JANDAKOT AIRPORT

GROUNDWATER MANAGEMENT PLAN

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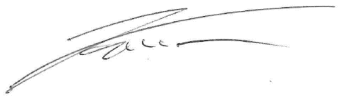
Declaration of accuracy

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both.

Signed 

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1 INTRODUCTION

Jandakot Airport is leased from the Commonwealth Government by Jandakot Airport Holdings (JAH) and is an important piece of state infrastructure, being Western Australia's major general aviation airport. The airport covers an area of approximately 622 ha which has been developed over a period of more than 50 years. 119 ha are designated Conservation Precincts within Jandakot Airport Master Plan 2020 (JAH 2020).

Jandakot Airport has a responsibility to aviation business and the community to ensure that infrastructure (including the construction and widening of runways, taxiways and aprons) is in place to meet aviation demand and ensure the safety, efficiency and regularity of aviation and other traffic on and around the Airport. In 2008/2009 the Airport and obtained approval of the Jandakot Airport Master Plan 2009 (JAH 2009) for Runway and Taxiway upgrades and a commercial development precinct.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) approval 2009/4796 was granted in March 2010 for the clearing of vegetation in accordance with the Jandakot Airport Master Plan 2009 and the Jandakot Airport Offset Plan (JAH 2014b). Conditions of approval were later amended and approved by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in April 2014 (refer Appendix 1 and Figure 1).

EPBC Act approval 2013/7032 (refer to Appendix 2) was granted in July 2014. This approval allowed for the clearing and development of Precincts 6 and 6A, as detailed in Jandakot Airport Master Plan 2014.

JAH is required under the *Airports Act 1996* to prepare a Master Plan every eight years. Master Plan 2020 was approved by the Minister for Infrastructure, Transport and Regional Development in August 2021. Subsequent development has occurred in accordance with this Master Plan and the Jandakot Airport/ City Leasing and Development Guidelines.

The purpose of the Groundwater Management Plan (GMP) is to detail the groundwater management and monitoring measures required at Jandakot Airport to protect the Jandakot Groundwater Mound (specifically the Priority 1 Source Protection Area) from the development and subsequent operation of Precincts 5, 6 and 6A.The GMP has also been updated to reflect the wetland Management Category change (further detailed in Section 4.3).

This GMP has been developed in accordance with Condition 7 of EPBC 2009/4796 and Condition 2 of EPBC 2013/7032 (refer to Appendix 1), which required the GMP to include:

- Groundwater Monitoring and Reporting (EPBC 2009/4796 and EPBC 2013/7032)
- Provision of groundwater monitoring reports to the WA Department of Water and Environment Regulation (DWER) and Water Corporation (EPBC 2009/4796 and EPBC 2013/7032)
- All relevant measures included in the Local Water Management Strategy (EPBC 2009/4796)
- A water management strategy, specifically designed for Precincts 6 and 6A (EPBC 2013/7032)
- Schedules for the independent audit of groundwater monitoring results and reports (EPBC 2009/4796 and EPBC 2013/7032)
- Spill avoidance, management and rehabilitation measures and procedures (EPBC 2009/4796 and EPBC 2013/7032)
- The introduction of a sewage system (EPBC 2009/4796 and EPBC 2013/7032)
- Acceptable development types (EPBC 2013/7032).

2 LEGISLATIVE REQUIREMENTS

The key pieces of legislation controlling the environment operations of the Airport are the *Airports Act 1996, Airports (Environment Protection) Regulations 1997* and the *Environment Protection and Biodiversity Conservation Act 1999*.

2.1 AIRPORTS ACT 1996

The *Airports Act 1996* requires the operator of an airport (Jandakot Airport Holdings Pty Ltd) to prepare an Airport Master Plan for review and approval by the Federal Minister for Infrastructure and Regional Development. This GMP complements the Jandakot Airport Environment Strategy 2020 which has been updated within the Jandakot Airport Master Plan 2020 and will act as a guide for environmental management of the airport for the next eight years (JAH 2020).

2.2 AIRPORTS (ENVIRONMENT PROTECTION) REGULATIONS 1997

The *Airports (Environment Protection) Regulations 1997* requires the development and adoption of a comprehensive environmental management system (EMS). Environmental management at Jandakot Airport is the responsibility of Jandakot Airport Holdings. The Jandakot Airport EMS comprises policies and procedures that ensure the protection of the environment within the airport, including preparation of management plans, incident reporting systems, awareness training, auditing, monitoring and reporting within a context of continuous improvement.

2.3 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take action that has, will have, or is likely to have a significant impact on any matters of NES without approval from the Australian Government Environment Minister.

This Groundwater Management Plan is consistent with the Jandakot Airport Master Plan 2020 and will satisfy the requirements Condition 7 of EPBC 2009/4796 and Condition 2 of EPBC 2013/7032.

2.4 STATE LEGISLATION

Some State environmental legislation can apply to Jandakot Airport under the provisions of the *Commonwealth Places (Application of Laws) Act 1970.* Regulation of environmental issues can therefore occur through state agencies in selected circumstances, typically in instances where Commonwealth legislation does not exist (i.e., waste management). Where State and Commonwealth legislation conflicts, Commonwealth legislation take precedence.

The key water related State Government legislation that is relevant to the development of this GMP is State Planning Policy 2.9: Planning for Water (draft). Draft SPP 2.9 and Guidelines will help streamline and simplify the current planning framework to deliver greater clarity around how water-related provisions are implemented. Once gazetted, it is intended that SPP 2.9 and Guidelines will replace water-related policies including State Planning Policy 2.9 Water Resources.

3 LINKS TO OTHER MANAGEMENT STRATEGIES AND PLANS

Information from the following strategies and plans has been integrated into the GMP and where relevant.

3.1 LOCAL WATER MANAGEMENT STRATEGY

JAH has developed a Local Water Management Strategy (LWMS), in consultation with the WA DWER, taking due cognisance of water reticulation, irrigation, sewage effluent disposal and wastewater reuse. The LWMS incorporates and provides for the implementation of Water Sensitive Urban Design (WSUD) at the airport and has been updated to specify the water management strategy for Precincts 5, 6, and 6A to meet the approval condition requirements of EPBC 2009/4796 and 2013/7032.

The LWMS identifies water management objectives for the Airport site that have been developed with consideration of site-specific issues and informed by statutory requirements, relevant policies, by-laws and guidelines including overarching objectives from *Better urban water management* (WAPC 2008).

The site-specific water management objectives are focussed on protection of public drinking water resources within the Jandakot Underground Water Pollution Control Area (JUWPCA) and maintaining the economic sustainability of Jandakot Airport into the future.

Water management objectives for the site are identified as follows:

- Prevent pollution of groundwater within the JUWPCA.
- Contribute to improving the health and sustainability of the Jandakot groundwater system.
- Provide a local drainage system with an appropriate level of amenity and safety during storm events; and
- Provide for the efficient use and re-use of water resources.

JAH is committed to adopting and implementing all relevant measures of the LWMS which is included as Appendix 3 of this GMP. Table 1 links LWMS groundwater management objectives within the relevant section/s of the GMP.

Table 1: LWMS Links

LWMS Objective	Relevant GMP Section Link
Prevent pollution of groundwater within the JUWPCA (Section 3.2 of the LWMS).	3.3 Construction Environmental Management Plans, Demolition Environmental Management Plans 3.4 Operational Environmental Management Plans 3.5 Tenant Resources 3.6 Spill Avoidance and Management Procedures 4.1 Acceptable Development 4.6 Groundwater (including most-recent groundwater data) 4.5 Sewerage (including current status) 5.1 Acid Sulfate Soil and Dewatering Management 5.2 Stormwater and Drainage Management 5.3 Sewerage and Wash Water Management 5.5 Groundwater Monitoring Program 5.6 Incidents and Emergencies 5.7 Contamination Management

LWMS Objective	Relevant GMP Section Link
Contribute to improving the health and sustainability of the Jandakot groundwater system and the wetland habitats it supports (Section 3.3 of the LWMS).	4.3 Wetlands (including wetland assessment detail) 4.6 Groundwater (including most-recent groundwater data) 5.1 Acid Sulfate Soil and Dewatering Management 5.2 Stormwater and Drainage Management 5.4 Groundwater Abstraction Management 5.5 Groundwater Monitoring Program
Provide a local drainage system with an appropriate level of amenity and safety during storm events (Section 3.4 of the LWMS).	4.4 Stormwater and Drainage 5.2 Stormwater and Drainage Management Please refer to the LWMS (Section 3.4) for specific information on stormwater clearances, retention, attenuation, etc.
Provide for the efficient use and re-use of water resources (Section 3.5 of the LWMS).	Specifically relating to the use and re-use of non-potable water resources (groundwater): 4.6 Groundwater (including most-recent groundwater data and abstraction information) 5.4 Groundwater Abstraction Management For further information on the use/reuse and supply of potable water, please refer to the LWMS (Section 3.5.1).

3.1.1 PRECINCTS 6 AND 6A

Master Plan 2020 identifies Precincts 6 and 6A for mixed business and aviation use, respectively. Key LWMS water management measures, specific to Precincts 6 and 6A (and to satisfy condition 2 c) of EPBC 2013/7032) include:

- Lot connection to reticulated sewerage via a local precinct gravity sewer network discharging to a new sewer pump station.
- 'At source' infiltration for developments within the JUWPCA, which promotes stormwater collection from clean roof surfaces, except where rainwater tanks are used.
- Stormwater from all roads, carparks, and external hardstands within the JUWPCA is discharged via piped drainage networks into drainage basins located outside of the JUWPCA boundary and sized to cater for the 1:100 year/24hr ARI storm event.
- Lot connection to Water Corporation's Integrated Water Supply System.

3.2 AERODROME EMERGENCY PLAN

The Aerodrome Emergency Plan (AEP) has been developed to ensure effective and efficient arrangements for the response to, and recovery from, an emergency at Jandakot Airport. This includes emergency response plans and procedures for potentially polluting events such as 'fuel and oil spills' and 'hazardous materials' consistent with the LWMS and GMP. The AEP is focused on emergencies associated with aerodrome operations, where JAH typically takes on a facilitation role, allowing emergency services personnel to respond as appropriate. Whilst JAH maintains some on-site capability to respond to spills, there is no central emergency response or spill control team based at the airport. Spill response (and subsequent remediation) is therefore the responsibility of the relevant tenant or contractor, as detailed within the relevant tenant Operational Environmental Management Plans (OEMP) or Construction Environmental Management Plans (CEMP).

3.3 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLANS, DEMOLITION ENVIRONMENTAL MANAGEMENT PLANS

All construction/civil works (including demolition) with the potential for environmental impacts require a CEMP, which must be reviewed and endorsed by the JAH Environmental Management team prior to works commencing. The requirement for CEMPs is typically included as a condition of the building/works/demolition permit issued by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA).

Clearing and construction activities associated with EPBC approved projects are undertaken in accordance with relevant CEMPs (as required by the conditions of approval) which must be approved by the Minister for the Environment.

3.4 OPERATIONAL ENVIRONMENTAL MANAGEMENT PLANS

Jandakot Airport tenants are responsible for managing their own operations in an environmentally responsible manner consistent with the approved Jandakot Airport Master Plan and conditions of lease. JAH has developed guidelines and templates to assist tenants in the development of OEMPs. The requirement for a tenant OEMP is directly linked to a tenant's environmental risk profile.

A Tenant Audit and OEMP Register has been developed as part of the Environmental Site Register (ESR) to record and track auditing and OEMP development. This register includes details of each tenant and location, including their audit/risk category, annual reporting details and audit/inspection records.

JAH reviews tenant auditing/inspections findings on a regular basis to determine if a tenant's environmental risk profile has changed.

3.5 TENANT RESOURCES

JAH maintains a suite of Tenant Resources containing relevant groundwater and contamination control information, consistent with the LWMS and GMP, on the JAH website, including:

- Tenant Environmental Handbook
- Management of Sewage and Greywater Policy
- Dangerous Goods and Hazardous Materials Policy
- Aircraft and Equipment Washdown Policy
- Storage of Empty Drums and Containers Policy.

3.6 SPILL AVOIDANCE AND MANAGEMENT PROCEDURES

The documents referenced in Sections 3.2, 3.3, 3.4, and 3.5 above contain numerous spill avoidance and management procedures applicable to the various activities that occur on the airport, with details relevant to the GMP summarised below.

EPBC clearing and civil construction activities are managed via the CEMP which includes Hazardous Materials Management Plan and Environmental Emergency Response Procedures.

Examples of specific spill avoidance measures include:

- Provide a contractor spill control plan to JAH EM.
- Ensure fully stocked spill kit is available on refuelling truck(s) and (if applicable) in the vicinity of hazardous material storage area(s).
- Provide a designated bunded storage area.

- Containers holding hazardous substances will be labelled and stored upright with lids closed on bunds in designated areas when not in use.

Similarly, CEMP and OEMP templates consistent with Master Plan 2020 and various policies detailed in Sections 3.3 and 3.4 provide guidance on the content required within an approved CEMP or tenant OEMP.

Examples of applicable spill avoidance mitigation measures include:

- Liquid chemicals, including hydrocarbons, of a volume 205L (44 gallons) or greater, must be stored within impervious bunding designed to contain 110% of the volume of the largest storage vessel (e.g., self-bunded spill pallet).
- If the storage area is not located in a covered area, bunding must have the capacity to allow for heavy rainfall events, preferably with overhead protection to restrict the entry of water.
- Suitably designed drip trays or other containment must be used for volumes less than 205L.
- Appropriate licensing must be obtained where required under legislation (e.g., Dangerous Goods Licence).
- A spill kit that is appropriate for the volume and type of substances stored must be kept on site.

4 DESCRIPTION OF THE DEVELOPMENT AND AREA

4.1 ACCEPTABLE DEVELOPMENT

The majority of Precinct 5 and approximately half of Precinct 6 and 6A are within in the Jandakot Groundwater Mound Area (Figure 3). It has been ascertained by the inclusion of non-structural and structural storm water controls and risk assessments that Precincts 5, 6 and 6A can be developed without posing additional risks to water resources (CyMod 2009a, Urbaqua, 2023).

Precinct 5 provides for mixed business use in a park-like setting which allows for uses appropriate to the JUWPCA and is responsive to its interface with rural-residential neighbours bordering the western boundary of the Airport. It will support warehouse, manufacturing and storage type development and land uses that will be generally consistent with the City of Cockburn's 'Mixed Business' zone from the City of Cockburn's Town Planning Scheme No. 3 (TPS 3). Uses will be responsive to the JUWPCA and potential pollutants will be minimised and managed by ensuring:

- Bulk storage (manifest quantities as defined under the *Dangerous Goods Safety Act 2004* and associated regulations), of potentially polluting dangerous goods, chemicals etc. within the Priority 1 Source Protection Area of the Jandakot Underground Water Pollution Control Area is not permitted.
- Minor chemical storage, consistent with the approved uses at the site, will be permitted only if managed under an approved Operational Environmental Management Plan that requires all chemicals to be managed in accordance with relevant Australian Standards.

Similar to Precinct 5, the objective of Precincts 6 is to provide a mixed-use business park-like setting and to provide uses appropriate for the JUWPCA (for the eastern half of the Precinct). Precinct 6 will support office, business, professional services, warehouse, manufacturing and storage type development that will be generally consistent with the City of Cockburn's 'Mixed Business' zone. Precinct 6A will be developed for uses that seek to capitalise on access to the airfield infrastructure and will include aviation activity and aviation support facilities.

Ultimately, any proposed development on land cleared under EPBC 2009/4796 and EPBC 2013/7032 is approved by DITRDCA under the *Airports Act 1996* and associated regulations, taking into account Master Plan 2020 and other relevant factors.

4.2 SOILS AND GEOLOGY

The Armadale and Fremantle 1:50 000 Environmental Geology Series indicates that Jandakot Airport consists of Quaternary superficial alluvial sediments, varying in thickness from around 30 m to 60 m. The sands unconformably overlay the older Osborne and Leederville formations, comprising of shale and siltstones.

The Swan Coastal Plain consists of a series of distinct dune systems aligned approximately north to south and extending from the coast to the Darling Scarp. The Quindalup and Spearwood dune systems lie closest to the coast, with the Bassendean dune system further to the east. Jandakot Airport lies approximately 3 km east of the Spearwood system boundary, within the Bassendean dune system. Bassendean sands are Aeolian, or windborne, soils derived from particles washed up by the ocean and blown by wind to form dunes. These sands are characterised as pale grey, white, medium grained, moderately sorted quartz sand with black heavy minerals scattered throughout.

The topography of the airport and surrounding areas is generally flat, with local variations in height of 20 m or less. Most of the site has an elevation of approximately 28-30 m AHD. High points of 40-45 m AHD occur in the south-eastern corner and within Precinct 1A.

4.2.1 ACID SULFATE SOILS

Acid sulfate soil (ASS) is the common name for soils that contain metal sulfides. In an undisturbed and waterlogged state, these soils may pose no or low risk. However, when acid sulfate soils are disturbed or exposed and react with oxygen, they produce sulfuric acid which may be accompanied by certain hazards. Metals may be released from sediments and become bioavailable in the environment, oxygen may be removed from the water column and gases such as hydrogen sulfide, sulfur dioxide and methane may be released.

Failure to appropriately manage acid sulfate soils may:

- Impact the quality of potable groundwater due to acidification and release of metals in acid sulfate soil areas and receiving waters.
- Impact the quality of groundwater extracted for non-potable purposes (i.e., irrigation).
- Impact infrastructure and the built environment by subsidence and corrosion.

According to DWER (DWER-055) the majority of the site is located in an area of moderate to low risk of ASS occurring within 3m of the natural soil surface but high to moderate risk of ASS beyond 3 m of the natural soil surface (i.e., Class 2). A small area of land in the south of the airport is categorised as 'high to moderate risk of ASS occurring within 3m of the natural soil surface' (i.e., Class 1) (Figure 4).

4.3 WETLANDS

Within Jandakot Airport there are no natural drainage channels or defined areas of surface water. Two wetlands occur on the airport as defined by the GWSCP dataset (DBCA-019) (DBCA, 2023). These are located in Precincts 1A and 2A of Master Plan 2020 (hereafter referred to as ‘wetland 1A’ and ‘wetland 2A’).

The wetlands fall within the Jandakot conservation area and are managed under the Jandakot Conservation Management Plan (CMP). The wetlands are managed to retain their conservation value by utilising the existing management strategies under the CMP.

A review of the wetland management categories, including an on-ground wetland assessment survey was undertaken in 2022/2023 by suitably qualified environmental consultants (Ecoscape, Umwelt, and Lateral, 2023).

Prior to the review, both wetlands were resource enhancement management category wetlands. The results indicated both wetlands 1A and 2A had values commensurate with conservation category wetlands. The findings were submitted to the DBCA for assessment.

As of 25 July 2023, wetland 1A is categorised as a conservation category management wetland (changed from resource enhancement, per comm, DBCA 2023), and wetland 2A is categorised as resource enhancement category management wetland as defined by the GWSCP dataset (DBCA-019) (DBCA, 2023).

DBCA is actively reviewing the categorisation of wetland 2A.The above listed statement provides the categorisation at a point in time and any future revisions may require this statement to be amended.

Conservation category wetlands are identified as highest priority wetlands which support a high level of attributes and functions (DBCA 2018).

4.4 STORMWATER AND DRAINAGE

Development which increases the area of impermeable surfaces such as buildings, roads, car parks, runways and apron areas will concentrate run-off following rainfall events.

Drainage swales and basins have been created in strategic areas of the airport to collect run-off from roads and other sealed surfaces. Due to the high permeability of the Bassendean soils, run-off is localised and short term as it generally infiltrates very quickly.

Water retention and ponding within drainage swales and basins is avoided where possible to deter water birds that may pose a bird strike risk to aircraft operations.

In general, and in accordance with the LWMS, stormwater throughout the proposed development will be managed via a combination of soakwells, open drains and swales complimented by an underground pipe drainage network. The soakwells, open drains and swales aim to maximise local infiltration i.e., recharge to the ground water system. All proposed non-aviation development will be consistent with the Jandakot City Leasing and Development Guidelines and will maintain on site attenuation of up to the 1:20 year storm event without onsite ponding through the use of soakwells or small infiltration areas within their respective lots. Onsite drainage will also attenuate and store up to the 1:100-year event. Larger storm events may result in discharge into the road reserves, swales and drainage basins.

4.5 SEWERAGE

Reticulated sewerage, linked to the local municipal sewer system, has been connected to Jandakot Airport. This system currently services all new and planned future developments within Precincts 4,5 and 6/6A as well as some of the established aviation areas of the airport. Some older established areas are still operating on septic tanks and Aerobic Treatment Units (ATUs).

As outlined in the Master Plan 2020, JAH intends to connect all facilities to the sewer system by 2024 where feasible. However, due to the ongoing issues regarding budgets and time constraints following on from COVID-19, this will likely be extended until 2028. Existing ATU's and septic tanks will be decommissioned and removed in accordance with the existing procedure which requires approval by the DITRDCA Airport Building Controller (ABC). Updates on the decommissioning and removal of these systems will be provided in Jandakot Airport Annual Environment Reports (AER).

To provide assurance that potential seepage from the existing septics and ATU systems are not impacting groundwater resources at Jandakot Airport, caffeine testing will be undertaken at groundwater monitoring bores located up-gradient and down-gradient of existing septics and ATU systems. Refer to Section 5.5 for further detail (e.g., testing bore locations, monitoring regime and assessment levels).

As reported in the 2022-23 AER, a number of tenants that previously operated on septic systems and ATUs have connected to the sewer system in recent years. The majority of these tenants are located within Precincts 3 and 4.

The reticulated sewer system currently services all new and planned future developments within Precincts 4, 5, 6 and 6A as well as some of the established aviation areas of the airport, including lots along:

- Baron Way
- Portions of Compass Road
- Bell Court
- The southern end of Mustang Road.

Master Plan 2020 commits to all new developments within Precincts 4, 5, 6 and 6A being constructed with connection to sewer, which has been achieved to date.

4.6 GROUNDWATER

Jandakot Airport is underlain by the Jandakot groundwater system. The Jandakot groundwater system provides water for public open space, horticulture, industry and gardens, and contributes to Perth's public water supply. The system comprises three main aquifers:

- Jandakot Mound (shallow, unconfined superficial).

- Leederville aquifer (deeper, mostly confined).
- Yarragadee aquifer (deeper, mostly confined).

Groundwater levels across the Jandakot Mound have declined over the last 30 years, but at a slower rate than seen in the Gnangara Mound (DWER 2020). This is due to a combination of factors including:

- The Jandakot Mound receives more rainfall than the Gnangara Mound;
- Abstraction pressure on the Jandakot Mound is less than the Gnangara Mound; and
- Large parts of the Jandakot Mound are now urbanised, increasing recharge.

The Jandakot Mound is a shallow sand aquifer covers an approximate area of 760 km^2, from the Swan River in the north to the Serpentine River in the south. The Jandakot Mound developed because the rate of infiltration exceeds the rate of horizontal groundwater flow through the aquifer.

Jandakot Airport is partially located on the northern margin of the Jandakot Mound, with the crest of the mound located south of the airport (Davidson 1995).

4.6.1 JANDAKOT UNDERGROUND WATER POLLUTION CONTROL AREA

The Jandakot Mound is gazetted as both a Public Drinking Water Supply Area (PDWSA) and an Underground Water Pollution Control Area (UWPCA). The JUWPCA defines the area of the Jandakot Mound groundwater system that provides public water supply as part of the Integrated Water Supply Scheme. The DWER manages Western Australia's water resources including the Jandakot Mound and restricts land uses that may pose a threat to the quantity or quality of water available from the mound for public water supply.

Within the JUWPCA, a three-level priority system is used (Figure 3). The priority classifications are determined by land tenure, land use and water flow patterns (WAPC 2021). Each priority classification is subject to the following management objectives:

- Priority 1 (P1) classification areas are managed to ensure that there is no degradation of the drinking water source by preventing the development of potentially harmful activities in these areas. The guiding principle is risk avoidance. This is the most stringent priority classification for drinking water sources. P1 areas normally encompass land owned or managed by State agencies, but may include private land that is strategically significant to the protection of the drinking water source (e.g., land immediately adjacent to a reservoir).
- Priority 2 (P2) classification areas are managed to ensure that there is no increased risk of water source contamination/pollution. For P2 areas, the guiding principle is risk minimisation. These areas include established low-risk land development (e.g., low intensity rural activity).
- Priority 3 (P3) classification areas are defined to manage the risk of pollution to the water source from catchment activities. Protection of P3 areas is mainly achieved through guided or regulated environmental (risk) management for land use activities. P3 areas are declared over land where water supply sources coexist with other land uses such as residential, commercial and light industrial development (DWER (WA) 2021).

In addition to the three Priority Classification Areas, specific protection zones are defined to protect drinking water sources from contamination in the immediate vicinity of water extraction facilities. Within these zones by-laws may prohibit, restrict or approve defined land uses and activities to prevent water source contamination or pollution. Wellhead protection zones (WHPZ) are used to protect underground sources of drinking water. They are circular with a radius of 300 – 500 m.

Portions of the airport land are within the P1 Source Protection Area of the JUWPCA, including:

- Conservation Precincts 2A, 2B and a portion of 1B.
- Portions of Precinct 4 and 5, which are already under development.
- Precinct 3, including existing infrastructure and portions of the proposed fourth runway and runway extension.
- The eastern and southern portions of Precinct 6/6A.

Other land uses in close proximity to the airport include:

- A Western Power development north of Jandakot Airport is currently being used as a warehousing and transport depot. This facility is located within the P1 area and partially straddles a wellhead protection zone.
- Development to the west of the airport includes rural residential, and residential. Parts of these developments straddle wellhead protection zones. Residential areas are sources of nutrients through the application of fertilisers.
- A large industrial subdivision north of Armadale Road partly over a wellhead protection zone.
- A retail development at the junction of Berrigan Drive and Jandakot Road is within a wellhead protection zone.
- Substantial portions of the Kwinana Freeway are not only within the JUWPCA boundary but over wellhead protection zones.

There are a number of production wells (Figure 5) and observation bores (Figure 6) in proximity to Jandakot Airport.

There are no wellhead protection zones within or near Precincts 5 and 6/6A.

Existing and future developments at the airport that are located within the JUWPCA are managed in accordance with this GMP.

4.6.2 GROUNDWATER FLOW DIRECTION AND LEVELS

The Perth Groundwater Atlas (WRC 1997) indicates that groundwater drains across Jandakot Airport in a north-westerly direction, towards the coast and Swan River. Ongoing monitoring indicated that groundwater flow was in a northerly direction over most of the airport and in a north-westerly direction in Precinct 5 (Urbaqua 2023). Following the inclusion of supplementary bores during 2017/18 monitoring, it is evident that there is a ridge of higher groundwater that runs from south to north across the site, with groundwater sloping downwards towards the north-east and north-west from the centre (Figure 7) (Urbaqua, 2023).

Since March 2012, groundwater levels have been monitored at nine locations across Jandakot Airport; this was expanded in December 2013 to the current network of eleven (11) monitoring wells. Although it is not possible to determine if annual minima and maxima have been recorded each year, the timing of monitoring events has been designed to capture the groundwater level close to its annual maximum and minimum.

Groundwater levels at Jandakot Airport are generally shallow (22 to 26 m AHD in recent years, refer to the hydrograph presented on Figure 8), with little variability in the groundwater levels throughout the year. Monitoring (to March 2023 shows that groundwater levels generally rise in September in response to infiltration from rainfall followed by a recession in March with the seasonal difference typically being less than 2 m.

A review of historical DWER data (collected by DWER as part of their water information reporting) shows that groundwater levels in the Jandakot area have receded markedly over

the last 35 to 40 years. However, similar to observations at Jandakot Airport, groundwater levels are slightly higher than in previous years at DWER bores (Figure 9).

4.6.3 LOCAL GROUNDWATER ABSTRACTION

JAH abstracts groundwater for irrigation and construction (primarily dust suppression during construction) purposes via a network of abstraction bores (Figure 10).

JAH recognises that sound management of groundwater abstraction is essential to ensure that the water resources are available to all consumers, including Jandakot Airport.

4.6.4 GROUNDWATER QUALITY

Groundwater quality has been monitored since March 2012 at nine locations across the Jandakot Airport estate, with an additional two locations added to the monitoring program in December 2013, totalling 11 bores currently. The following are summary observations based on the available monitoring data from the 2021/22 Annual Groundwater Monitoring Report (refer to data in Appendix 4):

- In situ measurement of pH values of groundwater range from 3.58 to 6.61, with an average pH of 5.08 indicating acidic conditions.
- Total nitrogen and total phosphorus were above guidelines as follows:
    - Total nitrogen concentration was in exceedance of Airports (Environment Protection) Regulations 1997 Schedule 2 assessment level (0.1 mg/L) across all bores. JAMB4 was also in exceedance of the Jandakot Airport GMP v5.6 assessment level (6.39 mg/L).
    - Total phosphorus concentration was in exceedance of Airports (Environment Protection) Regulations 1997 Schedule 2 assessment level (0.01 mg/L) across all bores. JAMB1, JAMB2B, JAMB3B, JAMB5 and JAMB9 were also in exceedance of the Jandakot Airport GMP v5.6 assessment level (0.12 mg/L).
- Aluminium, copper, lead and zinc concentrations were above guidelines as follows:
    - Dissolved aluminium concentration was in exceedance of the A(EP)R (1997) Schedule 2 assessment level (0.1 mg/L) at JAMB1, JAMB2B, JAMB4, JAMB5, JAMB7B, JAMB8, JAMB9, JAMB10 and JAMB11.
    - Dissolved copper concentration was in exceedance of the Jandakot Airport GMP v5.6 assessment level (0.003 mg/L) at all bores except JAMB2B, which was in exceedance of the A(EP)R (1997) Schedule 2 (0.002 mg/L).
    - Dissolved lead concentration was in exceedance of the Jandakot Airport GMP v5.6 assessment level (0.003 mg/L) at JAMB4, JAMB8 and JAMB9.
    - Dissolved zinc concentration was in exceedance of the A(EP)R (1997) Schedule 2 assessment level (0.005 mg/L) at JAMB1, JAMB2B, JAMB4, JAMB5, JAMB7B, JAMB8 and JAMB9.
- Petroleum hydrocarbons are stored on-site, however available groundwater data does not identify any adverse impacts from airport activities.

Low pH values are sometimes due to organic acids resulting from decomposition of vegetation in swampy environments (Davidson 1995). This is natural acidification through CO_2 production and root respiration in the soil in such environments. Appelo and Postma (2005) identified the lowest pH from CO_2 production in soil is around 4.6, so that groundwater which has a lower pH value must involve other processes of acidification.

A second possible source of acidification is the excessive use of ammonia and manure fertilisers. Another major acidification process is the oxidation of pyrite (FeS_2). Pyrite is

found, at least in small quantities, in most reduced sediments in the Bassendean Sand and swamp and lacustrine deposits at shallow depth. The lowering of the watertable by climate variability or from public and/or private abstraction may cause the oxidation of pyrite.

Groundwater monitoring at up-hydraulic locations (JAMB5, 6, 7, 8 and 9) identifies groundwater quality of a similar acidity which suggests the low pH levels are a regional issue and that conditions local to the Jandakot airport do not contribute significantly to the acidity of the regional aquifer (Coffey 2014).

