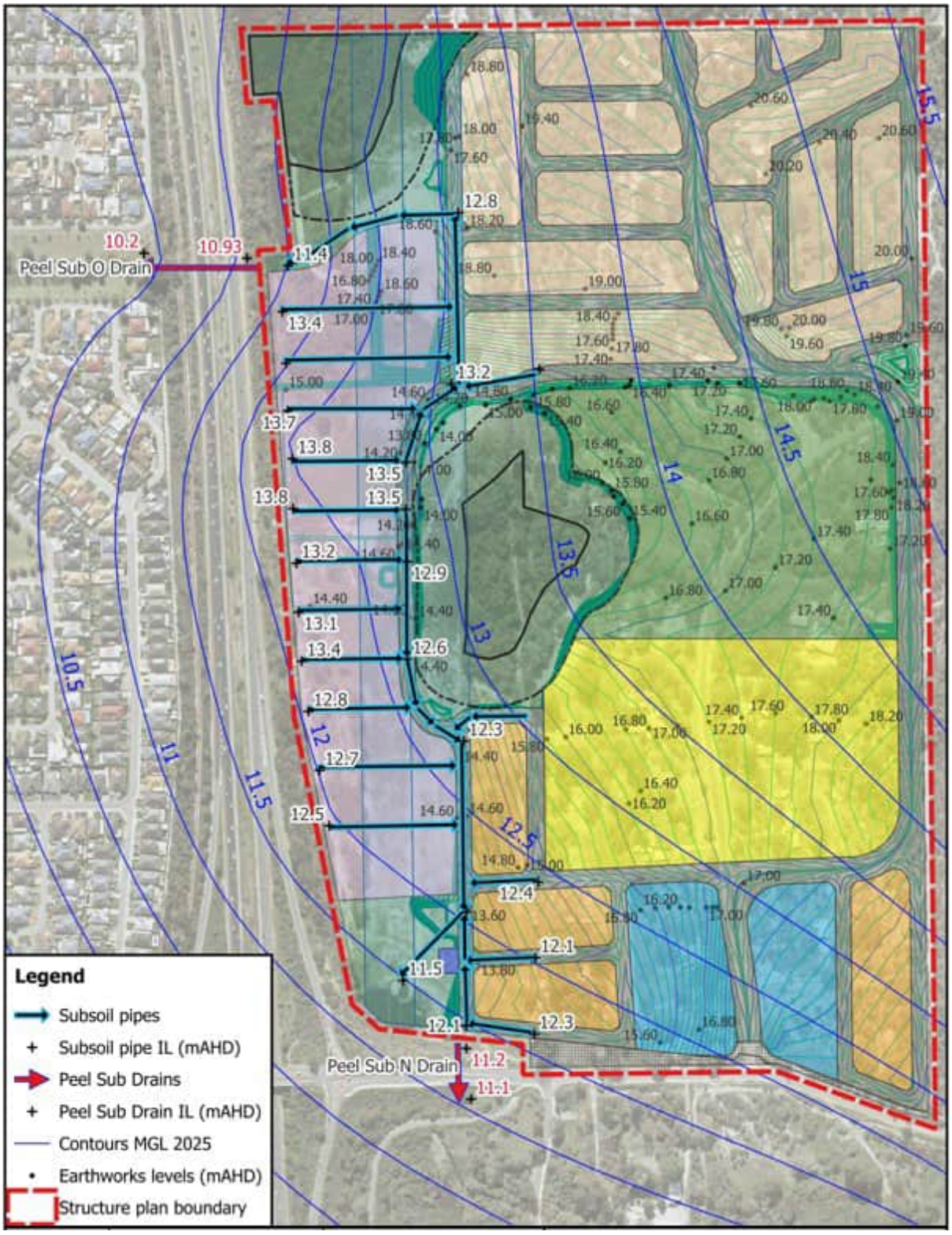


Figure 22: Conceptual subsoil drainage layout

Earthworks levels are proposed to be set at minimum 1.2 m from subsoil drain invert levels. Subsoil drains will be installed in road reserves, therefore the spacing will generally be at around 75 m (allowing for a 60 m wide lot cell and 15 m road reserve). The lots are proposed to be set at approximately 0.3 m above road level, therefore the lot levels will be set around 1.5 m above subsoil drain inverts.

A groundwater mounding and clearance analysis was undertaken using ENDRAIN software. ENDRAIN uses Bernoulli's energy equation and Darcy's law to estimate phreatic rise between drains in soil and water conditions specified by the user. The conceptual model is shown in Figure 23 below. The input parameters to the ENDRAIN model are described in Table 18 below.

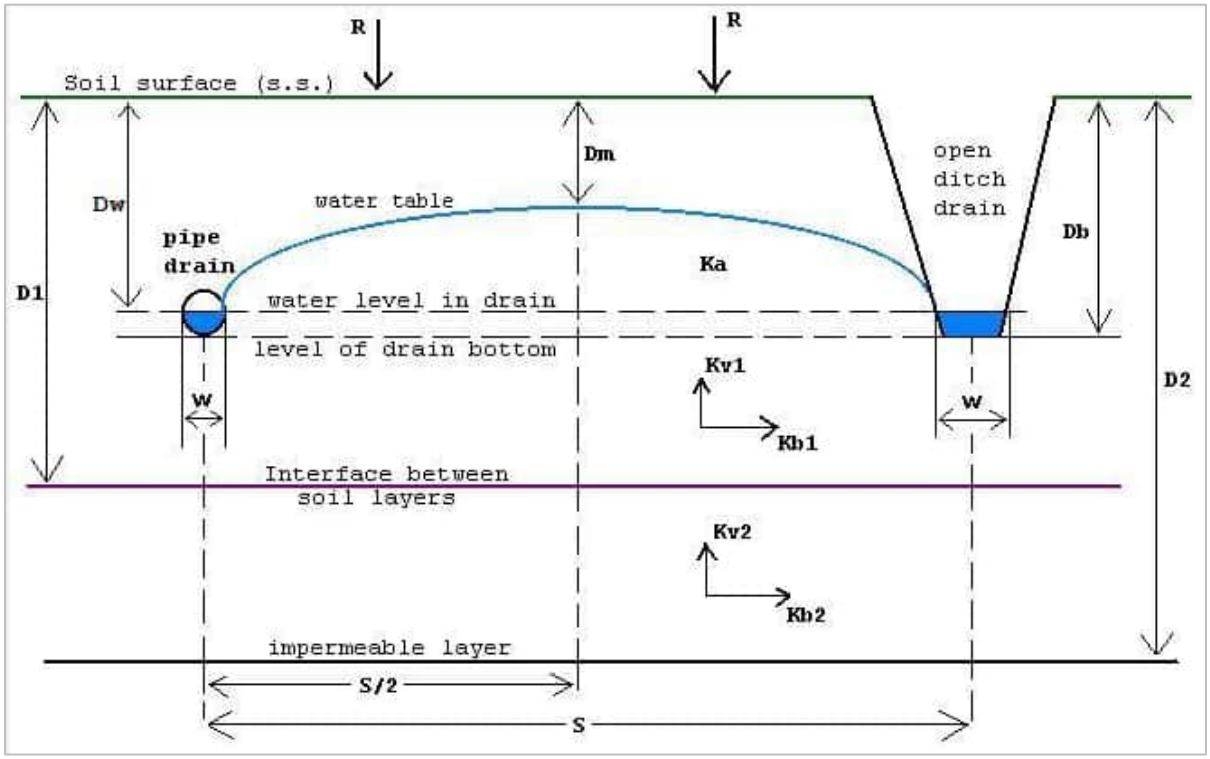


Figure 23: ENDRAIN conceptual model

Table 18: ENDRAIN model inputs

Input variable		Value	Description
Time average recharge or discharge	R (m/day)	0.0131	50% AEP - 72hr rainfall (78.7 mm), 50% recharge rate
Bottom depth of 1st layer below s.s.	D1 (m)	1.2	Assume 1.2m depth of fill with drains at base of fill in road reserves
Bottom depth of 2nd layer below s.s.	D2 (m)	2.7	Discontinuous coffee rock (assume sand for 30m)
Depth water level in drain below s.s.	Dw (m)	1.1	Assumes 100 mm of water in drain - conservative given depth to water
Depth of drain bottom below s.s.	Db (m)	1.2	Subsoils at base of fill
Entrance resistance at the drain	E (day/m)	0	Assumes free flowing subsoils (not blocked)

Input variable		Value	Description
Max. width of water body in the drain	W (m)	0.15	Minimum subsoil width (150mm diameter subsoil pipes)
Hydraulic permeability, above drain level	Ka (m/day)	5	Conservative fill criteria
Horizontal permeability, 1st soil layer	Kb1 (m/day)	5	Conservative fill criteria
Vertical permeability, 1st soil layer	Kv1 (m/day)	5	Conservative fill criteria (assuming isotropic fill)
Horizontal permeability, 2nd soil layer	Kb2 (m/day)	5	Expected K beneath fill for Bassendean Sand
Vertical permeability, 2nd soil layer	Kv2 (m/day)	0.5	Expected K beneath fill for Bassendean Sand (1:10 V to H anistropy)
Spacing between the drains	S (m)	80	Assumes subsoils in 15 m road reserves adjacent 60 m lot cell

The ENDRAIN model results indicate that subsoil drainage in road reserves will effectively control groundwater to 0.5 m below lot level in the 50% AEP – 72 hr event. This exceeds the minimum criteria of the IPWEA groundwater separation specifications (IPWEA, 2016), which nominate a clearance to the 50% AEP phreatic surface of 150 mm for residential lots less than 400 m^2 in area. The results are shown in Figure 24 below. Note, lot levels will be set at 1.5 m above subsoil drain levels.

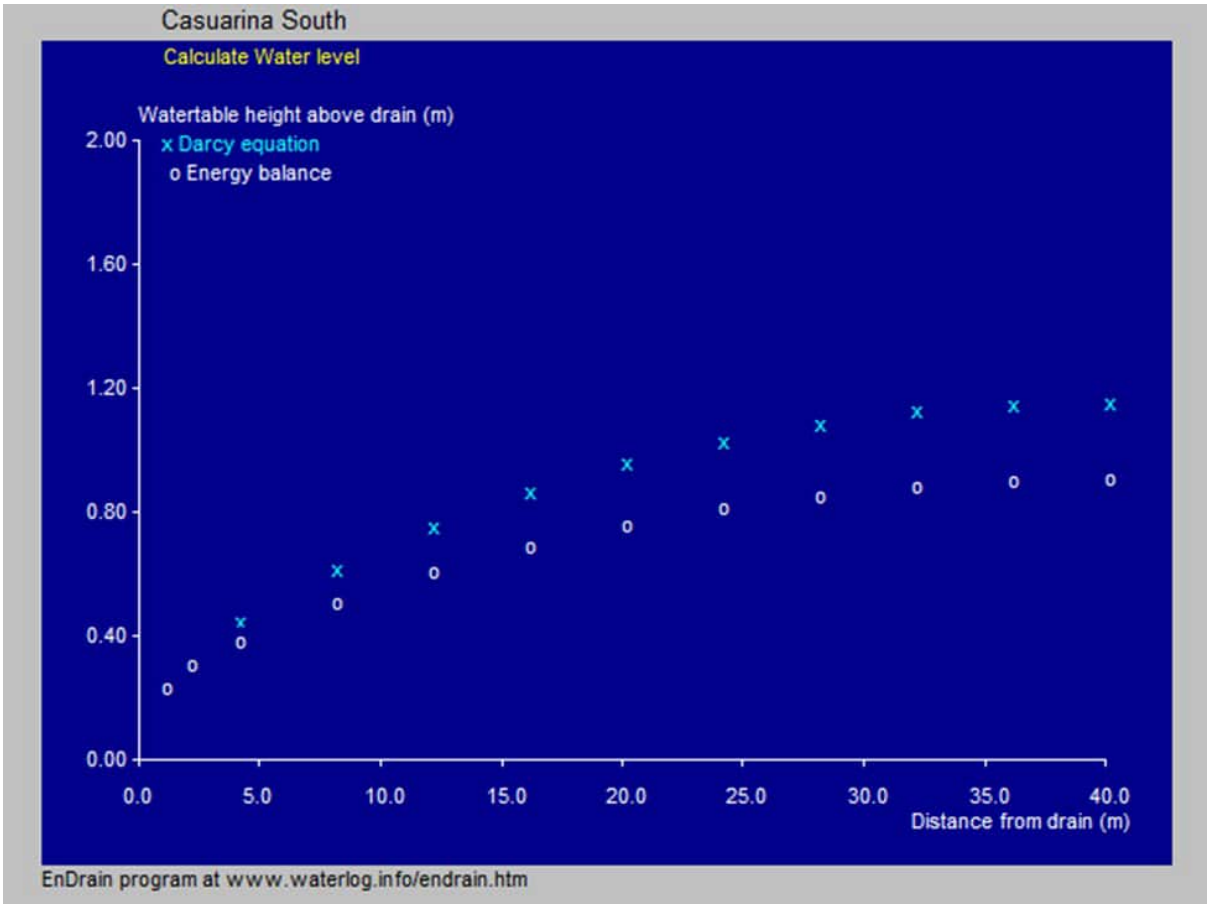


Figure 24: ENDRAIN model results

7.4. Groundwater quality management

Groundwater quality will primarily be managed through the stormwater drainage design and maintenance. The proposed stormwater management strategy includes a series of measures to retain and detain stormwater run-off as close to source as possible. These measures prevent the mobilisation of contaminants that are typically transported during first flush rainfall events, which will instead be retained and infiltrated in the catchment, providing further opportunity for nutrient uptake and attenuation through the soil profile.

Groundwater quality will be monitored post-development to verify that pre-development water quality is being maintained or improved.

Subsoil drains will discharge into wetlands. Since subsoil drains are proposed to be installed at or above MGL (thus will not be intercepting a significant contaminant load), pre-treatment is not required prior to discharge to downstream receiving environments (*pers. comm.* R. Ganesha, March 2026).

7.5. Protection of water dependent ecosystems (WDEs)

7.5.1. Wetlands

The key water dependent ecosystems are the conservation category wetlands in the north-western and central portions of the site (wetlands 1 and 2), and the Tumulus Organic Mound Spring in wetland 1 (see section 7.5.2 below). Management strategies for wetlands will need to be informed by Wetland Management Plans (WMP) having consideration of landform integration, management of stormwater and drainage interfaces and landscape including bushfire risk. WMPs will be prepared and implemented as part of the subdivision process. The appropriate protection of WDEs relate to both water quality and water quantity.

Actions to manage water quality risk to wetlands have been identified in Section 6 through the implementation of water sensitive urban design approaches throughout the development and in Section 7 through groundwater level and quality management measures. The establishment of appropriate controlled groundwater levels through the subsoil drainage system design (i.e. appropriate subsoil drain elevations) is a critical design component.

The groundwater management strategy for the LSP is cognisant of the existing hydrological regime and groundwater levels at the retained wetland areas. It is anticipated that further groundwater assessment will be undertaken to support the subdivision planning process and associated Urban Water Management Plans, to confirm that earthworks and drainage (stormwater and subsoil) levels, and drainage discharge locations and quality are appropriately designed to protect these areas. A Wetland Management Plan (WMP) will be developed to inform the subdivision design.

As part of the conceptual drainage design process, numerous measures to address the risks posed to WDEs by the development have been incorporated, which are summarised below. It is expected these measures will be further detailed as part of the subdivision design process and in consultation with the City, DWER and DBCA.

- The overarching approach to stormwater and groundwater management is to match pre-development conditions as best possible.
- Groundwater levels will be controlled via a subsoil drainage system set to the MGL to prevent excessive groundwater rise post-development.
- Stormwater quality will primarily be managed by treating and infiltrating the 15 mm event at-source in ‘higher and drier’ areas of the catchment. Soakwells will manage lot runoff. Bioretention areas will manage road runoff outside of wetlands and their 50 m buffers.
- Subsoil drainage and infiltrated stormwater will generally be routed through wetlands to maintain environmental flows. Only ‘cleaner’ stormwater exceeding the capacity of the 15 mm event infrastructure will discharge directly to wetlands.
- The CCWs in the centre and north-western corner are protected by 50 m buffers, in which revegetation and minimal earthworks are proposed.

- Stormwater and subsoil drainage discharge locations will be located outside of wetlands and their buffers, and will be diffused (i.e. not point discharges) prior to entering buffers, aligned with DWER advice (*pers. comm.* J. Sturgess March 2025).
- Wetland drainage outlets may be adjustable to allow flexibility in seasonal operation and adaptability in future climate scenarios. This would provide a means of managing wetland health in changing hydrological conditions.

Whilst all reasonable efforts will be made to ensure pre-development hydrological conditions are maintained post-development, it is acknowledged that the land use change across the catchment will result in some change to the local hydrology. For example, the subsoil system will reduce the variance in annual groundwater peak, and the increased rainfall recharge rates due to land use change will extend the duration of the groundwater peak. Due to the presence of CCWs and the Tumulus springs TEC on-site, it is recommended that wetland health and vegetation monitoring is undertaken post-development as well as water monitoring. This should be documented in the future Wetland and Wetland Buffer Management Plan.

7.5.2. Tumulus Organic Mound Spring

A Tumulus Organic Mound Spring (TOMS) TEC was identified within the CCW in the north-western corner of the LSP. The primary hydrologic risks to the TOMS associated with the proposed development are potential changes to water levels, flow rates, hydroperiod and water quality. The stormwater and groundwater management strategies address the risk to the TOMS as follows:

- The TOMS is 70 m from the nearest proposed road and 80 m from the nearest proposed lot. By comparison, the Freeway is 40 m away.
- There is no earthworks or infrastructure proposed to be built within Wetland 1 or its buffer, in which the TOMS is located.
- There will be negligible change to peak groundwater levels in Wetland 1 associated with the TOMS, on account of the controlled groundwater level (CGL). The subsoil system will likely lower the groundwater peaks and elevate the lows due to increased recharge across the development, which is understood to be the preferred habitat of the TOMS.
- The Wetland 1 stormwater and groundwater discharge inlets will be located outside of the mapped TOMS area.
- The land use change from urban residential from rural-residential is likely to improve water quality over time, due to removal of grazing animals, fertiliser use, etc.
- Stormwater runoff from the development is fully retained and infiltrated up to the 15 mm event, which constitutes over 95% of total annual rainfall.
- Subsoil drains are proposed to be installed at MGL, thus will not entrain a significant contaminant load (*pers. comm.* R. Ganesha, March 2026).

The risks and proposed management strategies for the TOMS outlined in this section were discussed with DWER, DBCA and the City of Kwinana, and deemed generally acceptable (*pers. comm.* DWER, DBCA, City of Kwinana, March 2026).

It is very unlikely the maximum water level in the wetland will be significantly impacted by the proposed development due to the controlled outlet level. It is also unlikely that the hydroperiod of the wetland will decrease. It is likely that the wetland minimum annual water level and the 'wet' cycle of the wetland hydroperiod will increase post-development. Water quality at the TOMS is expected to be maintained or improved post-development due to land use change and stormwater treatment.

The following sub-sections describe potential impacts to the TOMS conceptually. Additional pre-development water monitoring specific to the TOMS and its wetland is proposed to be undertaken, which will inform the baseline to which post-development monitoring data is compared. This will be documented in the future Wetland Management Plan.

Consideration must be given to climate change when assessing the potential impacts to the TOMS. Almost all future climate scenarios show a drying climate. In the context of climate change, and considering the implementation of the LSP is likely to be staged over the next decade or two, the increased recharge (and resulting increase in annual minimum water levels and hydroperiod) could be considered beneficial to the TOMS.

The mapped TOMS area in relation to the proposed development and its stormwater and groundwater infrastructure is shown in Figure 25 below.

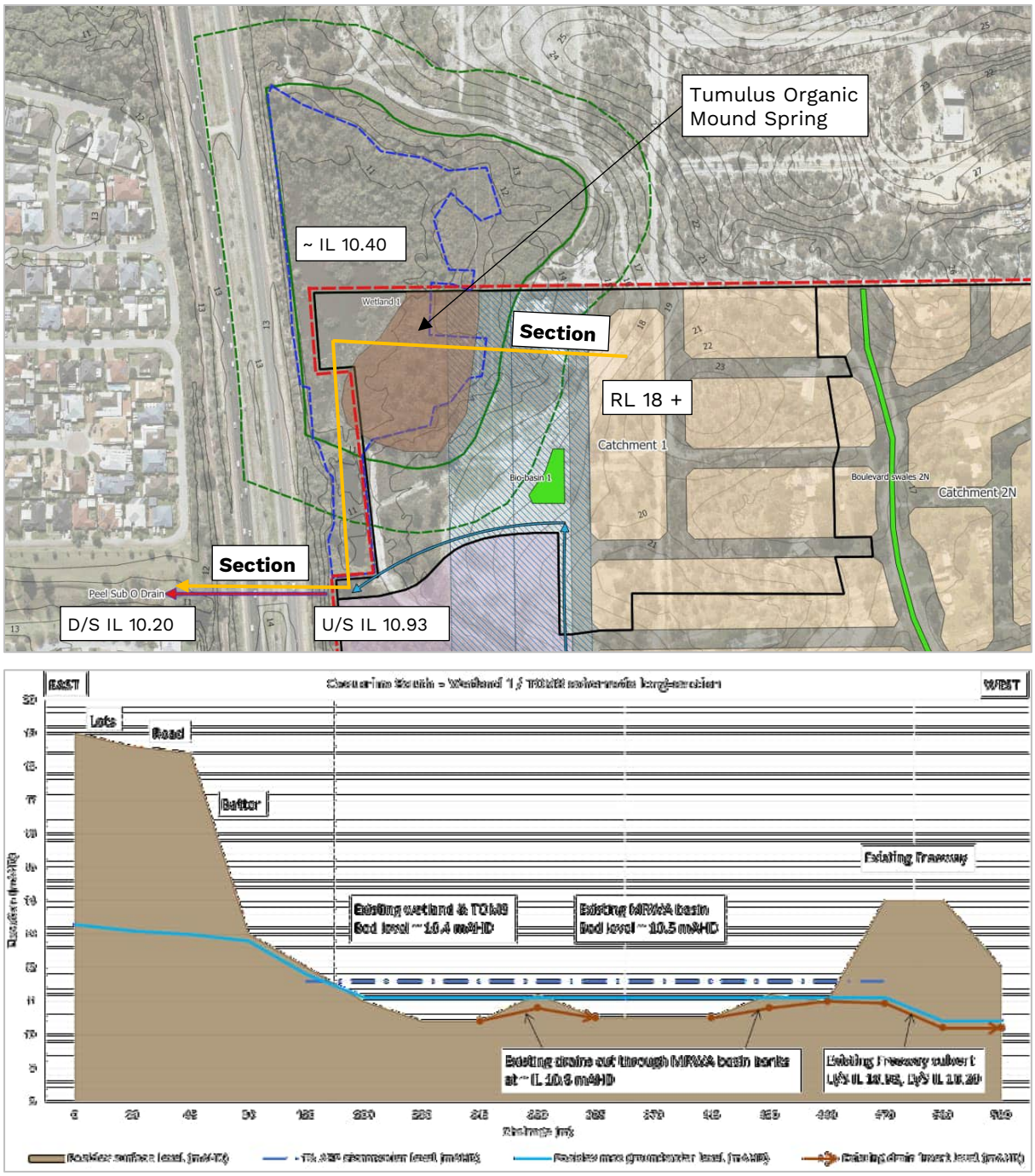


Figure 25: Mapped TOMS in relation to proposed development

7.5.2.1. Water levels

The seasonal fluctuation in water levels is likely to reduce post-development. The annual maximum groundwater level will potentially increase very marginally, but the annual minimum groundwater level will likely increase.

The annual maximum groundwater level will likely remain the same post-development due to the water level control effected by the Kwinana Freeway culverts. The Freeway culverts were constructed with upstream IL 10.93 mAHD (in Wetland 1) and downstream IL 10.20 mAHD in the Bertram Drain some 100 m west. There is no tailwater effect under baseflow conditions, so the culverts' inlet level and size control the upstream water level in the

culvert, i.e. the level at which surface water in the wetland can discharge. The excessive capacity of the culverts, which comprise 4x 900 mm diameter pipes, means that a modest increase in flow rate will cause only a very minor increase in upstream water level.

The upstream culvert IL 10.93 mAHD is some 0.6 m higher than the wetland bed level, which is estimated at IL 10.4 mAHD. There is no other outlet from the wetland other than infiltration and evapotranspiration. Thus, the wetland will continue to experience the same annual maximum groundwater level of approximately 11 mAHD.

The annual minimum groundwater level is likely to increase post-development due to increased groundwater recharge rates. The proportion of rainfall that is recharged to the superficial groundwater aquifer will increase from approximately 15% in pre-development conditions (semi-rural and bushland) to approximately 50% in post-development conditions (urban residential, school and commercial) due to land use change.

The elevation of the spring according to the mapping and regional lidar is between 11 and 12 mAHD, which is up to 1 m higher than the wetland CGL. This indicates that even with significant water level increase in the wetland (which is unlikely), the mapped TOMS area will not be significantly impacted. A small portion in the lower-lying western area of the mapped TOMS may be slightly impacted. However, given the vegetation community's ability to adapt to continually changing conditions (see section 7.5.2.4), this is not considered to be a significant risk to the TOMS.

7.5.2.2. Stormwater and groundwater flows

Flows to the TOMS will likely increase as a result of development due to increased groundwater recharge. These flows will express through the spring as groundwater discharge, rather than surface water inundation.

The vast majority of flows reporting to Wetland 1 will be via groundwater seepage. Stormwater runoff from the development up to the 15 mm event (which constitutes over 95% of annual runoff) is proposed to be infiltrated in soakwells on lots and biofilters in road reserves and POS. Only less frequent events exceeding the 15 mm in catchment 1 overflow to the wetland.

If, for example, the flow at the spring tripled, the change in water level would be minimal due to the outlet control at the Freeway. Assuming the approximately 50 mm flow depth measured in the Freeway culverts in July 2024 (Pentium Water, 2024) reflected baseflow, a threefold increase in flow would raise the water depth in the culverts (and the wetland upstream) by approximately 50 mm.

7.5.2.3. Hydroperiod

The hydroperiod of the TOMS will lengthen as a result of development. The increase in groundwater recharge upstream in the development will increase the length of time the wetland is wet for. A larger volume of water will be moving through the superficial aquifer to the TOMS, and it will take longer to discharge it.

Based on recent monitoring data by SLR and Urban Resources and aerial photographs from past decades, the TOMS' current 'wet' cycle is estimated to be approximately 9 months per year. Most years the wetland did not fully dry down, with water levels only receding slightly. Full dry down appears to occur approximately once in five to ten years.

It is anticipated that the frequency of wetland dry down will reduce post-development, with the increased groundwater recharge and controlled outlet level creating more stable water levels in the wetland. It is understood this is the preferred habitat of the TOMS.

7.5.2.4. Historic impacts

It is important to note that the wetland in which the TOMS is mapped has undergone significant hydrological change in past decades. The most notable changes are the regional drop in groundwater levels in the late 1990s-early 2000s and the construction of the Kwinana Freeway.

According to DWER long-term bores nearby and historic aerial imagery (MNG Access, 2026), the hydrological conditions some 30 years ago were very different to todays. In pre-1990 aerials the wetland appeared to have a far shorter wet cycle than today. The wetland also appears to have been drained from the 1950s.

A big difference in wet cycle occurred with Kwinana Freeway construction. The 2009-2010 aerials indicate the Freeway's 'damming' effect on the wetland (see Figure 26 below). The as-constructed details of the Freeway culverts indicate the upstream IL was significantly higher than the wetland bed.

The TOMS' resilience through these historic periods of significant hydrological change must be considered in the context of the possible impacts of the development. It is considered that the possible impacts from the proposed development are significantly less than, for example, the groundwater level drop of the 1990s or the construction of the Freeway.

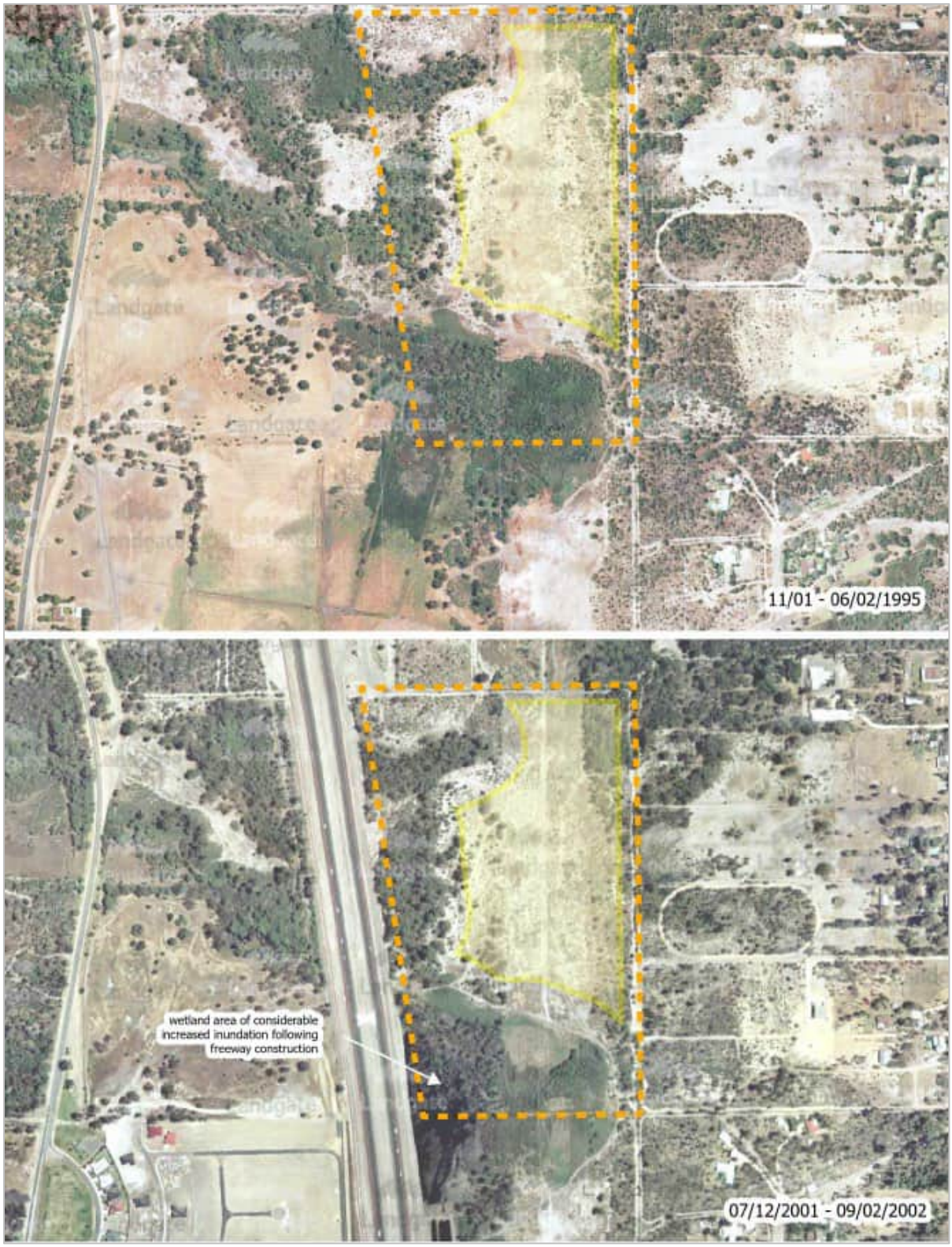


Figure 26: Wetland 1 aerial pre- and post- Kwinana Freeway construction (hyd2o, 2025)

7.6. Waste and construction management

Waste management plans will include provisions for stormwater protection through:

- "At source" management of litter, sediment, and organic material such as regular street sweeping during construction

- Prompt removal of litter when discovered
- Discouraging waste dumping in drains and drainage swale through restricted access (i.e., bollards) and signage
- Providing sufficient public facilities for rubbish disposal
- All development construction projects, including road and infrastructure construction, will be subject to sediment and erosion control measures.

8. Monitoring

8.1. Pre-development monitoring

As outlined above, pre-development groundwater monitoring (section 3.12.4 and 3.12.5) and surface water monitoring (section 3.13.4) programs have been completed.

8.2. Post-development monitoring

The objective of post-development monitoring is to demonstrate that there are no directly attributable significant impacts from the new urban development on water resources (DoW, 2012).

The proposed period for post-development monitoring is three years and will include groundwater and surface water monitoring.

8.2.1. Groundwater

Post-development groundwater monitoring is proposed for the on-site bores. If the pre-development bores are damaged or destroyed during construction, then a replacement bore would be installed as close as possible.

Groundwater levels and water quality is proposed to be monitored on a quarterly basis (January, April, July and October), with additional groundwater level monitoring to occur monthly over the period peak groundwater levels typically occur (June, August, September and November).

Groundwater bores would be purged, and in-situ parameters would be monitored including pH, EC, and temperature until stabilised. Following this, samples would then be collected and sent for laboratory analysis of the following nutrient suite: total nitrogen (TN), ammonia (NH_4-N), nitrogen oxides (NO_X-N), Total Kjeldahl Nitrogen (TKN), total phosphorus (TP) and filterable reactive phosphorus (FRP), as well as a bi-annual analysis of a suite of metals (Al, Ca, Fe, K, Mg, Na, S, As, Cd, Cr, Cu, Ni, Pb, Hg, and Zn) and pathogens (E.coli).

8.2.2. Surface water

Post-development surface water monitoring is proposed to ensure that the Peel Main Drain and wetlands have not been detrimentally impacted by the development. The post-development monitoring will include measuring water levels from staff gauges (and potentially capacitance loggers) at the pre-development monitoring sites. Surface water quality would be monitored on a quarterly basis if water is present. This would include in-situ measurement of pH, EC, and temperature and collection of grab samples for laboratory analysis of a nutrient suite (TN, TKN, NH_4-N, NO_x-N, TP, and FRP) as well as bi-annual analysis of a metal suite (Al, Ca, Fe, K, Mg, Na, S, As, Cd, Cr, Cu, Ni, Pb, Hg, and Zn) and pathogens (E.coli). The monitoring program will also include visual checks for the presence of algae in the wetlands on-site.

8.3. Trigger values

Trigger values have been established based on pre-development monitoring results obtained from the SLR monitoring program between October 2022 and 2024. Trigger values have been calculated at 20% above the mean pre-development results at each bore, as well as comparing to ANZG guidelines (ANZG, 2018) for wetlands and lowland rivers in the south-west of Australia, the DWER targets for the Peel-Harvey estuary (DWER, 2025), and the long-term targets outlined in the Jandakot DWMP (DoW, 2009). Trigger values are presented in Table 19 below.

Table 19: Post-development trigger values at SLR monitoring locations

Bore	Parameter (mg/L)												
	TSS	NH_4	TN	TKN	NO_X	NO_3-N	NO_2-N	TP	PO_4	Al	Al (filtered)	Fe	Fe (filtered)
ANZG (2018)	-	0.04	1.50	-	0.10	-	-	0.06	0.03	-	-	-	-
(DWER, 2025)	-	-	1.2	-	-	-	-	0.1	-	-	-	-	-
(DoW, 2009)	-	-	1.0	-	-	-	-	0.1	-	-	-	-	-
MC4	26	0.77	1.7	1.6	0.14	0.14	0.01	0.18	0.08	8.67	8.16	34.50	28.40
MB5	11	0.26	5.4	2.6	2.86	2.86	0.01	1.25	0.18	1.75	0.90	0.75	0.08
MB6	12	0.24	3.8	3.3	0.02	0.02	0.01	0.15	0.05	1.15	1.17	1.63	0.66
MB7	257	0.03	5.4	1.3	4.10	4.08	0.02	0.23	0.03	1.62	0.08	0.20	0.13
MB20	110	0.17	4.0	1.0	3.00	3.00	0.01	0.13	0.03	1.02	0.91	0.18	0.55
MB21	628	0.19	3.8	3.8	0.04	0.04	0.01	0.37	0.03	2.80	3.50	5.79	2.99

8.4. Contingency measures

In the event post-development data exceeds trigger values by at least 20% on two consecutive occasions, initially the City of Kwinana and DWER will be notified, and an investigation will be undertaken to establish the likely cause of the exceedances, the most likely impacts, and available mitigation strategies. If algae is found to be present in the wetlands on-site, further testing of chlorophyll-a and biochemical oxygen demand (BOD) in surface water will be undertaken to determine the likely cause.

The primary contingency measure available in the event of deterioration in water quality will include assessment of whether the pollution is a point or diffuse source. This will require an investigation into the location of the contamination and an assessment of whether the pollution is due to the development or an external factor. At that point, a specific contingency plan will be implemented, which may include:

- Removal of the pollution
- Assessment into the functionality of the drainage system
- Further soil amendment in infiltration / treatment areas
- Increased planting of nutrient stripping vegetation in biofiltration areas
- Review of drainage maintenance plans to ensure correct practices are being implemented
- Increased public awareness and education programs
- Increased monitoring program including monitoring up-gradient of the site to determine potential off-site nutrient sources

8.5. Reporting

The results obtained from post-development monitoring will be compared to pre-development monitoring trigger values set and ANZG guidelines (ANZG, 2018) (refer Table 19 above) and submitted to the City of Kwinana and DWER. The report will analyse any variations the development has had on the hydrological conditions and present necessary contingency measures where required.

9. Implementation

9.1. Further work to be completed at the UWMP stage

Following the approval of the LSP, the preparation of an Urban Water Management Plan (UWMP) will be required as a condition of subdivision approval for the development, and will include the following design measures in more detail:

- Compliance with this LWMS' criteria and objectives to the satisfaction of the City of Kwinana.
- Detailed stormwater drainage design including locations, dimensions, and final levels for drainage infrastructure, bioretention and flood storage areas, stormwater flow paths, and areas of inundation.
- Specific detailed information on structural and non-structural BMPs to be implemented.
- Final subdivision layout including any earthworks, minor and major drainage layouts, and overland flow paths.
- Management of subdivision works, including details of license application for dewatering or dust suppression if required.
- Detailed post-development monitoring program including sampling locations, parameters, and frequency, as well as water quality trigger levels.
- Finalised implementation plan including roles and responsibilities of all parties involved

9.2. Implementation plan

The proposed roles and responsibilities for future work for the subsequent UWMP as well as works associated with the LWMS are presented in Table 20. These will be refined at the UWMP stage. In general, the contractors and developer will be responsible during construction and the post-development defects liability period. Following handover, the City of Kwinana will be responsible for asset maintenance.

The Peel Sub O and N2 drains running through the LSP area are currently managed by Water Corporation. It is anticipated that as part of the development and urbanisation of the area, these drains will be modified to integrate them with open space areas, improve their aesthetics and enhance their hydrological function and ecological outcomes; for example by being modified into living streams. Opportunities to achieve these outcomes have been identified in this LSP and stormwater concept design. Within the LSP area, management of these drains will be transferred to the City of Kwinana post-development.

Table 20: Roles and responsibilities for implementation

Principle	Role	Responsibility	Timescale
Monitoring	Surface water and groundwater monitoring	The proponent	Surface water levels and monthly water quality monitoring at three locations. Groundwater level monitoring (monthly during the winter peak period) and quarterly water quality monitoring at five on-site bores and an additional DWER bore.
Reporting	Report on monitoring results	The proponent	Report on the 2025 pre-development monitoring results to DWER. At the completion of three years of post-development groundwater and surface water monitoring
	UWMP	The proponent	As a condition of subdivision

Principle	Role	Responsibility	Timescale
Subdivision management	Construction and site works management	The proponent	As required during construction until handover to City of Kwinana
	Waste and pollution management	The proponent	As required during construction until handover to City of Kwinana
	Dust suppression and erosion control	The proponent	As required during construction until handover to City of Kwinana
Drainage infrastructure	Visual inspections, rectifying issues and maintenance	The proponent	As required following practical completion until handover to City of Kwinana
POS and foreshore areas	Landscaping, revegetation, and ongoing replanting	The proponent	As specified within the POS design/ foreshore management plan documentation until handover to City of Kwinana
Public information	Supply of information and educational packages	The proponent	Upon settlement with residents

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Casuarina South LSP – Tumulus Organic Mound Spring: Meetings. (*pers. comm.* DWER, DBCA, City of Kwinana, March 2026)

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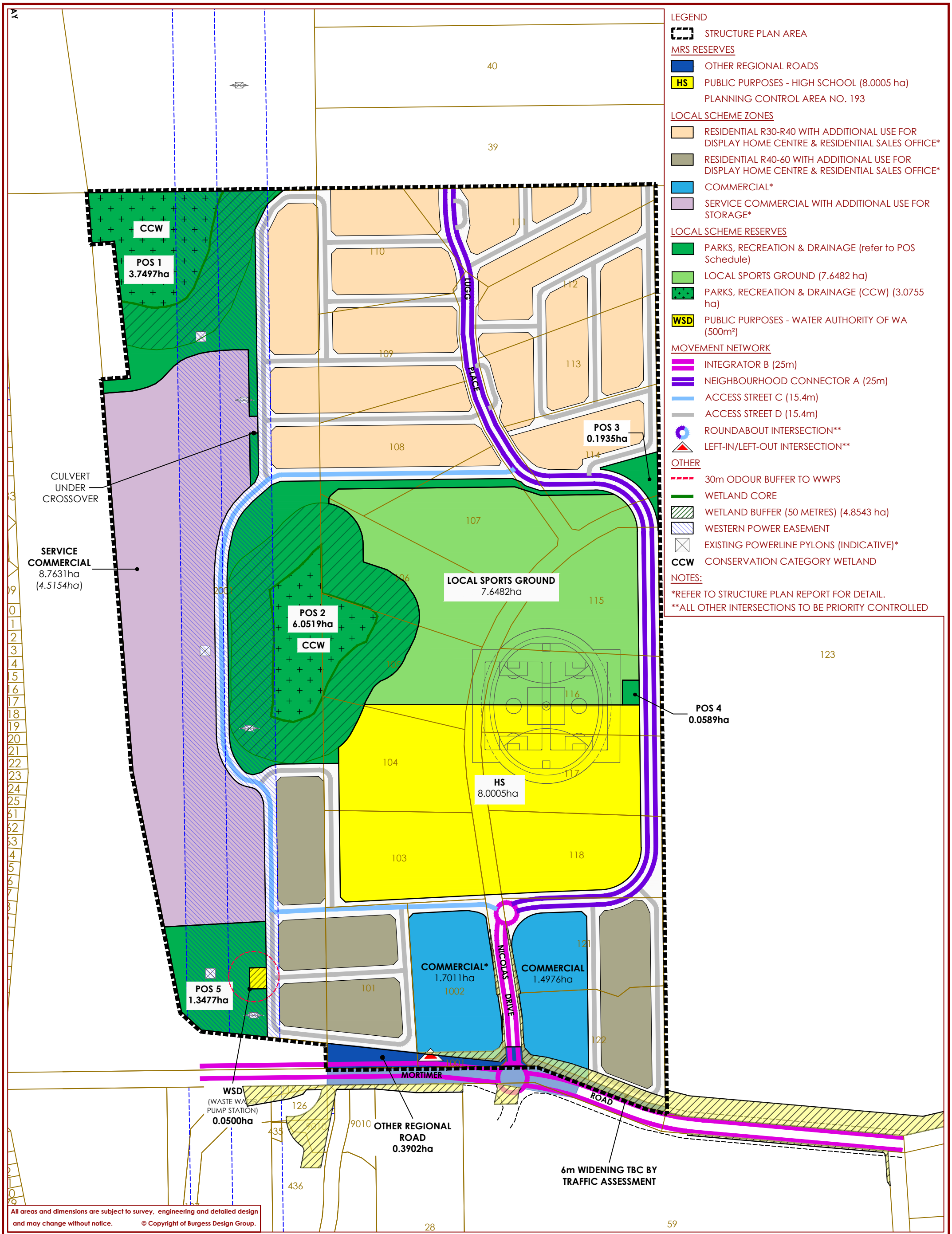
Appendix A: Casuarina South Local Structure Plan

(BDG, 2026)



All areas and dimensions are subject to survey, engineering and detailed design and may change without notice. © Copyright of Burgess Design Group.

NORTH

0 25 50 75 100m

SCALE 1:4,000 (A3)

FIGURE 9. STRUCTURE PLAN MAP WITH ROADS

CASUARINA SOUTH

CASUARINA

CITY OF KWINANA

BURGESS DESIGN GROUP
TOWN PLANNING + URBAN DESIGN
PO Box 8779, Perth Business Centre 6849
www.burgessdesigngroup.com.au
P (08) 9328 6411
F (08) 9328 4062

Plan No: PSC CAS 03-12-03 Client: PSC
Date: 21.04.26 Planner: JB/CT

Appendix B: Groundwater bore logs

(SLR, 2024), (Bioscience, 2011)

SLR - MB20

PROJECT Name: Casuarina LCP	Soil Bore ID: MB20	SHEET: 1 of 1	
PROJECT #: 4279	PROJECT Location: Casuarina		
Project Manager: KT	AOPC:	Elevation mAHD:	
Client:	Zone: Easting: 372068	Northing: 6431576	
Date: 21/6/23	Logged by:	Checked by:	
Drilled by:	Rig Type:	Drilling Method:	

SOIL DESCRIPTION (i.e. soil type, colour, plasticity or particle characteristics (size, grading, shape)) Ex: Clayey SAND, dark red, fine grained, poorly graded, subrounded	DEPTH	DRILLING METHOD	FIELD MONITORING: Moisture	FIELD MONITORING: PID	SAMPLE INTERVALS	COMMENTS (i.e. secondary/minor soil component Waste Material FILL / NATURAL)
		----	----	----	----	
SC, black, low plasticity, uniform grading, sub-angular to sub-rounded	0.50	Hand	moist			Concrete 0.5
SC, white, low plasticity, uniform grading, sub-angular to sub-rounded	1.50		1.5			Bentonite 1.0
SC, brown, low plasticity, uniform grading, sub-angular to sub-rounded	3.0	SPT	at 2.00 wet		H2O-Level	
SC, moderate plasticity, black, uniform grading	4.5					Gravel 4.5

Total depth = 5.25 m
Well depth = 4.5 m
Slotted screen = 3 m

SOIL BORE LOG

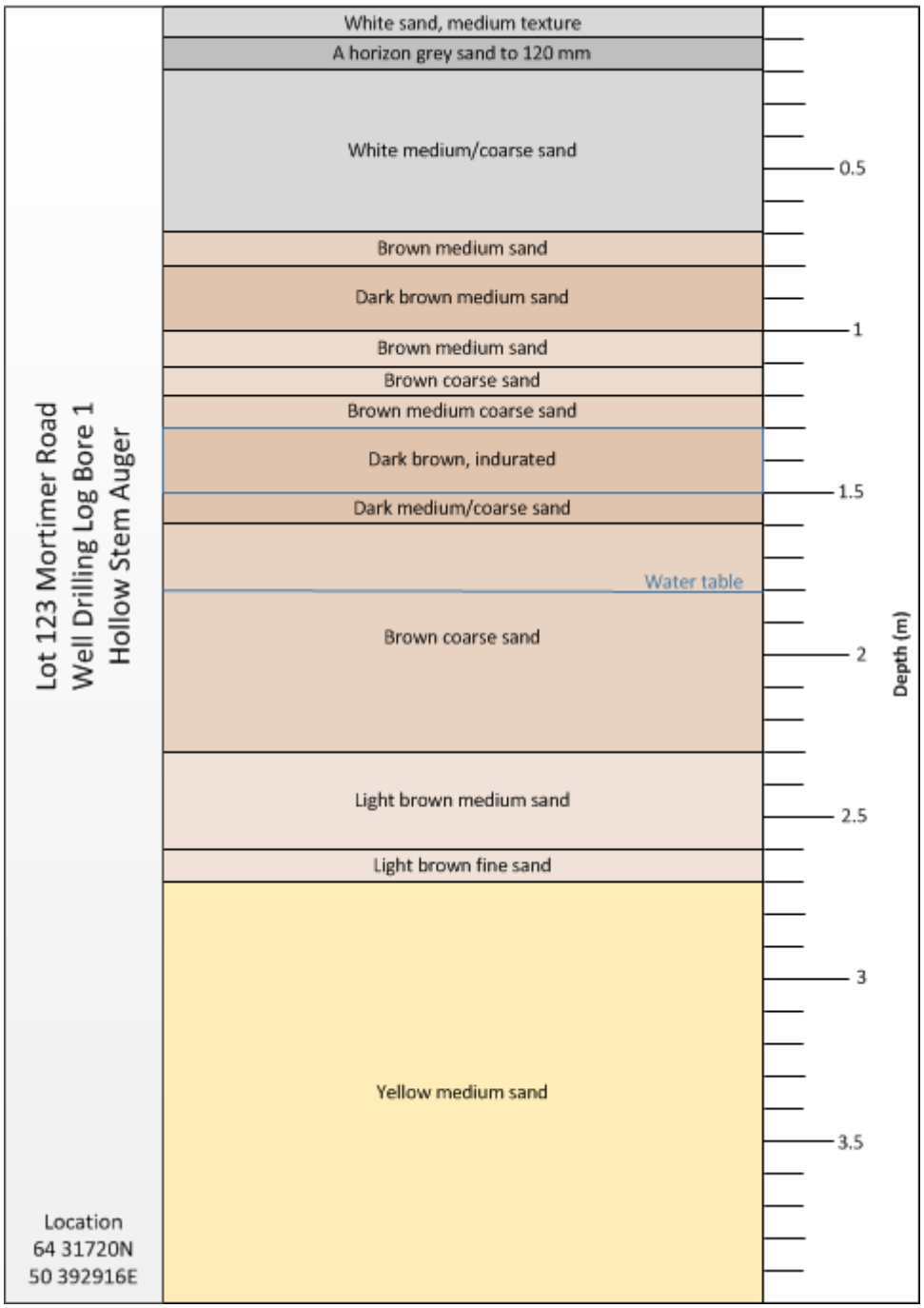
SLR - MB21

PROJECT Name: Casuarina LSP	Soil Bore ID: MB21	SHEET: 1 of 1	
PROJECT #: 4729	PROJECT Location: Casuarina		
Project Manager: ET	AOPC:	Elevation mAHD: 4.4 / 3.27	
Client:	Zone:	Easting: 391093	Northing:
Date: 25/8/23	Logged by:	Checked by:	
Drilled by:	Rig Type:	Drilling Method:	

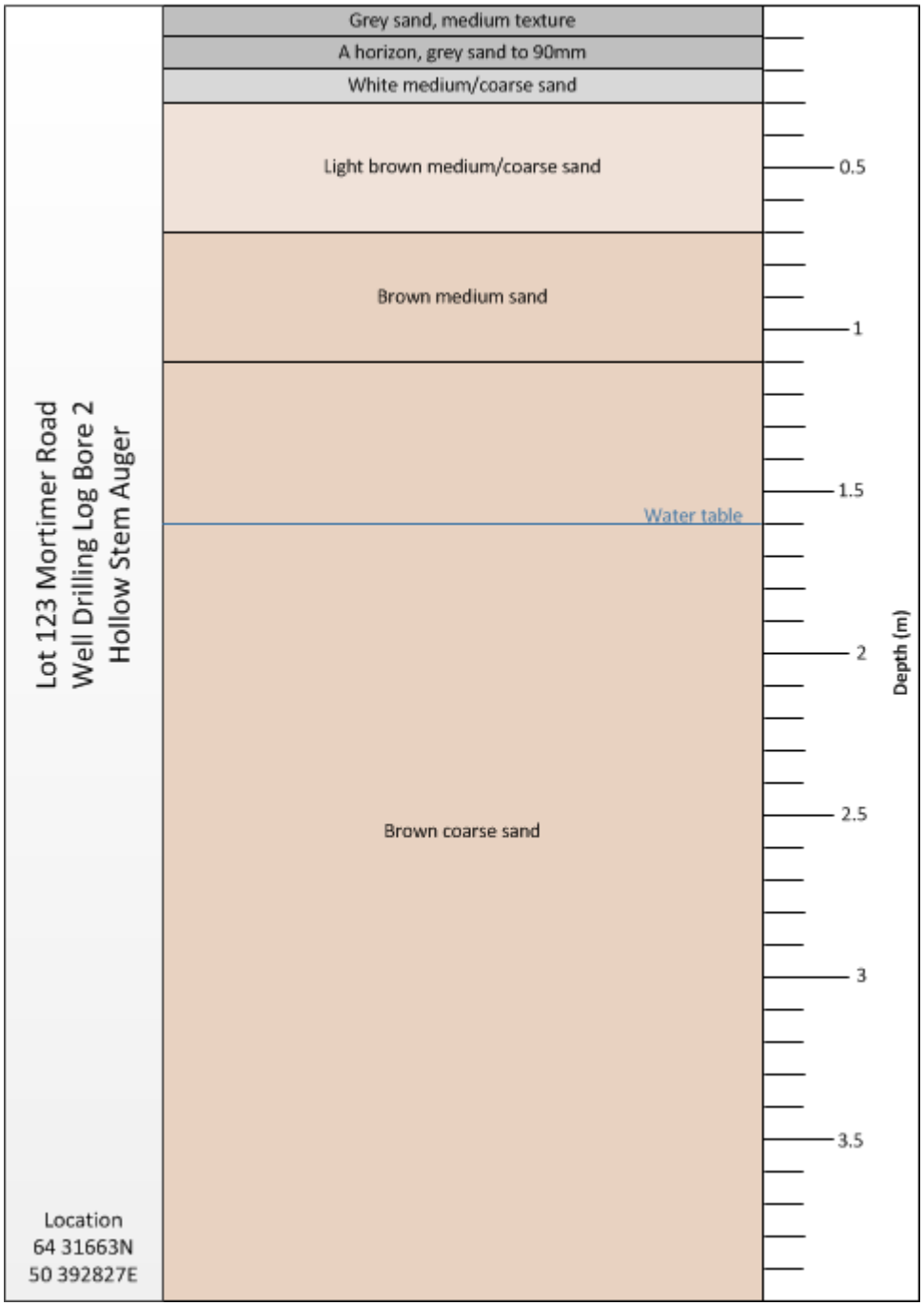
SOIL DESCRIPTION (i.e. soil type, colour, plasticity or particle characteristics (size, grading, shape)) Ex: Clayey SAND, dark red, fine grained, poorly graded, subrounded	DEPTH	DRILLING METHOD	FIELD MONITORING: Moisture	FIELD MONITORING: PID	SAMPLE INTERVALS	COMMENTS (i.e. secondary/minor soil component Waste Material FILL / NATURAL)
		----	----	----	----	Casing =
SC, black, moderate plasticity, uniform grading,	0.25		moist	25		0 Cuttings ~20cm Bentonite
SC, grey, high plasticity uniform grading	0.50				H2O level	0.5 Gravel + screen
CH, grey, high plasticity, uniform grading, sub-angular to sub-rounded	1.00		wet			
SC, grey, moderate plasticity, uniform grading, sub-angular to sub-rounded.	2.50					4.5 =

APPENDIX 1: Soil Profiles

Bioscience - MMB1



Bioscience - MMB2



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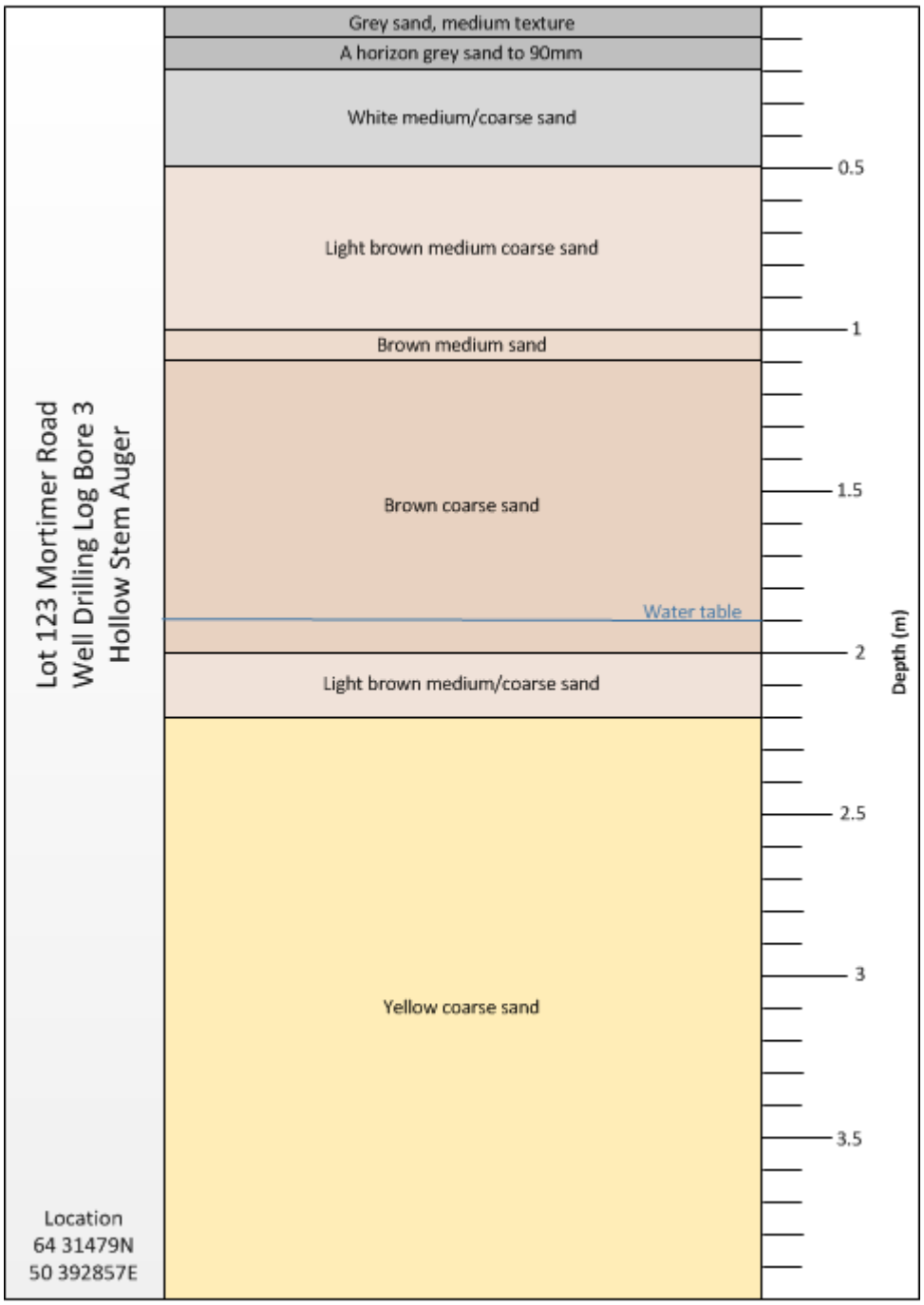

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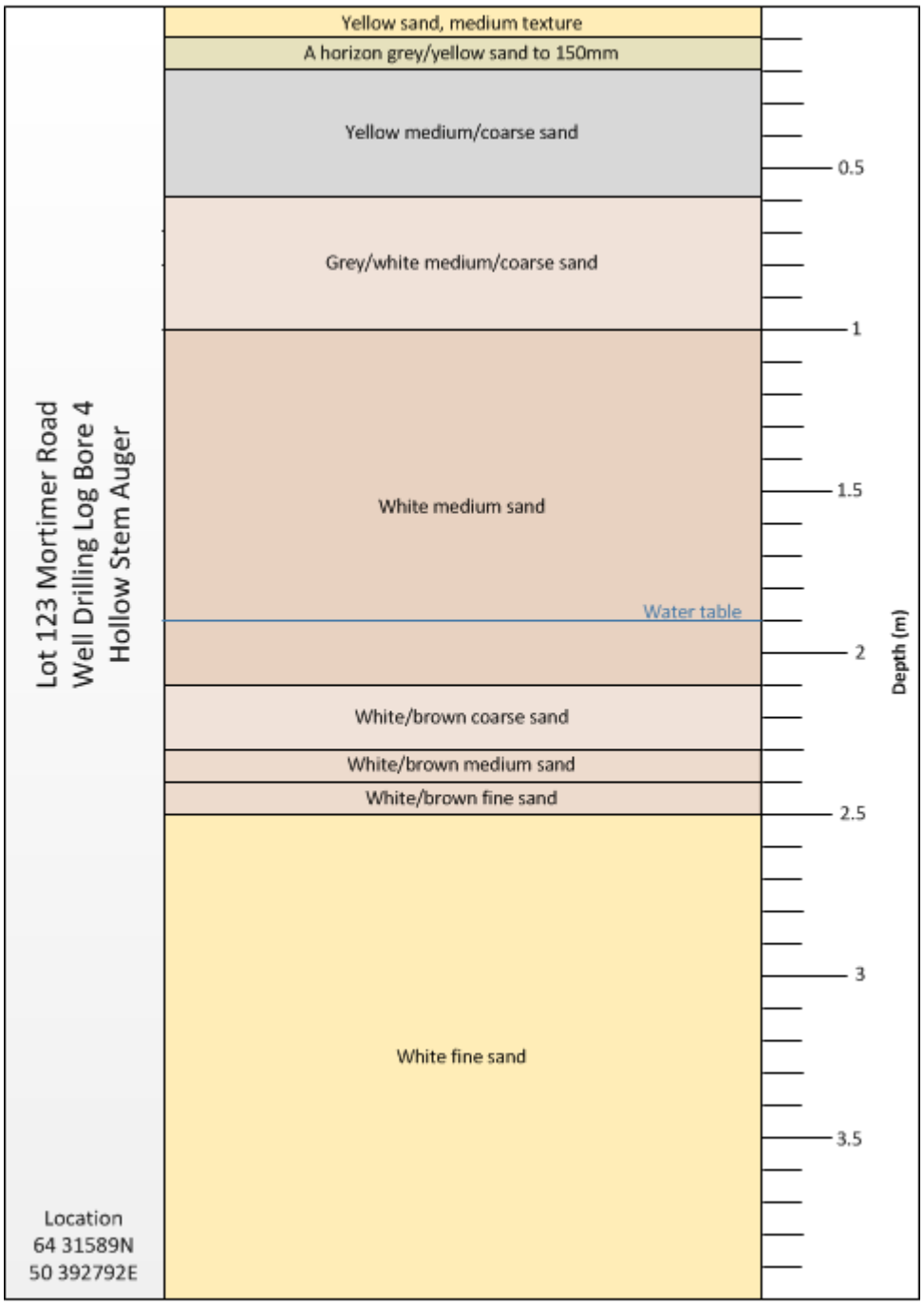
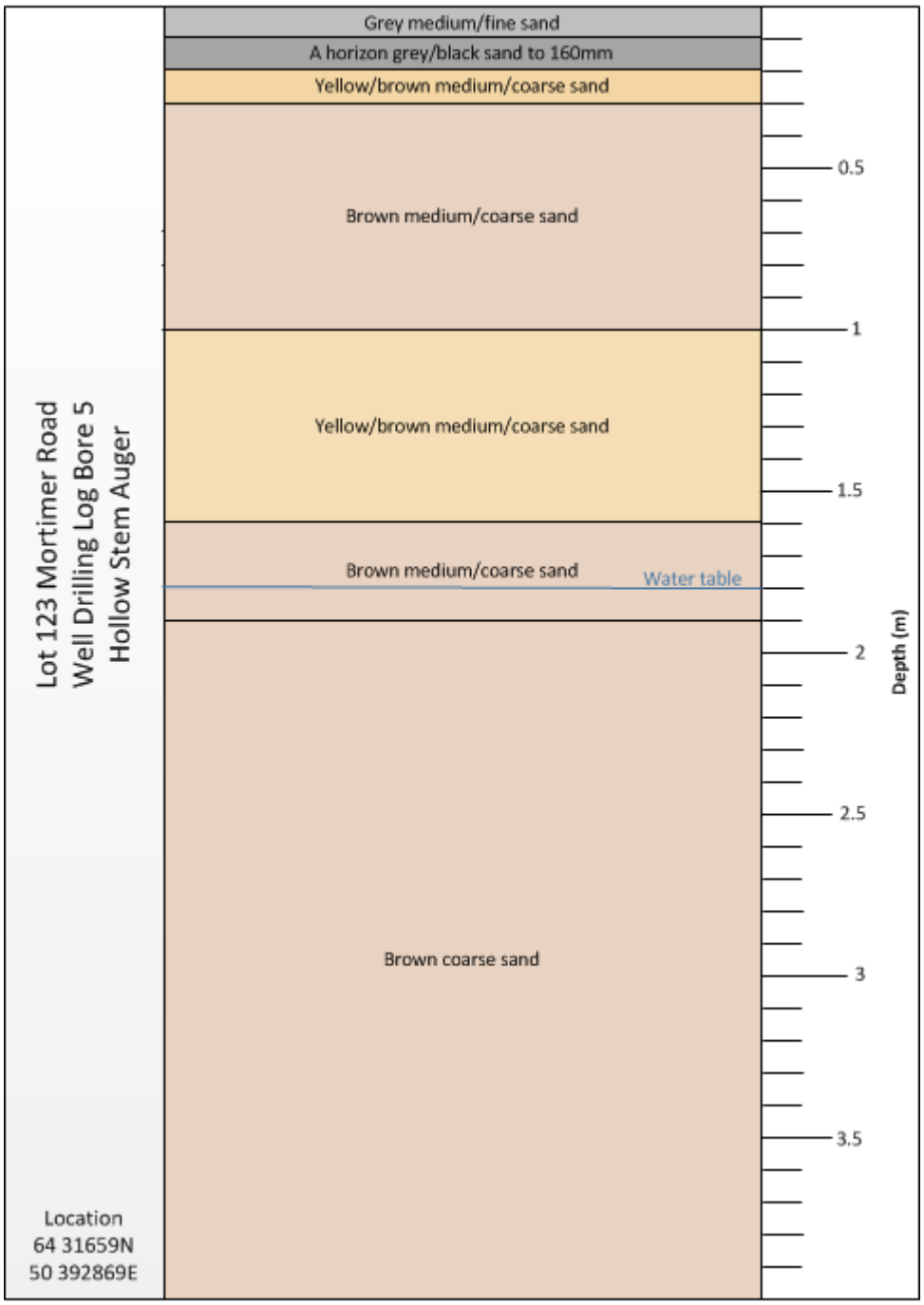


Bioscience - MMB5



Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

				Bore Name
Date :	5/07/2019	Job Number :	19022	**OR1**
Client :	Urban Resources	Start Hole :	8am	
Project:	Lot 9000 Orton Rd	End Hole :	9am	
Easting	392181 m	Logged by :	RB	
Northing	6432278 m	Total Depth :	5m	
Datum:	MGA50	RL Top of Casing	17.75 m AHD	
Drill type:	Auger	RL Nat Surface :	17.15 m AHD	
Hole diameter:	50mm			

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)					Grey					
					Light grey				Slighly moist	
				1.0m						
					Brown					
				2.0m						
		▽								
						Medium	Sand	Low	Moist	
				3.0m						
					Dark Brown					
				4.0m					Saturated	Some Coffee Rock
				5.0m						

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	16/07/2019
Stickup above NS (m)	0.6
Water Level bTOC (m)	3.04
Water Level bNS (m)	2.44

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

				Bore Name
Date :	5/07/2019	Job Number :	19022	
Client :	Urban Resources	Start Hole :	12.45pm	
Project:	Lot 9000 Orton Rd	End Hole :	1.30pm	**OR2**
Easting	392052 m	Logged by :	RB	
Northing	6432211 m	Total Depth :	5m	
Datum:	MGA50	RL Top of Casing	16.74 m AHD	
Drill type:	Auger	RL Nat Surface :	16.14 m AHD	
Hole diameter:	50mm			

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)					Dark grey					
					Grey				Slighly moist	
				1.0m	Light grey					
					Beige					
		▽		2.0m	Brown				Moist	
						Medium	Sand	Low		Some peaty material
				3.0m						2.5 to 3m
					Dark Brown				Saturated	
				4.0m						
				5.0m						

COLOUR : Black, White, Beige
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

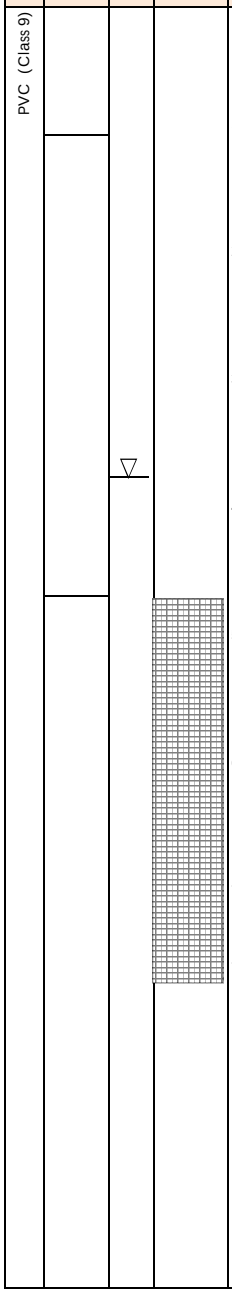
Date	16/07/2019
Stickup above NS (m)	0.6
Water Level bTOC (m)	2.68
Water Level bNS (m)	2.08

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	5/07/2019		Job Number :	19022	Bore Name
Client :	Urban Resources		Start Hole :	10.15am	**OR3**
Project:	Lot 9000 Orton Rd		End Hole :	11am	
Easting	391992 m		Logged by :	RB	
Northing	6432001 m		Total Depth :	7.5m	
Datum:	MGA50		RL Top of Casing	17.66 m AHD	
Drill type:	Auger		RL Nat Surface :	17.06 m AHD	
Hole diameter:	50mm				



Colour	Particle Size	Texture	Organic Content	Moisture	Comment
Light grey	Medium	Sand	Low	Slighly moist	
Beige					
Light Yellow					
Dark Yellow				Moist	
Yellow					
Light Yellow					
Beige					
Dark beige				Saturated	
					Peat Sand
					grey dark brown
					at 7.75m

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	16/07/2019
Stickup above NS (m)	0.6
Water Level bTOC (m)	4.29
Water Level bNS (m)	3.69

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

				Bore Name
Date :	5/07/2019	Job Number :	19022	
Client :	Urban Resources	Start Hole :	9.20am	
Project:	Lot 9000 Orton Rd	End Hole :	10am	**OR4**
Easting	392156 m	Logged by :	RB	
Northing	6432036 m	Total Depth :	6m	
Datum:	MGA50	RL Top of Casing	18.57 m AHD	
Drill type:	Auger	RL Nat Surface :	17.97 m AHD	
Hole diameter:	50mm			

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)				1.0m	Light Grey	Coarse	Sand	Low	Moist	
				2.0m	Beige					
		▽		3.0m	White				Saturated	
				4.0m	Dark beige					
					Light brown					
				5.0m	Dark beige					
					Dark beige					
				6.0m						Some coffee rock

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	16/07/2019
Stickup above NS (m)	0.6
Water Level bTOC (m)	4.25
Water Level bNS (m)	3.65

Lithological Log

Hyd2o
Suite 6B 103 Rokeby Rd
Subiaco, WA 6008

PO Box 1055
Subiaco WA 6904

Date :	8/07/2019				Bore Name
Client :	Urban Resources	Job Number :	19022		
Project:	Lot 9000 Orton Rd	Start Hole :	9am		**OR5**
Easting	392164 m	End Hole :	10am		
Northing	6431791 m	Logged by :	WH		
Datum:	MGA50	Total Depth :	1m		
Drill type:	Hand Auger	RL Top of Casing	14.32 m AHD		
Hole diameter:	50mm	RL Nat Surface :	13.72 m AHD		

support	backfill	water	Slot / Screen Depth	Depth (metres)	Soil Characteristics					
					Colour	Particle Size	Texture	Organic Content	Moisture	Comment
PVC (Class 9)		▽		1.0m	Grey - Dark Grey	Fine - Medium	Sand	Low (Traces Near Surface)	Moist	
				2.0m						
				3.0m						

COLOUR : Black, White, Biege
Dark/Medium/Light : Brown, Red, Orange, Yellow, Grey, Blue
Composition : Solid , Blemish, Mottle

PARTICLE SIZE : Fine, Medium, Course

TEXTURE : Sand, Loamy Sand, Clayey Sand
Silt, Loam, Sandy Loam, Clayey Loam
Clay, Sandy Clay

ORGANICS : High, Medium, Low

MOISTURE : Dry, Slightly Moist, Moist, Saturated

Static Water Level

Date	16/07/2019
Stickup above NS (m)	0.6
Water Level bTOC (m)	1.44
Water Level bNS (m)	0.84

Appendix C: Groundwater monitoring report October 2022-2024

(SLR, 2024)

Casuarina Groundwater Monitoring October 2022 to October 2024

Casuarina 6167, WA

Various Landowners (Casuarina LSP Area)

Casuarina Local Structure Plan Area

Prepared by:

SLR Consulting Australia

SLR Project No.: 675.0729597.00001

Client Reference No.: XXXX

13 May 2025

Revision: 1

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1	17 December 2024	D. Jarvis	S. Hyde	S. Hyde
1	13 May 2025	D. Jarvis	S. Hyde	S. Hyde

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Various Landowners (Casuarina LSP Area) (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work

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Appendix A **Field Documentation**

Appendix B **Laboratory Documentation**

Appendix C **Groundwater & Surface Water Levels, Physico-Chemical Tables**

Appendix D **Groundwater Quality and QA/QC Tables**

1.0 Introduction

SLR Consulting Australia Pty Ltd conducted monthly groundwater monitoring events (GMEs) at the Casuarina South area, northeast of the Kwinana Freeway and Mortimer Road, Western Australia referred to herein as the 'site'. This report compiles data from all three phases of GMEs conducted on site since October 2022 to support the preparation of a Structure Plan developed by Burgess Design Group (BDG). The groundwater monitoring results will inform the Local Structure Plan (LSP) and the Local Water Management Strategy (LWMS).