Onsite nutrient sources, nitrogen and phosphorous, include sewage/wastewater and chemical applications to the soil. Historically leasehold sites at Jandakot airport disposed of domestic wastewater via septic tanks and ATU's. Minor fertilising of the airfield grassed areas and phosphite treatment of dieback occasionally occurs onsite. No onsite point of source of nutrient contamination or on-site diffuse source has been identified. It is inferred it likely to be a regional issue with up-hydraulic groundwater monitoring showing similar results.

All new developments within the airport will be connected to reticulated wastewater system, furthermore existing septic and ATU's are to be progressively made redundant, consistent with commitments within Master Plan 2020. However, due to the ongoing issues regarding budgets and time constraints following on from COVID-19, these timeframes will likely be extended until 2028.

Elevated levels of aluminium, copper, lead and zinc have been detected in the 2021/22 results, consistent with previous years. The presence of the metals is considered due to the acidification of the regional aquifer, possible due to acid sulphate soils. Concentrations do not show clear trends correlating with on-site activities or potential sources.

Monocyclic aromatic hydrocarbons and total recoverable hydrocarbons were reported below the Airports (Environment Protection) Regulations 1997 Schedule 2 assessment level and the Jandakot Airport GMP v5.6 assessment level for all bores in 2021/22.

Monitoring bores situated within the site located on the southern boundary, up-gradient of any site operations, are considered to represent background conditions of groundwater entering the site. Generally, trends show there is no evidence of groundwater degradation associated with site operations, therefore risk to receptors such as Jandakot Mound, onsite users and workers is considered low.

4.6.5 GROUNDWATER FLOW AND CONTAMINANT MODELLING

The majority of Precinct 5 and approximately half of Precinct 6/6A are within in the Jandakot Groundwater Mound Area. A hydrological assessment of the impacts of the development at Jandakot airport on the downstream public water supply has been conducted (CyMod 2009a, 2009b) as the proposed development area is presently a Priority 1 groundwater protection zone.

The investigation simulated both long term contamination and a single accident contamination. It was found that exceedance of drinking water criterion at downstream locations would occur after more than 10 years, minimum for both cases, with an average of 20 years.

The investigation found that in a single accident contamination, the area can be effectively remediated using aquifer restoration via conventional recovery bores. Long term contamination, however, is less likely to be successful using recovery bores, and management plans should be developed to minimise long term contamination risks. It has been ascertained by the inclusion of non-structural and structural storm water controls and risk assessments that Precincts 5 and 6/6A can be developed without posing additional risks to water resources (CyMod 2009a, 2009b).

4.6.6 PFAS MONITORING

4.6.6.1 Background

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) were once commonly added to firefighting foams (known as AFFF) to improve their ability to smother fires. Due to their effectiveness in fighting liquid fuel fires, these firefighting foams were once used extensively worldwide and within Australia, including at airports. AFFF with PFAS was phased out from the early 2000s.

Ongoing monitoring of groundwater at Jandakot Airport detected PFAS at Jandakot Airport, including on the north-west boundary of the airport. Testing then commenced on public land off-site, including nearby residential properties in 2022.

4.6.6.2 Commonwealth PFAS Investigation

In July 2023, JAH and the Commonwealth Government entered into a Memorandum of Understanding which sets out a framework for a PFAS investigation at Jandakot Airport. The PFAS investigation at Jandakot Airport will be part of a program set up by the Commonwealth Government to:

- Investigate PFAS contamination at Australian airports where the Commonwealth previously used PFAS-containing foam in firefighting activities; and
- Support the management of PFAS contamination at those sites.

JAH understands that the four main stages to the investigation may include:

1. Preliminary Site Investigation (or ‘PSI’);
2. Detailed Site Investigation (or ‘DSI’, to commence following PSI report);
3. Human Health and Ecological Risk Assessment; and
4. Management, Remediation and Monitoring.

JAH understands that the PFAS investigation will commence in 2024 and will take at least two years to complete.

5 GROUNDWATER MANAGEMENT

5.1 ACID SULFATE SOIL AND DEWATERING MANAGEMENT

The WA Department of Water and Environment Regulation (DWER) released an Acid Sulfate Soils Guideline Series containing the following:

- Identification and investigation of acid sulfate soils and acidic landscapes (DWER 2015a).
- Treatment and management of soils and water in acid sulfate soil landscapes (DWER 2015b).

Consistent with the DWER guidelines, sites will be investigated for acid sulfate soils if any of the following are proposed:

- Soil or sediment disturbance of 100 m3 or in areas depicted in an ASS risk map as Class 1.
- Soil or sediment disturbance of 100 m3 or more with excavation from below the natural water table in an area depicted on an ASS risk map as Class 2.
- Lowering of the water table (i.e., dewatering), whether temporary or permanent, in areas depicted in an ASS risk map as Class 1 or Class 2.

Groundwater is identified as being located approximately 4 m below the natural surface. Any construction activity expected to require temporary or permanent dewatering will trigger consideration and investigation of acid sulfate soils.

In line with the *Airports (Building Control) Regulations 1996* and the Jandakot Airport/City Leasing and Development Guidelines, both JAH and the DITRDCA review the scope and design of development works prior to any building/works permits being issued. This allows potential triggers to be identified and for building/works permits to be appropriately conditioned regarding ASS management.

If the initial investigation confirms the presence of ASS, an ASS Management Plan, consistent with the DWER Acid Sulfate Soils Guideline Series and including dewatering management if required, will be developed and implemented.

5.2 STORMWATER AND DRAINAGE MANAGEMENT

Within developments that overlay the JUWPCA, all stormwater collected from roof surfaces, with the exception of that which may be diverted to rainwater tanks, is discharged directly to soakwells within each lease boundary via downpipes to facilitate and maximise groundwater recharge.

Stormwater from all roads, carparks and external hardstands within the Precinct 5, 6 and 6A JUWPCA is discharged into a drainage basin(s) located outside of the JUWPCA. As discussed above, stormwater basins at the airport are not designed to pond and hold water for extended periods, as is the case in many bioretention designs, as the risk of attracting waterbirds is too great.

A risk management approach is being adopted in accordance with the LWMS for stormwater runoff from each land use present within the Airport addressed as follows:

- Infiltrate uncontaminated stormwater runoff from roofs, paths and landscaped areas at source using soakwells, permeable paving or through direction of runoff to adjacent pervious areas.
- Stormwater runoff from low-risk areas of roads and hardstand will be directed to drainage basins for infiltration.

- Manage stormwater quality from higher risk areas through appropriate treatment devices such as interceptors and/or separators.

This approach will minimise the risk of significant contaminants entering the drainage system and subsequently being infiltrated via the basins. Where a basin is considered suitable, JAH may incorporate limited native sedges or other suitable vegetation into the basin design to provide additional nutrient stripping capability.

As surface water is unlikely to be present within the stormwater basins, surface water monitoring is likely to be unachievable. Through consultation with key stakeholders (DITRDCA and DWER), it has been determined that monitoring groundwater at a location downgradient from the points of discharge/infiltration will be sufficient to detect any impacts on groundwater quality. Monitoring bores (JAMB10 and JAMB11) were installed in 2013 and have been incorporated into the groundwater monitoring program as described in Section 5.5 from December 2013. Following construction of the Precinct 6/6A stormwater infiltration basin it was considered that JAMB4 will provide suitable downgradient monitoring coverage.

Additional bores may be installed if warranted in future, depending on the infrastructure developed and the activities undertaken. Similarly, where existing bores are determined by the groundwater monitoring consultant to be immaterial or irrelevant in their contribution towards the purpose of the groundwater monitoring program, those bores may be omitted from the groundwater monitoring program or sampled at an amended frequency.

5.3 SEWERAGE AND WASH WATER MANAGEMENT

All new developments within Precincts 4, 5 and 6/6A will be connected to reticulated sewerage as detailed within Master Plan 2020. Refer to Section 4.5 for further detail on likely extensions required by JAH to connect all facilities to the sewer system.

When a sewer connection is provided to a leased site, all wash water must be captured and either:

- Collected and disposed of by a licensed liquid waste management contractor; or
- Treated and discharged to the sewer under the conditions of a “Permit to Discharge Industrial Waste” obtained from the WA Water Corporation.

5.4 GROUNDWATER ABSTRACTION MANAGEMENT

All groundwater abstraction bores are metered and water consumption rates are monitored monthly.

JAH has consulted with the WA DWER regarding management of groundwater resources and groundwater abstraction. All abstraction occurs under a conditioned licence issued by the DWER, and JAH provides DWER with Annual Reports detailing groundwater abstraction volumes and groundwater quality monitoring results.

5.5 GROUNDWATER MONITORING PROGRAM

The purpose of the groundwater monitoring program is to:

- Establish baseline groundwater conditions against which future changes/trends can be measured.
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.
- Promote the health and sustainability of wetlands within the JAH site area.

Groundwater monitoring is undertaken by suitably qualified professional consultants.

5.5.1.1 Monitoring Bores

Nine groundwater monitoring bores were installed at Jandakot Airport in February 2012 at the locations proposed within the original approved GMP (V3, August 2011). Following consultation with DWER (then DoW), a further two bores (JAMB10 and JAMB11) were installed in 2013 to monitor groundwater quality downgradient to stormwater infiltration basins located to the east of the JUWPCA boundary in the eastern portion of Precinct 5. These groundwater monitoring bores (11 in total) are shown on Figure 10.

Caffeine monitoring has been added to five key locations across the site for future events as an additional measure to detect any seepage from septic tanks or ATU systems. Caffeine samples will be taken at these bores located up-gradient and down-gradient of existing septics and ATU systems. Up-gradient bores (JAMB6 and SWB001) and downgradient bores (JAMB2B, ADC1, and Aero 2) are shown Figure 11.

Refer to Section 5.2 for further information on bores that may be installed or omitted or sampled at an amended frequency if warranted in the future.

5.5.2 SAMPLING FREQUENCY

In order to establish baseline groundwater conditions, it is standard practice to undertake quarterly groundwater monitoring events (GMEs) for a two-year period. Providing results do not indicate the presence of contamination (which would warrant additional investigation), sampling is typically then reduced to biannual or annual GMEs.

JAMB1-JAMB9 were initially sampled quarterly for two years (i.e., a minimum of 8 sampling events during 2012 and 2013). Urbaqua (previously Essential Environmental) reviewed the monitoring results and concurred with Coffey (2014) that there were no issues that warranted ongoing quarterly investigation.

The data collected facilitated a review of assessment levels to adopt revised values for a number of analytes based on observed control sites. Ongoing biannual monitoring has since occurred (and will continue to occur) in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels.

Any additional monitoring bores installed will be sampled concurrently with the established biannual sampling regime unless results warrant further investigation.

See also Section 5.5.6 Amendment of Groundwater Sampling Program.

5.5.3 SUITE OF ANALYTES AND ASSESSMENT LEVELS

The suite of analytes and relevant assessment levels that will be applied to the groundwater sampling program are detailed in Table 2. This table has been updated in this GMP (v5.7) to include caffeine testing at five key bore locations across the site to detect any seepage from septic tanks or ATUs.

Under the *Airports (Environment Protection) Regulations 1997*, the accepted statutory limits of water pollution are defined in Schedule 2. Whilst Schedule 2 remains the statutory document, assessment levels have been developed to take into account local and site-specific baseline conditions when interpreting and reporting groundwater monitoring results.

When developing trigger values for water quality, *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG, 2018) recommend the use of the 90th percentile of an observed control site where the aim is to maintain water quality.

The data collected facilitated a review of assessment levels to adopt more appropriate, revised assessment levels for a number of analytes based on observed control upgradient sites. This is particularly relevant for nutrients and electrical conductivity since none of the previously applied targets have considered the typical range of concentrations found in Swan Coastal Plain shallow aquifer groundwater systems.

Revised assessment levels have been adopted for TN, TP, pH, Electrical Conductivity, Aluminium, Copper, Zinc, Lead and Iron based on the 90th percentile of collected groundwater data from ten monitoring events (March 2012 to September 2014) at bores JAMB5, 6, 7, 8 and 9 which are all located upgradient of infrastructure and operations on the Jandakot Airport estate and may therefore be considered 'observed control sites' consistent with the recommendations of ANZG 2018.

Under Part 5 Division 1 of the Regulations, the airport-lessee company (i.e., JAH) may propose a substitute standard that is applicable to the site if the existing standard defined in a Schedule to the Regulations is inappropriate, thereby establishing a 'local standard'. Whilst JAH does not intend to formally establish a local standard in the immediate future (noting it is lengthy process and rarely undertaken), it will consider the possibility at a future time and determine, following liaison with DITRDCA, if warranted.

5.5.4 QA/QC

All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures. Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed.

Table 2: Groundwater Assessment Levels

Parameter	Unit	A(EP)R 1997 Schedule 2	Assessment Level
On Site Field Measurements			
Rainfall	mm	n/a	n/a
Depth to Groundwater Level	mtoc	n/a	n/a
Groundwater level	mAHD	n/a	n/a
pH	Units	6.5-9.0	3.5-9.0
Temperature	°C	>2 above seasonal mean	>2 above seasonal mean
Electrical Conductivity (EC)	µS/cm	1,000	120-440
Dissolved Oxygen (DO)	%	>80	>80
	mg/L	>6	>6
Laboratory Analysis			
Electrical Conductivity (EC)	µS/cm	n/a	120-480
Total Dissolved Solids	mg/L	<1000 or 5% increase	<1000 or 5% increase
Total Acidity (as $CaCo_3$)	mg/L	n/a	60
Net Acidity (T_{acid}-T_{alk} as $CaCo_3$)	mg/L	n/a	60
Chloride (Cl)	mg/L	n/a	250
Sulphate (SO_4)	mg/L	n/a	500
Hardness (as $CaCo_3$)	mg/L	n/a	n/a
Caffeine	mg/L	n/a	An increase at down-gradient bores JAMB2B, ADC1 or Aero 2 compared to up-gradient
Nutrients			
Phosphorus (P)	mg/L	0.01	0.12
Nitrogen (N)	mg/L	0.1	6.39
Heavy Metals			
Aluminium	mg/L	0.1	3.34
Arsenic	mg/L	0.05	0.05
Cadmium	mg/L	0.0002	0.0002
Chromium	mg/L	0.01	0.01

Parameter	Unit	A(EP)R 1997 Schedule 2	Assessment Level
Copper	mg/L	0.002	0.003
Iron	mg/L	1	1.45
Lead	mg/L	0.001	0.003
Nickel	mg/L	0.015	0.015
Zinc	mg/L	0.005	0.019
Total Petroleum Hydrocarbons			
Fuel (C_6-C_9 fractions)	mg/L	0.15	0.15
Mineral Oil (>C_9 fractions)	mg/L	0.6	0.60
Monocyclic Aromatic Compounds			
Benzene	mg/L	0.3	<0.001
Toluene	mg/L	0.3	0.025
Ethylbenzene	mg/L	0.14	0.003
Xylene	mg/L	n/a	0.02

- Values in RED are assessment levels adopted based on the 90th percentile of collected groundwater data (March 2012 to September 2014) at observed control sites consistent with the recommendations of ANZG 2018. Figures in BLUE are ADWG assessment levels specified by the WA DoH.
- On site measurements are to be undertaken with appropriately calibrated equipment (certificates to be provided in AGMR)

5.5.5 REPORTING

Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e., within 72 hours of results becoming available) so necessary action can be agreed upon and implemented. As noted within Table 2, exceedances of A(EP)R triggers may occur regularly for certain parameters and does not necessarily constitute groundwater contamination.

Where an exceedance of an A(EP)R trigger indicates the potential presence of contamination, JAH will advise the DITRDCA Airport Environment Officer (AEO) within 14 days. The AEO (in consultation as necessary with JAH and the consultant undertaking groundwater monitoring) will determine if the nature of contamination is of a level that requires further action or for other agencies to be notified prior to the distribution of the Annual Report. For example, exceedances and/or increasing levels of nutrients that cannot be attributed to background conditions of groundwater entering the site may warrant investigation into the location and rates of on-site fertiliser use.

Groundwater monitoring results will be maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event. Note that an interim GME report is not warranted if the draft Annual Report, as detailed below, is provided to the JAH Environment Manager within 8 weeks of the final GME of the Financial Year.

Consultants undertaking the Annual Groundwater Monitoring Program will prepare an Annual Report, which details the results of monitoring undertaken as described within Section 5.5 of this plan. The Annual Monitoring Report will contain the following:

- An Executive Summary.
- An Introduction.
- Methodology.
- Results, including interpretation, tabular and graphical reporting of results, analysis of long-term trends and comparison with A(EP)R Schedule 2 and any

other relevant regional data that is available from the DWER and/or Water Corporation.

- Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels.
- QA/QC including a validation of analytical data by a critical review of all processes.

The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders identified in Section 6 below.

5.5.6 AMENDMENT OF GROUNDWATER SAMPLING PROGRAM

The bores sampled, sampling frequency and/or suite of analytes may be reviewed and amended from time to time when warranted.

Changes that increase the sampling frequency or suite of analytes (as defined in the Groundwater Monitoring Program) may occur at any time based on the recommendation of the groundwater consultant engaged to undertake the groundwater monitoring program.

Excluding changes describe above, any proposed changes in sampling frequency, suite of analytes or assessment levels as described in Table 2 will be proposed and justified within either a GME interim report or the Annual Groundwater Monitoring Report. Key stakeholders will be invited to comment on proposed changes prior to the GMP being amended, approved and implemented consistent with Conditions 12 of EPBC 2009/4796 and Conditions 2 and 7 of EPBC 2013/7032.

5.5.7 AUDITING

The Annual Groundwater Monitoring Reports are to be provided to key stakeholders and regulators annually (refer Sections 5.5.5 and 6), and comment and feedback is encouraged. This process allows for expert peer review, which may subsequently result in changes/improvements to the monitoring program.

Independent auditing of the groundwater monitoring program (including results and reports) will be undertaken every 5 years. Five yearly audits were conducted by GreenCap in November 2017 and June 2023, respectively. Upcoming five yearly independent audits of the groundwater monitoring program will be completed by the end of 2027 and 2032.

The audit report will be provided to key stakeholders for review and comment, following which the Groundwater Monitoring Program will be reviewed and if necessary, amended. Table 3 below shows the schedule for previously completed and upcoming five yearly independent audits . The GreenCap reports have been provided in Appendix 5.

Table 3: Audit Schedule

Audit	Auditor/Timing
Previous audit of: • Annual Groundwater Monitoring Report, August 2013 (Pendragon Environmental Solutions) • 2013-2014 Annual Groundwater Monitoring Report, Jandakot Airport, WA, 20 October 2014 (Coffey Environments Australia Pty Ltd) • 2014-2015 Annual Groundwater Monitoring Report, Jandakot Airport, WA, 30 September 2015 (Coffey Environments Australia Pty Ltd) • 2015-16 Annual Groundwater Monitoring Report, September 2016 (Essential Environmental [now Urbaqua]) • 2016-17 Annual Groundwater Monitoring Report, September 2017 (Essential Environmental [now Urbaqua])	GreenCap, November 2017

Previous audit of Urbaqua monitoring reports: • 2017-2018 Annual Monitoring Report • 2018-2019 Annual Monitoring Report • 2019-2020 Annual Monitoring Report • 2020-2021 Annual Monitoring Report • 2021-2022 Annual Monitoring Report	GreenCap, June 2023
Audit of future groundwater monitoring reports	Every 5 years, next due 2027 following the 2026-27 annual groundwater monitoring report

5.6 INCIDENTS AND EMERGENCIES

JAH staff, tenants and contractors are required to report all environmental incidents to JAH for investigation. This includes all spills that have the potential to cause environmental harm (i.e., soil and/or groundwater contamination), regardless of volume. Spill management is a critical tool in the prevention of soil and groundwater contamination. Spill avoidance and management procedures are outlined in Section 3.6.

All incidents are recorded within the JAH Safety Management System (SMS) and are subject to an initial assessment to determine if further investigation is required, and corrective actions are identified if warranted. For incidents resulting in potential contamination, corrective actions may include groundwater and/or soil sampling or the development and implementation of a remediation program.

Sites are inspected by JAH staff (or their consultants) for evidence of unreported spills during tenant audits, formal and informal site inspections and Environmental Site Assessments. Suspected spills are then reported and subsequently investigated as environmental incidents.

JAH reviews tenant auditing/inspection findings on a regular basis to determine if a tenant's environmental risk profile has changed. Refer to Section 3.4 for further detail on JAH's risk assessment process.

The Aerodrome Emergency Plan (AEP) (Section 3.2) has been developed to ensure effective and efficient arrangements for the response to, and recovery from, an emergency at Jandakot Airport. This includes emergency response plans for potentially polluting events such as 'fuel and oil spills' and 'hazardous materials.

In addition, Airport tenants who store chemicals or undertake activities that have the potential to result in environmental harm (including soil or groundwater contamination) are required to develop an Operational Environmental Management Plan (OEMP) that includes emergency response procedures, using a specified OEMP template, last reviewed in October 2023.

Similarly, contractors undertaking construction activities are required to develop CEMP that include emergency response procedures.

Outcomes and details of incidents, tenant audits and inspections are presented in the JAH AERs and EPBC Compliance Reports, which are submitted to DITRDCA and DCCEEW on an annual basis. Previously submitted annual compliance reports are available on the Jandakot website (https://www.jandakotairport.com.au/environment/environment-plans.html).

5.7 CONTAMINATION MANAGEMENT

All areas of confirmed or suspected contamination are reported and recorded on the JAH Contaminated Sites Register, which is a component of the Environmental Site Register.

Sites are ranked according to the nature of contamination and risks posed. Where investigation identifies sites as requiring remediation or ongoing monitoring (as confirmed or instructed by the AEO), appropriate plans are developed and implemented in line with the *Airports (Environment Protection) Regulations 1997*, *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM – as amended in 2013) and the DWER's Contaminated Sites Management Series Guidelines as appropriate.

6 COMMUNICATION PLAN

6.1 PUBLICATION AND AWARENESS

JAH communicates the contents of this Groundwater Management Plan via the following methods:

- Publication of the GMP on the JAH website where it is accessible to all staff, tenants, contractors and members of the public.
- Inclusion of relevant groundwater management information within CEMP and OEMP templates developed for contractor and tenant use.
- Inclusion of Oil Spill and Hazardous Materials Response Procedures within the Aerodrome Emergency Plan.
- The publication of Tenant Resources containing relevant groundwater and contamination control information on the JAH website; including:
    - Tenant Environmental Handbook
    - Management of Sewage and Greywater Policy
    - Dangerous Goods and Hazardous Materials Policy
    - Aircraft and Equipment Washdown Policy
    - Storage of Empty Drums and Containers Policy.

6.2 STAKEHOLDER CONSULTATION

Stakeholder consultation is recognised as an important component of sound environment management practices.

Jandakot Airport holds regular internal consultation meetings as well as with government departments and other external stakeholders as required. Key Stakeholder consultation relevant to the GMP is summarised below in Table 4:

Table 4: Stakeholder Consultation

Key Stakeholder	Timing
Commonwealth Regulatory Authorities	
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	As Required
Airport Environment Officer - Department of Infrastructure, Transport, Regional Development, Communications and the Arts (AEO DITRDCA)	Weekly
WA Government Agencies	
WA Department of Water and Environment Regulation (DWER)	As Required
WA Water Corporation	As Required

6.3 REPORTING REQUIREMENTS

Reporting against actions described in this plan will be included within the Jandakot Airport Annual Environment Report (AER). In line with the *Airports (Environment Protection) Regulations 1997*, the AER will be submitted to DITRDCA by 28th October each year. A copy of the report will be provided to DCCEEW by 28th October each year.

Annual Groundwater Monitoring Reports (refer Section 5.5.5) will be distributed by 28th October each year to DCCEEW, DITRDCA, DWER and the Water Corporation.

Reporting relevant to the GMP will also be included in an annual compliance report, as required under Condition 16 of EPBC 2009/4796, and published on the JAH website by 28th October each year.

7 IMPLEMENTATION

7.1 REVIEW AND AMENDMENT OF GMP

The GMP will require regular review and amendment to meet practical requirements on site as changing circumstances demand.

Once amended, the GMP will be submitted to DCCEEW for the Minister's approval (ref Conditions 7 and 12 of EPBC 2009/4796; Conditions 2 and 7 of EPBC 2013/7032). The approved management plan will be implemented.

7.2 SUMMARY OF ACTIONS

Table 5 below contains a list of summary actions relating to the GMP.

Table 5: Groundwater Management Plan- Summary of Actions

Action		Responsibility	Timing
Acid Sulfate Soil Management			
GMP1	Investigate Acid Sulfate Soils in line with DWER guidelines and triggers.	JAH EM to facilitate the proponent/ contractor undertaking the proposed action.	Prior to any action that triggers the requirement for investigation.
GMP2	Develop and implement an ASSMP consistent with the DWER Acid Sulfate Soils Guideline Series.	JAH EM to facilitate the proponent/ contractor undertaking the proposed action.	If required (based on the findings of GMP1), ASSMP to be developed prior to undertaking any action that disturbs ASS as identified in an ASS Investigation.
Stormwater Management			
GMP3	Within the JUWPCA stormwater from roofs is collected and discharged into soakwells in order to facilitate and maximise groundwater recharge. NB. This excludes any roof water captured in approved rainwater tanks.	JAH EM	Ongoing
GMP4	Stormwater from all roads, carparks and external hardstands within the JUWPCA is discharged into a drainage basin(s) located outside of the JUWPCA with stormwater from higher risk areas having passed through appropriate treatment devices such as interceptors and/or separators when warranted.	JAH EM	Ongoing
Sewage Management			
GMP5	All new developments will be connected to reticulated sewer consistent with Master Plan 2020.	JAH EM	Ongoing
Groundwater Abstraction			
GMP6	Water abstraction is to be consistent with the licence issued by the DWER.	JAH EM	Ongoing
GMP7	Provide an annual groundwater abstraction report, containing abstraction volumes obtained from monthly meter readings, to the DWER.	JAH EM	28 October Annually from 2015.
Groundwater Monitoring Program			
GMP8	Undertake groundwater monitoring	JAH EM and	Quarterly for the first two years

Action		Responsibility	Timing
	consistent with Section 5.5 of this GMP.	consultant engaged to undertake the task.	(from March 2012) and then biannual (or consistent with timing as determined in Section 5.5.6 if applicable).
GMP9	Exceedances of criteria interpreted by the consultant as representing potential contamination will be reported to JAH as soon as results become available.	Consultant engaged by JAH EM	Within 72 hours of results becoming available.
GMP10	GME results, in an interim report, will be provided by the consultant to JAH.	Consultant engaged by JAH EM	Within 8 weeks of a GME unless the draft Annual Report, is provided to the JAH Environment Manager within 8 weeks of the final GME of the Financial Year.
GMP11	An updated electronic database containing GME results will be provided by the consultant to JAH.	Consultant engaged by JAH EM	Within 8 weeks of a GME.
GMP12	Prepare an Annual Report, which details the results of monitoring undertaken as described within Section 5.5 of this plan.	Consultant engaged by JAH EM	28 October Annually
GMP13	Seek comment from key stakeholders regarding proposed changes in sampling frequency, suite of analytes or assessment levels as detailed in Section 5.5.6.	JAH EM	Prior to the GMP being amended and submitted for approval.
GMP14	Undertake an independent audit of the groundwater monitoring program.	JAH EM	Every 5 years (next due by the end of 2027).
Incidents and Emergencies			
GMP15	Incidents that have the potential to cause environmental harm are recorded in the JAH SMS. (Noting information regarding incidents is often initially reported/recorded in other formats (e.g., email) and relevant information transferred to the SMS at a later date. This does not cause delays in the initial assessment/response of an environmental incident).	All JAH staff, overseen by JAH EM.	ASAP after incident is reported.
GMP16	Reported incidents that have the potential to cause environmental harm are immediately reviewed by JAH Environmental staff and if required, further investigated and corrective actions assigned if necessary.	JAH EM in collaboration with the contractor/tenant responsible for the incident and the DITRDCA AEO.	The timing of this action is dependent on the nature of the incident and associated risk (e.g., volume, location, potential impacts etc.).
GMP17	Incident Reporting Requirements are detailed within the Jandakot Airport Tenant Environmental Handbook which is to be made available on the JAH webpage along with an Environmental Incident Report form.	JAH	At all times.
GMP18	Ensure that all OEMPs and CEMPs include emergency response and incident reporting procedures.	JAH EM	Prior to endorsing any CEMP or OEMP.
Contamination Management			
GMP19	Record all areas of confirmed or suspected contamination on the Environmental Site Register's (ESR) Contaminated Sites Register (CSR).	JAH EM	Whilst the ESR CSR is updated regularly as required, the CSR is to be fully reviewed and updated with all relevant information by 28 October annually for inclusion within

Action		Responsibility	Timing
			the AER.
GMP20	Investigate all reported/recorded incidents that have the potential to result in a contaminated site and (if required) determine any sampling, monitoring, remediation and validation requirements (noting in most instances, this action is the same as GMP16).	JAH EM in collaboration with the contractor/tenant responsible for the incident and the DITRDCA AEO.	The timing of this action is dependent on the nature of the incident and associated risk (e.g., volume, location, potential impacts etc.).
GMP21	Develop and implement (as and if required) sampling, monitoring, remediation and validation requirements as identified in above action consistent with the Regulations detailed in Section 5.7.	JAH	The timing of this action is dependent of the outcome of GMP20.
Communication and Awareness			
GMP22	Publish GMP on the JAH website.	JAH EM	Within 1 month of being approved by the Minister.
GMP23	Update the JAH CEMP and tenant OEMP templates with relevant groundwater management information (only required if information within current CEMP and OEMP templates is not consistent with the current GMP).	JAH EM	Within 3 months of GMP review completion and subsequent endorsement by relevant government regulator.
GMP24	Ensure all CEMPs and OEMPs submitted to JAH for review and endorsement adequately addresses Groundwater Management (i.e., groundwater protection and pollution prevention), relevant to the activities proposed to be undertaken.	JAH EM	Prior to endorsing CEMP or OEMP.
Reporting Requirements			
GMP25	Report against actions of the GMP within the Jandakot Airport Annual Environment Report (AER) and provide copies to DITRDCA and DCCEEW	JAH EM	28 October Annually.
GMP26	Distribute Annual Monitoring Report to Key Stakeholders.	JAH EM	28 October Annually.
GMP27	Report against actions of the GMP within an Annual Compliance Report (ref Condition 16 of EPBC 2009/4796) and publish on the JAH website.	JAH EM	28 October Annually.
Review and Amendment of GMP			
GMP28	Undertake a full comprehensive review and amendment of GMP	JAH EM	Within 6 months of approval of Master Plan 2028 and any associated EPBC approvals, or as otherwise directed by DCCEEW.

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9 ABBREVIATIONS AND ACRONYMS

ABC	Airport Building Controller
AEO	Airport Environment Officer
AEP	Aerodrome Emergency Plan
AER	Annual Environment Report
ANZG 2018	Updated version of Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Formerly ANZECC & ARMCANZ (2000))
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soil Management Plan
BMP	Best Management Practice
CEMP	Construction Environmental Management Plan
CMP	Conservation Management Plan
CSR	Contaminated Sites Register
DBCA	WA Department of Biodiversity, Conservation and Attractions (Formerly DPAW, DEC and CALM).
DITRDCA	Department of Infrastructure, Transport, Regional Development, Communications and the Arts (Formerly DIRDC, DIRD and DIT), the Commonwealth department that administers domestic and international aviation legislation and policies and is responsible for developing and implementing the regulatory regime for federally leased airports. The DITRDCA is responsible for appointing and overseeing the role of the AEO.
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Formerly DoE, DoEE, DAWE, DSEWPaC and DEWHA)
DWER	WA Department of Water and Environment Regulation (Formerly DER and DoW)
EMS	Environmental Management System
EPBC	*Environmental Protection and Biodiversity Conservation Act 1999*
ESR	Environmental Site Register
GME	Groundwater Monitoring Event
GMP	Groundwater Management Plan
JAH	Jandakot Airport Holdings
JUWPCA	Jandakot Underground Water Pollution Control Area
LWMS	Local Water Management Strategy
NATA	National Association of Testing Authorities
NES	National Environmental Significance
OEMP	Operational Environmental Management Plan
PDWSA	Public Drinking Water Supply Area
QA/QC	Quality Assurance/Quality Control
SMS	Safety Management System
UWPCA	Underground Water Pollution Control Area
WHPZ	Wellhead Protection Zone
WSUD	Water Sensitive Urban Design

Figure 1: Annexure A from EPBC 2009/4796

JANDAKOT AIRPORT

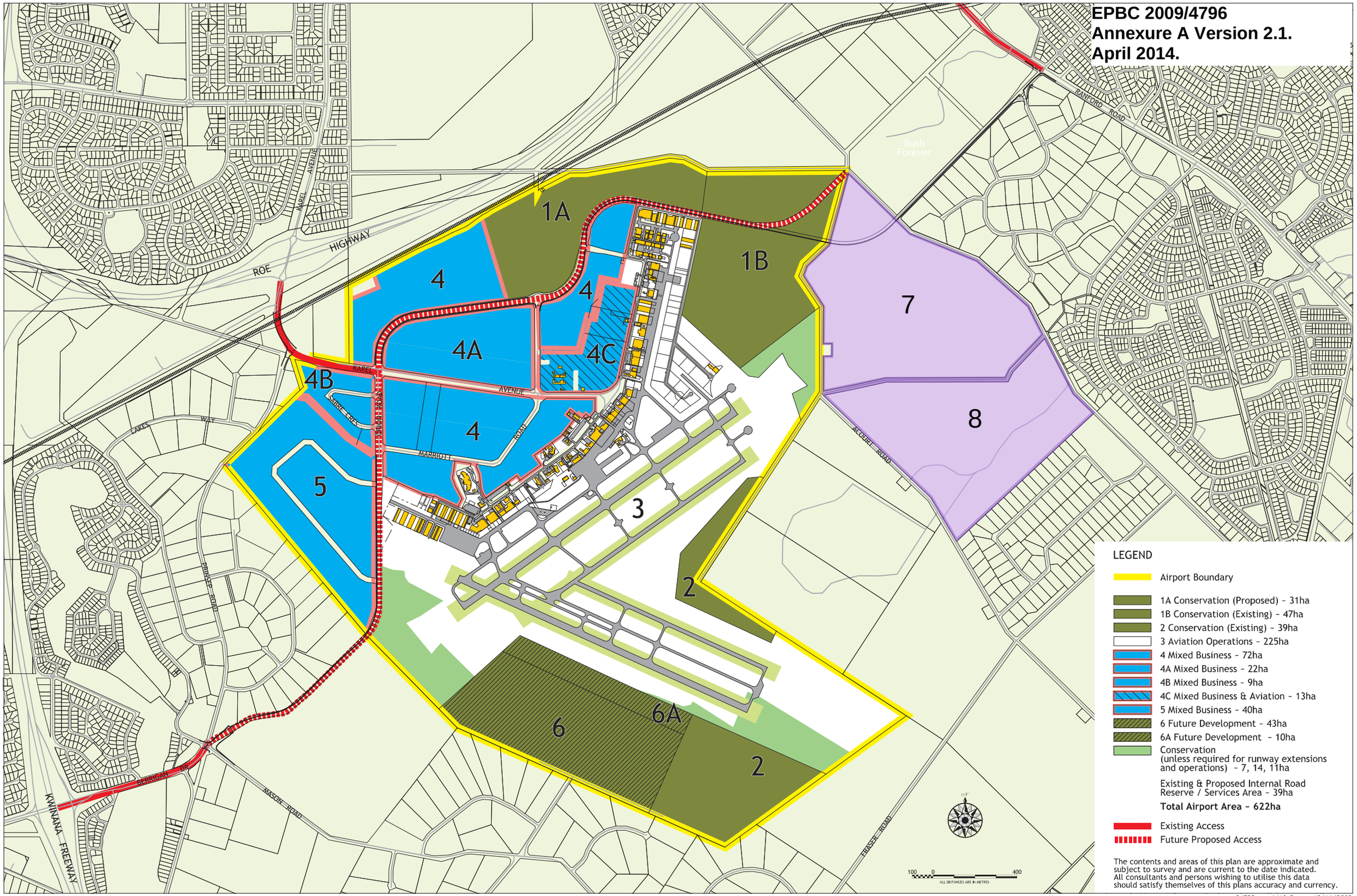


Figure 2: Master Plan 2020 Precinct Plan

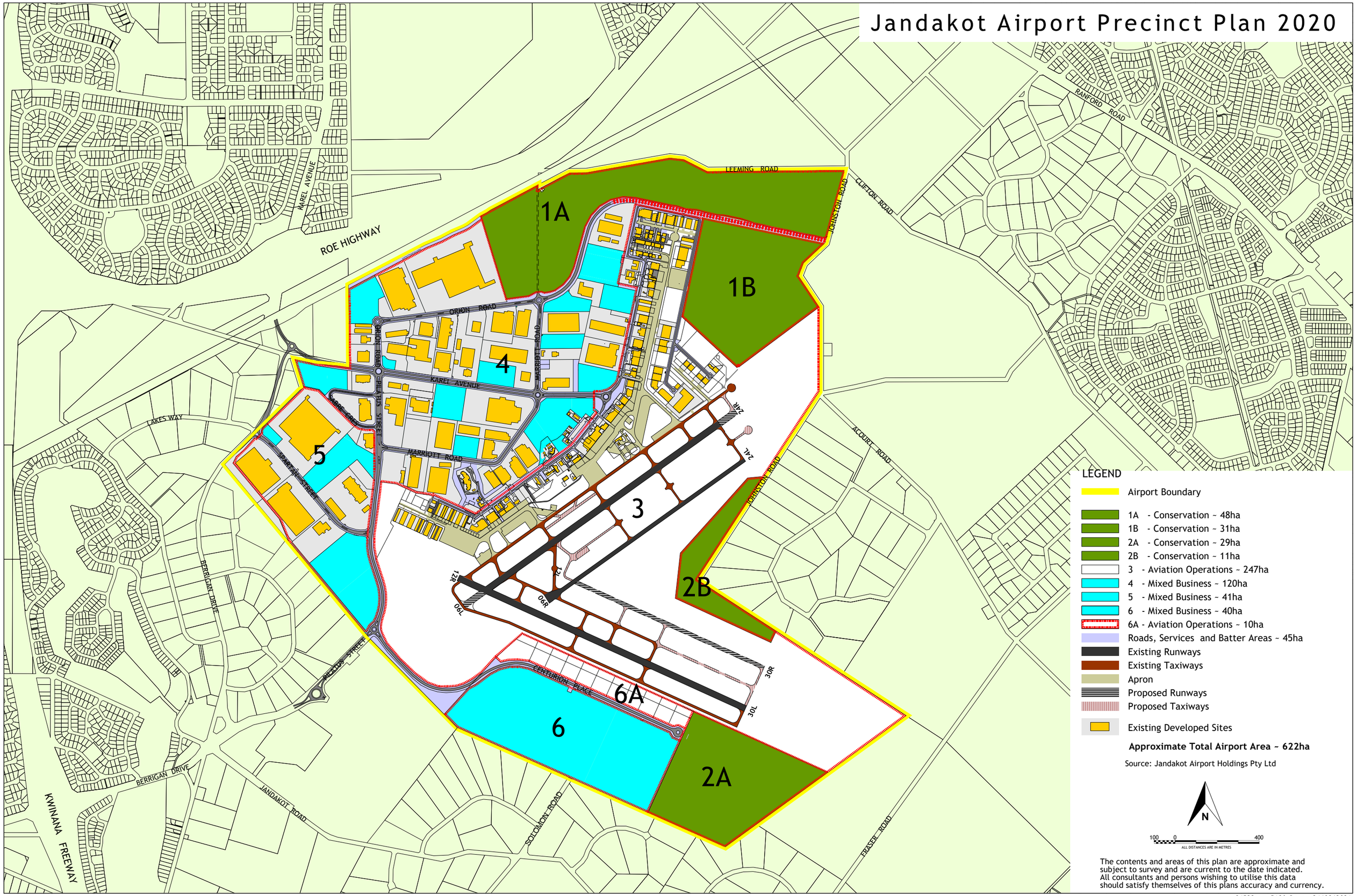
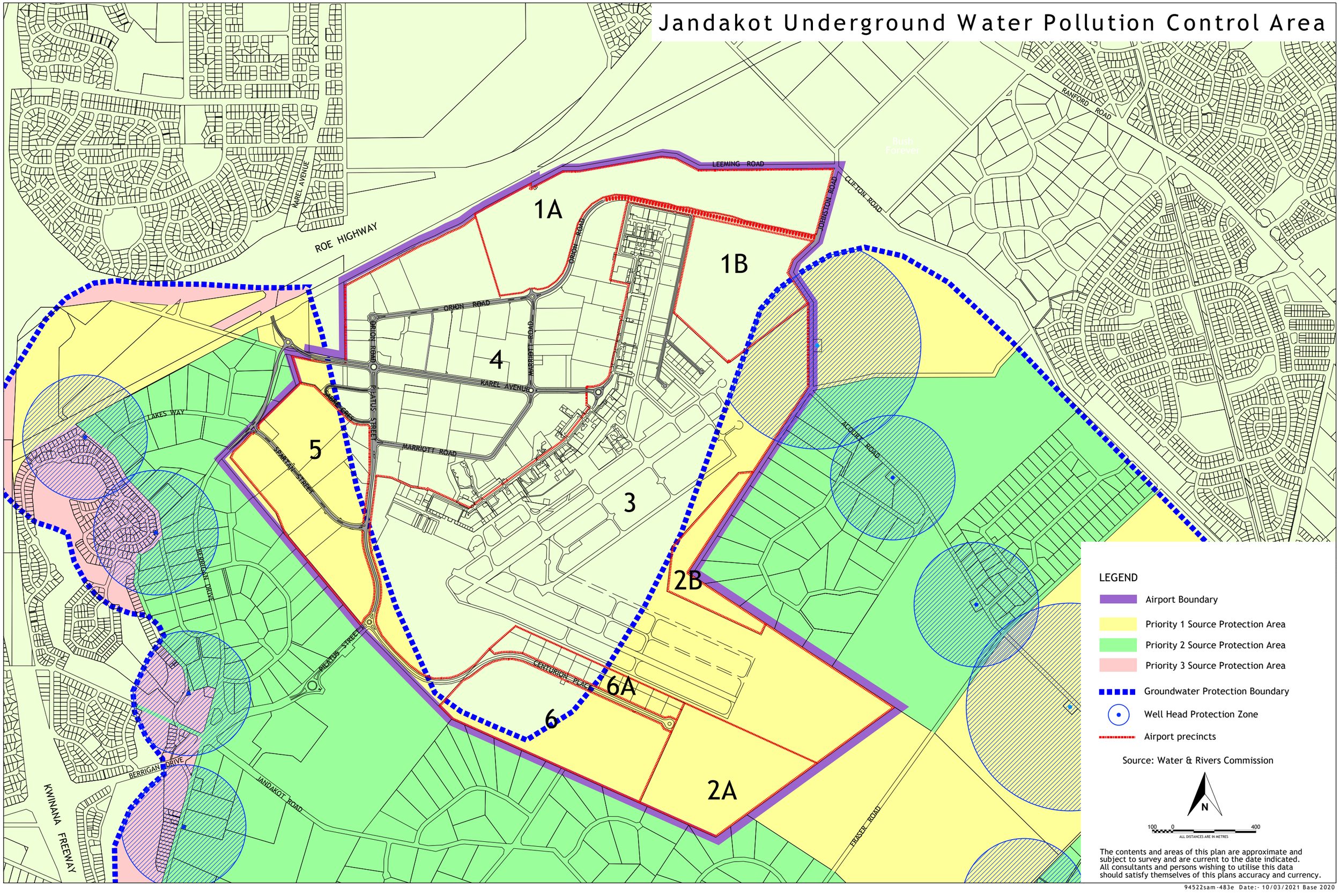
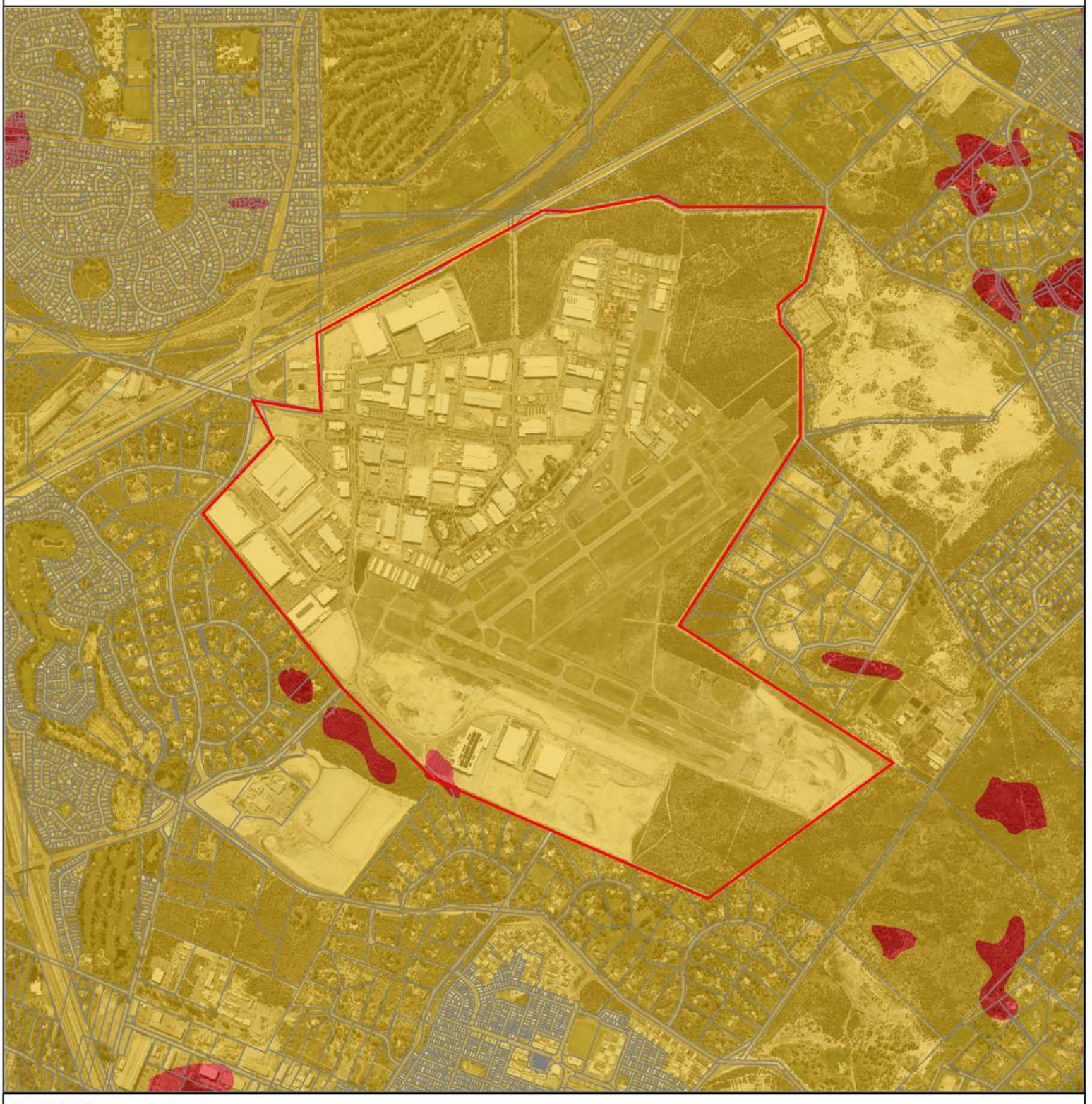


Figure 3: Jandakot Underground Water Pollution Control Area



Jandakot Airport - Groundwater Management Plan
Figure 4 - Acid sulfate soils



LEGEND:

- Airport boundary
- Cadastre

Acid sulfate soil risk category

- High to moderate risk
- Moderate to low risk

Data source: Landgate, MRWA, DWER. Created by: RM Projection: MGA: zone 50.

0 500

metres

Scale 1:25,000 @ A4

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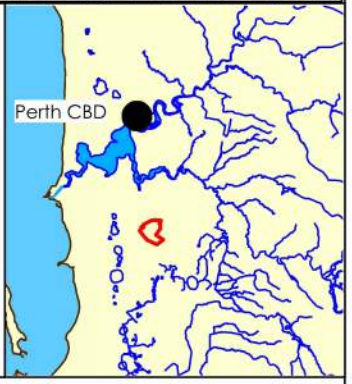
Jandakot Airport - Groundwater Management Plan
Figure 5 - Water Corporation Production Wells

LEGEND:

- Airport boundary
- Cadastre
- Production bore (Water Corporation)



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metres
Scale 1:30,000 @ A4

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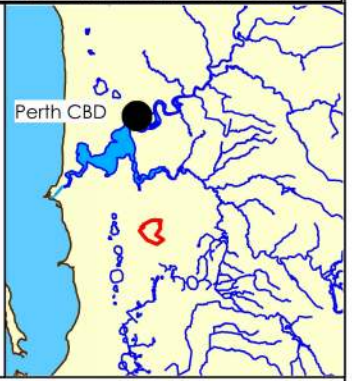
Jandakot Airport - Groundwater Management Plan
Figure 6 - DWER Observation Bores (WIN Database)

LEGEND:

- Airport boundary
- Cadastre
- Observation Bore



Data source: Landgate, MRWA Created by: RM Projection: MGA: zone 50.

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metres
Scale 1:20,000 @ A4

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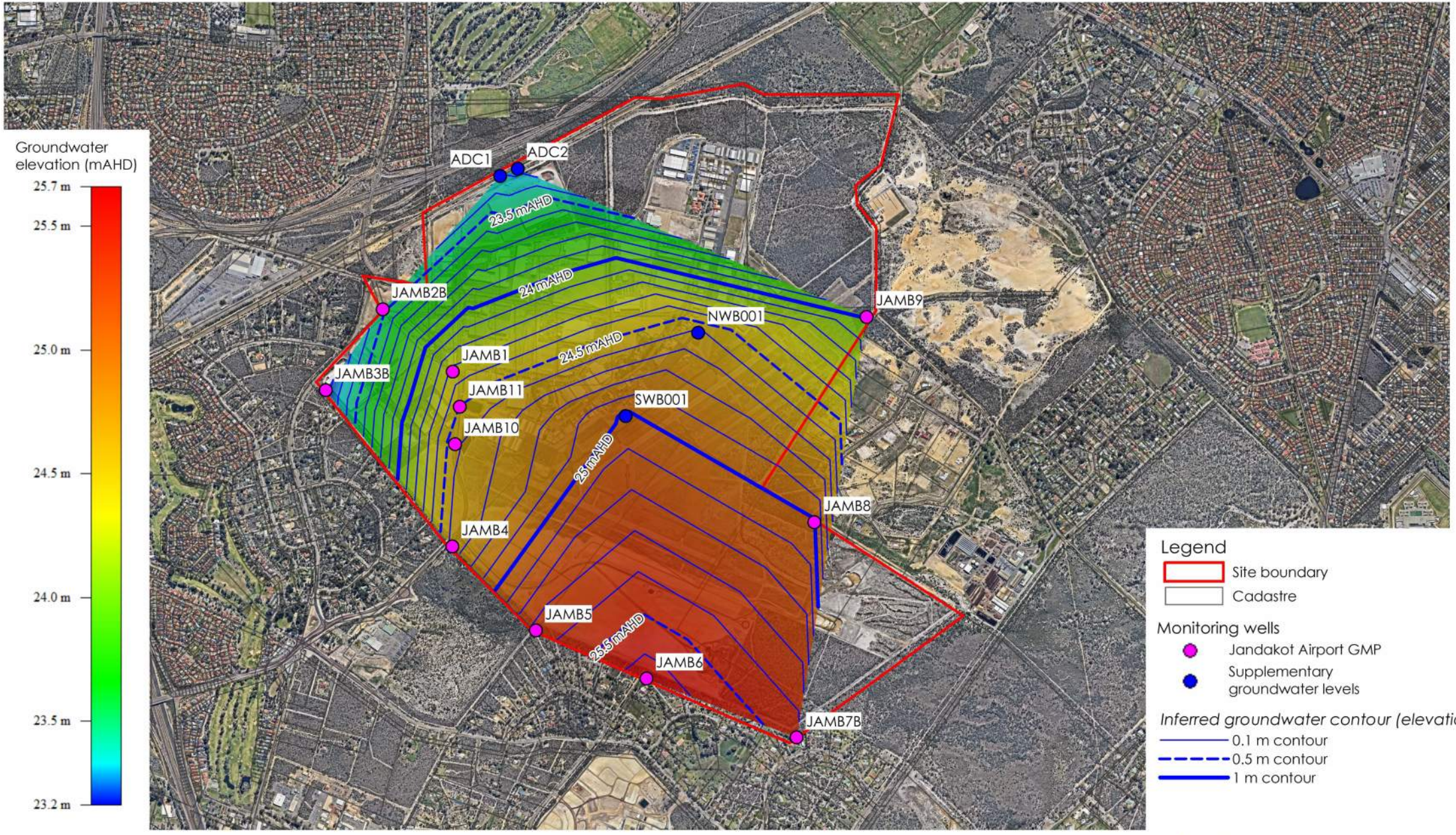
Figure 7 - March 2022 inferred groundwater contours



Data source: Landgate, JAH, MRWA, DPLH, DWER, Created by: AT Projection: MGA2020: zone 50.

0 1,000
metres
Scale 1:25,000@ A4

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FIGURE 8: GROUNDWATER LEVELS

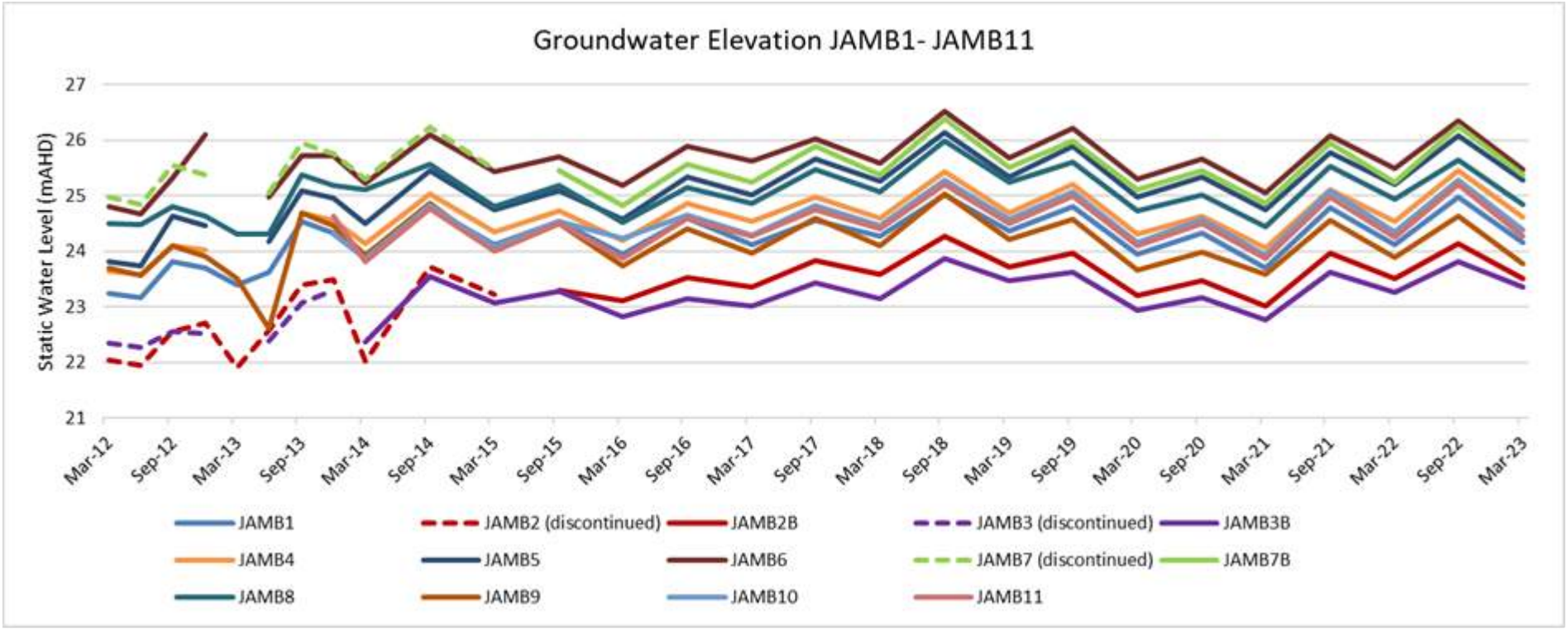
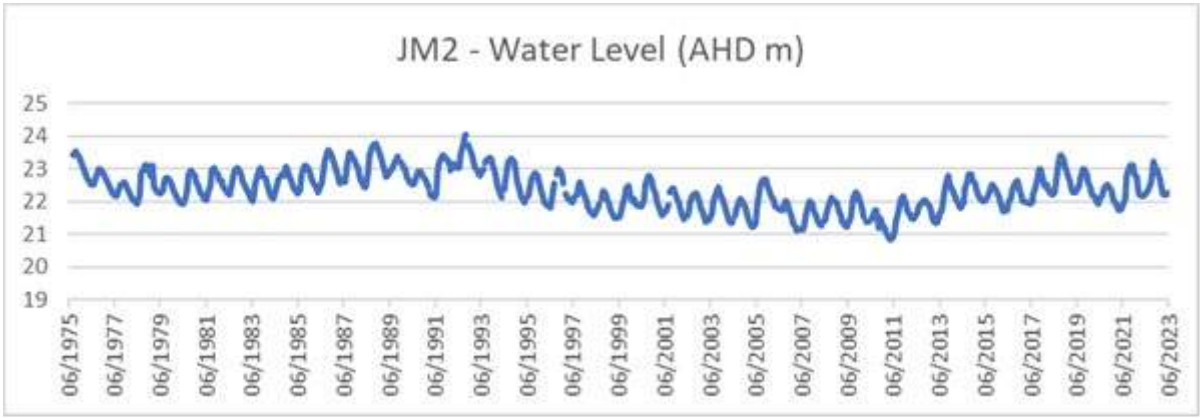
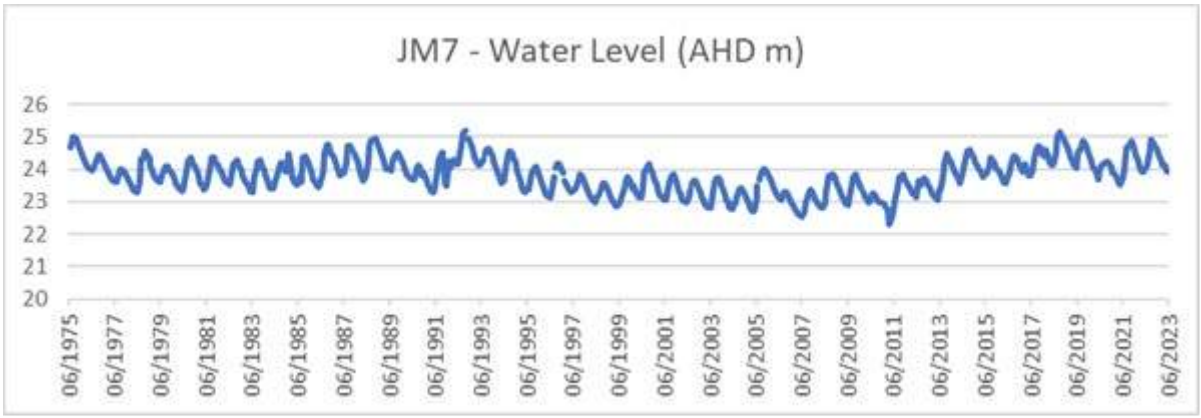
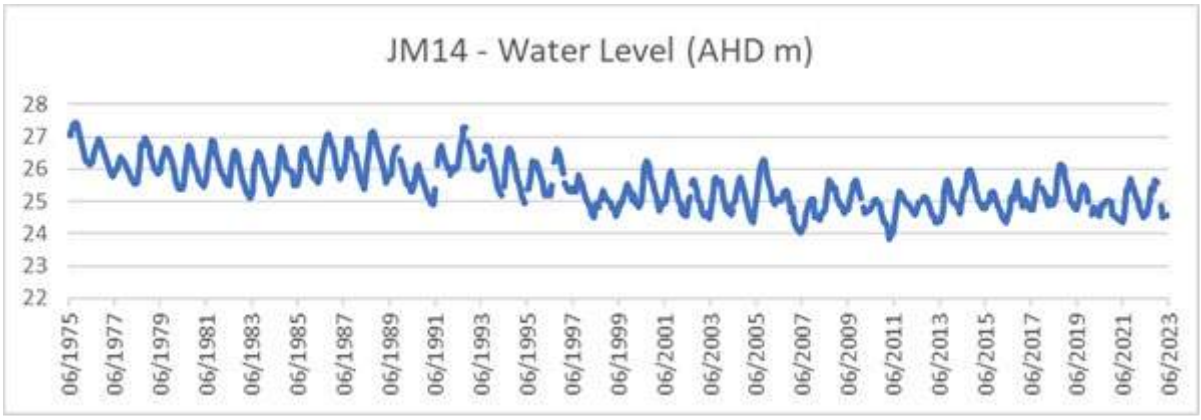
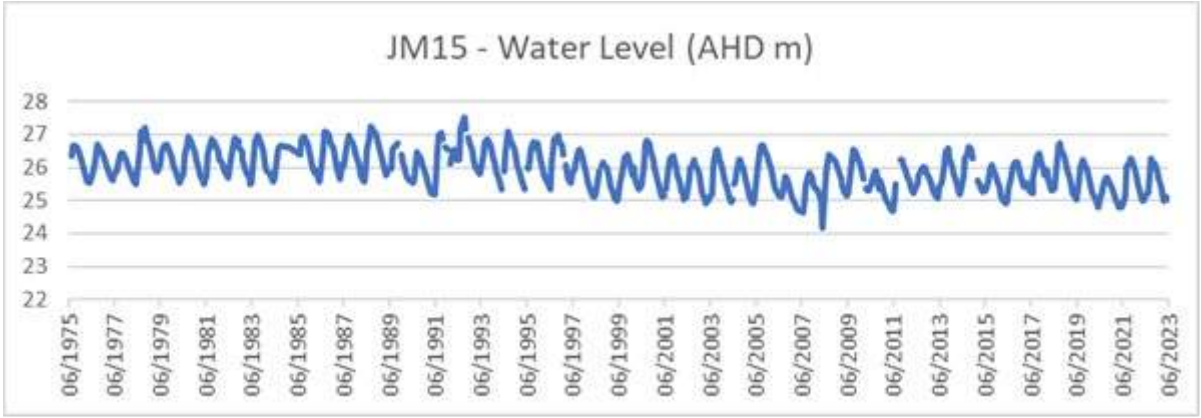