The groundwater monitoring was conducted in three different phases:

- Phase 1 October 2022 to March 2023
- Phase 2 July 2023 to October 2023
- Phase 3 May 2024 to October 2024

1.1 Objectives

The objectives of the GMEs were to provide groundwater level and water quality data to inform the development of the Local Structure Plan and the LWMS as required.

1.2 Scope of Works

The following scope of work was undertaken during the phase three (3) of GME:

- Present the results of two years of groundwater monitoring events (GMEs) of six bores at the site and two surface water locations.
    - Monthly measurement of groundwater water levels (GWLs) and surface water levels (SWLs),
    - monthly monitoring field physicochemical parameters [temperature, pH, electrical conductivity (EC), oxidation/reduction potential (ORP) and dissolved oxygen (DO)].
    - Periodic monitoring of groundwater quality with sample collection by low flow pumping methods, and submission of groundwater samples to a NATA accredited laboratory for analysis of a range of parameters as presented in **Table 1**.
- Preparation of this groundwater monitoring report for provision to the Burgess Design Group.

Table 1 Summary groundwater monitoring program

Bore ID	Parameter	Unit	Frequency
MC4, MB5, MB6, MB7, MB20 and MB21	Standing Water Level (SWL)	mAHD	Monthly
	Water temperature	°C	Oct 2022 (MC4, MB5, MB6 and MB7 only), Jul 2023, Aug 2023,
	Dissolved Oxygen	mg/L	
	Specific Conductivity	(µS/cm)	
	pH	pH Unit	

Bore ID	Parameter	Unit	Frequency
	Oxidation Reduction Potential (ORP)	mV	Sep 2023, Jun 2024, Sep 2024.
	Field Observation	---	
	Total suspended Solids (TSS)	mg/L	
	Nutrient (Ammonia as N, Nitrate as N, Nitrite as N, NOx-N, total Kjeldahl nitrogen, total nitrogen	mg/L	
	Nutrient (total phosphorus, filterable reactive phosphorus)	mg/L	
	Alkalinity (bicarbonate, carbonate, hydroxide, total alkalinity)	Mg CaCO3/L	
	Major ions (Aluminium, Iron, calcium, magnesium, potassium, sodium, bromide, chloride, sulfate)	mg/L	

2.0 Site Environmental Setting

2.1 Climate

The Site is located within a warm Mediterranean climate with warm summers and cool winters. The nearest long-term Bureau of Meteorology (BoM) weather station with a complete dataset is Jandakot Aero (Station 9172), located approximately 17 km northeast of the Site.

The temperature statistics use data from 1989 to 2024, and the rainfall statistics use data from 1972 to 2024 (BoM, 2024).

The mean annual maximum and minimum temperatures are 24.7°C and 11.7°C, respectively (**Figure 1**). The long-term mean maximum temperature ranges from 18.1°C (July) to 31.7°C (February). The long-term mean minimum temperature ranges from 7.2°C (July) to 17.2°C (February).

The long-term average annual rainfall in the area is 812.1 mm and the average annual rain days for the station is 108.5 days per year (BoM, 2024).

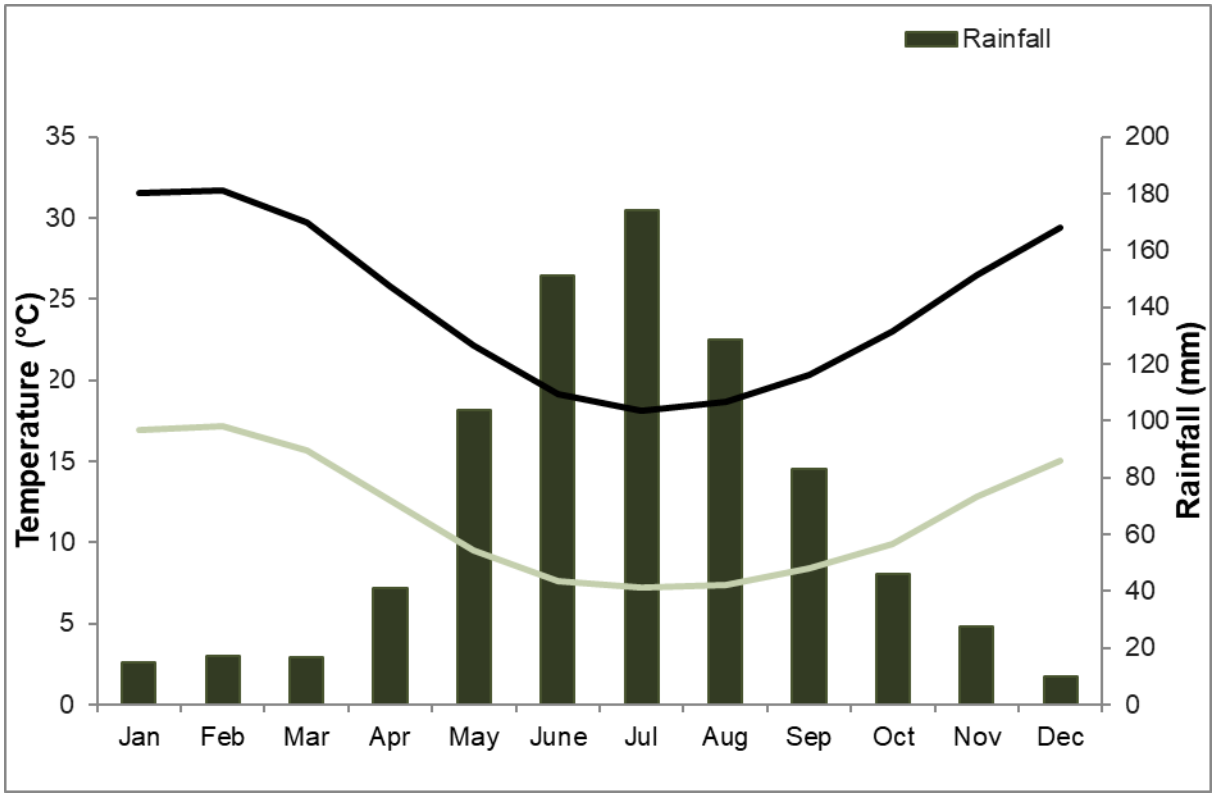

Figure 1: Long term and Monthly Total Rainfall, Maximum and Minimum Temperatures for Jandakot Aero (Station 9172).

2.2 Rainfall (Oct 2022 to Oct 2024)

Table 2 presents the monthly rainfall and long term average monthly rainfall for Jandakot Aero (Station 9172) from 2021 to 2024. Key points are as follows:

- Annual rainfall for period preceding monitoring (January 2021 to September 2022) was above average.
- Rainfall during the monitoring period (October 2022 – October 2024) was below average.
- Groundwater and Surface water levels are estimated to be close to the long term average controlled groundwater levels (CGLs) since the site has drains intersecting the northwest and southwest corners of the site.

Table 2: Jandakot Aero (Station 9172) Monthly Rainfall (2021 to 2024)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2021	0	47.4	41.6	51.8	110.6	95.2	315	79.8	47.2	125.8	5.6	2.6	922.6
2022	0	2.8	5.6	50.4	101.8	102.4	159	197.6	79	35.6	22.8	0	757
2023	0	0	40.4	43.2	56	189.2	126.6	59.6	67	6.8	6	0.6	595.4
2024	1.4	0.8	0.4	9.2	88.8	158.2	200.6	175.8	44.2				744.4
Long-term Mean	14.9	17.1	16.8	40.9	103.9	151.1	174	128.4	82.1	46.3	26.9	9.9	812.1

2.3 Surrounding Land Uses

2.3.1 Current Land Use

The Site is currently used for rural activities and rural residential development.

2.3.2 Historical Land Uses

A historical aerial photograph assessment identifies that the Site has predominantly been used for broad acre grazing and associated rural activities.

Land uses have subsequently changed for the creation of land parcels for rural residential properties and the development of the Kwinana Freeway adjacent to the Site.

2.3.3 Surrounding Land Uses

The Site is surrounded by the following land uses:

- Zoned ‘Development’ under LSP2 and Casuarina Nature Reserve to the east
- Residential development (Bertram) to the west
- Residential development to the south
- Rural residential development to the north
- Zoned ‘Parks and Recreation’ under LPS 2 to the northeast of the Site.

2.4 Topography

The topography of the Site ranges between 13m Australian Height Datum (AHD) and 23 mAHD across the Site. The site elevation is on a downward slope from north to south (Google Earth Pro, 2018).

2.5 Regional Geology and Soils

2.5.1 Soil Landscape and Land Systems

Soil landscapes and land system mapping of Western Australia describes broad soil and landscape characteristics from regional to local scales and has been captured at a scales ranging from 1:20,000 to 1:250,000 (DPIRD, 2022a).

The Site is within the Bassendean soil landscape land quality zone, which is described as Mid Pleistocene Bassendean sand. Fixed dunes inland from coastal dune zone. Non-calcareous sands, podsolised soils with low-lying wet areas (DPIRD, 2022b).

The Site occurs in the Bassendean Land System (212Bs), which is described as the Swan Coastal Plain (SCP) from Busselton to Jurien. Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths (DPIRD, 2022a).

The Site occurs within three (3) soil landscape subsystems:

- Bassendean B3 Phase (212Bs_B3)- Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.
- Bassendean B1 Phase (212Bs_B1)- Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.
- Bassendean B6 Phase (212Bs_B6)- Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

2.5.2 Acid Sulfate Soils

Acid Sulfate Soil (ASS) risk mapping identifies the wetlands within the Site as having ‘High to Moderate’ risk of ASS occurring within the first 3 m of natural soil surface (DWER, 2017). The remainder of the Site is mapped as having ‘Moderate to Low’ risk of ASS occurring within the first 3 m of natural soil surface (DWER, 2017).

2.5.3 Hydrogeology

2.5.3.1 Groundwater

The Site is not located within a Public Drinking Water Source Area (PDWSA). The nearest PDWSA is a P1 located approximately 0.6 km northeast of the Site. The PDWSA, P1 area is under the Jandakot Underground Water Pollution Control Area and connects with the P2 area (DWER, 2023a).

The Site is located within the Serpentine Groundwater Area and Jandakot Mount 2 Groundwater Subarea (DWER, 2018a; 2023b). The groundwater salinity in the Site region ranges between 500-1000 mg/l (DWER, 2018b).

2.5.3.2 Surface Water

There are no streams, or creeks, within the Site. The only surface water feature mapped within the Site include three wetlands (DBCA, 2023) The wetlands at the northwest and southwest corners are connected to the larger drainage network managed by WaterCorp.

2.6 Site Location and Monitoring Locations

The site location and monitoring locations are provided in **Figure 2.**

Figure 2: Site Location and Monitoring Locations.

3.0 Sampling and Analysis

3.1 Groundwater Monitoring Locations

Groundwater monitoring bores sampled as part of the current sampling program are presented in **Appendix A**. A summary of the survey data is presented in **Table 3.**

Table 3. Groundwater Monitoring Bore Survey Data.

Bore ID	Description	Easting (GDA94)	Northing (GDA94)	Top of Casing (ToC, mAHD)	Ground Level (GL, mAHD)	Depth to Base (DTB, mbTOC)
MC4	Two existing bores to the east of the site	392218.689	6431300.085	13.859	13.375	2.23
MB6		391999.759	6431331.303	13.970	13.473	3.76
MB5	Existing bore to the west of the site	392225.481	6431157.863	13.878	13.344	4.34
MB7	Existing bore to the southeast of the site	392032.154	6430945.604	16.017	15.616	5.35
MB20	New bores installed in 2024 to the north of the site	392064.128	6431619.423	15.130	14.406	3.40
MB21		391974.927	6431514.364	11.963	11.320	3.34

The groundwater monitoring event in September 2022 indicated that the monitoring bores, MC4, MB5, MB6 and MB7 were functional and suitable for monitoring. Two additional bores, MB20 and MB21, were installed and surveyed in August 2023.

3.2 Surface Water Locations

Two surface water locations, one for each of the two drains that intersect the site were introduced in October 2023 and surveyed at the top of concrete (mAHD) and at the zero point of the staff gauge (mAHD) to allow measurement of the controlled groundwater levels (CGL) at these locations (**Table 4**).

Table 4: Surface Water Location Survey Data

SW Location	Easting (GDA94)	Northing (GDA94)	Top of Concrete (mAHD)	RL Staff Gauge (mAHD)
Gauge1	392158.081	6430746.033	11.557	10.929
Gauge2	392086.095	6431219.798	17.785	12.007

3.3 Sampling Methods

Groundwater sampling methodology implemented at the site were based on the following standard guidelines:

- Australian/ New Zealand Standard AS/NZS 5667.1:1998 Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

- Australian/ New Zealand Standard AS/NZS 5667.11 Part 11: Guidance on sampling of Groundwater
- DWER (2021) Assessment and Management of Contaminated Sites Guidelines
- National Environment Protection Council (NEPC, 2013) National Environmental Protection Measure - Assessment of Site Contamination, as amended 2013.
- Samples were collected in accordance with the SLR method statements
    - Instrument Calibration
    - Purging and Sampling (Peri Pump).

3.4 Laboratory Analysis

All groundwater samples were analysed by Eurofins ARL, a National Association of Testing Authorities (NATA) accredited laboratory. Chain of Custody, Laboratory Analysis report and calibration certificates are compiled in **Appendix B**.

The groundwater quality was tested for following laboratory analytes:

- Nutrient (Ammonia as N, Nitrate as N, Nitrite as N, NOx-N, total Kjeldahl nitrogen (TKN), total nitrogen (TN), total phosphorus (TP) and filterable reactive phosphorus (FRP)
- Alkalinity (bicarbonate, carbonate, hydroxide, total alkalinity)
- Major ions (Aluminium, Iron, calcium, magnesium, potassium, sodium, bromide, chloride, sulphate)

The field water quality parameters were collected using multiparameter YSI probe measuring the following parameters:

- Water temperature in °C
- Dissolved oxygen (DO) in mg/L
- Specific conductivity (µS/cm)
- pH in pH units
- Oxidation reduction potential (ORP in mV)

3.5 Assessment Criteria

The following relevant assessment criteria have been provided for reference:

- Australian and New Zealand Governments (ANZG), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2019) – Fresh Water 95% (FWG)
- Western Australia Department of Health (2021), Contaminated sites ground and surface water chemical screening guidelines Non-Potable Groundwater Use (NPUG)
- Australian Drinking Water Guidelines (ADWG) Aesthetic (Updated September 2022, Version 3.8).

4.0 Groundwater Quality Data Usability and Validity

4.1 Field QA/QC Compliance

Table 5 summarises the compliance with the field QA/QC procedures.

Table 5 Field QA/QC Compliance

Field QA/QC	Component	Compliant	Comment
Calibration	Field equipment requiring calibration was calibrated prior to sampling and complied with calibration checks.	Y	All equipment were calibrated by the Suppliers.
Water sample collection	Targeted water samples were collected.	Y	None
	Standardised field documentation used to record field activities.	Y	None
	Laboratory prepared sample jars used for sample collection	Y	None
	Decontamination of sample equipment undertaken between samples	Y	Reusable equipment was decontaminated in line with the Method Statement presented in the SAQP (360 Environmental, 2020)
Sample handling and transit	Samples kept chilled at all times following sample collection	Y	Laboratory analysis reports identifying that samples were received appropriately chilled are provided in **Appendix B**
	Samples appropriately handled between field and laboratory	Y	None
	Samples transported under chain of custody	Y	Copies of the chain of custody is provided in **Appendix B**
	Samples received in good condition at the laboratory	Y	Laboratory analysis reports identifying that samples were received in good condition are provided in **Appendix B**

Table 6 summarises the number and frequency of field QC samples and compliance with the DQI evaluation criteria.

Table 6 Field QA/QC Sample Compliance

Date	QC Sample Type	Primary Sample	QC Sample	% of Primary Samples	Sufficient QC Samples Collected?	DQI non-compliances (RPD <30%)
Oct 2022	Duplicate	MB7	QC01	25%	Yes (>5%)	Phosphorous (43%)
Mar 2023	Duplicate	MB6	QC01	50%	Yes (>5%)	Aluminium (34%), Iron (31%)

Date	QC Sample Type	Primary Sample	QC Sample	% of Primary Samples	Sufficient QC Samples Collected?	DQI non-compliances (RPD <30%)
Jul 2023	Duplicate	MB7	QC01	20%	Yes (>5%)	Aluminium (138%), Iron (53%), Calcium (75%), Total Nitrogen (137%), Phosphorous (196%), TSS (199%)
Jun 2024	Duplicate	MB6	QC01	20%	Yes (>5%)	Total Nitrogen (84%), Kjeldahl Nitrogen total (84%) Phosphorous (133%)
Sep 2024	Duplicate	MB6	QC01	16.67%	Yes (>5%)	Phosphorous (100%)
Sep 2024	Triplicate	MB6	QC02	16.67%	Yes (>5%)	Sulphate (61%), Nox as N (56%), Nitrate as N (56%), Phosphorous (91%)

4.2 Elevated RPDs

An elevated relative percent difference (RPD) between a primary sample and its replicate sample was reported above the applicable level (50%) for 17 out of 123 primary/replicate sample sets (14%). Six of these exceedances were for metals and major ions (5%). Eleven of these exceedances were for nutrient species (9%).

4.3 Laboratory QA/QC

Outcomes of the laboratory QA/QC data validation assessment are summarised below in Table 7.

Table 7 Laboratory QA/QC Summary Table

QA/QC	Compliant?	QC non-compliances
Analytes Holding Times	Yes	None
Limits of Reporting (LOR)	Yes	None
Laboratory Duplicates	Yes	None
Laboratory Control Samples	Yes	None
Laboratory Matrix Spikes	Yes	None
Laboratory Surrogate Spikes	Yes	None
Laboratory Method Blanks	Yes	None
Laboratory QC Frequency	Yes	None

4.4 Data Usability Evaluation

In evaluating the data quality, it was identified that there were field and laboratory QA/QC DQI non-compliances associated with the analytical results as noted above. In consideration of the outcomes of the QA/QC evaluation above, the majority of reported non-compliances for RPDs are not considered to materially impact on the interpretation and use of the data.

5.0 Groundwater and Surface Water Level Results

The key findings of the groundwater monitoring program are summarised below. Field documentation is provided in **Appendix A** and laboratory documentation including analytical results are provided in **Appendix B**.

The following limitations to the data should apply:

- Rainfall for the monitoring period was
- The data are representative of the maximum and minimum groundwater conditions for the monitoring period (2022-2024) and are likely to be less than the historical maxima and minima for the site.
- The maximum and minimum values are not intended for design purposes, but rather, to inform the LSP, LWMS and other planning documents.

5.1 Groundwater Levels (Oct 2022 to Oct 2024)

Table 8 provides a summary of the groundwater levels and includes the following measured data and calculations:

- Top of Collar (ToC) – Surveyed, in mAHD.
- Ground Level (GL) – Surveyed, in mAHD.
- Maximum/Minimum Depth to Water (Max/MinDTW) – Measured, in metres below top of collar (mbToC).
- Maximum/Minimum Depth to Water (Max/MinDTW) – Calculated, in metres below ground level (mbgl).
- Minimum/Maximum Groundwater Levels (Min/MaxGWL) – Calculated, in mAHD.

Table 8: Groundwater Levels - Results Summary

GW Location	ToC (mAHD)	GL (mAHD)	MaxDTW (mbToC)	MaxDTW (mbgl)	MinGWL (mAHD)	MinDTW (mbToC)	MinDTW (mbgl)	MaxGWL (mAHD)	Max-Min (m)
MC4	13.859	13.375	2.220	1.736	11.639	0.550	0.295	13.080	1.441
MB5	13.970	13.473	3.330	2.833	10.640	1.500	1.003	12.470	1.830
MB6	13.878	13.344	2.200	1.666	11.678	0.735	0.204	13.140	1.462
MB7	16.017	15.616	Dry	4.439	11.177	4.100	3.696	11.920	0.743
MB20	15.130	14.406	3.300	2.576	11.830	2.850	2.126	12.280	0.450
MB21	11.963	11.320	2.820	2.177	9.143	0.900	0.260	11.060	1.917
Average		**13.589**		**2.571**	**11.018**		**1.264**	**12.325**	**1.307**

The depth to groundwater (DTW) level in metres below top of collar (mbToC) were recorded from September 2022 to October 2024 for MC4, MB5, MB6 and MB7. For the two additional bores installed in 2023 (MB20 and MB21), data is only recorded from August 2023 to October 2024. Key observations for the groundwater levels are as follows:

- The highest groundwater levels were recorded between August and October, with the majority of maxima occurring in September.
- The bores MC4 and MB7 were, on occasion, recorded as 'dry' during the late summer/early autumn months.
- The maximum groundwater levels ranged from 11.060 mAHD at MB21 to 13.140 mAHD at MB6. This is a difference of 2.08 m.
- The minimum groundwater levels ranged from 9.143 mAHD at MB21 to 11.830 at MB20. This is a difference of 2.687 m.
- Three bores MC4, MB6 and MB21 recorded shallow ground water (less than 0.3 mbgl) while MB5, MB6 and MB20 were within 2 mbgl. MB7 recorded the highest depth to the maximum watertable at 3.696 mbgl.
- **Figure 3** presents all groundwater levels (in mAHD) for 2022 to 2024 as a graph. Bores were recorded as 'dry' where data is missing.
- The complete groundwater level results table is presented in **Appendix D**.

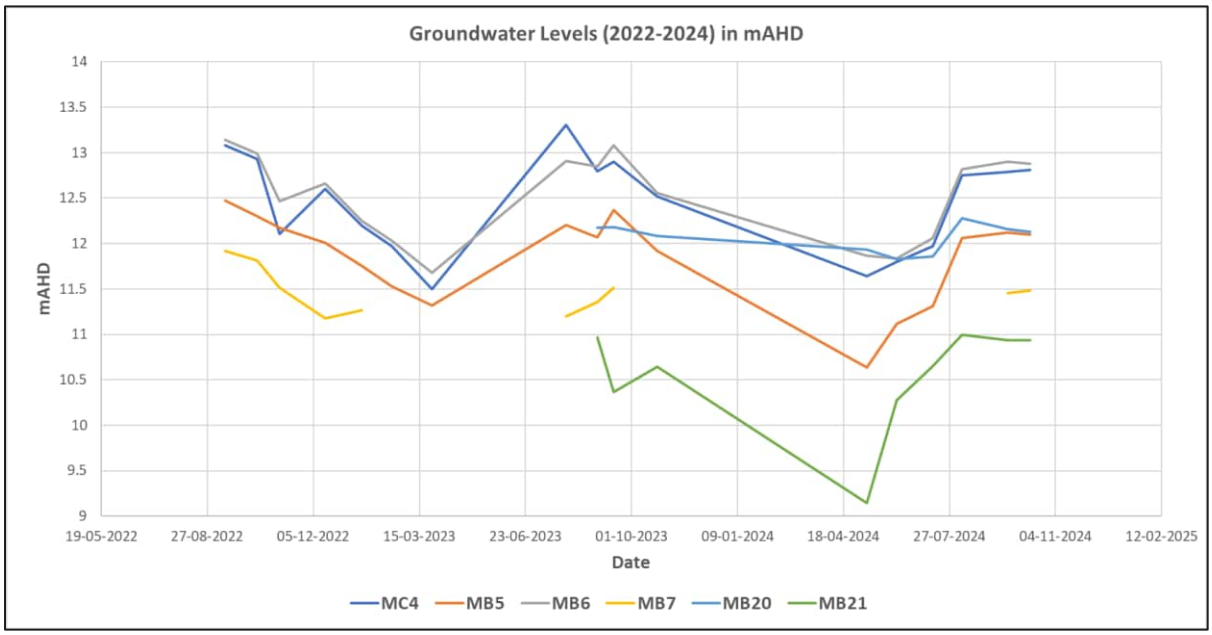

Figure 3: Groundwater Levels (2022-2024) in mAHD.

5.2 Surface Water Levels (Oct 2023 to Oct 2024)

Surface water monitoring station were established in October 2023. Data was collected from October 2023 to October 2024.

Table 9 provides a summary of the surface water levels and includes the following measured data and calculations:

- Top of Concrete – Surveyed, in mAHD.
- Reduced level (RL) of Staff Gauge – Surveyed, in mAHD.
- Maximum Staff Gauge (Max Staff Guage) – Measured, in metres.
- Maximum Surface Water Levels (MaxSWL) – Calculated, in mAHD.
- Minimum surface water levels are not included since surveyed locations are dry during the low groundwater period.

Table 9: Surface Water Levels - Results Summary

SW Location	Top Concrete (mAHD)	RL Staff Gauge (mAHD)	Max Staff Gauge (m)	MaxSWL (mAHD)
Gauge1	11.557	10.929	0.200	11.129
Gauge2	17.785	12.007	0.300	12.307

A summary of the results is as follows:

- The southern drain location at Gauge 1 had the lowest MaxSWL for the monitoring period at 11.129 mAHD. The wetland location (Gauge 2) had a MaxSWL of 12.307 mAHD.
- The drains at the northwest and southwest corners of the site are likely to maintain controlled groundwater levels (CGLs) during the high groundwater period. The MaxSWL at Gauge 1 (11.129 mAHD) represents the CGL at this location.
- Surface water levels were included in the dataset for the interpolated contours.
- The complete surface water level results table is presented in **Appendix D**.

5.3 Controlled Groundwater Levels (Oct 2022 to Oct 2024)

- When rainfall from the period leading up to and including the GME program is taken into account, GWLs and SWLs are estimated to be close to the long-term average maximum CGLs since the site has drains intersecting the northwest and southwest corners of the site.
- Historical maximum CGLs are likely to be marginally higher along the west of the site where the drains are located and higher toward the centre and east of the site.

6.0 Groundwater Level Contours

6.1 Maximum GWL Contours (2022-2024)

The Maximum GWL contours for the monitoring periods are provided in **Figure 4**. The lowest MaxGWLs were at the northwest and southwest corners of the site. These locations have groundwater controlling infrastructure in the form of drains.

Groundwater flow is to the west and ranges from 13 mAHD at the centre of the site to around 11 mAHD at the drain locations near the western boundary of the site. There were no bores in the eastern half of the site, however MaxGWLs are known to be greater than 13 mAHD.

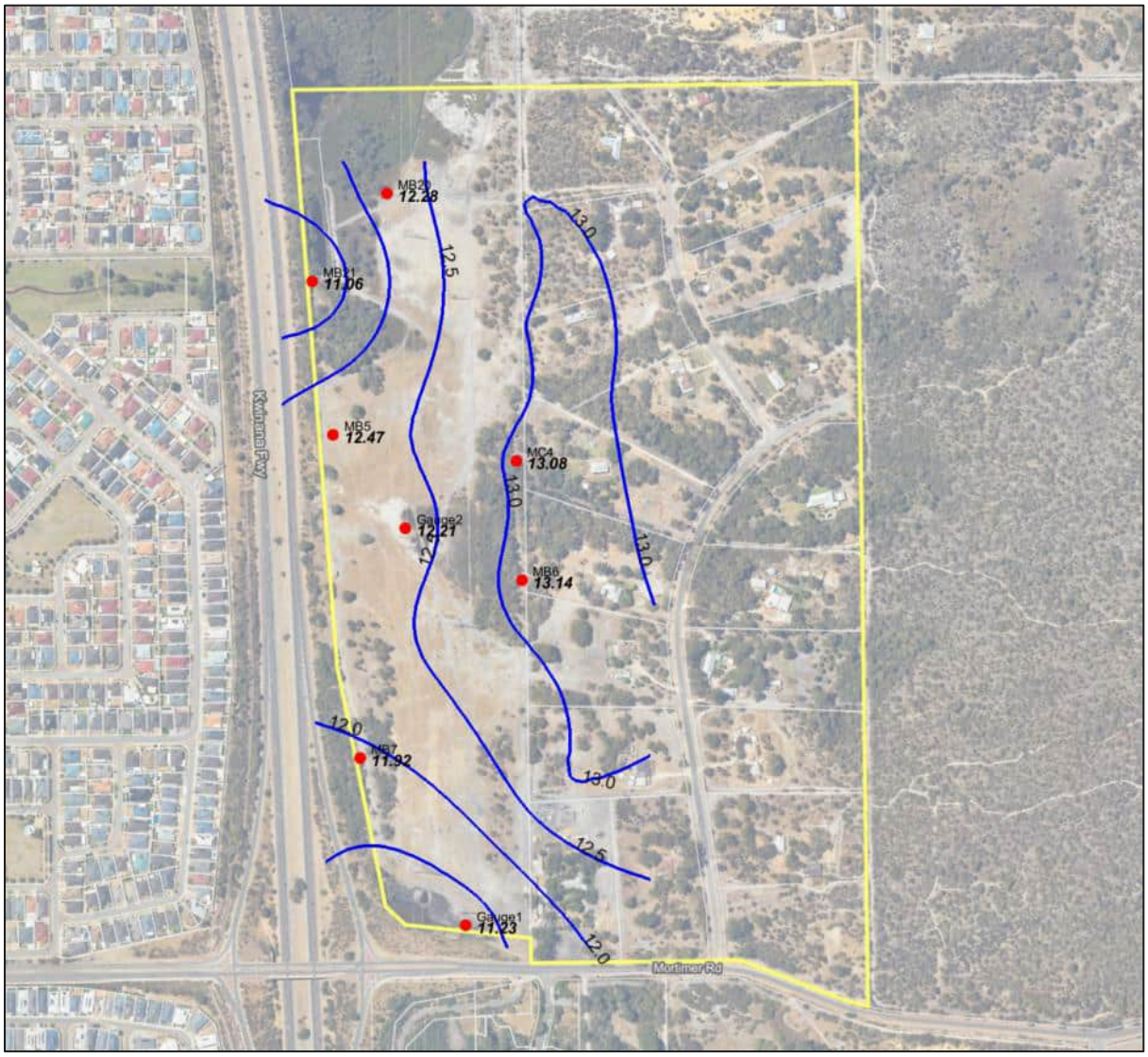

Figure 4: Maximum GWL Contours in mAHD (2022-2024)

6.2 Depth to Maximum GWL Contours (2022-2024)

The depth to Maximum GWL (thickness of the unsaturated zone in mbgl) was estimated by subtracting the contoured data for Maximum GWLs from the inferred topography contours (source: Online groundwater map at https : //maps.water.wa. gov.au/Groundwater/).

The depth to Maximum GWLs (**Figure 5**) was less than 2.5 mbgl in the central and western areas of the site. In the central western area of the site, the inferred depth to Maximum GWLs was less than 1.5 mbgl. Recorded data confirms that the depth to Maximum GWLs is less than 0.3 mbgl at MC4 and MB6, as well as at MB21 near the northwest corner of the site near the drain.

To the eastern half of the site, the topography rises to about 20 mAHD. It is likely that clearance above the watertable is more 5m along much of the eastern boundary.

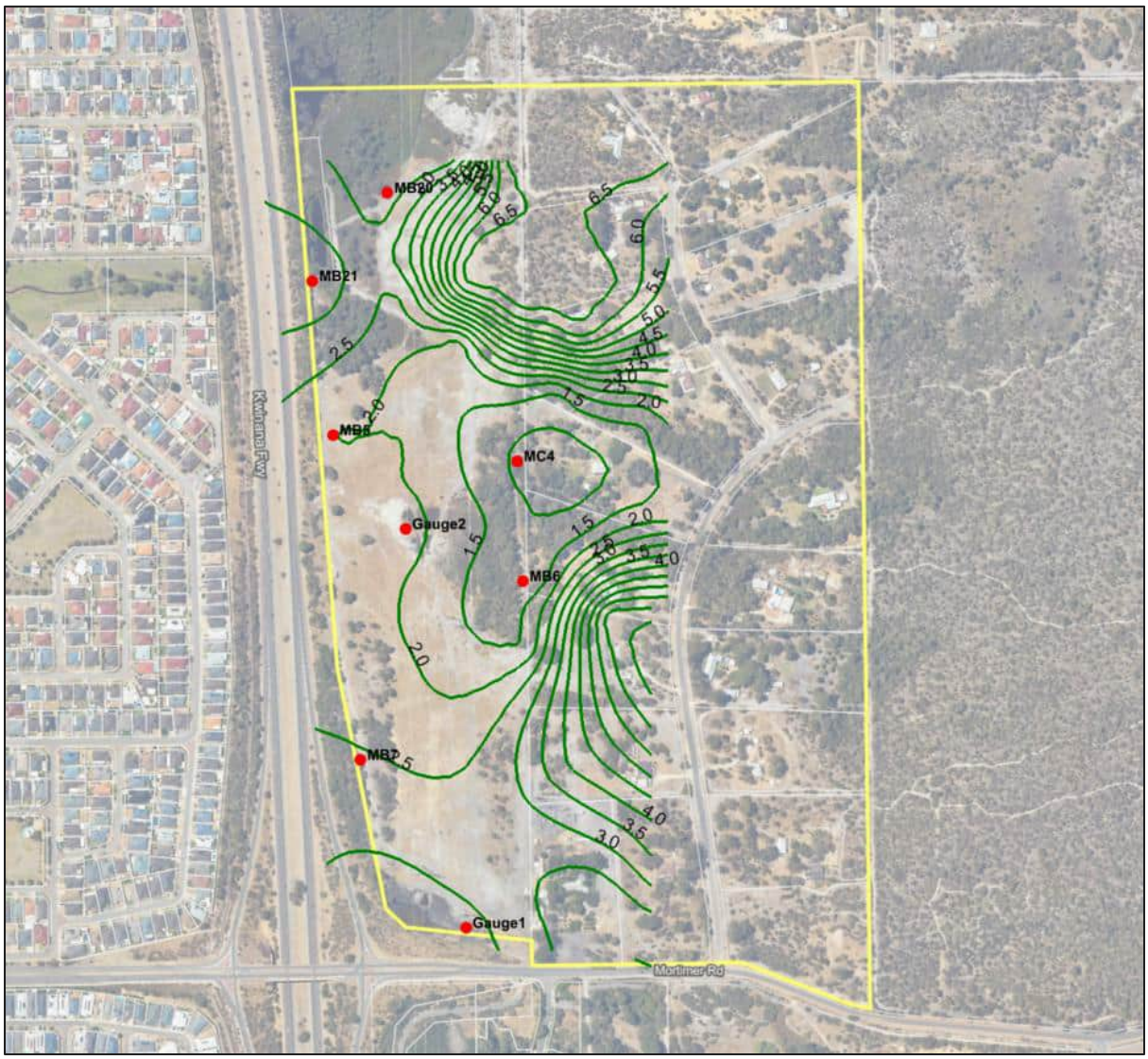

Figure 5: Depth to Maximum GWL Contours in mbgl (2022-2024)

6.3 Minimum GWLs Contours (2022-2024)

The Minimum GWL contours for the monitoring periods are provided in **Figure 6**. The lowest MinGWLs were at the north-western and south-western corners of the site.

Groundwater flow is generally to the west and ranges from approximately 12.5 mAHD at the central north of the site to less than 10 mAHD at the drain locations near the north-western boundary of the site.

There were no bores in the eastern half of the site, however MinGWLs are known to be greater than 12.5 mAHD.

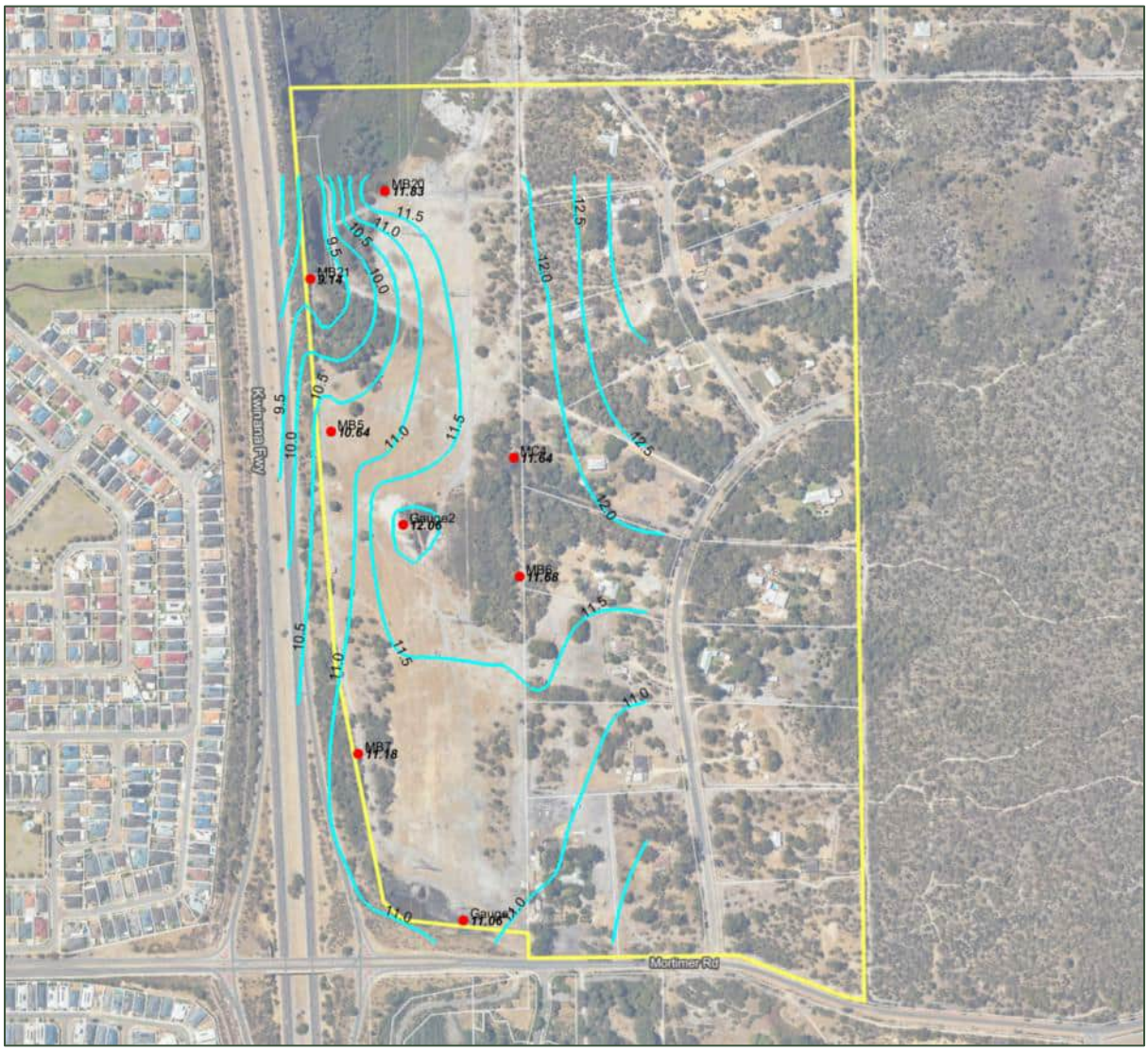

Figure 6: Minimum GWL Contours in mAHD (2022-2024)

7.0 Groundwater Quality

7.1 Groundwater Quality – Field Measured Parameters

The summary of field measured physico-chemical groundwater quality (GWQ) parameters is below and presented in **Table 10**:

- The groundwater at all locations was generally described as colourless, odourless and low turbidity. Occasionally, groundwater with a pale brown colour and higher turbidity was recorded at MB5.
- Dissolved oxygen (DO) ranged from 0.06 mg/L (MB6) to 7.37 mg/L (MB6). Mean DO values ranged from 0.16 mg/L (MC4) to 1.83 mg/L (MB5) indicating moderate aerobic conditions.
- Bore MC4 recorded higher electrical conductivity (EC) compared to the other bores. The brackish conditions at MC4 (2432 to 3,468 µS/cm, mean EC 2,916.54 µS/cm) could be attributed to its location within silty, organic soils near the central wetland. Bore MB21, located near the northern drain and wetland, recorded the second highest EC (max EC 1397 µS/cm, mean EC 598.28 µS/cm). The mean EC for all bores except MC4 was less than 1000 µS/cm indicating generally fresh water beneath the site.
- The pH of groundwater ranged from 4.14 to 5.77 pH units indicating moderate acidic conditions. MC4 and MB5 recorded the lowest pH with all recordings less than pH 5.
- The oxidation-reduction potential (ORP) ranged from -241.4 mV (MB6) to 218.5 mV (MC4) indicating both reductive conditions and oxidizing conditions. Mean ORP values ranged from -102.85 mV (MB6) to 57.18 mV (MB5), with four of the six bores having negative ORP values, indicating generally reductive conditions.
- All groundwater physico-chemical field results are presented in **Appendix D**.

Table 10: GWQ Field Measured Parameters

Monitoring Well	Statistic	DO (mg/L)	EC (µS/cm)	pH (pH unit)	ORP (mV)
MC4	Min	0.08	2432.00	4.22	-165.40
	Mean	0.16	2956.14	4.41	1.67
	Max	0.27	3468.00	4.60	218.50
MB5	Min	0.10	98.90	4.14	-85.70
	Mean	1.83	129.75	4.37	57.18
	Max	3.76	156.20	4.99	210.60
MB6	Min	0.06	366.60	5.09	-241.40
	Mean	1.29	496.34	5.33	-102.85
	Max	7.37	683.00	5.52	-38.60
MB7	Min	0.86	171.30	5.32	-157.70
	Mean	1.07	324.70	5.53	-86.30
	Max	1.37	520.40	5.77	42.70
MB20	Min	0.14	7.70	5.12	-152.80

Monitoring Well	Statistic	DO (mg/L)	EC (µS/cm)	pH (pH unit)	ORP (mV)
	Mean	0.37	254.40	5.33	-58.58
	Max	0.56	354.90	5.49	11.10
MB21	Min	0.34	60.40	5.03	-145.10
	Mean	1.27	598.28	5.47	-41.28
	Max	4.09	1397.00	5.64	27.40

7.2 Groundwater Quality – Laboratory Analytical Results

All groundwater quality analytical results and QAQC results are presented in Table A and Table B in **Appendix C**. The key findings from the water quality analysis are presented below:

- The concentration of aluminium and iron exceeded the NPUG guidelines (0.2 mg/L) at all locations during the monitoring period except at MB7 from July to September 2023.
- Other analytes that exceeded the assessment criteria were sulfate, sodium, chloride and ammonia as nitrogen. Bore MC4 is the only bore reporting exceedance of ADW Aesthetic guidelines for sulfate and sodium. Bore MC4 is also the only bore that reported exceedances of NPUG guidelines for chloride. Bore MC4 also reported the exceedance of ammonia-N for ADWG Aesthetic values (0.41 mg/L).
- All GWQ results including exceedances were considered typical of the pre-development groundwater quality for the area.
- The GWQ field and laboratory results represent pre-development baseline results for the site.

8.0 Key Findings

8.1 Groundwater Levels

The key findings for GWLs are as follows:

- The highest groundwater levels were recorded between August and October, with the majority of maxima occurring in September.
- The bores MC4 and MB7 were, on occasion, recorded as ‘dry’ during the late summer/early autumn months.
- The maximum groundwater levels ranged from 11.060 mAHD at MB21 to 13.140 mAHD at MB6. This is a difference of 2.08 m.
- The minimum groundwater levels ranged from 9.143 mAHD at MB21 to 11.830 at MB20. This is a difference of 2.687 m.
- Three bores MC4, MB6 and MB21 recorded shallow ground water (less than 0.3 mbgl) while MB5, MB6 and MB20 were within 2 mbgl. MB7 recorded the highest depth to the maximum watertable at 3.696 mbgl.
- The data are representative of the maximum and minimum groundwater conditions for the monitoring period (2022-2024) and are likely to be less than the historical maxima and minima for the site.
- The lowest MaxGWLs were at the northwestern and southwestern corners of the site. These locations have groundwater controlling infrastructure in the form of drains.
- In the central western area of the site, the inferred depth to Maximum GWLs was less than 1.5 mbgl.
- Recorded data confirms that the depth to Maximum GWLs is less than 0.3 mbgl at MC4 and MB6, as well as at MB21 near the northwest corner of the site near the drain.
- The interpolated contours and inferred topography are not intended for design purposes, but rather, to inform the LSP, LWMS and other planning documents.

8.2 Surface Water Levels

The key findings for SWLs are as follows:

- The southern drain location at Gauge 1 had a MaxSWL for the monitoring period of 11.129 mAHD. The wetland location (Gauge 2) had a MaxSWL of 12.307 mAHD.
- The WaterCorp drains at the northwest and southwest corners of the site are likely to maintain controlled groundwater levels (CGLs) during the high groundwater period. The MaxSWL at Gauge 1 (11.129 mAHD) represents the CGL at this location.
- Surface water levels were included in the dataset for the interpolated contours.

8.3 Controlled Groundwater Levels

- When rainfall from the period leading up to and including the GME program is taken into account, GWLs and SWLs are estimated to be close to the long-term average maximum CGLs since the site has drains intersecting the northwest and southwest corners of the site.

- Historical maximum CGLs are likely to be marginally higher along the west of the site where the drains are located and higher toward the centre and east of the site.

8.4 Groundwater Quality

The key findings for GWQ are as follows:

- The pH of groundwater ranged from 4.14 to 5.77 pH units indicating moderate acidic conditions. MC4 and MB5 recorded the lowest pH with all recordings less than pH 5.
- Bore MC4 recorded higher electrical conductivity (EC) compared to the other bores (2432 to 3,468 µS/cm, mean EC 2916.54 µS/cm). The mean EC for all bores except MC4 was less than 1000 µS/cm indicating generally fresh water beneath the site.
- The concentration of aluminium and iron exceeded the NPUG guidelines (0.2 mg/L) at all locations at some time during the monitoring period. Other analytes that exceeded the assessment criteria were sulfate, sodium, chloride and ammonia-N with MC4 recording the most exceedances.
- All GWQ results including exceedances were considered typical of the pre-development groundwater quality for the area.
- The GWQ field and laboratory results represent pre-development baseline results for the site.

9.0 Bibliography

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Appendix A Field Documentation

Casuarina Groundwater Monitoring October 2022 to October 2024

Casuarina 6167, WA

Various Landowners (Casuarina LSP Area)

SLR Project No.: 675.0729597.00001

13 May 2025

360 environmental

PROJECT FIELD LOG (DAILY)

Date: 13/10 **Project Number:** 4763 **Project Name:** Casuarina Sth

Arrived: 800 **Departed:** 1150 **Weather:** Clear

PM: AP

Field Personnel: Declan

Contractors: -

Client Contact: - **Site Contact:** Phil Bailey

Purpose of Visit (Tick Appropriate Box):

☑ Site Inspection ☑ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

Peri, Dipper, YSI

☑ Calibration Certificate Received :_____ ☐ Calibration Undertaken:_____

Sampling:

Sampling Conducted: ☑ Y ☐ N Matrix: ☐ Soil ☑ Water ☐ Air

CoC Completed: ☑ Y ☐ N

Primary Lab: Eurofins Secondary Lab: _____

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC 01		13/10	MB7	water
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

Description of Activities:

800 - Arrive to site

830 - Dip round and well inspection

940 - Sample MB7, MB6, MB5
MC4

1150 - Depart site

360 environmental

Groundwater Monitoring (Synoptic Water Level Measurements)

Time Started: 830 Time Finished:_____

Monitoring Well ID	DTW (mBTOC)	DTB (mBTOC)	Construction (Gatic/Riser)	Casing height* (m above/below ground)	Condition
830 ~~MW~~ MB7	4.205	5.08	Riser	0.43	Roots - unblocked
835 ~~MW~~ MB6	0.890	3.74	Riser	0.46	Good
840 ~~MW~~ MB5	1.670	4.32	Riser	0.48	Good
920 ~~MW~~ MC4	0.93	1.99	Riser	0.60	No lid
930 ~~MW~~ MB7	4.205	5.08	Riser	0.43	Good
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
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MW					
MW					
MW					
MW					
MW					

* Gatic cover (also referred to as flush mount) riser height should be a negative value

NAPL Detected:_____
Location:_____
Thickness:_____

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP
360 Job No.: 4763
Location:
360 Field Representative: DB
Date: 13/10/22

Monitoring Well ID: MC4
Inner Diameter: 50mm
Depth to Water (mbTOC): 0.93
Depth of Well (mbTOC): 1.99
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:												
1120	1.025		16.2		0.34		3380		5.49		-107.2		Odourless, colourless
1125			16.4		0.12		3031		4.92		-85.0		V/low turb
1130	1.025		16.5		0.12		2962		4.67		-74.5		
1135			16.5		0.08		2959		4.59		-71.1		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP
360 Job No.: 4763
Location:
360 Field Representative: DB
Date: 13/10/22

Monitoring Well ID: MB5
Inner Diameter: 50mm
Depth to Water (mbTOC): 1.670
Depth of Well (mbTOC): 4.320
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Peri
Total Volume purged: 4000mL
Pump Intake (mbTOC):

Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Temp (°C) Reading	Temp (°C) 3% % between readings	D.O[4] (mg/L) Reading	D.O[4] (mg/L) 10% % between readings	Spec. Cond. (µS/cm) Reading	Spec. Cond. (µS/cm) 3% % between readings	pH (unit) Reading	pH (unit) ± 0.1 ±between readings	ORP (mV) Reading	ORP (mV) ±10 ±between readings	Comments
Start:	Start:												
1052	1.675	200mL	19.7		3.81		125.8		4.41		-38.9		Odourless, Pale brown
1057			19.7		3.59		123.5		4.19		-36.2		Low turb
1102	1.675		19.7		3.41		123.9		4.16		-32.3		
1107			19.7		3.40		124.8		4.14		-30.7		Couldit filter
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP
360 Job No.: 4763
Location:
360 Field Representative: DB
Date: 13/10/22

Pump Type: Peri
Total Volume purged: 4000mL
Pump Intake (mbTOC):

Monitoring Well ID: MB6
Inner Diameter: 50mm
Depth to Water (mbTOC): 0.890
Depth of Well (mbTOC): 3.74
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:												
1022	0.920	200mL	17.6		0.23		482.2		5.68		-95.6		Slight organic odour
1027			17.6		0.10		496.8		5.58		-95.4		Pale yellow colour
1032	0.920		17.6		0.13		501.8		5.53		-94.4		Low turb
1037			17.6		0.10		503.3		5.48		-91.0		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP
360 Job No.: 4763
Location:
360 Field Representative: DB
Date: 13/10/22

Pump Type: Peri
Total Volume purged: 4000mL
Pump Intake (mbTOC):

Monitoring Well ID: MB7
Inner Diameter: 50mm
Depth to Water (mbTOC): 4.205
Depth of Well (mbTOC): 5.08
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:				1.18								
945	4.205	200mL	18.1		[illegible]		184.6		6.10		-29.2		Odourless, colourless
950			18.2		0.99		187.8		5.94		-30.9		V/low turb
955	4.210		18.2		0.91		194.0		5.82		-33.3		
1000			18.3		0.86		201.2		5.77		-41.2		QC01
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

360 environmental

PROJECT FIELD LOG (DAILY)

Date: 27/3/23 **Project Number:** 4763 **Project Name:** Casuarina GMF

Arrived: 8:30AM **Departed:** 1:45pm **Weather:** Sunny

PM: K. Tshering

Field Personnel: L. Dorji

Contractors: ✓

Client Contact: _____ **Site Contact:** ✓

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☐ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

YSI, Dipper & Peri Pump

☐ Calibration Certificate Received :_____ ☐ Calibration Undertaken: 27/3/23

Sampling:

Sampling Conducted: ☐ Y ☐ N Matrix: ☐ Soil ☐ Water ☐ Air

CoC Completed: ☐ Y ☐ N

Primary Lab: Eurofins. Secondary Lab: ✓

360 environmental

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC 1	Duplicate	27/3/23	MBC	Water
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

360 environmental

Description of Activities:

8:30 Am – Arrived at the site.

9:35 Am – Commenced Sampling. Sampled from following wells.
MB3, MC4, MB5, MB6, MB7. However, MB3, MC4 and MB7 were found dry. Only sample taken from MB6.

issue / Vehicle could not fly to MB3 due to large piles of sand. Also took time due to vehicle bogged down into sand. Spent around ½ hrs to get out.

2:00pm Dropped samples at Eurofins.

2:23pm – Back to office.

360 environmental

Groundwater Monitoring (Synoptic Water Level Measurements)

Time Started: _____ Time Finished: _____

Monitoring Well ID	DTW (mBTOC)	DTB (mBTOC)	Construction (Gatic/Riser)	Casing height* (m above/below ground)	Condition
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
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MW					
MW					
MW					
MW					
MW					
MW					

* Gatic cover (also referred to as flush mount) riser height should be a negative value

NAPL Detected: _____
Location: _____
Thickness: _____

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Cashmore Care
Project:
360 Job No.: 4763
Location: Cashmore
360 Field Representative: AD
Date: 27-3-23

Pump Type: Peri Pump
Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MW3
Inner Diameter: 50mm
Depth to Water (mbTOC): Dry
Depth of Well (mbTOC): 1.74m.
Top of Well Screen (mbTOC): –
Bottom of Well Screen (mbTOC): –
Height of Riser*(m above/below ground) –
Presence & thickness of LNAPL: –

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:												
SAMPLING:													

Dry

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina GMT
Project:
360 Job No.: 4763
Location: Casuarina
360 Field Representative: PD
Date: 27-3-23

Monitoring Well ID: MC4
Inner Diameter: 50mm
Depth to Water (mbTOC): Dry
Depth of Well (mbTOC): 2.23m
Top of Well Screen (mbTOC): -
Bottom of Well Screen (mbTOC): -
Height of Riser*(m above/below ground) -
Presence & thickness of LNAPL: -

Pump Type: Peristaltic Pump
Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
					Dry								
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Caguarina Club
Project:
360 Job No.: 4763
Location: Caguarina.
360 Field Representative: P.D
Date: 27-3-23

Pump Type: Peri Pump. Total Volume purged: —
Pump Intake (mbTOC):

Monitoring Well ID: MW5
Inner Diameter: 50mm.
Depth to Water (mbTOC): 2.65m
Depth of Well (mbTOC): 4.33m
Top of Well Screen (mbTOC): —
Bottom of Well Screen (mbTOC): —
Height of Riser*(m above/below ground) —
Presence & thickness of LNAPL: —

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
9:35	2.66	—	26.4		1.17		136.5		4.28		266.0		Brownish colour, odourless and low turbidity.
9:40	2.66	—	26.3		0.72		137.9		4.30		228.5		
9:45	2.66	—	26.7		0.58		138.9		4.32		201.8		
9:50	2.66	—	26.8		0.56		139.4		4.33		188.9		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Cosmetic Gate
Project:
360 Job No.: 4763
Location: Cosmetics.
360 Field Representative: PD
Date: 27-3-23

Pump Type: Peri Pump
Pump Intake (mbTOC):
Total Volume purged:

Monitoring Well ID: MW6
Inner Diameter: 50mm
Depth to Water (mbTOC): 2.2m
Depth of Well (mbTOC): 3.745m
Top of Well Screen (mbTOC): —
Bottom of Well Screen (mbTOC): —
Height of Riser*(m above/below ground) —
Presence & thickness of LNAPL: —

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
10:16	2.5	—	22.4		0.50		505.7		5.62		-43.9		colourless, sulphur smell/rotten eggs and low turbidity.
10:21	2.6	—	22.2		0.25		488.4		5.48		-93.2		
10:26	2.6	—	22.2		0.22		489.9		5.45		-120.9		
10:31	2.6	—	22.3		0.30		490.6		5.46		-128.1		C2c1 taken from here.
10:36	2.6	—	22.3		0.34		486.5		5.46		-133.5		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina GME
Project:
360 Job No.: 4263
Location: Casuarina.
360 Field Representative: P.D.
Date: 27-3-23

Monitoring Well ID: MW7
Inner Diameter: 50mm.
Depth to Water (mbTOC): Dry.
Depth of Well (mbTOC): 5.14 m
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Peri Pump.
Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
8.54					Dry								
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

360 environmental

PROJECT FIELD LOG (DAILY)

Date: 3/07/23 **Project Number:** 4763 **Project Name:** Cessnock Link

Arrived: 7:24am **Departed:** 1:15pm **Weather:** Sunny.