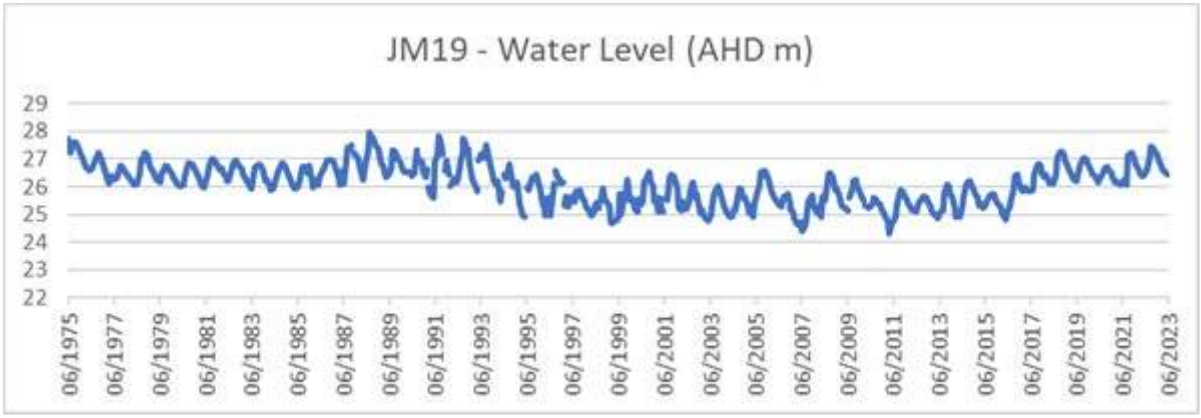
FIGURE 9: GROUNDWATER LEVELS (DWER)










JM19 - Water Level (AHD m)
29
28
27
26
25
24
23
22
06/1975
06/1977
06/1979
06/1981
06/1983
06/1985
06/1987
06/1989
06/1991
06/1993
06/1995
06/1997
06/1999
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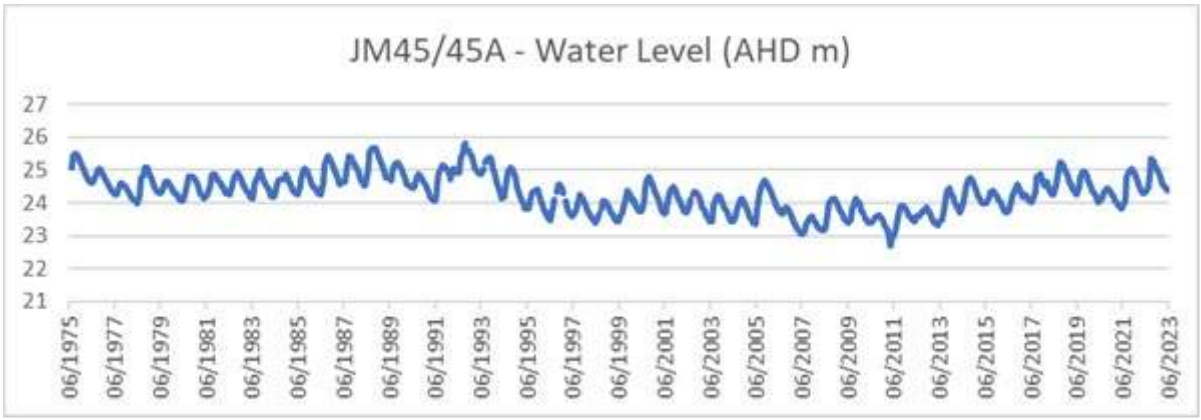
06/2021
06/2023


JM45/45A - Water Level (AHD m)
27
26
25
24
23
22
21
06/1975
06/1977
06/1979
06/1981
06/1983
06/1985
06/1987
06/1989
06/1991
06/1993
06/1995
06/1997
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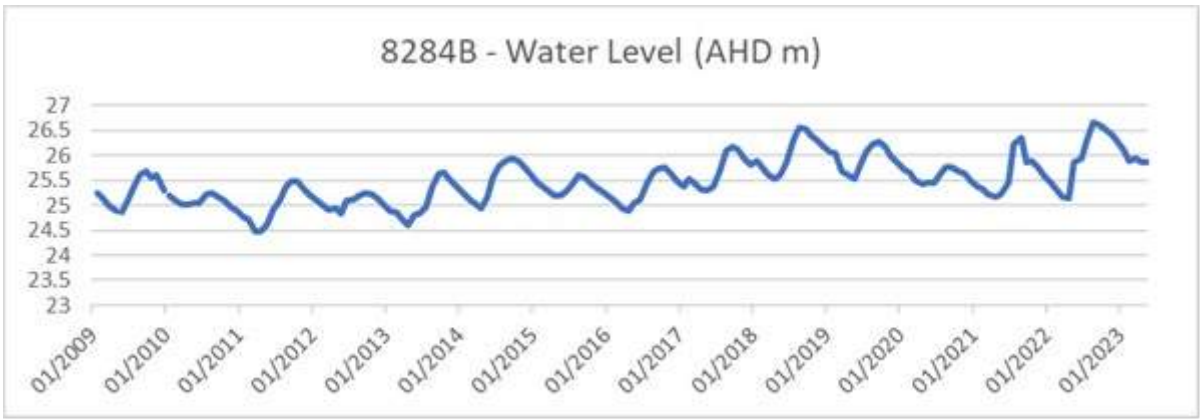
06/2021
06/2023


8284B - Water Level (AHD m)
27
26.5
26
25.5
25
24.5
24
23.5
23
01/2009
01/2010
01/2011
01/2012
01/2013
01/2014
01/2015
01/2016
01/2017
01/2018
01/2019
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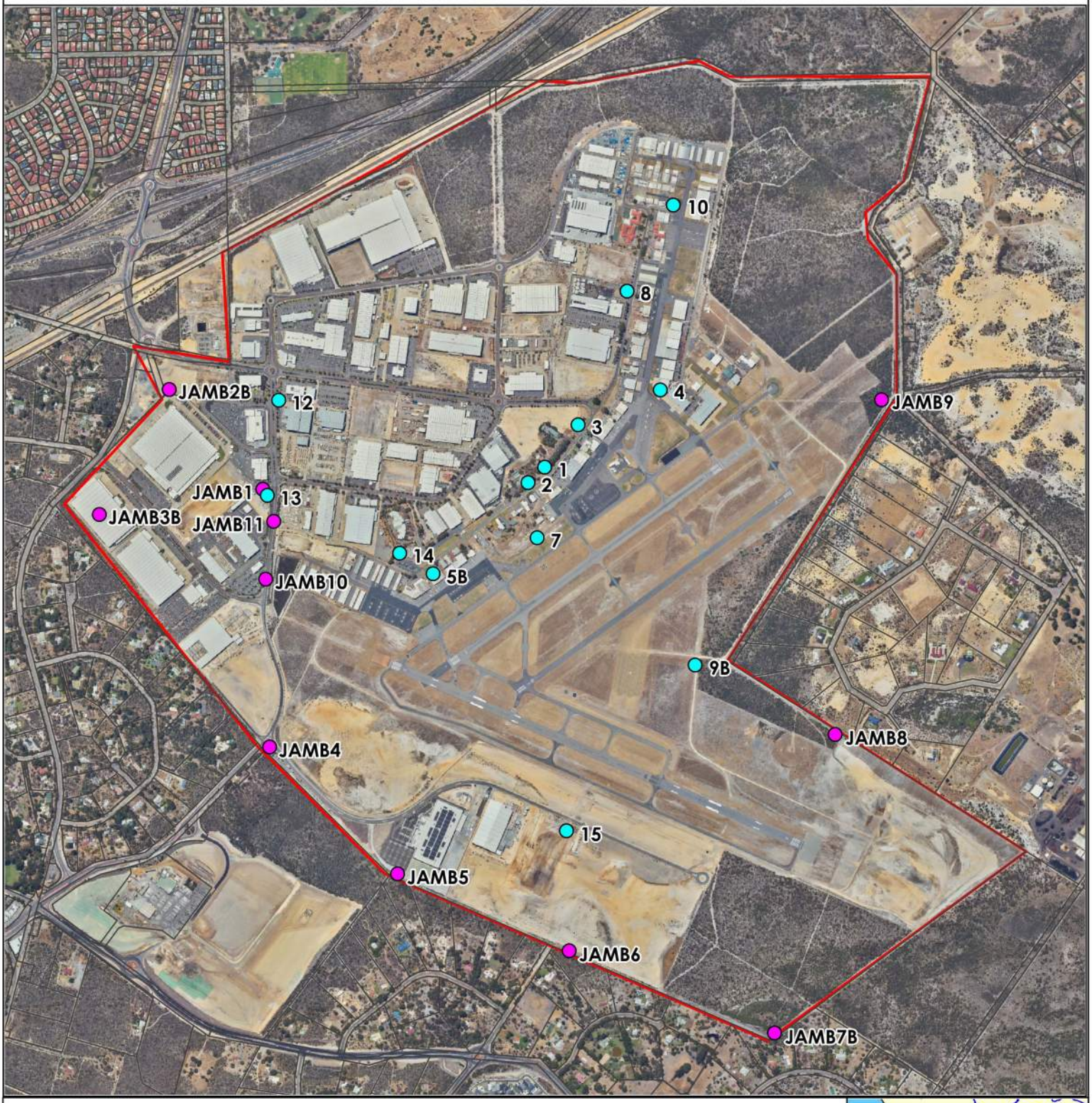
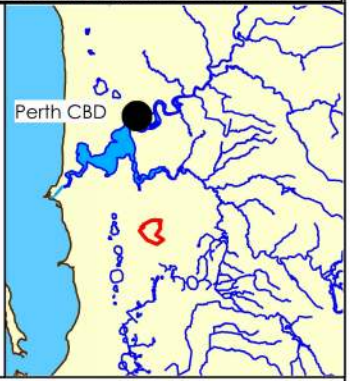
01/2021
01/2022
01/2023

Jandakot Airport - Groundwater Management Plan
Figure 10 - Jandakot Airport Groundwater Abstraction and Monitoring Bores



LEGEND:

- Airport boundary
- Cadastre
- Abstration bores
- Monitoring bores



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metres
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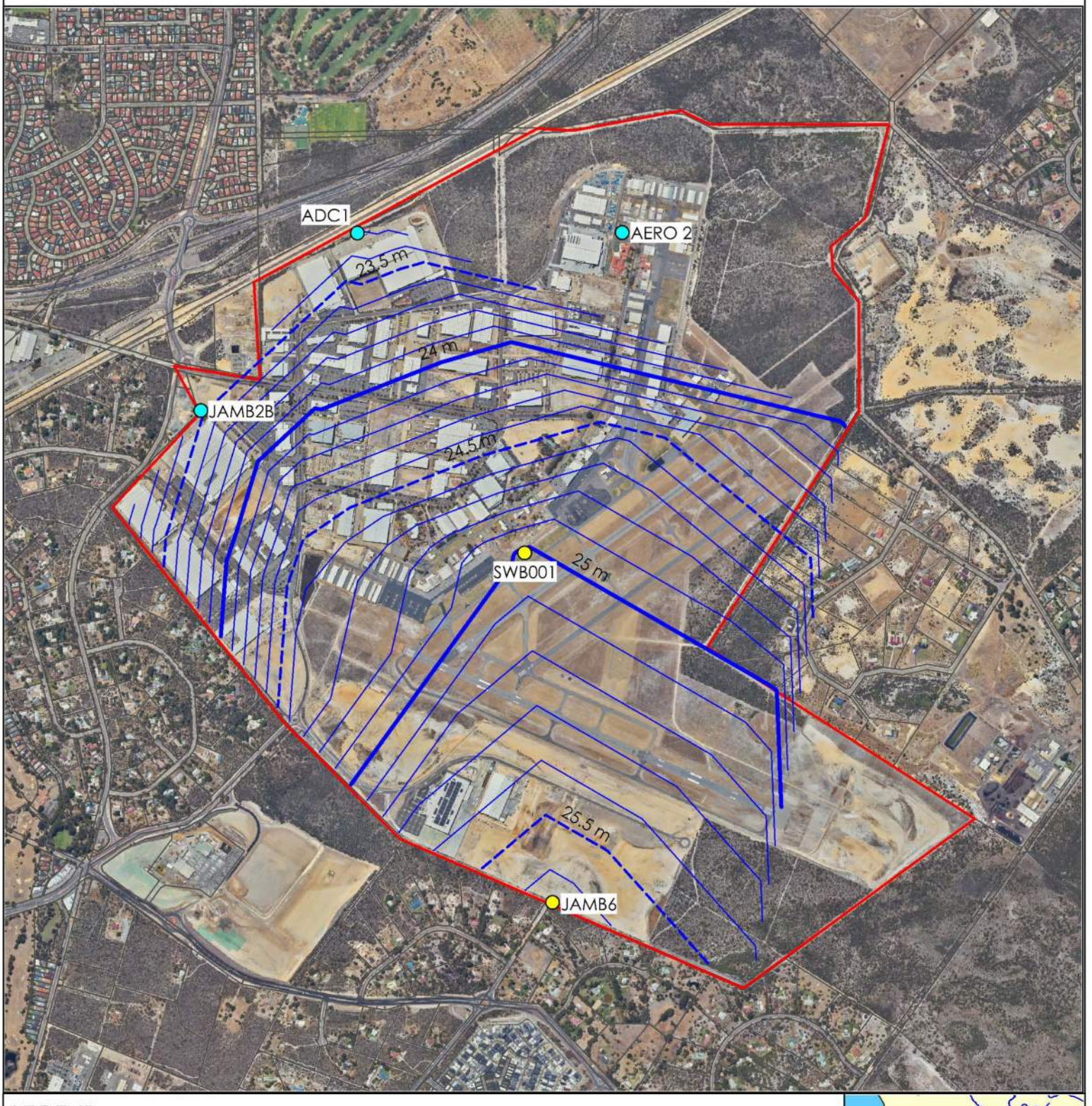
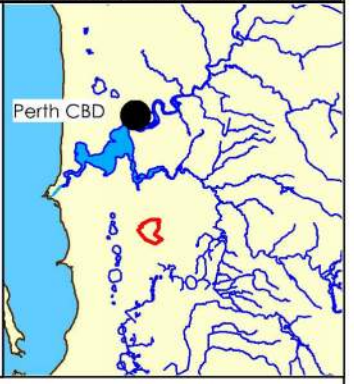
Jandakot Airport - Groundwater Management Plan
Figure 11 - Bores Up-Gradient and Down-Gradient of Septics and ATUs



LEGEND:

- Airport boundary
- Cadastre
- 0.1 m contour
- 0.5 m contour
- 1 m contour
- Bore down-gradient of septics/ATUs
- Bore up-gradient of septics/ATUs



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metres
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APPENDIX 1: CONDITIONS OF APPROVAL REFERENCE TABLE

The table below summarises compliance with EPBC 2009/4796 and EPBC 2013/7032 conditions of approval during the 2021/22 reporting period.

EPBC 2013/7032 Cond.	EPBC 2009/4796 Cond.	Plan Reference	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
2. To mitigate the impacts to the environment from an action on Commonwealth land, in particular the Jandakot Groundwater Mound, the person taking the action must prepare and submit a revised Groundwater Management Plan to the Minister for approval. The revised plan must be submitted at least 3 months prior to commencement of the action. The revised plan must include, but not limited to:	7. The person taking the action must develop and submit a Jandakot Groundwater Mound Management Plan which must include but not be limited to:	All sections	Compliant The Jandakot Airport Groundwater Management Plan had already been submitted and approved by the Minister. Minor amendments (v4 3/7/12) were approved by the Minister in 2012. The GMP was further reviewed and amended in early 2014 and submitted to DOEE for approval in July 2014. Following approval of EPBC 2013/7032, JAH made further amendments to the GMP (including reviewing and amending the local water management strategy) to address the requirements of both EPBC 2009/4796 and EPBC 2013/7032 within a single document. This GMP (v5.4) was submitted 4/3/15 and approved 24/7/15, with the DOEE confirming that it satisfied the requirements of condition 7. A minor amendment (raised with DOEE 21/10/15) to the GMP (v5.5) was submitted 1/2/16 and approved 14/3/16, with the DOEE confirming that it satisfied the requirements of condition 7. The GMP was reviewed and amended in 2018 and submitted to DOEE 21/12/18. The amended GMP (v5.6) was approved by DOEE 19/7/19. The approved GMP (v5.6) that addresses condition 7 of EPBC 2009/4796 and Condition 2 of EPBC 2013/7032 is published on the JAH website: http://www.jandakotairport.com.au/environment/environment-
a) the introduction of a sewerage system;	f) The introduction of a sewerage system	Sections 4.6 and 5.3	
b) provision of groundwater monitoring reports to the Western Australian Department of Water[1] and Water Corporation;	b) provision of groundwater monitoring reports to the Western Australian Department of Water and Water Corporation;	Sections 5.4, 5.5.7 and 6.3	
c) a water management strategy, specifically designed for precincts 6 and 6A;	c) Address all relevant measures included in the Local Water Management Strategy;	Sections 3.1 and Appendix 3	
d) schedules for the independent audit of groundwater monitoring results and reports;	d) schedules for the independent audit of groundwater monitoring results and reports;	Section 5.5.7	

[1] Note, now Department of Water and Environmental Regulation

e) spill avoidance, management and rehabilitation measures and procedures;	e) spill avoidance, management and rehabilitation measures and procedures;	Sections 3.2, 3.3, 3.5, 3.6, 5.6 and 6.1	plans.html
f) groundwater monitoring; and	a) groundwater monitoring and reporting	Sections 4.6.4 and 5.5	
g) acceptable development types.		Section 4.1	

APPENDIX 2: EPBC ACT APPROVALS (EPBC 2009/4796 AND EPBC 2013/7032)

JANDAKOT AIRPORT
EPBC ACT APPROVALS
(EPBC 2009/4796 & EPBC 2013/7032)

GROUNDWATER MANAGEMENT PLAN
APPENDIX 2

Jandakot Airport Holdings Pty Ltd
16 Eagle Drive
Jandakot WA 6164

EPBC 2009/4796

Australian Government

Department of the Environment

VARIATION TO CONDITIONS ATTACHED TO APPROVAL

Jandakot Airport Expansion, Commercial Development and Clearance of Native Vegetation, WA (EPBC 2009/4796)

This decision to vary a condition of approval is made under section 143 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Approved action

Person to whom the approval is granted	Jandakot Airport Holdings Pty Ltd **ACN 081643156**
Approved action	To construct a fourth runway and associated taxiways, runway extensions, and clear land for the development of aviation and commercial precincts as described in the Jandakot Airport Master Plan 2009, as described in the referral received on 17 March 2009 (EPBC 2009/4796)

Variation

Variation of conditions of approval	The variation is: Delete conditions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and Annexure A and B attached to the approval dated 25 March 2010 and substitute the conditions and Annexure A attached to this instrument. Add conditions 14, 15, 16, and 17 as specified in this instrument. Delete definitions for 'Construction' and 'Fauna Species' attached to the approval dated 25 March 2010 and substitute the definitions as specified in this instrument. Add new definitions as specified in this instrument. To provide clarity, all definitions for the approval are included below
Date of effect	This variation has effect on the date the instrument is signed

Person authorised to make decision

name and position

Shane Gaddes
Assistant Secretary
Compliance and Enforcement Branch
Environment Assessment and Compliance Division

Signature S. Gaddes

Date of decision 8 April 2014

Conditions attached to the approval

1. The person taking the action must not clear more than 167 hectares of native vegetation within precincts 1B, 3, 4 and 5 on Jandakot Airport shown in Annexure A. For all **clearing** the following requirements must be met:

a) Vegetation **clearing** must be undertaken in a staged manner, with **clearing** only to occur in areas in which project or non-project related construction will commence in the following 12 months.

b) **Clearing** of remnant or regrowth native vegetation within precincts 1A, 1B, 2A and 2B shown at Annexure A is not permitted unless for the purpose of constructing the roads shown in Annexure A, or for establishing or managing firebreaks and emergency access tracks.

c) **Clearing** for the establishment or management of firebreaks and emergency access tracks within precincts 1A, 1B, 2A and 2B shown at Annexure A may only be undertaken if:

i. the Conservation Management Plan required under condition 6 provides justification and detail for the locations and areas impacted by the firebreaks / emergency access tracks; and

ii. the Conservation Management Plan has been approved by the **Minister**.

Note: Vegetation cleared for the maintenance or establishment of new firebreaks and emergency access tracks is excluded from the 167 hectare limit required under condition 1.

2. The person taking the action must retain and manage precinct 6 for conservation until both of the following requirements have been fulfilled:

a) the successful implementation of rehabilitation requirements under conditions 4 and 5 of this approval; and

b) the referral and approval of any **clearing** activities on precinct 6 under the *Environment Protection and Biodiversity Conservation Act 1999* or subsequent environmental legislation administered by the **Minister**.

3. The person taking the action must conserve in perpetuity all land in precincts 1A, 1B, 2A and 2B shown at Annexure A, with the exception of that land required to construct the roads shown in Annexure A and **clearing** required for the establishment or management of firebreaks and emergency access tracks outlined in condition 1 and condition 6(d)v.

4. The person taking the action must develop and submit a Jandakot Airport Offset Plan which must include but not be limited to:

a) The rehabilitation of precincts 7 and 8 shown at Annexure A must take place in accordance with condition 5 and with the consent of Canning City Council. Evidence of consent from Canning City Council must be provided.

Note: As Canning City Council did not provide consent to condition 4(a) of this approval, condition 4(a), 5 and 6(b) are no longer active conditions. This note has been inserted for clarity during the variation of conditions process, April 2014.

b) If consent cannot be obtained from Canning City Council to rehabilitate precincts 7 and 8 as required under condition 4(a) by 30 June 2010, the person taking the action must provide to **DPaW** the sum of $9.2 million and topsoil from the Jandakot Airport lease site for use in the rehabilitation and conservation of banksia woodland at an alternative site or sites. The areas to be rehabilitated or conserved must be within 45 kilometres of the Jandakot Airport lease site unless the **Minister** agrees to alternative siting. The transportation costs for the topsoil are to be paid for out of the $9.2 million. The funding must be provided prior to the commencement of each clearing stage and in proportion to the area cleared.

c) The acquisition and protection in perpetuity of a minimum of 1600 hectares of land containing Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*) foraging habitat. The person taking the action must demonstrate that the proportion of the 1600 hectares of land that has been secured for protection, is not less than the proportion of the land to be cleared on Jandakot Airport each year, prior to that staged annual clearing occurring.

d) Provide details of the future ownership, funding arrangements and management of the land to be used as the offset.

e) Funding details, including research, on recovery actions for Carnaby's Black-cockatoo (*Calyptorhynchus latirostris),* for a minimum of $150,000 per year, over five years.

The Jandakot Airport Offset Plan must be submitted to and approved by the **Minister** prior to **construction**. The approved Jandakot Airport Offset Plan must be implemented.

5. If Canning City Council agrees to the rehabilitation of precincts 7 and 8, as required under condition 4(a), then the person taking the action must develop and submit a Jandakot Airport Rehabilitation Strategy which must include but not be limited to:

a) The Bushland Rehabilitation Proposal and Success Criteria report, July 2009.

b) Management of precincts 7 and 8 for long term conservation values.

The Jandakot Airport Rehabilitation Strategy must be submitted to the **Minister** after 30 June 2010. The person taking the action cannot clear more than 42 hectares of remnant and regrowth vegetation for the proposed development until the Jandakot Airport Rehabilitation Strategy has been approved by the **Minister**. The Jandakot Airport Rehabilitation Strategy must be implemented.

6. The person taking the action must develop and submit a Conservation Management Plan to the **Minister**. The plan must include measures to manage remnant and regrowth vegetation and native **fauna species** and **flora species** in conservation areas, including but not limited to:

a) Management of remnant and regrowth vegetation and native **fauna species** and **flora species** on the Jandakot Airport lease.

b) If Canning City Council agrees to the rehabilitation of precincts 7 and 8, the management of remnant and regrowth vegetation and native **fauna species** and **flora species** in precincts 7 and 8.

c) If Melville City Council agrees, the management of remnant and regrowth vegetation and native **fauna species** and **flora species** in Ken Hurst Park.

d) Native vegetation management, including but not limited to:

- **i.** Mapping of native vegetation, including type, condition and *Phytophthora cinnamomi* dieback infested areas;
- **ii.** Environmentally significant areas and their protection;
- **iii.** Monitoring regimes and survey methods;
- **iv.** Thresholds for triggering further management intervention in response to condition 6(d)iii outputs;
- **v.** Bushfire management including firebreaks and emergency access tracks;
- **vi.** Weed control;
- **vii.** *Phytophthora cinnamomi* dieback control;
- **viii.** Rehabilitation and revegetation guidelines;

e) Orchid management, including but not limited to:

- **i.** Mapping of individual *Caladenia huegelii* and *Drakaea elastica* plants;
- **ii.** Results of surveys and details of any current and future surveys;

iii. Monitoring regimes and survey methods;

iv. Thresholds for triggering further management intervention in response to condition 6(e)ii and 6(e)iii outputs;

v. Grand Spider-orchid (*Caladenia huegelii*) management and translocation procedures;

vi. Details and funding arrangements for 'The Jandakot Rare Orchid Research Program: Integrated Conservation and Translocation of *Caladenia huegelii* – Key Concepts in the Development of an Integrated Conservation Program for Western Australian Caladenia' (Dixon and Swarts, undated);

vii. Justification of the road alignment through precinct 1B.

f) Fauna management, including but not limited to:

i. Mapping of Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*), Quenda (*Isoodon obesulus fusciventer*) and Western Brush Wallaby (*Macropus irma*) habitat and occurrence;

ii. Monitoring regimes and survey methods for Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*), Quenda (Isoodon obesulus fusciventer) and Western Brush Wallaby (*Macropus irma*);

iii. Thresholds for triggering further management intervention in response to condition 6(f)i and 6(f)ii outputs;

iv. Feral animal control measures for the protection of Quenda (*Isoodon obesulus fusciventer*) and Western Brush Wallaby (*Macropus irma*);

v. A fauna road crossing strategy to facilitate terrestrial fauna movement;

vi. A fencing strategy to facilitate terrestrial fauna movement;

vii. Management options for EPBC Act listed or WA priority fauna and flora species found on Jandakot Airport in the future which have not been identified as occurring on site.

g) A strategy for public consultation and public participation in the management of the areas mentioned in condition 6(b) and 6(c).

The Conservation Management Plan must include a provision to provide an annual Compliance report to the **department** detailing progress against objectives and targets outlined in the Conservation Management Plan and in the Jandakot Airport Environment Strategy.

The Conservation Management Plan must be submitted and approved by the **Minister** before **construction** commences. The approved Conservation Management Plan must be implemented.

7. The person taking the action must develop and submit a Jandakot Groundwater Mound Management Plan which must include but not be limited to:

a) Groundwater monitoring and reporting;

b) Provision of groundwater monitoring reports to the Western Australian Department of Water and Water Corporation;

c) Address all relevant measures included in the **Local Water Management Strategy**;

d) Schedules for the independent audit of groundwater monitoring results and reports;

e) Spill avoidance, management and rehabilitation measures and procedures;

f) The introduction of a sewerage system;

The Jandakot Groundwater Mound Management Plan must be submitted within four (4) months of the date of this approval. **Construction** must not commence within precinct 5 until the Jandakot Groundwater Mound Management Plan has been approved by the **Minister**. The approved Jandakot Groundwater Mound Management Plan must be implemented.

8. The person taking the action must develop and submit a Construction Environment Management Plan (CEMP) to the **Minister** for approval. The plan must include but not be limited to:

a) Establishment and maintenance of fences and signage of "**no go areas**" in areas of priority and threatened species habitat;

b) A landscaping vegetation schedule identifying plant species to be planted. Flora species to be planted must consist of Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*) foraging plant species;

c) Identification and implementation of erosion and sedimentation control measures during and following **clearing**;

d) Identification and implementation of dust control measures during and following **clearing**;

e) Identification and implementation of appropriate weed and dieback hygiene measures;

f) Induct clearing and construction workers and contractors about requirements to protect priority and threatened species in accordance with relevant legislation;

g) Measures to reduce impacts on listed threatened species; and

h) Indicative environmental management checklists to assist with monitoring the implementation of environmental management obligations during **construction** works.

Unless otherwise specified, the person taking the action must submit a report of performance against the requirements of the CEMP annually until final **construction** is completed.

The CEMP must be approved by the **Minister** before **construction** commences. The approved CEMP must be implemented.

9. The person taking the action must ensure that all Major Development Plan proposals are consistent with this *Environment Protection and Biodiversity Conservation Act 1999* approval.

10. The person taking the action must ensure that all Jandakot Airport Master Plan documents and all Jandakot Airport Environment Strategy documents are consistent with this *Environment Protection and Biodiversity Conservation Act 1999* approval.

11. If the **Minister** believes that it is necessary or desirable for the better protection of the environment, the **Minister** may request that the person taking the action make specified revisions to a plan or strategy approved pursuant to conditions 4, 5, 6, 7 and 8, and submit the revised plan or measure for the **Minister**'s approval. The person taking the action must comply with any such request. If the **Minister** approves a revised plan or measure pursuant to this condition, the person taking the action must implement that plan or measure instead of the plan or measure as originally approved.

12. If the person taking the action wishes to carry out any activity other than in accordance with a plan or strategy approved pursuant to conditions 4, 5, 6, 7 and 8 the person taking the action must submit for the **Minister**'s approval a request for revision of the plan. If the **Minister** approves the revised plan or measure so submitted, the person taking the action must implement that plan or measure instead of the plan or measure as originally approved.

13. If, at any time after 5 years from the date of this approval, the **Minister** notifies the person taking the action in writing that the **Minister** is not satisfied that there has been **substantial commencement** of the development, the development must not thereafter be commenced.

14. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement

the management plans and strategies required by this approval and report upon management measures undertaken, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department**'s website. The results of audits may also be publicised through the general media.

15. Upon the direction of the **Minister**, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the commencement of the audit. Audit criteria must be agreed to by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister**.

16. By 28 October of each year, commencing 2014, the person taking the action must publish an annual report on their website addressing the compliance with each of the conditions of this approval, including implementation of management plans required under the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be reported to the **Department** at the same time as the compliance report is published.

17. Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish all management plans and strategies required under conditions 4, 5, 6, 7 and 8 on their website. Each management plan must be published on the website within 1 month of being approved by the **Minister**. These online publications must remain on the website for the duration of the approval or until otherwise accepted in writing by the **Minister**.

Definitions:

Revised:

Construction – Any **clearing** or building works undertaken within precincts 1B, 3, 4 and 5, with the exception of the following:

- Removal or translocation of listed threatened orchids as outlined in 'The Jandakot Rare Orchid Research Program: Integrated Conservation and Translocation of *Caladenia huegelii* – Key Concepts in the Development of an Integrated Conservation Program for Western Australian Caladenia' (Dixon and Swarts, undated)'; and
- Activities associated with the development of required linear infrastructure (such as powerlines and sewage but excluding roads); and
- Other minor works approved by the **Minister**.

Fauna Species – Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*), Quenda (*Isoodon obesulus fusciventer*) and Western Brush Wallaby (*Macropus irma*).

New:

Clearing - The cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation.

Department - The Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.

DPaW – The Western Australian Government's Department of Parks and Wildlife (or equivalent agency).

Local Water Management Strategy – The document titled *Local Water Management Strategy* (VDM Environmental, 2009. Issue No. 2, October 2009), or a later version of the document that has been revised due to requirements of relevant regulatory agencies.

Existing:

Fragmentation - The breaking up of a large intact area of a single vegetation or habitat type into smaller intact units.

Minister - The Minister responsible for the administration of the Environment Protection and Biodiversity Conservation Act 1999 and includes a delegate of the Minister.

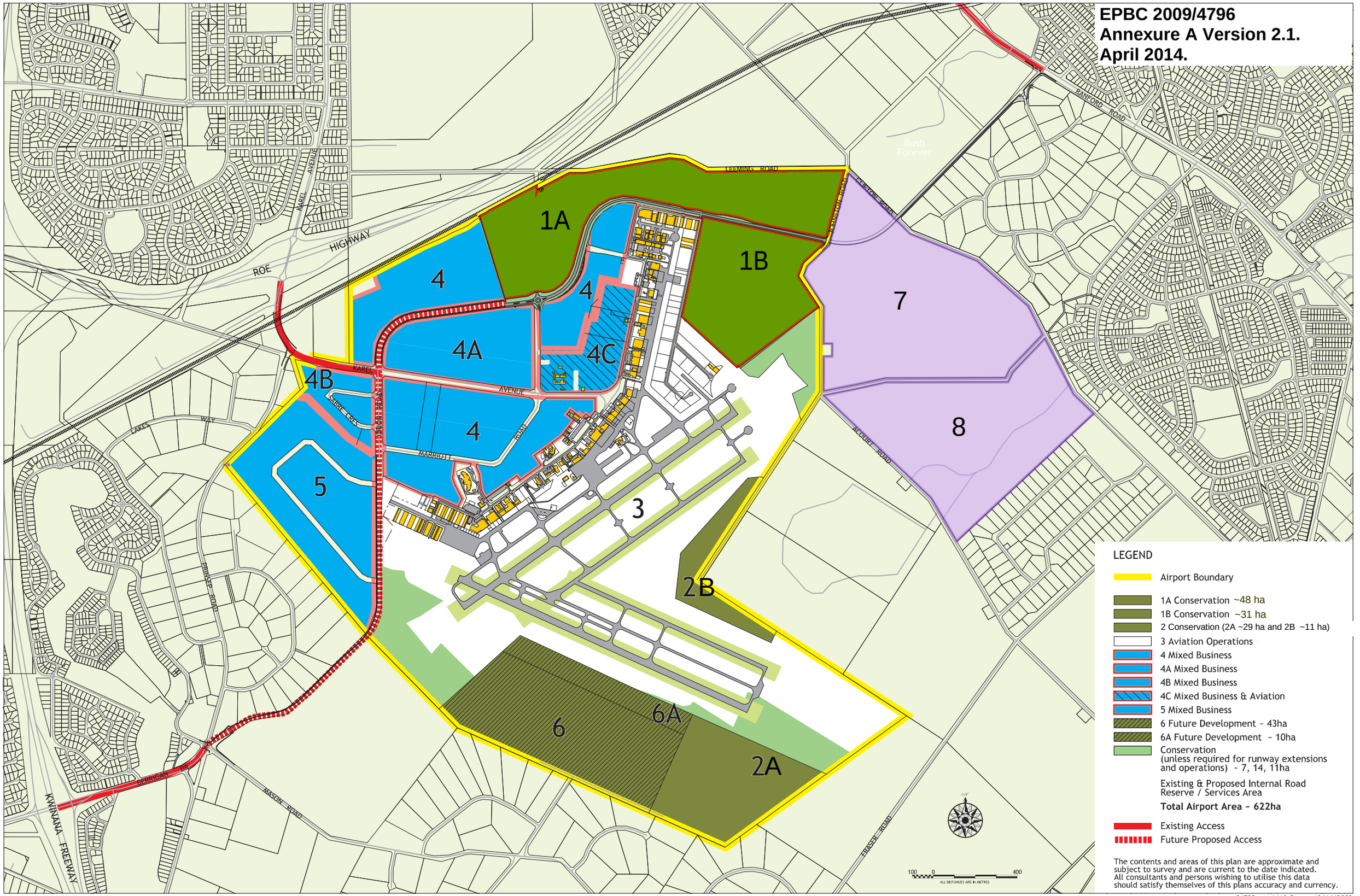
No Go Areas – Areas identified within the Jandakot Airport Lease which requires protection from construction and temporary impacts including: the movement of construction vehicles and machinery, stockpiling and any actions that will degrade or damage grassland species.

Substantial commencement – The construction of any infrastructure, excluding fences and signage, associated with the proposed action.

Flora Species – Grand Spider-orchid (*Caladenia huegelii*) and Glossy-leaved Hammer-orchid (*Drakaea elastica*).

JANDAKOT AIRPORT

EPBC 2009/4796
Annexure A Version 2.1.
April 2014.



LEGEND

- Airport Boundary
- 1A Conservation ~48 ha
- 1B Conservation ~31 ha
- 2 Conservation (2A ~29 ha and 2B ~11 ha)
- 3 Aviation Operations
- 4 Mixed Business
- 4A Mixed Business
- 4B Mixed Business
- 4C Mixed Business & Aviation
- 5 Mixed Business
- 6 Future Development ~ 43ha
- 6A Future Development ~ 10ha
- Conservation (unless required for runway extensions and operations) ~ 7, 14, 11ha
- Existing & Proposed Internal Road Reserve / Services Area
- **Total Airport Area ~ 622ha**
- Existing Access
- Future Proposed Access

The contents and areas of this plan are approximate and subject to survey and are current to the date indicated. All consultants and persons wishing to utilise this data should satisfy themselves of this plans accuracy and currency.

94522sam-141f Date:- 18/11/2009

EPBC 2013/7032

Australian Government
Department of the Environment

Approval

Jandakot Airport Precinct 6 and 6A (EPBC 2013/7032).

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

person to whom the approval is granted	Jandakot Airport Holdings Pty Ltd
proponent's ACN (if applicable)	ABN: 57 081 643 156
proposed action	Clearing of 51 hectares of native vegetation within Jandakot Airport Precinct 6 and 6A [See EPBC Act referral 2013/7032].

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (sections 18 & 18A)	Approved
Commonwealth land (sections 26 & 27A)	Approved

conditions of approval

This approval is subject to the conditions specified below.

expiry date of approval

This approval has effect until 30 June 2097.

Decision-maker

name and position	Dr. Simon Banks Assistant Secretary West Assessment Branch
signature	Simon Banks
date of decision	09 July 2014

Conditions attached to the approval

1. The person taking the action must not **clear** more than 51 hectares (ha) of native vegetation that provides **foraging habitat** for Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) from the **proposal site** ("Precincts 6 and 6A" within the Map at Schedule 1 and 2). This clearing may only be undertaken if the **management plans** required under conditions 2 and 3 have both been approved by the **Minister**.

2. To mitigate impacts to the environment from an action on Commonwealth land, in particular the **Jandakot Groundwater Mound**, the person taking the action must prepare and submit a revised **Groundwater Management Plan** to the **Minister** for approval. The revised plan must be submitted at least 3 months prior to **commencement of the action**.

   The revised plan must include, but not be limited to:

   a) the introduction of a sewerage system;

   b) provision of groundwater monitoring reports to the Western Australian Department of Water and Water Corporation;

   c) a water management strategy, specifically designed for Precincts 6 and 6A;

   d) schedules for the independent audit of groundwater monitoring results and reports;

   e) spill avoidance, management and rehabilitation measures and procedures;

   f) groundwater monitoring; and

   g) acceptable development types.

   If the **Minister** approves the revised plan the approved revised plan must be implemented.

3. To mitigate impacts to the environment on Commonwealth land and Carnaby's Black Cockatoo, prior to the **commencement of the action**, the person taking the action must prepare and submit a Construction Environmental Management Plan (CEMP) to the **Minister** for approval. The CEMP must be submitted at least 3 months prior to **commencement of the action**.

   The CEMP must include, but not be limited to:

   a) avoidance and mitigation measures to prevent impacts to Carnaby's Black Cockatoos following the **commencement of the action**;

   b) measures to physically delineate areas that are within **Conservation Precinct** 2A (as illustrated within the map at Schedule 1);

   c) management measures to control weeds, *Phytophthora* dieback, erosion, sedimentation, dust and construction noise;

   d) details of monitoring, reporting and contingency measures if performance indicators are not met;

   e) timeframes for the implementation of the above measures; and

f) descriptions of the roles and responsibilities of personnel associated with implementing each of the above measures.

If the **Minister** approves the CEMP the approved CEMP must be implemented.

4. To offset the loss of Carnaby's Black Cockatoo **foraging habitat**, the person taking the action must:

   a) Prior to **commencement of the action**, provide the **Department** with written evidence that funds have been provided to the Western Australian Department of Parks and Wildlife (**DPaW**) for the acquisition of at least a 600 ha **offset property** in the vicinity of Gingin, Western Australia.

   b) Provide a textual description and map clearly defining the location and boundaries of the **offset property** and be accompanied with the **offset attributes** and **shapefiles**.

5. Within 30 days after the **commencement of the action**, the person taking the action must advise the **Department** in writing of the actual date of commencement.

6. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the **management plans** required by this approval, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.

7. If the person taking the action wishes to carry out any activity otherwise than in accordance with the **management plans** as specified in the conditions, the person taking the action must submit to the **Department** for the **Minister's** written approval a revised version of the **management plans**. The varied activity shall not commence until the **Minister** has approved the varied **management plans** in writing. The **Minister** will not approve the varied **management plans** unless the revised **management plans** would result in an equivalent or improved environmental outcome over time. If the **Minister** approves the revised **management plans**, the **management plans** must be implemented in place of the **management plans** originally approved.

8. If the **Minister** believes that it is necessary or convenient for the better protection of listed threatened species and communities to do so, the **Minister** may request that the person taking the action make specified revisions to the **management plans** specified in the conditions and submit the revised **management plans** for the **Minister's** written approval. The person taking the action must comply with any such request. The revised approved **management plans** must be implemented. Unless the **Minister** has approved the revised **management plans**, then the person taking the action must continue to implement the **management plans** originally approved, as specified in the conditions.

9. Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish the **management plans** referred to in these conditions of approval on their website. The **management plans** must be published on the website within one (1) month of being approved. The **management plans** must remain on the website for the duration of the action.

Definitions

Clear/Clearing is defined as the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation.

Commencement of the action, means any preparatory works required to be undertaken including clearing vegetation, the erection of any onsite temporary structures, tunnel enhancement works and the use of heavy duty equipment for demolition or other purposes relating to the action, including the breaking of ground.

Conservation Precincts, means precincts 1A, 1B, 2A and 2B (as illustrated in the Map at Schedule 1).

Department, the Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.

DPaW means the Western Australian Department of Parks and Wildlife or any successor agency.

EPBC Act is the *Environment Protection and Biodiversity Conservation Act 1999*.

Foraging habitat as defined in the former Department of Sustainability, Environment, Water, Population & Communities, *EPBC Act Referral Guidelines for three species of Western Australian black cockatoos: Carnaby's black cockatoo (Endangered) (Calyptorhynchus latirostris), Baudin's black cockatoo (Vulnerable) (Calyptorhynchus baudinii), Forest red-tailed black cockatoo (Calyptorhynchus banksii naso)* (October 2012).

Groundwater Management Plan is the plan named Ground Water Management plan and dated August 2011, approved by a delegate of the Minister on 19 August 2011 under condition 7 of the approved conditions for EPBC 2009/4796.

Jandakot Groundwater Mound is a shallow sand aquifer that covers an approximate area of 760 km^2 from the Swan River in the north to the Serpentine River in the south.

Management Plans means the Groundwater Management Plan (GMP) and the Construction Environmental Management Plan (CEMP)

Minister is the Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the Minister.

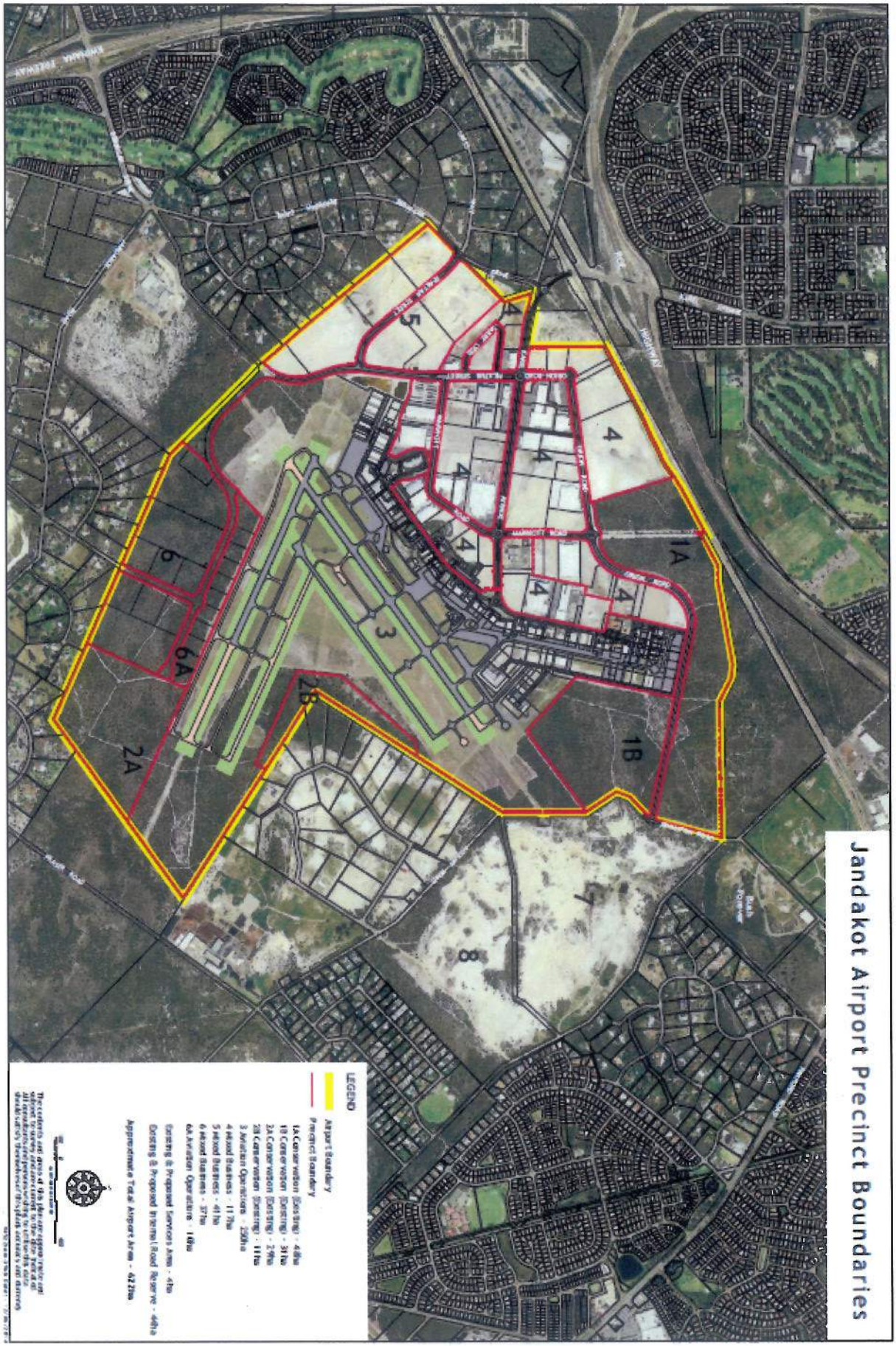
Offset attributes means an '.xls' file capturing relevant attributes of the Offset Area, including the EPBC reference ID number, the physical address of the offset site, coordinates of the boundary points in decimal degrees, the EPBC protected matters that the offset compensates for, any additional EPBC protected matters that are benefiting from the offset, and the size of the offset in hectares.

Offset property means the acquisition of a 600 ha offset property in the vicinity of Gingin, that contains at least 600 ha of Carnaby's Black Cockatoo **foraging habitat**.

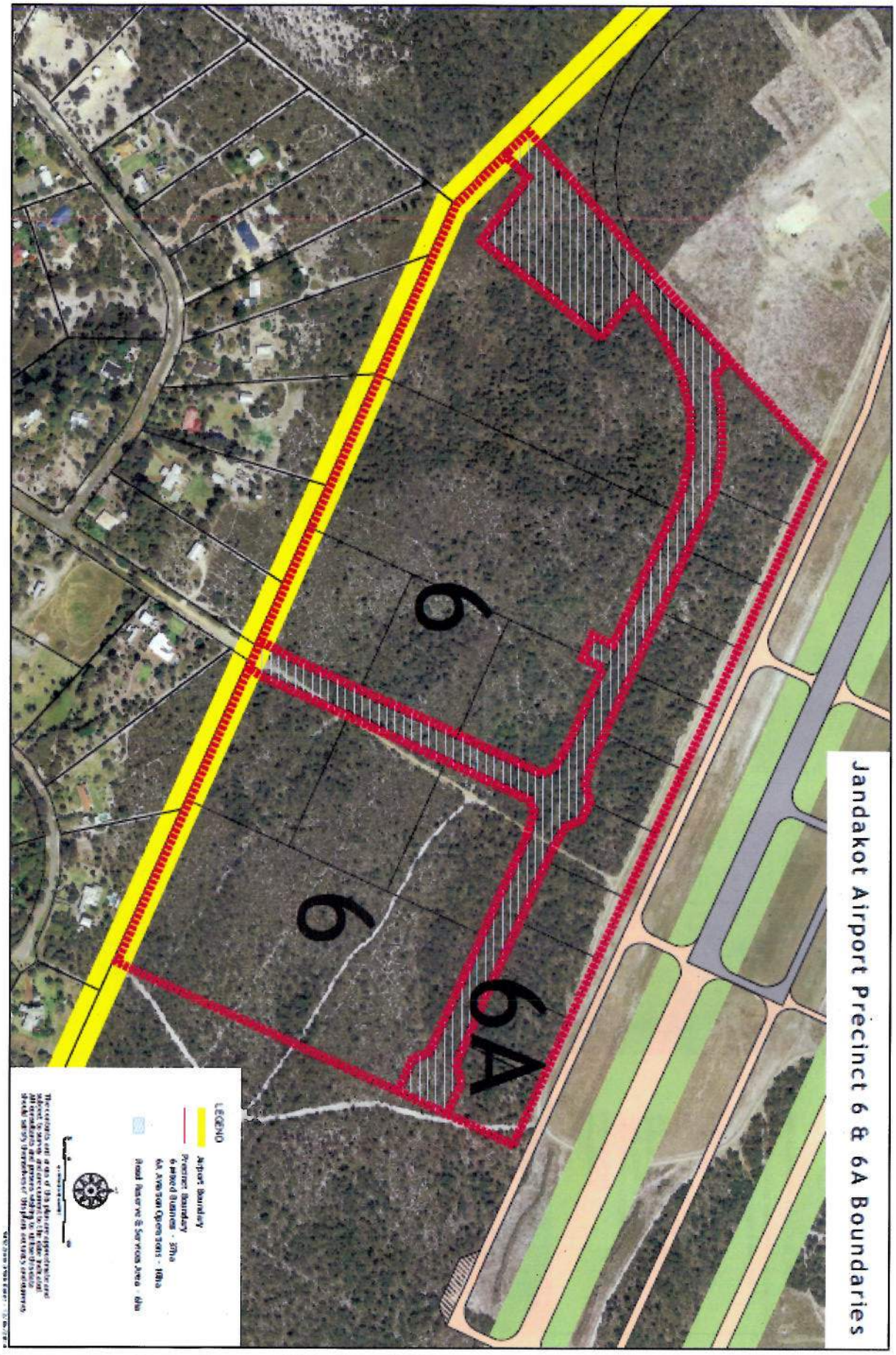
Proposal site means Precincts 6 and 6A as illustrated in Schedule 2.

Shapefiles means an ESRI Shapefile containing '.shp', '.shx' and '.dbf' files and other files capturing attributes of the Offset Area, including the shape, EPBC reference ID number and EPBC protected matters present at the relevant site. Attributes should also be captured in '.xls' format and in accordance with Departmental Requirements.

Schedule 1


Jandakot Airport Precinct Boundaries
LEGEND
Airport Boundary
Precinct Boundary
1A Conservation (Existing) - 48ha
1B Conservation (Existing) - 31ha
2A Conservation (Existing) - 29ha
2B Conservation (Existing) - 11ha
3 Aviation Operations - 220ha
4 Mixed Business - 117ha
5 Mixed Business - 41ha
6 Mixed Business - 37ha
6A Aviation Operations - 18ha
Existing & Proposed Services Area - 4ha
Existing & Proposed Impact Road Reserve - 40ha
Approximate Total Airport Area - 621ha
1A
1B
2A
2B
3
4
5
6
6A
7
8

Schedule 2


Jandakot Airport Precinct 6 & 6A Boundaries
6
6
6A
LEGEND
Airport Boundary
Precinct Boundary
6 Inland Business - 30ha
6A Aviation Operations - 10ha
Road Reserve & Service Area - 4ha

APPENDIX 3: LOCAL WATER MANAGEMENT STRATEGY

JANDAKOT AIRPORT

LOCAL WATER MANAGEMENT STRATEGY

Jandakot Airport Holdings Pty Ltd
16 Eagle Drive
Jandakot WA 6164

Prepared for Jandakot Airport Holdings, By Urbaqua

January 2024

Disclaimer and Limitation

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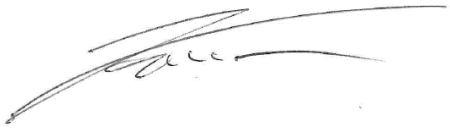
Declaration of accuracy

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both.

Signed 

Full name (please print) John Fraser

Organisation Jandakot Airport Holdings

Date 11/7/2024

Contents

Tables

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Appendices

1 INTRODUCTION

Jandakot Airport is leased from the Commonwealth Government by Jandakot Airport Holdings (JAH) and is an important piece of infrastructure, being Western Australia's major general aviation airport.

1.1 Legislative background

Jandakot Airport is Commonwealth Land and is therefore subjected to Commonwealth legislation (Primarily the *Airports Act 1966*, *Airports (Environment Protection) Regulations 1997* and the *Environmental Protection and Biodiversity Conservation Act 1999*). State legislation may apply where Commonwealth Legislation is silent or does not conflict.

1.1.1 Commonwealth Legislation

Airports Act 1996

The *Airports Act 1996* requires the operator of an airport to prepare a Master Plan for review and approval by the Federal Minister for Infrastructure and Regional Development. This Local Water Management Strategy (LWMS) complements the Jandakot Airport Environment Strategy 2020 which has been updated within the Jandakot Airport Master Plan 2020 (JAMP 2020) and will act as a guide for environmental management of the airport for the next eight years.

The Environment Strategy builds upon the Environment Management Framework (EMF) which incorporates measures to meet Jandakot Airport's obligations under Commonwealth and relevant State legislation. This Environment Strategy has been developed with consideration of current airport operations as well as proposed future development.

Airports (Environment Protection) Regulations 1997

The Airport (Environment Protection) Regulations 1997 requires the development and adoption of a comprehensive environmental management system (EMS). Environmental management at the Airport is the responsibility of JAH. The Jandakot Airport EMS comprises policies and procedures that ensure the protection of the environment within the airport, including preparation of management plans, incident reporting systems, awareness training, auditing, monitoring and reporting within a context of continuous improvement.

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take action that has, will have, or is likely to have a significant impact on any matters of NES without approval from the Australian Government Environment Minister.

The initial *Jandakot Airport Local Water Management Strategy* (LWMS) and *Groundwater Management Plan* (GMP) were developed to support the expansion of development of Jandakot Airport into Precinct 5, which is located within the Priority 1 Source Protection Area of the Jandakot Underground Water Pollution Control Area (JUWPCA). The requirement for the LWMS and GMP was (and remains) directly associated with EPBC 2009/4796 conditions of approval, specifically Condition 7 which states:

"The person taking the action must develop and submit a Jandakot Groundwater Mound Management Plan which must include but not be limited to:

a. Groundwater monitoring and reporting;
b. Provision of groundwater monitoring reports to the Western Australian Department of Water[1] and the Water Corporation;
c. Address all relevant measures included in the **Local Water Management Strategy**;
d. Schedules for the independent audit of groundwater monitoring results and reports;
e. Spill avoidance, management and rehabilitation measures and procedures; and
f. The introduction of a sewerage system.

The Jandakot Groundwater Mound Management Plan must be submitted within four (4) months of the date of this approval.

***Construction** must not commence within precinct 5 until the Jandakot Groundwater Mound Management Plan has been approved by the **Minister**. The approved Jandakot Groundwater Mound Management Plan must be implemented."*

In 2014, the Department of Climate Change, Energy, the Environment and Water (DCCEEW), formerly known as the Department of Environment approved EPBC 2013/7032, which allows for the clearing and development of Precinct 6, which is also partially within the Priority 1 Source Protection Area of the JUWPCA. Condition 2 of EPBC 2013/7032 states:

2. *To mitigate impacts to the environment from an action on Commonwealth land, in particular the Jandakot Groundwater Mound, the person taking the action must prepare and submit a revised Groundwater Management Plan to the Minister for approval. The revised plan must be submitted at least 3 months prior to commencement of the action.*

   The revised plan must include, but not be limited to:

a. The introduction of a sewerage system;
b. Provision of groundwater monitoring reports to the Western Australian Department of Water[1] and the Water Corporation;
c. A water management strategy, specifically designed for Precincts 6 and 6A;
d. Schedule for the independent audit of groundwater monitoring results and reports
e. Spill avoidance, management and rehabilitation measures and procedures
f. Groundwater monitoring; and
g. Acceptable development types.

   If the minister approves the revised plan the approved revised plan must be implemented.

This LWMS has been prepared as an update to the previous LWMS (Essential Environmental, 2015) which was developed to provide water management strategies relevant to the Jandakot Airport estate with particular focus on the ongoing development of precincts 5, 6 and 6A.

[1] Note: Now the Department of Water and Environmental Regulation

1.1.2 State Legislation

Some State legislation can apply to Jandakot Airport under the provisions of the *Commonwealth Places (Application of Laws) Act 1970*. Regulation of environmental issues can therefore occur through state agencies in selected circumstances, typically in instances where Commonwealth legislation does not exist (i.e., waste management). Where State and Commonwealth legislation conflicts; Commonwealth legislation takes precedence. The key water related State Government legislation that is relevant to the development of this LWMS is State Planning Policy 2.9: Planning for Water (draft).

State Planning Policy 2.9: Draft Planning for Water and Planning for Water Guidelines (SPP2.9)

The intent of the draft State Planning Policy 2.9 Planning for Water and the draft Planning for Water Guidelines (SPP 2.9) is to deliver greater clarity around how water related provisions are implemented.

The draft SPP 2.9 and Guidelines incorporate improvements that will lead to better planning decision-making through consideration of appropriate management measures to achieve optimal water resource and development outcomes.

The draft SPP 2.9, when gazetted, will replace the current SPP 2.9: Water Resources and SPP 2.3: Jandakot Groundwater Protection, as well as other water related policies.

1.2 Key documents

The following documents inform this plan's strategies and management principles:

- Jandakot Airport Master Plan 2020 (JAH, 2020a)
- Jandakot Airport Holdings Environment Strategy (JAH, 2020b)
- Jandakot Airport Holdings Annual Environment Report 2021-2022 (JAH, 2021)
- Jandakot Airport Groundwater Management Plan (JAH, 2019)
- Draft State Planning Policy 2.9 Planning for Water (WAPC, 2021)
- Stormwater Management Manual for Western Australia (DWER, 2004-07).

Table 1 below displays key documents that are discussed throughout the LWMS.

This LWMS has been prepared in accordance with the requirements of *draft SPP2.9: Planning for Water* and *Planning for Water Guidelines* (WAPC 2021), and the Department of Water and Environmental Regulation's *Interim: Developing a local water management strategy* (2008).

Table 1: Key Document Summary

Document	Objective	Regulating Entity	Date	Link
Jandakot Airport Master Plan 2020	A 20-year strategic vision for the airport that details how Jandakot Airport will be developed and operated.	DITRDCA	2021	https://www.jandakotairport.com.au/corporate/master-plan.html

Document	Objective	Regulating Entity	Date	Link
Jandakot Airport Holdings Annual Environment Reports	Reports Jandakot Airport Holdings (JAH) environmental management of Jandakot Airport on an annual basis. This satisfies the statutory annual reporting requirements of the Airports (Environment Protection) Regulations 1997 (A(EP)R) as well as reporting requirements within management plans linked to *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* EPBC 2009/4796 conditions of approval	DCCEEW	Annual	Submitted to DCCEEW annually by 28th of October each year. This is not a publicly available document.
Jandakot Airport Annual EPBC Compliance Reports	Annual summary of compliance to EPBC 2009/4796 conditions of approval	DCCEEW	Annual	https://www.jandakotairport.com.au/environment/environment-plans.html
Jandakot Airport Groundwater Management Plan	Detail the groundwater management and monitoring measures required at Jandakot Airport to protect the Jandakot Groundwater Mound (specifically the Priority 1 Source Protection Area).	DCCEEW	2023	https://www.jandakotairport.com.au/environment/environment-plans.html

1.3 Scope of the Strategy

Consistent with the requirements of Condition 2 of EPBC 2013/7032 (refer to Appendix 1) and SPP 2.9, this LWMS has been prepared to provide updated information and strategies relevant to the Jandakot Airport estate with particular focus on the ongoing development of Precincts 5, 6 and 6A and to inform the preparation of a GMP in accordance with Condition 7 of EPBC 2013/7032.

The GMP also requires regular review and amendment to meet practical requirements on site as changing circumstances demand, including a review following the approval of the Jandakot Airport Master Plan. In accordance with the *Airports Act 1996*, Jandakot Airport Holdings is required to have a Master Plan (which includes the Environment Strategy) reviewed and approved at least every eight years. The Jandakot Airport Master Plan 2020 was approved by the Minister on 22 August 2021.

Precincts 5, 6, and 6A have been cleared and developed in accordance with Jandakot Airport Master Plan 2014 and Jandakot Airport LWMS. Since approval of the Jandakot Airport

Master Plan in 2020, no clearing has taken place; however, development continues to be undertaken in accordance with the current 2020 Master Plan and the Jandakot Airport and city leasing and development guidelines. Therefore, this revised LWMS includes revisions to update background information and reflect the land use and development changes that have occurred since 2015 when the previous LWMS was prepared.

Two wetlands are present at Jandakot Airport, as defined by the Geomorphic Wetland Swan Coastal Plain (GWSCP) dataset (DBCA-019) (DBCA, 2023). These are located within Precincts 1A and 2A of Master Plan 2020 (hereafter referred to as 'wetland 1A' and 'wetland 2A'), both of which are designated conservation areas.

Due to recent DBCA wetland reclassification, Wetland 1A is now categorised as Conservation Management (per comm, DBCA 2023), and wetland 2A is categorised as Resource Enhancement Management, as defined by the GWSCP dataset (DBCA-019) (DBCA, 2023). The wetland reclassification is detailed further in Section 2.3.

This LWMS and the associated GMP have been updated to reflect the wetland management category change. Water management strategies providing protection to the wetlands at the Airport have been in place at the Airport since 2009, including management measures to prevent pollution of groundwater within the JUWPCA which, consistent with Western Australian policy, requires more stringent water quality controls than would typically be required for protection of wetlands in the reclassified CCW management category. Management measures in place to prevent pollution of groundwater are further discussed in Section 2.8.5.