PM: JH / KT.

Field Personnel: P.D

Contractors: ✓

Client Contact: ✓ **Site Contact:** ✓

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

Peristaltic pump, YSI, Dipper.

☐ Calibration Certificate Received : ✓ ☑ Calibration Undertaken:

Sampling:

Sampling Conducted: ☑ Y ☐ N Matrix: ☐ Soil ☑ Water ☐ Air

CoC Completed: ☑ Y ☐ N

Primary Lab: Eurofins Secondary Lab: ✓

360 environmental

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC01	Duplicate	31/08/23	MW	Water
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

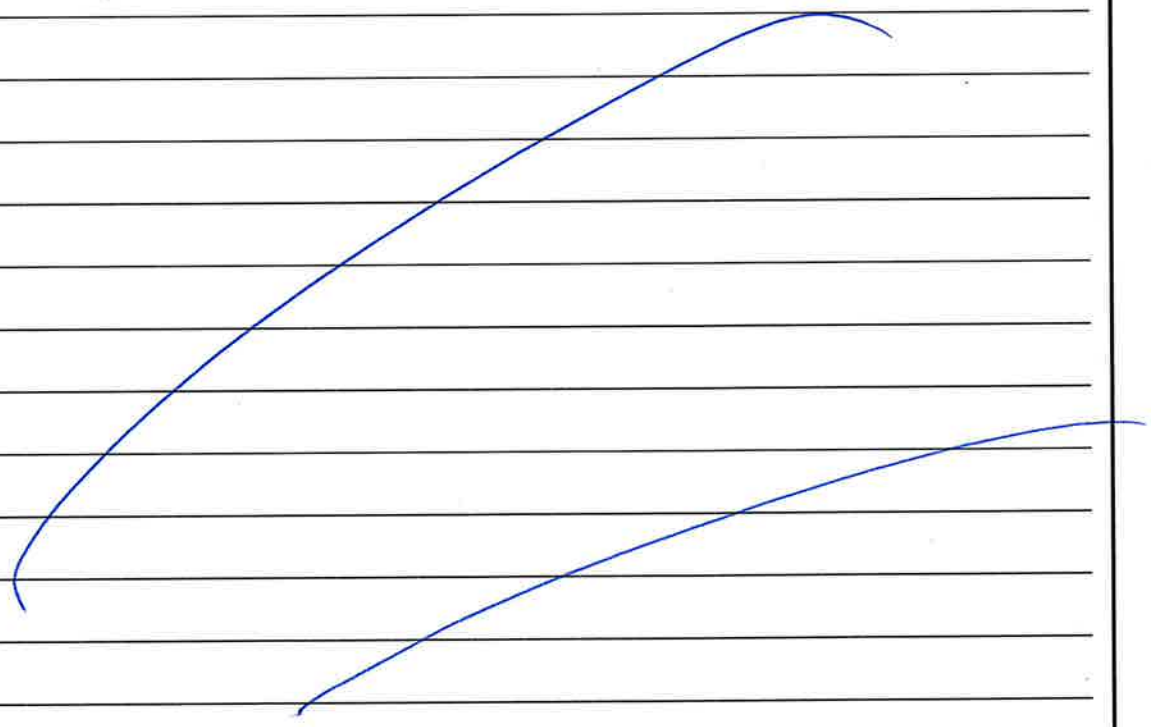
QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

360 environmental

Description of Activities:

9:20 Am – Arrived at site
– Sampled from following wells, MB7, MB5, MB6, MC4, MB8.
– Dropped sample at Eurofins.
– Back to office. Completed paperwork.
– Departed for site at 1.15 pm.



360 environmental

Groundwater Monitoring (Synoptic Water Level Measurements)

Time Started: _____ Time Finished: _____

Monitoring Well ID	DTW (mBTOC)	DTB (mBTOC)	Construction (Gatic/Riser)	Casing height* (m above/below ground)	Condition
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
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MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					
MW					

* Gatic cover (also referred to as flush mount) riser height should be a negative value

NAPL Detected: _____
Location: _____
Thickness: _____

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Cessnock City Council
Project: Cessnock
360 Job No.: 4763
Location: Cessnock
360 Field Representative: PP
Date: 31/07/23

Pump Type: Peri Pump
Total Volume purged: /
Pump Intake (mbTOC):

Monitoring Well ID: MB7
Inner Diameter: —
Depth to Water (mbTOC): 4.82
Depth of Well (mbTOC): 5.12
Top of Well Screen (mbTOC): —
Bottom of Well Screen (mbTOC): —
Height of Riser*(m above/below ground) —
Presence & thickness of LNAPL: —

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
9:52	4.86	250	17.8		2.21		546.3		5.77		-151.8		Colourless, odourless, medium/high turbidity
9:57	4.85		17.6		1.24		519.2		5.72		-142.4		
10:02	4.85		17.6		1.15		514.8		5.70		-139.5		
10:07	4.85		17.7		1.22		520.4		5.69		-132.1		Recirculation from here.
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 ENVIRONMENTAL

Client: Cessnock Gmt
Project: Cessnock
360 Job No.: 4763
Location: Aberdeen.
360 Field Representative: P.D
Date: 31/05/23

Pump Type: Fin Pump
Pump Intake (mbTOC):

Total Volume purged: —

Monitoring Well ID: MB5
Inner Diameter: —
Depth to Water (mbTOC): 1.77m
Depth of Well (mbTOC): 4.39
Top of Well Screen (mbTOC): —
Bottom of Well Screen (mbTOC): —
Height of Riser*(m above/below ground) —
Presence & thickness of LNAPL: —

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
10:25	1.78	250	17.8		4.50		125.8		4.39		100.9	91.8	Light brown, cloudy, low turbidity.
10:30	1.78		18.0		3.85		125.7		4.36		122.9		
10:35	1.78		18.0		3.55		128.3		4.35		132.6		
10:40	1.78		18.0		3.40		128.5		4.34		140.7		
SAMPLING:													

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Groundwater Low Flow Purging: Water Quality Measurement Form

360

Client: Casuarina Gulf
Project: Casuarina
360 Job No.: 4767
Location: Casuarina.
360 Field Representative: RD
Date: 31/07/23

Pump Type: Peri Pump
Pump Intake (mbTOC):
Total Volume purged:

Monitoring Well ID: MW6
Inner Diameter: —
Depth to Water (mbTOC): 0.97m
Depth of Well (mbTOC): 3.72m
Top of Well Screen (mbTOC): —
Bottom of Well Screen (mbTOC): —
Height of Riser*(m above/below ground) —
Presence & thickness of LNAPL: —

Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
			Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:												
10:51	1.00	250	15.1		2.32		396.1		5.18		44.2		colourless, odourless, low turbidity.
10:56	1.00		15.0		1.19		357.8		5.22		-7.5		
11:01	1.00		14.9		1.72		354.4		5.28		-27.2		
11:06	1.00		14.9		1.35		368.5		5.30		-32.4		
11:11	1.00		14.9		1.35		366.6		5.30		-44.6		
SAMPLING:													

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Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Cessnock Cars
Project: Cessnock
360 Job No.: 4267
Location: Cessnock.
360 Field Representative: D.D
Date: 31/7/17

Pump Type: Peri Pump
Total Volume purged: /
Pump Intake (mbTOC):

Monitoring Well ID: MW4
Inner Diameter: -
Depth to Water (mbTOC): 0.55
Depth of Well (mbTOC): 2.21
Top of Well Screen (mbTOC): -
Bottom of Well Screen (mbTOC): -
Height of Riser*(m above/below ground) -
Presence & thickness of LNAPL: /

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
11:27	0.59	250	14.0		1.90		2800		4.82		-98.0		O, C, C.
11:32	0.59	|	14.7		0.38		2675		4.55		-92.4		
11:37	0.59	|	14.9		0.21		2650		4.52		-89.3		
11:42	0.59	|	14.5		0.22		2645		4.51		-89.2		
SAMPLING:													

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Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Cannon Gart
Project: Cannon
360 Job No.: M53 Cannon
Location: (1)
360 Field Representative:
Date: 31/03/21

Pump Type: Low flow pump
Pump Intake (mbTOC):
Total Volume purged:

Monitoring Well ID: MS3
Inner Diameter: —
Depth to Water (mbTOC): 1.63
Depth of Well (mbTOC): 2.65
Top of Well Screen (mbTOC): —
Bottom of Well Screen (mbTOC): —
Height of Riser*(m above/below ground) —
Presence & thickness of LNAPL: —

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
12:15	1.63	25%	17.5		4.77		196.7		5.48		1.6		colourless, odourless
12:20	1.63		17.6		3.66		197.2		5.48	-3.2			high turbidity.
12:25	1.63		17.6		3.51		197.9		5.48	-4.6			
12:30	1.63		17.7		3.30		198.2		5.48	-5.3			* organic matter present.
12:35	1.63		17.7		3.18		199.1		5.48	-6.2			
SAMPLING:													

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PROJECT FIELD LOG (DAILY)

Date: 30-08-2023 **Project Number:** 4739 **Project Name:** Casuarina South LSP - GME

Arrived: 930 **Departed:** 1230 **Weather:** Clear

PM: KT

Field Personnel: DB / OS

Contractors: -

Client Contact: - **Site Contact:** -

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

YSI, Peri pump, dipper, tube cutters

☐ Calibration Certificate Received : ☑ Calibration Undertaken:

Sampling:

Sampling Conducted: ☑ Y ☐ N Matrix: ☐ Soil ☑ Water ☐ Air

CoC Completed: ☑ Y ☐ N

Primary Lab: ARL Secondary Lab:

360 environmental

Description of Activities:

930 arrive to site

945 - Sample wells MB6, MC4

- Install tube and sample MB20, MB21

- Sample MB5, MB7

1230 - Depart site

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP - GME
360 Job No.: 4739
Location:
360 Field Representative: DB / OS
Date: 30-08-2023

Monitoring Well ID: MC4
Inner Diameter:
Depth to Water (mbTOC): 1.06
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
10.00	1.06		15.0		6.33		2973		4.26		-139.0		O, C, low turb
10.05	1.10		15.5		0.38		3044		4.25		-163.5		
10.10	1.10		15.6		0.29		3048		4.29		-163.9		
10.15			15.7		0.20		3057		4.30		-165.4		
SAMPLING:													

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DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP - GME
360 Job No.: 4739
Location:
360 Field Representative: DB / OS
Date: 30-08-2023

Monitoring Well ID: MB5
Inner Diameter:
Depth to Water (mbTOC): 1.90
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
11.35	1.90		18.8		40.9		147.5		9.78		-9.9		0, pale yellow, med
11.40	1.90		18.5		1.94		190.9		4.27		-0.7		1.6
11.45	1.90		18.9		1.70		142.7		4.19		8.6		
11.50	-"-		18.9		1.67		142.0		4.16		17.5		
SAMPLING:													

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DO = dissolved oxygen
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Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP - GME
360 Job No.: 4739
Location:
360 Field Representative: DB / OS
Date: 30-08-2023

Monitoring Well ID: MB6
Inner Diameter:
Depth to Water (mbTOC): 1.03
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Temp (°C) Reading	Temp (°C) 3% % between readings	D.O[4] (mg/L) Reading	D.O[4] (mg/L) 10% % between readings	Spec. Cond. (µS/cm) Reading	Spec. Cond. (µS/cm) 3% % between readings	pH (unit) Reading	pH (unit) ± 0.1 ±between readings	ORP (mV) Reading	ORP (mV) ±10 ±between readings	Comments
Start:	Start:												
9.38	1.03		16.2		0.38		524		5.96		-290.5		O, C, low flow MB6
9.43			16.0		0.23		580		5.32		-277.9		
9.48	1.04		15.9		0.21		614		5.17		-267.0		
9.53			15.8		0.26		673		5.13		-251.7		
9.58	1.06		15.8		0.27		683		5.15		-241.4		
SAMPLING													

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Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP - GME
360 Job No.: 4739
Location:
360 Field Representative: DB / OS
Date: 30-08-2023

Monitoring Well ID: MB7
Inner Diameter:
Depth to Water (mbTOC): 4.66
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type:
Total Volume purged:
Pump Intake (mbTOC):

Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Temp (°C) Reading	Temp (°C) 3% % between readings	D.O[4] (mg/L) Reading	D.O[4] 10% % between readings	Spec. Cond. (µS/cm) Reading	Spec. Cond. 3% % between readings	pH (unit) Reading	pH ± 0.1 ±between readings	ORP (mV) Reading	ORP ±10 ±between readings	Comments
Start:	Start:												
12.01	4.66		18.9		6.42		402.8		4.95		21.5		O, C, Low flow
12.06	4.66		18.5		0.62		337.6		5.24		-166 stable -7		
12.11	-11-		18.5		0.76		319.1		5.24		-160.7		
12.16	-11-		18.5		0.91		318.6		5.32		-157.7		
SAMPLING:													

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Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP - GME
360 Job No.: 4739
Location:
360 Field Representative: DB / OS
Date: 30-08-2023

Monitoring Well ID: MB20
Inner Diameter:
Depth to Water (mbTOC): 2.96
Depth of Well (mbTOC): 5.10
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
10.33	2.96		19.1		3.71		436.5		5.16		-109.5		0, pale yellow, low
10.38	2.97		19.1		0.75		325.5		5.31		-141.7		med turb
10.43	2.97		19.1		0.75		322.9		5.32		-141.2		
10.48	-"-		19.1		0.55		342.8		5.34		-147.0		
10.53	-"-		19.2		0.37		354.5		5.37		-152.8		
SAMPLING:													

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[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stable.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:
Project: Casuarina South LSP - GME
360 Job No.: 4739
Location:
360 Field Representative: DB / OS
Date: 30-08-2023

Monitoring Well ID: MB 21
Inner Diameter:
Depth to Water (mbTOC): 1.0
Depth of Well (mbTOC): 3.37
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
11.05	1.0		15.6		0.54		604		5.98		-109.2		Brown, ~~[illegible]~~ turbid
11.10	1.10		14.5		0.19		577		5.45		-153.6		colourless
11.15	1.16		14.3		0.31		572		5.49		-157.5		
11.20	1.17		14.2		0.57		567		5.54		-150.0		sediment filter
11.25	1.18		14.1		0.90		560		5.57		-145.1		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

360 environmental

PROJECT FIELD LOG (DAILY)

Date: 26/10/23 **Project Number:** 4762 **Project Name:** Casuarina South LSP - GMT

Arrived: 10.30 **Departed:** _____ **Weather:** Sunny

PM: KT

Field Personnel: OS

Contractors: _____

Client Contact: _____ **Site Contact:** _____

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☐ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

YSI, Peri, dipper

☐ Calibration Certificate Received :_____ ☐ Calibration Undertaken:_____

Sampling:

Sampling Conducted: ☐ Y ☐ N Matrix: ☐ Soil ☐ Water ☐ Air

CoC Completed: ☐ Y ☐ N

Primary Lab: _____ Secondary Lab: _____

360 environmental

Description of Activities:

10.30 Arrive at site

Start sampling MB6, MC4, MB10, MB21, MB5

MB7 – Dry

13.00 Leave site

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina South LSP- GME
Project: 4763
360 Job No.:
Location: Casuarina, WA
360 Field Representative: DS
Date: ~~18~~ 25 Oct 2023

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB6
Inner Diameter:
Depth to Water (mbTOC): 1.32
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
10.43	1.32		19.3		4.73		494.4		5.33		-41.0		
10.48	1.32		18.4		0.17		500.0		5.33		-42.1		O, C, & yellow
10.53	↓		18.4		0.10		509.7		5.37		-43.2		
10.58			18.3		0.06		513.2		5.37		-38.6		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina South LSP- GME
Project: 4763
360 Job No.:
Location: Casuarina, WA
360 Field Representative: OS
Date: ~~19~~ 25 Oct 2023

Pump Type: _____ Total Volume purged: _____
Pump Intake (mbTOC): _____

Monitoring Well ID: MC4
Inner Diameter:
Depth to Water (mbTOC): 1.34
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
11.13	1.34		18.1		2.~~10~~		3151		2.11		132.8		O, C, C
11.18	↓		16.5		0.25		3402		0.96		177.7		
11.23			16.2		0.12		3465		0.52		209.6		
11.28			16.2		0.13		3468		0.38		218.5		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina South LSP- GME
Project: 4763
360 Job No.:
Location: Casuarina, WA
360 Field Representative: OS
Date: 19 Oct 2023 25
Pump Type: Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB20
Inner Diameter:
Depth to Water (mbTOC): 3.05
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
11.41	3.05		22.1		2.48		515.2		5.12		21.1		O, C, yellow
11.46	↓		19.1		0.13		386.4		5.22		9.4		
11.51			19.0		0.05		336.1		5.19		7.9		
11.56	↓		18.9		0.14		304.0		5.12		11.1		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabillsed.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina South LSP- GME
Project: 47 63
360 Job No.:
Location: Casuarina, WA
360 Field Representative: OS
Date: 14 Oct 2023 25

Monitoring Well ID: MB21
Inner Diameter:
Depth to Water (mbTOC): 1.32
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Pump Type: Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
12.11	1.32		19.1		4.33		54.1		5.64		7.6		brown, med T, odours
12.16	1.55		17.2		0.13		61.7		5.64		-12.1		
12.21	1.65		17.6		0.15		61.0		5.55		-11.0		
12.26			17.3		0.37		60.4		5.60		-14.6		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina South LSP- GME
Project: 4763
360 Job No.:
Location: Casuarina, WA
360 Field Representative: OS
Date: ~~18~~ 25 Oct 2023
Pump Type: Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB5
Inner Diameter:
Depth to Water (mbTOC): 2.05
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
			Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:												
12.25	2.05		22.4		1.40		119		4.56		63.8		yellow, low T, odourless
12.30	2.07		22.0		0.73		115		4.31		29.2		
12.35	2.07		21.9		0.58		117		4.32		5.3		
12.40	2.07		21.9		0.57		117		4.32		0.9		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Casuarina South LSP- GME
Project: 4763
360 Job No.:
Location: Casuarina, WA
360 Field Representative: OS
Date: ~~19~~ 25 Oct 2023

Pump Type: _____ Total Volume purged: _____
Pump Intake (mbTOC): _____

Monitoring Well ID: MW7
Inner Diameter: _____
Depth to Water (mbTOC): 4.73
Depth of Well (mbTOC): 4.96
Top of Well Screen (mbTOC): _____
Bottom of Well Screen (mbTOC): _____
Height of Riser*(m above/below ground) _____
Presence & thickness of LNAPL: _____

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
	4.78												
SAMPLING:													

DRef

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

SLR

PROJECT FIELD LOG (DAILY)

Date: 10/5/24 **Project Number:** 72155 **Project Name:** Casuarina

Arrived: _____ **Departed:** _____ **Weather:** Sunny

PM: KT

Field Personnel: OS + LS

Contractors: BE surveyors

Client Contact: _____ **Site Contact:** _____

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☐ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

Dipper

☐ Calibration Certificate Received :_____ ☐ Calibration Undertaken:_____

Sampling:

Sampling Conducted: ☐ Y ☐ N Matrix: ☐ Soil ☐ Water ☐ Air

CoC Completed: ☐ Y ☐ N

Primary Lab: _____ Secondary Lab: _____

SLR

Description of Activities:

9.45 Arrive @ site & meet Surveyor

Start dipping & survey

	Well	SWL	DTB
Surveyed	MB6	blocked @ 2.01 (roots)	
	MC4	roots @ 2.22	
	MB5	3.33	4.33
	MB7	Dry @ 4.96	
	MB20	Dry @ 3.19	
	MB21	2.82	3.30

12.30 Depart site

SLR

PROJECT FIELD LOG (DAILY)

Date: 07/06/2024 **Project Number:** 072155 **Project Name:** Casuarina LSP - Byford West

Arrived: 10 am **Departed:** _____ **Weather:** Cloudy

PM: Kuenzang Tshering

Field Personnel: Kavindi Sahabandu

Contractors: —

Client Contact: — **Site Contact:** _____

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Other (Specify):

Equipment Used:

YSI, Pevi, Dipper

☑ Calibration Certificate Received : _____ ☐ Calibration Undertaken: _____

Sampling:

Sampling Conducted: ☑ Y ☐ N Matrix: ☐ Soil ☑ Water ☐ Air

CoC Completed: ☑ Y ☐ N

Primary Lab: Eurofins Secondary Lab: _____

Description of Activities:

Arrived at site by 10 am

MB20 – purged

MB21 – slow recharging rate, purged with a slower rate

MB5 – purged

MB7 – dry

MB6 – roots, dtw may not be accurate, purged (QC1)

MC4 – purged, roots, ", changed the tubing

Left site by 3.45 pm

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client:	Pentium Water	Monitoring Well ID:	MC4
Project:	Casuarina LSP / Casuarina GME 2024	Inner Diameter:	
SLR Job No.:	072155 / 072597	Depth to Water (mbTOC):	2.06m
Location:	Casuarina	Depth of Well (mbTOC):	
SLR Field Representative:	KS	Top of Well Screen (mbTOC):	
Date:	07.06.2024	Bottom of Well Screen (mbTOC):	
Pump Type:	Peri	Height of Riser*(m above/below ground)	
Total Volume purged:		Presence & thickness of LNAPL:	
Pump Intake (mbTOC):			

* well is kinda blocked with roots, depth to water may not be accurate

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
14.39	2.06m	25	19.7		0.24		2417		4.21	-	33.9		
14.44	2.06	25	19.7		0.27		2426		4.21	-	47.9		0, C, C
14.49	2.06	25	19.7		0.27		2429		4.22	-	52.3		
14.54	2.06	25	19.8		0.27		2432		4.22	-	55.4		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client:	Pentium Water	Monitoring Well ID:	MB5
Project:	Casuarina LSP / Casuarina GME 2024	Inner Diameter:	
SLR Job No.:	072155 / 072597	Depth to Water (mbTOC):	2.85m
Location:	Casuarina	Depth of Well (mbTOC):	
SLR Field Representative:	KS	Top of Well Screen (mbTOC):	
Date:	07.06.2024	Bottom of Well Screen (mbTOC):	
		Height of Riser*(m above/below ground)	
Pump Type:	Peri	Presence & thickness of LNAPL:	
Pump Intake (mbTOC):		Total Volume purged:	

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
12.41 pm	2.85	25	23.4		0.29		159.6		5.07	-	80.3		no odour
12.46 pm	2.85		23.3		0.3		150.8		5.05	-	81.8		clear
12.51 pm	2.85		23.4		0.23		152.2		5.03	-	87.4		pale yellow
12.56 pm	2.85		23.6		0.10		156.2		4.99	-	85.7		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client: Pentium Water
Project: Casuarina LSP / Casuarina GME 2024
SLR Job No.: 072155 / 072597
Location: Casuarina
SLR Field Representative: KS
Date: 07.06.2024

Pump Type: Peri
Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB6
Inner Diameter:
Depth to Water (mbTOC): 2.04
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

* Well is kinda blocked by roots, Depth to water may not be accurate.

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
13.41	2.04	25	20.1		6.60		486.2		5.47	–	123.2		Sulfur ~~smell~~ odour
13.46	2.09	25	20.2		7.39		495.8		5.49	–	119.7		clear
13.51	2.09	25	20.1		7.67		493.9		5.56	–	117.2		pale yellow
13.56	2.09	25	20.1		7.37		498		5.52	–	126.3		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client:	Pentium Water	Monitoring Well ID:	MB20
Project:	Casuarina LSP / Casuarina GME 2024	Inner Diameter:	
SLR Job No.:	072155 / 072597	Depth to Water (mbTOC):	3.30 m
Location:	Casuarina	Depth of Well (mbTOC):	
SLR Field Representative:	KS	Top of Well Screen (mbTOC):	
Date:	07.06.2024	Bottom of Well Screen (mbTOC):	
		Height of Riser*(m above/below ground)	
Pump Type:	Peri	Presence & thickness of LNAPL:	
Pump Intake (mbTOC):		Total Volume purged:	

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start: 11.10	Start:												
11.14	3.30	50	22.7		9.59		7.6		6.75	-	99.3		
11.19	3.30	50	22.8		7.37		8.2		6.10	-	121.3		odourless
11.24	3.30	50	22.7		6.09		8.1		6.01	-	98.9		clear
11.29	3.30	50	22.8		5.54		7.7		5.44	-	92.9		pale yellow
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client: Pentium Water
Project: Casuarina LSP / Casuarina GME 2024
SLR Job No.: 072155 / 072597
Location: Casuarina
SLR Field Representative: KS
Date: 07.06.2024

Pump Type: Peri
Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB21
Inner Diameter:
Depth to Water (mbTOC): 1.69
Depth of Well (mbTOC):
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

* Very slow recharging rate hence slower purge rate.

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
15.15	1.69	15	18.5		5.21		1400		5.07		5.6		odourless
15:20	1.71	15	18.5		4.92		1390		5.08		15.1		clear
15.25	1.76	15	18.3		4.33		1400		5.04		25.2		pale yellow
15.30	1.79	15	18.2		4.09		1397		5.03		27.4		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

PROJECT FIELD LOG (DAILY)

Date: 11/07 **Project Number:** ~~72577~~ 72155/ **Project Name:** Casuarina LSP/ Casuarina GME

Arrived: 10 am **Departed:** _____ **Weather:** Sunny

PM: KT

Field Personnel: KS

Contractors: -

Client Contact: _____ **Site Contact:** -

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Surface Water Sampling ☐ Other (Specify):

Equipment Used:

Dipper

☐ Calibration Certificate Received :_____ ☐ Calibration Undertaken:_____

Sampling:

Sampling Conducted: ☐ Y ☑ N Matrix: ☐ Soil ☐ Water ☐ Air

CoC Completed: ☐ Y ☑ N

Primary Lab: _____ Secondary Lab: _____

Description of Activities:

10 am arrived on site

MB 6 - 1.82 m (blocked by roots)

MC 4 - 1.89 m blocked at 2.17 m

MB 20 - blocked at 3.27 m

MB 21 - 1.31 m

MB 5 - 2.66 m

MB 7 - dry/blocked at 5.1 m

11.30 am - left the site

SLR

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

PROJECT FIELD LOG (DAILY)

Date: 08/08/24 **Project Number:** 072597 / 072155 **Project Name:** Casuarina GME

Arrived: 09.50 **Departed:** 10.30 **Weather:** Sunny

PM: KT

Field Personnel: KS + PD

Contractors: -

Client Contact: - **Site Contact:** -

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Surface Water Sampling ☐ Other (Specify):

Equipment Used:

Dipper

☐ Calibration Certificate Received :_____ ☐ Calibration Undertaken:_____

Sampling:

Sampling Conducted: ☐ Y ☑ N Matrix: ☐ Soil ☐ Water ☐ Air

CoC Completed: ☐ Y ☐ N

Primary Lab: _____ Secondary Lab: _____

SLR

Description of Activities:

09.50 – Arrived on site

MB7 – Dry at 5m

MB5 – dtw 1.91 dtb 4.31

MB6 – dtw 1.06 dtb/blocked 2.21 (check historical data)

MC4 – dtw 1.11 " 2.17 "

MB20 – dtw 2.85 dtb 3.27

MB21 – dtw 0.97 dtb 3.37

10.30 – Left site

SLR

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

PROJECT FIELD LOG (DAILY)

Date: 20/09/24 **Project Number:** 72597 **Project Name:** Casuarina GME

Arrived: 09.30am **Departed:** 1.15pm **Weather:** Sunny

PM: KT

Field Personnel: KS

Contractors: –

Client Contact: – **Site Contact:** –

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Surface Water Sampling ☐ Other (Specify):

Equipment Used:

Dipper, YSI, Peri pump

☑ Calibration Certificate Received : ☐ Calibration Undertaken:

Sampling:

Sampling Conducted: ☑ Y ☐ N Matrix: ☐ Soil ☑ Water ☐ Air

CoC Completed: ☑ Y ☐ N

Primary Lab: Eurofins Secondary Lab: ALS

Description of Activities:

9.30 am - arrived on site

Conducted GW monitoring

MB5, MB21, MB20, MC4, MB 16 (QC1 + QC2) & MB7

1.15 pm - left site

SLR

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC 01	Duplicate	20/09/24	MB6	W.
QC 02	Triplicate			
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client:	Pentium Water	Monitoring Well ID:	MC4
Project:	Casuarina UME	Inner Diameter:	-
360 Job No.:	72155 / 72597	Depth to Water (mbTOC):	1.03
Location:	Casuarina	Depth of Well (mbTOC):	2.18
360 Field Representative:	KS	Top of Well Screen (mbTOC):	-
Date:	20/09/24	Bottom of Well Screen (mbTOC):	-
Pump Type:	Peri	Height of Riser*(m above/below ground)	-
Total Volume purged:		Presence & thickness of LNAPL:	-
Pump Intake (mbTOC):			

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
11.33	1.06		16.8		3.19		2991		4.34	-	24.2		
11.38	1.07		16.8		0.44		3045		4.32	-	23.4		O, C, C
11.43	1.07		16.9		0.30		3077		4.30	-	23.0		
11.48	↓		16.9		0.18		3136		4.28	-	24.9		
11.53			16.9		0.14		3180		4.27	-	24.7		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client: Pentium water
Project: Casuarina GME
SLR Job No.: 72155
Location: Casuarina
SLR Field Representative: KS
Date: 20/09/24

Monitoring Well ID: MB5
Inner Diameter: -
Depth to Water (mbTOC): 1.85 m
Depth of Well (mbTOC): 4.31 m
Top of Well Screen (mbTOC): -
Bottom of Well Screen (mbTOC): -
Height of Riser*(m above/below ground) -
Presence & thickness of LNAPL: -

Pump Type: Peri
Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
09.54	1.85	150	19.8		4.03		98.7		4.52		224.7		Pale yellow
09.59	1.85	↓	19.8		3.69		97.0		4.39		232.6		no odour
10.04	↓		19.8		3.62		98.4		4.37		222.5		clear
10.09			19.8		3.76		98.9		4.36		210.6		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

360 environmental

Client: Pentium Water
Project: Casuarina GME
360 Job No.: 72597/72155
Location: Casuarina
360 Field Representative: KS
Date: 20/09/24

Pump Type: Peri
Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB6
Inner Diameter: –
Depth to Water (mbTOC): 0.97
Depth of Well (mbTOC): 2.13
Top of Well Screen (mbTOC): –
Bottom of Well Screen (mbTOC): –
Height of Riser*(m above/below ground) –
Presence & thickness of LNAPL: –

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	Comments
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	
Start:	Start:												
12.08	0.98		18.0		0.83		452.4		5.11	–	16.2		yellow
12.13	0.98		17.9		0.42		456.6		5.05	–	35.0		sulphur odour
12.18	↓		17.9		0.28		468.0		5.04	–	61.0		low Turb
12.23	↓		17.9		0.36		470.1		5.09	–	62.0		
													pCO2 + pCO2
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client: Pentium Water
Project: Casuarina GME
SLR Job No.: ~~[illegible]~~ 72597
Location: Casuarina
SLR Field Representative: KC
Date: 20/09/24

Monitoring Well ID: MB7
Inner Diameter: -
Depth to Water (mbTOC): 4.57
Depth of Well (mbTOC): 4.97
Top of Well Screen (mbTOC): -
Bottom of Well Screen (mbTOC): -
Height of Riser*(m above/below ground) -
Presence & thickness of LNAPL: -

Pump Type: Peri
Total Volume purged:
Pump Intake (mbTOC):

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
12.47	4.57		19.9		2.01		188.5		5.51		46.5		
12.52	4.57		19.7		1.10		173.9		5.37		50.3		O, S, C
12.57	↓		19.6		1.15		174.2		5.49		45.7		
13.02	↓		19.5		1.37		171.3		5.51		42.7		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well runs dry
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

Client: Pentium Water
Project: Casuarina GME
SLR Job No.: 72155
Location: Casuarina
SLR Field Representative: KS
Date: 20/09/24

Pump Type: Peri
Total Volume purged:
Pump Intake (mbTOC):

Monitoring Well ID: MB20
Inner Diameter:
Depth to Water (mbTOC): 2.97
Depth of Well (mbTOC): 3.20 (Concrete/blocked bottom)
Top of Well Screen (mbTOC):
Bottom of Well Screen (mbTOC):
Height of Riser*(m above/below ground)
Presence & thickness of LNAPL:

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	Depth to groundwater (mbTOC)[2]	Purge rate (mL/min)[3]	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	Comments
Start:	Start:												
10.58	2.97	150	19.8		1.12		317.0		5.60	-	31.6		Pale yellow
11.03	↓	↓	19.8		0.44		283.9		5.55	-	41.4		no odour
11.08			19.8		0.49		263.3		5.48	-	40.5		clear
11.13			19.8		0.55		261.1		5.45	-	43.8		
11.18			19.8		0.56		260.4		5.45	-	44.0		
SAMPLING:													

Notes:
[1] Readings to be collected every five minutes or greater.
[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.
[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.
[4] 10% for values greater than 0.5 mg/L; if three *DO values* are less that 0.5 mg/L, consider these values as stabilised.
The depth to groundwater measurement must be recorded before SAMPLING
VOC samples must be collected first
Pump intake should be located within the screen interval & at the mid point of the saturated screnn length
* Gatic cover riser height should be a negative value
In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged
If a well runs dry, it is assumed that stabilisation will have occurred once the it has recharged and that samples can be collected straight after
A minimum of 4 readings are required, unless the well *runs dry*
To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:
mbTOC= metres below top of casing
DO = dissolved oxygen
ORP = oxygen reduction potential

Groundwater Low Flow Purging: Water Quality Measurement Form

SLR

Client:	Pentium water	**Monitoring Well ID:**	MB21
Project:	~~72155~~ Casuarina GME	**Inner Diameter:**	
Job No.:	72155	**Depth to Water (mbTOC):**	1.00
Location:	Casuarina	**Depth of Well (mbTOC):**	3.37
Field Representative:	KS	**Top of Well Screen (mbTOC):**	
Date:	20/09/24	**Bottom of Well Screen (mbTOC):**	
		Height of Riser*(m above/below ground)	
Pump Type:	Peri	**Presence & thickness of LNAPL:**	
Pump Intake (mbTOC):		**Total Volume purged:**	

			Temp (°C)	3%	D.O[4] (mg/L)	10%	Spec. Cond. (µS/cm)	3%	pH (unit)	± 0.1	ORP (mV)	±10	
Time[1]	**Depth to groundwater (mbTOC)[2]**	**Purge rate (mL/min)[3]**	Reading	% between readings	Reading	% between readings	Reading	% between readings	Reading	±between readings	Reading	±between readings	**Comments**
Start:	Start:												
10.25	1.03	150	17.5		2.83		700		5.45		77.2		roots at the bottom
10.30	1.03	↓	17.1		0.86		709		5.43	-	19.7		O, S, C
10.35	↓	↓	17.1		0.42		710		5.48	-	23.1		
10.40	↓	↓	17.0		0.34		710		5.51	-	23.2		
10.45	↓	↓	17.0		0.34		711		5.52	-	23.5		
SAMPLING:													

Notes:

[1] Readings to be collected every five minutes or greater.

[2] Drawdown should not exceed 9 cm ONCE first set of readings obtained. This allows for natural drawdown stabilisation to occur.

[3] Must be such that the drawdown doesn't exceed 9 cm, or if it does exceed, remains stabile.

[4] 10% for values greater than 0.5 mg/L; if three DO values are less that 0.5 mg/L, consider these values as stabilised.

The depth to groundwater measurement must be recorded before SAMPLING

VOC samples must be collected first

Pump intake should be located within the screen interval & at the mid point of the saturated screen length

* Gatic cover riser height should be a negative value

In the event that the recharge is very slow and the well runs dry, the readings may be collected at intervals of less than 5 minutes or for every litres purged

If a well runs dry, it is assumed that stabilisation will have occurred once the the well has recharged and that samples can be collected straight after

A minimum of 4 readings are required, unless the well runs dry

To calculate % difference, use the following equation: ((R2-R1)/((R2+R1)/2))*100

Legend:

mbTOC= metres below top of casing

DO = dissolved oxygen

ORP = oxygen reduction potential

SLR

PROJECT FIELD LOG (DAILY)

Date: 11/10/24 **Project Number:** 72597 **Project Name:** Casuarina GME

Arrived: 10.30 **Departed:** 11-30 **Weather:** Sunny

PM: KT

Field Personnel: KS + PD

Contractors: _____

Client Contact: — **Site Contact:** —

Purpose of Visit (Tick Appropriate Box):

☐ Site Inspection ☐ Well Integrity Assessment

☐ Soil Bore Advancement (Drill Rig) ☐ Hand Augering ☐ Test Pits ☐ Soil Sampling

☐ Monitoring Well Installation (Drill Rig) ☑ Groundwater Monitoring ☐ Sediment Sampling

☐ Sub-slab Vapour Probe Installation ☐ Landfill Gas Well Installation ☐ Gas/ Vapour Sampling

☐ Remediation Works Oversight ☐ Surface Water Sampling ☐ Other (Specify):

Equipment Used:

Dipper

☑ Calibration Certificate Received :_____ ☐ Calibration Undertaken:_____

Sampling:

Sampling Conducted: ☐ Y ☑ N Matrix: ☐ Soil ☐ Water ☐ Air

CoC Completed: ☐ Y ☐ N

Primary Lab: _____ Secondary Lab: _____

Description of Activities:

10.30am – Arrived on site

	dt w	dt6
MB7	4.53	4.98
MB5	1.87	4.35
MC4	1.05	2.20
MB20	3.00	3.40
MB21	1.03	3.34
MB6	1.00	~~2.20~~ 2.14

11.30 am – left the site

Quality Control Details:

QC	Type	Date and time	Primary	Media
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				
QC				

QC	Collection Point	Collection Location	Date and time	Rinsate water batch #
RS				
RS				
RS				
RS				
RS				

QC	Date and time	Trip blank batch #
TB		
TB		
TB		
TB		
TB		

QC	Date and time	Collection Location	Blank water batch #
FB			
FB			
FB			
FB			
FB			

Appendix B Laboratory Documentation

Casuarina Groundwater Monitoring October 2022 to October 2024

Casuarina 6167, WA

Various Landowners (Casuarina LSP Area)

SLR Project No.: 675.0729597.00001

13 May 2025

CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

☐ **Sydney Laboratory** Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066 02 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory** Unit 1 21 Smallwood Place Murarrie QLD 4172 07 3902 4600 EnviroSampleQLD@eurofins.com

☑ **Perth Laboratory** Unit 2 91 Leach Highway Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 6 Monterey Road Dandenong South VIC 3175 03 8564 5000 EnviroSampleVic@eurofins.com

Company	360 Environmental	Project №	4763	Project Manager	Alison Prior
Address	10 Bermondsey St, West Leederillve WA 6007	Project Name	Casuarina South Groundwater Monitoring	EDD Format (ESdat, EQuIS etc)	
Contact Name	Declan Bowen				
Phone №	0400 213 314				
Special Directions					
Purchase Order					
Quote ID №	360 Blanket Quote				

Sampler(s)	Declan Bowen
Handed over by	Declan Bowen
Email for Invoice	accounts@360environmental.com.au
Email for Results	labresults@360environmental.com.au, 360environmental@esdat.com.au

Analyses Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing

Containers Change container type & size if necessary.

Required Turnaround Time (TAT) Default will be 5 days if not ticked.

♦Surcharge will apply

☐ Overnight (reporting by 9am)♦

☐ Same day♦ ☐ 1 day♦

☐ 2 days♦ ☐ 3 days♦

☐ 5 days (Standard)

☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total suspended solids	Total nitrogen (TN)	Ammonia nitrogen (NH3 as N)	Nitrate nitrogen (NO3 as N)	Nitrite nitrogen	Total phosphorous (TP)	Reactive phosphorous (RP)	Total titratable acidity and total alkalinity	Major anions (chloride, bromide and sulfate)	Major cations (calcium, magnesium, sodium and potassium)	Iron and aluminium	TRH/BTEX				500mL Plastic	250mL Plastic	50mL Plastic	40mL Vial				Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MC4	13/10/22	W	X	X	X	X	X	X	X	X	X	X	X					1		1						
2	MB5	13/10/22	W	X	X	X	X	X	X	X	X	X	X	X					1		1						couldn't filter 50ml metals
3	MB6	13/10/22	W	X	X	X	X	X	X	X	X	X	X	X					1		1						
4	MB7	13/10/22	W	X	X	X	X	X	X	X	X	X	X	X					1		1						
5	QC01	13/10/22	W	X	X	X	X	X	X	X	X	X	X	X					1		1						
6	Trip Blank		W												X							1					
7																											
8																											
9																											
10																											
		Total Counts		5	5	5	5	5	5	5	5	5	5	5	1				5		5	1					

Method of Shipment	☐ Courier (#)	☐ Hand Delivered	☐ Postal	Name		Signature		Date		Time	
Eurofins | mgt Laboratory Use Only	Received By	BH	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	13/10/22	Time	16:00	Temperature	2.8
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	931547

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

360 Environmental
10 Bermondsey St
West Leederville
WA 6007

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Alison Prior**

Report **931547-W**
Project name CASUARINA SOUTH GROUNDWATER MONITORING
Project ID 4763
Received Date Oct 13, 2022

Client Sample ID			**MC4**	**MC5**	**MC6**	**MC7**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L22-Oc0025564**	**L22-Oc0025565**	**L22-Oc0025566**	**L22-Oc0025567**
Date Sampled			**Oct 13, 2022**	**Oct 13, 2022**	**Oct 13, 2022**	**Oct 13, 2022**
Test/Reference	LOR	Unit				
Alkalinity	5	mg CaCO3/L	< 5	< 5	16	13
Ammonia-N	0.02	mg/L	0.48	0.05	0.25	0.03
Bicarbonate	5	mg CaCO3/L	< 5	< 5	16	13
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Chloride	5	mg/L	590	21	130	28
Filterable Reactive Phosphorus	0.01	mg/L	0.03	0.15	0.02	< 0.01
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Nitrate-N	0.01	mg/L	< 0.01	1.9	< 0.01	5.0
Nitrite-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.03
NOx-N	0.01	mg/L	< 0.01	1.9	< 0.01	5.0
Sulfate	1	mg/L	400	< 1	38	23
Total Kjeldahl Nitrogen	0.2	mg/L	0.8	1.8	0.9	< 0.2
Total Nitrogen	0.2	mg/L	0.8	3.7	0.9	5.0
Total Phosphorus	0.01	mg/L	0.29	0.18	0.14	0.14
Total Suspended Solids	5	mg/L	< 5	8.0	< 5	< 5
Total Titratable Acidity	5	mg CaCO3/L	130	33	38	22
Bromide	0.1	mg/L	1.3	0.3	0.5	0.2
Heavy Metals						
Aluminium	0.05	mg/L	7.0	1.4	0.67	1.4
Iron	0.01	mg/L	21	0.20	0.91	0.18
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	71	7.3	6.4	4.2
Magnesium	0.5	mg/L	89	3.2	12	6.5
Potassium	0.5	mg/L	14	0.6	5.8	5.6
Sodium	0.5	mg/L	430	10.0	84	30

Client Sample ID			QC01	Trip Blank
Sample Matrix			Water	Water
Eurofins Sample No.			L22-Oc0025568	L22-Oc0025569
Date Sampled			Oct 13, 2022	Oct 13, 2022
Test/Reference	LOR	Unit		
Alkalinity	5	mg CaCO3/L	15	-
Ammonia-N	0.02	mg/L	0.03	-
Bicarbonate	5	mg CaCO3/L	15	-
Carbonate	5	mg CaCO3/L	< 5	-
Chloride	5	mg/L	31	-
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01	-
Hydroxide	5	mg CaCO3/L	< 5	-
Nitrate-N	0.01	mg/L	4.4	-
Nitrite-N	0.01	mg/L	0.03	-
NOx-N	0.01	mg/L	4.4	-
Sulfate	1	mg/L	23	-
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	-
Total Nitrogen	0.2	mg/L	4.4	-
Total Phosphorus	0.01	mg/L	0.09	-
Total Suspended Solids	5	mg/L	< 5	-
Total Titratable Acidity	5	mg CaCO3/L	9.4	-
Bromide	0.1	mg/L	0.2	-
Naphthalene[N02]	0.01	mg/L	-	< 0.01
Heavy Metals				
Aluminium	0.05	mg/L	1.5	-
Iron	0.01	mg/L	0.18	-
Eurofins Suite B11C: Na/K/Ca/Mg				
Calcium	0.5	mg/L	4.3	-
Magnesium	0.5	mg/L	6.4	-
Potassium	0.5	mg/L	5.2	-
Sodium	0.5	mg/L	32	-
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	0.02	mg/L	-	< 0.02
BTEX				
Benzene	0.001	mg/L	-	< 0.001
Toluene	0.001	mg/L	-	< 0.001
Ethylbenzene	0.001	mg/L	-	< 0.001
m&p-Xylenes	0.002	mg/L	-	< 0.002
o-Xylene	0.001	mg/L	-	< 0.001
Xylenes - Total*	0.003	mg/L	-	< 0.003
Total Recoverable Hydrocarbons				
TRH C6-C10	0.02	mg/L	-	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	-	< 0.02

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Alkalinity	Welshpool	Oct 14, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
Bicarbonate	Welshpool	Oct 14, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
Carbonate	Welshpool	Oct 14, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
Hydroxide	Welshpool	Oct 14, 2022	14 Day
- Method: ARL037 - Alkalinity in Water			
Ammonia-N	Welshpool	Oct 14, 2022	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Chloride	Welshpool	Oct 14, 2022	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Oct 14, 2022	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Oct 14, 2022	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Oct 14, 2022	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
Sulfate	Welshpool	Oct 14, 2022	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Total Phosphorus	Welshpool	Oct 14, 2022	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Total Suspended Solids	Welshpool	Oct 14, 2022	7 Days
- Method: ARL No. 016 - Total Suspended Solids			
Bromide	Welshpool	Oct 14, 2022	28 Days
- Method: ARL323 - Bromide in Water by Discrete Analyser			
Heavy Metals	Welshpool	Oct 14, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Oct 14, 2022	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
NOx-N	Welshpool	Oct 14, 2022	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Oct 14, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Oct 14, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Oct 14, 2022	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Oct 14, 2022	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Total Recoverable Hydrocarbons	Melbourne	Oct 14, 2022	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			

eurofins

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IANZ# 1290

Company Name: 360 Environmental
Address: 10 Bermondsey St
West Leederville
WA 6007

Project Name: CASUARINA SOUTH GROUNDWATER MONITORING
Project ID: 4763

Order No.:
Report #: 931547
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Oct 13, 2022 12:00 AM
Due: Oct 24, 2022
Priority: 7 Day
Contact Name: Alison Prior

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Ammonia-N	Bromide	Chloride	Filterable Reactive Phosphorus	Iron	Nitrate-N	Nitrite-N	Sulfate	Total Phosphorus	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B1	Eurofins Suite B11C: Na/K/Ca/Mg	Total Nitrogen	Alkalinity
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																					
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**																
1	MC4	Oct 13, 2022		Water	L22-Oc0025564	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
2	MC5	Oct 13, 2022		Water	L22-Oc0025565	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
3	MC6	Oct 13, 2022		Water	L22-Oc0025566	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
4	MC7	Oct 13, 2022		Water	L22-Oc0025567	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
5	QC01	Oct 13, 2022		Water	L22-Oc0025568	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
6	Trip Blank	Oct 13, 2022		Water	L22-Oc0025569													X			
Test Counts						5	5	5	5	5	5	5	5	5	5	5	5	1	5	5	5

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Titratable Acidity	mg CaCO3/L	< 5			5	Pass	
Bromide	mg/L	< 0.1			0.1	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	101			80-120	Pass	
Iron	%	98			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	103			80-120	Pass	
Magnesium	%	109			80-120	Pass	
Potassium	%	108			80-120	Pass	
Sodium	%	106			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Chloride	L22-Oc0025213	NCP	%	96			70-130	Pass	
NOx-N	L22-Oc0025544	NCP	%	117			80-120	Pass	
Sulfate	L22-Oc0025213	NCP	%	82			70-130	Pass	
Total Phosphorus	L22-Oc0025564	CP	%	96			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	L22-Oc0025563	NCP	%	103			75-125	Pass	
Iron	L22-Oc0025563	NCP	%	101			75-125	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L22-Oc0025563	NCP	%	91			75-125	Pass	
Magnesium	L22-Oc0025563	NCP	%	82			75-125	Pass	
Potassium	L22-Oc0025563	NCP	%	102			75-125	Pass	
Sodium	L22-Oc0025563	NCP	%	Q05			75-125	Fail	Q05
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
				Result 1					
Ammonia-N	L22-Oc0025568	CP	%	120			80-120	Pass	
Filterable Reactive Phosphorus	L22-Oc0025568	CP	%	109			80-120	Pass	
Nitrite-N	L22-Oc0025568	CP	%	113			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Chloride	L22-Oc0026264	NCP	mg/L	160	170	5.6	30%	Pass	
Sulfate	L22-Oc0026264	NCP	mg/L	130	130	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	L22-Oc0025108	NCP	mg/L	5.2	5.3	1.5	30%	Pass	
Iron	L22-Oc0025108	NCP	mg/L	0.30	0.29	1.9	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L22-Oc0025108	NCP	mg/L	5.0	5.1	1.6	30%	Pass	
Magnesium	L22-Oc0025108	NCP	mg/L	5.8	5.9	1.6	30%	Pass	
Potassium	L22-Oc0025108	NCP	mg/L	1.8	1.8	1.6	30%	Pass	
Sodium	L22-Oc0025108	NCP	mg/L	16	16	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Phosphorus	L22-Oc0025565	CP	mg/L	0.18	0.18	3.4	20%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia-N	L22-Oc0025567	CP	mg/L	0.03	0.02	8.0	20%	Pass	
Filterable Reactive Phosphorus	L22-Oc0025567	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Nitrate-N	L22-Oc0025567	CP	mg/L	5.0	5.1	2.4	30%	Pass	
Nitrite-N	L22-Oc0025567	CP	mg/L	0.03	0.03	7.1	20%	Pass	
NOx-N	L22-Oc0025567	CP	mg/L	5.0	5.2	2.4	20%	Pass	
Total Phosphorus	L22-Oc0025567	CP	mg/L	0.14	0.12	11	20%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Alkalinity	L22-Oc0025055	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Bicarbonate	L22-Oc0025055	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Carbonate	L22-Oc0025055	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Hydroxide	L22-Oc0025055	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined

Authorised by:

Natalie Hill	Analytical Services Manager
Kim Rodgers	Senior Analyst-Metal
Lauren Killin	Senior Analyst-Inorganic
Sam Becker	Senior Analyst-Inorganic
Sean Sangster	Senior Analyst-Metal

Kim Rodgers
Business Unit Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

☐ **Sydney Laboratory** Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066 02 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory** Unit 1 21 Smallwood Place Murarrie QLD 4172 07 3902 4600 EnviroSampleQLD@eurofins.com

☑ **Perth Laboratory** Unit 2 91 Leach Highway Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 6 Monterey Road Dandenong South VIC 3175 03 8564 5000 EnviroSampleVic@eurofins.com

Company	360 Environmental part of SLR	**Project №**	4763	**Project Manager**	Kuenzang	**Sampler(s)**	Pema
Address	500 Hay Street, Subiaco	**Project Name**	Casuarina South LSP LWMS	**EDD Format** ESdat, EQuIS etc	EsDat	**Handed over by**	Pema
Contact Name	Kuenzang Tshering					**Email for Invoice**	360accounts@slrconsulting.com
Phone №	426036143					**Email for Results**	labresults@360environmental.com.au, ktshering@slrconsulting.com
Special Directions							
Purchase Order							
Quote ID №	360 Blanket Quote						

Analyses Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Containers Change container type & size if necessary

Required Turnaround Time (TAT) Default will be 5 days if not ticked

♦Surcharge will apply

☐ Overnight (reporting by 9am)♦ ☐ Same day♦ ☐ 1 day♦ ☐ 2 days♦ ☐ 3 days♦ ☑ 5 days (Standard) ☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total Suspended Solids	Total Nitrogen	Ammonia as Nitrogen	Nitrate as Nitrogen	Nitrite as Nitrogen	Total Phosphorus	Reactive Phosphorus	Total titrable acidity and total alkalinity	Major anions (Chloride, bromide and sulfate)	Major cations (Calsium, magnesium, sodium and Potassium)	Iron and Aluminium	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MC4	27-03-23																					Dry
2	MB3	27-03-23																					Dry
3	MB5	27-03-23	W	X	X	X	X	X	X	X	X	X	X	X									
4	MB6	27-03-23	W	X	X	X	X	X	X	X	X	X	X	X									
5	MB7	27-03-23																					Dry
6	QC01	27-03-23	W	X	X	X	X	X	X	X	X	X	X	X									
7																							
8																							
9																							
	Total Counts								3	3	3	3	3	3									

Method of Shipment ☐ Courier (#) ☑ Hand Delivered ☐ Postal

Name		Signature		Date		Time		Time	
Eurofins | mgt Laboratory Use Only	Received By	Hayley	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	27/3/23	Time	4:00	Temperature	25.2
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	975129

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

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NATA# 2377 Site# 2370

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NATA# 1261 Site# 25403

Sydney
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Tel: 0800 856 450
IANZ# 1290

Sample Receipt Advice

Company name:	SLR Consulting Australia Pty Ltd
Contact name:	Kuenzang Tshering
Project name:	CASUARINA SOUTH LSP LWMS
Project ID:	4763
Turnaround time:	7 Day
Date/Time received	Mar 27, 2023 2:00 PM
Eurofins reference	975729

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 25.2 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Natalie Hill on phone : or by email: NatalieHill@eurofins.com

Results will be delivered electronically via email to Kuenzang Tshering - ktshering@slrconsulting.com.

Note: A copy of these results will also be delivered to the general SLR Consulting Australia Pty Ltd email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Tel: 0800 856 450
IANZ# 1290

Company Name: SLR Consulting Australia Pty Ltd
Address: Level 1, 500 Hay Street
Subiaco
WA 6008

Project Name: CASUARINA SOUTH LSP LWMS
Project ID: 4763

Order No.:
Report #: 975729
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Mar 27, 2023 2:00 PM
Due: Apr 5, 2023
Priority: 7 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Bromide	Iron	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg	Nutrients in water
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X
External Laboratory													
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**								
1	MB5	Mar 27, 2023		Water	L23-Ma0063846	X	X	X	X	X	X	X	X
2	MB6	Mar 27, 2023		Water	L23-Ma0063847	X	X	X	X	X	X	X	X
3	QC01	Mar 27, 2023		Water	L23-Ma0063848	X	X	X	X	X	X	X	X
Test Counts						3	3	3	3	3	3	3	3

CHAIN OF CUSTODY RECORD

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☑ **Perth Laboratory** Unit 2 91 Leach Highway Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 6 Monterey Road Dandenong South VIC 3175 03 8564 5000 EnviroSampleVic@eurofins.com

Company	360 Environmental part of SLR	**Project №**	4763	**Project Manager**	Kuenzang Tshering
Address	500 Hay Street, Subiaco	**Project Name**	Casuarina South LSP LWMS	**EDD Format** ESdat, EQuIS etc	EsDat
Contact Name	Kuenzang Tshering				
Phone №	426036143				
Special Directions					
Purchase Order					
Quote ID №	360 Blanket Quote				

Sampler(s)	Pema Dorji	
Handed over by	Pema Dorji	
Email for Invoice	AccountsPayableAU@slrconsulting.com	
Email for Results	labresults@360environmental.com.au, ktshering@slrconsulting.com	

Analyses Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Containers Change container type & size if necessary.

Required Turnaround Time (TAT) Default will be 5 days if not ticked. *Surcharge will apply

☐ Overnight (reporting by 9am)* ☐ Same day* ☐ 1 day* ☐ 2 days* ☐ 3 days* ☑ 5 days (Standard) ☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total Suspended Solids	Total Nitrogen	Ammonia as Nitrogen	Nitrate as Nitrogen	Nitrite as Nitrogen	Total Phosphorus	Reactive Phosphorus	Total titratable acidity and total alkalinity	Major anions (Chloride, bromide and sulfate)	Major cations (Calcium, magnesium, sodium and Potassium)	Iron and Aluminium	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MC4	31/07/23	W	X	X	X	X	X	X	X	X	X	X	X	1		1						Lab filter
2	MB3	31/07/23	W	X	X	X	X	X	X	X	X	X	X	X	1		1						Lab filter
3	MB5	31/07/23	W	X	X	X	X	X	X	X	X	X	X	X	1		1						Lab filter
4	MB6	31/07/23	W	X	X	X	X	X	X	X	X	X	X	X	1		1						Lab filter
5	MB7	31/07/23	W	X	X	X	X	X	X	X	X	X	X	X	1		1						Lab filter
6	QC01	31/07/23	W	X	X	X	X	X	X	X	X	X	X	X	1		1						Lab filter
7																							
8																							
9																							
		Total Counts													6		6						

Method of Shipment ☐ Courier (#) ☑ Hand Delivered ☐ Postal Name Signature Date Time

Eurofins | mgt Laboratory Use Only	Received By	Hayley	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	31/7/23	Time	16:34	Temperature	18.7
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	1012541

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NATA# 1261 Site# 20794

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Site# 25079 & 25289

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IANZ# 1290

Sample Receipt Advice

Company name:	SLR Consulting Australia Pty Ltd
Contact name:	Kuenzang Tshering
Project name:	CASUARINA SOUTH LSP LWMS
Project ID:	4763
Turnaround time:	5 Day
Date/Time received	Jul 31, 2023 4:34 PM
Eurofins reference	1012541

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 18.9 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Natalie Hill on phone : or by email: NatalieHill@eurofins.com

Results will be delivered electronically via email to Kuenzang Tshering - ktshering@slrconsulting.com.

Note: A copy of these results will also be delivered to the general SLR Consulting Australia Pty Ltd email address.

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Company Name: SLR Consulting Australia Pty Ltd
Address: Level 1, 500 Hay Street
Subiaco
WA 6008

Project Name: CASUARINA SOUTH LSP LWMS
Project ID: 4763

Order No.:
Report #: 1012541
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Jul 31, 2023 4:34 PM
Due: Aug 7, 2023
Priority: 5 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium (filtered)	Bromide	Chloride	Iron (filtered)	Sulfate	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Alkalinity	Eurofins Suite B19E
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X								
External Laboratory															
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
1	MC4	Jul 31, 2023		Water	L23-Au0000428	X	X	X	X	X	X	X	X	X	X
2	MB3	Jul 31, 2023		Water	L23-Au0000429	X	X	X	X	X	X	X	X	X	X
3	MB5	Jul 31, 2023		Water	L23-Au0000430	X	X	X	X	X	X	X	X	X	X
4	MB6	Jul 31, 2023		Water	L23-Au0000431	X	X	X	X	X	X	X	X	X	X
5	MB7	Jul 31, 2023		Water	L23-Au0000432	X	X	X	X	X	X	X	X	X	X
6	QC01	Jul 31, 2023		Water	L23-Au0000433	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6

SLR Consulting Australia Pty Ltd
Level 1, 500 Hay Street
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WA 6008

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Kuenzang Tshering**

Report **1012541-W**
Project name CASUARINA SOUTH LSP LWMS
Project ID 4763
Received Date Jul 31, 2023

Client Sample ID			**MC4**	**MB3**	**MB5**	**MB6**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L23-Au0000428**	**L23-Au0000429**	**L23-Au0000430**	**L23-Au0000431**
Date Sampled			**Jul 31, 2023**	**Jul 31, 2023**	**Jul 31, 2023**	**Jul 31, 2023**
Test/Reference	LOR	Unit				
Alkalinity	5	mg CaCO3/L	< 5	18	< 5	16
Ammonia-N	0.02	mg/L	0.59	0.08	0.08	0.03
Bicarbonate	5	mg CaCO3/L	< 5	18	< 5	16
Bromide	0.5	mg/L	< 2	< 0.5	< 0.5	< 0.5
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Chloride	5	mg/L	540	34	19	74
Filterable Reactive Phosphorus	0.01	mg/L	0.45	0.13	0.21	0.20
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Nitrate-N	0.01	mg/L	< 0.01	< 0.01	3.8	< 0.01
Nitrite-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
NOx-N	0.01	mg/L	< 0.01	< 0.01	3.8	< 0.01
Sulfate	1	mg/L	470	24	< 1	49
Total Kjeldahl Nitrogen	0.2	mg/L	0.9	0.7	0.6	1.6
Total Nitrogen	0.2	mg/L	0.9	0.7	4.4	1.6
Total Phosphorus	0.01	mg/L	0.45	0.13	7.0	0.20
Total Suspended Solids	5	mg/L	5.0	45	6.0	5.0
Total Titratable Acidity	5	mg CaCO3/L	130	20	29	39
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	5.6	0.35	0.83	1.4
Iron (filtered)	0.01	mg/L	22	0.11	0.09	0.17
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	40	2.8	4.7	8.2
Magnesium	0.5	mg/L	69	5.2	2.7	9.8
Potassium	0.5	mg/L	12	1.7	1.0	2.9
Sodium	0.5	mg/L	360	24	10.0	52

Client Sample ID			MB7	QC01
Sample Matrix			Water	Water
Eurofins Sample No.			L23-Au0000432	L23-Au0000433
Date Sampled			Jul 31, 2023	Jul 31, 2023
Test/Reference	LOR	Unit		
Alkalinity	5	mg CaCO3/L	27	25
Ammonia-N	0.02	mg/L	< 0.02	< 0.02
Bicarbonate	5	mg CaCO3/L	27	25
Bromide	0.5	mg/L	< 0.5	< 0.5
Carbonate	5	mg CaCO3/L	< 5	< 5
Chloride	5	mg/L	140	140
Filterable Reactive Phosphorus	0.01	mg/L	0.12	0.12
Hydroxide	5	mg CaCO3/L	< 5	< 5
Nitrate-N	0.01	mg/L	1.3	1.4
Nitrite-N	0.01	mg/L	< 0.01	0.01
NOx-N	0.01	mg/L	1.3	1.4
Sulfate	1	mg/L	34	40
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	5.6
Total Nitrogen	0.2	mg/L	1.3	7.0
Total Phosphorus	0.01	mg/L	0.12	12
Total Suspended Solids	5	mg/L	8.0	2700
Total Titratable Acidity	5	mg CaCO3/L	21	17
Heavy Metals				
Aluminium (filtered)	0.05	mg/L	0.12	0.66
Iron (filtered)	0.01	mg/L	0.24	0.14
Eurofins Suite B11C: Na/K/Ca/Mg				
Calcium	0.5	mg/L	2.6	5.7
Magnesium	0.5	mg/L	7.4	8.9
Potassium	0.5	mg/L	5.0	6.2
Sodium	0.5	mg/L	89	83

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Alkalinity	Welshpool	Aug 03, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Bicarbonate	Welshpool	Aug 03, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Carbonate	Welshpool	Aug 03, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Hydroxide	Welshpool	Aug 03, 2023	14 Day
- Method: ARL037 - Alkalinity in Water			
Ammonia-N	Welshpool	Aug 03, 2023	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Aug 03, 2023	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Aug 03, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Aug 03, 2023	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Aug 03, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Aug 01, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Aug 03, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Aug 03, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Bromide	Sydney	Aug 02, 2023	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Total Suspended Solids	Welshpool	Aug 03, 2023	7 Days
- Method: ARL No. 016 - Total Suspended Solids			
Heavy Metals (filtered)	Welshpool	Aug 03, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Aug 03, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Chloride	Welshpool	Aug 03, 2023	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Aug 03, 2023	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			

eurofins

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Project Name: CASUARINA SOUTH LSP LWMS
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Order No.:
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Received: Jul 31, 2023 4:34 PM
Due: Aug 7, 2023
Priority: 5 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium (filtered)	Bromide	Chloride	Iron (filtered)	Sulfate	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Alkalinity	Eurofins Suite B19E
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X								
External Laboratory															
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
1	MC4	Jul 31, 2023		Water	L23-Au0000428	X	X	X	X	X	X	X	X	X	X
2	MB3	Jul 31, 2023		Water	L23-Au0000429	X	X	X	X	X	X	X	X	X	X
3	MB5	Jul 31, 2023		Water	L23-Au0000430	X	X	X	X	X	X	X	X	X	X
4	MB6	Jul 31, 2023		Water	L23-Au0000431	X	X	X	X	X	X	X	X	X	X
5	MB7	Jul 31, 2023		Water	L23-Au0000432	X	X	X	X	X	X	X	X	X	X
6	QC01	Jul 31, 2023		Water	L23-Au0000433	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Bromide	mg/L	< 0.5			0.5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Total Suspended Solids	mg/L	< 5			5	Pass	
Total Titratable Acidity	mg CaCO3/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Bromide	%	101			70-130	Pass	
Total Phosphorus	%	80			80-120	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	89			80-120	Pass	
Iron (filtered)	%	83			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	82			80-120	Pass	
Magnesium	%	100			80-120	Pass	
Potassium	%	87			80-120	Pass	
Sodium	%	100			80-120	Pass	
CRM - % Recovery							
Ammonia-N	%	102			80-120	Pass	
Chloride	%	101			80-120	Pass	
Filterable Reactive Phosphorus	%	101			80-120	Pass	
Nitrate-N	%	111			80-120	Pass	
NOx-N	%	112			80-120	Pass	
Sulfate	%	107			80-120	Pass	
Total Nitrogen	%	84			80-120	Pass	
Total Suspended Solids	%	100			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Bromide	S23-Au0002471	NCP	%	81			70-130	Pass	
Total Phosphorus	L23-Jl0064032	NCP	%	88			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium (filtered)	L23-Jl0065379	NCP	%	93			75-125	Pass	
Iron (filtered)	L23-Jl0065379	NCP	%	81			75-125	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L23-Jl0068483	NCP	%	71			75-125	Fail	Q08
Magnesium	L23-Jl0068483	NCP	%	99			75-125	Pass	
Potassium	L23-Jl0068483	NCP	%	85			75-125	Pass	
Sodium	L23-Jl0068483	NCP	%	Q05			75-125	Fail	Q05
Spike - % Recovery									
				Result 1					
Total Nitrogen	L23-Au0000429	CP	%	108			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia-N	L23-Au0000433	CP	%	99			80-120	Pass	
Chloride	L23-Au0000433	CP	%	87			70-130	Pass	
Filterable Reactive Phosphorus	L23-Au0000433	CP	%	90			80-120	Pass	
Nitrate-N	L23-Au0000433	CP	%	103			70-130	Pass	
Nitrite-N	L23-Au0000433	CP	%	102			80-120	Pass	
NOx-N	L23-Au0000433	CP	%	103			80-120	Pass	
Sulfate	L23-Au0000433	CP	%	115			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Bromide	L23-Au0000428	CP	mg/L	< 2	< 2	<1	30%	Pass	
Total Nitrogen	L23-Au0000428	CP	mg/L	0.9	0.9	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	L23-Jl0065378	NCP	mg/L	0.07	0.07	<1	30%	Pass	
Iron (filtered)	L23-Jl0065378	NCP	mg/L	0.32	0.32	1.2	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L23-Jl0068482	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Magnesium	L23-Jl0068482	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Potassium	L23-Jl0068482	NCP	mg/L	6.0	6.0	1.3	30%	Pass	
Sodium	L23-Jl0068482	NCP	mg/L	150	150	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia-N	L23-Au0000432	CP	mg/L	< 0.02	< 0.02	<1	20%	Pass	
Chloride	L23-Au0000432	CP	mg/L	140	140	1.1	30%	Pass	
Filterable Reactive Phosphorus	L23-Au0000432	CP	mg/L	0.12	0.11	7.0	20%	Pass	
Nitrate-N	L23-Au0000432	CP	mg/L	1.3	1.3	2.4	30%	Pass	
Nitrite-N	L23-Au0000432	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx-N	L23-Au0000432	CP	mg/L	1.3	1.3	2.4	20%	Pass	
Sulfate	L23-Au0000432	CP	mg/L	34	34	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Suspended Solids	L23-Au0000433	CP	mg/L	2700	2900	7.1	20%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Ryan Phillips	Senior Analyst-Inorganic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

☐ **Sydney Laboratory**
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory**
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07 3902 4600 EnviroSampleQLD@eurofins.com

☑ **Perth Laboratory**
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08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory**
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	SLR Consulting Australia Pty Ltd	**Project №**	4739	**Project Manager**	Kuenzang
Address	Level 1, 500 Hay Street, Subiaco, Australia, WA 6008	**Project Name**	Casuarina South LSP	**EDD Format** (ESdat, EQuIS etc)	EsDat
Contact Name	Kuenzang Tshering				
Phone №	0426036143				
Special Directions					
Purchase Order					
Quote ID №	SLR Blanket Quote				

Sampler(s)	Olivia	
Handed over by	Olivia	
Email for Invoice	AccountsPayableAU@slrconsulting.com	
Email for Results	labresults@360environmental.com.au, ktshering@slrconsulting.com	

Analyses (Where metals are requested, please specify "Total" or "Filtered" - SUITE code must be used to attract SUITE pricing)

Containers (Change container type & size if necessary.)