The LWMS aims to demonstrate to the satisfaction of relevant agencies:

- How the key principles and strategies of this plan have been addressed.
- How the urban structure will address water use and management.
- Existing and required water management infrastructure.
- Detailed land requirements for water management.

1.4 Implementation of the strategy

The principles and strategies contained within this *LWMS* should be implemented as part of land use planning and development and are consistent with the framework and requirements in the draft *Planning for Water Guidelines* (WAPC 2021).

Table 7 summarises the roles and responsibilities relating to implementation of this *LWMS*.

1.5 The Strategy Area

Jandakot Airport is located approximately 18 km south of the Perth CBD, within the City of Cockburn. The airport covers an area of approximately 622 hectares (ha) of land, which is owned by the Commonwealth Government. Of this 622 ha, approximately 119 ha is bushland. The land within Jandakot Airport that is the subject of this LWMS is delineated in Figure 1.

The subject land is currently zoned 'Public Purpose – Commonwealth Government' under the Metropolitan Region Scheme and has been identified as a 'Specialised Centre' in State Planning Policy 4.2 – Activity Centres for Perth and Peel. The land is similarly zoned 'Public Purpose – Commonwealth Government' under the City of Cockburn's Town Planning Scheme No 3 which also identifies the land within the 'Jandakot Airport Special Control Area'.

Part of the subject land lies within the Metropolitan Region Scheme Reserve for 'Water Catchments'. The Jandakot Airport estate lies wholly within the boundary of the City of Cockburn. Part of the northern boundary of the estate (Leeming Road and Ken Hurst Park) abuts the southern boundary of the City of Melville, and the western boundary of the City of Canning abuts the northeast airport boundary.

1.5.1 Acceptable Development under EPBC2013/7032

To meet condition 2 G) of EPBC 2013/7032, this section outlines acceptable development specific to Precincts 6 and 6A.

Precinct 6 provides a mixed business use in a park-like setting which allows for uses appropriate to the JUWPCA (Figure 12) and is responsive to its interface with rural-residential neighbours bordering the southern boundary of the Airport. It will support warehouse, manufacturing and storage type development and land uses that will be generally consistent with the City of Cockburn's 'Mixed Business' zone from the City of Cockburn's Town Planning Scheme No. 3 (TPS 3, see Section 2.8.2). Uses will be responsive to the JUWPCA and potential pollutants will be minimised and managed by ensuring:

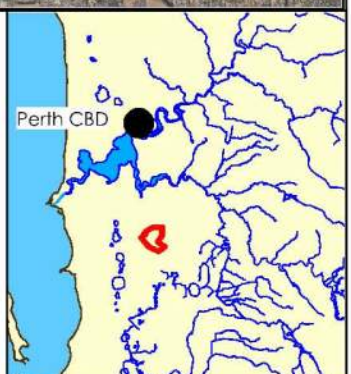
- Bulk storage (manifest quantities as defined under the *Dangerous Goods Safety Act 2004* and associated regulations), of potentially polluting dangerous goods, chemicals etc. within the Priority 1 Source Protection Area of the Jandakot Underground Water Pollution Control Area is not permitted.
- Minor chemical storage, consistent with the approved uses at the site, will be permitted only if managed under an approved Operational Environmental Management Plan that requires all chemicals to be managed in accordance with relevant Australian Standards.
- Precinct 6A will be developed for uses that seek to capitalise on access to the new taxiway system within Precinct 3 and will include aviation activity and aviation support facilities.

Any proposed development on land cleared under EPBC 2013/7032 is approved by DITRDCA under the *Airports Act 1996* and associated regulations, in accordance with Jandakot Airport Master Plan 2020.

Jandakot Airport - Local Water Management Strategy
Figure 1 - Location Plan

LEGEND:

- Airport boundary
- Local government boundary
- Roads



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2 CONTEXT

2.1 Climate

The site is located in the south-west of Western Australia and experiences a Mediterranean climate associated with warm, dry summers and cool, wet winters.

A Bureau of Meteorology (BOM) weather station (number 9217) is located at Jandakot Airport and has been operating continuously since 1972. Rainfall has been recorded at the site since its establishment and temperature has been recorded since 1989.

The long term annual average rainfall recorded at Jandakot Airport is 817 mm. Most of the year's rainfall is typically received during May to September, as shown in Chart 1 below.

Temperatures recorded at Jandakot Airport range between 15 and 32 degrees in summer and between 7 and 19 degrees in winter.

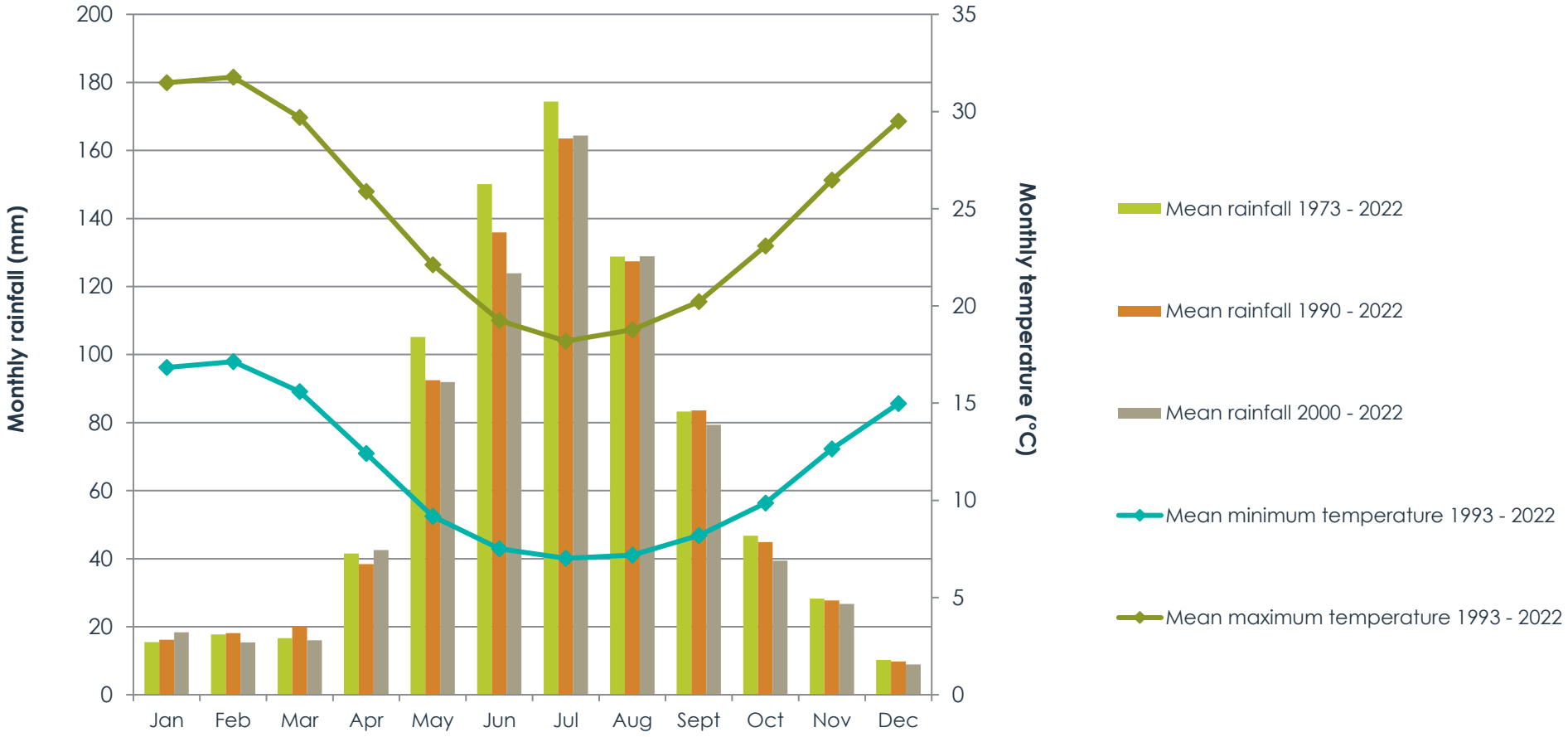


Chart 1: Climate summary data - Jandakot Airport (BOM, 2023)

2.2 Geotechnical Conditions

2.2.1 *Topography and geology*

Jandakot Airport is partially located on the northern margin of the Jandakot Ground Water Mound with the crest of the mound located south of the airport.

The topography of the airport and surrounding areas is generally flat, with local variations in height of 20 m or less. Most of the site has an elevation of approximately 28-30 m AHD. High points of 40-45 m AHD occur in the south-eastern corner and within Precinct 1A (Figure 2).

Jandakot Airport lies approximately 3 km east of the Spearwood dune system boundary and within the Bassendean north-south striking dune system.

The Armadale and Fremantle 1:50 000 Environmental Geology Series indicates Jandakot Airport consists of Quaternary superficial alluvial sediments, varying in thickness from around 30m to 60m. The sands unconformably overlay the older Osborne and Leederville formations, comprising of shale and siltstones. The surface geology presented in Figure 2 comprises of fine to medium grained sand (S8) as a thin veneer over silts and clays in some parts (S10).

2.2.2 *Acid sulfate soils*

According to Department of Water and Environmental Regulation (DWER) mapping, the majority of the site is located in an area of moderate to low risk of ASS occurring within 3 metres of the natural soil surface (i.e., Class 2). A small area of land in the south of the airport is categorised as 'high to moderate risk of ASS occurring within 3 metres of the natural soil surface' (i.e., Class 1) (DWER 2017). Refer to Figure 3.

Consistent with DWER guidelines, sites should be investigated for acid sulfate soils if any of the following are proposed:

- Soil or sediment disturbance of 100m3 or in areas depicted in an ASS risk map as Class 1 (High to moderate risk);
- Soil or sediment disturbance of 100m3 or more with excavation from below the natural water table in an area depicted on an ASS risk map as Class 2 (moderate to low risk); and
- Lowering of the water table (i.e., dewatering), whether temporary or permanent, in areas depicted in an ASS risk map as Class 1 or Class 2.

Groundwater is identified as being located approximately 4-5 m below the natural surface. Any construction activity expected to require temporary or permanent dewatering should trigger consideration and investigation of acid sulfate soils.

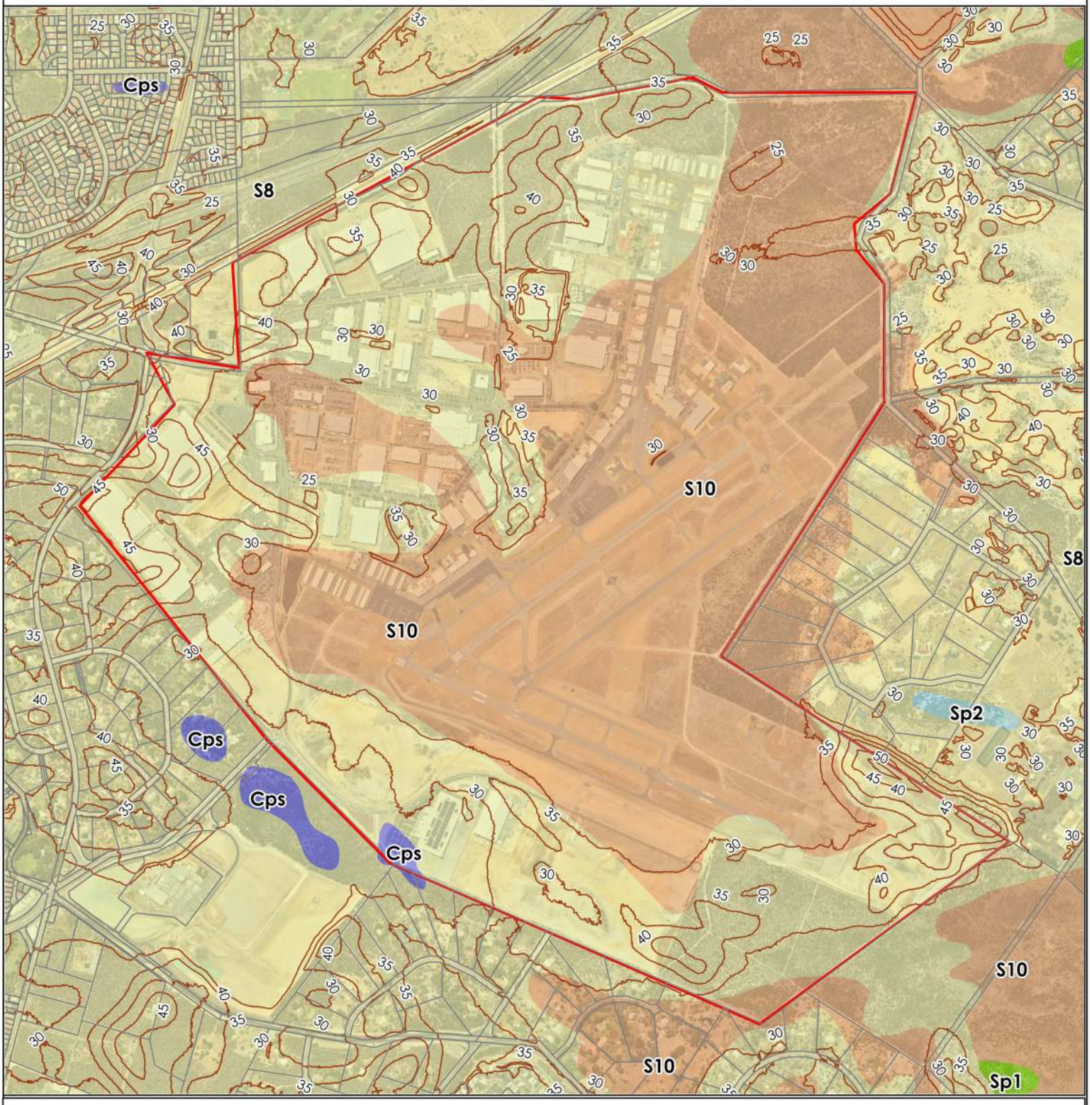
2.2.3 *Contaminated sites*

A search of the DWER contaminated sites database identified no known or suspected contaminated sites within the study area (Figure 4). A group of three lots classified '*Remediated – restricted use*' are located on the eastern boundary of the site. These lots were formerly used for sand extraction and have been subdivided to form 30 lots, some of which contain residential dwellings. The registered sites are located to the southeast (hydrologically up gradient) of the subject land.

It is acknowledged, considering the past and current activities associated with an operational airport, that a number of potential sources of contamination may be present within the airport boundaries. Contamination and contaminated sites are managed in accordance with the *Airports (Environment Protection) Regulations 1997*. JAH is required to maintain an Environmental Site Register that includes records of known and suspected contaminated sites. Sites are ranked according to the nature of contamination and risks posed. Where investigation identifies sites as requiring remediation or ongoing monitoring, appropriate plans are developed and implemented.

None of the contaminated sites on the Environmental Site Register are located within the JUWPCA.

Jandakot Airport - Local Water Management Strategy
Figure 2 - Topography and surface geology



LEGEND:

- Airport boundary
- Cadastre
- Topographic contours (mAHD)

Surface geology

- Cps - Peaty clay
- Ms5 - Sandy silt
- S10 - as S8 sand over sandy clay to clayey sand
- S8 - Sand
- Sp1 - Peaty sand
- Sp2 - Peat rich sand

Data source: Landgate, DMIRS Created by: RM Projection: MGA: zone 50.

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Jandakot Airport - Local Water Management Strategy
Figure 3 - Acid sulfate soils

LEGEND:

- Airport boundary
- Cadastre

Acid sulfate soil risk category

- High to moderate risk
- Moderate to low risk

Data source: Landgate, MRWA, DWER. Created by: RM Projection: MGA: zone 50.

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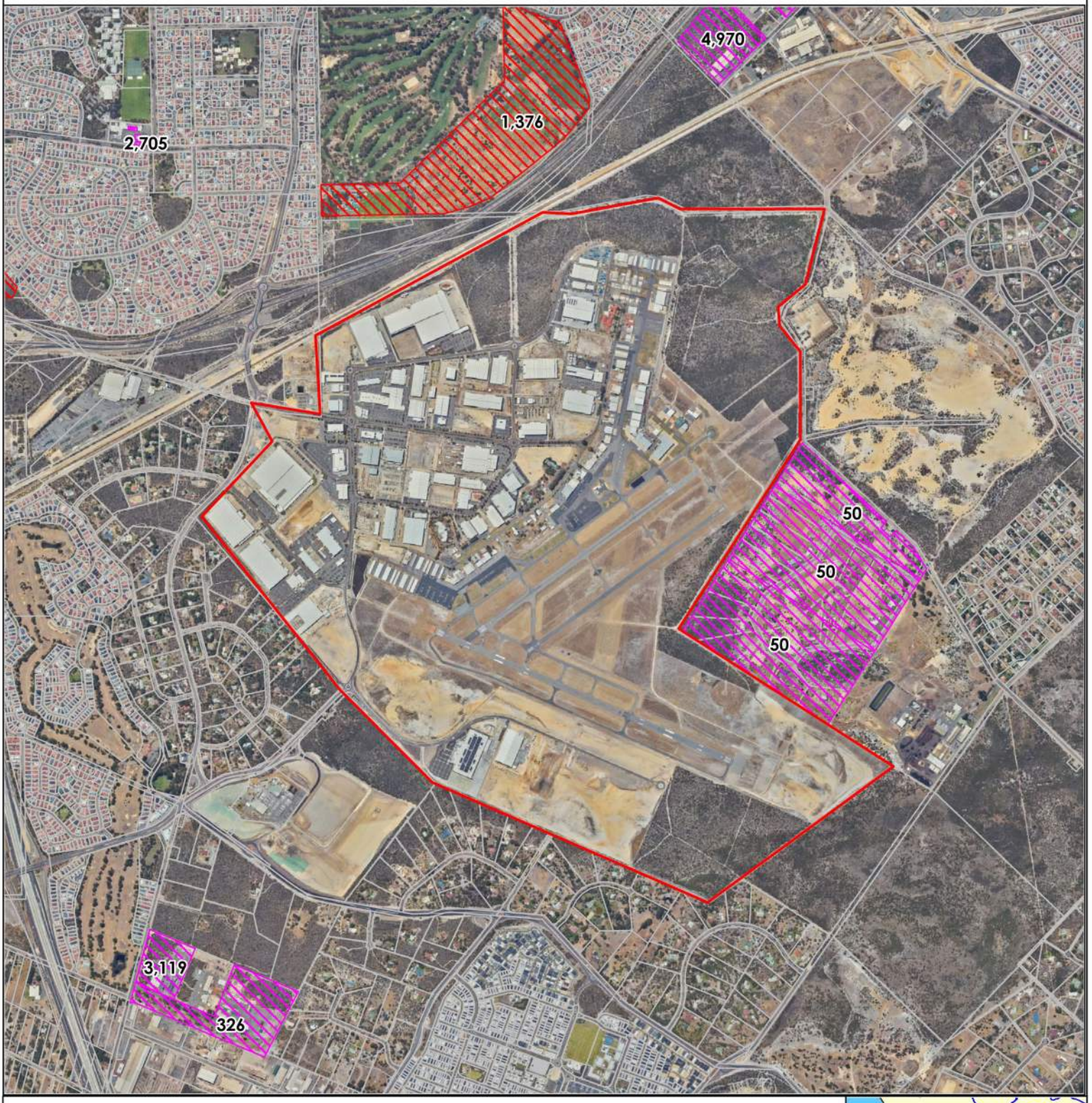
Jandakot Airport - Local Water Management Strategy
Figure 4 - Contaminated sites

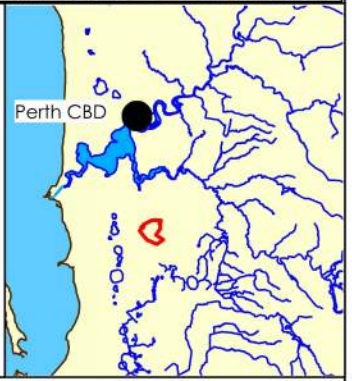


LEGEND:

- Airport boundary
- Cadastre

Contaminated site classification:

- Contaminated - remediation required
- Contaminated - restricted use
- Remediated for restricted use



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2.3 Wetlands

Two wetlands occur within the bounds of the airport as defined by the GWSCP dataset (DBCA-019) (DBCA, 2023). These are located in Precincts 1A and 2A of Master Plan 2020 (hereafter referred to as 'wetland 1A' and 'wetland 2A'), both of which are designated conservation areas in the Master Plan (Figure 5).

During the public comment period for Master Plan 2020, JAH received a recommendation from DBCA to review and assess the wetland management categories for the wetlands located in the conservation areas at Jandakot Airport, both of which were classified by DBCA as Resource Enhancement category wetlands (damplands) (DBCA, 2023).

A review of the wetland management categories, including an on-ground wetland assessment survey were undertaken in 2022/2023 by suitably qualified environmental consultants (Ecoscape, Umwelt, and Lateral).

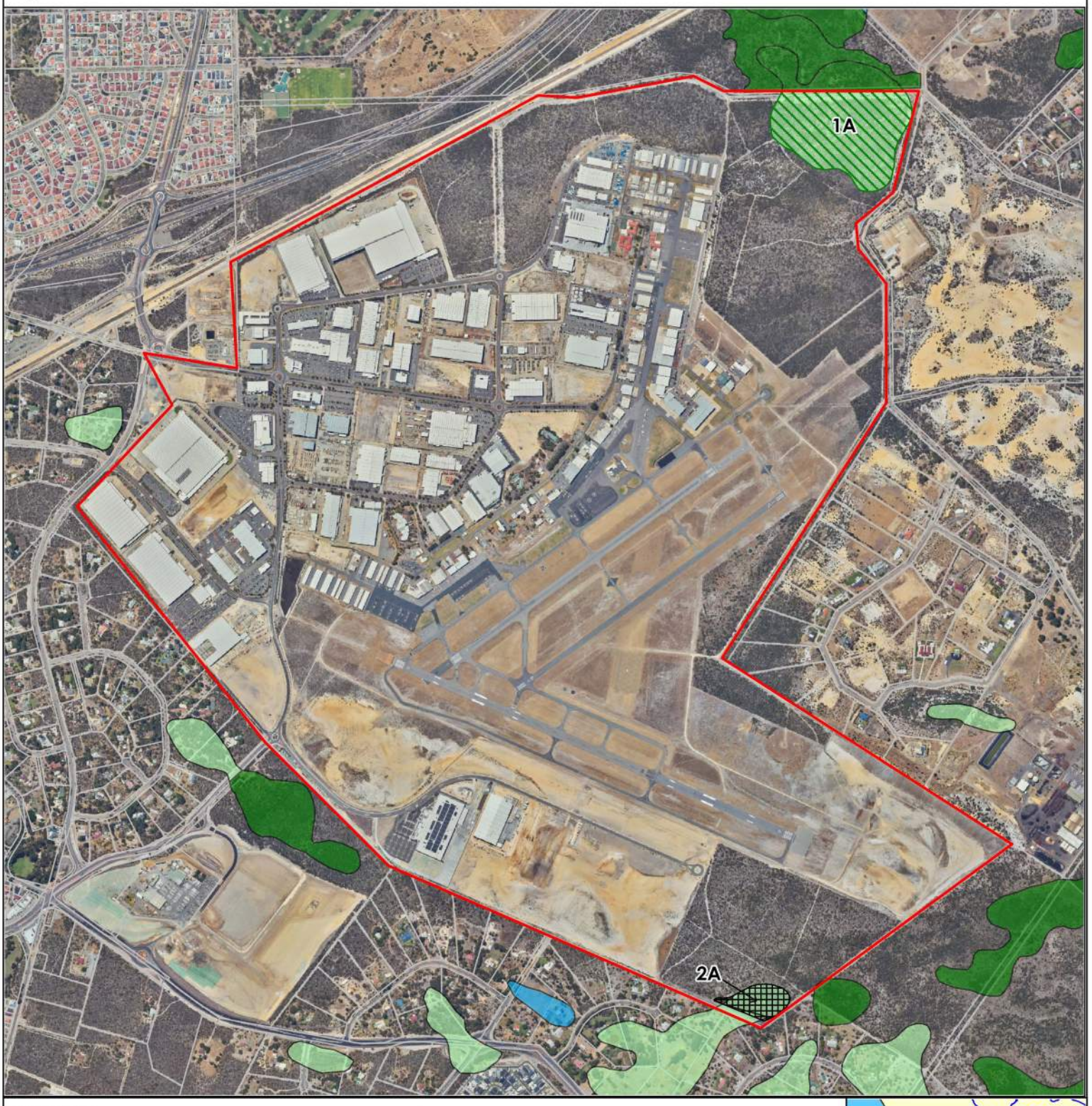
Prior to the review, both wetlands were resource enhancement management category wetlands. The results indicated both wetlands 1A and 2A had values commensurate with conservation category wetlands. The findings of these reviews were submitted to DBCA for assessment.

As of 25 July 2023, wetland 1A has been reclassified as Conservation Management (per comm, DBCA 2023), and wetland 2A is still categorised as Resource Enhancement Management, as defined by the GWSCP dataset (DBCA-019) (DBCA, 2023).

DBCA is actively reviewing the categorisation of wetland 2A, but the above listed statement provides the categorisation at a point in time and any future revisions may require this statement to be amended.

Conservation category wetlands are identified as highest priority wetlands which support a high level of attributes and functions (DBCA 2018).

Jandakot Airport - Local Water Management Strategy
Figure 5 - Wetlands



LEGEND:

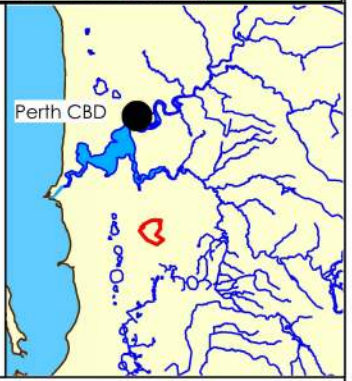
- Airport boundary
- Cadastre

Wetland changes:

- 1A: Proposed Conservation category
- 2A: Currently Resource Enhancement category, still under review.

Geomorphic wetland categories (Swan Coastal Plain):

- Conservation
- Multiple Use
- Resource Enhancement



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2.4 Hydrology

2.4.1 Surface water

Within the study area there are no natural drainage channels or defined areas of surface water. Naturally there would be little runoff generated in the study area with most rainfall directly recharging the Jandakot mound groundwater aquifers by infiltration through the predominantly sandy soils. In larger storm events runoff would flow to one of the several low points present at the northern and western boundaries of the site where seasonal damplands have been identified.

Drainage swales and basins have been created in strategic areas of the airport to collect run-off from roads and other sealed surfaces. Due to the high permeability of the Bassendean soils, run-off is localised and short term as it generally infiltrates very quickly.

Groundwater downgradient from drainage basins adjacent to the Jandakot Underground Water Pollution Control Area, is monitored to ensure that water quality is not adversely impacted by stormwater management practices at the airport.

2.4.2 Groundwater

Jandakot Airport is underlain by the Jandakot groundwater system. The Jandakot groundwater system provides water for public open space, horticulture, industry and gardens, and contributes to Perth's public water supply.

Jandakot Airport is partially located on the northern margin of the Jandakot Groundwater Mound, with the crest of the mound located just south of the airport (Davidson, 1995).

The system comprises three main aquifers:

- Jandakot Mound (shallow, unconfined superficial);
- Leederville aquifer (deeper, mostly confined); and
- Yarragadee aquifer (deeper, mostly confined).

Groundwater levels across the Jandakot Mound have declined over the last 30 years, but at a slower rate than seen in the Gnangara Mound (DWER, 2014). This is due to a combination of factors including:

- The Jandakot Mound receives more rainfall than the Gnangara Mound;
- Abstraction pressure on the Jandakot Mound is less than on the Gnangara Mound; and
- Large parts of the Jandakot Mound are now urbanised, which has increased recharge.

Inferred groundwater contour mapping indicates that groundwater flows in a northerly direction over much of the airport, with a north westerly flow in some areas; notably Precinct 5 and more western areas of the airport.

Ministerial criteria sites (Jandakot Mound)

The Jandakot Mound is gazetted under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* as both an Underground Water Pollution Control Area (UWPCA) and a Public Drinking Water Supply Area (PDWSA). DWER is bound to manage abstraction of groundwater for public and private water supply from the Jandakot Mound with provision for environmental water

requirements, as documented in Ministerial statement 688. The statement sets environmental water provisions in the form of water level criteria at 23 sites across the Jandakot Mound. These sites include 10 wetland sites, nine terrestrial phreatophytic vegetation monitoring sites (phreatophytic vegetation is vegetation that utilises groundwater to meet at least part of its water needs) and four rare flora sites. Some sites have more than one water level criterion. Water level criteria include:

- Absolute minimum water levels; and
- Rate of decline and timing of drying (referred to as other water level criteria).

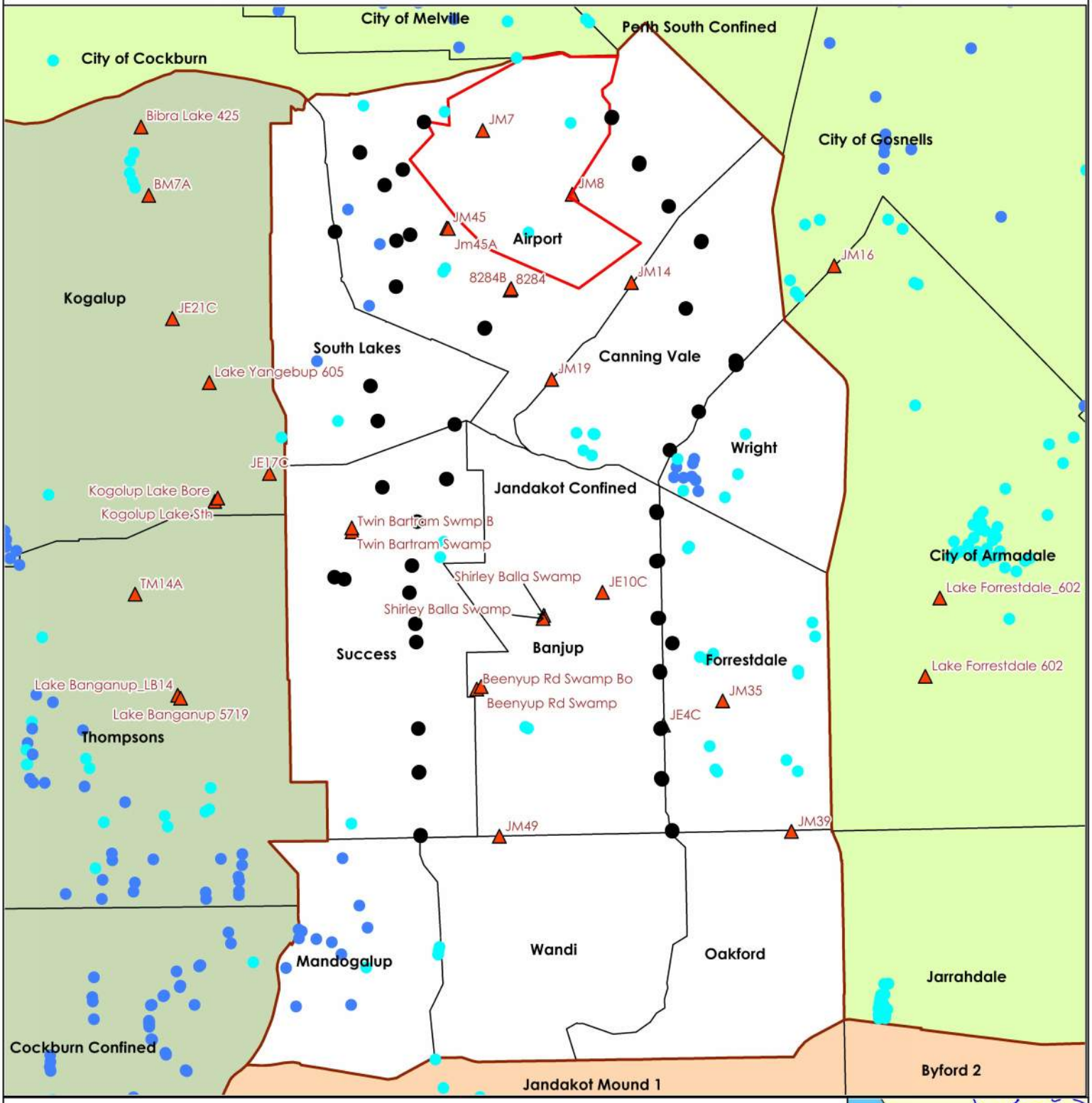
DWER is bound through the statement to manage abstraction and/or development to meet these water level criteria to achieve set objectives including:

- Manage abstraction of groundwater for public and private water supply from the Jandakot Mound sustainably;
- Protect significant environmental values of groundwater dependent ecosystems; and
- Minimise environmental impacts associated with abstraction.