Required Turnaround Time (TAT) (Default will be 5 days if not ticked.)

♦Surcharge will apply
☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☑ 5 days (Standard)
☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total Suspended Solids	Total Nitrogen	Ammonia as Nitrogen	Nitrate as Nitrogen	Nitrite as Nitrogen	Total Phosphorus	Reactive Phosphorus	Total titraable acidity and total alkalinity	Major anions (Chloride, bromide and sulfate)	Major cations (Calcium, magnesium, sodium and Potassium)	Iron and Aluminium	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MC4	30-08-23	W	X	X	X	X	X	X	X	X	X	X	X									
2	MB5	30-08-23	W	X	X	X	X	X	X	X	X	X	X	X									
3	MB6	30-08-23	W	X	X	X	X	X	X	X	X	X	X	X									
4	MB7	30-08-23	W	X	X	X	X	X	X	X	X	X	X	X									
5	MB20	30-08-23	W	X	X	X	X	X	X	X	X	X	X	X									
6	MB21	30-08-23	W	X	X	X	X	X	X	X	X	X	X	X									
7																							
8																							
9																							
	Total Counts								6	6	6	6	6	6									

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name		Signature		Date		Time	
Eurofins | mgt Laboratory Use Only	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	M. B	Date	30/8/23	Time	16:30	Temperature	16.4
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

1021623

www.eurofins.com.au EnviroSales@eurofins.com

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Tel: +64 9 525 0568
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Sample Receipt Advice

Company name:	SLR Consulting Australia Pty Ltd
Contact name:	Kuenzang Tshering
Project name:	CASUARINA SOUTH LSP
Project ID:	4739
Turnaround time:	5 Day
Date/Time received	Aug 30, 2023 4:30 PM
Eurofins reference	1021623

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 16.4 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
N/A	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Natalie Hill on phone : or by email: NatalieHill@eurofins.com

Results will be delivered electronically via email to Kuenzang Tshering - ktshering@slrconsulting.com.

Note: A copy of these results will also be delivered to the general SLR Consulting Australia Pty Ltd email address.

Global Leader - Results you can trust

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: SLR Consulting Australia Pty Ltd
Address: Level 1, 500 Hay Street
Subiaco
WA 6008

Project Name: CASUARINA SOUTH LSP
Project ID: 4739

Order No.:
Report #: 1021623
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Aug 30, 2023 4:30 PM
Due: Sep 6, 2023
Priority: 5 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Bromide	Chloride	Iron	Sulfate	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Alkalinity	Nutrients in water	Total Dissolved Solids (TDS)
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X								
External Laboratory															
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
1	MC4	Aug 30, 2023		Water	L23-Au0077795	X	X	X	X	X	X	X	X	X	X
2	MB5	Aug 30, 2023		Water	L23-Au0077796	X	X	X	X	X	X	X	X	X	X
3	MB6	Aug 30, 2023		Water	L23-Au0077797	X	X	X	X	X	X	X	X	X	X
4	MB7	Aug 30, 2023		Water	L23-Au0077798	X	X	X	X	X	X	X	X	X	X
5	MB20	Aug 30, 2023		Water	L23-Au0077799	X	X	X	X	X	X	X	X	X	X
6	MB21	Aug 30, 2023		Water	L23-Au0077800	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6

SLR Consulting Australia Pty Ltd
Level 1, 500 Hay Street
Subiaco
WA 6008

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Kuenzang Tshering**

Report **1021623-W**
Project name CASUARINA SOUTH LSP
Project ID 4739
Received Date Aug 30, 2023

Client Sample ID			**MC4**	**MB5**	**MB6**	**MB7**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L23-Au0077795**	**L23-Au0077796**	**L23-Au0077797**	**L23-Au0077798**
Date Sampled			**Aug 30, 2023**	**Aug 30, 2023**	**Aug 30, 2023**	**Aug 30, 2023**
Test/Reference	LOR	Unit				
Alkalinity	5	mg CaCO3/L	< 5	< 5	20	25
Ammonia-N	0.02	mg/L	0.38	0.09	0.23	0.05
Bicarbonate	5	mg CaCO3/L	< 5	< 5	20	25
Bromide	0.5	mg/L	< 5	< 5	< 5	< 5
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Chloride	5	mg/L	680	19	170	46
Filterable Reactive Phosphorus	0.01	mg/L	0.02	0.21	< 0.01	< 0.01
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Nitrate-N	0.01	mg/L	< 0.01	4.0	< 0.01	3.6
Nitrite-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.02
NOx-N	0.01	mg/L	< 0.01	4.0	< 0.01	3.6
Sulfate	1	mg/L	490	< 1	66	29
Total Kjeldahl Nitrogen	0.2	mg/L	0.9	1.0	1.6	< 0.2
Total Nitrogen	0.2	mg/L	0.9	5.0	1.6	3.6
Total Phosphorus	0.01	mg/L	0.02	0.21	0.05	0.04
Total Suspended Solids	5	mg/L	< 5	< 5	< 5	6.0
Total Titratable Acidity	5	mg CaCO3/L	160	35	51	30
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	7.5	0.77	0.58	0.06
Iron (filtered)	0.01	mg/L	25	0.07	1.2	0.07
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	72	7.5	17	2.5
Magnesium	0.5	mg/L	93	3.2	19	4.9
Potassium	0.5	mg/L	16	0.9	6.9	4.8
Sodium	0.5	mg/L	440	9.6	100	56

Client Sample ID			MB20	MB21
Sample Matrix			Water	Water
Eurofins Sample No.			L23-Au0077799	L23-Au0077800
Date Sampled			Aug 30, 2023	Aug 30, 2023
Test/Reference	LOR	Unit		
Alkalinity	5	mg CaCO3/L	19	42
Ammonia-N	0.02	mg/L	0.15	0.11
Bicarbonate	5	mg CaCO3/L	19	42
Bromide	0.5	mg/L	< 5	< 5
Carbonate	5	mg CaCO3/L	< 5	< 5
Chloride	5	mg/L	75	140
Filterable Reactive Phosphorus	0.01	mg/L	0.07	0.02
Hydroxide	5	mg CaCO3/L	< 5	< 5
Nitrate-N	0.01	mg/L	3.8	< 0.01
Nitrite-N	0.01	mg/L	< 0.01	< 0.01
NOx-N	0.01	mg/L	3.8	< 0.01
Sulfate	1	mg/L	29	46
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	4.7
Total Nitrogen	0.2	mg/L	3.9	4.7
Total Phosphorus	0.01	mg/L	0.06	0.51
Total Suspended Solids	5	mg/L	20	520
Total Titratable Acidity	5	mg CaCO3/L	33	26
Heavy Metals				
Aluminium (filtered)	0.05	mg/L	0.82	0.64
Iron (filtered)	0.01	mg/L	0.82	0.88
Eurofins Suite B11C: Na/K/Ca/Mg				
Calcium	0.5	mg/L	6.4	30
Magnesium	0.5	mg/L	8.0	24
Potassium	0.5	mg/L	2.1	3.3
Sodium	0.5	mg/L	56	87

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Alkalinity	Welshpool	Aug 31, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Bicarbonate	Welshpool	Aug 31, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Carbonate	Welshpool	Aug 31, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Hydroxide	Welshpool	Aug 31, 2023	14 Day
- Method: ARL037 - Alkalinity in Water			
Ammonia-N	Welshpool	Aug 31, 2023	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Aug 31, 2023	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Aug 31, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Aug 31, 2023	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Aug 31, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Aug 31, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Aug 31, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Aug 31, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Bromide	Sydney	Sep 01, 2023	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Total Suspended Solids	Welshpool	Aug 31, 2023	7 Days
- Method: ARL No. 016 - Total Suspended Solids			
Heavy Metals (filtered)	Welshpool	Aug 31, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Aug 31, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Chloride	Welshpool	Aug 31, 2023	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Aug 31, 2023	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			

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Company Name: SLR Consulting Australia Pty Ltd
Address: Level 1, 500 Hay Street
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WA 6008

Project Name: CASUARINA SOUTH LSP
Project ID: 4739

Order No.:
Report #: 1021623
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Aug 30, 2023 4:30 PM
Due: Sep 6, 2023
Priority: 5 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Bromide	Chloride	Iron	Sulfate	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Alkalinity	Nutrients in water	Total Dissolved Solids (TDS)
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X								
External Laboratory															
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**										
1	MC4	Aug 30, 2023		Water	L23-Au0077795	X	X	X	X	X	X	X	X	X	X
2	MB5	Aug 30, 2023		Water	L23-Au0077796	X	X	X	X	X	X	X	X	X	X
3	MB6	Aug 30, 2023		Water	L23-Au0077797	X	X	X	X	X	X	X	X	X	X
4	MB7	Aug 30, 2023		Water	L23-Au0077798	X	X	X	X	X	X	X	X	X	X
5	MB20	Aug 30, 2023		Water	L23-Au0077799	X	X	X	X	X	X	X	X	X	X
6	MB21	Aug 30, 2023		Water	L23-Au0077800	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Bromide	mg/L	< 0.5			0.5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Total Suspended Solids	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Bromide	%	85			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	99			80-120	Pass	
Iron (filtered)	%	98			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	95			80-120	Pass	
Magnesium	%	98			80-120	Pass	
Potassium	%	88			80-120	Pass	
Sodium	%	96			80-120	Pass	
CRM - % Recovery							
Ammonia-N	%	106			80-120	Pass	
Chloride	%	110			80-120	Pass	
Filterable Reactive Phosphorus	%	101			80-120	Pass	
Nitrate-N	%	103			80-120	Pass	
Nitrite-N	%	112			80-120	Pass	
NOx-N	%	101			80-120	Pass	
Sulfate	%	105			80-120	Pass	
Total Suspended Solids	%	104			80-120	Pass	
CRM - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	100			90-110	Pass	
Iron (filtered)	%	93			90-110	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Ammonia-N	L23-Au0077186	NCP	%	113			80-120	Pass	
Bromide	S23-Au0072121	NCP	%	97			70-130	Pass	
Chloride	L23-Au0076893	NCP	%	106			70-130	Pass	
Filterable Reactive Phosphorus	L23-Au0076893	NCP	%	108			80-120	Pass	
Nitrate-N	L23-Au0077186	NCP	%	113			70-130	Pass	
Nitrite-N	L23-Au0077186	NCP	%	106			80-120	Pass	
NOx-N	L23-Au0077186	NCP	%	110			80-120	Pass	
Sulfate	L23-Au0076893	NCP	%	114			70-130	Pass	
Total Nitrogen	L23-Au0075686	NCP	%	103			70-130	Pass	
Total Phosphorus	L23-Au0075330	NCP	%	93			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium (filtered)	L23-Au0077796	CP	%	90			75-125	Pass	
Iron (filtered)	L23-Au0077796	CP	%	95			75-125	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L23-Au0077799	CP	%	121			75-125	Pass	
Magnesium	L23-Au0077799	CP	%	120			75-125	Pass	
Potassium	L23-Au0077799	CP	%	111			75-125	Pass	
Sodium	L23-Au0077799	CP	%	105			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia-N	L23-Au0077795	CP	mg/L	0.38	0.38	1.3	20%	Pass	
Bromide	L23-Au0077795	CP	mg/L	< 5	< 5	<1	30%	Pass	
Chloride	L23-Au0077795	CP	mg/L	680	700	2.4	30%	Pass	
Filterable Reactive Phosphorus	L23-Au0077795	CP	mg/L	0.02	0.02	11	20%	Pass	
Nitrate-N	L23-Au0077795	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Nitrite-N	L23-Au0077795	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx-N	L23-Au0077795	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Sulfate	L23-Au0077795	CP	mg/L	490	490	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	L23-Au0077795	CP	mg/L	7.5	7.5	<1	30%	Pass	
Iron (filtered)	L23-Au0077795	CP	mg/L	25	25	1.2	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Nitrogen	L23-Au0077798	CP	mg/L	3.6	3.9	9.7	30%	Pass	
Total Phosphorus	L23-Au0077798	CP	mg/L	0.04	0.05	8.6	20%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L23-Au0077798	CP	mg/L	2.5	2.4	2.9	30%	Pass	
Magnesium	L23-Au0077798	CP	mg/L	4.9	4.9	<1	30%	Pass	
Potassium	L23-Au0077798	CP	mg/L	4.8	4.8	<1	30%	Pass	
Sodium	L23-Au0077798	CP	mg/L	56	56	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Suspended Solids	L23-Au0077800	CP	mg/L	520	500	3.9	20%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Ryan Phillips	Senior Analyst-Inorganic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

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02 9900 8400 EnviroSampleNSW@eurofins.com

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☐ **Melbourne Laboratory**
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03 8564 5000 EnviroSampleVic@eurofins.com

Company	SLR Consulting Australia Pty Ltd	**Project №**	4739	**Project Manager**	Kuenzang
Address	Level 1, 500 Hay Street, Subiaco, Australia, WA 6008	**Project Name**	Casuarina South LSP	**EDD Format** (ESdat, EQuIS etc)	EsDat
Contact Name	Kuenzang Tshering				
Phone №	0426036143				
Special Directions					
Purchase Order					
Quote ID №	SLR Blanket Quote				

Sampler(s)	Kuenzang and Phuntsho	
Handed over by	Courier service by Eurofin	
Email for Invoice	AccountsPayableAU@slrconsulting.com	
Email for Results	labresults@360environmental.com.au, ktshering@slrconsulting.com	

Analyses (Where metals are requested please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing)

Containers (Change container type & size if necessary.)

Required Turnaround Time (TAT) (Default will be 5 days if not ticked.)

♦Surcharge will apply
☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☑ 5 days (Standard)
☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total Suspended Solids	Total Nitrogen	Ammonia as Nitrogen	Nitrate as Nitrogen	Nitrite as Nitrogen	Total Phosphorus	Reactive Phosphorus	Total titrasble acidity and total alkalinity	Major anions (Chloride, bromide and sulfate)	Major cations (Calcium, magnesium, sodium and Potassium)	Iron and Aluminium	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MC4	14-09-23	W	X	X	X	X	X	X	X	X	X	X	X									
2	MB5	14-09-23	W	X	X	X	X	X	X	X	X	X	X	X									
3	MB6	14-09-23	W	X	X	X	X	X	X	X	X	X	X	X									
4	MB7	14-09-23	W	X	X	X	X	X	X	X	X	X	X	X									
5	MB20	14-09-23	W	X	X	X	X	X	X	X	X	X	X	X									
6	MB21	14-09-23	W	X	X	X	X	X	X	X	X	X	X	X									
7																							
8																							
9																							
	Total Counts								6	6	6	6	6	6									

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name		Signature		Date		Time	
Eurofins | mgt Laboratory Use Only	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	15/9/23	Time	15:20	Temperature	3.6
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	1026581

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

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Sample Receipt Advice

Company name:	SLR Consulting Australia Pty Ltd
Contact name:	*ALL RESULTS/SRA/COC"S
Project name:	CASUARINA SOUTH LSP
Project ID:	4739
Turnaround time:	5 Day
Date/Time received	Sep 15, 2023 1:20 PM
Eurofins reference	1026581

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 3.6 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
N/A	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Natalie Hill on phone : or by email: NatalieHill@eurofins.com

Results will be delivered electronically via email to *ALL RESULTS/SRA/COC"S - labresults@slrconsulting.com.

Note: A copy of these results will also be delivered to the general SLR Consulting Australia Pty Ltd email address.

Global Leader - Results you can trust

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: SLR Consulting Australia Pty Ltd
Address: Level 1, 500 Hay Street
Subiaco
WA 6008

Project Name: CASUARINA SOUTH LSP
Project ID: 4739

Order No.:
Report #: 1026581
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Sep 15, 2023 1:20 PM
Due: Sep 22, 2023
Priority: 5 Day
Contact Name: *ALL RESULTS/SRA/COC"S

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Ammonia-N	Bromide	Chloride	Filterable Reactive Phosphorus	Iron	Nitrate-N	Nitrite-N	Sulfate	Total Phosphorus	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Nitrogen	Alkalinity
Perth Laboratory - NATA # 2377 Site # 2370						X	X		X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217								X												
External Laboratory																				
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**															
1	MC4	Sep 14, 2023		Water	L23-Se0036148	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB5	Sep 14, 2023		Water	L23-Se0036149	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB6	Sep 14, 2023		Water	L23-Se0036150	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	MB7	Sep 14, 2023		Water	L23-Se0036151	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	MB20	Sep 14, 2023		Water	L23-Se0036152	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	MB21	Sep 14, 2023		Water	L23-Se0036153	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

SLR Consulting Australia Pty Ltd
Level 1, 500 Hay Street
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WA 6008

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Kuenzang Tshering**

Report **1026581-W**
Project name CASUARINA SOUTH LSP
Project ID 4739
Received Date Sep 15, 2023

Client Sample ID			**MC4**	**MB5**	**MB6**	**MB7**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L23-Se0036148**	**L23-Se0036149**	**L23-Se0036150**	**L23-Se0036151**
Date Sampled			**Sep 14, 2023**	**Sep 14, 2023**	**Sep 14, 2023**	**Sep 14, 2023**
Test/Reference	LOR	Unit				
Alkalinity	5	mg CaCO3/L	< 5	< 5	15	29
Ammonia-N	0.02	mg/L	0.76	0.12	0.12	0.03
Bicarbonate	5	mg CaCO3/L	< 5	< 5	15	29
Bromide	0.5	mg/L	0.9	17	< 0.5	17
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Chloride	5	mg/L	590	18	120	41
Filterable Reactive Phosphorus	0.01	mg/L	0.22	0.15	0.01	< 0.01
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Nitrate-N	0.01	mg/L	0.76	3.9	< 0.01	4.0
Nitrite-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.03
NOx-N	0.01	mg/L	0.76	3.9	< 0.01	4.1
Sulfate	1	mg/L	520	< 1	67	28
Total Kjeldahl Nitrogen	0.2	mg/L	4.0	7.1	16	4.7
Total Nitrogen	0.2	mg/L	4.8	11	16	8.8
Total Phosphorus	0.01	mg/L	0.22	0.22	0.45	0.62
Total Suspended Solids	5	mg/L	96	27	33	840
Total Titratable Acidity	5	mg CaCO3/L	130	24	32	14
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	7.3	0.66	0.94	< 0.05
Iron (filtered)	0.01	mg/L	24	0.05	0.29	0.02
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	60	5.9	14	3.5
Magnesium	0.5	mg/L	88	2.6	11	5.4
Potassium	0.5	mg/L	14	0.8	8.3	4.7
Sodium	0.5	mg/L	400	9.4	75	48

Client Sample ID			MB20	MB21
Sample Matrix			Water	Water
Eurofins Sample No.			L23-Se0036152	L23-Se0036153
Date Sampled			Sep 14, 2023	Sep 14, 2023
Test/Reference	LOR	Unit		
Alkalinity	5	mg CaCO3/L	6.5	49
Ammonia-N	0.02	mg/L	0.03	0.08
Bicarbonate	5	mg CaCO3/L	6.5	49
Bromide	0.5	mg/L	19	0.6
Carbonate	5	mg CaCO3/L	< 5	< 5
Chloride	5	mg/L	27	110
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01	0.02
Hydroxide	5	mg CaCO3/L	< 5	< 5
Nitrate-N	0.01	mg/L	4.5	< 0.01
Nitrite-N	0.01	mg/L	< 0.01	< 0.01
NOx-N	0.01	mg/L	4.5	< 0.01
Sulfate	1	mg/L	14	38
Total Kjeldahl Nitrogen	0.2	mg/L	1.7	6.3
Total Nitrogen	0.2	mg/L	6.2	6.3
Total Phosphorus	0.01	mg/L	0.44	0.76
Total Suspended Solids	5	mg/L	240	1000
Total Titratable Acidity	5	mg CaCO3/L	18	24
Heavy Metals				
Aluminium (filtered)	0.05	mg/L	0.69	5.2
Iron (filtered)	0.01	mg/L	0.09	4.1
Eurofins Suite B11C: Na/K/Ca/Mg				
Calcium	0.5	mg/L	4.2	20
Magnesium	0.5	mg/L	3.0	21
Potassium	0.5	mg/L	1.1	4.0
Sodium	0.5	mg/L	19	87

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Alkalinity	Welshpool	Sep 19, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Bicarbonate	Welshpool	Sep 19, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Carbonate	Welshpool	Sep 19, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Hydroxide	Welshpool	Sep 19, 2023	14 Day
- Method: ARL037 - Alkalinity in Water			
Ammonia-N	Welshpool	Sep 19, 2023	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Sep 19, 2023	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Sep 19, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Sep 19, 2023	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Sep 19, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Sep 15, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Sep 19, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Sep 19, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Bromide	Sydney	Sep 20, 2023	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Total Suspended Solids	Welshpool	Sep 19, 2023	7 Days
- Method: ARL No. 016 - Total Suspended Solids			
Heavy Metals (filtered)	Welshpool	Sep 19, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Sep 19, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Chloride	Welshpool	Sep 19, 2023	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Sep 19, 2023	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			

eurofins

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Company Name: SLR Consulting Australia Pty Ltd
Address: Level 1, 500 Hay Street
Subiaco
WA 6008

Project Name: CASUARINA SOUTH LSP
Project ID: 4739

Order No.:
Report #: 1026581
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Sep 15, 2023 1:20 PM
Due: Sep 22, 2023
Priority: 5 Day
Contact Name: *ALL RESULTS/SRA/COC"S

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Ammonia-N	Bromide	Chloride	Filterable Reactive Phosphorus	Iron	Nitrate-N	Nitrite-N	Sulfate	Total Phosphorus	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Nitrogen	Alkalinity
Perth Laboratory - NATA # 2377 Site # 2370						X	X		X	X	X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217								X												
External Laboratory																				
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**															
1	MC4	Sep 14, 2023		Water	L23-Se0036148	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB5	Sep 14, 2023		Water	L23-Se0036149	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB6	Sep 14, 2023		Water	L23-Se0036150	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	MB7	Sep 14, 2023		Water	L23-Se0036151	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	MB20	Sep 14, 2023		Water	L23-Se0036152	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	MB21	Sep 14, 2023		Water	L23-Se0036153	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Bromide	mg/L	< 0.5			0.5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Total Suspended Solids	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Bromide	%	99			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	95			80-120	Pass	
Iron (filtered)	%	98			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	113			80-120	Pass	
Magnesium	%	111			80-120	Pass	
Potassium	%	113			80-120	Pass	
Sodium	%	108			80-120	Pass	
CRM - % Recovery							
Chloride	%	106			80-120	Pass	
Sulfate	%	108			80-120	Pass	
Total Phosphorus	%	90			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium (filtered)	L23-Se0040647	NCP	%	89			75-125	Pass	
Iron (filtered)	L23-Se0040647	NCP	%	88			75-125	Pass	
Spike - % Recovery									
				Result 1					
Bromide	L23-Se0036149	CP	%	74			70-130	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L23-Se0036149	CP	%	90			75-125	Pass	
Magnesium	L23-Se0036149	CP	%	101			75-125	Pass	
Potassium	L23-Se0036149	CP	%	94			75-125	Pass	
Sodium	L23-Se0036149	CP	%	95			75-125	Pass	
Spike - % Recovery									
				Result 1					
Ammonia-N	L23-Se0036152	CP	%	118			80-120	Pass	
Chloride	L23-Se0036152	CP	%	98			70-130	Pass	
Filterable Reactive Phosphorus	L23-Se0036152	CP	%	107			80-120	Pass	
Nitrate-N	L23-Se0036152	CP	%	108			70-130	Pass	
Nitrite-N	L23-Se0036152	CP	%	107			80-120	Pass	
NOx-N	L23-Se0036152	CP	%	108			80-120	Pass	
Sulfate	L23-Se0036152	CP	%	117			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia-N	L23-Se0036076	NCP	mg/L	0.11	0.11	<1	20%	Pass	
Bromide	L23-Se0036148	CP	mg/L	0.9	1.0	<1	30%	Pass	
Total Nitrogen	L23-Se0036058	NCP	mg/L	< 0.2	< 0.2	<1	30%	Pass	
Total Phosphorus	L23-Se0036058	NCP	mg/L	0.05	0.05	<1	20%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	L23-Se0040646	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Iron (filtered)	L23-Se0040646	NCP	mg/L	0.20	0.21	4.0	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L23-Se0036148	CP	mg/L	60	74	20	30%	Pass	
Magnesium	L23-Se0036148	CP	mg/L	88	89	1.1	30%	Pass	
Potassium	L23-Se0036148	CP	mg/L	14	14	1.1	30%	Pass	
Sodium	L23-Se0036148	CP	mg/L	400	410	1.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	L23-Se0036151	CP	mg/L	41	41	<1	30%	Pass	
Filterable Reactive Phosphorus	L23-Se0036151	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Nitrate-N	L23-Se0036151	CP	mg/L	4.0	4.0	<1	30%	Pass	
Nitrite-N	L23-Se0036151	CP	mg/L	0.03	0.04	2.9	20%	Pass	
NOx-N	L23-Se0036151	CP	mg/L	4.1	4.1	<1	20%	Pass	
Sulfate	L23-Se0036151	CP	mg/L	28	29	2.5	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Suspended Solids	L23-Se0036153	CP	mg/L	1000	1000	<1	20%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Lauren Killin	Senior Analyst-Inorganic
Ryan Phillips	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

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☐ **Brisbane Laboratory** Unit 1 21 Smallwood Place Murarrie QLD 4172 07 3902 4600 EnviroSampleQLD@eurofins.com

☑ **Perth Laboratory** Unit 2 91 Leach Highway Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 6 Monterey Road Dandenong South VIC 3175 03 8564 5000 EnviroSampleVic@eurofins.com

Company	SLR Consulting Australia Pty Ltd	Project №	675.V64739.00000	Project Manager	Kuenzang
Address	Level 1, 500 Hay Street, Subiaco WA Australia 6008	Project Name	Casuarina South LSP LWMS	EDD Format (ESdat, EQuIS etc)	EsDat
Contact Name	Kuenzang Tshering			Sampler(s)	Olivia Susanto
Phone №	0426036143			Handed over by	Olivia Susanto
Special Directions				Email for Invoice	AccountsPayableAU@slrconsulting.com
Purchase Order				Email for Results	labresults@360environmental.com.au, ktshering@slrconsulting.com
Quote ID №	SLR Blanket Quote				

Analyses (Where metals are requested, please specify 'Total' or 'Filtered'. SUITE code must be used to attract SUITE pricing)

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Total Suspended Solids	Total Nitrogen	Ammonia as Nitrogen	Nitrate as Nitrogen	Nitrite as Nitrogen	Total Phosphorus	Reactive Phosphorus	Total titrable acidity and total alkalinity	Major anions (Chloride, bromide and sulfate)	Major cations (Calsium, magnesium, sodium and Potassium)	Iron and Aluminium
1	MC4	25/10/23	W	X	X	X	X	X	X	X	X	X	X	X
2	MB5	25/10/23	W	X	X	X	X	X	X	X	X	X	X	X
3	MB6	25/10/23	W	X	X	X	X	X	X	X	X	X	X	X
4	MB20	25/10/23	W	X	X	X	X	X	X	X	X	X	X	X
5	MB21	25/10/23	W	X	X	X	X	X	X	X	X	X	X	X
6														
7														
8														
9														
	Total Counts								5	5	5	5	5	5

Containers (Change container type & size if necessary)

500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)

Required Turnaround Time (TAT) Default will be 5 days if not ticked

*Surcharge will apply

- ☐ Overnight (reporting by 9am)*
- ☐ Same day* ☐ 1 day*
- ☐ 2 days* ☐ 3 days*
- ☑ 5 days (Standard)
- ☐ Other( )

Sample Comments / Dangerous Goods Hazard Warning

Method of Shipment ☐ Courier (#) ☑ Hand Delivered ☐ Postal

Eurofins | mgt Laboratory Use Only	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Name		Signature	
	Received By	[signature]	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	[signature]	Date	25/10/23
						Time	15:50
						Temperature	2.7°
						Report №	1038180

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

CS3006_09 Modified by: F. Sanayei Approved by: D. R.Symons Approved on: 10 December 2018

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Sample Receipt Advice

Company name:	SLR Consulting Australia Pty Ltd - ENV
Contact name:	*ALL RESULTS/SRA/COC"S
Project name:	CASUARINA SOUTH LSP LWMS
Project ID:	675.V64739.00000
Turnaround time:	5 Day
Date/Time received	Oct 25, 2023 3:50 PM
Eurofins reference	1038181

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 2.7 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
N/A	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Natalie Hill on phone : or by email: NatalieHill@eurofins.com

Results will be delivered electronically via email to *ALL RESULTS/SRA/COC"S - labresults@slrconsulting.com.

Note: A copy of these results will also be delivered to the general SLR Consulting Australia Pty Ltd - ENV email address.

Global Leader - Results you can trust

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: SLR Consulting Australia Pty Ltd - ENV
Address: Level 1, 500 Hay Street
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WA 6008

Project Name: CASUARINA SOUTH LSP LWMS
Project ID: 675.V64739.00000

Order No.:
Report #: 1038181
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Oct 25, 2023 3:50 PM
Due: Nov 1, 2023
Priority: 5 Day
Contact Name: *ALL RESULTS/SRA/COC"S

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Acidity	Aluminium	Ammonia-N	Bromide	Filterable Reactive Phosphorus	Iron	Nitrate-N	Nitrite-N	Sulfate	Total Phosphorus	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Nitrogen
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X		X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217									X										
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	MC4	Oct 25, 2023		Water	L23-Oc0060209	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB5	Oct 25, 2023		Water	L23-Oc0060210	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB6	Oct 25, 2023		Water	L23-Oc0060211	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	MB20	Oct 25, 2023		Water	L23-Oc0060212	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	MB21	Oct 25, 2023		Water	L23-Oc0060213	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						5	5	5	5	5	5	5	5	5	5	5	5	5	5

SLR Consulting Australia Pty Ltd
Level 1, 500 Hay Street
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WA 6008

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Kuenzang Tshering**

Report **1038181-W**
Project name CASUARINA SOUTH LSP LWMS
Project ID 675.V64739.00000
Received Date Oct 25, 2023

Client Sample ID			**MC4**	**MB5**	**MB6**	**MB20**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L23-Oc0060209**	**L23-Oc0060210**	**L23-Oc0060211**	**L23-Oc0060212**
Date Sampled			**Oct 25, 2023**	**Oct 25, 2023**	**Oct 25, 2023**	**Oct 25, 2023**
Test/Reference	LOR	Unit				
Alkalinity	5	mg CaCO3/L	< 5	< 5	24	22
Ammonia-N	0.02	mg/L	0.64	0.14	0.43	0.22
Bicarbonate	5	mg CaCO3/L	< 5	< 5	24	22
Bromide	0.5	mg/L	< 5	< 0.5	< 0.5	< 0.5
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Chloride	5	mg/L	670	17	120	47
Filterable Reactive Phosphorus	0.01	mg/L	0.03	0.14	0.01	< 0.01
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Nitrate-N	0.01	mg/L	< 0.01	2.3	0.03	2.4
Nitrite-N	0.01	mg/L	< 0.01	0.01	< 0.01	< 0.01
NOx-N	0.01	mg/L	< 0.01	2.3	0.03	2.4
Sulfate	1	mg/L	600	< 1	39	27
Total Kjeldahl Nitrogen	0.2	mg/L	0.7	< 0.2	0.8	0.2
Total Nitrogen	0.2	mg/L	0.7	2.4	0.8	2.6
Total Phosphorus	0.01	mg/L	0.03	0.16	0.01	< 0.01
Total Suspended Solids	5	mg/L	< 5	< 5	< 5	15
Total Titratable Acidity	5	mg CaCO3/L	230	22	19	13
Heavy Metals						
Aluminium	0.05	mg/L	9.9	1.2	0.65	1.00
Iron	0.01	mg/L	46	0.10	0.92	0.16
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	83	6.2	3.6	6.4
Magnesium	0.5	mg/L	110	2.4	11	6.9
Potassium	0.5	mg/L	16	0.8	2.9	1.8
Sodium	0.5	mg/L	510	9.5	85	40

Client Sample ID			MB21
Sample Matrix			Water
Eurofins Sample No.			L23-Oc0060213
Date Sampled			Oct 25, 2023
Test/Reference	LOR	Unit	
Alkalinity	5	mg CaCO3/L	59
Ammonia-N	0.02	mg/L	0.39
Bicarbonate	5	mg CaCO3/L	59
Bromide	0.5	mg/L	1.0
Carbonate	5	mg CaCO3/L	< 5
Chloride	5	mg/L	120
Filterable Reactive Phosphorus	0.01	mg/L	0.03
Hydroxide	5	mg CaCO3/L	< 5
Nitrate-N	0.01	mg/L	< 0.01
Nitrite-N	0.01	mg/L	< 0.01
NOx-N	0.01	mg/L	< 0.01
Sulfate	1	mg/L	4.1
Total Kjeldahl Nitrogen	0.2	mg/L	1.3
Total Nitrogen	0.2	mg/L	1.3
Total Phosphorus	0.01	mg/L	0.07
Total Suspended Solids	5	mg/L	50
Total Titratable Acidity	5	mg CaCO3/L	27
Heavy Metals			
Aluminium	0.05	mg/L	2.8
Iron	0.01	mg/L	8.0
Eurofins Suite B11C: Na/K/Ca/Mg			
Calcium	0.5	mg/L	12
Magnesium	0.5	mg/L	17
Potassium	0.5	mg/L	3.2
Sodium	0.5	mg/L	82

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Alkalinity	Welshpool	Oct 28, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Bicarbonate	Welshpool	Oct 28, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Carbonate	Welshpool	Oct 28, 2023	14 Days
- Method: ARL037 - Alkalinity in Water			
Hydroxide	Welshpool	Oct 28, 2023	14 Day
- Method: ARL037 - Alkalinity in Water			
Ammonia-N	Welshpool	Oct 28, 2023	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Oct 28, 2023	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Oct 28, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Oct 28, 2023	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Oct 28, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Oct 26, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Oct 28, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Oct 28, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Bromide	Sydney	Oct 30, 2023	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Total Suspended Solids	Welshpool	Oct 28, 2023	7 Days
- Method: ARL No. 016 - Total Suspended Solids			
Heavy Metals	Welshpool	Oct 28, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Oct 28, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Chloride	Welshpool	Oct 28, 2023	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Oct 28, 2023	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			

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Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Acidity	Aluminium	Ammonia-N	Bromide	Filterable Reactive Phosphorus	Iron	Nitrate-N	Nitrite-N	Sulfate	Total Phosphorus	Total Suspended Solids	Total Titratable Acidity	Eurofins Suite B11C: Na/K/Ca/Mg	Total Nitrogen
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X		X	X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217									X										
External Laboratory																			
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**														
1	MC4	Oct 25, 2023		Water	L23-Oc0060209	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB5	Oct 25, 2023		Water	L23-Oc0060210	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB6	Oct 25, 2023		Water	L23-Oc0060211	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	MB20	Oct 25, 2023		Water	L23-Oc0060212	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	MB21	Oct 25, 2023		Water	L23-Oc0060213	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						5	5	5	5	5	5	5	5	5	5	5	5	5	5

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Total Suspended Solids	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	101			80-120	Pass	
Iron	%	99			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	99			80-120	Pass	
Magnesium	%	100			80-120	Pass	
Potassium	%	100			80-120	Pass	
Sodium	%	101			80-120	Pass	
CRM - % Recovery							
Chloride	%	93			80-120	Pass	
Nitrite-N	%	108			80-120	Pass	
Sulfate	%	94			80-120	Pass	
Total Suspended Solids	%	98			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Ammonia-N	L23-Oc0060057	NCP	%	111			80-120	Pass	
Chloride	L23-Oc0060057	NCP	%	100			70-130	Pass	
Filterable Reactive Phosphorus	L23-Oc0060057	NCP	%	109			80-120	Pass	
Nitrate-N	L23-Oc0060057	NCP	%	110			70-130	Pass	
Nitrite-N	L23-Oc0060057	NCP	%	104			80-120	Pass	
NOx-N	L23-Oc0060057	NCP	%	107			80-120	Pass	
Sulfate	L23-Oc0060057	NCP	%	104			70-130	Pass	
Total Nitrogen	L23-Oc0060030	NCP	%	94			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Phosphorus	L23-Oc0060030	NCP	%	89			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	L23-Oc0061551	NCP	%	101			75-125	Pass	
Iron	L23-Oc0061551	NCP	%	101			75-125	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L23-Oc0061551	NCP	%	93			75-125	Pass	
Magnesium	L23-Oc0061551	NCP	%	95			75-125	Pass	
Potassium	L23-Oc0061551	NCP	%	102			75-125	Pass	
Sodium	L23-Oc0061551	NCP	%	75			75-125	Pass	
Spike - % Recovery									
				Result 1					
Bromide	L23-Oc0060210	CP	%	97			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Alkalinity	L23-Oc0060020	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Ammonia-N	L23-Oc0060056	NCP	mg/L	0.04	0.03	12	20%	Pass	
Bicarbonate	L23-Oc0060020	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Bromide	L23-Oc0060209	CP	mg/L	< 5	< 5	<1	30%	Pass	
Carbonate	L23-Oc0060020	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Chloride	L23-Oc0060056	NCP	mg/L	< 5	< 5	<1	30%	Pass	
Filterable Reactive Phosphorus	L23-Oc0060056	NCP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Hydroxide	L23-Oc0060020	NCP	mg CaCO3/L	< 5	< 5	<1	20%	Pass	
Nitrate-N	L23-Oc0060056	NCP	mg/L	0.05	0.04	11	30%	Pass	
Nitrite-N	L23-Oc0060056	NCP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx-N	L23-Oc0060056	NCP	mg/L	0.05	0.04	11	20%	Pass	
Sulfate	L23-Oc0060056	NCP	mg/L	< 1	< 1	<1	30%	Pass	
Total Nitrogen	L23-Oc0060029	NCP	mg/L	6.3	3.9	5.5	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	L23-Oc0061578	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L23-Oc0061578	NCP	mg/L	67	69	2.5	30%	Pass	
Magnesium	L23-Oc0061578	NCP	mg/L	17	16	2.5	30%	Pass	
Potassium	L23-Oc0061578	NCP	mg/L	3.5	3.5	1.1	30%	Pass	
Sodium	L23-Oc0061578	NCP	mg/L	55	50	9.2	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Phosphorus	L23-Oc0060213	CP	mg/L	0.07	0.07	8.9	20%	Pass	
Total Suspended Solids	L23-Oc0060213	CP	mg/L	50	42	17	20%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Lauren Killin	Senior Analyst-Inorganic
Ryan Phillips	Senior Analyst-Inorganic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

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☐ Brisbane Laboratory
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☑ Perth Laboratory
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☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	SLR Consulting Australia Pty Ltd	**Project №**	72155.00004	**Project Manager**	Kuenzang
Address	Level 1, 500 Hay Street, Subiaco, Australia, WA 6008	**Project Name**	Casuarina GME 2024	**EDD Format** (ESdat, EQuIS etc)	EsDat
Contact Name	Kavindi Sahabandu				
Phone №	0406245350				
Special Directions					
Purchase Order					
Quote ID №	SLR Blanket Quote				

Sampler(s)	Kavindi Sahabandu
Handed over by	Kavindi Sahabandu
Email for Invoice	AccountsPayableAU@slrconsulting.com
Email for Results	ktshering@slrconsulting.com, ksahabandu@slrconsulting.com

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing

№	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix Solid (S) Water (W)	Ammonia as N	Nitrate as N	Nitrite as N	Nox-N	Total Kjeldahl nitrogen	Total nitrogen	Total phosphorus	Filterable reactive phosphorus	bicarbonate	Carbonate	Hydroxide	Total alkalinity	Major ions (Aluminium, Iron, calcium, magnesium, potassium, sodium, bromide, chloride, sulfate)
1	MC4	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB5	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB6	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
4	MB7	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
5	MB20	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
6	MB21	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
7	QC01	7-06-24	W	X	X	X	X	X	X	X	X	X	X	X	X	X
8																
9																
			Total Counts	7	7	7	7	7	7	7	7	7	7	7	7	7

Containers — Change container type & size if necessary

500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)

Required Turnaround Time (TAT) — Default will be 5 days if not ticked

♦Surcharge will apply

- ☐ Overnight (reporting by 9am)♦
- ☐ Same day♦ ☐ 1 day♦
- ☐ 2 days♦ ☐ 3 days♦
- ☑ 5 days (Standard)
- ☐ Other( )

Sample Comments / Dangerous Goods Hazard Warning

Method of Shipment	☐ Courier (#)	☑ Hand Delivered	☐ Postal	Name		Signature		Date		Time	

Eurofins | mgt Laboratory Use Only									
Received By	Kayla	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	7/6/24	Temperature	7.6
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	17:05	Report №	105981

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

× No sample was filtered.

SLR Consulting Australia Pty Ltd
Level 1, 500 Hay Street
Subiaco
WA 6008

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Kuenzang Tshering**

Report **1105981-W**
Project name CASUARINA GME 2024
Received Date Jun 07, 2024

Client Sample ID			**MC4**	**MB5**	**MB6**	**MB20**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L24-Jn0019913**	**L24-Jn0019914**	**L24-Jn0019915**	**L24-Jn0019916**
Date Sampled			**Jun 07, 2024**	**Jun 07, 2024**	**Jun 07, 2024**	**Jun 07, 2024**
Test/Reference	LOR	Unit				
Ammonia-N	0.02	mg/L	1.2	0.95	0.21	0.22
Bromide	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5
Chloride	5	mg/L	550	38	140	120
Filterable Reactive Phosphorus	0.01	mg/L	0.05	0.02	0.04	0.03
Nitrate-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.02
Nitrite-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
NOx-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.02
Sulfate	1	mg/L	420	13	40	44
Total Kjeldahl Nitrogen	0.2	mg/L	1.2	3.9	1.6	1.6
Total Nitrogen	0.2	mg/L	1.2	3.9	1.6	1.6
Total Phosphorus	0.01	mg/L	0.03	0.15	< 0.01	0.03
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	< 5	7.2	9.3	19
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	< 5	7.2	9.3	19
Heavy Metals						
Aluminium	0.05	mg/L	3.4	2.1	0.96	0.74
Iron	0.01	mg/L	22	2.1	1.4	0.18
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	57	3.7	2.4	7.9
Magnesium	0.5	mg/L	64	5.1	10	10
Potassium	0.5	mg/L	14	1.8	2.7	2.2
Sodium	0.5	mg/L	330	16	88	61

Client Sample ID			MB21	QC01
Sample Matrix			Water	Water
Eurofins Sample No.			L24-Jn0019917	L24-Jn0019918
Date Sampled			Jun 07, 2024	Jun 07, 2024
Test/Reference	LOR	Unit		
Ammonia-N	0.02	mg/L	0.17	0.19
Bromide	0.5	mg/L	< 0.5	< 0.5
Chloride	5	mg/L	310	110
Filterable Reactive Phosphorus	0.01	mg/L	0.03	0.03
Nitrate-N	0.01	mg/L	0.15	< 0.01
Nitrite-N	0.01	mg/L	< 0.01	< 0.01
NOx-N	0.01	mg/L	0.16	< 0.01
Sulfate	1	mg/L	280	40
Total Kjeldahl Nitrogen	0.2	mg/L	2.3	3.9
Total Nitrogen	0.2	mg/L	2.5	3.9
Total Phosphorus	0.01	mg/L	0.17	0.05
Alkalinity (speciated)				
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	6.9	9.0
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	6.9	9.0
Heavy Metals				
Aluminium	0.05	mg/L	2.5	1.3
Iron	0.01	mg/L	0.98	1.6
Eurofins Suite B11C: Na/K/Ca/Mg				
Calcium	0.5	mg/L	29	2.4
Magnesium	0.5	mg/L	61	9.9
Potassium	0.5	mg/L	2.9	2.5
Sodium	0.5	mg/L	170	86

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Ammonia-N	Welshpool	Jun 14, 2024	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Jun 14, 2024	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate-N	Welshpool	Jun 14, 2024	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite-N	Welshpool	Jun 14, 2024	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx-N	Welshpool	Jun 14, 2024	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Jun 10, 2024	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Jun 14, 2024	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Jun 14, 2024	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Bromide	Sydney	Jun 14, 2024	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Heavy Metals	Welshpool	Jun 14, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Jun 14, 2024	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Chloride	Welshpool	Jun 14, 2024	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate	Welshpool	Jun 14, 2024	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Alkalinity (speciated)	Welshpool	Jun 14, 2024	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			

eurofins

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Company Name: SLR Consulting Australia Pty Ltd - ENV
Address: Level 1, 500 Hay Street
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WA 6008

Project Name: CASUARINA GME 2024

Order No.:
Report #: 1105981
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Jun 7, 2024 5:05 PM
Due: Jun 14, 2024
Priority: 5 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Bromide	Iron	Eurofins Suite B11C: Na/K/Ca/Mg	Eurofins Suite B19E	Eurofins Suite B11E
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X				
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	MC4	Jun 07, 2024		Water	L24-Jn0019913	X	X	X	X	X	X
2	MB5	Jun 07, 2024		Water	L24-Jn0019914	X	X	X	X	X	X
3	MB6	Jun 07, 2024		Water	L24-Jn0019915	X	X	X	X	X	X
4	MB20	Jun 07, 2024		Water	L24-Jn0019916	X	X	X	X	X	X
5	MB21	Jun 07, 2024		Water	L24-Jn0019917	X	X	X	X	X	X
6	QC01	Jun 07, 2024		Water	L24-Jn0019918	X	X	X	X	X	X
Test Counts						6	6	6	6	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia-N	mg/L	< 0.02			0.02	Pass	
Chloride	mg/L	< 5			5	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Nitrate-N	mg/L	< 0.01			0.01	Pass	
Nitrite-N	mg/L	< 0.01			0.01	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Hydroxide Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Method Blank							
Bromide	mg/L	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Bromide	%	101			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	107			80-120	Pass	
Iron	%	102			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	105			80-120	Pass	
Magnesium	%	109			80-120	Pass	
Potassium	%	100			80-120	Pass	
Sodium	%	104			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Ammonia-N	L24-Jn0019914	CP	%	111			80-120	Pass	
Bromide	S24-Jn0013363	NCP	%	96			70-130	Pass	
Chloride	L24-Jn0019914	CP	%	118			70-130	Pass	
Filterable Reactive Phosphorus	L24-Jn0019914	CP	%	118			80-120	Pass	
Nitrate-N	L24-Jn0019914	CP	%	110			70-130	Pass	
Nitrite-N	L24-Jn0019914	CP	%	101			80-120	Pass	
NOx-N	L24-Jn0019914	CP	%	106			80-120	Pass	
Sulfate	L24-Jn0019914	CP	%	103			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Aluminium	L24-Jn0019916	CP	%	106			75-125	Pass	
Iron	L24-Jn0019916	CP	%	100			75-125	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L24-Jn0019916	CP	%	100			75-125	Pass	
Magnesium	L24-Jn0019916	CP	%	105			75-125	Pass	
Potassium	L24-Jn0019916	CP	%	98			75-125	Pass	
Sodium	L24-Jn0019916	CP	%	88			75-125	Pass	
Spike - % Recovery									
				Result 1					
Total Nitrogen	L24-Jn0019918	CP	%	95			70-130	Pass	
Total Phosphorus	L24-Jn0019918	CP	%	91			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia-N	L24-Jn0019913	CP	mg/L	1.2	1.2	3.6	20%	Pass	
Chloride	L24-Jn0019913	CP	mg/L	550	560	1.0	30%	Pass	
Filterable Reactive Phosphorus	L24-Jn0019913	CP	mg/L	0.05	0.05	<1	20%	Pass	
Nitrate-N	L24-Jn0020325	NCP	mg/L	2.8	2.9	3.3	30%	Pass	
Nitrite-N	L24-Jn0019913	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx-N	L24-Jn0019692	NCP	mg/L	0.25	0.26	4.8	20%	Pass	
Sulfate	L24-Jn0019913	CP	mg/L	420	420	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Bromide	N24-Jn0015476	NCP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	L24-Jn0019915	CP	mg/L	0.96	0.94	2.3	30%	Pass	
Iron	L24-Jn0019915	CP	mg/L	1.4	1.4	<1	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L24-Jn0019915	CP	mg/L	2.4	2.4	2.6	30%	Pass	
Magnesium	L24-Jn0019915	CP	mg/L	10	10	2.4	30%	Pass	
Potassium	L24-Jn0019915	CP	mg/L	2.7	2.6	1.9	30%	Pass	
Sodium	L24-Jn0019915	CP	mg/L	88	86	2.4	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Nitrogen	L24-Jn0019917	CP	mg/L	2.5	2.2	11	30%	Pass	
Total Phosphorus	L24-Jn0019917	CP	mg/L	0.17	0.16	9.5	20%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Ryan Phillips	Senior Analyst-Inorganic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

CHAIN OF CUSTODY RECORD

Eurofins | mgt ABN 50 005 085 521

☐ **Sydney Laboratory** Unit F3 Bld,F 16 Mars Road Lane Cove West NSW 2066 02 9900 8400 EnviroSampleNSW@eurofins.com

☐ **Brisbane Laboratory** Unit 1 21 Smallwood Place Murarrie QLD 4172 07 3902 4600 EnviroSampleQLD@eurofins.com

☑ **Perth Laboratory** Unit 2 91 Leach Highway Kewdale WA 6105 08 9251 9600 EnviroSampleWA@eurofins.com

☐ **Melbourne Laboratory** 6 Monterey Road Dandenong South VIC 3175 03 8564 5000 EnviroSampleVic@eurofins.com

Company	SLR Consulting Australia Pty Ltd	**Project №**	72597	**Project Manager**	Kuenzang
Address	Level 1, 500 Hay Street, Subiaco, Australia, WA 6008	**Project Name**	Casuarina GME 2024	**EDD Format** ESdat, EQuIS etc	EsDat
Contact Name	Kavindi Sahabandu				
Phone №	0406245350				
Special Directions	Please forward QC02 to the ALS Lab				
Purchase Order					
Quote ID №	SLR Blanket Quote				

Sampler(s)	Kavindi Sahabandu
Handed over by	Kavindi Sahabandu
Email for Invoice	AccountsPayableAU@slrconsulting.com
Email for Results	ktshering@slrconsulting.com, ksahabandu@slrconsulting.com

Analyses Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Containers Change container type & size if necessary.

Required Turnaround Time (TAT) Default will be 5 days if not ticked.

♦Surcharge will apply

☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☑ 5 days (Standard)
☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Nutrient (Ammonia as N, Nitrate as N, Nitrite as N, NOx-N, total Kjeldahl nitrogen, total nitrogen	Nutrient (total phosphorus filterable reactive phosphorus)	Alkalinity (bicarbonate, carbonate, hydroxide, total alkalinity)	Major ions (Aluminium, Iron, calcium, magnesium, potassium, sodium, bromide, chloride, sulfate)	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MC4	20-09-24	W	X	X	X	X									
2	MB5	20-09-24	W	X	X	X	X									
3	MB6	20-09-24	W	X	X	X	X									
4	MB7	20-09-24	W	X	X	X	X									
5	MB20	20-09-24	W	X	X	X	X									
6	MB21	20-09-24	W	X	X	X	X									
7	QC01	20-09-24	W	X	X	X	X									
8																
9																
			Total Counts	7	7	7	7									

Method of Shipment ☐ Courier (#) ☑ Hand Delivered ☐ Postal Name Signature Date Time

Eurofins | mgt Laboratory Use Only

Received By SYD | BNE | MEL | PER | ADL | NTL | DRW Signature Date 20/9/24 Time 1620 Temperature 6°C

Received By SYD | BNE | MEL | PER | ADL | NTL | DRW Signature Date Time Report № 114275

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

SLR Consulting Australia Pty Ltd
Level 1, 500 Hay Street
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WA 6008

NATA Accredited
Accreditation Number 2377
Site Number 2370 & 2554

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Kuenzang Tshering**

Report **1142175-W**
Project name CASUARINA GME 2024
Project ID 72597
Received Date Sep 20, 2024

Client Sample ID			**MC4**	**MB5**	**MB6**	**MB7**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L24-Se0059836**	**L24-Se0059837**	**L24-Se0059838**	**L24-Se0059839**
Date Sampled			**Sep 20, 2024**	**Sep 20, 2024**	**Sep 20, 2024**	**Sep 20, 2024**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.02	mg/L	0.44	< 0.02	< 0.02	< 0.02
Bromide	0.5	mg/L	< 2.5	< 0.5	< 0.5	< 0.5
Chloride	5	mg/L	590	14	81	20
Filterable Reactive Phosphorus	0.01	mg/L	0.03	0.12	0.01	< 0.01
Nitrate (as N)	0.01	mg/L	< 0.01	3.1	0.09	3.1
Nitrite (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
NOx (as N)	0.01	mg/L	< 0.01	3.1	0.09	3.1
Sulfate (as SO4)	1	mg/L	580	< 1	62	20
Total Kjeldahl Nitrogen	0.2	mg/L	0.7	0.6	1.7	0.5
Total Nitrogen	0.2	mg/L	0.7	3.7	1.8	3.6
Total Phosphorus	0.01	mg/L	0.03	0.18	0.03	0.02
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	11	15
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	11	15
Heavy Metals						
Aluminium	0.05	mg/L	8.6	1.1	1.4	1.3
Iron	0.01	mg/L	26	0.13	0.16	0.16
Eurofins Suite B11C: Na/K/Ca/Mg						
Calcium	0.5	mg/L	70	4.9	16	1.9
Magnesium	0.5	mg/L	98	2.2	9.9	4.1
Potassium	0.5	mg/L	13	< 0.5	12	3.8
Sodium	0.5	mg/L	500	8.1	71	25

Client Sample ID			MB20	MB21	QC01
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**L24-Se0059840**	**L24-Se0059841**	**L24-Se0059842**
Date Sampled			**Sep 20, 2024**	**Sep 20, 2024**	**Sep 20, 2024**
Test/Reference	LOR	Unit			
Ammonia (as N)	0.02	mg/L	0.10	0.05	< 0.02
Bromide	0.5	mg/L	< 0.5	0.5	< 0.5
Chloride	5	mg/L	45	120	85
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01	0.02	0.01
Nitrate (as N)	0.01	mg/L	1.8	< 0.01	0.08
Nitrite (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01
NOx (as N)	0.01	mg/L	1.8	< 0.01	0.08
Sulfate (as SO4)	1	mg/L	26	110	61
Total Kjeldahl Nitrogen	0.2	mg/L	0.7	1.2	1.7
Total Nitrogen	0.2	mg/L	2.5	1.2	1.8
Total Phosphorus	0.01	mg/L	0.02	0.05	0.01
Alkalinity (speciated)					
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	12	16	12
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5
Hydroxide Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5
Total Alkalinity (as CaCO3)	5	mg/L	12	16	12
Heavy Metals					
Aluminium	0.05	mg/L	0.80	1.7	1.3
Iron	0.01	mg/L	0.12	5.5	0.16
Eurofins Suite B11C: Na/K/Ca/Mg					
Calcium	0.5	mg/L	5.4	17	16
Magnesium	0.5	mg/L	6.7	27	9.6
Potassium	0.5	mg/L	1.3	3.1	11
Sodium	0.5	mg/L	36	96	69

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Ammonia (as N)	Welshpool	Sep 26, 2024	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Sep 26, 2024	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate (as N)	Welshpool	Sep 26, 2024	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite (as N)	Welshpool	Sep 26, 2024	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx (as N)	Welshpool	Sep 26, 2024	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Sep 24, 2024	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Sep 26, 2024	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Sep 26, 2024	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Bromide	Sydney	Sep 25, 2024	28 Days
- Method: In-house method LTM-INO-4270 Anions by Ion Chromatography			
Heavy Metals	Welshpool	Sep 26, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Eurofins Suite B11C: Na/K/Ca/Mg	Welshpool	Sep 26, 2024	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Chloride	Welshpool	Sep 26, 2024	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Sulfate (as SO4)	Welshpool	Sep 26, 2024	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Alkalinity (speciated)	Welshpool	Sep 26, 2024	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			

eurofins

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Address: Level 1, 500 Hay Street
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WA 6008

Project Name: CASUARINA GME 2024
Project ID: 72597

Order No.:
Report #: 1142175
Phone: 08 9388 8360
Fax: 08 9381 2360

Received: Sep 20, 2024 4:20 PM
Due: Sep 30, 2024
Priority: 5 Day
Contact Name: Kuenzang Tshering

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Aluminium	Bromide	Iron	Eurofins Suite B11C: Na/K/Ca/Mg	Eurofins Suite B19E	Eurofins Suite B11E
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X	X	X
Sydney Laboratory - NATA # 1261 Site # 18217							X				
External Laboratory											
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
1	MC4	Sep 20, 2024		Water	L24-Se0059836	X	X	X	X	X	X
2	MB5	Sep 20, 2024		Water	L24-Se0059837	X	X	X	X	X	X
3	MB6	Sep 20, 2024		Water	L24-Se0059838	X	X	X	X	X	X
4	MB7	Sep 20, 2024		Water	L24-Se0059839	X	X	X	X	X	X
5	MB20	Sep 20, 2024		Water	L24-Se0059840	X	X	X	X	X	X
6	MB21	Sep 20, 2024		Water	L24-Se0059841	X	X	X	X	X	X
7	QC01	Sep 20, 2024		Water	L24-Se0059842	X	X	X	X	X	X
Test Counts						7	7	7	7	7	7

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	**Colour:** Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Nitrate (as N)	mg/L	< 0.01			0.01	Pass	
Nitrite (as N)	mg/L	< 0.01			0.01	Pass	
NOx (as N)	mg/L	< 0.01			0.01	Pass	
Sulfate (as SO4)	mg/L	< 1			1	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Hydroxide Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Method Blank							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							
Chloride	mg/L	< 5			5	Pass	
Method Blank							
Bromide	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	99			80-120	Pass	
Iron	%	99			80-120	Pass	
LCS - % Recovery							
Eurofins Suite B11C: Na/K/Ca/Mg							
Calcium	%	100			80-120	Pass	
Magnesium	%	106			80-120	Pass	
Potassium	%	102			80-120	Pass	
Sodium	%	103			80-120	Pass	
LCS - % Recovery							
Bromide	%	98			70-130	Pass	
CRM - % Recovery							
Sulfate (as SO4)	%	101			80-120	Pass	
CRM - % Recovery							
Chloride	%	93			80-120	Pass	
CRM - % Recovery							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	%	110			70-130	Pass	
Hydroxide Alkalinity (as CaCO3)	%	110			70-130	Pass	
Total Alkalinity (as CaCO3)	%	110			70-130	Pass	
CRM - % Recovery							
Sulfate (as SO4)	%	111			80-120	Pass	
CRM - % Recovery							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chloride			%	95			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Ammonia (as N)	L24-Se0054700	NCP	%	101			80-120	Pass	
Chloride	L24-Se0054700	NCP	%	111			70-130	Pass	
Filterable Reactive Phosphorus	L24-Se0064807	NCP	%	109			80-120	Pass	
Nitrate (as N)	L24-Se0054700	NCP	%	105			70-130	Pass	
Nitrite (as N)	L24-Se0054700	NCP	%	110			80-120	Pass	
NOx (as N)	L24-Se0054700	NCP	%	107			80-120	Pass	
Sulfate (as SO4)	L24-Se0054700	NCP	%	114			70-130	Pass	
Total Nitrogen	L24-Se0059705	NCP	%	102			70-130	Pass	
Total Phosphorus	L24-Se0059705	NCP	%	101			80-120	Pass	
Spike - % Recovery									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1					
Calcium	L24-Se0064171	NCP	%	92			75-125	Pass	
Magnesium	L24-Se0064171	NCP	%	102			75-125	Pass	
Potassium	L24-Se0064171	NCP	%	102			75-125	Pass	
Sodium	L24-Se0064171	NCP	%	96			75-125	Pass	
Spike - % Recovery									
				Result 1					
Bromide	L24-Se0059842	CP	%	103			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	L24-Se0061182	NCP	mg/L	< 0.02	< 0.02	<1	20%	Pass	
Bromide	L24-Se0059836	CP	mg/L	< 2.5	< 2.5	<1	30%	Pass	
Chloride	L24-Se0061182	NCP	mg/L	29	29	<1	30%	Pass	
Filterable Reactive Phosphorus	L24-Se0064806	NCP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Nitrate (as N)	L24-Se0061279	NCP	mg/L	0.84	0.85	2.0	30%	Pass	
Nitrite (as N)	L24-Se0061182	NCP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx (as N)	L24-Se0061279	NCP	mg/L		0.85	2.0	20%	Pass	
Sulfate (as SO4)	L24-Se0061182	NCP	mg/L	16	16	1.0	30%	Pass	
Total Nitrogen	L24-Se0059704	NCP	mg/L	1.7	1.6	10	30%	Pass	
Total Phosphorus	L24-Se0059704	NCP	mg/L	0.03	0.03	10	20%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium	L24-Oc0002769	NCP	mg/L	1.3	**	2.0	30%	Pass	
Iron	L24-Oc0002769	NCP	mg/L	16	**	1.0	30%	Pass	
Duplicate									
Eurofins Suite B11C: Na/K/Ca/Mg				Result 1	Result 2	RPD			
Calcium	L24-Oc0002769	NCP	mg/L	260	**	6.0	30%	Pass	
Magnesium	L24-Oc0002769	NCP	mg/L	19	**	1.0	30%	Pass	
Potassium	L24-Oc0002769	NCP	mg/L	16	**	1.0	30%	Pass	
Sodium	L24-Oc0002769	NCP	mg/L	73	**	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Ryan Phillips	Senior Analyst-Inorganic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

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☐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: portkembla@alsglobal.com

CLIENT: SLR Consulting	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
OFFICE: Level 1/ 500 Hay Street, Subiaco, WA 6008	
PROJECT: Casuarina GME 2024	ALS QUOTE NO.:
ORDER NUMBER:	675.072597.00001
PROJECT MANAGER: Kuenzang Tshering	CONTACT PH: 0426036143
SAMPLER: Kavindi Sahabandu	SAMPLER MOBILE: 0406245350
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): ktshering@slrconsulting.com; ksahabandu@slrconsulting.com;	
Email Invoice to (will default to PM if no other addresses are listed): AccountsPayableAU@slrconsulting.com)	
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:	

COC SEQUENCE NUMBER (Circle)

COC:	1	2	3	4	5	6
OF:	1	2	3	4	5	6

Yes No N/A

Yes No N/A

°C

RELINQUISHED BY:	RECEIVED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME: ALS 1115 25/9	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	Nutrient (Ammonia as N, Nitrate as N, Nitrite as N, NOx-N, total Kjeldahl nitrogen, total nitrogen	Nutrient (total phosphorus filterable reactive phosphorus)	Alkalinity (bicarbonate, carbonate, hydroxide, total alkalinity)	Major Ions (Aluminium, Iron, calcium, magnesium, potassium, sodium, bromide, chloride, sulfate)			Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	QC02	20-09-2024	W			X	X	X	X			
				TOTAL								

Environmental Division Perth

Work Order Reference

EP2413874

Telephone : +61-8-9406 1301

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	: **EP2413874**	Page	: 1 of 4
Client	: **SLR CONSULTING AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: KUENZANG TSHERING	Contact	: Georgina Nearygrant
Address	: 503 MURRAY STREET PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: Casuarina GME 2024	Date Samples Received	: 25-Sep-2024 11:15
Order number	: 675.072597.00001	Date Analysis Commenced	: 26-Sep-2024
C-O-C number	: ----	Issue Date	: 03-Oct-2024 16:58
Sampler	: Kavindi Sahabandu		
Site	: ----		
Quote number	: EN-000		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 Contract 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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Bromide conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC02	----	----	----	----
				Sampling date / time	20-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2413874-001	--------	--------	--------	--------
					Result	----	----	----	----
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**0.186**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**8**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**8**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**33**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**116**	----	----	----	----
ED093T: Total Major Cations									
Calcium	7440-70-2	1	mg/L		**13**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**9**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**58**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**11**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**1.15**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.13**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.16**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.16**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.5**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	QC02	----	----	----	----
				Sampling date / time	20-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP2413874-001	--------	--------	--------	--------
					Result	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**1.7**	**----**	**----**	**----**	**----**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.08**	**----**	**----**	**----**	**----**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	**----**	**----**	**----**	**----**

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry / Biology).

(WATER) ED009: Anions

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2413874**	Page	: 1 of 8
Client	: **SLR CONSULTING AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: KUENZANG TSHERING	Telephone	: +61-8-9406 1301
Project	: Casuarina GME 2024	Date Samples Received	: 25-Sep-2024
Site	: ----	Issue Date	: 03-Oct-2024
Sampler	: Kavindi Sahabandu	No. of samples received	: 1
Order number	: 675.072597.00001	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED009: Anions	EM2416394--001	Anonymous	**Bromide**	24959-67-9	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP2413818--001	Anonymous	**Nitrite + Nitrate as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / **Container** / Client Sample ID(s)	*Extraction / Preparation*			*Analysis*		
	Date extracted	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EK055G: Ammonia as N by Discrete Analyser						
Clear Plastic Bottle - Natural						
QC02	----	----	----	26-Sep-2024	21-Sep-2024	**5**
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural						
QC02	----	----	----	26-Sep-2024	22-Sep-2024	**4**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser						
Clear Plastic Bottle - Natural						
QC02	----	----	----	27-Sep-2024	22-Sep-2024	**5**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser						
Clear Plastic Bottle - Natural						
QC02	28-Sep-2024	21-Sep-2024	**7**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser						
Clear Plastic Bottle - Natural						
QC02	28-Sep-2024	22-Sep-2024	**6**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser						
Clear Plastic Bottle - Natural						
QC02	----	----	----	26-Sep-2024	22-Sep-2024	**4**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)						
Total Metals by ICP-MS - Suite A	EG020A-T	0	11	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED009: Anions							
Clear Plastic Bottle - Natural (ED009-X)							
QC02	**20-Sep-2024**	**----**	----	**----**	**01-Oct-2024**	18-Oct-2024	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
QC02	**20-Sep-2024**	**----**	----	**----**	**03-Oct-2024**	04-Oct-2024	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
QC02	**20-Sep-2024**	**----**	----	**----**	**03-Oct-2024**	18-Oct-2024	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
QC02	**20-Sep-2024**	**----**	----	**----**	**03-Oct-2024**	18-Oct-2024	✓
ED093T: Total Major Cations							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (ED093T)							
QC02	**20-Sep-2024**	**01-Oct-2024**	18-Oct-2024	✓	**01-Oct-2024**	18-Oct-2024	✓
EG020T: Total Metals by ICP-MS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG020A-T)							
QC02	**20-Sep-2024**	**01-Oct-2024**	19-Mar-2025	✓	**01-Oct-2024**	19-Mar-2025	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK055G)							
QC02	**20-Sep-2024**	**----**	----	**----**	**26-Sep-2024**	21-Sep-2024	✗
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
QC02	**20-Sep-2024**	**----**	----	**----**	**26-Sep-2024**	22-Sep-2024	✗
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Natural (EK059G)							
QC02	**20-Sep-2024**	**----**	----	**----**	**27-Sep-2024**	22-Sep-2024	✗
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Natural (EK061G)							
QC02	**20-Sep-2024**	**28-Sep-2024**	21-Sep-2024	✗	**02-Oct-2024**	26-Oct-2024	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Natural (EK067G)							
QC02	**20-Sep-2024**	**28-Sep-2024**	22-Sep-2024	✗	**02-Oct-2024**	26-Oct-2024	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
QC02	**20-Sep-2024**	**----**	----	**----**	**26-Sep-2024**	22-Sep-2024	×

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(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by Auto Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Total	ED093T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	11	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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
Standard Anions -by IC (Extended Method)	ED009-X	WATER	In house: Referenced to APHA 4110B. This method is compliant with NEPM Schedule B(3)
Alkalinity by Auto Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
Major Cations - Total	ED093T	WATER	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Samples are digested by USEPA 3005 prior to analysis. The ICPAES technique ionises the sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

QUALITY CONTROL REPORT

Work Order	: **EP2413874**	Page	: 1 of 5
Client	: **SLR CONSULTING AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: KUENZANG TSHERING	Contact	: Georgina Nearygrant
Address	: 503 MURRAY STREET PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: Casuarina GME 2024	Date Samples Received	: 25-Sep-2024
Order number	: 675.072597.00001	Date Analysis Commenced	: 26-Sep-2024
C-O-C number	: ----	Issue Date	: 03-Oct-2024
Sampler	: Kavindi Sahabandu		
Site	: ----		
Quote number	: EN-000		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Efua Wilson	Metals Chemist	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED009: Anions (QC Lot: 6090574)									
EM2416394-001	Anonymous	ED009-X: Bromide	24959-67-9	0.01	mg/L	1.47	1.42	3.7	0% - 20%
EP2413853-006	Anonymous	ED009-X: Bromide	24959-67-9	0.01	mg/L	0.496	0.452	9.3	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 6093416)									
EP2413774-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	190	187	1.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	190	187	1.9	0% - 20%
EP2413782-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	343	341	0.6	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	343	341	0.6	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6082703)									
EP2413900-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	466	466	0.0	0% - 20%
EP2413864-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	18	18	0.0	0% - 50%
ED045G: Chloride by Discrete Analyser (QC Lot: 6082704)									
EP2413900-006	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1680	1670	1.0	0% - 20%
EP2413864-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	128	129	0.0	0% - 20%
ED093T: Total Major Cations (QC Lot: 6087045)									
EP2413874-001	QC02	ED093T: Calcium	7440-70-2	1	mg/L	13	13	0.0	0% - 50%
		ED093T: Magnesium	7439-95-4	1	mg/L	9	10	0.0	No Limit
		ED093T: Sodium	7440-23-5	1	mg/L	58	62	6.2	0% - 20%
		ED093T: Potassium	7440-09-7	1	mg/L	11	11	0.0	0% - 50%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 6087044)									
EP2413834-004	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.03	0.05	34.7	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.16	0.18	13.3	No Limit
EP2413932-003	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 6082979)									
EP2413864-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2413892-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6082701)									
EP2413900-006	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2413864-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 6082980)									
EP2413864-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	0.0	No Limit
EP2413892-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6084280)									
EP2413664-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.6	27.8	No Limit
EP2413806-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	102	101	0.8	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 6084279)									
EP2413664-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.02	0.06	113	No Limit
EP2413806-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.04	0.03	0.0	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 6082702)									
EP2413900-006	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP2413864-002	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.02	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED009: Anions (QCLot: 6090574)								
ED009-X: Bromide	24959-67-9	0.01	mg/L	<0.010	2 mg/L	101	93.0	109
ED037P: Alkalinity by PC Titrator (QCLot: 6093416)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	91.4	85.1	126
				<1	200 mg/L	94.4	90.5	111
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6082703)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	99.1	89.9	112
				<1	500 mg/L	97.2	89.9	112
ED045G: Chloride by Discrete Analyser (QCLot: 6082704)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.9	88.6	113
				<1	1000 mg/L	97.4	88.6	113
ED093T: Total Major Cations (QCLot: 6087045)								
ED093T: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	114	85.0	115
ED093T: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	114	85.0	115
ED093T: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	110	85.0	115
ED093T: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	106	85.0	115
EG020T: Total Metals by ICP-MS (QCLot: 6087044)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	103	91.6	114
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100	95.0	132
EK055G: Ammonia as N by Discrete Analyser (QCLot: 6082979)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	102	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6082701)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	100	88.7	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6082980)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6084280)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	95.6	80.0	115
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6084279)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6084279) - continued								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	93.8	70.0	110
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 6082702)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	104	89.4	109

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED009: Anions (QCLot: 6090574)							
EM2416394-001	Anonymous	ED009-X: Bromide	24959-67-9	0.2 mg/L	# Not Determined	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6082703)							
EP2413864-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	98.5	70.4	130
ED045G: Chloride by Discrete Analyser (QCLot: 6082704)							
EP2413864-001	Anonymous	ED045G: Chloride	16887-00-6	200 mg/L	126	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 6082979)							
EP2413818-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	96.5	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6082701)							
EP2413864-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	104	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6082980)							
EP2413818-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6084280)							
EP2413664-005	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	85.0	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6084279)							
EP2413664-005	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	82.6	70.0	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 6082702)							
EP2413864-001	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	111	70.0	130

Appendix C Groundwater & Surface Water Levels, Physico-Chemical Tables

Casuarina Groundwater Monitoring October 2022 to October 2024

Casuarina 6167, WA

Various Landowners (Casuarina LSP Area)

SLR Project No.: 675.0729597.00001

13 May 2025

Groundwater Levels

Monitoring Well	Sampling date	Easting	Northing	ToC (mAHD)	GL (mAHD)	DTW (mbTOC)	DTW (mbgl)	GWL (mAHD)	Water Temperature (°C)	DO (mg/L)	Specific Conductivity (µS/cm)	pH (pH unit)	ORP (mV)	Field observation
MC4	13-Sep-22	392218.689	6431300.085	13.859	13.375	---	---	---	---	---	---	---	---	---
MC4	13-Oct-22	392218.689	6431300.085	13.859	13.375	0.93	0.45	12.93	16.50	0.08	2959.00	4.59	-71.10	Odourless, colourless, low turbidity
MC4	03-Nov-22	392218.689	6431300.085	13.859	13.375	1.75	1.27	12.11	---	---	---	---	---	---
MC4	16-Dec-22	392218.689	6431300.085	13.859	13.375	1.26	0.78	12.60	---	---	---	---	---	---
MC4	20-Jan-23	392218.689	6431300.085	13.859	13.375	1.66	1.18	12.20	---	---	---	---	---	---
MC4	17-Feb-23	392218.689	6431300.085	13.859	13.375	1.89	1.41	11.97	---	---	---	---	---	---
MC4	27-Mar-23	392218.689	6431300.085	13.859	13.375	Dry	---	---	---	---	---	---	---	---
MC4	31-Jul-23	392218.689	6431300.085	13.859	13.375	0.55	0.07	13.31	14.90	0.22	2649.00	4.51	-89.20	Colourless, odourless, low turbidity
MC4	30-Aug-23	392218.689	6431300.085	13.859	13.375	1.06	0.58	12.80	15.70	0.20	3097.00	4.30	-165.40	Colourless, odourless, low turbidity
MC4	14-Sep-23	392218.689	6431300.085	13.859	13.375	0.96	0.48	12.90	16.50	0.09	2980.00	4.60	199.00	Colourless, odourless, low turbidity
MC4	25-Oct-23	392218.689	6431300.085	13.859	13.375	1.34	0.86	12.52	16.20	0.13	3468.00	4.38	218.50	Colourless, odourless, no turbidity
MC4	10-May-24	392218.689	6431300.085	13.859	13.375	2.22	1.74	11.64	---	---	---	---	---	---
MC4	07-Jun-24	392218.689	6431300.085	13.859	13.375	2.06	1.58	11.80	19.80	0.27	2432.00	4.22	-55.40	Odourless, Colourless, clear
MC4	11-Jul-24	392218.689	6431300.085	13.859	13.375	1.89	1.41	11.97	---	---	---	---	---	---
MC4	08-Aug-24	392218.689	6431300.085	13.859	13.375	1.11	0.63	12.75	---	---	---	---	---	---
MC4	20-Sep-24	392218.689	6431300.085	13.859	13.375	1.07	0.59	12.79	16.80	0.14	3108.00	4.27	-24.70	Colourless, odourless, no turbidity
MC4	11-Oct-24	392218.689	6431300.085	13.859	13.375	1.05	0.57	12.81	---	---	---	---	---	---
MB5	13-Sep-22	391999.759	6431331.303	13.97	13.473	1.50	1.00	12.47	---	---	---	---	---	---
MB5	13-Oct-22	391999.759	6431331.303	13.97	13.473	1.67	1.17	12.30	19.70	3.40	124.80	4.14	-30.70	Odourless, pale brown, low turbidity
MB5	03-Nov-22	391999.759	6431331.303	13.97	13.473	1.80	1.30	12.17	---	---	---	---	---	---
MB5	16-Dec-22	391999.759	6431331.303	13.97	13.473	1.96	1.46	12.01	---	---	---	---	---	---
MB5	20-Jan-23	391999.759	6431331.303	13.97	13.473	2.22	1.72	11.75	---	---	---	---	---	---
MB5	17-Feb-23	391999.759	6431331.303	13.97	13.473	2.44	1.94	11.53	---	---	---	---	---	---
MB5	27-Mar-23	391999.759	6431331.303	13.97	13.473	2.65	2.15	11.32	26.80	0.56	139.40	4.33	188.90	Brownish colour, odourless, low turbidity
MB5	31-Jul-23	391999.759	6431331.303	13.97	13.473	1.77	1.27	12.20	18.00	3.40	128.50	4.34	140.90	Light brown, odourless, low turbidity
MB5	30-Aug-23	391999.759	6431331.303	13.97	13.473	1.90	1.40	12.07	10.90	1.67	142.00	4.16	17.50	Light brown, odourless, medium turbidity
MB5	14-Sep-23	391999.759	6431331.303	13.97	13.473	1.60	1.10	12.37	17.00	1.20	131.20	4.30	15.00	Light brown, odourless, medium turbidity
MB5	25-Oct-23	391999.759	6431331.303	13.97	13.473	2.05	1.55	11.92	21.90	0.57	117.00	4.32	0.90	Pale yellow colour, odourless, low turbidity
MB5	10-May-24	391999.759	6431331.303	13.97	13.473	3.33	2.83	10.64	---	---	---	---	---	---
MB5	07-Jun-24	391999.759	6431331.303	13.97	13.473	2.85	2.35	11.12	23.60	0.10	156.20	4.99	-85.70	Odourless, Pale yellow, low turbidity
MB5	11-Jul-24	391999.759	6431331.303	13.97	13.473	2.66	2.16	11.31	---	---	---	---	---	---
MB5	08-Aug-24	391999.759	6431331.303	13.97	13.473	1.91	1.41	12.06	---	---	---	---	---	---
MB5	20-Sep-24	391999.759	6431331.303	13.97	13.473	1.85	1.35	12.12	19.80	3.76	98.90	4.36	210.60	Odourless, Pale yellow, low turbidity
MB5	11-Oct-24	391999.759	6431331.303	13.97	13.473	1.87	1.37	12.10	---	---	---	---	---	---
MB6	13-Sep-22	392225.481	6431157.863	13.878	13.344	0.74	0.20	13.14						
MB6	13-Oct-22	392225.481	6431157.863	13.878	13.344	0.89	0.36	12.99	17.60	0.10	503.30	5.48	-91.00	Slight organic odour, pale yellow colour, low turbidity
MB6	03-Nov-22	392225.481	6431157.863	13.878	13.344	1.41	0.88	12.47	---	---	---	---	---	---
MB6	16-Dec-22	392225.481	6431157.863	13.878	13.344	1.22	0.69	12.66	---	---	---	---	---	---
MB6	20-Jan-23	392225.481	6431157.863	13.878	13.344	1.63	1.10	12.25	---	---	---	---	---	---
MB6	17-Feb-23	392225.481	6431157.863	13.878	13.344	1.85	1.32	12.03	---	---	---	---	---	---
MB6	27-Mar-23	392225.481	6431157.863	13.878	13.344	2.20	1.67	11.68	22.30	0.34	486.50	5.46	-133.90	Colourless, rotten egg smell, low turbidity
MB6	31-Jul-23	392225.481	6431157.863	13.878	13.344	0.97	0.44	12.91	14.90	1.35	366.60	5.30	-44.60	Colourless, odourless, low turbidity
MB6	30-Aug-23	392225.481	6431157.863	13.878	13.344	1.03	0.50	12.85	15.80	0.27	683.00	5.15	-241.40	Colourless, odourless, low turbidity
MB6	14-Sep-23	392225.481	6431157.863	13.878	13.344	0.80	0.27	13.08	16.21	0.50	450.00	5.30	-85.00	Colourless, odourless, low turbidity
MB6	25-Oct-23	392225.481	6431157.863	13.878	13.344	1.32	0.79	12.56	18.30	0.06	513.20	5.37	-38.60	Colourless, odourless, low turbidity
MB6	10-May-24	392225.481	6431157.863	13.878	13.344	2.01	1.48	11.87	---	---	---	---	---	Roots blockage at 2.01 mbgl
MB6	07-Jun-24	392225.481	6431157.863	13.878	13.344	2.04	1.51	11.84	20.10	7.37	498.00	5.52	-126.30	Sulfur odour, Pale yellow, low turbidity
MB6	11-Jul-24	392225.481	6431157.863	13.878	13.344	1.82	1.29	12.06	---	---	---	---	---	---
MB6	08-Aug-24	392225.481	6431157.863	13.878	13.344	1.06	0.53	12.82	---	---	---	---	---	---
MB6	20-Sep-24	392225.481	6431157.863	13.878	13.344	0.98	0.45	12.90	17.90	0.36	470.10	5.09	-62.00	Sulfur odour, Pale yellow, low turbidity
MB6	11-Oct-24	392225.481	6431157.863	13.878	13.344	1.00	0.47	12.88	---	---	---	---	---	---

Groundwater Levels

Monitoring Well	Sampling date	Easting	Northing	ToC (mAHD)	GL (mAHD)	DTW (mbTOC)	DTW (mbgl)	GWL (mAHD)	Water Temperature (°C)	DO (mg/L)	Specific Conductivity (µS/cm)	pH (pH unit)	ORP (mV)	Field observation
MB7	13-Sep-22	392032.154	6430945.604	16.017	15.616	4.10	3.70	11.92	---	---	---	---	---	---
MB7	13-Oct-22	392032.154	6430945.604	16.017	15.616	4.20	3.80	11.81	18.30	0.86	201.20	5.77	-41.20	Odourless, colourless, low turbidity
MB7	03-Nov-22	392032.154	6430945.604	16.017	15.616	4.50	4.10	11.52	---	---	---	---	---	---
MB7	16-Dec-22	392032.154	6430945.604	16.017	15.616	4.84	4.44	11.18	---	---	---	---	---	---
MB7	20-Jan-23	392032.154	6430945.604	16.017	15.616	4.75	4.35	11.27	---	---	---	---	---	---
MB7	17-Feb-23	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	---
MB7	27-Mar-23	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	---
MB7	31-Jul-23	392032.154	6430945.604	16.017	15.616	4.82	4.42	11.20	17.70	1.22	520.40	5.69	-132.10	Colourless, odourless, medium turbidity
MB7	30-Aug-23	392032.154	6430945.604	16.017	15.616	4.66	4.26	11.36	18.50	0.91	318.60	5.32	-157.70	Colourless, odourless, low turbidity
MB7	14-Sep-23	392032.154	6430945.604	16.017	15.616	4.50	4.10	11.52	19.60	1.00	412.00	5.36	-143.20	Colourless, odourless, low turbidity
MB7	25-Oct-23	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	Bore was dry
MB7	10-May-24	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	Bore was dry
MB7	07-Jun-24	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	Bore was dry
MB7	11-Jul-24	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	Bore was dry
MB7	08-Aug-24	392032.154	6430945.604	16.017	15.616	Dry	---	---	---	---	---	---	---	Bore was dry
MB7	20-Sep-24	392032.154	6430945.604	16.017	15.616	4.57	4.17	11.45	19.50	1.37	171.30	5.51	42.70	Colourless, odourless, low turbidity
MB7	11-Oct-24	392032.154	6430945.604	16.017	15.616	4.53	4.13	11.49	---	---	---	---	---	---
MB20	13-Sep-22	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	13-Oct-22	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	03-Nov-22	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	16-Dec-22	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	20-Jan-23	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	17-Feb-23	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	27-Mar-23	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	31-Jul-23	392064.128	6431619.423	15.13	14.406	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB20	30-Aug-23	392064.128	6431619.423	15.13	14.406	2.96	2.24	12.17	19.20	0.37	354.90	5.37	-152.80	Pale yellow colour, odourless, medium turbidity
MB20	14-Sep-23	392064.128	6431619.423	15.13	14.406	2.95	2.23	12.18	18.90	0.24	345.00	5.24	-14.30	Pale yellow colour, odourless, less turbidity
MB20	25-Oct-23	392064.128	6431619.423	15.13	14.406	3.05	2.33	12.08	18.90	0.14	304.00	5.12	11.10	Pale yellow colour, odourless, less turbidity
MB20	10-May-24	392064.128	6431619.423	15.13	14.406	3.20	2.48	11.93	---	---	---	---	---	---
MB20	07-Jun-24	392064.128	6431619.423	15.13	14.406	3.30	2.58	11.83	22.80	0.54	7.70	5.49	-92.90	Odourless, Pale yellow, low turbidity
MB20	11-Jul-24	392064.128	6431619.423	15.13	14.406	3.27	2.55	11.86	---	---	---	---	---	---
MB20	08-Aug-24	392064.128	6431619.423	15.13	14.406	2.85	2.13	12.28	---	---	---	---	---	---
MB20	20-Sep-24	392064.128	6431619.423	15.13	14.406	2.97	2.25	12.16	19.80	0.56	260.40	5.45	-44.00	Odourless, Pale yellow, low turbidity
MB20	11-Oct-24	392064.128	6431619.423	15.13	14.406	3.00	2.28	12.13	---	---	---	---	---	---
MB21	13-Sep-22	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	13-Oct-22	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	03-Nov-22	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	16-Dec-22	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	20-Jan-23	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	17-Feb-23	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	27-Mar-23	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	31-Jul-23	391974.927	6431514.364	11.963	11.32	---	---	---	---	---	---	---	---	Bores were installed in Aug. 2023
MB21	30-Aug-23	391974.927	6431514.364	11.963	11.32	1.00	0.36	10.96	14.10	0.90	560.00	5.57	-145.10	Brown, odourless, high turbidity
MB21	14-Sep-23	391974.927	6431514.364	11.963	11.32	1.60	0.96	10.36	16.30	0.65	263.00	5.64	-50.60	Brown, odourless, high turbidity
MB21	25-Oct-23	391974.927	6431514.364	11.963	11.32	1.32	0.68	10.64	17.30	0.37	60.40	5.60	-14.60	Brown, odourless, medium turbidity
MB21	10-May-24	391974.927	6431514.364	11.963	11.32	2.82	2.18	9.14	---	---	---	---	---	---
MB21	07-Jun-24	391974.927	6431514.364	11.963	11.32	1.69	1.05	10.27	18.20	4.09	1397.00	5.03	27.40	Odourless, Pale yellow, low turbidity
MB21	11-Jul-24	391974.927	6431514.364	11.963	11.32	1.31	0.67	10.65	---	---	---	---	---	---
MB21	08-Aug-24	391974.927	6431514.364	11.963	11.32	0.97	0.33	10.99	---	---	---	---	---	---
MB21	20-Sep-24	391974.927	6431514.364	11.963	11.32	1.03	0.39	10.93	17.00	0.34	711.00	5.52	-23.50	Colourless, odourless, low turbidity
MB21	11-Oct-24	391974.927	6431514.364	11.963	11.32	1.03	0.39	10.93	---	---	---	---	---	---

*Standing water level for bores MB20 and MB21 are in mAHD while rest of the bores are in mbgl

Surface water Levels

Location	Easting	Northing	Date	RL Top of concrete (mAHD)	RL Staff zero (mAHD)	Staff Reading (m)	Surface Water Level (mAHD)	Observation
Gauge 1	392158.081	6430746.033	10-Oct-23	11.557	10.929	0.10	11.029	Installation of gauges
Gauge 1	392158.081	6430746.033	23-Oct-23	11.557	10.929	0.06	10.989	
Gauge 1	392158.081	6430746.033	10-May-24	11.557	10.929			Dry
Gauge 1	392158.081	6430746.033	11-Jul-24	11.557	10.929			Dry
Gauge 1	392158.081	6430746.033	08-Aug-24	11.557	10.929			No water on the gauge but there is water to the western part of the wetland
Gauge 1	392158.081	6430746.033	20-Sep-24	11.557	10.929	0.15	11.079	
Gauge 1	392158.081	6430746.033	11-Oct-24	11.557	10.929	0.2	11.129	
Gauge 2	392086.095	6431219.798	10-Oct-23	17.785	12.007	0.075	12.082	Installation of gauges
Gauge 2	392086.095	6431219.798	23-Oct-23	17.785	12.007	0.04	12.047	
Gauge 2	392086.095	6431219.798	10-May-24	17.785	12.007	0		Dry
Gauge 2	392086.095	6431219.798	11-Jul-24	17.785	12.007	0		Dry
Gauge 2	392086.095	6431219.798	08-Aug-24	17.785	12.007	0.26	12.267	
Gauge 2	392086.095	6431219.798	20-Sep-24	17.785	12.007	0.3	12.307	
Gauge 2	392086.095	6431219.798	11-Oct-24	17.785	12.007	0.3	12.307	

Appendix D Groundwater Quality and QA/QC Tables

Casuarina Groundwater Monitoring October 2022 to October 2024

Casuarina 6167, WA

Various Landowners (Casuarina LSP Area)

SLR Project No.: 675.0729597.00001

13 May 2025

Table A - Analytical Results

			Metals				Major/minor ions						Inorganics												
			Aluminium	Aluminium (filtered)	Iron	Iron (filtered)	Calcium	Magnesium	Potassium	Sulphate (filtered)	Sodium	Chloride (filtered)	Alkalinity (total) as CaCO3	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Bromide	TSS	Ammonia as N	Nitrogen (Total)	Kjeldahl Nitrogen Total	Nitrite + Nitrate as N	Nitrate (as N)	Nitrite (as N)	Phosphorus	Phosphorous filterable reactive (P)
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL			0.05	0.05	0.01	0.01	0.5	0.5	0.5	1	0.5	5	5	5	5	5	0.1	5	0.02	0.2	0.2	0.01	0.01	0.01	0.01	0.01
ADWG 2011 Aesthetic (Updated September 2022, Version 3.8)					0.3	0.3				250	180	250							0.4118[#1]							
AMCS 2021 NPUG Update			0.2	0.2	0.3	0.3				1,000		250														
ANZG (2018) Freshwater 95% toxicant DGVs			0.055[#2]	0.055[#2]															0.9[#3]							
Field ID	Date	Lab Report Number																								
MC4	13 Oct 2022	931547	7	-	21	-	71	89	14	400	430	590	<5	<5	-	<5	1.3	<5	0.48	0.8	0.8	<0.01	<0.01	<0.01	0.29	0.03
	31 Jul 2023	1012541	-	5.6	-	22	40	69	12	470	360	540	<5	<5	<5	<5	<2	5	0.59	0.9	0.9	<0.01	<0.01	<0.01	0.45	0.45
	30 Aug 2023	1021623	-	7.5	-	25	72	93	16	490	440	680	<5	<5	<5	<5	<5	<5	0.38	0.9	0.9	<0.01	<0.01	<0.01	0.02	0.02
	14 Sep 2023	1026581	-	7.3	-	24	60	88	14	520	400	590	<5	<5	<5	<5	0.9	96	0.76	4.8	4	0.76	0.76	<0.01	0.22	0.22
	25 Oct 2023	1038181	9.9	-	46	-	83	110	16	600	510	670	<5	<5	<5	<5	<5	<5	0.64	0.7	0.7	<0.01	<0.01	<0.01	0.03	0.03
	07 Jun 2024	1105981	3.4	-	22	-	57	64	14	420	330	550	<5	<5	<5	<5	<0.5	-	1.2	1.2	1.2	<0.01	<0.01	<0.01	0.03	0.05
	20 Sep 2024	1142175	8.6	-	26	-	70	98	13	580	500	590	<5	<5	<5	<5	<2.5	-	0.44	0.7	0.7	<0.01	<0.01	<0.01	0.03	0.03
MB5	13 Oct 2022	931547	1.4	-	0.2	-	7.3	3.2	0.6	<1	10	21	<5	<5	<5	<5	0.3	8	0.05	3.7	1.8	1.9	1.9	<0.01	0.18	0.15
	27 Mar 2023	975729	1.5	-	0.58	-	8.2	4	1.5	<1	20	26	<5	<5	<5	<5	<0.5	11	0.31	2.1	2.1	0.05	0.05	<0.01	0.26	0.19
	31 Jul 2023	1012541	-	0.83	-	0.09	4.7	2.7	1	<1	10	19	<5	<5	<5	<5	<0.5	6	0.08	4.4	0.6	3.8	3.8	<0.01	7	0.21
	30 Aug 2023	1021623	-	0.77	-	0.07	7.5	3.2	0.9	<1	9.6	19	<5	<5	<5	<5	<5	<5	0.09	5	1	4	4	<0.01	0.21	0.21
	14 Sep 2023	1026581	-	0.66	-	0.05	5.9	2.6	0.8	<1	9.4	18	<5	<5	<5	<5	17	27	0.12	11	7.1	3.9	3.9	<0.01	0.22	0.15
	25 Oct 2023	1038181	1.2	-	0.1	-	6.2	2.4	0.8	<1	9.5	17	<5	<5	<5	<5	<0.5	<5	0.14	2.4	<0.2	2.3	2.3	0.01	0.16	0.14
	07 Jun 2024	1105981	2.1	-	2.1	-	3.7	5.1	1.8	13	16	38	7.2	7.2	<5	<5	<0.5	-	0.95	3.9	3.9	<0.01	<0.01	<0.01	0.15	0.02
	20 Sep 2024	1142175	1.1	-	0.13	-	4.9	2.2	<0.5	<1	8.1	14	<5	<5	<5	<5	<0.5	-	<0.02	3.7	0.6	3.1	3.1	<0.01	0.18	0.12
MB6	13 Oct 2022	931547	0.67	-	0.91	-	6.4	12	5.8	38	84	130	16	16	<5	<5	0.5	<5	0.25	0.9	0.9	<0.01	<0.01	<0.01	0.14	0.02
	27 Mar 2023	975729	1.1	-	3.4	-	2.6	10	2.9	29	110	140	11	11	<5	<5	<0.5	14	0.31	0.7	0.7	<0.01	<0.01	<0.01	0.09	<0.01
	31 Jul 2023	1012541	-	1.4	-	0.17	8.2	9.8	2.9	49	52	74	16	16	<5	<5	<0.5	5	0.03	1.6	1.6	<0.01	<0.01	<0.01	0.2	0.2
	30 Aug 2023	1021623	-	0.58	-	1.2	17	19	6.9	66	100	170	20	20	<5	<5	<5	<5	0.23	1.6	1.6	<0.01	<0.01	<0.01	0.05	<0.01
	14 Sep 2023	1026581	-	0.94	-	0.29	14	11	8.3	67	75	120	15	15	<5	<5	<0.5	33	0.12	16	16	<0.01	<0.01	<0.01	0.45	0.01
	25 Oct 2023	1038181	0.65	-	0.92	-	3.6	11	2.9	39	85	120	24	24	<5	<5	<0.5	<5	0.43	0.8	0.8	0.03	0.03	<0.01	0.01	0.01
	07 Jun 2024	1105981	0.96	-	1.4	-	2.4	10	2.7	40	88	140	9.3	9.3	<5	<5	<0.5	-	0.21	1.6	1.6	<0.01	<0.01	<0.01	<0.01	0.04
	20 Sep 2024	1142175	1.4	-	0.16	-	16	9.9	12	62	71	81	11	11	<5	<5	<0.5	-	<0.02	1.8	1.7	0.09	0.09	<0.01	0.03	0.01
MB7	13 Oct 2022	931547	1.4	-	0.18	-	4.2	6.5	5.6	23	30	28	13	13	<5	<5	0.2	<5	0.03	5	<0.2	5	5	0.03	0.14	<0.01
	31 Jul 2023	1012541	-	0.12	-	0.24	2.6	7.4	5	34	89	140	27	27	<5	<5	<0.5	8	<0.02	1.3	<0.2	1.3	1.3	<0.01	0.12	0.12
	30 Aug 2023	1021623	-	0.06	-	0.07	2.5	4.9	4.8	29	56	46	25	25	<5	<5	<5	6	0.05	3.6	<0.2	3.6	3.6	0.02	0.04	<0.01
	14 Sep 2023	1026581	-	<0.05	-	0.02	3.5	5.4	4.7	28	48	41	29	29	<5	<5	17	840	0.03	8.8	4.7	4.1	4	0.03	0.62	<0.01
	20 Sep 2024	1142175	1.3	-	0.16	-	1.9	4.1	3.8	20	25	20	15	15	<5	<5	<0.5	-	<0.02	3.6	0.5	3.1	3.1	<0.01	0.02	<0.01
MB20	30 Aug 2023	1021623	-	0.82	-	0.82	6.4	8	2.1	29	56	75	19	19	<5	<5	<5	20	0.15	3.9	<0.2	3.8	3.8	<0.01	0.06	0.07
	14 Sep 2023	1026581	-	0.69	-	0.09	4.2	3	1.1	14	19	27	6.5	6.5	<5	<5	19	240	0.03	6.2	1.7	4.5	4.5	<0.01	0.44	<0.01
	25 Oct 2023	1038181	1	-	0.16	-	6.4	6.9	1.8	27	40	47	22	22	<5	<5	<0.5	15	0.22	2.6	0.2	2.4	2.4	<0.01	<0.01	<0.01
	07 Jun 2024	1105981	0.74	-	0.18	-	7.9	10	2.2	44	61	120	19	19	<5	<5	<0.5	-	0.22	1.6	1.6	0.02	0.02	<0.01	0.03	0.03
	20 Sep 2024	1142175	0.8	-	0.12	-	5.4	6.7	1.3	26	36	45	12	12	<5	<5	<0.5	-	0.1	2.5	0.7	1.8	1.8	<0.01	0.02	<0.01
MB21	30 Aug 2023	1021623	-	0.64	-	0.88	30	24	3.3	46	87	140	42	42	<5	<5	<5	520	0.11	4.7	4.7	<0.01	<0.01	<0.01	0.51	0.02
	14 Sep 2023	1026581	-	5.2	-	4.1	20	21	4	38	87	110	49	49	<5	<5	0.6	1,000	0.08	6.3	6.3	<0.01	<0.01	<0.01	0.76	0.02
	25 Oct 2023	1038181	2.8	-	8	-	12	17	3.2	4.1	82	120	59	59	<5	<5	1	50	0.39	1.3	1.3	<0.01	<0.01	<0.01	0.07	0.03
	07 Jun 2024	1105981	2.5	-	0.98	-	29	61	2.9	280	170	310	6.9	6.9	<5	<5	<0.5	-	0.17	2.5	2.3	0.16	0.15	<0.01	0.17	0.03
	20 Sep 2024	1142175	1.7	-	5.5	-	17	27	3.1	110	96	120	16	16	<5	<5	0.5	-	0.05	1.2	1.2	<0.01	<0.01	<0.01	0.05	0.02
	Statistics																									
	Number of Results		22	17	22	17	39	39	39	39	39	39	39	11	11	11	39	28	39	39	39	39	39	39	39	32
	Minimum Concentration		0.65	<0.05	0.1	0.02	1.9	2.2	<0.5	<1	8.1	14	<5	<5	<5	<5	0.2	5	<0.02	0.7	0.2	<0.01	<0.01	0.01	0.01	0.01
	Maximum Concentration		9.9	7.5	46	25	83	110	16	600	510	680	59	19	<5	<5	19	1,000	1.2	16	16	5	5	0.03	7	0.22
	Average Concentration *		2.4	2	6.4	4.7	19	24	5.2	120	121	174	14	9.4	2.5	2.5	2.1	106	0.25	3.3	2	1.3	1.3	0.0068	0.35	0.048

* A Non Detect Multiplier of 0.5 has been applied.

Comments

#1 Applied a conversion factor of 0.823 from NH3 (as NH3) to NH3 (as N)

#2 Moderate reliability

#3 High reliability. Ammonia as total ammonia, measured as [NH3-N] at pH 8. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species).

Environmental Standards

ANZG, 2018, ANZG (2018) Freshwater 95% toxicant DGVs

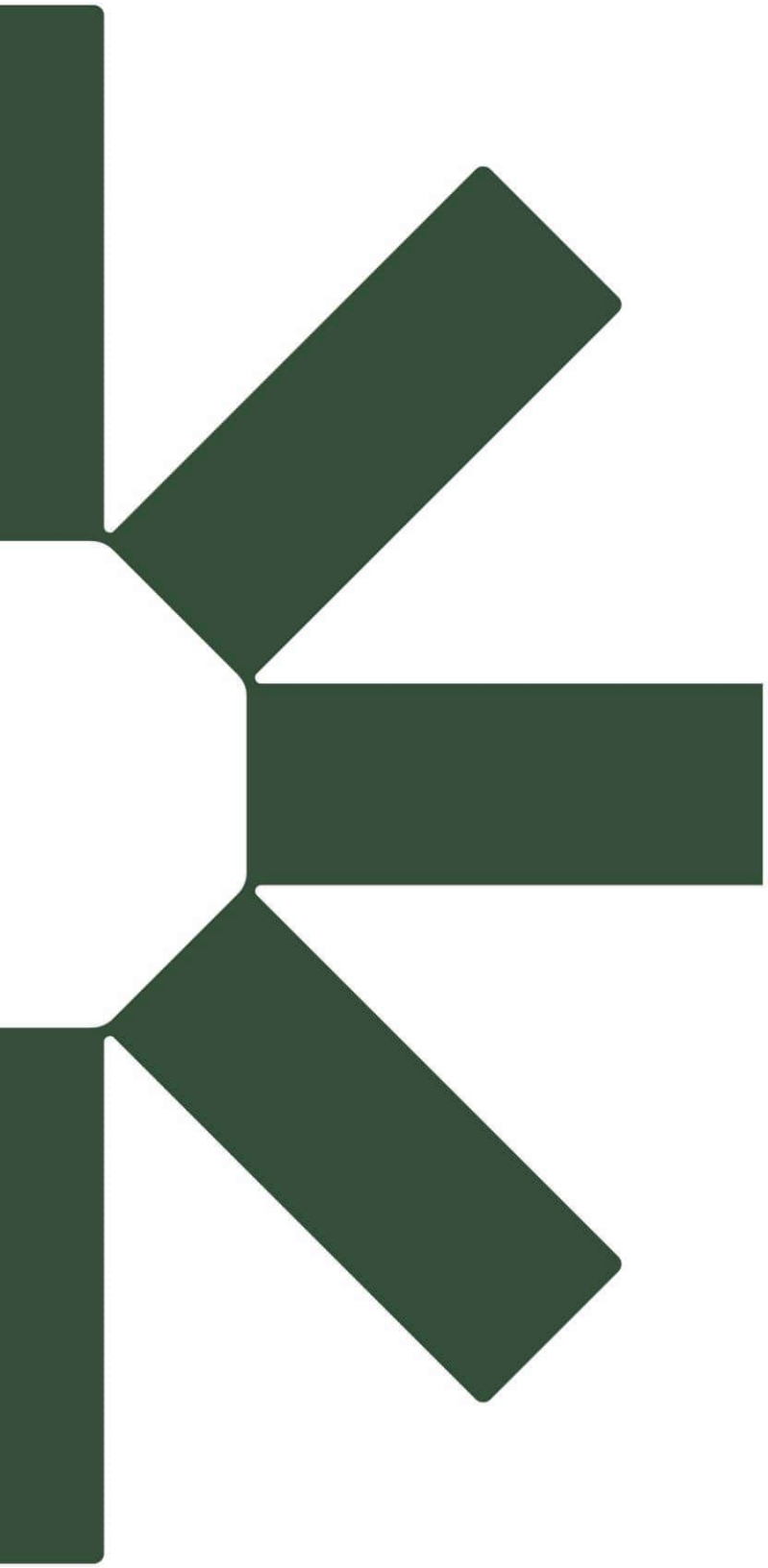
Table B - Historical QA/QC Results

Date			13-10-2022	13-10-2022	RPD	27-03-2023	27-03-2023	RPD	31-07-2023	31-07-2023	RPD	07 Jun 2024	07 Jun 2024	RPD	20 Sep 2024	20 Sep 2024	RPD	20 Sep 2024	20 Sep 2024	RPD
Sample Type			Normal	Field_D		Normal	Field_D		Normal	Field_D		Normal	Field_D		Normal	Field_D		Normal	Interlab_D	
Field ID			MC7	QC01		MB6	QC01		MB7	QC01		MB6	QC01		MB6	QC01		MB6	QC02	
Lab Report Number			L22-Oc0025567	L22-Oc0025568		L23-Ma0063847	L23-Ma0063848		1012541	1012541		1105981	1105981		1142175	1142175		1142175	EP2413874	
			Eurofins	Eurofins		Eurofins	Eurofins		Eurofins	Eurofins		Eurofins ARL	Eurofins ARL		Eurofins ARL	Eurofins ARL		Eurofins ARL	ALS	
	Unit	EQL																	
Metals																			
Aluminium	mg/L	0.01	1.4	1.5	7%	1.1	0.78	34%	0.12	0.66	138%	0.96	1.3	30	1.4	1.3	7	1.4	1.15	20
Iron	mg/L	0.01	0.18	0.18	0%	3.4	2.5	31%	0.24	0.14	53%	1.4	1.6	13	0.16	0.16	0	0.16	0.13	21
Major/minor ions																			
Calcium	mg/L	0.5	4.2	4.3	2%	2.6	2.3	12%	2.6	5.70	75%	2.4	2.4	0	16	16	0	16	13	21
Magnesium	mg/L	0.5	6.5	6.4	2%	10	9.6	4%	7.4	8.90	18%	10	9.9	1	9.9	9.6	3	9.9	9	10
Potassium	mg/L	0.5	5.6	5.2	7%	2.9	2.7	7%	5	6.20	21%	2.7	2.5	8	12	11	9	12	11	9
Sulphate (filtered)	mg/L	1	23	23	0%	29	27	7%	34	40.00	16%	40	40	0	62	61	2	62	33	61
Sodium	mg/L	0.5	30	32	6%	110	90	20%	89	83.00	7%	88	86	2	71	69	3	71	58	20
Chloride (filtered)	mg/L	1	28	31	10%	140	140	0%	140	140.00	0%	140	110	24	81	85	5	81	116	-
Inorganics																			
Alkalinity (total) as CaCO3	mg/L	1	13	15	14%	11	13	NC	27	25.00	8%	9.3	9	3	11	12	9	11	8	32
Alkalinity (Bicarbonate as CaCO	mg/L	1	13	15	14%	11	13	17%	27	25.00	8%	9.3	9	3	11	12	9	11	8	32
Alkalinity (Carbonate as CaCO3)	mg/L	1	<5	<5	NC	<5	<5	NC	<5	<5	NC	<5	<5	0	<5	<5	0	<5	<1	0
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<5	<5	NC	<5	<5	NC	<5	<5	NC	<5	<5	0	<5	<5	0	<5	<1	0
Bromide	mg/L	0.01	0.2	0.2	0%	<0.5	<0.5	NC	<5	<5	NC	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.186	0
Ammonia as N	mg/L	0.01	0.03	0.03	0%	0.31	0.34	9%	<0.02	0.02	NC	0.21	0.19	10	<0.02	<0.02	0	<0.02	<0.01	0
Nitrogen (Total)	mg/L	0.1	5	4.4	13%	0.7	0.7	0%	1.3	7.00	137%	1.6	3.9	84	1.8	1.8	0	1.8	1.7	6
Kjeldahl Nitrogen Total	mg/L	0.1	<0.2	<0.2	NC	0.7	0.7	0%	<0.2	5.60	NC	1.6	3.9	84	1.7	1.7	0	1.7	1.5	12
Nitrite + Nitrate as N	mg/L	0.01	5	4.4	13%	<0.01	<0.01	NC	1.3	1.40	7%	<0.01	<0.01	0	0.09	0.08	12	0.09	0.16	56
Nitrate (as N)	mg/L	0.01	5	4.4	13%	<0.01	<0.01	NC	1.3	1.40	7%	<0.01	<0.01	0	0.09	0.08	12	0.09	0.16	56
Nitrite (as N)	mg/L	0.01	0.03	0.03	0%	<0.01	<0.01	NC	<0.01	<0.02	NC	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0
Phosphorus	mg/L	0.01	0.14	0.09	43%	0.09	0.08	12%	0.12	12.00	196%	<0.01	0.05	133	0.03	0.01	100	0.03	0.08	91
Phosphorous filterable reactive	mg/L	0.01	<0.01	<0.01	NC	<0.01	<0.01	NC	0.12	0.12	NC	0.04	0.03	29	0.01	0.01	0	0.01	<0.01	-
Total Suspended Solids	mg/L	5.00	<5	<5	NC	14	9	43%	8	2700	199%	-	-	-	-	-	-	-	-	-

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 30 (1 - 10 x EQL); 30 (10 - 30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory



Making Sustainability Happen

Appendix D: Jandakot DWMP post-development model long-sections

(DoW, 2009)

THE INFORMATION CONTAINED HEREIN IS SUBJECT TO ONGOING REVIEW AND AMENDMENTS AND SHOULD BE READ IN CONJUNCTION WITH THE ASSOCIATED REPORT.

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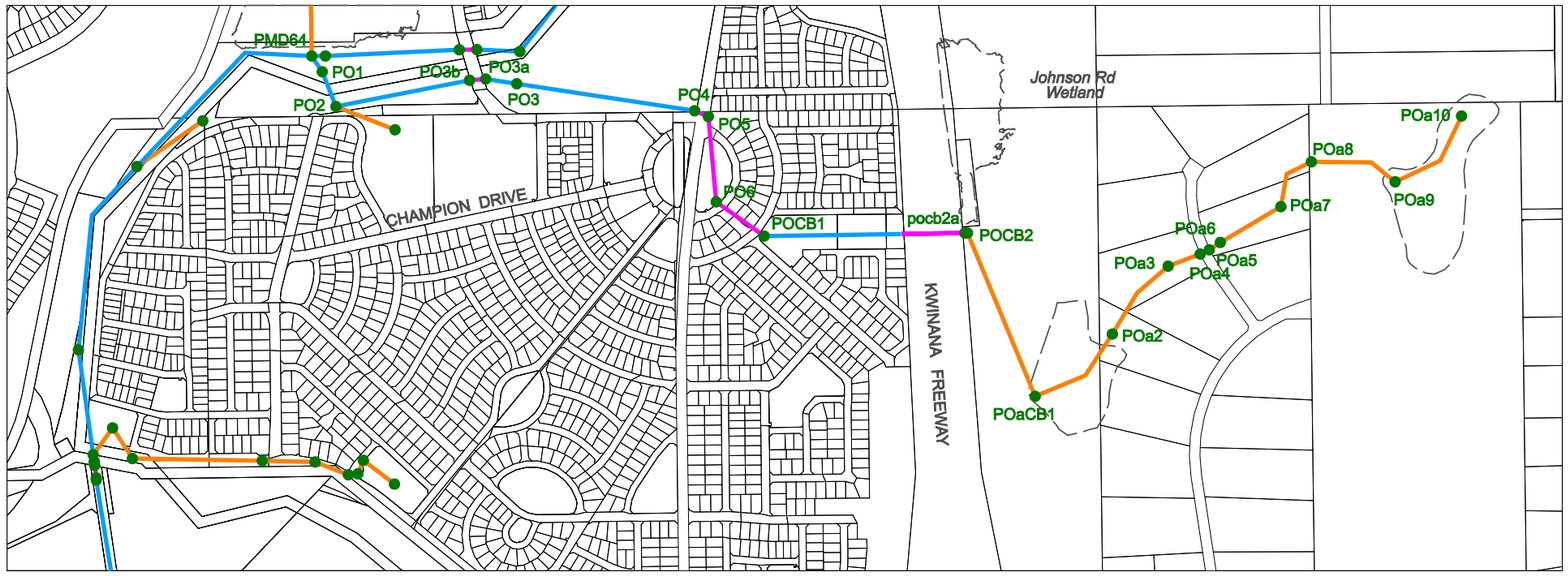

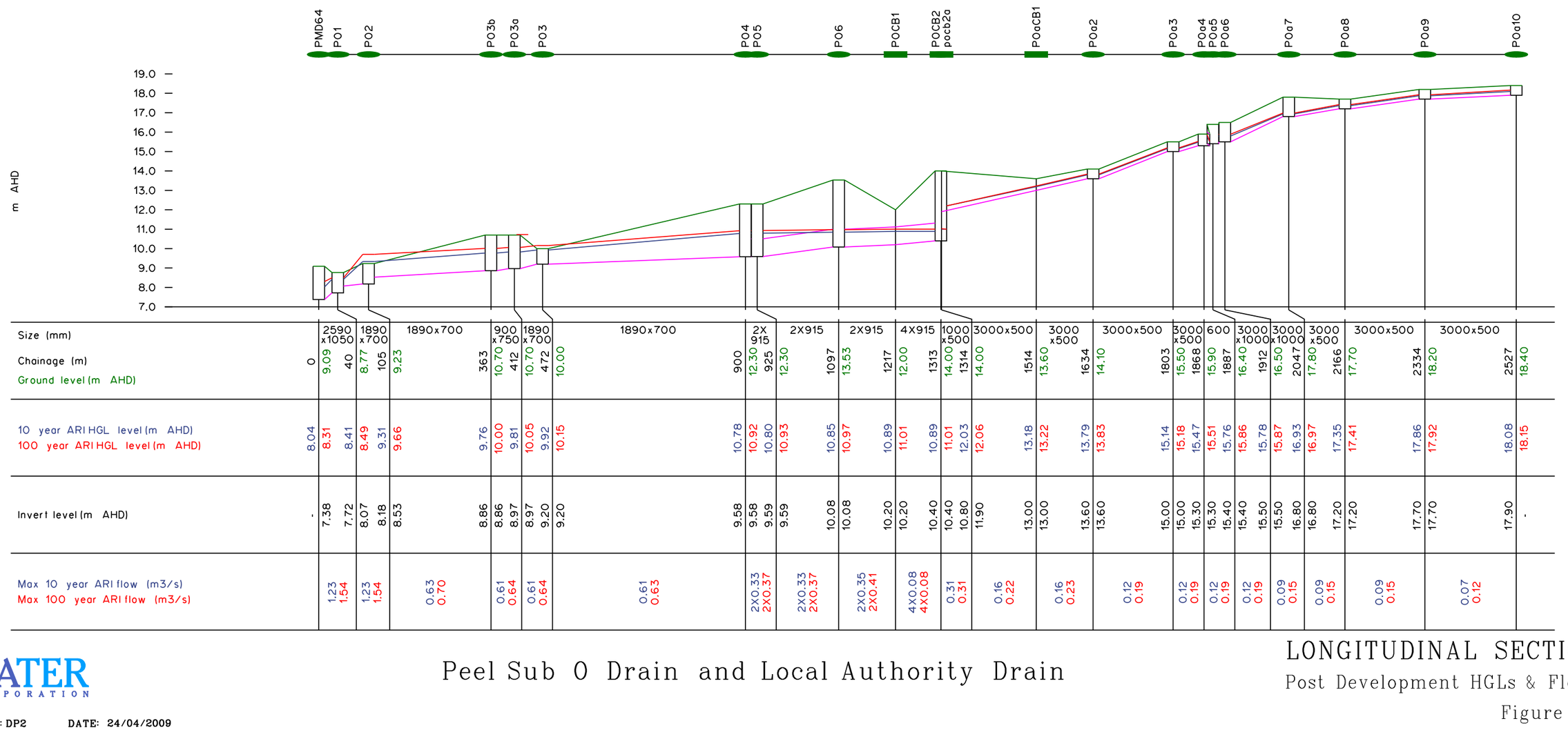

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THE INFORMATION CONTAINED HEREIN IS SUBJECT TO ONGOING REVIEW AND AMENDMENTS AND SHOULD BE READ IN CONJUNCTION WITH THE ASSOCIATED REPORT.