Any proposed developments or groundwater license applications under the *Rights and Water Irrigation Act 1914* located in close proximity to Ministerial Criteria Sites (Figure 6) will be required to demonstrate negligible impact on these receptors.

There are a number of ministerial criteria sites (rare flora) located within (JM7) and adjacent to Jandakot Airport. According to the most recent DWER compliance report (DWER, 2020) these sites are currently compliant with relevant groundwater level criteria. Previous non-compliance has occurred at these bores; with water levels declining by greater than 0.1 m/year during 2006/07 and 2010/11. These sites have been compliant in all other years since 2000.

Jandakot Airport - Local Water Management Strategy
Figure 6 - Jandakot groundwater system - location of Ministerial sites



LEGEND:

- Airport boundary
- Ministerial criteria site
- Water Corporation bore

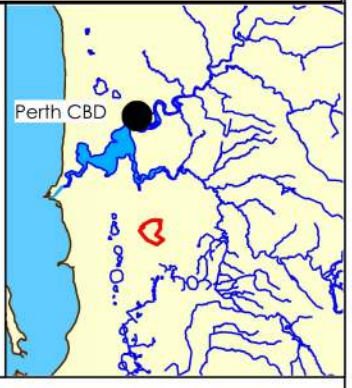
Private drawpoints (minus LG and WC):

- > 250,000 kL
- > 50,000 kL

Groundwater Area:

- Serpentine
- Jandakot
- Cockburn
- Perth

Groundwater subareas



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Groundwater levels

The Perth Groundwater Map (DWER, 2023) indicates that regional groundwater flows in a north westerly direction, towards the coast and Swan River (Figure 7). The historical maximum groundwater level lies at approximately 26 to 28 m AHD. Given that elevation at the site varies between approximately 30 and 50 m AHD, this suggests that the minimum depth to groundwater at the site is approximately 4 m below ground level (BGL).

Since March 2012, groundwater levels have been monitored at nine locations across the Jandakot Airport estate (Chart 2), with an additional two locations added to the monitoring program in December 2013, totalling 11 sites currently.

The maximum measured groundwater level during the monitoring period has varied between 2 and 12 m below ground level. Although it is not possible to determine if annual minima and maxima have been recorded each year, the timing of monitoring events has been designed to capture the groundwater level close to its annual maximum and minimum. Groundwater monitoring locations and levels recorded in March 2023 are presented in Figure 7.

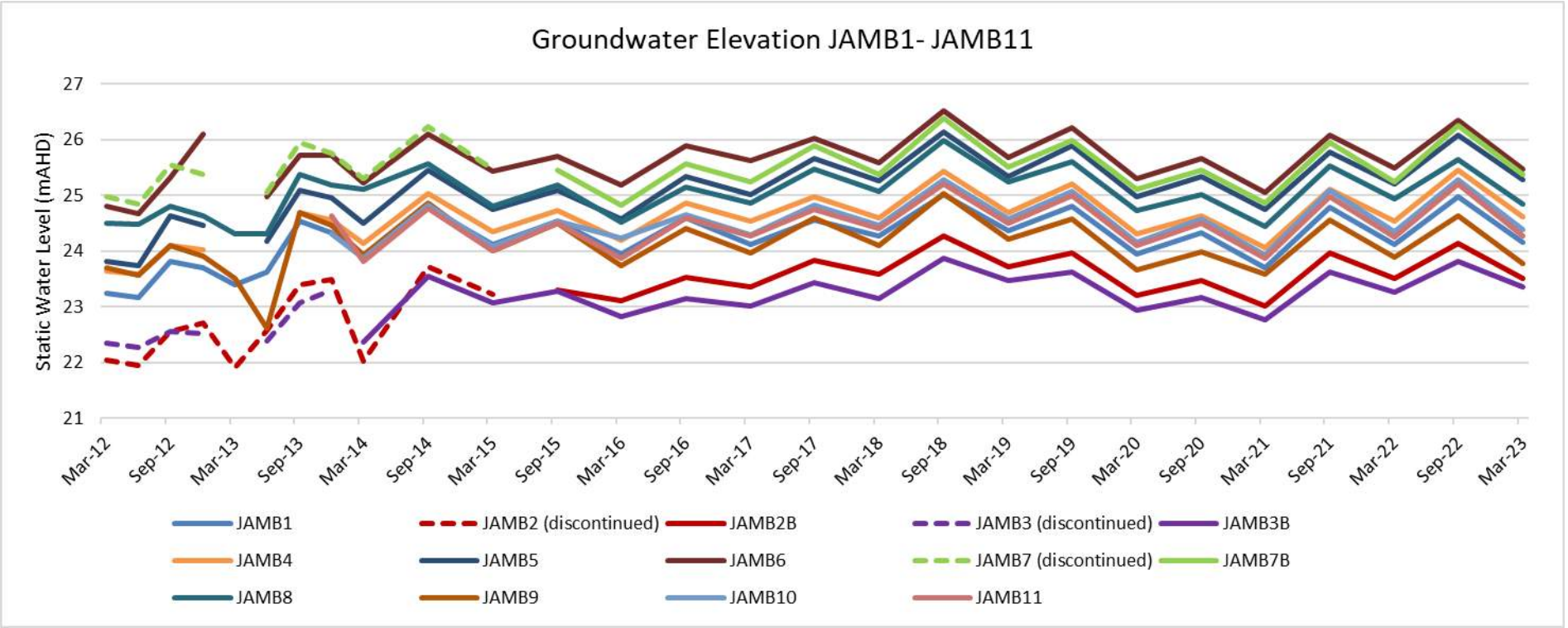


Chart 2: Available groundwater level data

Groundwater quality

Groundwater quality has been monitored since March 2012 at nine locations across the Jandakot Airport estate, with an additional two locations added to the program in December 2013, totalling 11 sites currently.

Groundwater monitoring locations and water quality data for total nitrogen and total phosphorus from the 2021/22 monitoring are presented in Figure 8 and Figure 9. Tables extracted from the 2021/22 Annual Groundwater Monitoring Report (Urbaqua, 2022) are provided in Appendix 2.

The following are summary observations based on the 2021/22 monitoring data:

- In situ measurement of pH values of groundwater range from 3.58 to 6.61, with an average pH of 5.08 indicating acidic conditions.
- Total nitrogen and total phosphorus were above guidelines as follows;
    - Total nitrogen concentration was in exceedance of Airports (Environment Protection) Regulations 1997 Schedule 2 assessment level (0.1 mg/L) across all bores. JAMB4 was also in exceedance of the Jandakot Airport GMP v5.6 assessment level (6.39 mg/L).
    - Total phosphorus concentration was in exceedance of Airports (Environment Protection) Regulations 1997 Schedule 2 assessment level (0.01 mg/L) across all bores. JAMB1, JAMB2B, JAMB3B, JAMB5 and JAMB9 were also in exceedance of the Jandakot Airport GMP v5.6 assessment level (0.12 mg/L).
- Aluminium, copper, lead and zinc concentrations were above guidelines as follows;
    - Dissolved aluminium concentration was in exceedance of the A(EP)R (1997) Schedule 2 assessment level (0.1 mg/L) at JAMB1, JAMB2B, JAMB4, JAMB5, JAMB7B, JAMB8, JAMB9, JAMB10 and JAMB11;
    - Dissolved copper concentration was in exceedance of the Jandakot Airport GMP v5.6 assessment level (0.003 mg/L) at all bores except JAMB2B, which was in exceedance of the A(EP)R (1997) Schedule 2 (0.002 mg/L);
    - Dissolved lead concentration was in exceedance of the Jandakot Airport GMP v5.6 assessment level (0.003 mg/L) at JAMB4, JAMB8 and JAMB9;
    - Dissolved zinc concentration was in exceedance of the A(EP)R (1997) Schedule 2 assessment level (0.005 mg/L) at JAMB1, JAMB2B, JAMB4, JAMB5, JAMB7B, JAMB8 and JAMB9;
- Petroleum hydrocarbons are stored on-site, however available groundwater data does not identify any adverse impacts from airport activities.

Low pH values are sometimes due to organic acids resulting from decomposition of vegetation in swampy environments (Davidson 1995). This is natural acidification through CO^2 production and root respiration in the soil in such environments. Appelo and Postma (2005) identified the lowest pH from CO^2 production in soil is around 4.6, so that groundwater which has a lower pH value must involve other processes of acidification.

A second possible source of acidification is the excessive use of ammonia and manure fertilisers. Another major acidification process is the oxidation of pyrite (FeS2). Pyrite is found, at least in small quantities, in most reduced sediments in the Bassendean Sand and swamp and lacustrine deposits at shallow depth. The lowering of the watertable by climate variability or from public and/or private abstraction may cause the oxidation of pyrite.

Groundwater monitoring at up-hydraulic locations (JAMB5, 6, 7, 8 and 9) identifies groundwater quality of a similar acidity which suggests the low pH levels are a regional issue and that conditions local to the Jandakot Airport do not contribute significantly to the acidity of the regional aquifer (Coffey, 2014).

Onsite nutrient sources, nitrogen and phosphorous, include sewage/wastewater and chemical applications to the soil. Historically leasehold sites at Jandakot Airport disposed of domestic wastewater via septic tanks and aerobic treatment units (ATU's). Minor fertilising of the airfield grassed areas and phosphite treatment of dieback has occurred onsite. No onsite point of source of nutrient contamination or on-site diffuse source has been identified. It is inferred it likely to be a regional issue with up-hydraulic groundwater monitoring showing similar results.

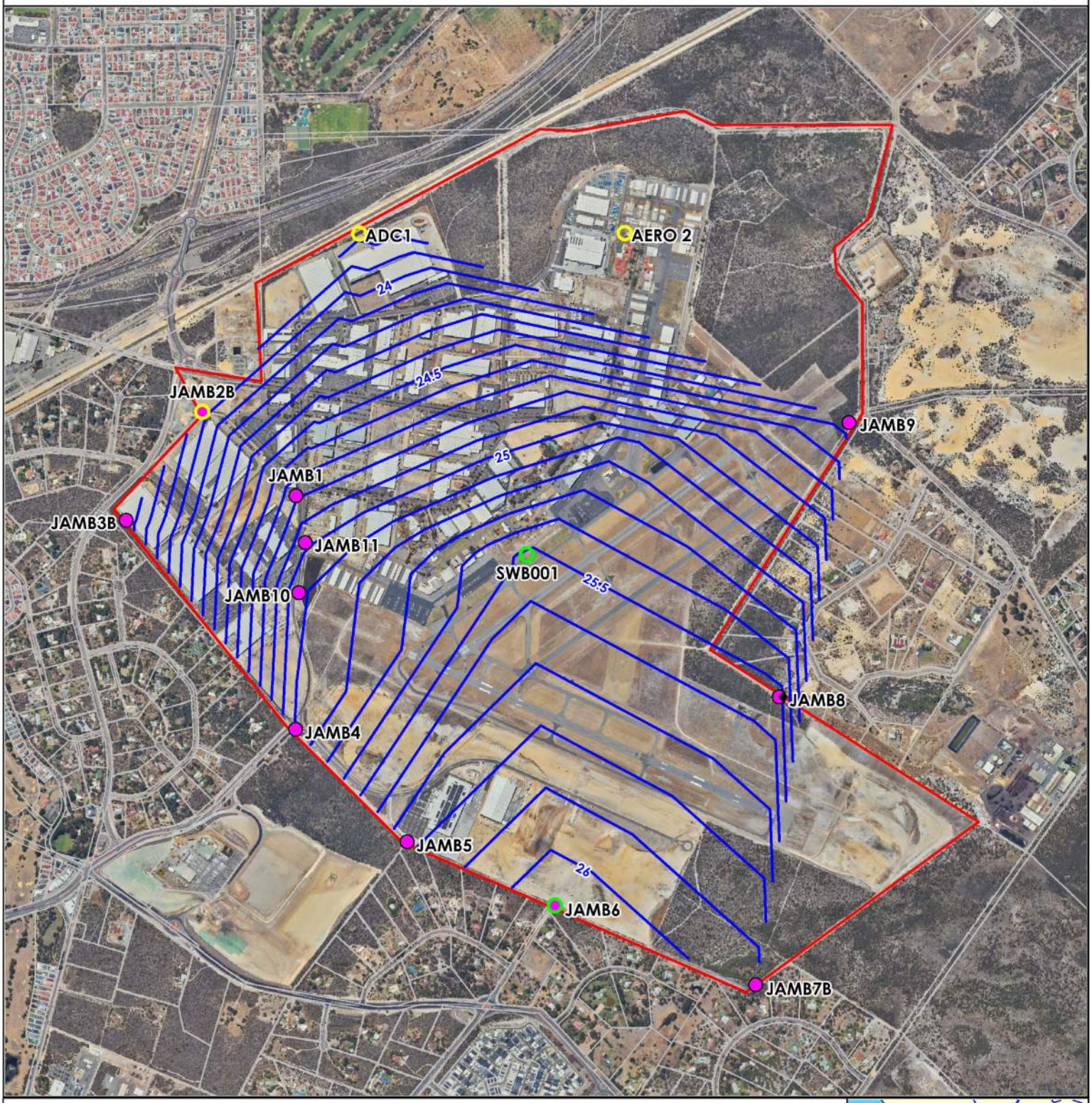
All new developments within the airport shall be connected to reticulated wastewater system, furthermore existing septic and ATU's are to be progressively made redundant, consistent with commitments within Master Plan 2020. However, due to the ongoing issues regarding budgets and time constraints following on from COVID-19, these timeframes will likely be extended until 2028.

Elevated levels of aluminium, copper, lead and zinc have been detected in the 2021/22 results, consistent with previous years. The presence of the metals is considered due to the acidification of the regional aquifer, possible due to acid sulphate soils. Concentrations do not show clear trends correlating with on-site activities or potential sources.

Monocyclic aromatic hydrocarbons and total recoverable hydrocarbons were reported below the assessment levels for all bores in 2021/22.

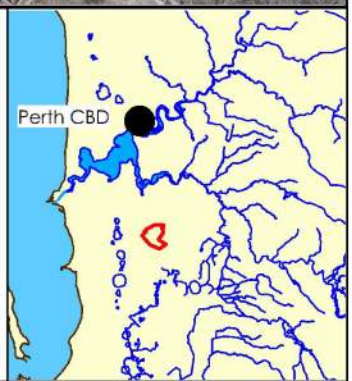
Monitoring bores situated within the site located on the southern boundary, up-gradient of any site operations, are considered to represent background conditions of groundwater entering the site. Generally, trends show there is no evidence of groundwater degradation associated with site operations, therefore risk to receptors such as Jandakot Mound, onsite users and workers is considered low.

Jandakot Airport - Local Water Management Strategy
Figure 7 - Groundwater monitoring network and mapped groundwater levels



LEGEND:

- Airport boundary
- Cadastre
- Monitoring well - full groundwater quality suite (not including caffeine unless circled)
- Caffeine monitoring - down-gradient of septic & ATUs
- Caffeine monitoring - up-gradient of septic & ATUs
- Groundwater contour (mAHD)



Data source: Landgate, MRWA Created by: RM Projection: MGA: zone 50.

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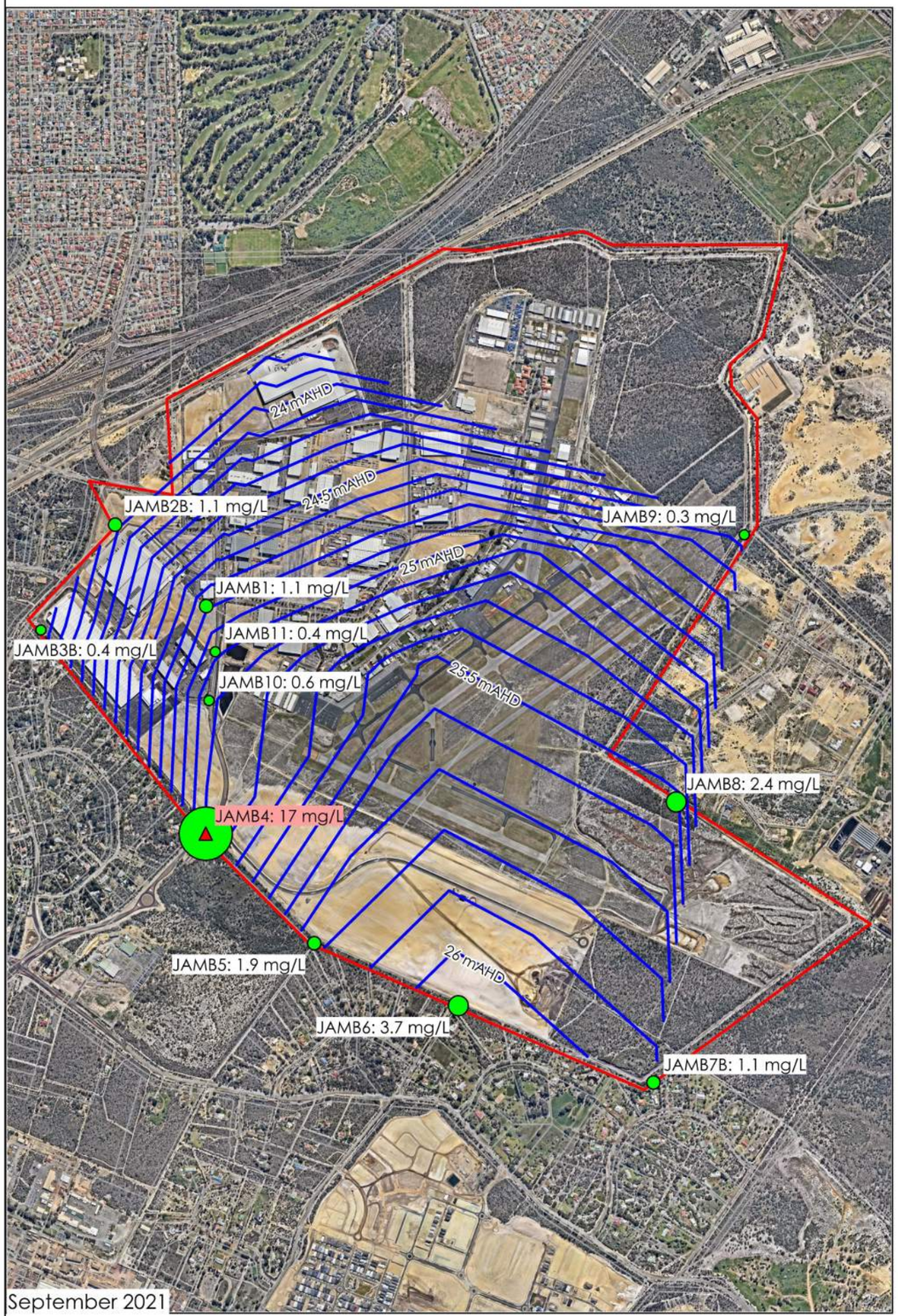
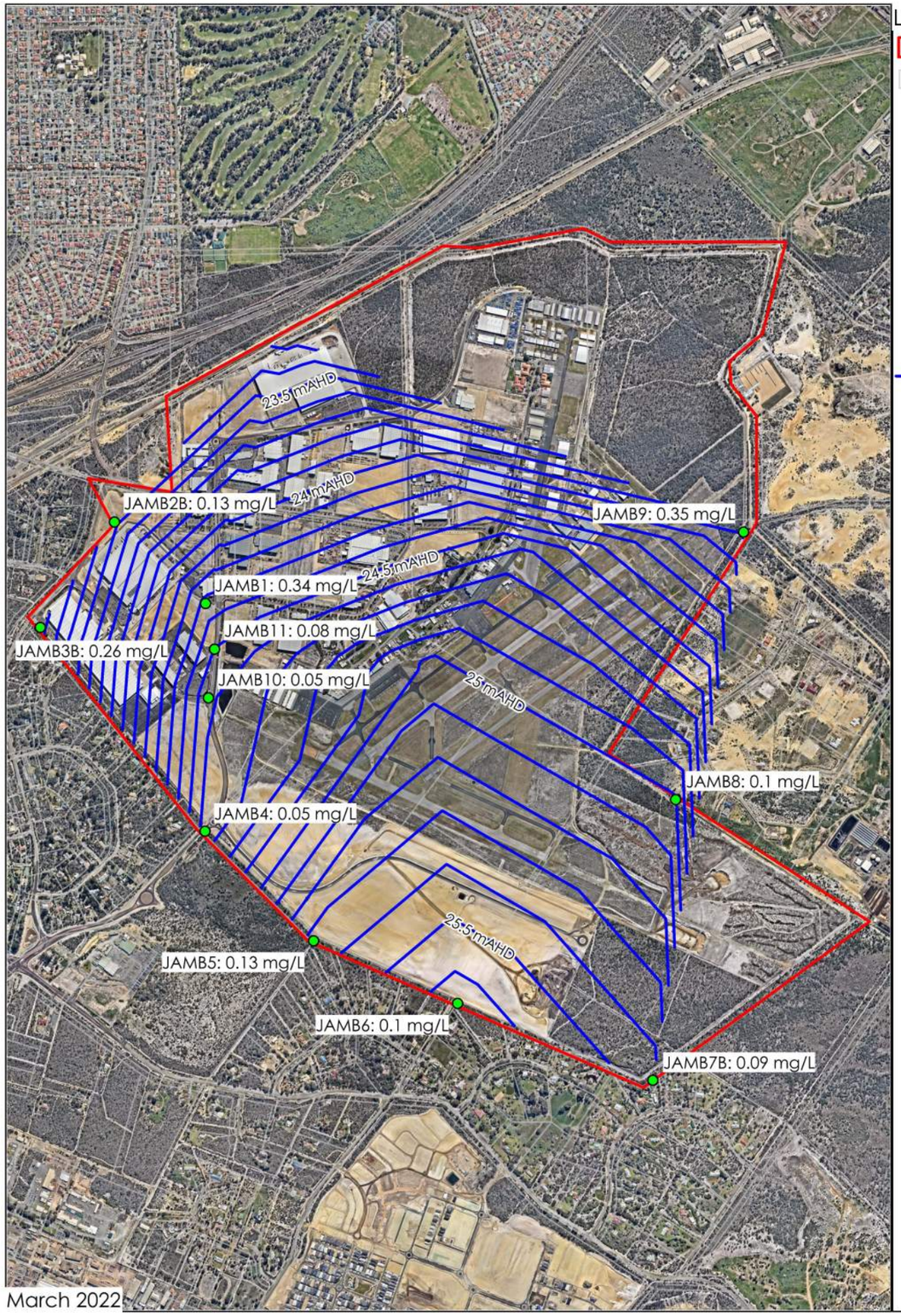
Jandakot Airport - Local Water Management Strategy
Figure 8 - Total nitrogen concentrations 2021-2022



September 2021



March 2022

LEGEND:

- Airport boundary
- Cadastre

Total nitrogen concentration (mg/L)

- 8 to 18
- 4 to 8
- 2 to 4
- 1 to 2
- 0 to 1
- Exceeds Jandakot Airport GMP v5.6 assessment level (6.39 mg/L)
- Groundwater contours (mAHD)

Data source: Landgate, JAH, MRWA, DPLH, DWER, Created by: AT Projection: MGA2020: zone 50.

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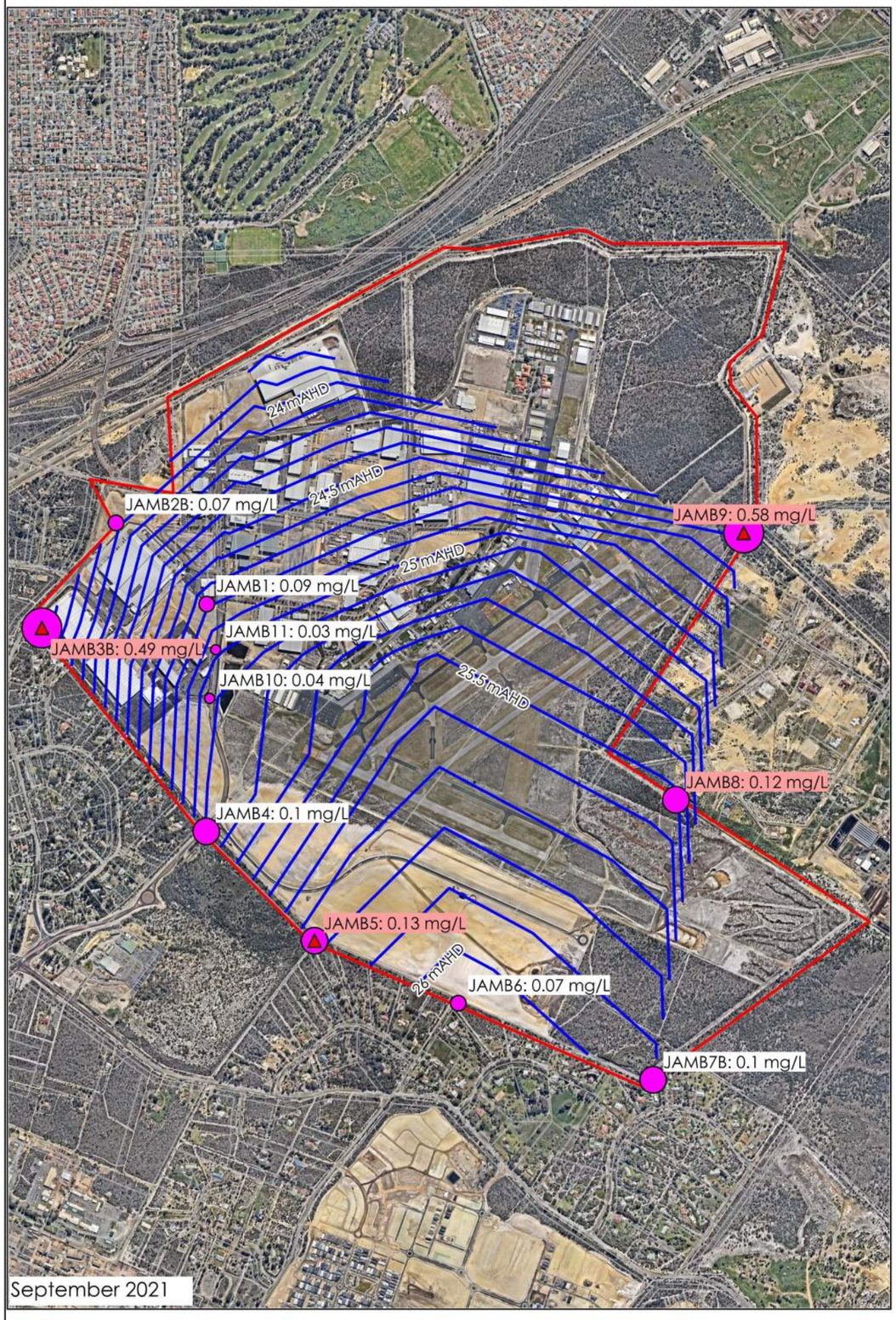
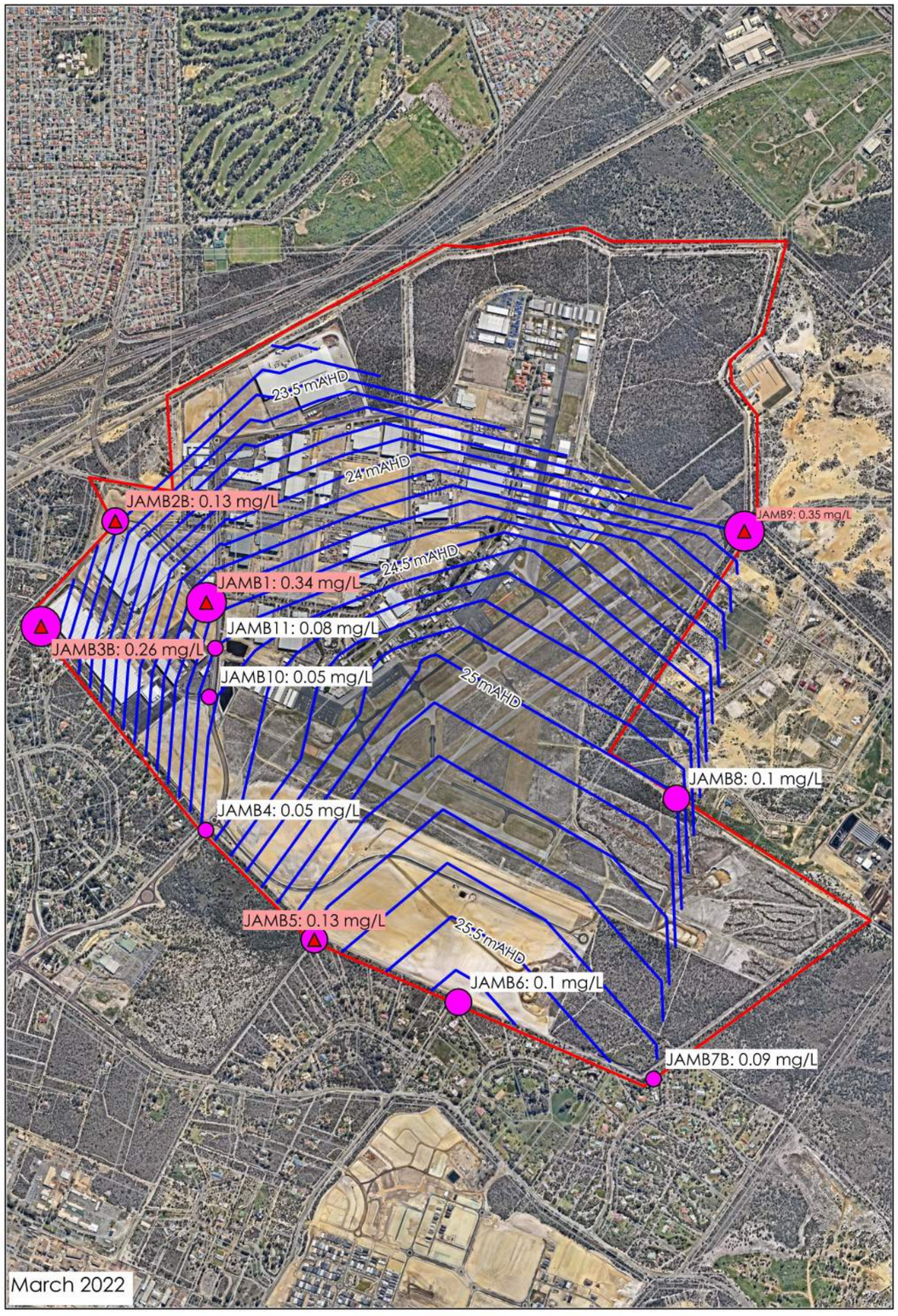
Jandakot Airport - Local Water Management Strategy
Figure 9 - Total phosphorus concentrations





LEGEND:

- Airport boundary
- Line
- Cadastre

Total phosphorus concentration (mg/L)

- 0.2 to 0.6
- 0.1 to 0.2
- 0.05 to 0.1
- 0 to 0.05
- Exceeds Jandakot Airport GMP v5.6 assessment level (0.12 mg/L)
- Groundwater contours (mAHD)

Data source: Landgate, JAH, MRWA, DPLH, DWER, Created by: AT Projection: MGA2020: zone 50.