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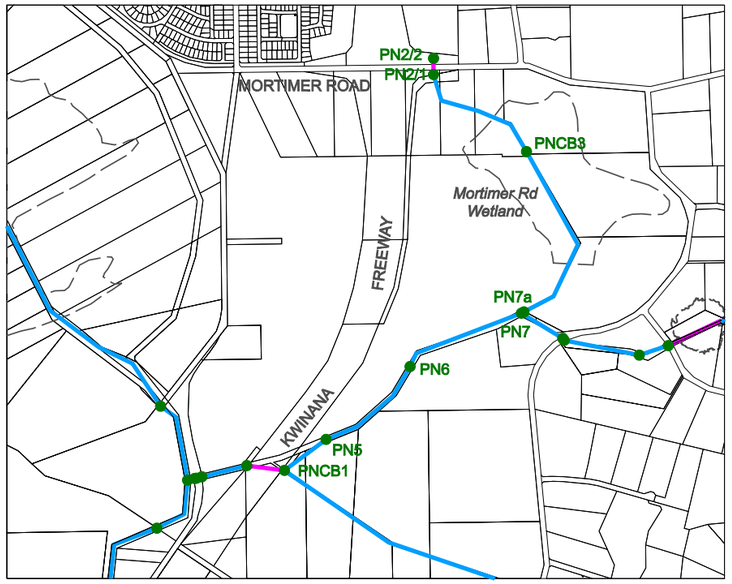

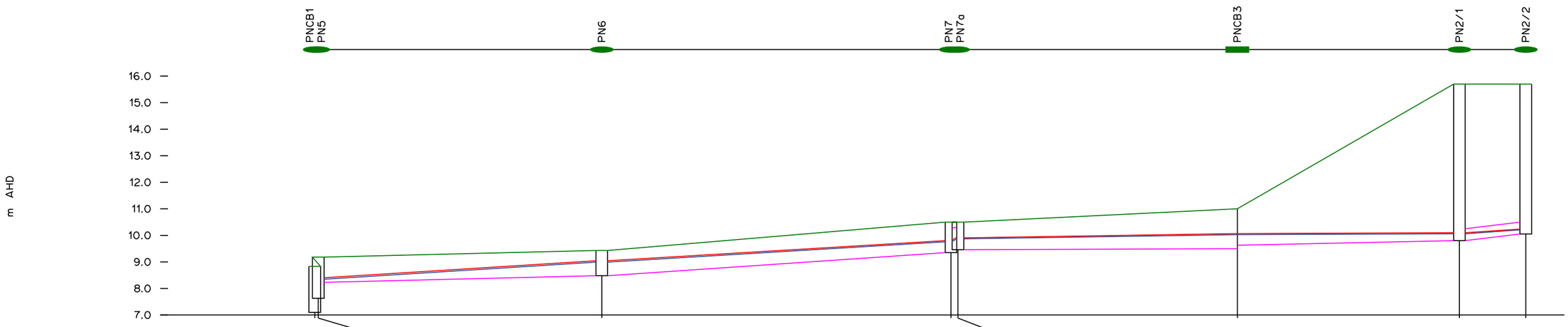

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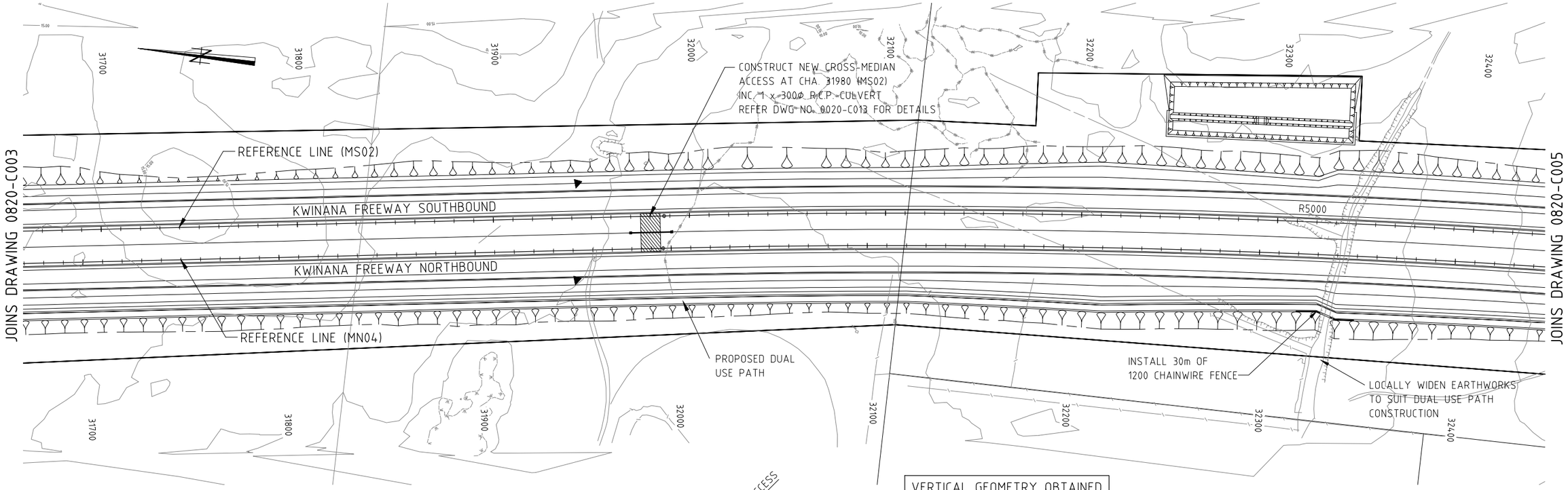
Appendix E: Kwinana Fwy and Mortimer Rd plans

Johnson Rd and Wake Wy basins as-constructed drawings (Main Roads, 2000)

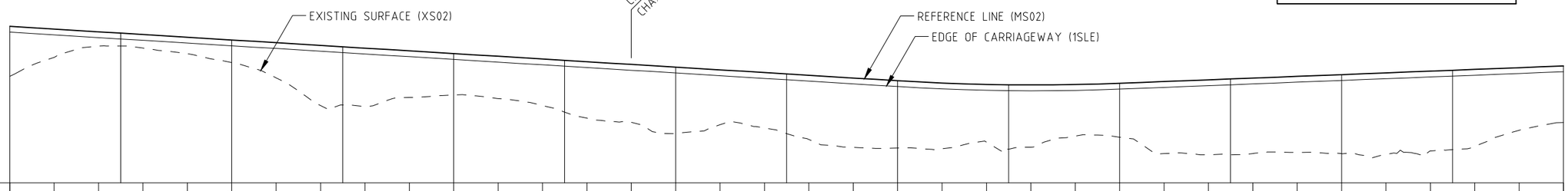
Kwinana Fwy widening conceptual design drawing (Main Roads, 2026)

Mortimer Rd upgrade conceptual design drawings (DPLH, 2025)



VERTICAL GEOMETRY OBTAINED BY OFFSET FROM NORTHBOUND REFERENCE LINE MN04

AS CONSTRUCTED



DATUM 9.000

CHAINAGE MS02	GROUND LINE (MS02)	SOUTHBOUND REF MS02	SOUTHBOUND LEFT EDGE (1SLE)
31700	13.808	16.063	15.801
31720	14.665	15.940	15.678
31740	15.167	15.818	15.555
31760	15.086	15.695	15.432
31780	14.827	15.572	15.310
31800	14.430	15.450	15.187
31820	13.741	15.327	15.064
31840	12.492	15.204	14.942
31860	12.445	15.081	14.819
31880	12.855	14.959	14.696
31900	12.965	14.836	14.573
31920	12.807	14.713	14.451
31940	12.492	14.590	14.328
31960	11.920	14.468	14.205
31980	11.736	14.345	14.082
31987.081	11.225	14.223	13.960
32000	11.621	14.100	13.838
32020	11.479	13.978	13.715
32040	10.960	13.856	13.593
32060	10.601	13.733	13.471
32080	10.574	13.611	13.348
32100	10.541	13.508	13.245
32120	10.840	13.444	13.182
32140	10.614	13.421	13.158
32160	11.113	13.437	13.175
32180	11.064	13.494	13.231
32200	10.322	13.572	13.309
32220	10.268	13.650	13.388
32240	10.327	13.729	13.466
32260	10.377	13.807	13.545
32280	10.319	13.886	13.623
32300	10.293	13.964	13.702
32320	10.441	14.043	13.780
32340	10.648	14.121	13.859
32360	11.372	14.200	13.937
32380	11.725	14.278	14.016
32400			

HORIZ GEOMETRY MS02: TANGENT (31700 – 31987.081); CURVE RIGHT RADIUS 5000 (31987.081 – 32400)

SOUTHBOUND SUPERELEVATION: -2.5%

AMENDMENTS			
REV	DESCRIPTION	DATE	CHK
A	85% DESIGN REVIEW	5/00	J.S.W.
0	ISSUED FOR CONSTRUCTION	9/00	B.H.B
1	FENCING ADDED	05/01	JSW
2	CONFIRMATION OF AS CONSTRUCTED	09/01	JSW

SMEC AUSTRALIA PTY LTD © ACN 065 475 149 — VERIFIED — DATE

Thiess Contractors Pty Limited A.C.N. 010 221 486 Tel. +61 8 9214 4200 Fax. +61 8 9214 4244 — PROJECT MANAGER T. CARISS — DATE SEPT '01

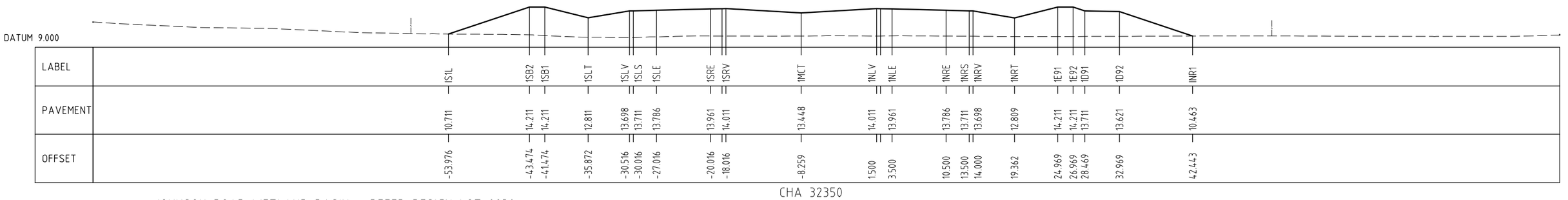
Gutteridge Haskins & Davey Pty Ltd CONSULTING ENGINEERS ENVIRONMENTAL SCIENTISTS & PLANNERS PROJECT MANAGERS ACN 008 488 373 PERTH • BUNBURY • GERALDTON • KALGOORLIE — APPROVED B. BEAMES — DATE 19.09.00

SCALE 1:2000H, 1:200V
DATUM AHD
GRID PCG
DRN. WM
DES. HD-J/VS
CHK. VS

MAIN ROADS Western Australia — PROJECT/CONTRACT MANAGER — DATE: — PROJECT DIRECTOR — DATE:

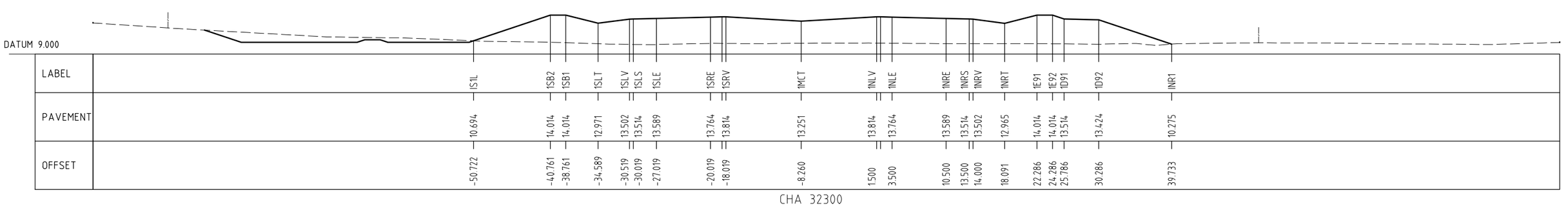
PROJECT: KWINANA FREEWAY INTERCHANGES & EXTENSION
LOCALITY: CHA. 31700 TO CHA. 32400
DRAWING TITLE: PLAN PROFILE SOUTHBOUND CARRIAGEWAY

LOCAL AUTHORITY (105) TOWN OF KWINANA — MAIN ROADS RESPONSIBILITY AREA
MRWA DRAWING NUMBER 0148-4232
PLOT DATE
CAD. FILE No K:\GHD_DRAWINGS\DWG\0820\ASCON\0820-C004.DWG
DRAWING TYPE — JOB No. 5687-01 — DRAWING No. 0820-C004-2

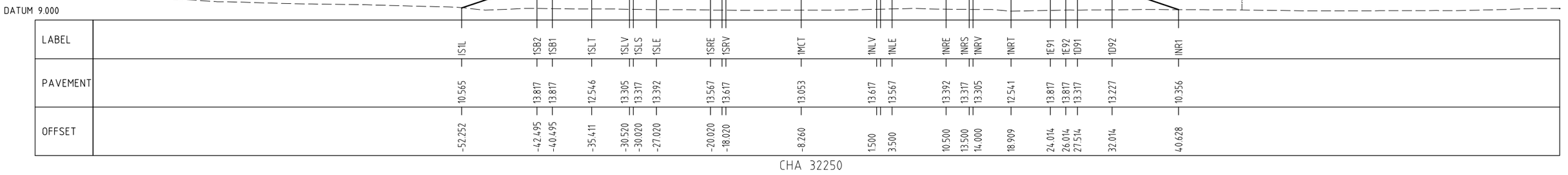


CHA 32350

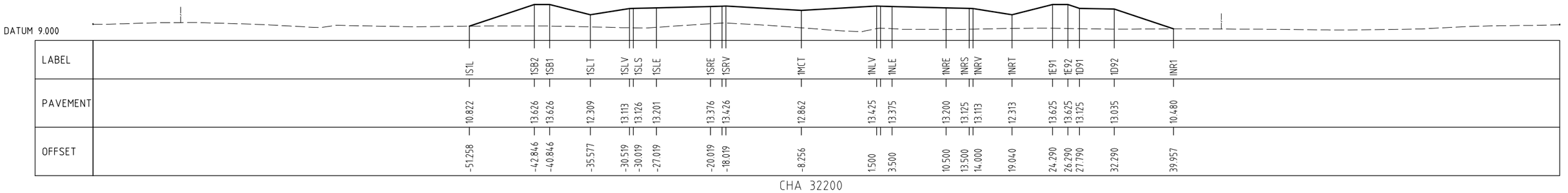
JOHNSON ROAD WETLAND BASIN - REFER DESIGN LOT 0930



CHA 32300



CHA 32250



CHA 32200

AS CONSTRUCTED

AMENDMENTS			
REV.	DESCRIPTION	DATE	CHK
A	70% DESIGN REVIEW	1/00	
B	85% DESIGN REVIEW	5/00	J.S.W.
0	ISSUED FOR CONSTRUCTION	9/00	BHB
1	CONFIRMATION OF		
	AS CONSTRUCTED	09/01	JSW

SMEC AUSTRALIA PTY LTD
© ACN 065 475 149

VERIFIED DATE

Thiess Contractors Pty Limited
A.C.N. 010 221 486
Tel. +61 8 9214 4200
Fax. +61 8 9214 4244

PROJECT MANAGER T. CARISS DATE SEPT '01

Gutteridge Haskins & Davey Pty Ltd
CONSULTING ENGINEERS ENVIRONMENTAL SCIENTISTS & PLANNERS PROJECT MANAGERS
ACN 008 488 373
PERTH • BUNBURY • GERALDTON • KALGOORLIE

APPROVED B. BEAMES DATE 19.09.00

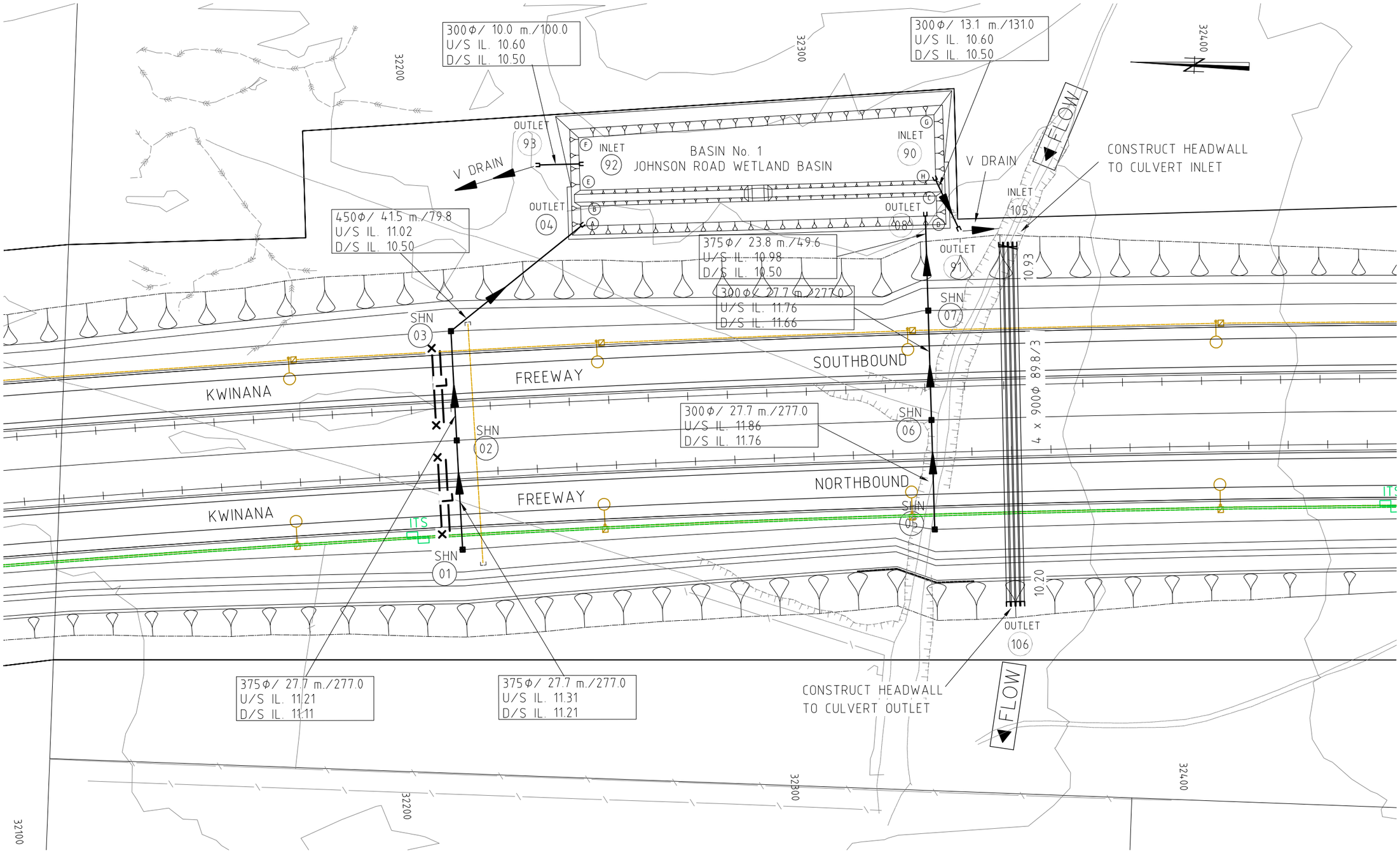
SCALE 1:500
DATUM AHD
GRID PCG
DRN. AMC
DES. HD-J/VS
CHK. VS

MAIN ROADS
Western Australia

PROJECT/CONTRACT MANAGER DATE:
PROJECT DIRECTOR DATE:

PROJECT
KWINANA FREEWAY INTERCHANGES & EXTENSION
LOCALITY
CHA. 32200 TO CHA. 32350
DRAWING TITLE
CROSS SECTIONS

LOCAL AUTHORITY (105) TOWN OF KWINANA
MAIN ROADS RESPONSIBILITY AREA
MRWA DRAWING NUMBER 0148-4276
PLOT DATE
CAD. FILE No K:\GHD_DRAWINGS\DWG\0820\ASCON\0820-C059.DWG
DRAWING TYPE
JOB No. 5687-01
DRAWING No. 0820-C059-1



FIRST BASIN CO-ORDINATES		
POINT	EASTING	NORTHING
A	41727.27	230595.04
B	41732.27	230595.34
C	41738.27	230505.54
D	41733.27	230505.24

SECOND BASIN CO-ORDINATES		
POINT	EASTING	NORTHING
E	41736.27	230595.64
F	41749.57	230596.54
G	41758.77	230506.94
H	41742.27	230505.84

CULVERT DETAILS

KWINANA FREEWAY CHAINAGE (REFERENCE LINE - MN04)	SKEW	INLET				OUTLET			
		SIDE		HEADWALL HEIGHT ABOVE OBVERT (mm)	APRON LENGTH (m)	SIDE		HEADWALL HEIGHT ABOVE OBVERT (mm)	APRON LENGTH (m)
		L	R			L	R		
32360.3	+89.6°	L		400	2000		R	400	2000

NOTES:
1. FOR GENERAL NOTES, LEGENDS AND COORDINATE TABLE REFER TO DRG No. 0930-C008.
2. FOR TYPICAL DRAINAGE BASIN CONSTRUCTION DETAILS REFER TO DRG No. 0030-C007.
3. FOR DRAINAGE BASIN DETAILS REFER TO DRG No. 0930-C008.

AS CONSTRUCTED

AMENDMENTS			
REV.	DESCRIPTION	DATE	CHK
A	85% DESIGN REVIEW	4/00	J.S.W.
0	ISSUED FOR CONSTRUCTION	7/00	JSW
1	CONFIRMATION OF		
	AS CONSTRUCTED	10/01	JSW

SMEC AUSTRALIA PTY LTD © ACN 065 475 149
VERIFIED DATE

Thiess Contractors Pty Limited A.C.N. 010 221 486
Tel. +61 8 9214 4200 Fax. +61 8 9214 4244
PROJECT MANAGER T. CARISS DATE OCT '01

Gutteridge Haskins & Davey Pty Ltd
CONSULTING ENGINEERS ENVIRONMENTAL SCIENTISTS & PLANNERS PROJECT MANAGERS
ACN 008 488 373
PERTH • BUNBURY • GERALDTON • KALGOORLIE
APPROVED J. S. WHITE DATE 19.07.00

SCALE 1:1000
DATUM AHD
GRID PCG
DRN. LP
DES. TT
CHK. BHB

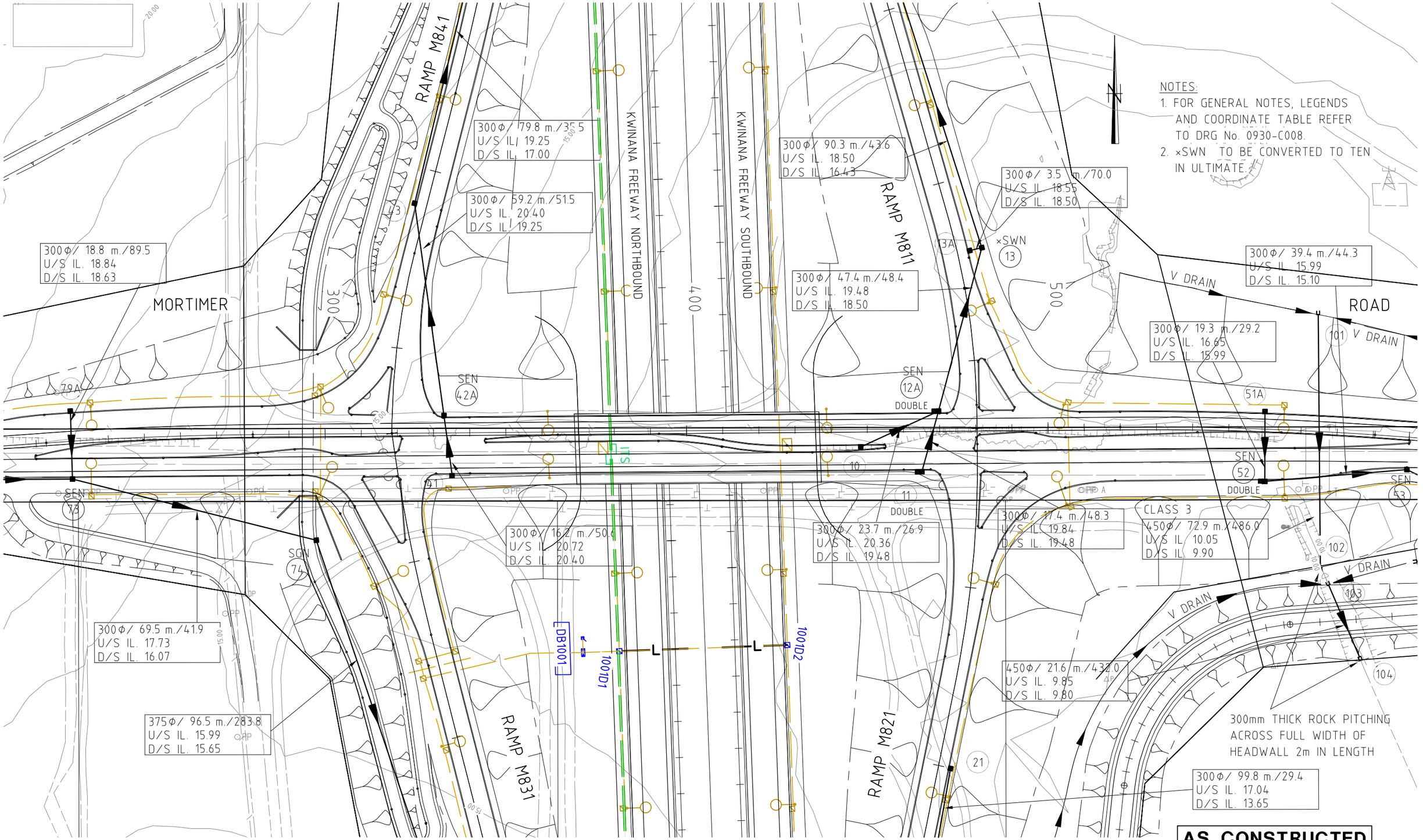
MAIN ROADS Western Australia
PROJECT/CONTRACT MANAGER DATE:
PROJECT DIRECTOR DATE:

PROJECT: KWINANA FREEWAY INTERCHANGES & EXTENSION
LOCALITY: MORTIMER ROAD
DRAWING TITLE: DRAINAGE AND UTILITIES PLAN SHEET 6 OF 7

LOCAL AUTHORITY (105) TOWN OF KWINANA
MAIN ROADS RESPONSIBILITY AREA
MRWA DRAWING NUMBER 0148-4381
PLOT DATE
CAD. FILE No 0930-C006-1.DWG
DRAWING TYPE
JOB No. 5687-01
DRAWING No. 0930-C006-1

BASIN NUMBER AND LOCATION	APPROX. CHAINAGE	BOTTOM OF BASIN STRING LABEL	DIMENSIONS OF BASINS								(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
			FIRST BASIN			FOREBAY		SECOND BASIN			EXISTING GROUND (E) OR TOP OF BUND (B)	BASE OF DEEP FOREBAY	BASE OF FIRST BASIN	INVERT OF PIPE CONNECTING BASINS	WEIR OVERFLOW	TOP OF WEIR	GRATE RL ON STRUCTURE	BASE OF SECOND BASIN	TOP OF BRICK HEADWALL WEIR	DISCHARGE PIPE INVERT	TOP OF BRICK HEADWALL
			LENGTH L	WIDTH W	SIDE SLOPE	LENGTH L	WIDTH W	LENGTH L	WIDTH W	SIDE SLOPE											
MORTIMER ROAD																					
1. JOHNSON ROAD WETLAND	32300	N.A.	90.00	5.00	3	5.00	2.00	90.00	~15	3	11.25(B)	10.00	10.50	N.A.	10.90	11.00	N.A.	10.50	11.08	10.60	10.75

JOINS DRG. 0930-C003



NOTES:
1. FOR GENERAL NOTES, LEGENDS AND COORDINATE TABLE REFER TO DRG No. 0930-C008.
2. ×SWN TO BE CONVERTED TO TEN IN ULTIMATE.

JOINS DRG. 0930-C002

JOINS DRG. 0930-C002

JOINS DRG. 0930-C004

AS CONSTRUCTED

AMENDMENTS			
REV.	DESCRIPTION	DATE	CHK
A	85% DESIGN REVIEW	4/00	JSW
0	ISSUED FOR CONSTRUCTION	7/00	JSW
1	DRAINAGE AMENDED	8/00	JSW
2	PIT 10 ADDED	10/00	JSW
3	CONFIRMATION OF AS CONSTRUCTED	10/01	JSW

SMEC AUSTRALIA PTY LTD
© ACN 065 475 149
VERIFIED DATE

Thiess Contractors Pty Limited
A.C.N. 010 221 486
Tel. +61 8 9214 4200
Fax. +61 8 9214 4244
PROJECT MANAGER T. CARISS DATE OCT '01

Gutteridge Haskins & Davey Pty Ltd
CONSULTING ENGINEERS ENVIRONMENTAL SCIENTISTS & PLANNERS PROJECT MANAGERS
ACN 008 488 373
PERTH • BUNBURY • GERALDTON • KALGOORLIE
APPROVED J. S. WHITE DATE 19.07.00

SCALE	1:1000
DATUM	AHD
GRID	PCG
DRN.	CO
DES.	TT
CHK.	BHB

MAIN ROADS
Western Australia
PROJECT/CONTRACT MANAGER DATE:
PROJECT DIRECTOR DATE:

PROJECT: KWINANA FREEWAY INTERCHANGES & EXTENSION
LOCALITY: MORTIMER ROAD
DRAWING TITLE: DRAINAGE AND UTILITIES PLAN SHEET 1 OF 7

LOCAL AUTHORITY (105) TOWN OF KWINANA | MAIN ROADS RESPONSIBILITY AREA
MRWA DRAWING NUMBER 0148-4376
PLOT DATE
CAD. FILE No 0930-C001-3.DWG
DRAWING TYPE | JOB No. 5687-01 | DRAWING No. 0930-C001-3

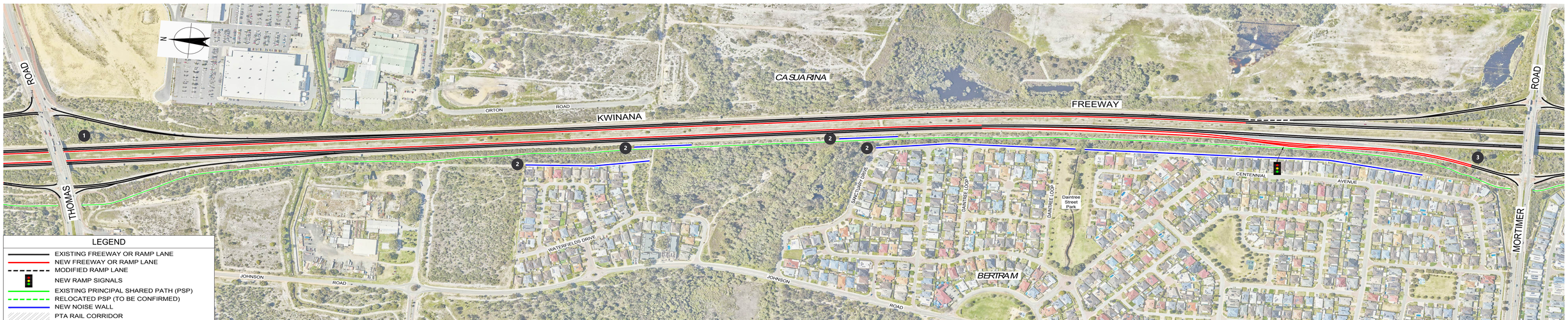
Kwinana Freeway Upgrade - Roe Highway to Safety Bay Road Concept Design

Thomas Road to Mortimer Road (Sheet 7)

November 2025

Australian Government
BUILDING AUSTRALIA

mainroads WESTERN AUSTRALIA

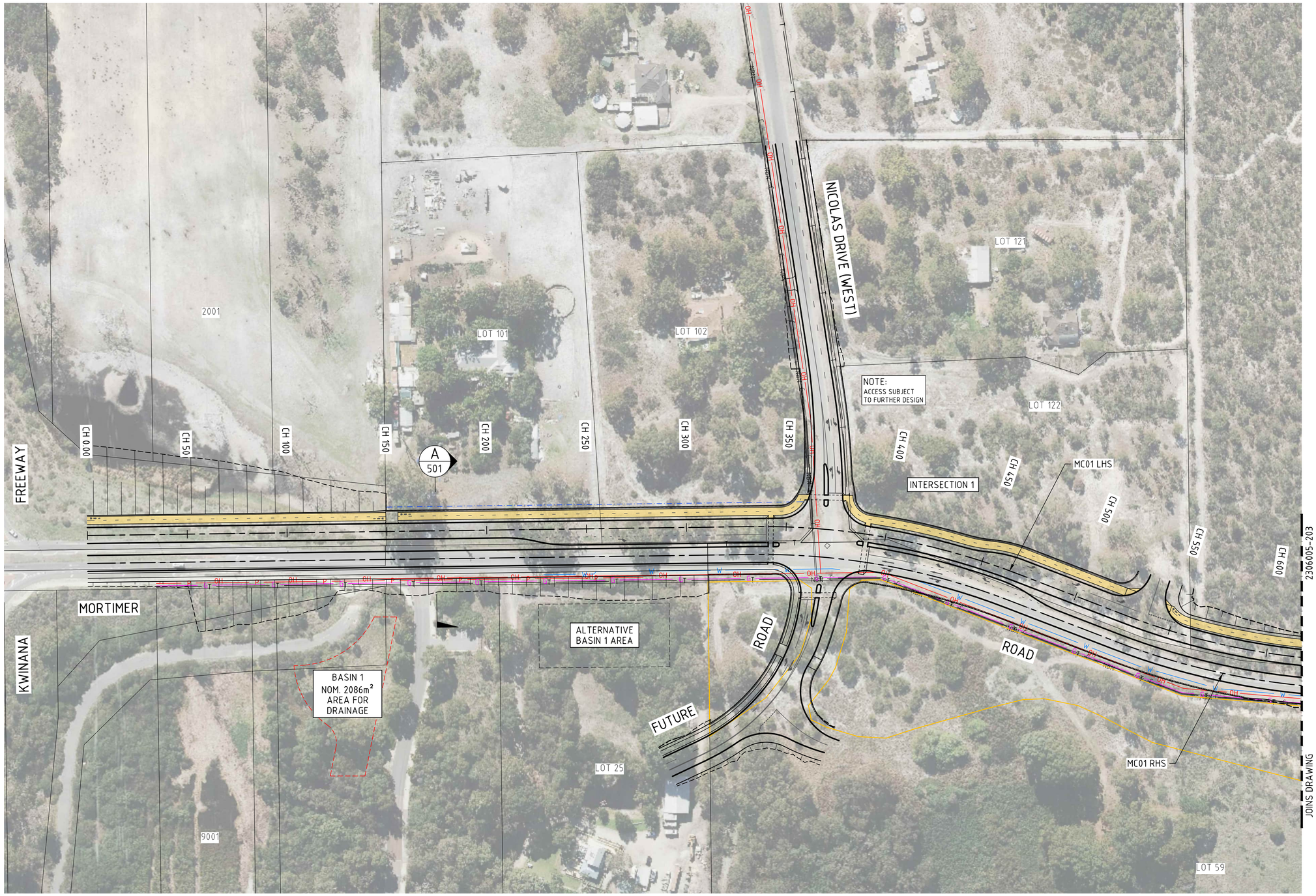


1. Lane widening toward the median between the rail portal north of Thomas Road and Mortimer Road.
2. New noise walls constructed within the road reserve in front of an existing wall, or as a standalone structure (where there is no existing noise wall).
3. Additional lane on freeway on-ramp at Mortimer Road (northbound) to reduce merge congestion.

THIS CONCEPT DESIGN IS PRELIMINARY INFORMATION AND MAY BE SUBJECT TO CHANGE.

NOTES

1. LOCAL ROADS ARE CONCEPTUAL ONLY AND SUBJECT TO FURTHER INVESTIGATION.
2. FOR EARTHWORKS: FURTHER INVESTIGATION OF SPILL OVER EARTHWORKS AND RETAINING WALL REQUIREMENTS TO BE UNDERTAKEN AT DETAILED DESIGN STAGE.
3. PRAM RAMP LOCATIONS SUBJECT TO FURTHER DESIGN



PLAN
1:1000

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WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE INDICATIVE ONLY AND MUST NOT BE RELIED UPON FOR EXCAVATION. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES PRIOR TO CONSTRUCTION. USE WWW.BYDA.COM.AU

DESIGN INFO:

MORTIMER ROAD	
DESIGN VEHICLES:	19.0m SEMI-TRAILER
DESIGN SPEED	80km/hr
POSTED SPEED:	70km/hr

LEGEND

- CADASTRAL BOUNDARY
- P — EXISTING UNDERGROUND POWER
- OH — EXISTING OVERHEAD POWER
- OF — EXISTING OPTIC FIBRE
- T — EXISTING TELSTRA
- G — EXISTING GAS
- W — EXISTING WATER
- LOT 1 INDICATIVE FUTURE DAYCARE CARPARK EXTENT
- LOT 51 INDICATIVE LSP BOUNDARY
- PROPOSED RETAINING WALL
- PROPOSED ALIGNMENT
- CH 100 — PROPOSED CHAINAGE
- PROPOSED KERB FACE
- PROPOSED VERGE
- PROPOSED LINEMARKING
- FUTURE ROAD
- PRPOPOSED BASIN LOCATION
- ALTERNATIVE BASIN LOCATION
- 4.0m PRINCIPLE SHARED PATH (PSP)

SCALE 1:1000

A1

REV	DATE	REVISION DESCRIPTION	CHK	APP	DRG No.	REFERENCE DRAWING TITLE
B	29.04.25	INTERSECTION 1 UPDATED	JB	JB		
A	24.08.23	ISSUED FOR CLIENT REVIEW	JB	JB		

CLIENT: Department of Planning, Lands and Heritage — GOVERNMENT OF WESTERN AUSTRALIA

SCALE @A1
HORIZ: 1:1000

PROJ. DATUM
HORIZONTAL: MGA94
VERTICAL: AHD

LOCAL AUTHORITY
CITY OF WANNEROO

SHAWMAC

INFORMATION ONLY

PROJECT INFORMATION	
DESIGNED BY:	TM
DRAWN BY:	CRF
PROJECT No.	2306005
PROJ. MANAGER	J. BRIDGE

MORTIMER ROAD CONCEPT DESIGN
ROAD RESERVATION STUDY - OPTION 1
CARRIAGEWAY PATTERN
SHEET 1 OF 4

DRAWING NUMBER: 2306005-202

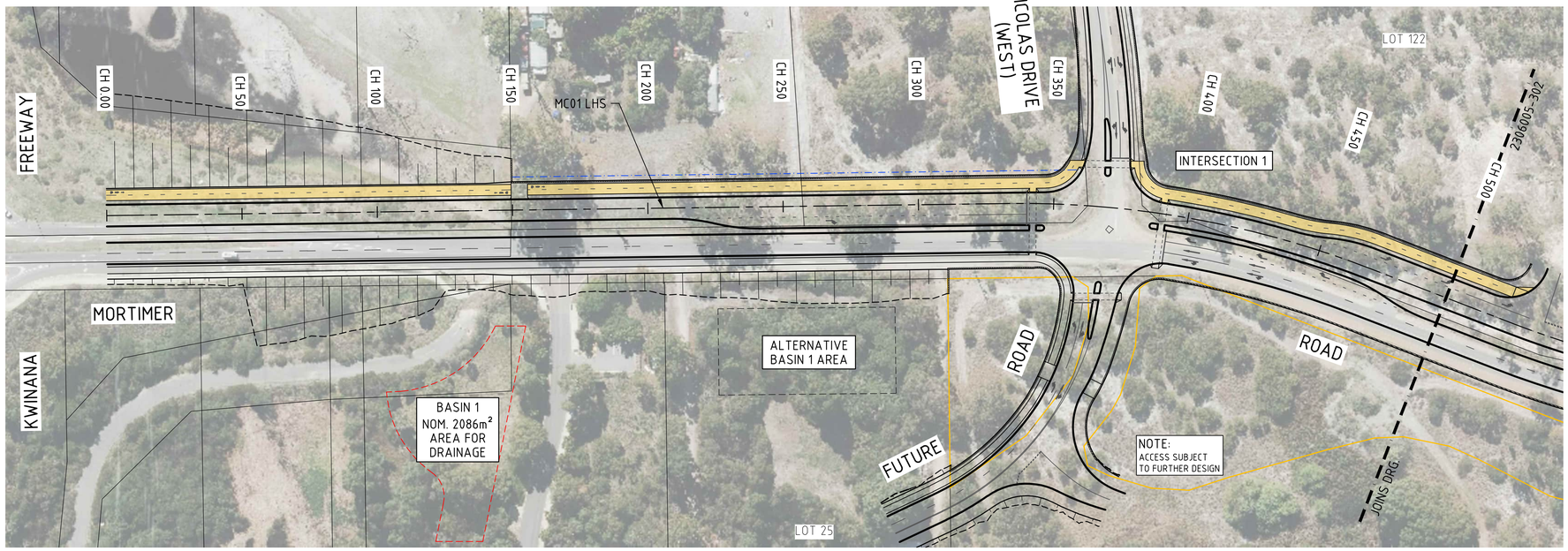
REV. B

FILE REF: Y:\Jobs Active 2023\CE -Roads & Drainage\DPLH_Alternative Concept_2306005\4. Drawings\Option 1\2306005-202 to 205 Carriageway pattern

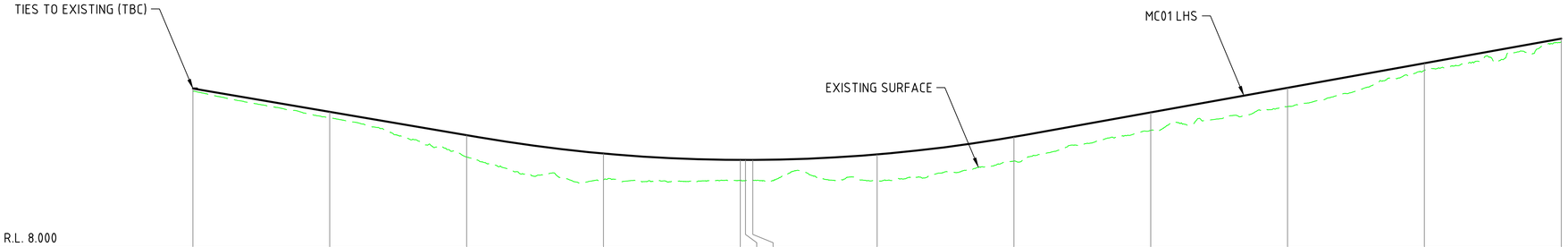
LAST SAVED BY: Crfar DATE: 29 April 2025 3:51 PM

NOTES

1. VERTICAL PROFILES ARE SHOWN INDICATIVE ONLY.
2. FOR CARRIAGEWAY PLAN REFER TO DRAWINGS 2306005-202 TO 205.
3. FOR LAND REQUIREMENT PLANS REFER TO DRAWINGS 2306005-206 TO 209.
4. FOR EARTHWORKS: FURTHER INVESTIGATION OF SPILL OVER EARTHWORKS AND RETAINING WALL REQUIREMENTS TO BE UNDERTAKEN AT DETAILED DESIGN STAGE.
5. LOCAL ROADS ARE CONCEPTUAL ONLY AND SUBJECT TO FURTHER INVESTIGATION BY LOCAL GOVERNMENT.
6. PRAM RAMP LOCATIONS SUBJECT TO FURTHER DESIGN.



PLAN
1:1000



Datum R.L. 8.000

VERTICAL GRADE VCL & LENGTH BETWEEN CURVES RADIUS K VALUE	-3.4% L=104.569								VCL=200.000 R=2863.314 K=28.63								3.58% L=206.171						
HORIZONTAL ALIGNMENT																	R=357.000 L=135.951						
DESIGN ROAD LEVEL R.L. (m)	19.640		17.940		16.240		14.901		14.430	14.430	14.431		14.833		16.109		17.898		19.691		21.483		23.275
EARTHWORKS (+FILL, -CUT)	0.183		0.451		1.599		1.945		1.511	1.504	1.482		1.949		1.751		1.318		1.369		0.509		0.237
EXISTING GROUND LEVEL	19.457		17.489		14.641		12.956		12.919	12.926	12.949		12.884		14.358		16.580		18.322		20.974		23.039
CHAINAGE (m)	0.000		50.000		100.000		150.000		200.000	201.925	204.569		250.000		300.000		350.000		400.000		450.000		500.000
SUPER ELEVATION	RHS 3% LHS -3%																				LHS 4%		

PROFILE
1:1000H 1:200V

LEGEND

- CADASTRAL BOUNDARY
- P — EXISTING UNDERGROUND POWER
- OH — EXISTING OVERHEAD POWER
- OF — EXISTING OPTIC FIBRE
- T — EXISTING TELSTRA
- G — EXISTING GAS
- W — EXISTING WATER
- LOT 1 INDICATIVE FUTURE DAYCARE CARPARK EXTENT
- LOT 51 INDICATIVE LSP BOUNDARY
- PROPOSED RETAINING WALL
- PROPOSED ALIGNMENT
- CH 100 — PROPOSED CHAINAGE
- PROPOSED KERB FACE
- PROPOSED VERGE
- PROPOSED LINEMARKING
- FUTURE ROAD
- PRPOPOSED BASIN LOCATION
- ALTERNATIVE BASIN LOCATION
- 4.0m PRINCIPLE SHARED PATH (PSP)

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WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE INDICATIVE ONLY AND MUST NOT BE RELIED UPON FOR EXCAVATION. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES PRIOR TO CONSTRUCTION. USE WWW.BYDA.COM.AU

DESIGN INFO:
MORTIMER ROAD
DESIGN VEHICLES: 19.0m SEMI-TRAILER
DESIGN SPEED 80km/hr
POSTED SPEED: 70km/hr

SCALE 1:1000 1:200

A1

REV	DATE	REVISION DESCRIPTION	CHK	APP	DRG No.	REFERENCE DRAWING TITLE
B	29.04.25	INTERSECTION 1 UPDATED	JB	JB		
A	24.08.23	ISSUED FOR CLIENT REVIEW	JB	JB		

CLIENT: Department of Planning, Lands and Heritage — GOVERNMENT OF WESTERN AUSTRALIA

SCALE @A1
HORIZ: 1:1000
VERT: 1:200

PROJ. DATUM
HORIZONTAL: MGA94
VERTICAL: AHD

LOCAL AUTHORITY
CITY OF WANNEROO

SHAWMAC

INFORMATION ONLY

PROJECT INFORMATION

DESIGNED BY:	TM
DRAWN BY:	CRF
PROJECT No.	2306005
PROJ. MANAGER	J. BRIDGE

MORTIMER ROAD CONCEPT DESIGN
ROAD RESERVATION STUDY - OPTION 1
MC01 LHS PLAN & PROFILES
CH 0.00 TO CH 500.00

DRAWING NUMBER: 2306005-301

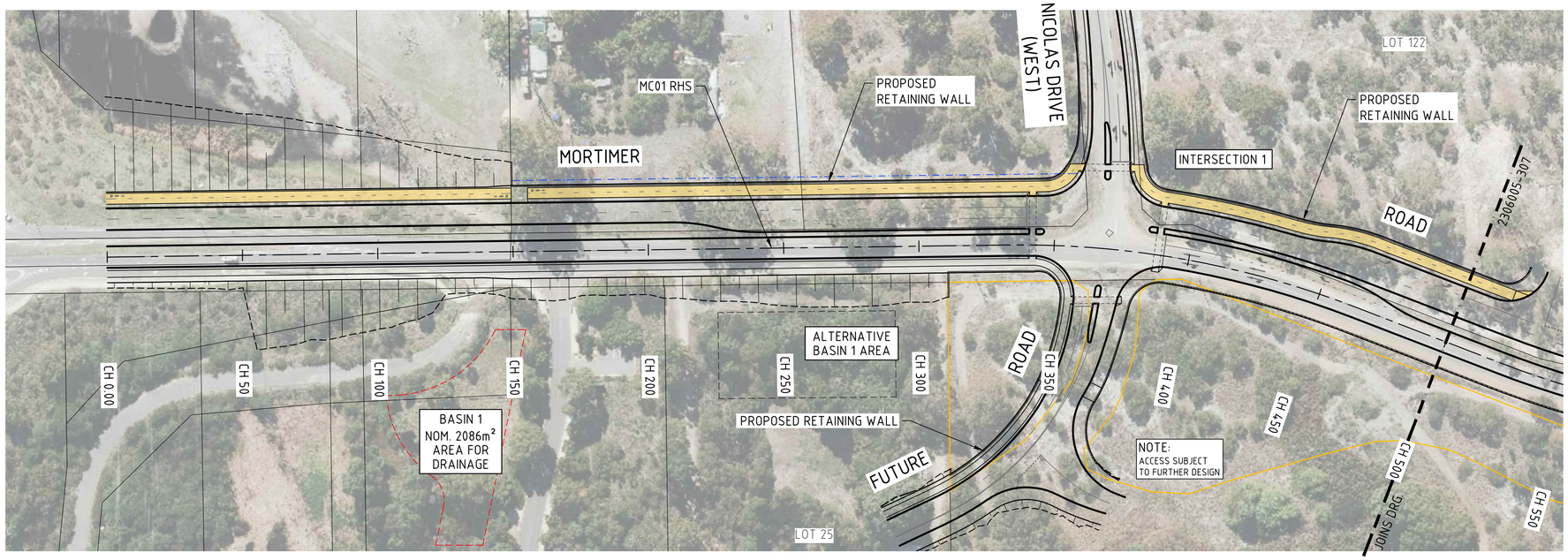
REV. B

FILE REF: Y:\Jobs Active 2023\CE -Roads & Drainage\DPLH_Alternative Concept_2306005\4. Drawings\Option 1\2306005-301 to 305 Plan profiles LHS

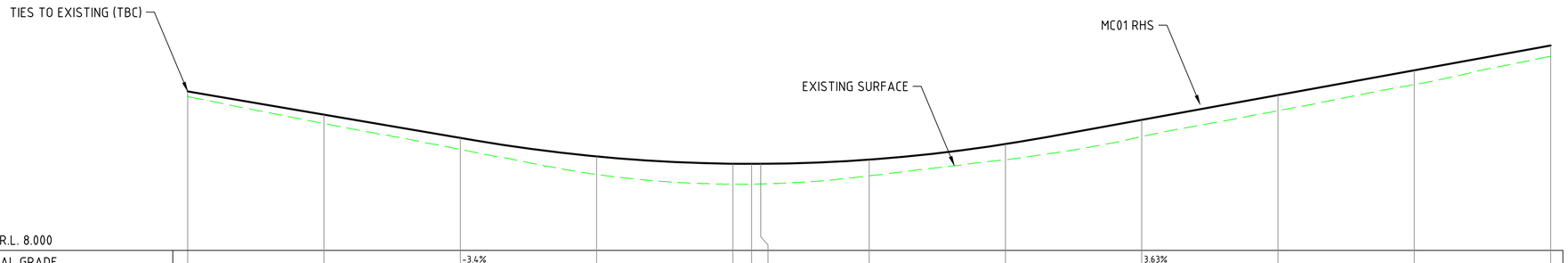
LAST SAVED BY: Crfar DATE: 29 April 2025 3:50 PM

NOTES

1. VERTICAL PROFILES ARE SHOWN INDICATIVE ONLY.
2. FOR CARRIAGEWAY PLAN REFER TO DRAWINGS 2306005-202 TO 205.
3. FOR LAND REQUIREMENT PLANS REFER TO DRAWINGS 2306005-206 TO 209.
4. FOR EARTHWORKS: FURTHER INVESTIGATION OF SPILL OVER EARTHWORKS AND RETAINING WALL REQUIREMENTS TO BE UNDERTAKEN AT DETAILED DESIGN STAGE.
5. LOCAL ROADS ARE CONCEPTUAL ONLY AND SUBJECT TO FURTHER INVESTIGATION BY LOCAL GOVERNMENT.



PLAN
1:1000



Datum R.L. 8.000													
VERTICAL GRADE VCL & LENGTH BETWEEN CURVES RADIUS K VALUE			-3.4%						3.63%				
		L=105.230			VCL=210.000 R=2989.203 K=29.89						L=202.858		
HORIZONTAL ALIGNMENT										R=343.000 L=130.620			
DESIGN ROAD LEVEL R.L. (m)	19.640	17.940	16.240	14.875	14.342	14.334	14.336	14.646	15.785	17.559	19.372	21.184	22.997
EARTHWORKS (+FILL, -CUT)		0.661	0.851	1.317	1.503	1.488	1.476	1.169	1.152	1.233	1.151	1.051	0.791
EXISTING GROUND LEVEL		17.280	15.389	13.558	12.840	12.846	12.860	13.477	14.633	16.326	18.220	20.133	22.206
CHAINAGE (m)	0.000	50.000	100.000	150.000	200.000	206.866	210.230	250.000	300.000	350.000	400.000	450.000	500.000
SUPER ELEVATION		RHS 3% LHS -3%									LHS 4% RHS -4%		

PROFILE
1:1000H 1:200V

LEGEND

- CADASTRAL BOUNDARY
- P — EXISTING UNDERGROUND POWER
- OH — EXISTING OVERHEAD POWER
- OF — EXISTING OPTIC FIBRE
- T — EXISTING TELSTRA
- G — EXISTING GAS
- W — EXISTING WATER
- LOT 1 INDICATIVE FUTURE DAYCARE CARPARK EXTENT
- LOT 51 INDICATIVE LSP BOUNDARY
- PROPOSED RETAINING WALL
- PROPOSED ALIGNMENT
- CH 100 — PROPOSED CHAINAGE
- PROPOSED KERB FACE
- PROPOSED VERGE
- PROPOSED LINEMARKING
- FUTURE ROAD
- PRPOPOSED BASIN LOCATION
- ALTERNATIVE BASIN LOCATION
- 4.0m PRINCIPLE SHARED PATH (PSP)

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WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE INDICATIVE ONLY AND MUST NOT BE RELIED UPON FOR EXCAVATION. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES PRIOR TO CONSTRUCTION. USE WWW.BYDA.COM.AU

DESIGN INFO:
MORTIMER ROAD
DESIGN VEHICLES: 19.0m SEMI-TRAILER
DESIGN SPEED 80km/hr
POSTED SPEED: 70km/hr

SCALE 1:1000 1:200

REV	DATE	REVISION DESCRIPTION	CHK	APP	DRG No.	REFERENCE DRAWING TITLE
B	29.04.25	INTERSECTION 1 UPDATED	JB	JB		
A	24.08.23	ISSUED FOR CLIENT REVIEW	JB	JB		

CLIENT: Department of Planning, Lands and Heritage — GOVERNMENT OF WESTERN AUSTRALIA

SCALE @A1
HORIZ: 1:1000
VERT: 1:200

PROJ. DATUM
HORIZONTAL: MGA94
VERTICAL: AHD

LOCAL AUTHORITY: CITY OF WANNEROO

SHAWMAC

INFORMATION ONLY

PROJECT INFORMATION

DESIGNED BY:	TM
DRAWN BY:	CRF
PROJECT No.	2306005
PROJ. MANAGER	J. BRIDGE

MORTIMER ROAD CONCEPT DESIGN
ROAD RESERVATION STUDY - OPTION 1
MC01 RHS PLAN & PROFILES
CH 0.00 TO CH 500.00

DRAWING NUMBER: 2306005-306

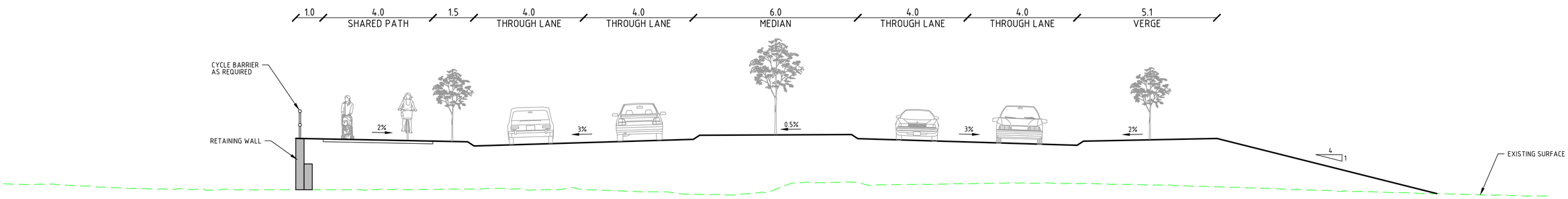
REV. B

FILE REF: Y:\Jobs Active 2023\CE -Roads & Drainage\DPLH_Alternative Concept_2306005\4. Drawings\Option 1\2306005-306 to 310 Plan profiles RHS

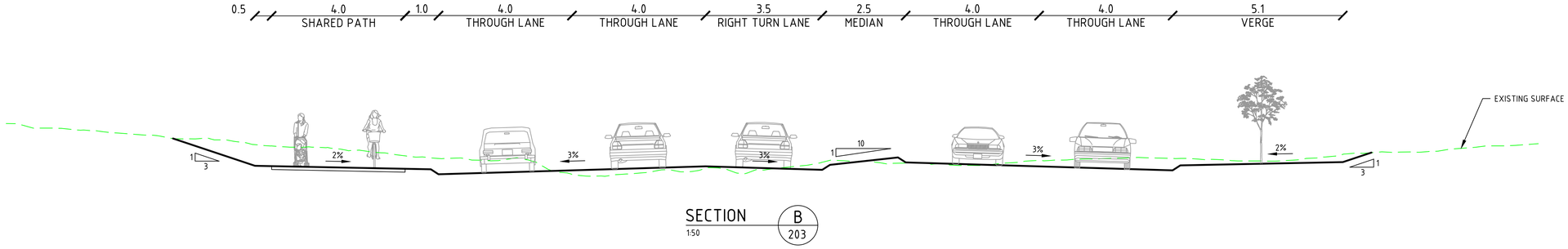
LAST SAVED BY: Crfar DATE: 29 April 2025 3:49 PM

NOTES:

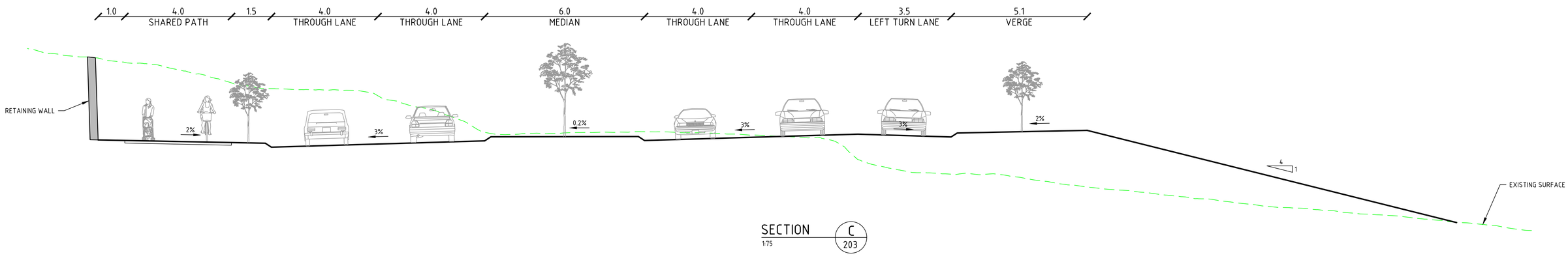
1. ALL DIMENSIONS SHOWN ARE IN METRES UNLESS NOTED OTHERWISE
2. SHARED PATH ALIGNMENT IS SHOWN INDICATIVELY ONLY AND IS TO BE ASSESSED AT THE NEXT DESIGN STAGE.



SECTION A
1:75
202



SECTION B
1:50
203



SECTION C
1:75
203

SCALE 1:75 — A1

REV	DATE	REVISION DESCRIPTION	CHK	APP	DRG No.	REFERENCE DRAWING TITLE
C	01.05.25	MINOR AMENDMENT	JB	JB		
B	29.04.25	INTERSECTION 1 UPDATED	JB	JB		
A	24.08.23	ISSUED FOR CLIENT REVIEW	JB	JB		

CLIENT: Department of Planning, Lands and Heritage — GOVERNMENT OF WESTERN AUSTRALIA

SCALE @A1: HORIZ: 1:50

PROJ. DATUM: HORIZONTAL: MGA94; VERTICAL: AHD

LOCAL AUTHORITY: CITY OF WANNEROO

SHAWMAC

INFORMATION ONLY

PROJECT INFORMATION

DESIGNED BY: TM

DRAWN BY: CRF

PROJECT No. 2202009

PROJ. MANAGER I. BROADLEY

MORTIMER ROAD CONCEPT DESIGN
ROAD RESERVATION STUDY - OPTION 1
TYPICAL SECTIONS
SHEET 1 OF 2

DRAWING NUMBER: 2306005-501

REV. C

FILE REF: Y:\Jobs Active 2023\CE -Roads & Drainage\DPLH_Alternative Concept_2306005\4. Drawings\Option 1\2306005-500 Typicals

LAST SAVED BY: Crfar DATE: 1 May 2025 4:45 PM

Appendix F: Landscape concept

(LD Total, 2026)

Landscape Masterplan

CASUARINA SOUTH

CASUARINA

Landgren Rd

Lugg Pl

Kwinana Fwy

Nicholas Drive

Mortimer Rd

Sunrise Rd

A

A′

B

B′

21.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00

1
2
3
4
5
6
7
8
9
10
11

LEGEND

- PROPOSED STREET TREES
- RETAINED POTENTIAL BLACK COCKATOO NESTING TREE
- RETAINED SUITABLE BLACK COCKATOO NESTING TREE
- POTENTIAL BLACK COCKATOO FORAGING HABITATS

1. CONSERVATION CATEGORY WETLAND
2. POS 2
3. POS 3
4. POS 4
5. POS 5
6. LOCAL SPORTS GROUND
7. PUBLIC PURPOSES - HIGH SCHOOL
8. SERVICE COMMERCIAL
9. COMMERCIAL
10. COMMERCIAL
11. WASTE WATER PUMP STATION

NOTE:
Subdivision layout is indicative only. POS Design is subject to detailed design, budget allocation and approval with City of Kwinana. Road reserve boundary and existing trees to be confirmed with additional feature survey. POS design subject to water allocation.

north

20m 0m 20m 40m 100m
SCALE: 1:2000 @ A1

LD TOTAL

MGP PROPERTY	10.7130	F	27.05.2026
CLIENT	PROJECT NO	REVISION	DATE

Landscape Masterplan

CASUARINA SOUTH

CASUARINA

DESIGN STORM	1%AEP
BASE INVERT LEVEL (m AHD)	10.4
BASE AREA (m2)	0
T.W.L. (m AHD)	11.60
TWL AREA (m2)	33028
TWL VOL. (m3)	19173
SIDE SLOPES (m/m)	1:6

DESIGN STORM (mm)	15
BASE INVERT LEVEL (m AHD)	16.6
BASE AREA (m2)	600
T.W.L. (m AHD)	16.95
TWL AREA (m2)	726
TWL VOL. (m3)	232
SIDE SLOPES (m/m)	1:4

BOULEVARD SWALES 2N

DESIGN STORM (mm)	15
BASE INVERT LEVEL (m AHD)	VARIES
BASE AREA (m2)	152
T.W.L. (m AHD)	VARIES
TWL AREA (m2)	636
TWL VOL. (m3)	180
SIDE SLOPES (m/m)	1:4

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	18.5
BASE AREA (m2)	180
T.W.L. (m AHD)	18.81
TWL AREA (m2)	285
TWL VOL. (m3)	72
SIDE SLOPES (m/m)	1:4

DESIGN STORM	~20%AEP
BASE INVERT LEVEL (mAHD)	18.5
BASE AREA (m2)	180
T.W.L. (m AHD)	19.61
TWL AREA (m2)	662
TWL VOL. (m3)	438
SIDE SLOPES (m/m)	1:6

POS SWALES 2N

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	VARIES
BASE AREA (m2)	200
T.W.L. (m AHD)	VARIES
TWL AREA (m2)	591
TWL VOL. (m3)	191
SIDE SLOPES (m/m)	1:4

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	13.7
BASE AREA (m2)	300
T.W.L. (m AHD)	14.01
TWL AREA (m2)	404
TWL VOL. (m3)	108
SIDE SLOPES (m/m)	1:4

DESIGN STORM	1%AEP
BASE INVERT LEVEL (m AHD)	13.0
BASE AREA (m2)	10000
T.W.L. (m AHD)	13.99
TWL AREA (m2)	26715
TWL VOL. (m3)	17447
SIDE SLOPES (m/m)	1:6

BOULEVARD SWALES 5

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	VARIES
BASE AREA (m2)	176
T.W.L. (m AHD)	VARIES
TWL AREA (m2)	589
TWL VOL. (m3)	106
SIDE SLOPES (m/m)	1:4

LEGEND

1. BIO-BASIN 1
2. BIO-BASIN 2N
3. BIO-BASIN 3
4. BASIN 3
5. WETLAND 1
6. WETLAND 2

NOTE:
Subdivision layout is indicative only. POS Design is subject to detailed design, budget allocation and approval with City of Kwinana. Road reserve boundary and existing trees to be confirmed with additional feature survey. POS design subject to water allocation.

north

10m 0m 10m 20m 50m
SCALE: 1:1000 @ A1

LD TOTAL

MGP PROPERTY	10.7130	F	27.05.2026
CLIENT	PROJECT NO	REVISION	DATE

Landscape Masterplan

CASUARINA SOUTH

CASUARINA

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	13.6
BASE AREA (m2)	150
T.W.L. (m AHD)	13.92
TWL AREA (m2)	205
TWL VOL. (m3)	56
SIDE SLOPES (m/m)	1:4

6

DESIGN STORM	1%AEP
BASE INVERT LEVEL (m AHD)	16.0
BASE AREA (m2)	50
T.W.L. (m AHD)	16.95
TWL AREA (m2)	366
TWL VOL. (m3)	174
SIDE SLOPES (m/m)	1:6

9

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	12.8
BASE AREA (m2)	700
T.W.L. (m AHD)	13.13
TWL AREA (m2)	919
TWL VOL. (m3)	275
SIDE SLOPES (m/m)	1:4

7

DESIGN STORM	1%AEP
BASE INVERT LEVEL (mAHD)	11.0
BASE AREA (m2)	2000
T.W.L. (m AHD)	12.16
TWL AREA (m2)	7942
TWL VOL. (m3)	6664
SIDE SLOPES (m/m)	1:6

8

BOULEVARD SWALES 4

DESIGN STORM (mm)	15
BASE INVERT LEVEL (mAHD)	VARIES
BASE AREA (m2)	136
T.W.L. (m AHD)	VARIES
TWL AREA (m2)	523
TWL VOL. (m3)	113
SIDE SLOPES (m/m)	1:4

17.00
18.00
16.00
15.00
14.00
13.00
16.00

Nicholas Drive
Mortimer Rd
Sunrise Rd

LEGEND

- 6 BIO-BASIN 2S
- 7 BIO-BASIN 4
- 8 BASIN 4
- 9 BASIN 5

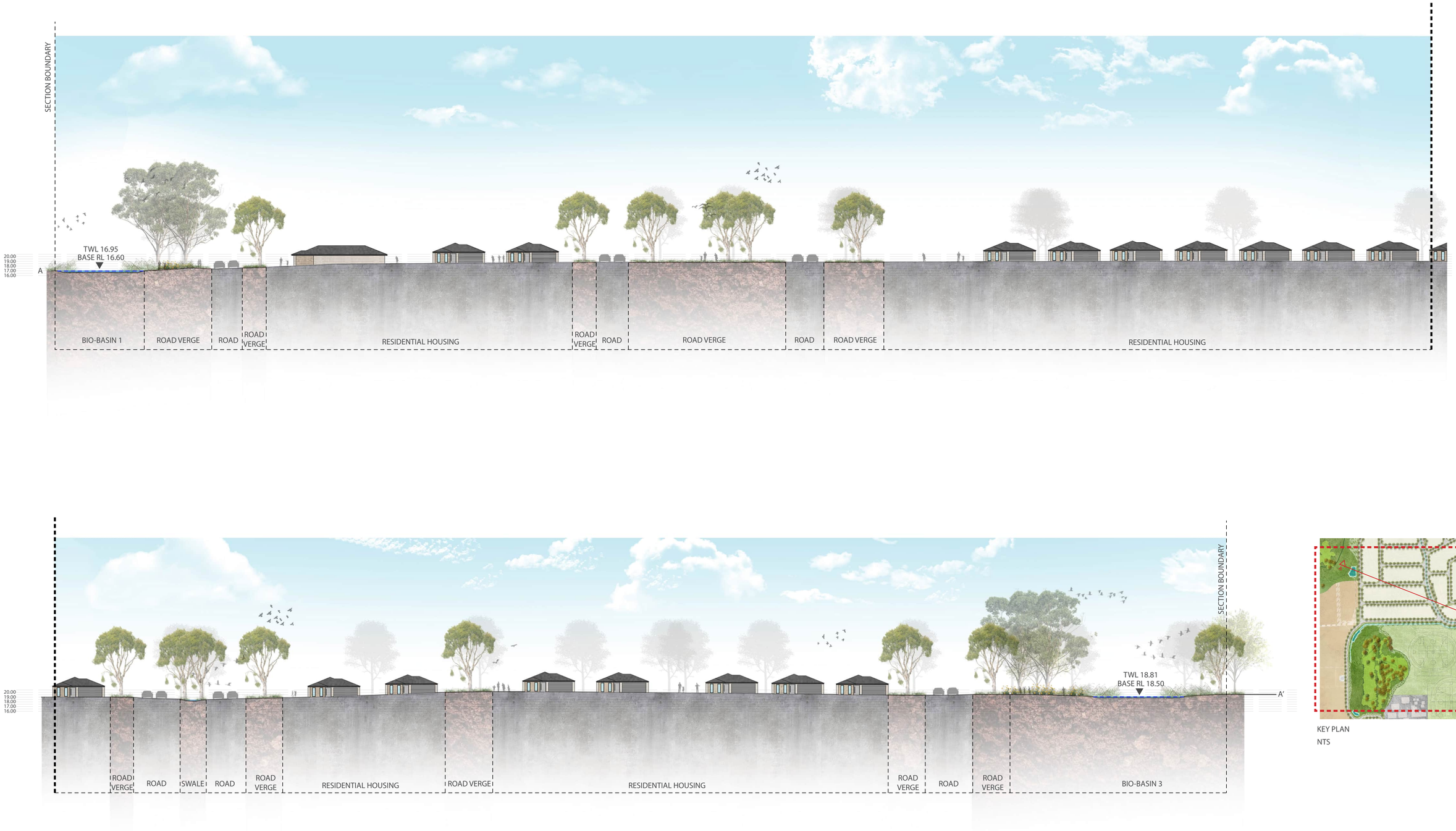
NOTE:
Subdivision layout is indicative only. POS Design is subject to detailed design, budget allocation and approval with City of Kwinana. Road reserve boundary and existing trees to be confirmed with additional feature survey. POS design subject to water allocation.

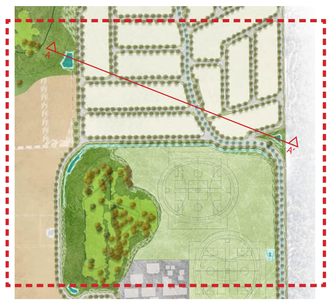
north

10m 0m 10m 20m 50m
SCALE: 1:1000 @ A1

LD TOTAL

MGP PROPERTY	10.7130	F	27.05.2026
CLIENT	PROJECT NO	REVISION	DATE





KEY PLAN
NTS

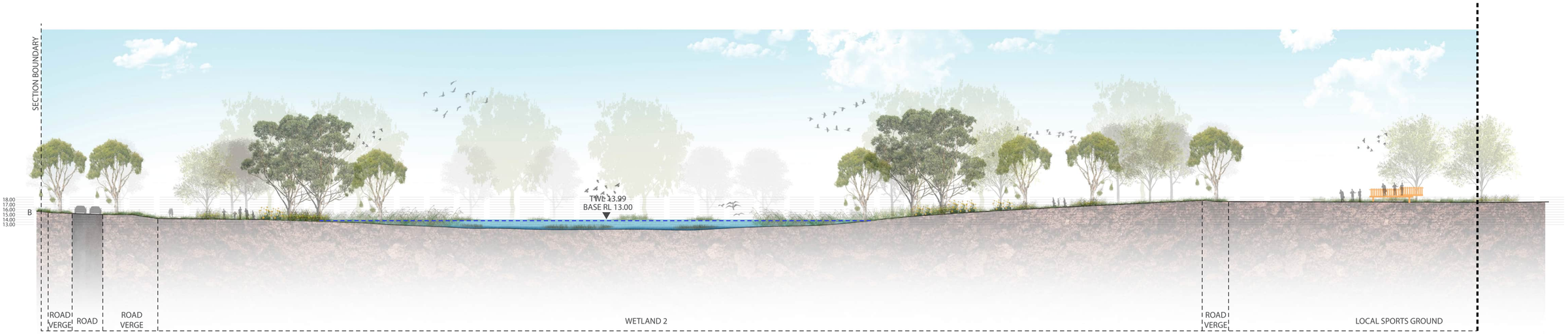
LD TOTAL

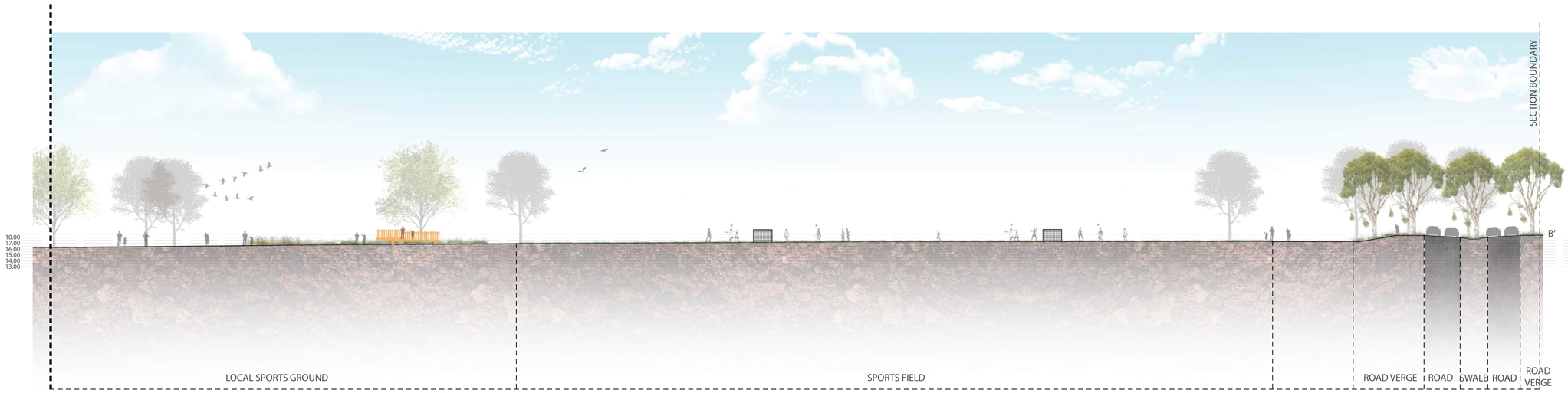
MGP PROPERTY
CLIENT

10.7130
PROJECT NO

F
REVISION

27.05.2026
DATE





KEY PLAN
NTS

LD TOTAL

MGP PROPERTY
CLIENT

10.7130
PROJECT NO

F
REVISION

27.05.2026
DATE

Government of **Western Australia**
Department of **Water and Environmental Regulation**

Your Ref:
Our Ref: DWERVT18248
Enquiries: Kristie Weil
Phone: 9550 4205

316 Property Pty Ltd
32 Sciano Ave
SUCCESS WA 6164

c/o: Jake Faranda – Engineering Hydrologist
Pentium Water
jfaranda@pentiumwater.com.au

Dear Applicant,

Re: Additional information required for a licence under the *Rights in Water and Irrigation Act 1914*

Properties: Various lots for CASUARINA SOUTH URBAN EXPANSION AREA
LOT 108 ON PLAN 14441 - 21 Lugg Place, CASUARINA
LOT 110 ON PLAN 14441 - 35 Lugg Place, CASUARINA
LOT 111 ON PLAN 14441 - 34 Lugg Place, CASUARINA
LOT 114 ON PLAN 14441 - 2 Lugg Place, CASUARINA

Thank you for your application dated 25/06/2025 for a licence to construct a well and take water to draw **89,750 kilolitres per annum** from the Serpentine, Jandakot Mound 2, Perth - Superficial Swan resource for irrigation of up to 5 hectares of District Open Space, 2.7 hectares of Public Open Space and 3.2 hectares of a proposed high school for the Casuarina South Urban Expansion Area development.

The Department of Water and Environmental Regulation has completed an initial review of your application however we require further information to complete the assessment. In accordance with Schedule 1, Division 2, Clause 4(1c) & (2) of the *Rights in Water and Irrigation Act 1914*, we require the following information to assess the application:

- **A level of hydrogeological assessment** as per *Operational policy no. 5.12 - Hydrogeological reporting associated with a groundwater well licence*.

The department has received regional hydrogeological advice in relation to your application as follows.

- The site features typical fine-medium (coarse at base) Bassendean Sands of approximately 30 meters depth and 25-28 meters of saturated aquifer. This is underlain by confining siltstones/shales of the Pinjar member of the Leederville Formation. Conservative values of transmissivity range from 300-500 m²/d and

the water is likely to be fresh at <500mg/L.

- The proposed location of a single bore near the planned high school and co-located District Open Space is approximately 50 meters from areas of groundwater dependant ecosystems (GDE's) and the full take of 89,750 kilolitres per annum from this one point would likely result in impacts to the GDE. Therefore, it may be more beneficial to propose additional drawpoints for the full allocation requested.

Therefore, there are two options for your consideration to determine the level of hydrogeological assessment required for your application.

1. The current application to construct one bore for irrigation of district open space, public open space and a high school, at the proposed location (Lot 115) as per correspondence dated 4 September 2025, at a minimum would have possible impacts to the GDE's and would therefore require a *H2 – basic hydrogeological assessment* including drilling and test pumping.

2. If the draw was spread between 2 or more bores of minimum 300 meters distance from each other, then a *H1 – desktop hydrogeological assessment* would be acceptable upon assessment of the bore locations. Placing the bores in a suitable location, such as a minimum of 200 meters distance from sensitive receptors may further reduce the need for additional monitoring as determined by the hydrogeological assessment, if required. Additionally, as future management of the irrigation bores is likely to be shared between the Department of Education and the local government, separate bores would be a beneficial consideration for this purpose.

- **Evidence of the outcome of the EPBC Act referral**

Please provide the outcome of the EPBC Act referral for the management of Banksia Woodlands and black cockatoo habitat on the properties, as this will determine which environmentally sensitive areas are being retained and therefore can allow the assessment and management of potential impacts from groundwater abstraction.

- **Confirmation of water requirements**

The department acknowledges that it is early in the structure planning process, however the Serpentine, Jandakot Mound 2, Perth - Superficial Swan resource is reaching full allocation and therefore we need proponents to justify their water requirements and ensure that they are implementing water efficient design and prioritising water allocation to high value POS such as sports/playing fields and schools.

Please confirm/clarify the amount of irrigated POS required. Please also provide a further breakdown of POS types, irrigated areas and irrigation rates, and provide a landscape concept plan (once available). Please note that as detailed design and development approvals progress, the department may further refine/revise your water requirements for the irrigation of POS.

Please also advise if groundwater is to be abstracted for temporary dust suppression for earthworks and construction purposes.

- **Demonstration of legal access**

The department acknowledges the fragmented ownership of the development area and proof of legal access proforma provided with the application for Lots acquired by the applicant to date. However, please provide proof of legal access (such as a Certificate of Title or written agreement) for the remaining Lots once available.

This letter is notifying you that you have until **30/04/2026** to provide this information to us.

If you believe there are extenuating circumstances to justify why you cannot provide the information, you should write to us with these reasons.

Should the information (or explanation of the extenuating circumstances) not be received within this timeframe, we will return your application to you as it is incomplete and there is insufficient information to allow us to make an informed decision.

If you have any queries please contact Kristie Weil by telephone on 9550 4205.

Yours sincerely,

Carlie Slodecki
District/Program Manager
Peel Region
10 October 2025

Peel Region
107 Breakwater Parade Mandurah Western Australia 6210
Telephone (08) 9550 4222 Fax (08) 9581 4560
www.dwer.wa.gov.au

Appendix G: Engineering earthworks and drainage drawings

(Peritas, 2026)

CONTINUES ON SHEET CI-02.01

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NOTES:

EXISTING ELECTRICAL TOWER
EX. R.L. 12.87m AHD

BATTER 1 IN 4

10m

WETLAND 2

BASE INVERT LEVEL (m AHD)	= 12.80
T.W.L. (m AHD)	= 14.00
DEPTH OF WATER (m)	= VARIES
SIDE SLOPES (m/m)	= VARIES
STORAGE REQUIRED (m3)	= 17,447
STORAGE PROVIDED (m3)	= 17,645

WETLAND 2

BLVD SWALES 5

BASE INVERT LEVEL (m AHD)	= VARIES
T.W.L. (m AHD)	= VARIES
AVG. DEPTH OF WATER (m)	= 0.18
SIDE SLOPES (m/m)	= 1:4
BASE AREA (m2)	= 154
STORAGE REQUIRED (m3)	= 106
STORAGE PROVIDED (m3)	= 125

BASIN 5

BASE INVERT LEVEL (m AHD)	= 16.00
T.W.L. (m AHD)	= 16.95
TWL AREA (m2)	= 366
DEPTH OF WATER (m)	= 0.95
SIDE SLOPES (m/m)	= 1:6
BASE AREA (m2)	= 50
STORAGE REQUIRED (m3)	= 174
STORAGE PROVIDED (m3)	= 189

BOULEVARD SWALES 5

LUGG PLACE

BIO-BASIN 2S

BASE INVERT LEVEL (m AHD)	= 13.60
T.W.L. (m AHD)	= 13.92
DEPTH OF WATER (m)	= 0.32
SIDE SLOPES (m/m)	= 1:4
BASE AREA (m2)	= 150
STORAGE REQUIRED (m3)	= 56
STORAGE PROVIDED (m3)	= 60

HIGH SCHOOL

ROAD 05

BLVD SWALES 4

BASE INVERT LEVEL (m AHD)	= VARIES
T.W.L. (m AHD)	= VARIES
AVG. DEPTH OF WATER (m)	= 0.23
SIDE SLOPES (m/m)	= 1:4
BASE AREA (m2)	= 270
STORAGE REQUIRED (m3)	= 113
STORAGE PROVIDED (m3)	= 120

HIGH POINT

BATTER 1 IN 6

BOULEVARD SWALES 4

BIO-BASIN 4

BASE INVERT LEVEL (mAHD)	= 12.80
T.W.L. (m AHD)	= 13.13
DEPTH OF WATER (m)	= 0.33
SIDE SLOPES (m/m)	= 1:4
BASE AREA (m2)	= 700
STORAGE REQUIRED (m3)	= 275
STORAGE PROVIDED (m3)	= 333

ROAD 02

ROAD 03

ROAD 04

BASIN 4

BASE INVERT LEVEL (m AHD)	= 11.00
T.W.L. (m AHD)	= 12.16
T.W.L AREA (m2)	= 794.2
DEPTH OF WATER (m)	= 1.16
SIDE SLOPES (m/m)	= VARIES
STORAGE REQUIRED (m3)	= 6664
STORAGE PROVIDED (m3)	= 6400

WWPS SITE
PAD R.L. 13.40m AHD

EXISTING ELECTRICAL TOWER
EX. R.L. 11.53m AHD

BATTER 1 IN 6

KWINANA FREEWAY

NICHOLAS DRIVE

ROAD 01

BOULEVARD SWALES 4

MORTIMER ROAD

25.0m ROAD RESERVE

4.5m	6.0m	4.0m	6.0m	4.5m
VERGE	CARRIAGEWAY	SWALE	CARRIAGEWAY	VERGE

1 IN 4 SLOPES (TYP.) — 0.5m — FLUSH KERB (TYP.)

TYPICAL BOULEVARD CROSS SECTION
SCALE 1:100

NOTE:
THIS DRAWING HAS BEEN PREPARED IN COLOUR. FAILURE TO PLOT HARD COPIES IN COLOUR MAY RESULT IN LOSS OF CRITICAL INFORMATION.

LEGEND

- EARTHWORKS BOUNDARY
- 15.0 EXISTING SURFACE (0.2m INTERVAL)
- 15.0 FINISHED SURFACE CONTOUR (0.2m INTERVAL)
- 15.0 1% TWL LEVEL (mAHD)
- AREAS OF FILL
- AREAS OF CUT
- 25.10 PROPOSED PAD LEVEL
- 25.10 EXISTING PAD LEVEL

EARTHWORK VOLUME DETAILS:

TOTAL CUT	=	-656,685m³
TOTAL FILL	=	418,458m³
TOTAL BALANCE	=	-238,227m³
EXCESS OF CUT OVER FILL	=	-238,227m³

NOTE:
CALCULATIONS ARE BETWEEN FINISHED SURFACE LEVELS AT ROAD PAVEMENT LEVEL TO NATURAL SURFACE LEVELS.

CLEARING OF ANY TREES SUBJECT TO LANDSCAPE DESIGN & CITY OF KWINANA APPROVAL.

1:1000 AT A1
0 10m 20m 40m 60m

ISSUED FOR INFORMATION

REVISION	DESCRIPTION	DRAWN	DATE
A	ISSUED FOR INFORMATION	DA	25/07/2025
B	ISSUED FOR INFORMATION	HL	12/08/2025
C	ISSUED FOR INFORMATION	HL	27/08/2025
D	ISSUED FOR INFORMATION	HL	12/09/2025
E	ISSUED FOR INFORMATION	DA	25/09/2025
F	ISSUED FOR INFORMATION	SB	15/05/2026

peritas
PERTH
P: 08 6336 9299
A: 74 GOODWOOD PDE, BURSWOOD, WA 6100
MELBOURNE
P: 03 8657 9292
A: TWO MELBOURNE QUARTER, SUITE 307, 697 COLLINS ST, DOCKLANDS, VIC 3008
ENQUIRIES@PERITAS.AU

CLIENT:
URBAN RESOURCES

DESIGNED:	DRAWN:	CHECKED:
D.AYRES	H.LUONG	A.SMITH
SURVEY DATUM:	WAPC No:	SCALE:
MGA 50, AHD	N/A	1:1000 @ A1
DWG IS NOT FOR CONSTRUCTION UNLESS SIGNED BELOW:		DATE CREATED:
		JUL 2025

PROJECT:
CASUARINA LDP AREA
CASUARINA W.A 6167

TITLE:
EARTHWORKS PLAN
SHEET 1 OF 2

PROJECT NUMBER:	DRG NUMBER:	REV:
PC21340	CI-02.00	F

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NOTES

LEGEND

- EARTHWORKS BOUNDARY
- 15.0 EXISTING SURFACE (0.2m INTERVAL)
- 15.0 FINISHED SURFACE CONTOUR (0.2m INTERVAL)
- 15.0 1% TWL LEVEL (mAHD)
- AREAS OF FILL
- AREAS OF CUT
- 25.10 PROPOSED PAD LEVEL
- 25.10 EXISTING PAD LEVEL

CLEARING OF ANY TREES SUBJECT TO LANDSCAPE DESIGN & CITY OF KWINANA APPROVAL.

1:1000 AT A1

0 10m 20m 40m 60m

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	DRAWN	DATE
A	ISSUED FOR INFORMATION	DA	25/07/2025
B	ISSUED FOR INFORMATION	HL	12/08/2025
C	ISSUED FOR INFORMATION	HL	27/08/2025
D	ISSUED FOR INFORMATION	HL	12/09/2025
E	ISSUED FOR INFORMATION	DA	25/09/2025
F	ISSUED FOR INFORMATION	SB	15/05/2026

peritas
PERTH
P: 08 6336 9299
A: 74 GOODWOOD PDE, BURSWOOD, WA 6100
MELBOURNE
P: 03 8657 9292
A: TWO MELBOURNE QUARTER, SUITE 307, 697 COLLINS ST, DOCKLANDS, VIC 3008
ENQUIRIES@PERITAS.AU

CLIENT:
URBAN RESOURCES

DESIGNED:	DRAWN:	CHECKED:
D.AYRES	H.LUONG	A.SMITH
SURVEY DATUM:	WAPC No:	SCALE:
MGA 50, AHD	N/A	1:1000 @ A1
DWG IS NOT FOR CONSTRUCTION UNLESS SIGNED BELOW:		DATE CREATED:
		JUL 2025

PROJECT:
CASUARINA LDP AREA
CASUARINA W.A 6167

TITLE:
EARTHWORKS PLAN
SHEET 2 OF 2

PROJECT NUMBER:	DRG NUMBER:	REV:
PC21340	CI-02.01	F

NOTE:
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CONTINUES ON SHEET CI-02.00

WETLAND 1
BASE INVERT LEVEL (m AHD) = 10.00
T.WL. (m AHD) = 11.60
T.W.L.AREA (m2) =33,028
DEPTH OF WATER (m) = 1.2
SIDE SLOPES (m/m) = VARIES
STORAGE REQUIRED (m3) = 19,173
STORAGE PROVIDED (m3) = 18,990

BIO-BASIN 1
BASE INVERT LEVEL (m AHD) = 16.60
T.W.L. (m AHD) = 16.95
DEPTH OF WATER (m) = 0.35
SIDE SLOPES (m/m) = 1:4
BASE AREA (m2) = 600
STORAGE REQUIRED (m3) = 232
STORAGE PROVIDED (m3) = 235

BLVD SWALES 2N
BASE INVERT LEVEL (m AHD) = VARIES
T.W.L. (m AHD) = VARIES
AVG DEPTH OF WATER (m) = 0.28
SIDE SLOPES (m/m) = 1:4
BASE AREA (m2) = 152
STORAGE REQUIRED (m3) = 180
STORAGE PROVIDED (m3) = 180

BIO-BASIN 3
BASE INVERT LEVEL (m AHD) = 18.50
T.W.L. (m AHD) = 18.83
DEPTH OF WATER (m) = 0.33
SIDE SLOPES (m/m) = 1:4
BASE AREA (m2) = 180
STORAGE REQUIRED (m3) = 72
STORAGE PROVIDED (m3) = 73.5

BIO-BASIN 2N
BASE INVERT LEVEL (m AHD) = 13.70
T.W.L. (m AHD) = 13.96
DEPTH OF WATER (m) = 0.26
SIDE SLOPES (m/m) = 1:4
BASE AREA (m2) = 300
STORAGE REQUIRED (m3) = 108
STORAGE PROVIDED (m3) = 110

POS SWALES 2N
BASE INVERT LEVEL (m AHD) = VARIES
T.W.L. (m AHD) = VARIES
DEPTH (m) = 0.5 MAX.
SIDE SLOPES (m/m) = 1:4
BASE AREA (m2) = 154
STORAGE REQUIRED (m3) = 191
STORAGE PROVIDED (m3) = 212

BASIN 3
BASE INVERT LEVEL (m AHD) = 18.50
T.W.L. (m AHD) = 19.61
DEPTH OF WATER (m) = 1.11
SIDE SLOPES (m/m) = VARIES
STORAGE REQUIRED (m3) = 438
STORAGE PROVIDED (m3) = 483

BLVD SWALES 5
BASE INVERT LEVEL (m AHD) = VARIES
T.W.L. (m AHD) = VARIES
AVG DEPTH OF WATER (m) = 0.18
SIDE SLOPES (m/m) = 1:4
BASE AREA (m2) = 154
STORAGE REQUIRED (m3) = 106
STORAGE PROVIDED (m3) = 125

U/S 11.58 450/ 250 D 75.2m D/S 11.28
U/S 11.28 450/ 502 D 90.5m D/S 11.10
U/S 12.32 450/ 250 D 186.4m D/S 11.58
U/S 12.40 450/ 250 D 19.0m D/S 12.32
U/S 12.50 450/ 250 D 25.2m D/S 12.40
U/S 12.60 450/ 250 D 25.3m D/S 12.50
U/S 12.85 450/ 250 D 61.5m D/S 12.60
U/S 13.10 450/ 43 D 10.7m D/S 12.85

MH 02, MH 03, MH 04, MH 05, MH 06, MH 07, MH 08, HW 01, HW 09

EXISTING ELECTRICAL TOWER
EX. R.L. 18.82m AHD

PROPOSED OVERFLOW PIPE. SHOWN INDICATIVELY.

BATTER 1 IN 6

BOULEVARD SWALES 2

PROPOSED 0.5m BUND. RL 19.91m

0.85%

0.60%

ROAD 06, ROAD 07, ROAD 08, ROAD 09, ROAD 10, ROAD 11, ROAD 12, ROAD 13, ROAD 14, ROAD 15, ROAD 16, ROAD 03

LUGG PLACE

KWINANA FREEWAY

WETLAND 1

WETLAND 2

EXISTING WETLAND

DISTRICT OPEN SPACE

BASIN 3

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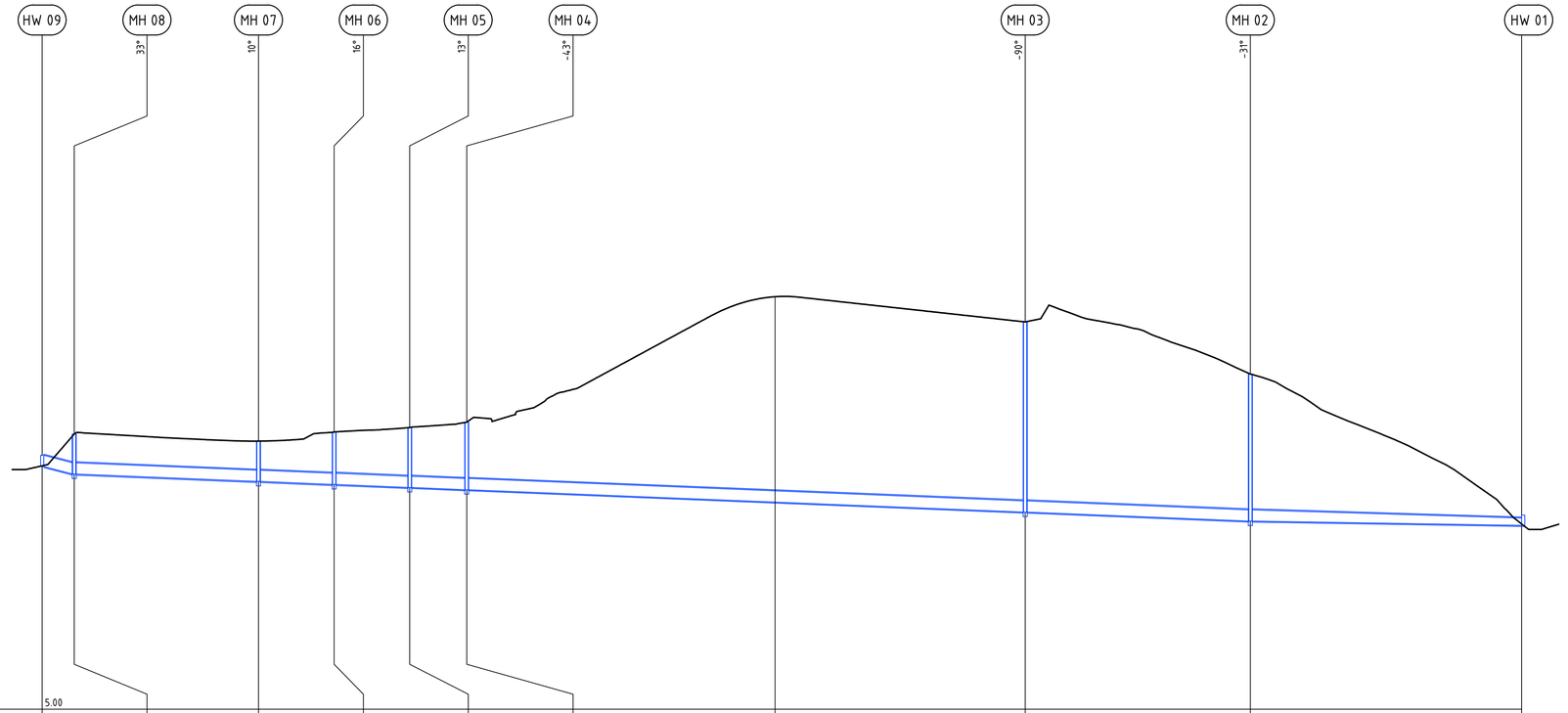
NOTES:



DATUM RL		5.00										
FINISHED SURFACE LEVEL	13.12	14.18	13.95	14.25	14.40	14.58	18.77	17.93	16.19	11.00		
DEPTH TO INVERT		0.02	1.33	1.33	1.35	1.35	1.75	1.75	2.00	2.00	2.25	2.25	6.85	6.85	6.35	6.35	4.91	4.91	0.00	0.00
INVERT LEVEL		13.10		12.85		12.60		12.50		12.40		12.32		11.92		11.58		11.28		11.10
PIPE CHAINAGE	0.00	10.69		72.19		97.44		122.67		141.68		244.60		328.06		403.22		493.76		

1:100 AT A1
0 1m 2m 4m 6m

1:1000 AT A1
0 10m 20m 40m 60m

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	DRAWN	DATE
A	ISSUED FOR INFORMATION	HL	12/08/2025
B	ISSUED FOR INFORMATION	HL	27/08/2025
C	ISSUED FOR INFORMATION	HL	09/09/2025
D	ISSUED FOR INFORMATION	SB	15/05/2026

peritas

PERTH
P: 08 6336 9299
A: 74 GOODWOOD PDE, BURSWOOD, WA 6100

MELBOURNE
P: 03 8657 9292
A: TWO MELBOURNE QUARTER, SUITE 307, 697 COLLINS ST, DOCKLANDS, VIC 3008

ENQUIRIES@PERITAS.AU

CLIENT:
URBAN RESOURCES

DESIGNED:	DRAWN:	CHECKED:
D.AYRES	H.LUONG	A.SMITH
SURVEY DATUM:	WAPC No:	SCALE:
MGA 50, AHD	N/A	1:1000 @ A1
DWG IS NOT FOR CONSTRUCTION UNLESS SIGNED BELOW:		DATE CREATED:
		JUL 2025

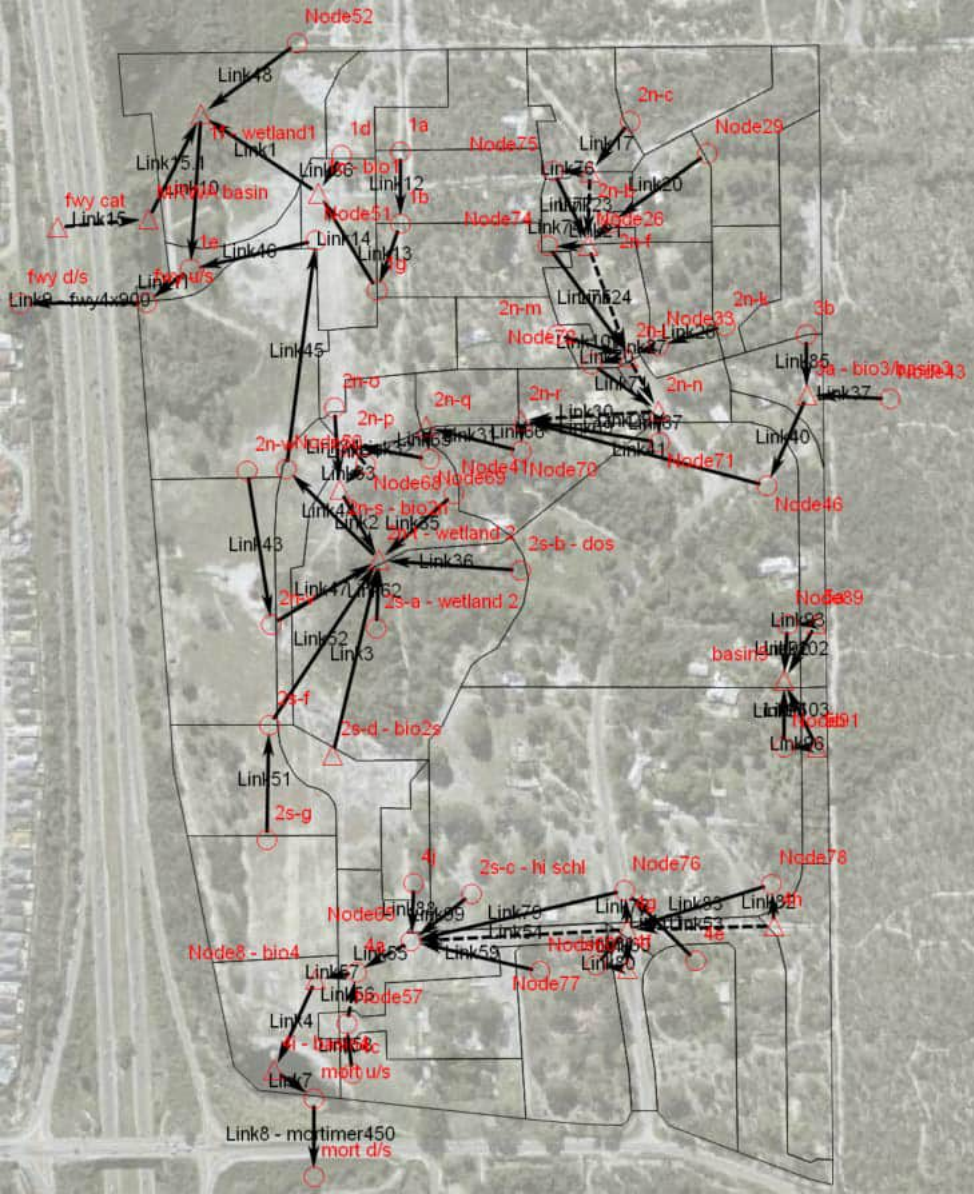
PROJECT:
CASUARINA LDP AREA
CASUARINA W.A 6167

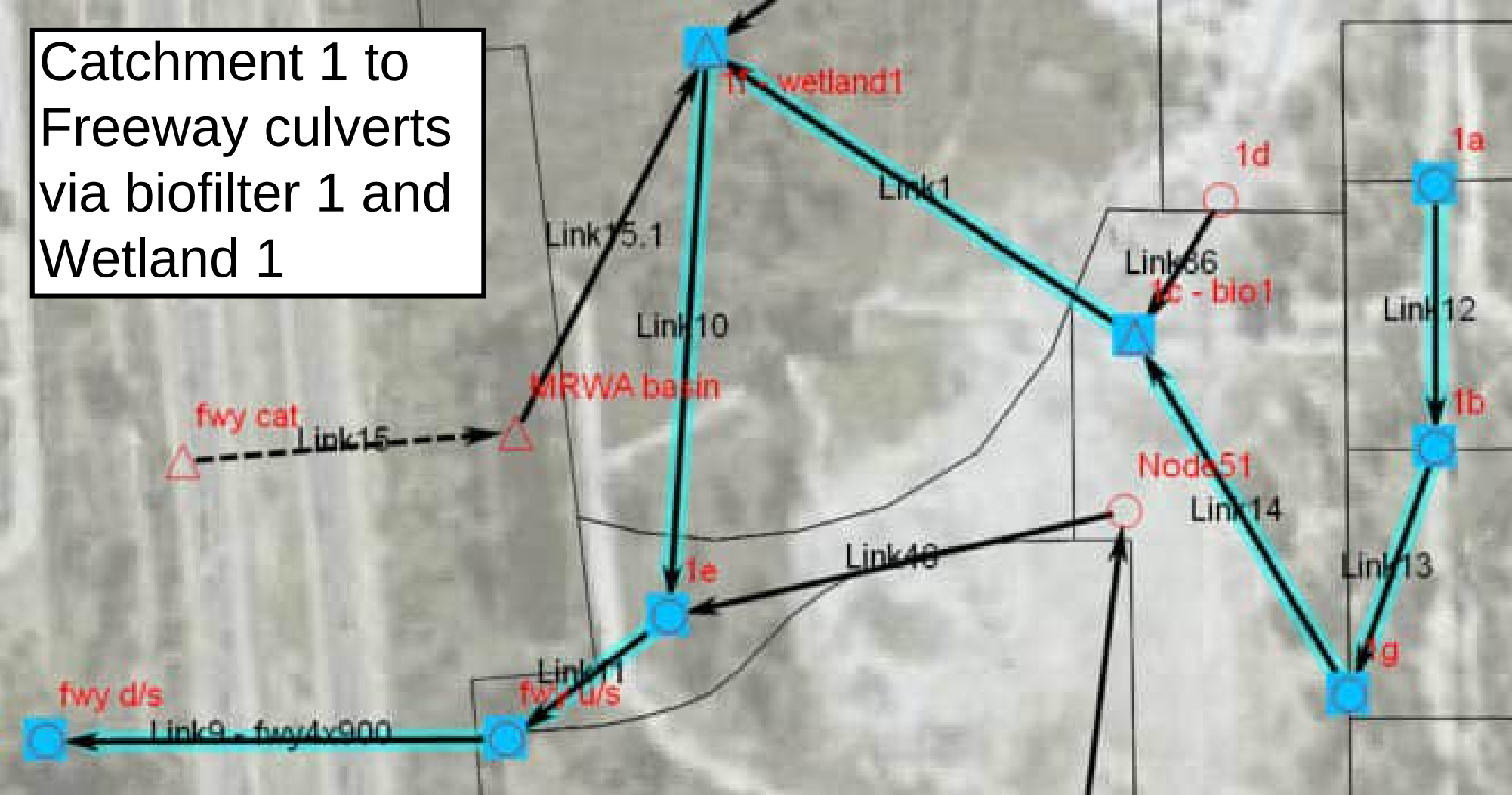
TITLE:
DRAINAGE LONGITUDINAL SECTION

PROJECT NUMBER:	DRG NUMBER:	REV:
PC21340	CI-02.10	D

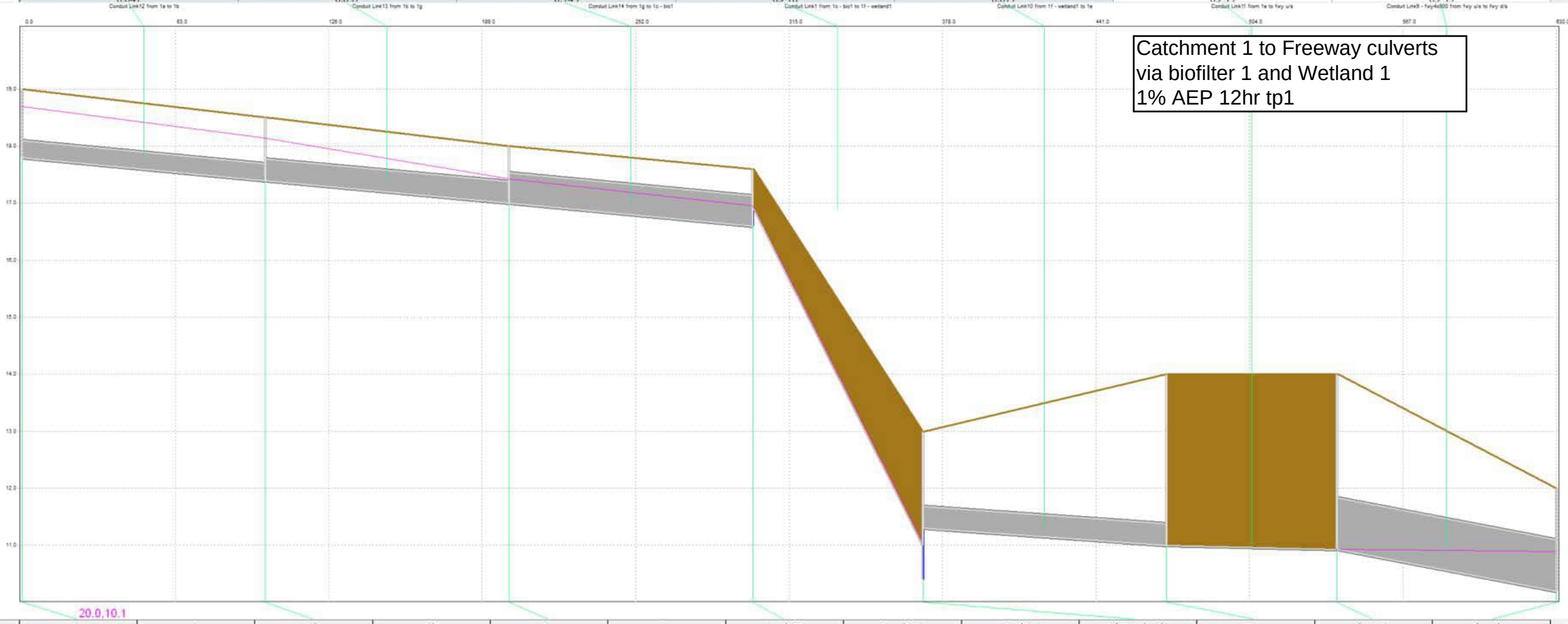
Appendix H: Stormwater model long-sections

(Pentium Water, 2026)


Node52
Link18
1f - wetland1
Link15
Link1
1d
1a
Node75
Link17
2n-c
Node29
Link16
bio1
Link12
Link10
basin
1b
Node51
Node74
Link76
2n-b
Link20
fwy cat
Link15
Link23
Node26
2n-f
1e
Link14
Link46
Link13
1g
fwy d/s
fwy u/s
Link8
fwy4x900
Link24
2n-m
Node78
Node33
2n-k
3b
Link45
Link35
3a - bio3
Link37
2n-o
2n-q
2n-r
2n-n
2n-p
Link40
Node41
Node70
Node71
Node69
Node68
Node46
2n-s - bio2n
Link43
Link2
Link85
2n1 - wetland 2
2s-b - dos
Link36
2s-a - wetland 2
Node89
Link32
Link3
basin3
2s-f
2s-d - bio2s
Link51
2s-g
4l
2s-c - hi schl
Node76
Node78
Node65
Link88
Link99
Link76
Link54
Link53
4e
Node8 - bio4
4g
Link63
Link59
Node77
Link57
Link56
Node57
Link4
4i - bio5
mort u/s
Link7
Link8 - mortimer450
mort d/s

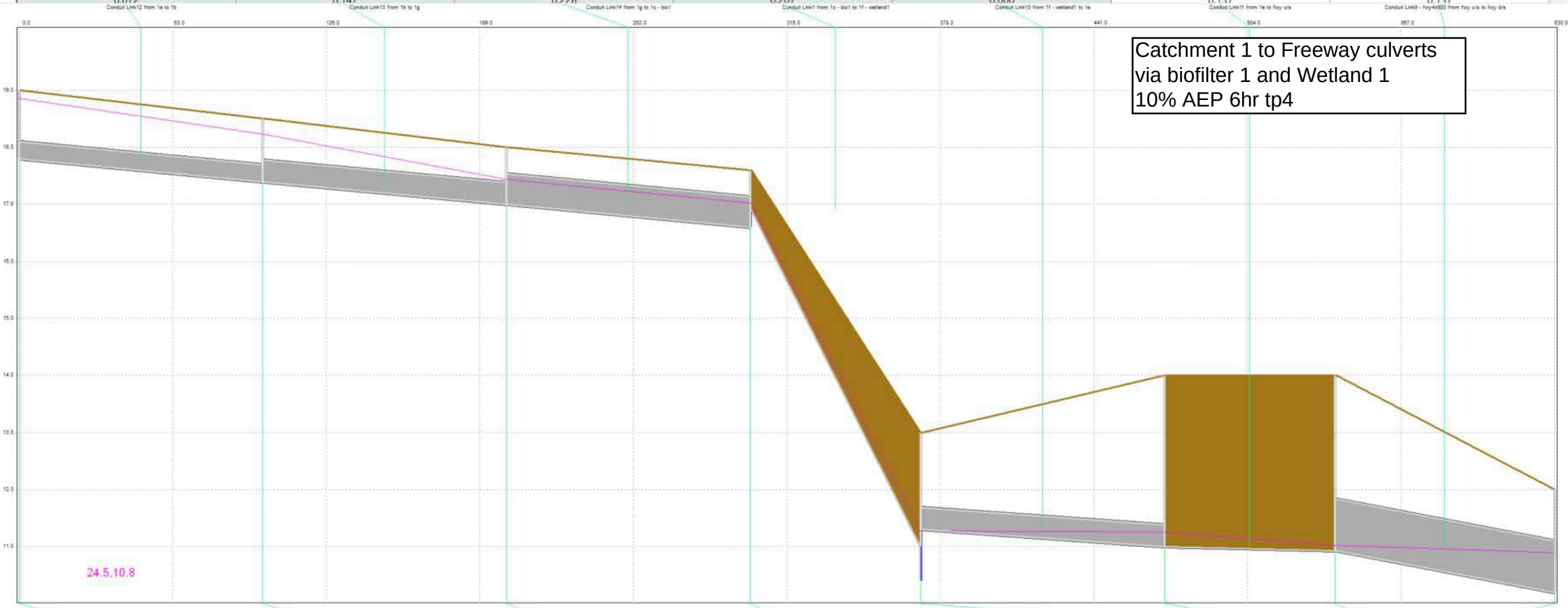

Catchment 1 to Freeway culverts via biofilter 1 and Wetland 1
1f - wetland1
1d
1a
Link1
Link15.1
Link86
1c - bio1
Link12
Link10
MRWA basin
1b
fwy cat
Link15
Node51
Link14
Link13
Link40
1e
1g
Link11
fwy d/s
fwy u/s
Link9 - fwy4x900

	Link12	Link13	Link14	Link1	Link10	Link11	Link9 - fwy4x900
Storm	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1
Diameter (Height)	0.300	0.375	0.525	0.500	0.375	1.000	0.900
Length	100.000	100.000	100.000	70.000	100.000	70.000	90.000
Max Flow	0.047	0.097	0.149	0.216	0.077	0.239	0.239



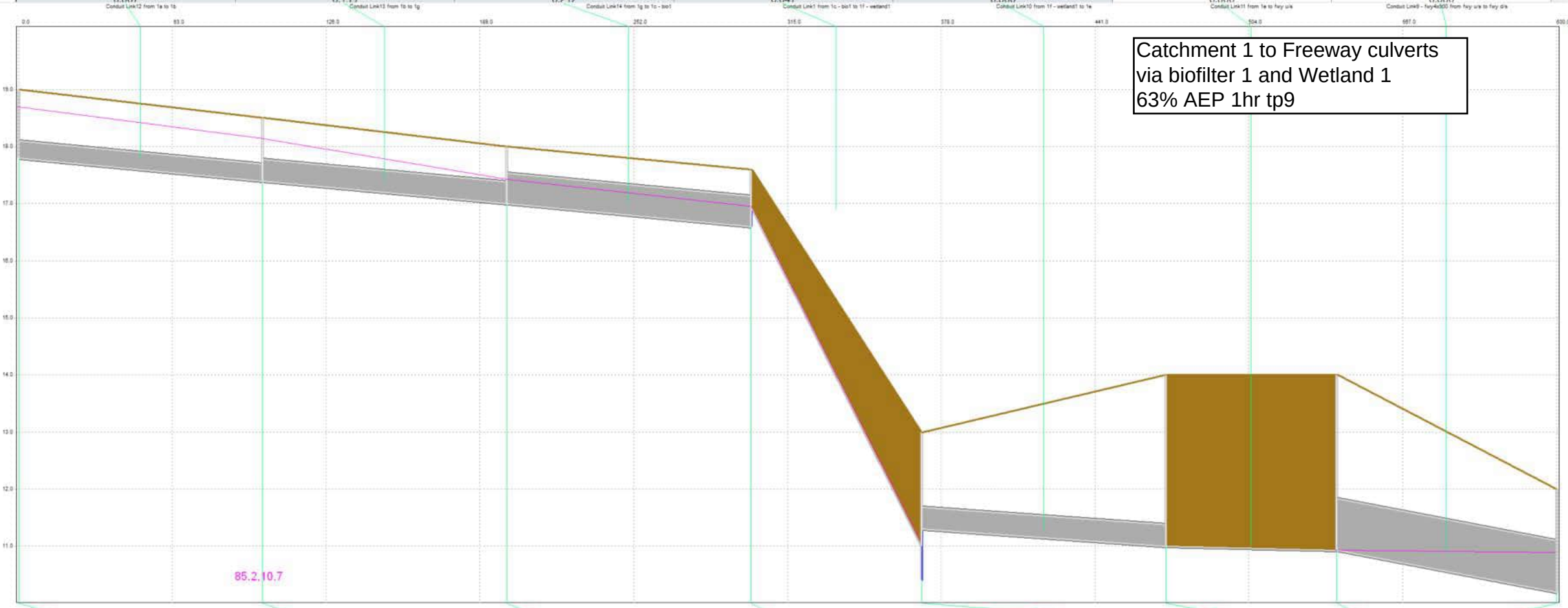
	1a	1a	1b	1b	1g	1g	1c - bio1	1c - bio1	1c - bio1	1f - wetland1	1e	fwy u/s	fwy d/s
Invert Elevation	17.800		17.400		17.000		16.600			10.400	11.000	10.930	10.200
Max Water Depth	0.220		0.294		0.316		0.416			1.196	0.312	0.122	0.690
Max Volume	0.268		0.359		0.386		279.501			19173.055	0.380	0.148	0.842
Max Water Elevati	18.020		17.694		17.316		17.016			11.596	11.312	11.052	10.890

	Link12	Link13	Link14	Link1	Link10	Link11	Link9 - fwy4x900
Storm	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4
Diameter (Height)	0.300	0.375	0.525	0.500	0.375	1.000	0.900
Length	100.000	100.000	100.000	70.000	100.000	70.000	90.000
Max Flow	0.072	0.147	0.228	0.207	0.000	0.137	0.137

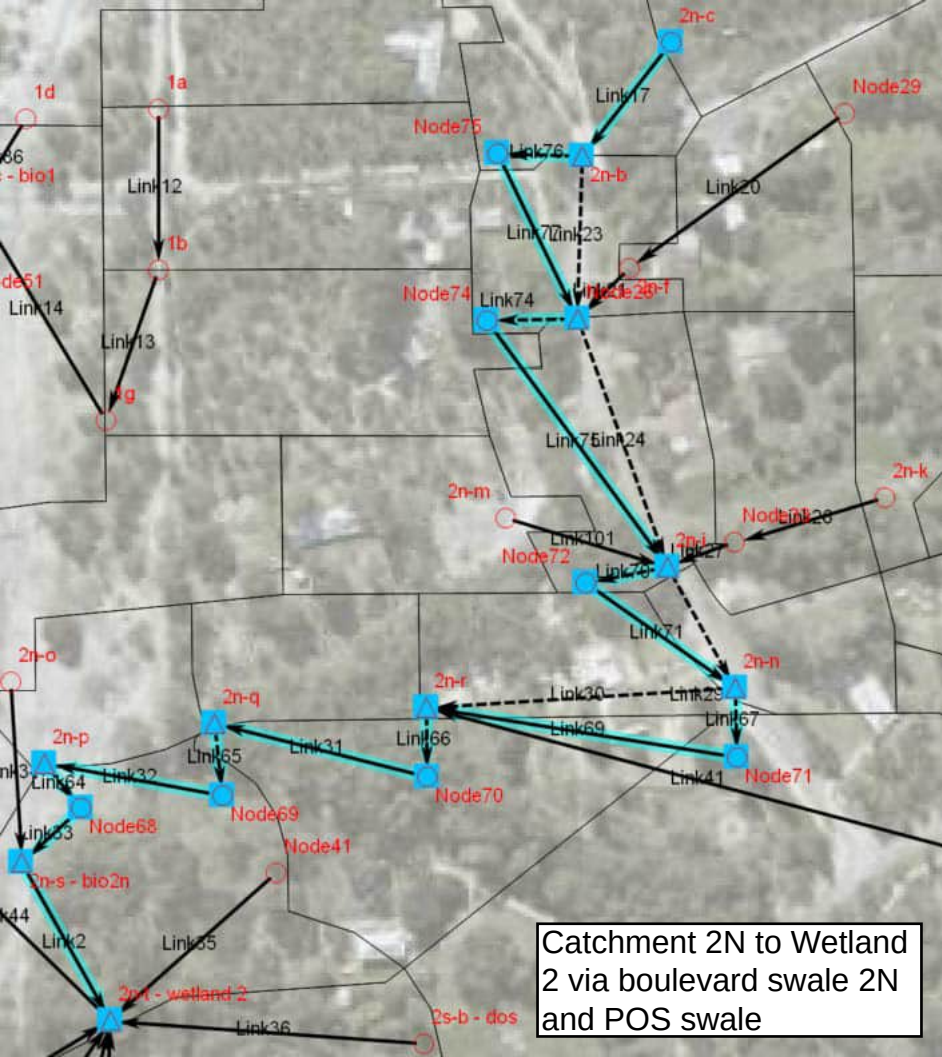


	1a	1a	1b	1b	1g	1g	1c - bio1	1c - bio1	1c - bio1	1f - wetland1	1e	fwy u/s	fwy d/s
Invert Elevation	17.800		17.400		17.000		16.600			10.400	11.000	10.930	10.200
Max Water Depth	1.049		0.830		0.433		0.415			0.869	0.249	0.093	0.690
Max Volume	1.287		1.019		0.534		284.907			9172.889	0.304	0.114	0.842
Max Water Elevati	18.849		18.230		17.433		17.015			11.269	11.249	11.023	10.890

	Link12	Link13	Link14	Link1	Link10	Link11	Link9 - fwy4x900
Storm	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9
Diameter (Height)	0.300	0.375	0.525	0.500	0.375	1.000	0.900
Length	100.000	100.000	100.000	70.000	100.000	70.000	90.000
Max Flow	0.067	0.139	0.212	0.047	0.000	0.000	0.000

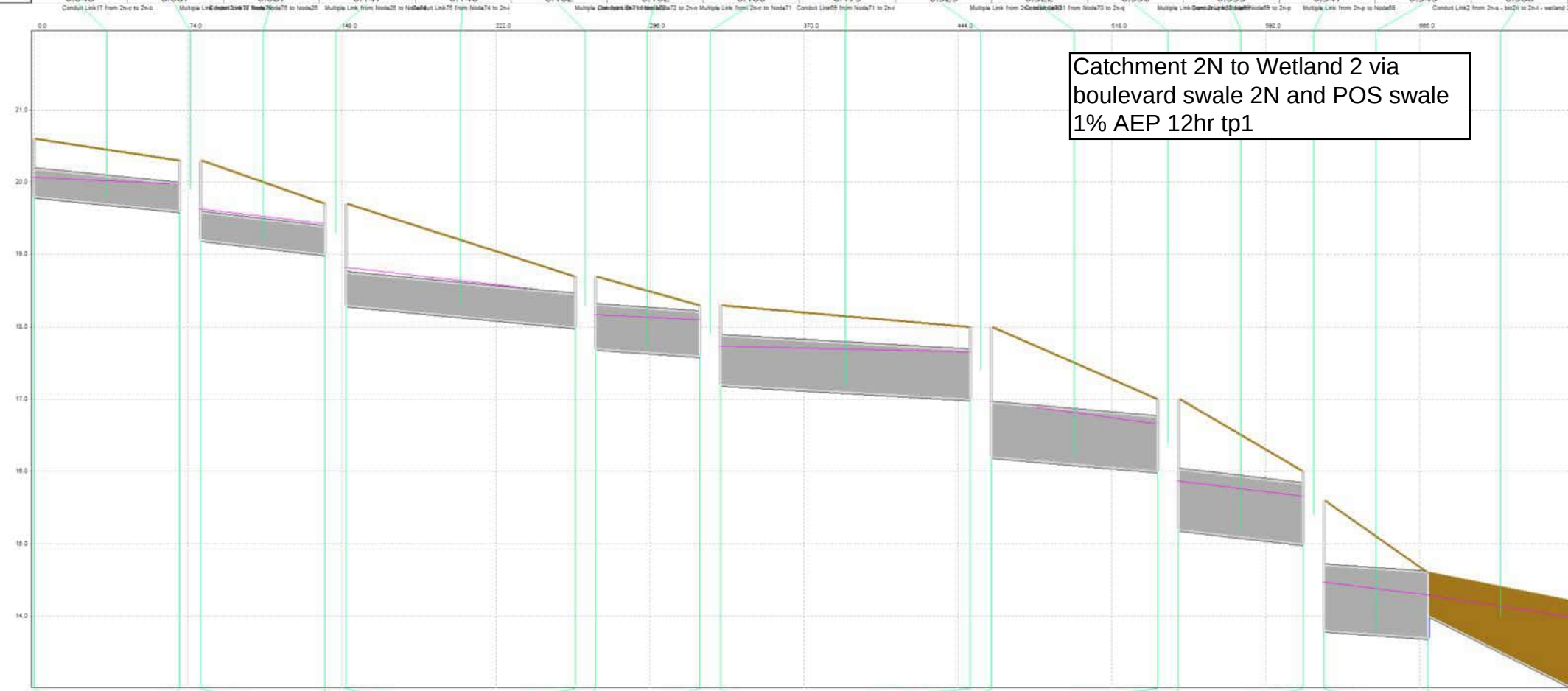


	1a	1a	1b	1b	1g	1g	1c - bio1	1c - bio1	1c - bio1	1f - wetland1	1e	fwy u/s	fwy d/s
Invert Elevation	17.800		17.400		17.000		16.600			10.400	11.000	10.930	10.200
Max Water Depth	0.899		0.741		0.422		0.353			0.624	0.000	0.000	0.690
Max Volume	1.099		0.905		0.515		232.474			3844.696	0.000	0.000	0.842
Max Water Elevati	18.699		18.141		17.422		16.953			11.024	11.000	10.930	10.890



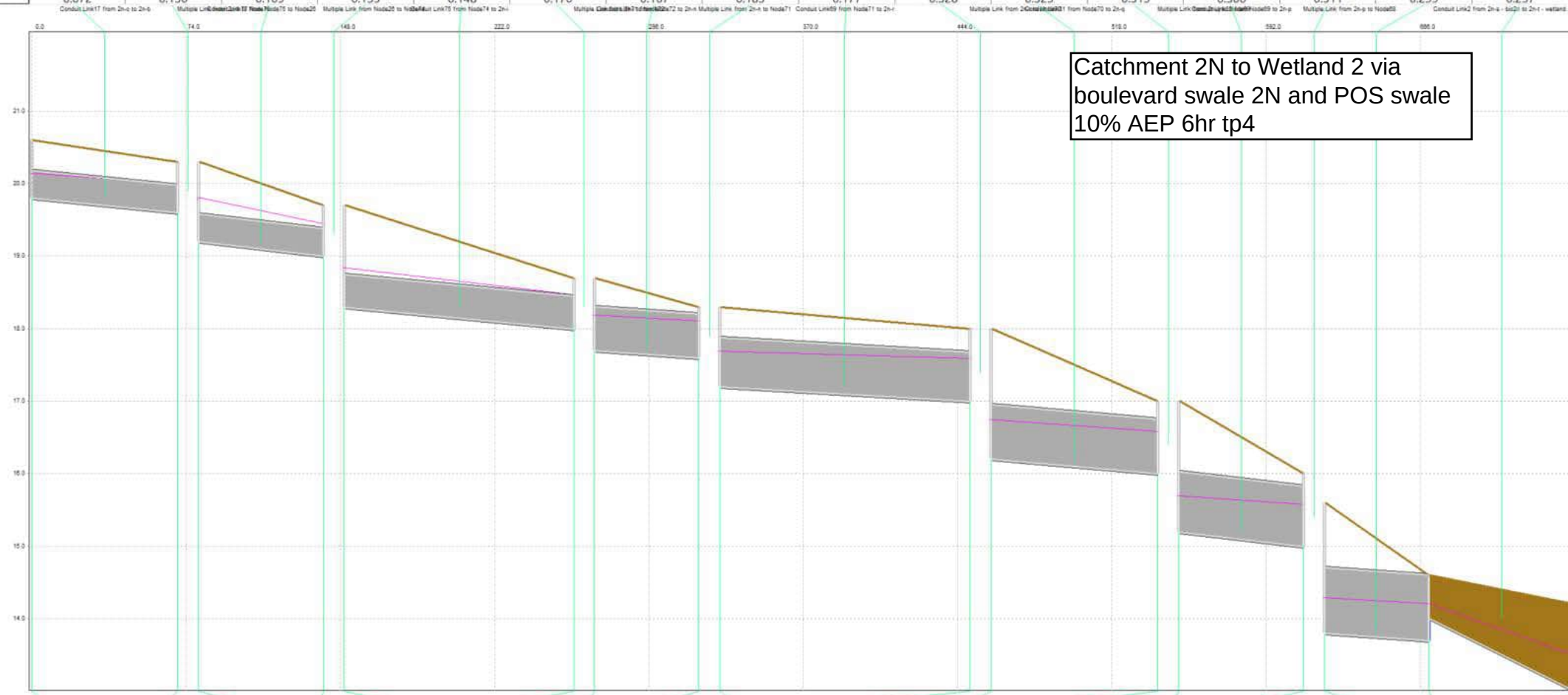
Catchment 2N to Wetland 2 via boulevard swale 2N and POS swale

	Link17	blvd 2n-b weir	Link77	blvd 2n-e weir	Link75	blvd 2n-i weir	Link71	blvd 2n weir 1	Link69	pos 2n-3 weir	Link31	pos 2n-q weir	Link32	pos 2n-p weir	Link33	Link2
Storm	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr	FLTW 1pct 12hr
Diameter (Height)	0.375		0.375		0.450		0.600		0.675		0.750		0.825		0.900	0.500
Length	70.000		60.000		110.000		50.000		120.000		80.000		60.000		50.000	70.000
Max Flow	0.048	0.087	0.087	0.147	0.146	0.162	0.162	0.180	0.179	0.525	0.522	0.536	0.535	0.547	0.545	0.588



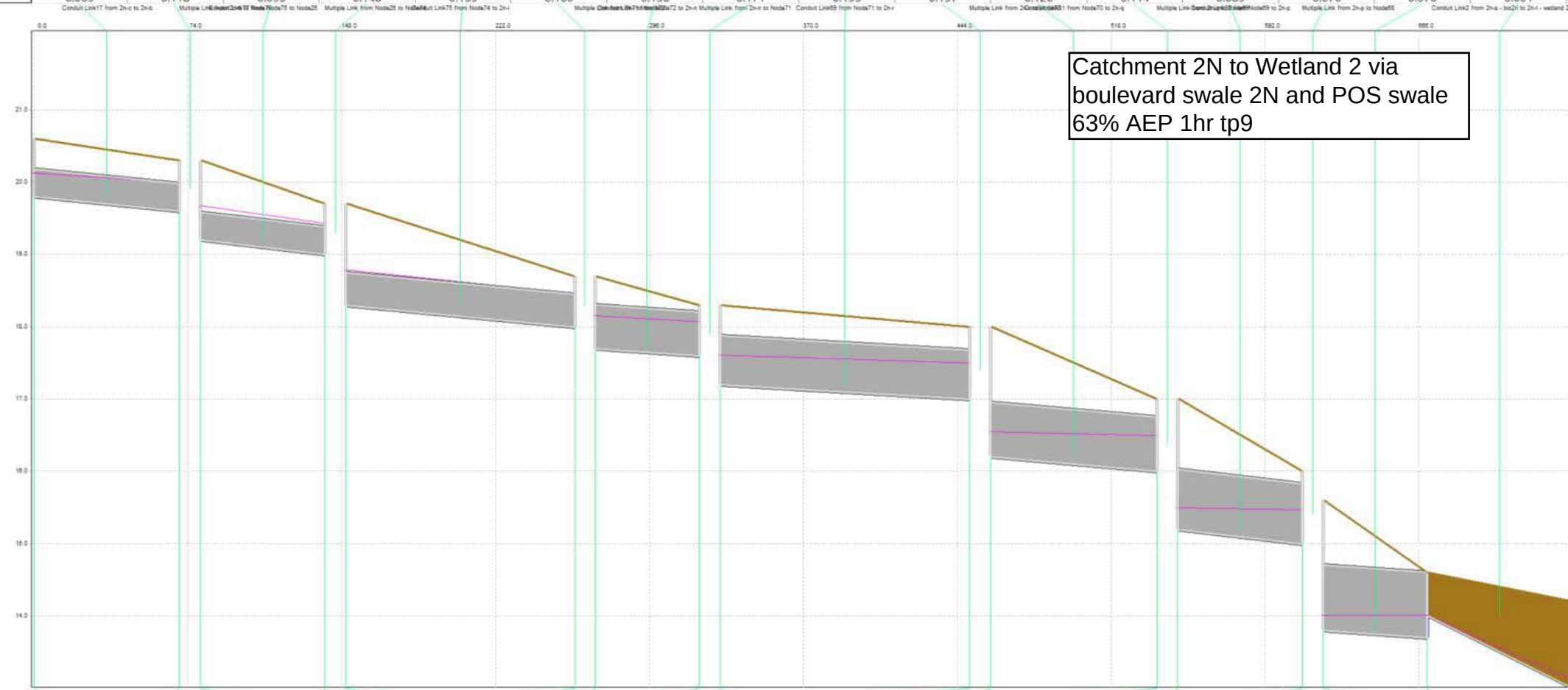
	2n-c	2n-c	2n-b	2n-b	Node75	Node26	Node26	Node74	2n-i	2n-i	Node72	2n-n	2n-n	Node71	2n-r	2n-r	2n-r	Node70	2n-q	2n-q	2n-q	Node69	2n-p	2n-p	2n-p	Node68	2n-s - bio	2n-s - bio	2n-t - wet
Invert Elevation	19.800		19.600		19.200	19.000		18.300	18.000		17.700	17.600		17.200	17.000			16.200	16.000			15.200	15.000			13.800	13.700		13.000
Max Water Depth	0.262		0.377		0.427	0.429		0.527	0.458		0.470	0.494		0.538	0.655			0.771	0.658			0.666	0.662			0.670	0.588		0.986
Max Volume	0.320		36.400		0.522	27.018		0.644	54.896		0.574	61.722		0.656	130.310			0.944	95.435			0.812	72.247			0.819	238.641		17446.88
Max Water Elevation	20.062		19.977		19.627	19.429		18.827	18.458		18.170	18.094		17.738	17.655			16.971	16.658			15.866	15.662			14.470	14.288		13.986

	Link17	blvd 2n-b weir	Link77	blvd 2n-e weir	Link75	blvd 2n-i weir	Link71	blvd 2n weir 1	Link69	pos 2n-3 weir	Link31	pos 2n-q weir	Link32	pos 2n-p weir	Link33	Link2
Storm	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr	FLTW_10pct_6hr
Diameter (Height)	0.375		0.375		0.450		0.600		0.675		0.750		0.825		0.900	0.500
Length	70.000		60.000		110.000		50.000		120.000		80.000		60.000		50.000	70.000
Max Flow	0.072	0.130	0.109	0.155	0.148	0.170	0.167	0.185	0.177	0.328	0.323	0.319	0.306	0.311	0.299	0.257

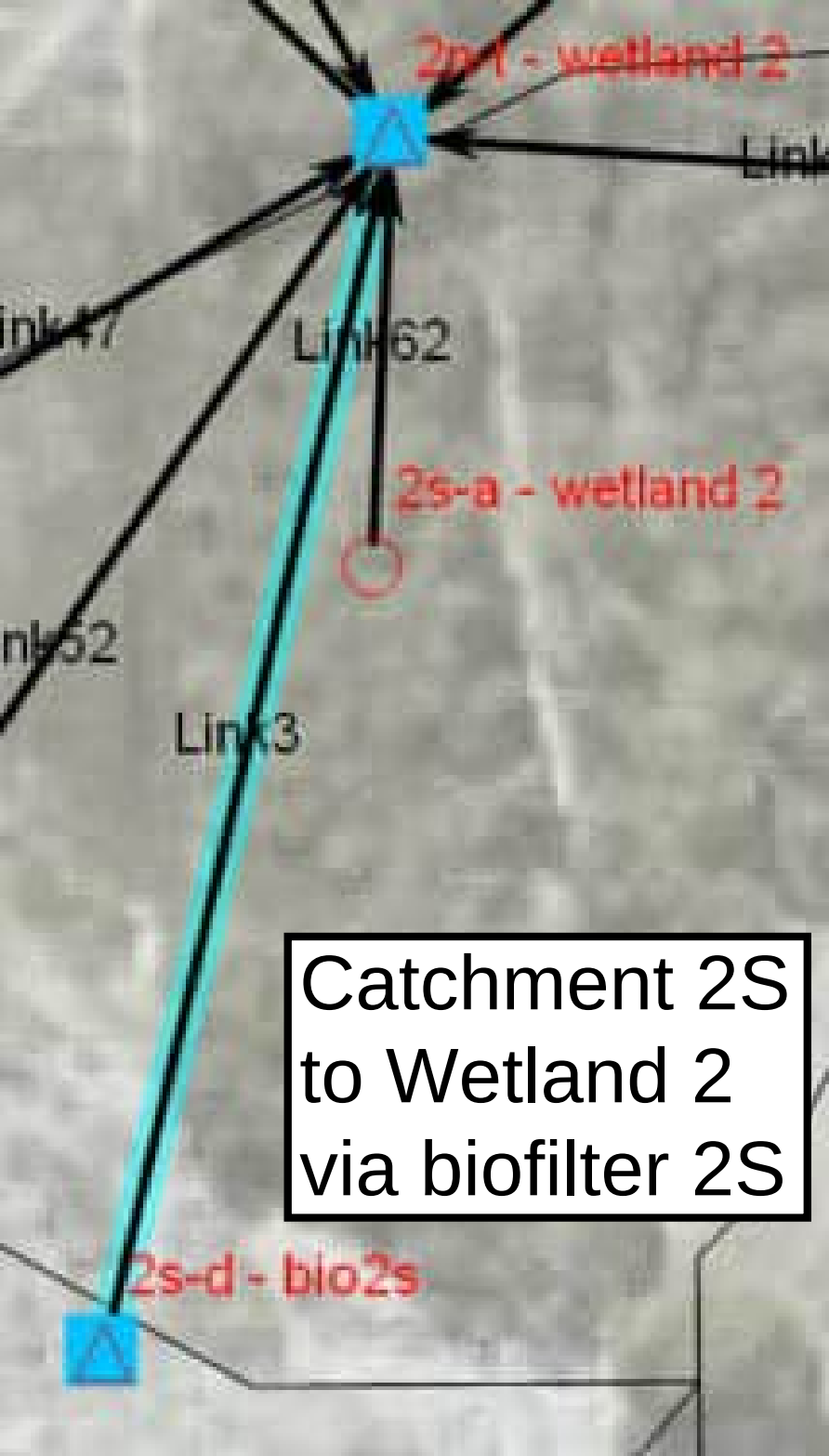


	2n-c	2n-c	2n-b	2n-b	Node75	Node26	Node26	Node74	2n-i	2n-i	Node72	2n-n	2n-n	Node71	2n-r	2n-r	2n-r	Node70	2n-q	2n-q	2n-q	Node69	2n-p	2n-p	2n-p	Node68	2n-s - bio	2n-s - bio	2n-t - wet
Invert Elevation	19.800		19.600		19.200	19.000		18.300	18.000		17.700	17.600		17.200	17.000			16.200	16.000			15.200	15.000			13.800	13.700		13.000
Max Water Depth	0.349		0.402		0.581	0.445		0.544	0.473		0.481	0.505		0.487	0.586			0.542	0.583			0.490	0.580			0.490	0.508		0.498
Max Volume	0.426		40.532		0.745	28.628		0.664	57.904		0.594	64.589		0.597	110.553			0.663	79.104			0.603	58.851			0.599	199.695		6750.169
Max Water Elevation	20.149		20.002		19.781	19.445		18.844	18.473		18.181	18.105		17.687	17.586			16.742	16.583			15.690	15.580			14.290	14.208		13.498

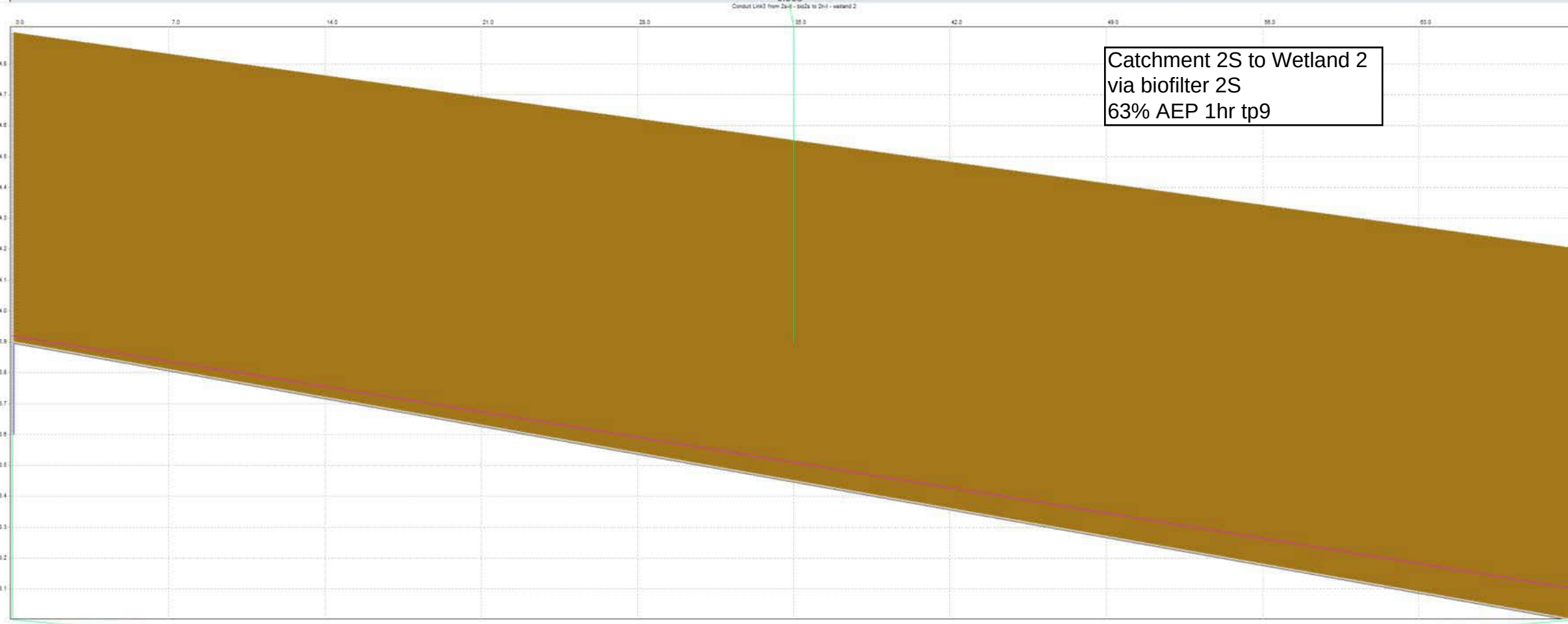
	Link17	blvd 2n-b weir	Link77	blvd 2n-e weir	Link75	blvd 2n-i weir	Link71	blvd 2n weir 1	Link69	pos 2n-3 weir	Link31	pos 2n-q weir	Link32	pos 2n-p weir	Link33	Link2
Storm	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr	FLTW 63pct 1hr
Diameter (Height)	0.375		0.375		0.450		0.600		0.675		0.750		0.825		0.900	0.500
Length	70.000		60.000		110.000		50.000		120.000		80.000		60.000		50.000	70.000
Max Flow	0.069	0.118	0.093	0.148	0.139	0.160	0.156	0.171	0.155	0.137	0.120	0.114	0.089	0.076	0.070	0.001



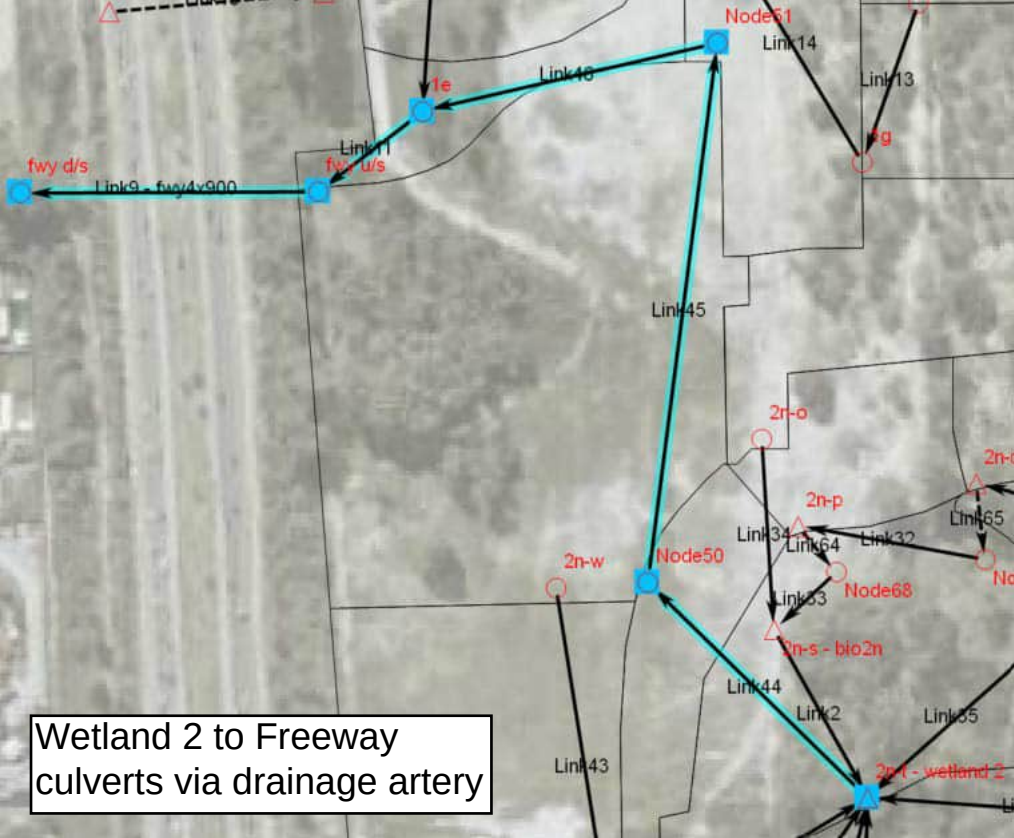
	2n-c	2n-c	2n-b	2n-b	Node75	Node26	Node26	Node74	2n-i	2n-i	Node72	2n-n	2n-n	Node71	2n-r	2n-r	2n-r	Node70	2n-q	2n-q	2n-q	Node69	2n-p	2n-p	2n-p	Node68	2n-s - bio	2n-s - bio	2n-t - wet
Invert Elevation	19.800		19.600		19.200	19.000		18.300	18.000		17.700	17.600		17.200	17.000			16.200	16.000			15.200	15.000			13.800	13.700		13.000
Max Water Depth	0.332		0.394		0.449	0.431		0.488	0.455		0.451	0.475		0.409	0.504			0.345	0.492			0.289	0.471			0.209	0.309		0.100
Max Volume	0.405		39.252		0.582	27.570		0.597	55.241		0.551	58.127		0.499	86.917			0.426	60.731			0.359	42.804			0.256	108.162		1065.696
Max Water Elevation	20.132		19.994		19.649	19.431		18.788	18.455		18.151	18.075		17.609	17.504			16.545	16.492			15.489	15.471			14.009	14.009		13.100


2p-1 - wetland 2
Link
Link62
2s-a - wetland 2
Link3
2s-d - bio2s
Catchment 2S
to Wetland 2
via biofilter 2S

	Link3
Storm	FLTW 63pct 1hr 9
Diameter (Height)	1.000
Length	70.000
Max Flow	0.003

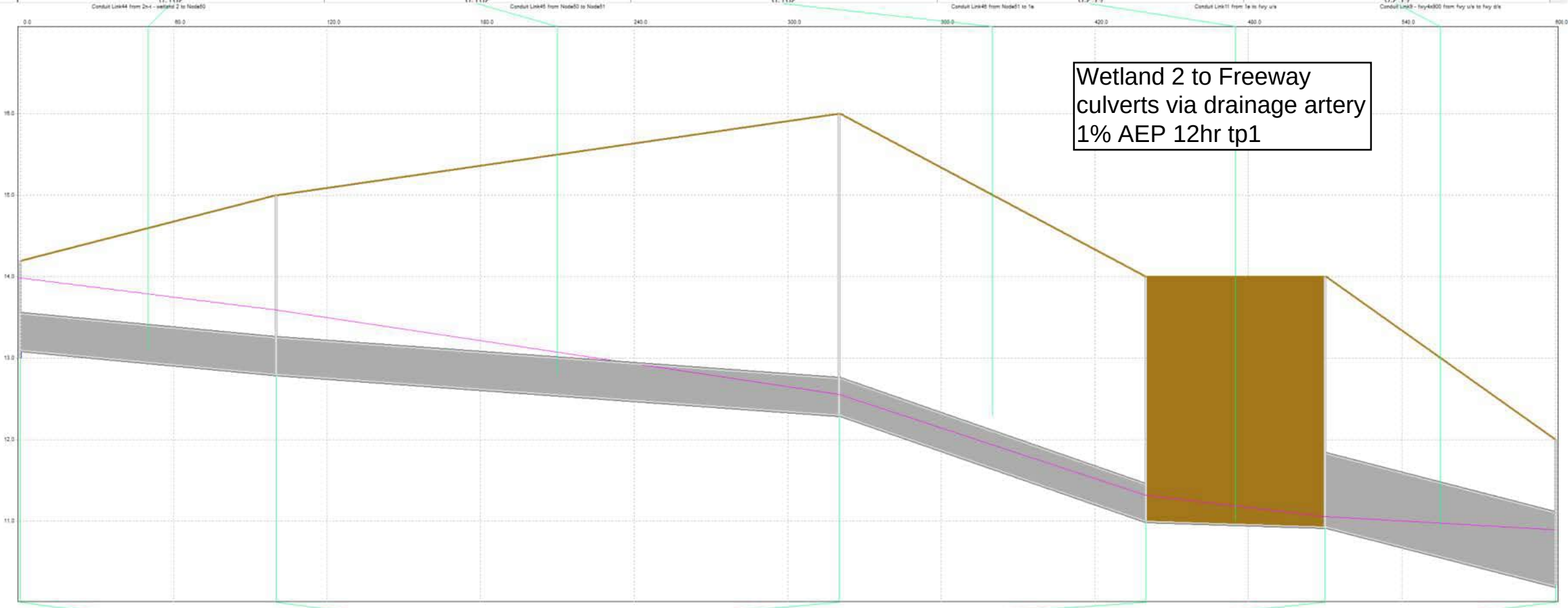


	2s-d - bio2s	2s-d - bio2s	2s-d - bio2s	2n-t - wetland 2
Invert Elevation	13.600			13.000
Max Water Depth	0.319			0.100
Max Volume	56.381			1065.696
Max Water Elevation	13.919			13.100



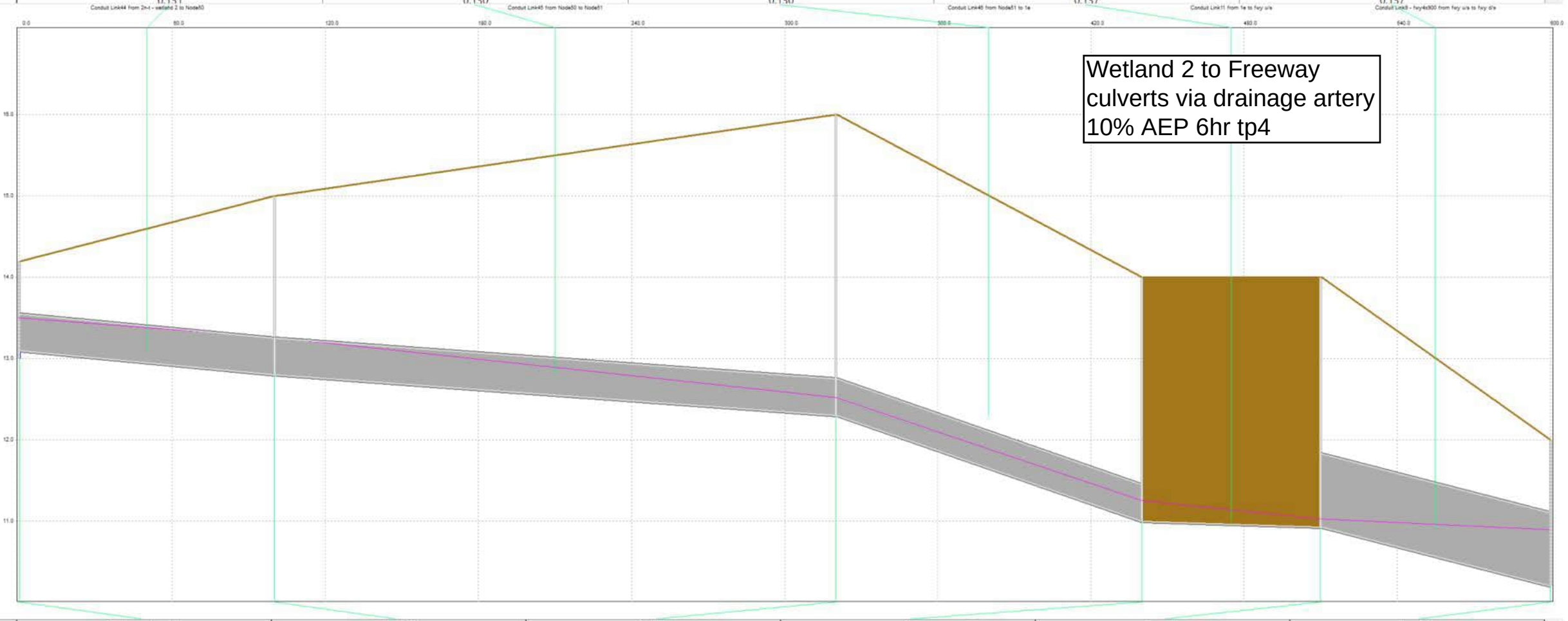
Wetland 2 to Freeway culverts via drainage artery

	Link44	Link45	Link46	Link11	Link9 - fwy4x900
Storm	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1
Diameter (Height)	0.450	0.450	0.450	1.000	0.900
Length	100.000	220.000	120.000	70.000	90.000
Max Flow	0.162	0.162	0.162	0.239	0.239

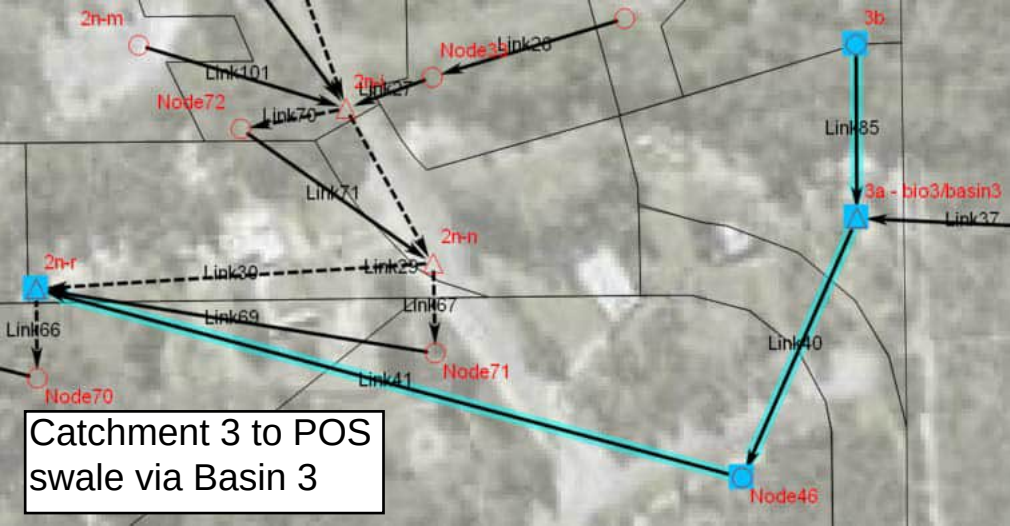


	2n-t - wetland 2	Node50	Node51	1e	fwy u/s	fwy d/s
Invert Elevation	13.000	12.800	12.300	11.000	10.930	10.200
Max Water Depth	0.986	0.789	0.255	0.312	0.122	0.690
Max Volume	17447.292	0.963	0.311	0.380	0.148	0.842
Max Water Elevati	13.986	13.589	12.555	11.312	11.052	10.890

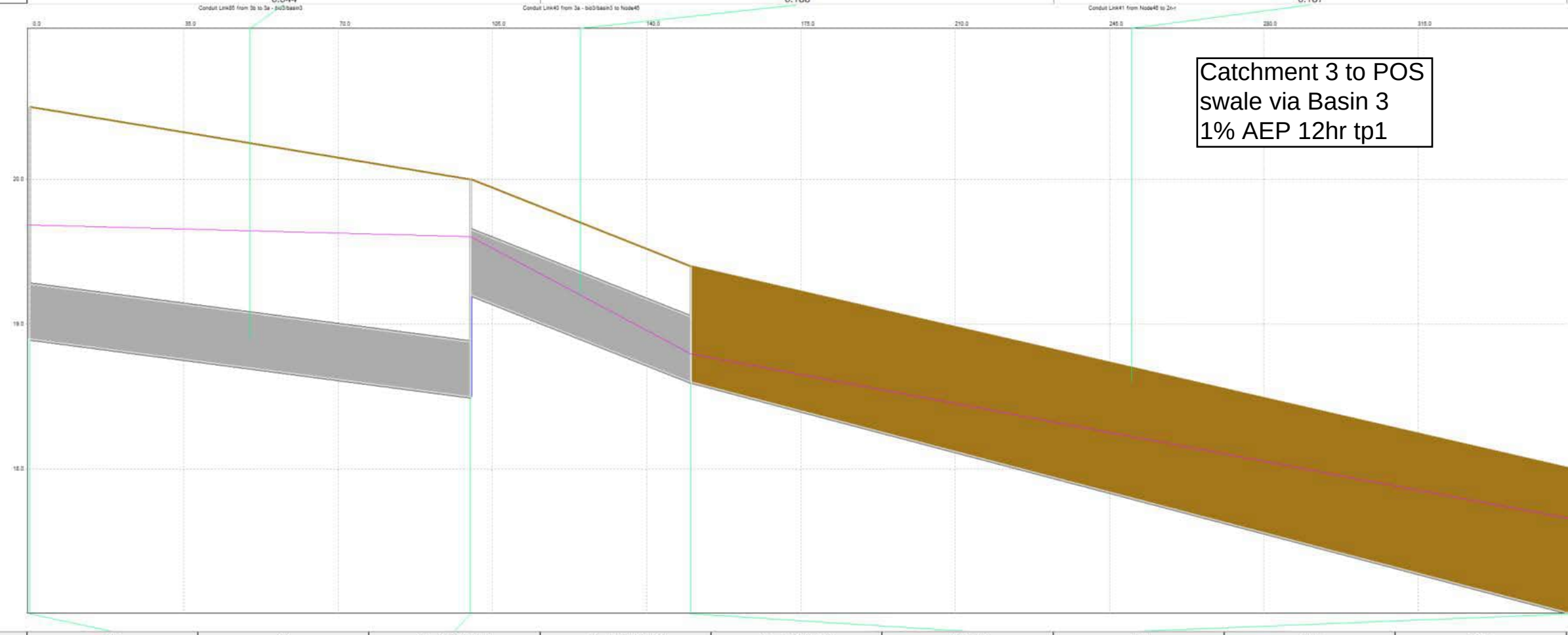
	Link44	Link45	Link46	Link11	Link9 - fwy4x900
Storm	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4
Diameter (Height)	0.450	0.450	0.450	1.000	0.900
Length	100.000	220.000	120.000	70.000	90.000
Max Flow	0.131	0.130	0.130	0.137	0.137



	2n-t - wetland 2	Node50	Node51	1e	fwy u/s	fwy d/s
Invert Elevation	13.000	12.800	12.300	11.000	10.930	10.200
Max Water Depth	0.498	0.460	0.223	0.249	0.093	0.690
Max Volume	6749.423	0.561	0.273	0.304	0.114	0.842
Max Water Elevati	13.498	13.260	12.523	11.249	11.023	10.890

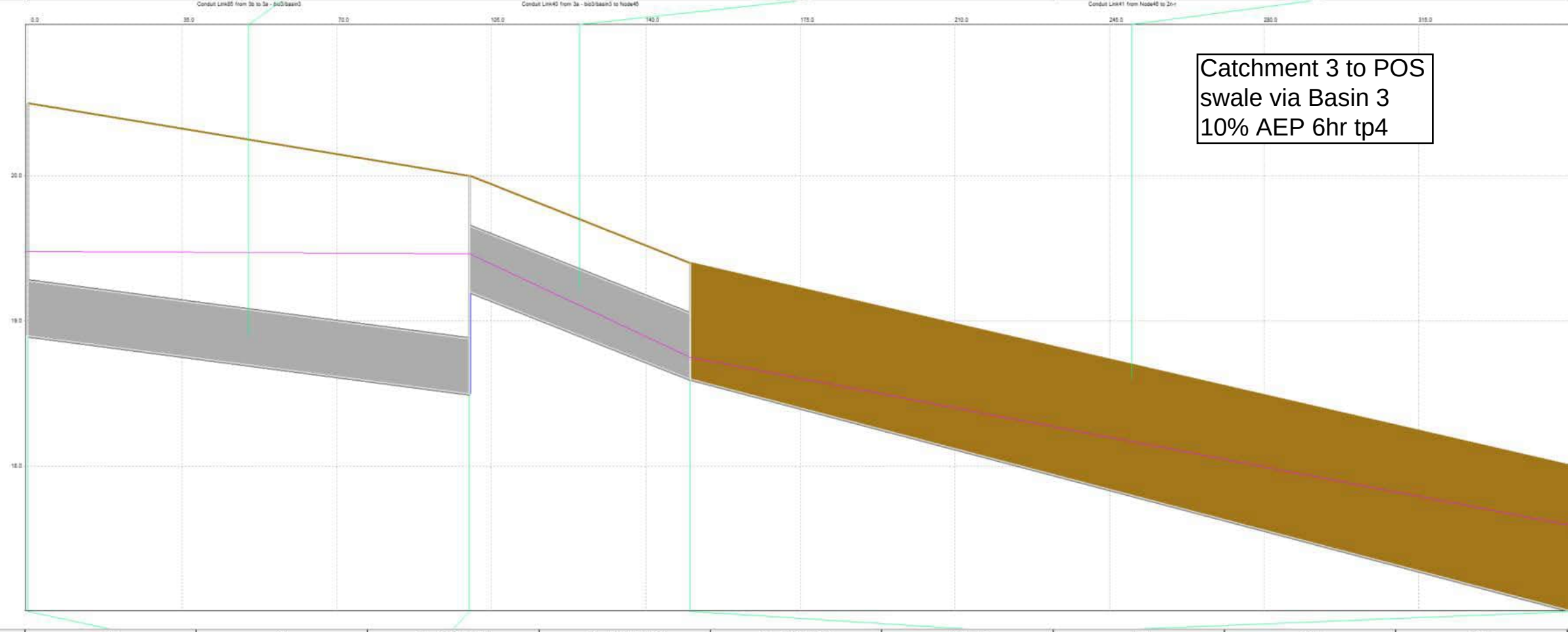

2n-m
Link101
Node72
Link70
2n-l
Link27
Node73
Link26
3b
Link85
3a - bio3/basin3
Link37
Link71
2n-n
2n-r
Link30
Link29
Link67
Link66
Link69
Node70
Node71
Link41
Link40
Node46
Catchment 3 to POS swale via Basin 3

	Link85	Link40	Link41
Storm	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1
Diameter (Height)	0.375	0.450	0.500
Length	100.000	50.000	200.000
Max Flow	0.044	0.188	0.187



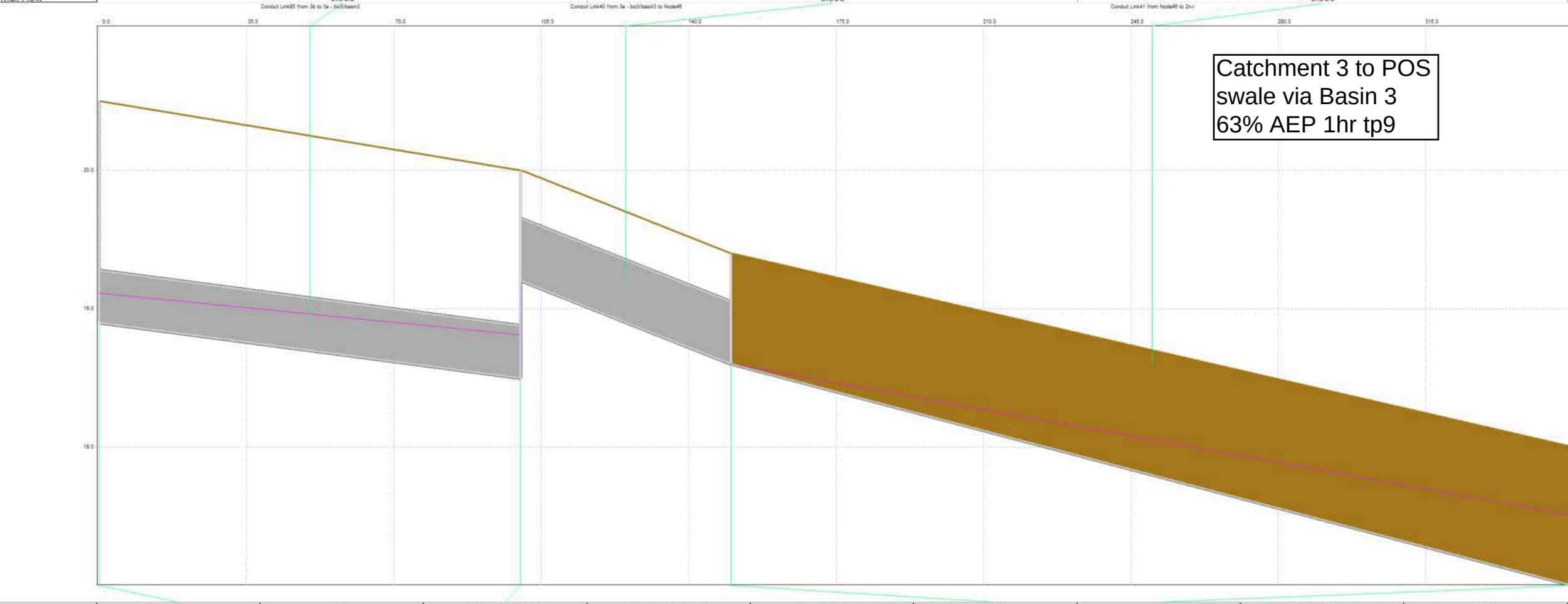
	3b	3b	3a - bio3/basin3	3a - bio3/basin3	3a - bio3/basin3	Node46	2n-r	2n-r	2n-r
Invert Elevation	18.900		18.500			18.600	17.000		
Max Water Depth	0.783		1.105			0.194	0.655		
Max Volume	0.955		437.526			0.237	130.310		
Max Water Elevation	19.683		19.605			18.794	17.655		

	Link85	Link40	Link41
Storm	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4
Diameter (Height)	0.375	0.450	0.500
Length	100.000	50.000	200.000
Max Flow	0.063	0.112	0.110

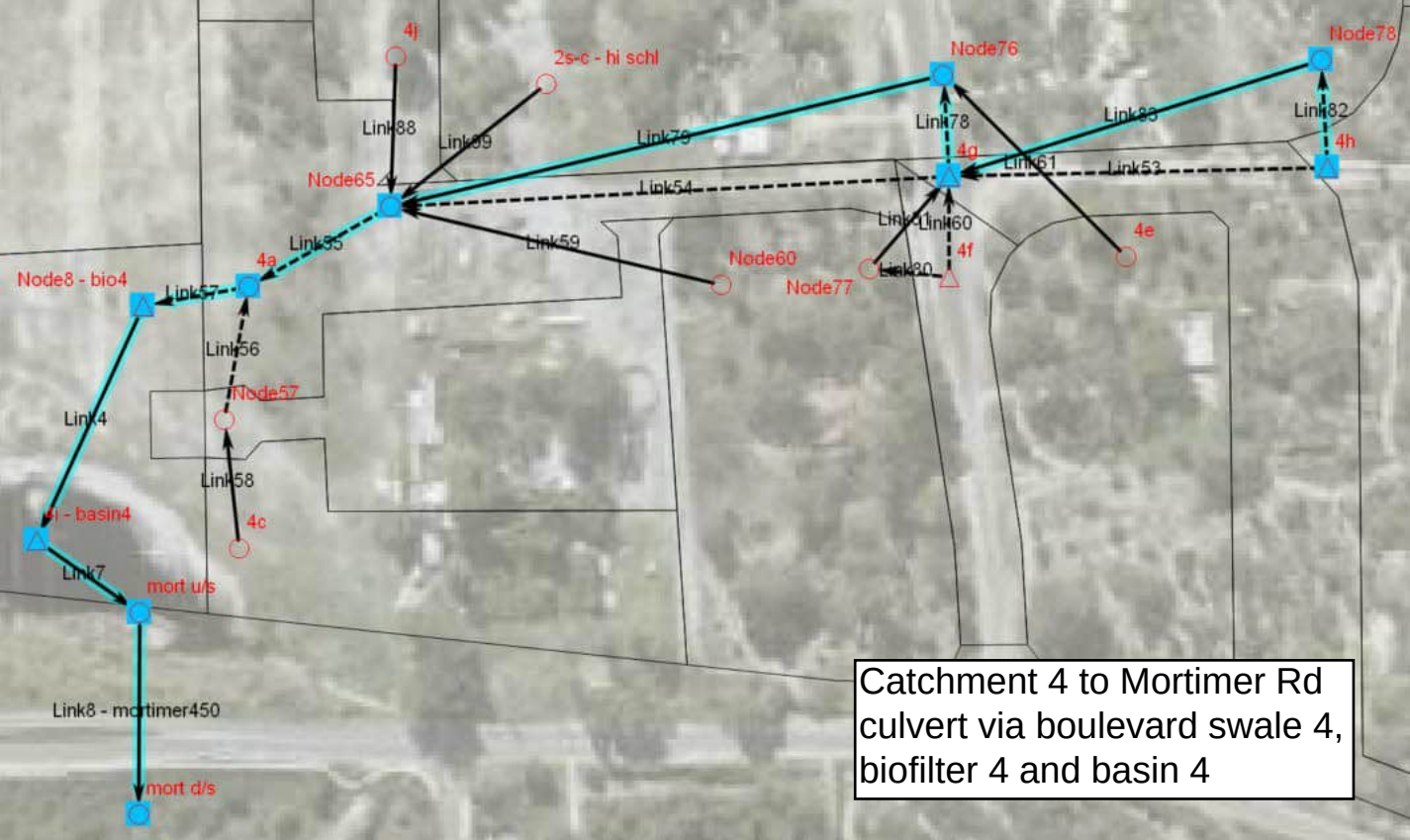


	3b	3b	3a - bio3/basin3	3a - bio3/basin3	3a - bio3/basin3	Node46	2n-r	2n-r	2n-r
Invert Elevation	18.900		18.500			18.600	17.000		
Max Water Depth	0.578		0.961			0.150	0.586		
Max Volume	0.705		347.785			0.183	110.553		
Max Water Elevation	19.478		19.461			18.750	17.586		

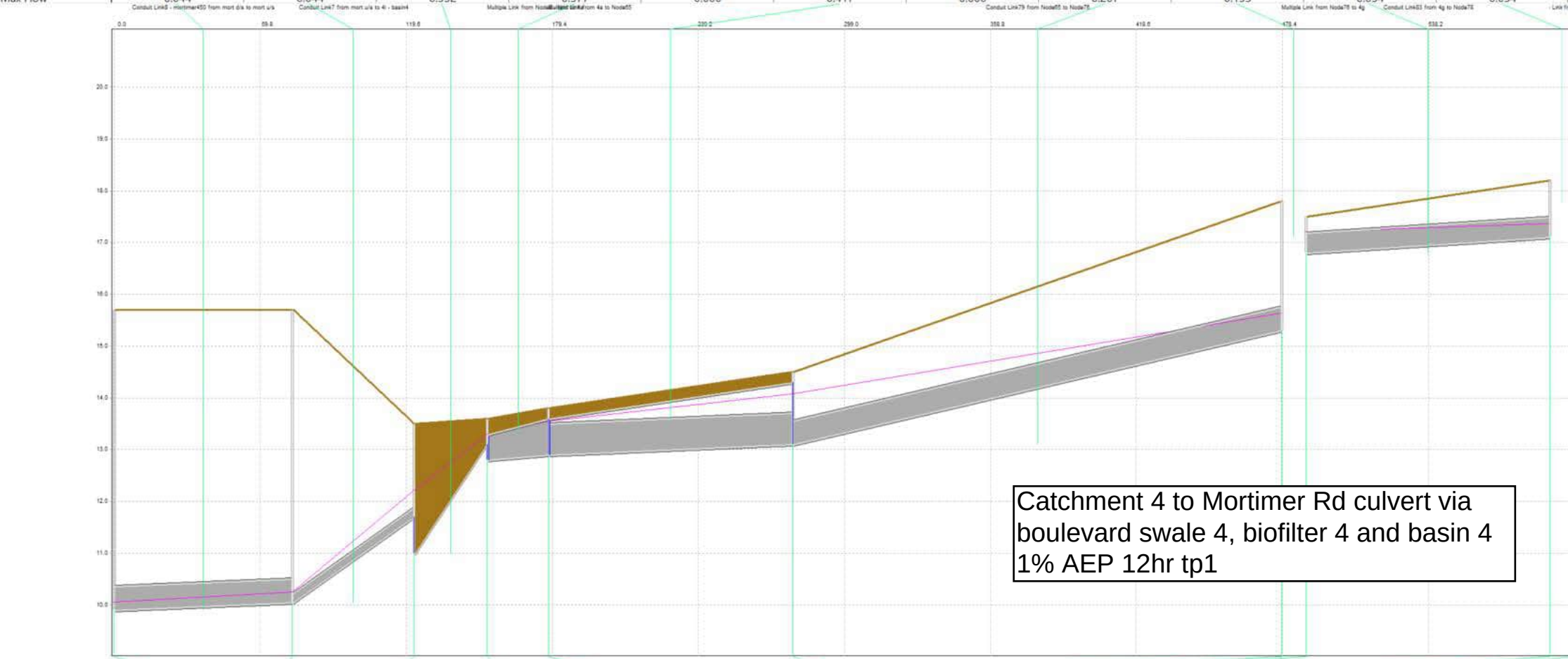
	Link85	Link40	Link41
Storm	FLTW 63oct 1hr 9	FLTW 63oct 1hr 9	FLTW 63oct 1hr 9
Diameter (Height)	0.375	0.450	0.500
Length	100.000	50.000	200.000
Max Flow	0.060	0.000	0.000



	3b	3b	3a - bio3/basin3	3a - bio3/basin3	3a - bio3/basin3	Node46	2n-r	2n-r	2n-r
Invert Elevation	18.900		18.500			18.600	17.000		
Max Water Depth	0.214		0.312			0.000	0.504		
Max Volume	0.261		71.994			0.000	86.917		
Max Water Elevation	19.114		18.812			18.600	17.504		

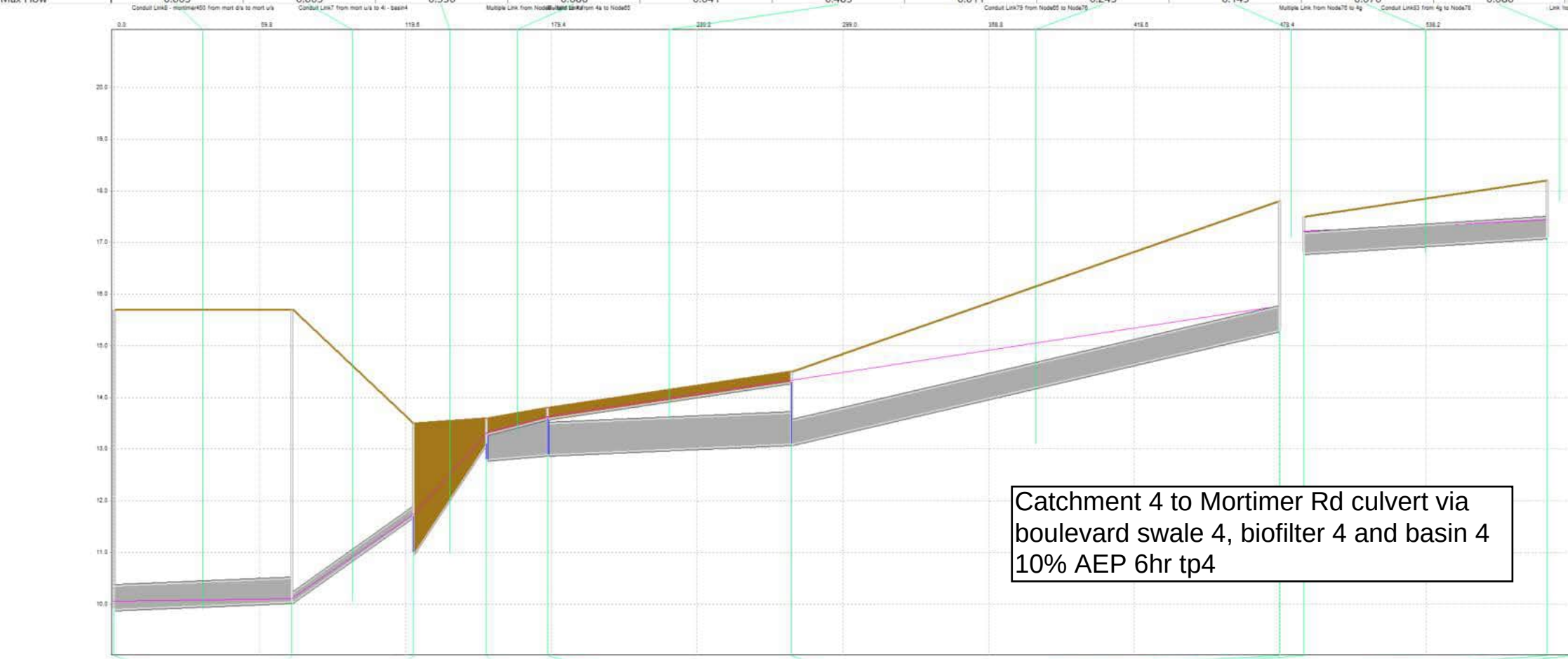

4j
2s-c - hi schl
Node76
Node78
Link88
Link89
Link79
Link78
Link83
Link82
4h
4g
Link61
Link53
Node65
Link54
Link60
4e
Link95
Link59
4a
4f
Node60
Node77
Node8 - bio4
Link57
Link56
Node57
Link4
Link58
4c
i - basin4
Link7
mort u/s
Link8 - mortimer450
mort d/s
Catchment 4 to Mortimer Rd culvert via boulevard swale 4, biofilter 4 and basin 4

	Link8 - mortimer450	Link7	Link4	322.1	blvd-pos 4i	320.1	blvd-4a	Link79	blvd 4g weir	Link83	blvd 4h weir
Storm	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1	FLTW 1pct 12hr 1
Diameter (Height)	0.450	0.180	0.500	0.750	0.200	0.600	0.200	0.450		0.375	
Length	73.000	50.000	30.000	25.000	25.000	100.000	100.000	200.000		100.000	
Max Flow	0.044	0.044	0.552	0.577	0.000	0.417	0.000	0.207	0.133	0.054	0.054



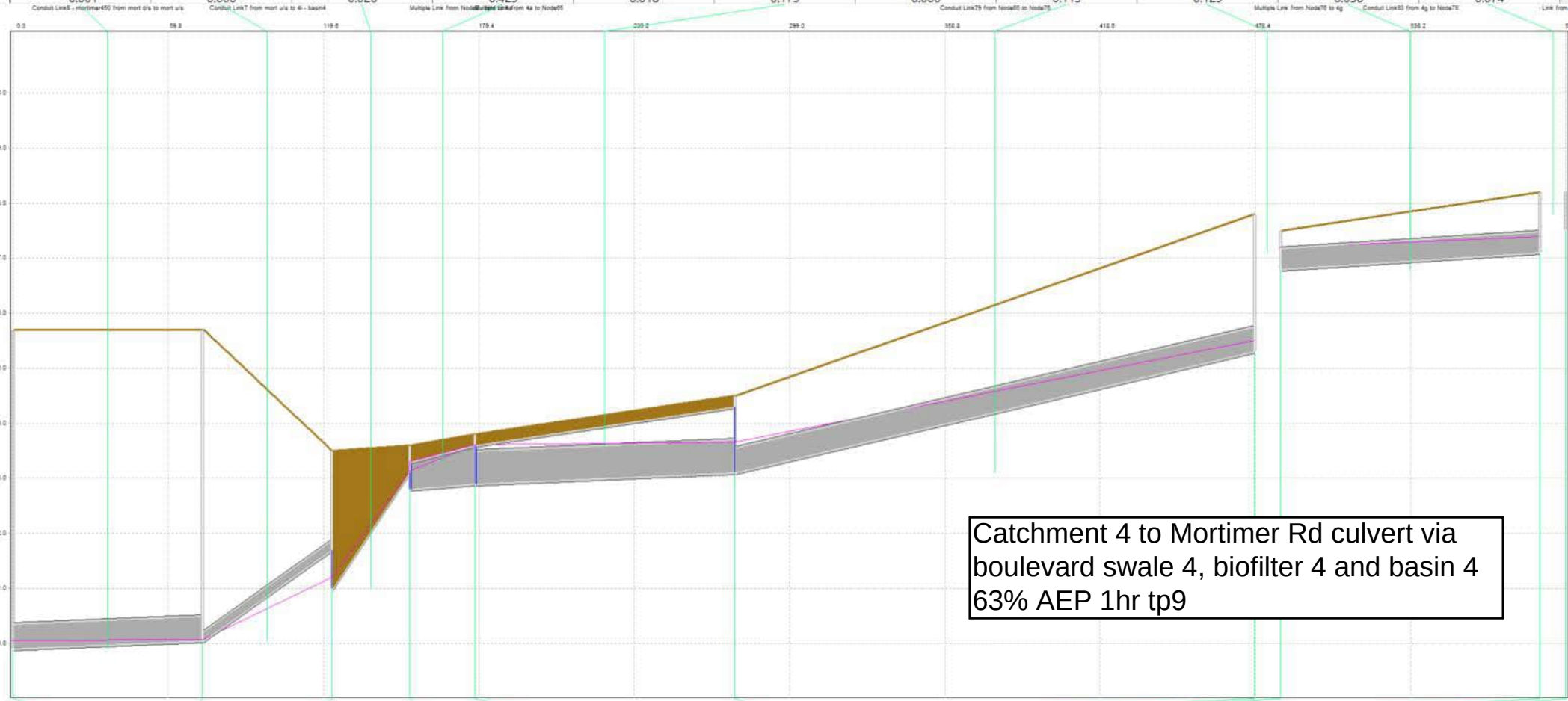
	mort d/s	mort u/s	4i - basin4	Node8 - bio4	4a	4a	Node65	Node76	4g	4g	Node78	4h	4h
Invert Elevation	9.900	10.050	11.000	12.800	12.900		13.100	15.300	16.800		17.100	17.500	
Max Water Depth	0.160	0.204	1.224	0.494	0.647		0.976	0.340	0.406		0.263	0.356	
Max Volume	0.195	0.249	6657.375	422.855	0.790		1.191	0.415	49.289		0.322	23.149	
Max Water Elevation	10.060	10.254	12.224	13.294	13.547		14.076	15.640	17.206		17.363	17.856	

	Link8 - mortimer450	Link7	Link4	322.1	blvd-pos 4i	320.1	blvd-4a	Link79	blvd 4g weir	Link83	blvd 4h weir
Storm	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4
Diameter (Height)	0.450	0.180	0.500	0.750	0.200	0.600	0.200	0.450		0.375	
Length	73.000	50.000	30.000	25.000	25.000	100.000	100.000	200.000		100.000	
Max Flow	0.003	0.003	0.530	0.686	0.041	0.485	0.011	0.245	0.145	0.070	0.080

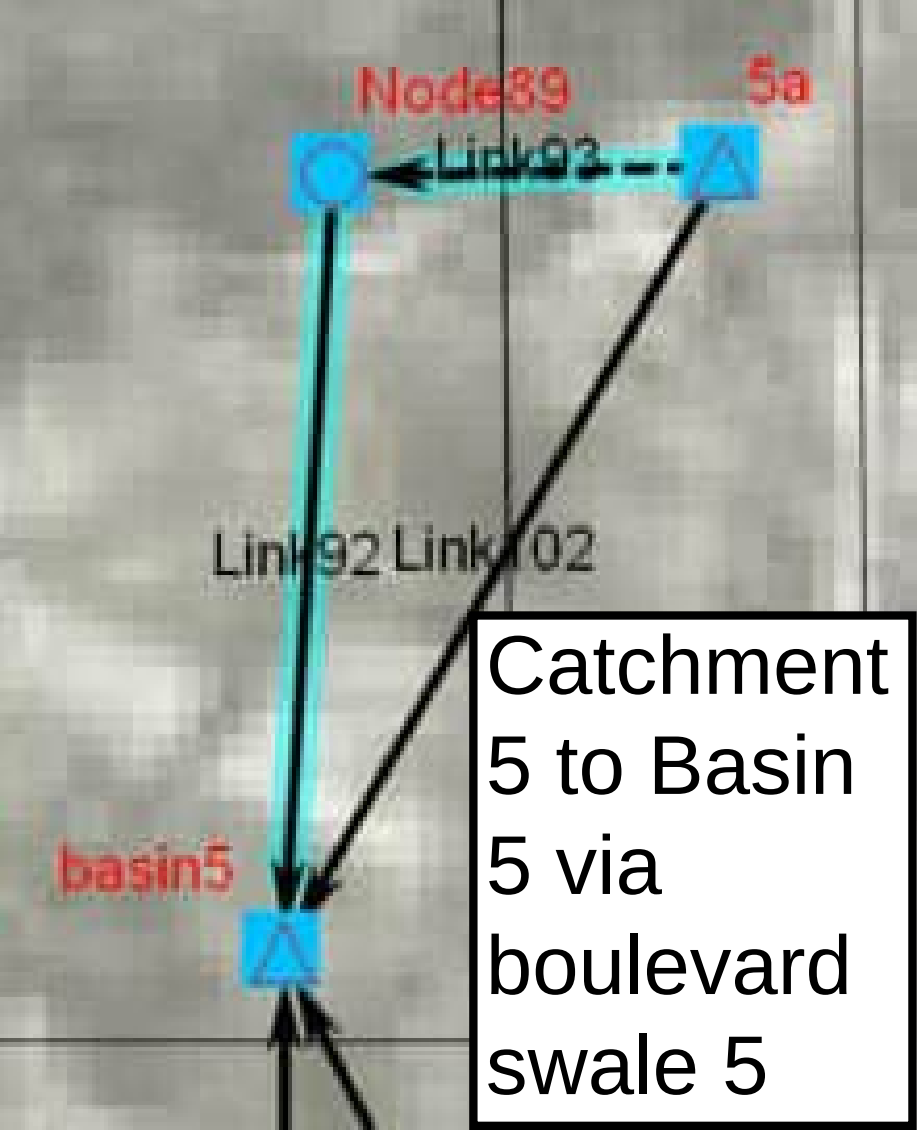


	mort d/s	mort u/s	4i - basin4	Node8 - bio4	4a	4a	Node65	Node76	4g	4g	Node78	4h	4h
Invert Elevation	9.900	10.050	11.000	12.800	12.900		13.100	15.300	16.800		17.100	17.500	
Max Water Depth	0.160	0.053	0.734	0.490	0.721		1.233	0.442	0.426		0.331	0.373	
Max Volume	0.195	0.065	2890.862	424.579	0.880		1.507	0.582	53.891		0.413	24.978	
Max Water Elevation	10.060	10.103	11.734	13.290	13.621		14.333	15.742	17.226		17.431	17.873	

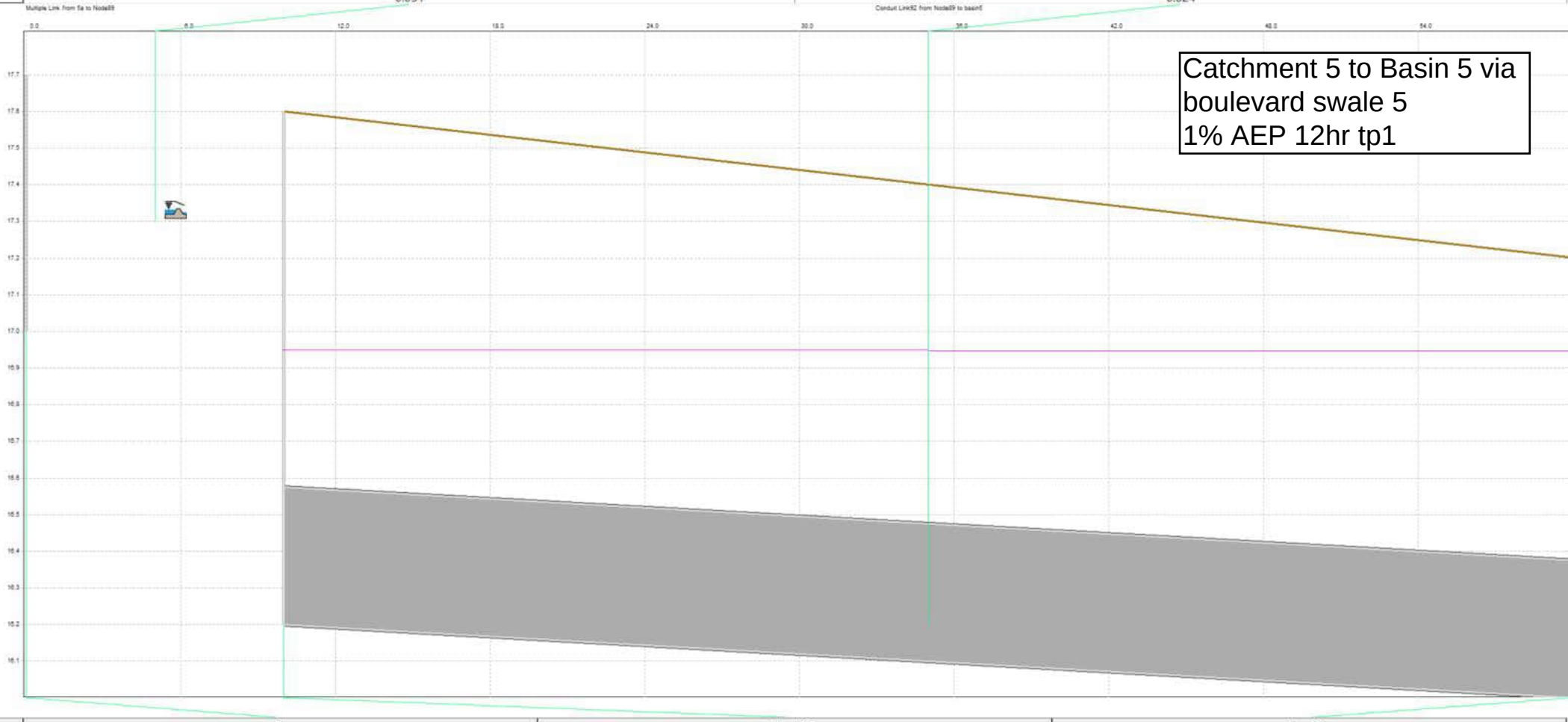
	Link8 - mortimer450	Link7	Link4	322.1	blvd-pos 4i	320.1	blvd-4a	Link79	blvd 4g weir	Link83	blvd 4h weir
Storm	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9
Diameter (Height)	0.450	0.180	0.500	0.750	0.200	0.600	0.200	0.450		0.375	
Length	73.000	50.000	30.000	25.000	25.000	100.000	100.000	200.000		100.000	
Max Flow	-0.001	0.000	0.026	0.429	0.018	0.179	0.000	0.113	0.129	0.058	0.074



	mort d/s	mort u/s	4i - basin4	Node8 - bio4	4a	4a	Node65	Node76	4g	4g	Node78	4h	4h
Invert Elevation	9.900	10.050	11.000	12.800	12.900		13.100	15.300	16.800		17.100	17.500	
Max Water Depth	0.160	0.012	0.200	0.339	0.713		0.546	0.200	0.400		0.276	0.369	
Max Volume	0.195	0.017	437.037	275.010	0.871		0.677	0.257	48.450		0.354	24.562	
Max Water Elevation	10.060	10.062	11.200	13.139	13.613		13.646	15.500	17.200		17.376	17.869	

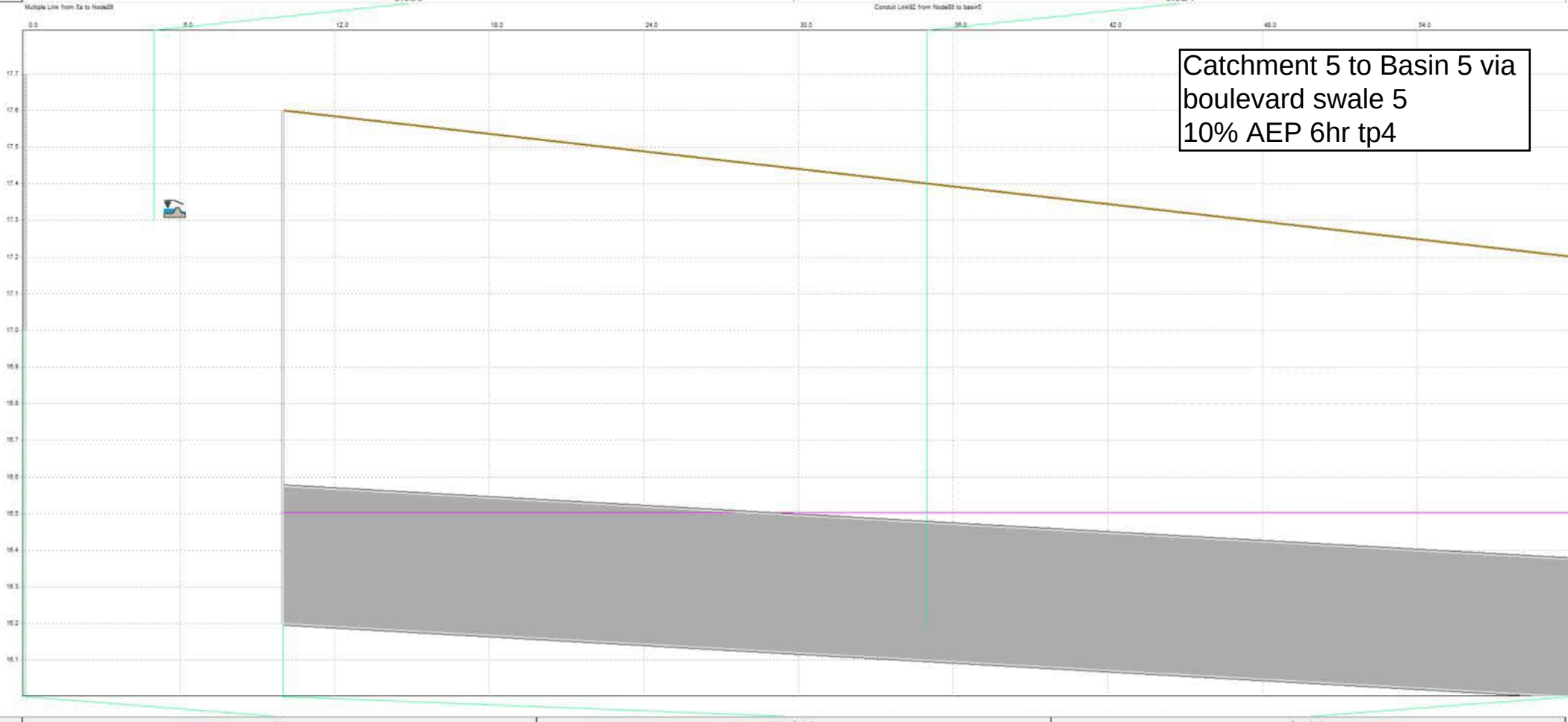

Node89
5a
Link93
Link92
Link102
basin5
Catchment 5 to Basin 5 via boulevard swale 5

	blvd 5a weir	Link92
Storm	FLTW_1pct_12hr_1	FLTW_1pct_12hr_1
Diameter (Height)		0.375
Length		50.000
Max Flow	0.031	0.024



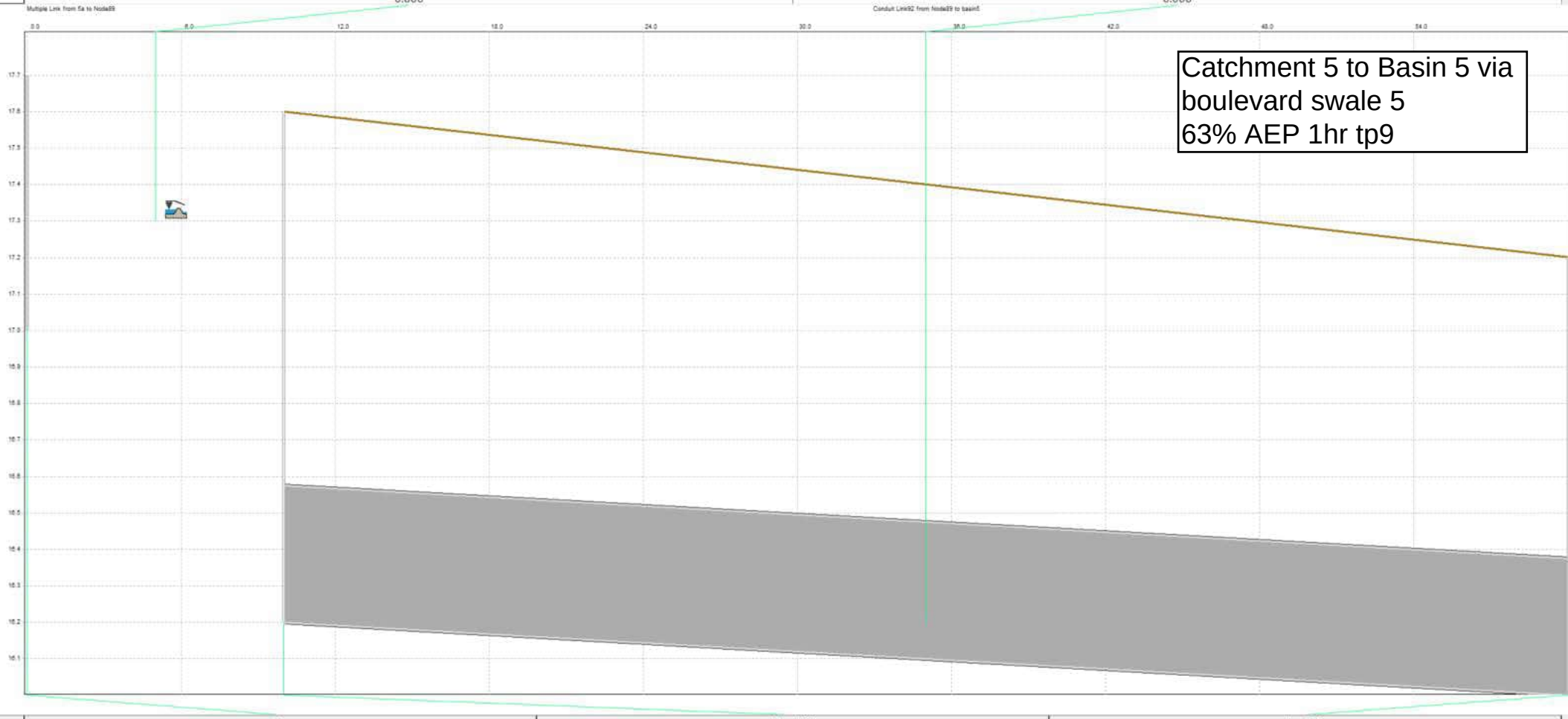
	5a	Node89	basin5
Invert Elevation	17.000	16.200	16.000
Max Water Depth	0.338	0.748	0.947
Max Volume	85.188	0.913	174.238
Max Water Elevation	17.338	16.948	16.947

	blvd 5a weir	Link92
Storm	FLTW 10pct 6hr 4	FLTW 10pct 6hr 4
Diameter (Height)		0.375
Length		50.000
Max Flow	0.030	0.024



	5a	Node89	basin5
Invert Elevation	17.000	16.200	16.000
Max Water Depth	0.338	0.302	0.503
Max Volume	85.628	0.369	54.767
Max Water Elevation	17.338	16.502	16.503

	blvd 5a weir	Link92
Storm	FLTW 63pct 1hr 9	FLTW 63pct 1hr 9
Diameter (Height)		0.375
Length		50.000
Max Flow	0.000	0.000



	5a	Node89	basin5
Invert Elevation	17.000	16.200	16.000
Max Water Depth	0.298	0.000	0.000
Max Volume	69.319	0.000	0.000
Max Water Elevation	17.298	16.200	16.000