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Groundwater flow and contaminant modelling

The majority of Precinct 5 and approximately half of Precinct 6/6A are within in the Jandakot Groundwater Mound Area. A hydrological assessment of the impacts of the development at Jandakot Airport on the downstream public water supply has been conducted (Cymod, 2009) as the proposed development area is presently a Priority 1 groundwater protection zone.

The investigation simulated both long term contamination and a single accident contamination. It was found that exceedance of drinking water criterion at downstream locations would occur after more than 10 years, minimum for both cases, with an average of 20 years.

The investigation found that in a single accident contamination, the area can be effectively remediated using aquifer restoration via conventional recovery bores. Long term contamination, however, is less likely to be successful using recovery bores, and management plans should be developed to minimise long term contamination risks. It has been ascertained by the inclusion of non-structural and structural storm water controls and risk assessments that Precincts 5 and 6/6A can be developed without posing additional risks to water resources (CyMod 2009).

Groundwater availability

The site lies within the Airport and Jandakot Confined subareas of the Jandakot groundwater area. Groundwater is not available for allocation licensing to private users within the Leederville or Yarragadee Aquifers because the water is reserved for public water supply and groundwater available for private licensing within the Superficial Aquifer is fully allocated (shown in Table 2). Jandakot Airport Holdings currently hold a license for 225,000 kL from the Superficial Aquifer.

Table 2: Groundwater allocations

Subarea	Aquifer	Allocation limit – private users (kL/year)	Availability June 2023
Airport	Perth – Superficial Swan	1,048,456	No
Jandakot Confined	Perth - Leederville	0	No
	Perth – Yarragadee North	0	No

Groundwater use

Groundwater is used within the Jandakot Airport estate for irrigation of areas of landscaping abstracted under Jandakot Airport Holdings (JAH) current groundwater licence (GWL95741(5)). The license is held for 225,000 kL of groundwater from the superficial aquifer based on a rate of 7,500 kL/ha of irrigated lawn/garden area.

The 2021/22 reporting year is the eighth year that all abstraction was 100% recorded by water meters. Prior to 2014/15, water use for some bores was estimated as the meter installation program was rolled out.

Current uses for groundwater are summarised as follows and areas are estimated in Table 3.

Airside: Irrigation of approximately 8.47 ha of lawn/grass. This is a reduction from 9.40 ha in 2020/21, associated sealing several grassed aircraft parking areas. The watering of lawn/grass areas in the airside area is undertaken for two reasons: (1) To provide stable grassed areas for aircraft parking; and (2) for aircraft safety purposes, such as dust management and soil stabilisation in the vicinity of aircraft movement areas. Irrigated areas are anticipated to increase in coming years, associated with additional planned airside developments in Precinct 6.

However, this may possibly be offset in some areas where existing grassed aircraft parking areas are scheduled to be replaced with hardstand.

Landside: Irrigation of approximately 2.66 ha of lawns and gardens, including verges, median strips and amenity garden beds. This area remains unchanged from 2020/21, noting it had previously been reduced (from 3.34 ha in 2016/2017) due to development and the implementation of water saving initiatives. This area is likely to increase in future years as development in the landside aviation precincts expands.

New Commercial: Irrigation of 4.65 ha of lawns and gardens, including verges, median strips and amenity garden beds (reduced from 4.75 ha in 2020/21). The area under irrigation is likely to increase as development of commercial areas increases significantly in the next few years, particularly within Precinct 6.

Table 3: Irrigation Area estimates

	Area Irrigated by Groundwater (ha)							
Areas	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022 (Current)**	***Future 2023+**
Airside	10.47	10.47	10.14	9.38	9.40	9.40	8.47	14
Landside	3.34	3.34	2.63	2.63	2.63	2.66	2.66	4
New Commercial	2.75	2.75	4.63	4.87	4.75	4.75	4.65	12

*Unconfirmed estimates only, calculated for the purpose of this report.

Construction: Groundwater is used from designated bores (currently 13 and 15) for construction activities – notably dust suppression, road construction, site levelling, compaction etc. From late 2014, bore 13 was used for both construction and verge irrigation within the newly developed Precinct 5; however, it was not utilised for construction irrigation in 2021/22. A new bore, bore 15 was commissioned in January 2016. Major construction involving bulk earthworks/activities are anticipated to continue for a number of years. Bulk earthworks (e.g., levelling and compaction) require approximately 450kL per day of operation, and cutting to level and other activities generally utilises 100kL/day per day of operation.

Groundwater abstraction

In 2021/22, 13 groundwater abstraction bores existed at Jandakot Airport (Figure 10).

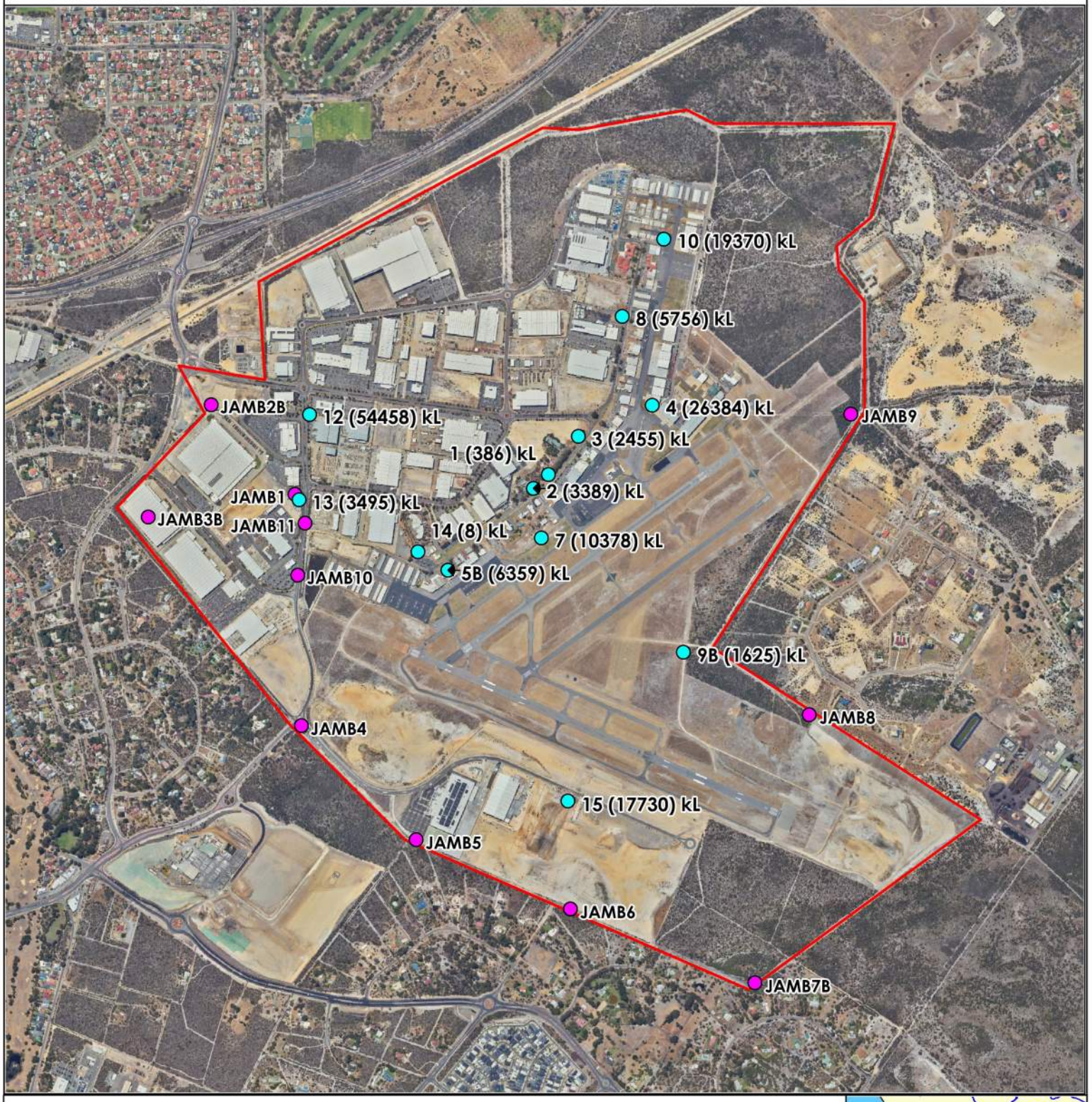
Groundwater abstraction for the financial year 2021/2022 is provided in Table 4 and compared to longer term abstraction rates in Chart 3 and Chart 4. Abstraction was within the allocation specified within the licence (GWL95741(5)). In 2021/22 JAH used 151,793 kL. This is a 6.56% decrease from 2020/21 (162,453 kL).

In 2021/22 20,274 kL (13.36%) was utilised for construction activities and 131,519 kL (86.64%) was utilised for irrigation.

Use of groundwater for construction increased by 31% compared to 2020/21 (15,470 kL). This corresponds with the commencement of large construction projects in 2021/22.

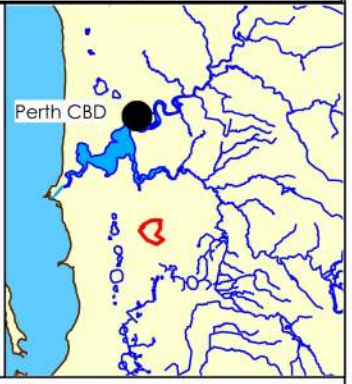
There has been a decrease in the volume of water abstracted for irrigation purposes (10.5%), and a decrease in the total area under irrigation (down 6.2% from 16.8 ha to 15.78 ha). In 2021/22, 131,519 kL was utilised compared to 146,983 kL in 2020/21 and 148,824 kL in 2019/20.

Jandakot Airport - Local Water Management Strategy
Figure 10 - Location of Groundwater Abstraction Bores and Monitoring Bores



LEGEND:

- Airport boundary
- Abstraction bore (2021-22 abstraction volume, kL)
- Monitoring bores



Data source: Landgate, MRWA Created by: RM Projection: MGA: zone 50.

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Table 4: Annual water use from July 2021 to June 2022

Bore ID	Status	Primary use	Annual use (kL)
1	Operational	Landside irrigation	386
2	Operational	Landside irrigation	3,389
3	Operational	Landside irrigation	2,455
4	Operational	Airside irrigation	26,384
5B	Operational	Landside irrigation	6,359
7	Operational	Airside irrigation	10,378
8*	Operational	Landside irrigation 50% and construction 50%	5,756
9B	Operational	Airside irrigation	1,625
10	Operational	Airside irrigation	19,370
12	Operational	Commercial irrigation	54,458
13	Operational	Commercial irrigation and construction	3,495
14	Operational	Tenant – Irrigation (CSWAFC)	8
15	Operational	Construction 80% and commercial irrigation 20%	17,730
Annual Water Use (kL) - Irrigation			**131,519**
Annual Water Use (kL) - Construction			**20,274**
Annual Water Use (kL) - Total			**151,793**

*Recently decommissioned and is no longer operational

Airside and Landside irrigation currently meets the proposed efficient use target of 7,500 Kl/ha (Section 3.5.2), utilising 6823 Kl/ha and 5264 Kl/ha respectively. Compared to 2020/21, Airside irrigation increased by 7.67% and Landside irrigation decreased by 21.31%. Commercial irrigation decreased by 18.57% and used 12,856 Kl/ha, exceeding the target.

When all irrigated areas are combined, JAH utilised 8,336 Kl/ha, which is above the target of 7,500 Kl/ha; however, it is an improvement on 2020/21 (8,672 Kl/ha).

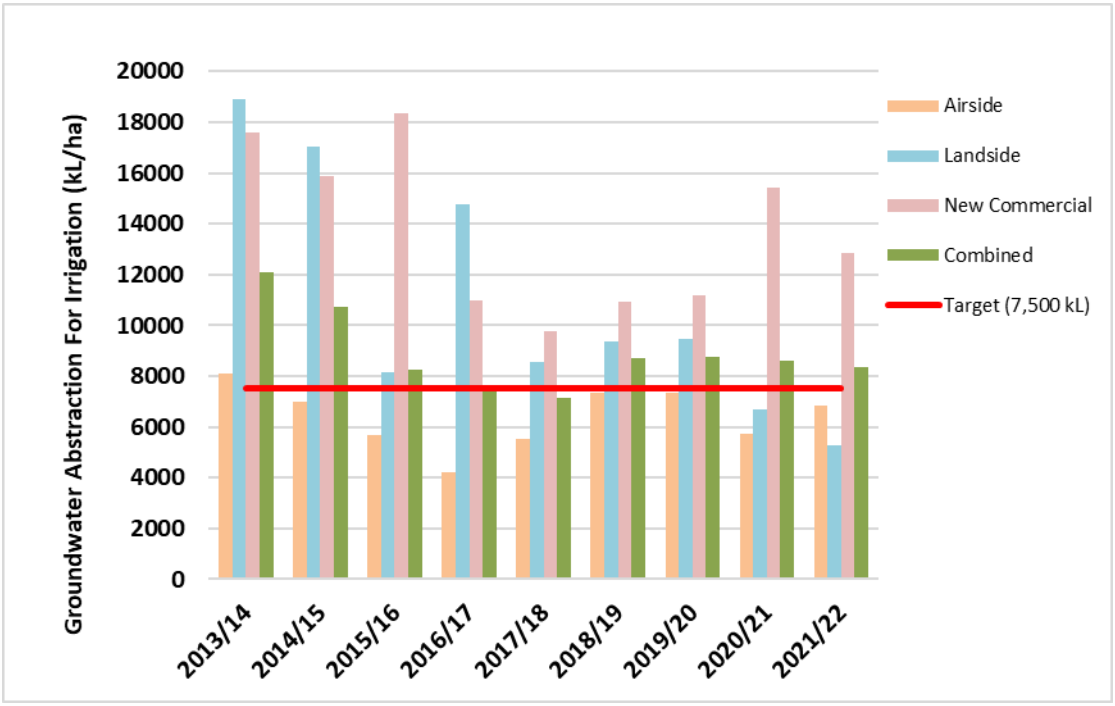


Chart 3: Jandakot Airport Irrigation Rates 2013/14 - 2021/22

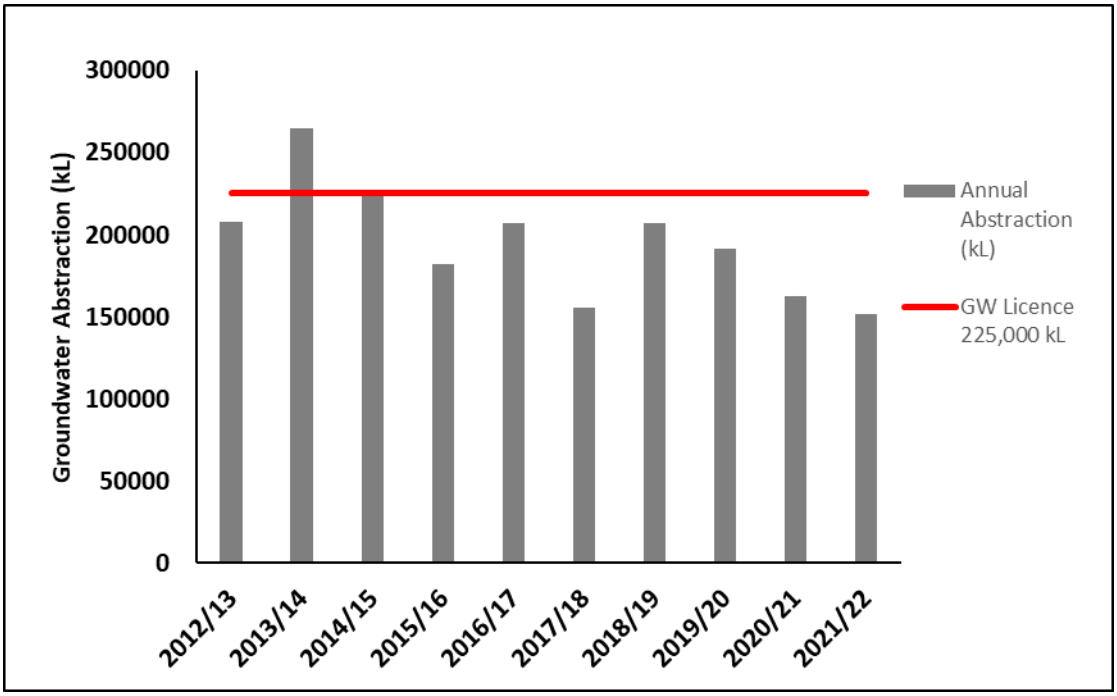


Chart 4: Jandakot Airport Annual Groundwater Abstraction 2012/13 - 2021/22

2.5 Flora

The following information is from the Jandakot Airport Master Plan 2020:

"Jandakot Airport is located in the Swan Coastal Plain Unit of the Drummond Botanical Subdistrict, part of the greater South-West Botanical District (Beard 1990). Under the Interim Biogeographic Regionalisation for Australia (IBRA), the airport is within the Swan Coastal Plain subregion (DoEE2017). Within the Bassendean Coastal Plain, the airport is situated on one major geomorphological system, the Bassendean Dunes (Mattiske 2017). The Bassendean Dune System comprises vegetation on dis-continuous older leached sands. This system is characterised by Banksia low woodland (B. attenuata, B. menziesii, and B. ilicifolia), Eucalyptus todtiana (to the north), E. marginata (to the south) and Nuytsia floribunda over a dense understorey of sclerophyll shrubs. Low lying areas of the Bassendean system are dominated by mixtures of Melaleuca preissiana, M. rhaphiophylla, B. littoralis, Casurarina obesa, E. rudis and/or sedges (Beard 1990)."

2.5.1 Environmentally Significant Areas

Conservation Precincts as designated in Master Plan 2020 are considered environmentally significant primarily due to the presence of banksia woodland, which provides foraging habitat for Carnaby's Cockatoos (*Calyptorhynchus latirostris*). In addition, the presence of the Grand Spider Orchid (*Caladenia huegelii*) in Precinct 1A and to a lesser extent Precinct 1B, adds to the significance of these specific conservation areas. Vegetation within the Conservation Precincts mainly comprises low banksia woodland with dense understory.

Reflecting the evolution of development, aviation requirements and management of Jandakot Airport, the Master Plan identifies Precincts 6 and 6A as Mixed Business and Aviation Operation respectively. As required under Commonwealth legislation, the proposed development of Precincts 6 and 6A was subject to assessment, and EPBC Approval 2013/7032 resulted in the provision of offsets by JAH and measures to protect the Jandakot Groundwater Mound. The 2014 Master Plan also split the former Precinct 2 in Precincts 2A and 2B, whilst retaining the proposed use as Conservation.

JAH recognises that the airport estate contains environmental values that are listed under Commonwealth and State legislation. Impacts proposed to listed values require consideration under applicable legislation, most notably, the EPBC Act. Defining areas as environmentally significant under the *Airports Act 1996* does not therefore afford listed natural values an increased level of protection.

2.5.2 Threatened Ecological Communities (TEC)

Banksia Woodlands of the Swan Coastal Plain ecological community has been listed as a TEC under section 184 of the EPBC Act in the 'Endangered' category.

2.5.3 Protected flora

Two endangered flora species protected under the EPBC Act have been previously identified as occurring within the bushland of Jandakot Airport:

- Grand Spider Orchid (Caladenia huegelii); and
- Glossy-leaved Hammer Orchid (Drakaea elastica).
- However, surveys by Mattiske (2010, 2013 and 2017) to identify new and previously recorded Glossy-leaved Hammer Orchids did not locate any plants and it is now suspected that it was initially misidentified and that no specimens are present on site.

- Surveys of the airport have confirmed populations of the Grand Spider Orchid at Jandakot Airport in Precinct 1A, 1B and a single individual being located in 2A.

2.6 Fauna

2.6.1 Key species

Environmental assessments have identified two EPBC listed threatened fauna species that are known to occur or potentially occur at Jandakot Airport (Western Wildlife 2017; JAH 2022a) including:

- Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*); and
- Forest Red-tailed Black-cockatoo (*Calyptorhynchus banksii naso*).

Other conservation significant fauna potentially occurring (visiting) Jandakot Airport include:

- Forktailed Swift (*Apus pacificus*);
- Rainbow Bee-eater *(Merops ornatus)*; and
- Peregrine Falcon (*Falco peregrinus*).

Eight Priority Species listed under the Wildlife Conservation Regulations 2018 that occur, or potentially occur, at Jandakot Airport are:

- Perth Lined Lerista (*Lerista lineata*) –Priority 3;
- Jewelled Ctenotus (*Ctenotus gemmula*) – Priority 3;
- Black-striped Snake (*Neelaps calonotos*) – Priority 3;
- Western False Pipistrelle (*Falsistrellus mackenziei*) – Priority 4;
- Western Brush Wallaby (*Notamacropus irma*) – Priority 4;
- Quenda (*Isoodon fusciventer*) – Priority 4;
- Graceful Sun-moth (*Synemon gratiosa*) – Priority 4; and
- Katydid or Bush Cricket (*Throscodectes xiphos*) – Priority 1.

2.7 Heritage and Culture

The Jandakot Airport Heritage Management Plan (Appendix I to the Conservation Management Plan) was developed to ensure that JAH conducts its developments in a manner that complies with the *Airports Act 1996* and other statutory requirements in relation to areas of cultural significance.

2.7.1 Indigenous Heritage

Prior to the approval of the Jandakot Airport Master Plan 2009 and Environment Strategy 2009, JAH engaged Australian Interaction Consultants (AIC 2008) to undertake an Ethnographic and Archaeological Site Identification Survey of the areas to be impacted under the Jandakot Airport Master Plan 2009. The surveys, involving archaeologists and indigenous custodians, encompassed the entire airport including all areas of development to which this LWMS applies.

Archival research revealed two sites (artefact scatters) which were believed to be within the airport boundary; Site 4309 Princep Road and Site 3513 Lukin Swamp. The 2008 investigation concluded:

- No new ethnographic or archaeological sites were identified.

- Site 3513 Lukin Swamp could not be located within Jandakot Airport.
- Previously identified Site 4309 Princep Road is no longer a site within the meaning of Section 5 of the *Aboriginal Heritage Act 1972*.
- A Section 18 application is not required for the Jandakot Airport Master Plan to proceed.

The potential for ground disturbing activities to encounter previously unknown archaeological deposits (which may contain cultural materials) was noted and JAH addresses this within the Cultural Heritage Management Plan and relevant Construction Environment Management Plans.

JAH are currently in the process of updating and amending the Jandakot Airport Cultural Heritage Management Plan and will consider recent changes to the Western Australian heritage laws, subsidiary legislation and associated guidelines, if applicable.

2.7.2 European Heritage

No European heritage sites have been registered within the City of Cockburn Local Government Inventory and Heritage List, the State Heritage Register or the Commonwealth Heritage List. There are also no visible signs of European heritage on site.

Jandakot was utilised for grazing activities from 1867. Experienced vegetable and orchard gardeners were attracted to the Cockburn region when Fremantle and Perth grew rapidly due to Western Australia's gold rush. Rural housing developments commenced in the post war years and Jandakot Airport opened in 1963 following closure of the Maylands airfield (JAH 2020).

2.8 Current and proposed land use and infrastructure

2.8.1 *Jandakot Airport Master Plan 2020*

The *Jandakot Airport Master Plan* 2020 (the Masterplan) defines land use precincts within the estate (Figure 11) as:

- Precinct 1A (48 ha) – Conservation;
- Precinct 1B (31 ha) – Conservation;
- Precinct 2A (29ha) – Conservation;
- Precinct 2B (11 ha) – Conservation;
- Precinct 3 (247 ha) – Aviation Operations;
- Precinct 4 (120 ha) – Mixed Business;
- Precinct 5 (41 ha) – Mixed Business;
- Precinct 6 (40 ha) – Mixed Business; and
- Precinct 6A (10 ha) – Aviation Operations.

The remainder of the 622-ha site is allocated to roads and services (approximately 45 ha). This results in the following overall land use areas:

- Conservation – 119 hectares (19%);
- Aviation Operations (includes runways and taxiways) – 257 hectares (42%);
- Non-Aviation Development – 201 hectares (32%); and
- Existing and Proposed Internal Roads and Services Area – 45 hectares (7%).

Future aviation development

The proposed aviation related development at Jandakot Airport will facilitate a significant increase in the economic activity at the site. At full development, estimated within the 20-year period of the Masterplan, it is anticipated that the estate will accommodate approximately 155,000 square metres of aviation related and aircraft hangar floor space. This increase will predominantly come from the development of Precinct 6A which will accommodate approximately 40,000 square metres of aviation-related and aircraft hangar floor space.

Future non-aviation development

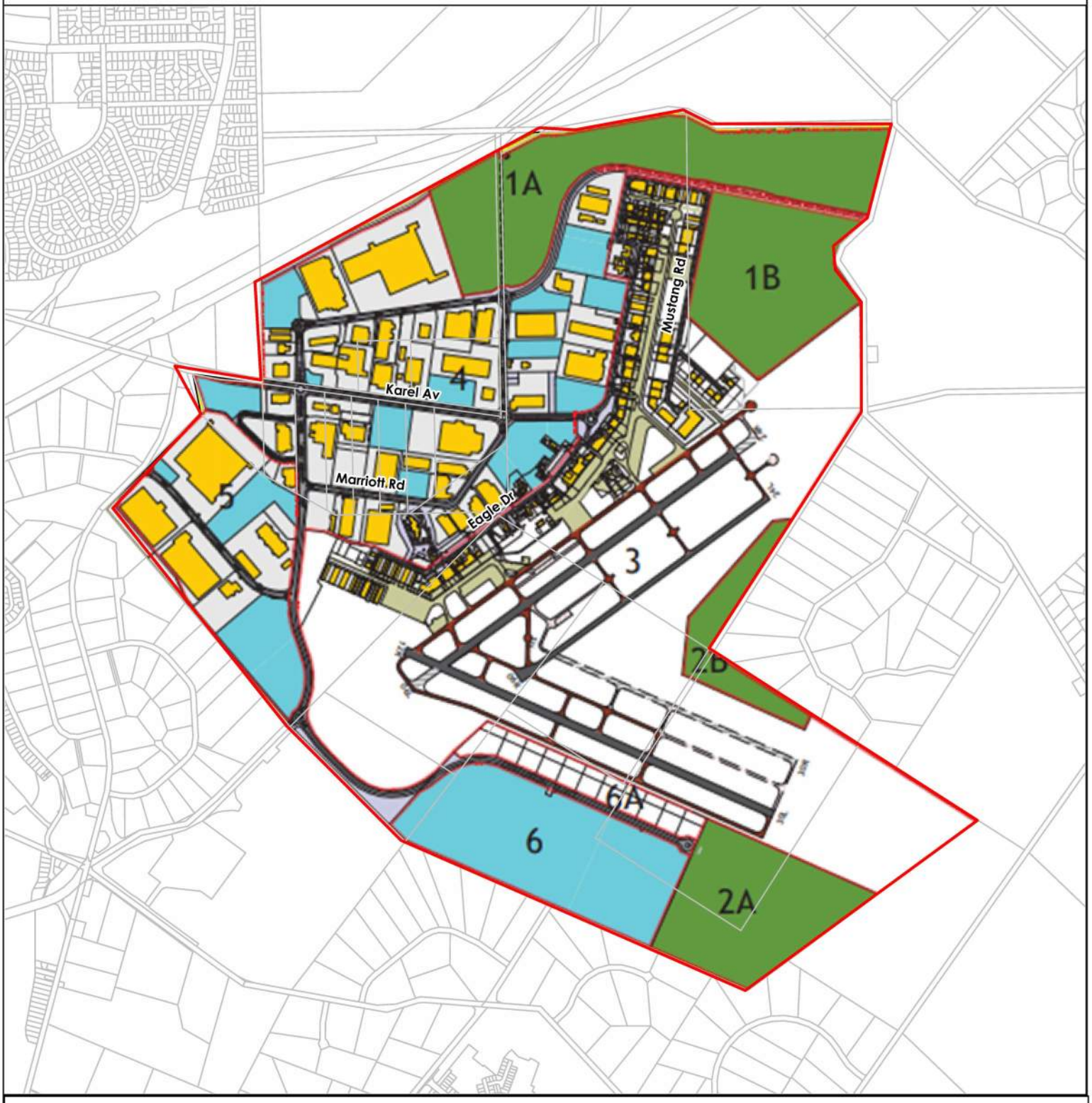
At full development, it is anticipated that the estate will accommodate approximately 725,000 square metres of non-aviation floor space, comprising 525,000 square metres of warehouse, 128,000 square metres of manufacturing, 67,000 square metres of office and 5,000 square metres of retail (already constructed) floor space.

2.8.2 *City of Cockburn Town Planning Scheme No. 3*

The Jandakot Airport estate is currently zoned 'Public Purpose – Commonwealth Government' under the City of Cockburn's Town Planning Scheme No 3 and is covered by the 'Jandakot Airport Special Control Area'.

The ongoing aviation use and development of Jandakot Airport is supported through the Town Planning Scheme, such that land surrounding the airport has been zoned 'Resource' so as to prevent more intensive residential development which may be sensitive to aircraft noise.

Jandakot Airport - Local Water Management Strategy
Figure 11 - Precinct plan



LEGEND:

- Airport boundary
- Cadastre
- Roads

Precinct plan areas:

- 3 - Aviation operations
- 1A, 1B, 2A, 2B - Conservation
- 4, 5, 6 - Mixed business
- Existing developed sites
- 6A - Aviation operations
- Roads, services and batter areas
- Existing runways
- Existing taxiways
- Apron
- Proposed runways
- Proposed taxiways

Data source: Landgate, MRWA, JAH Created by: RM Projection: MGA: zone 50.

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2.8.3 *Metropolitan Region Scheme*

Jandakot Airport estate is reserved for 'Public Purposes: Commonwealth Government' under the Metropolitan Region Scheme (Figure 12). Additionally, the entire estate is identified as 'Bush Forever Area' whilst only western and southern portions of the site are contained within the 'water catchments' reserve which coincides with the boundary of the JUWPCA (Figure 13).

The MRS does not place any limitations on permissible uses in the designated reservations. That is, under the provisions of the MRS, any use can be approved on any reserved land. The 'Public Purposes: Commonwealth Government' and 'Water Catchments' reservations, and 'Bush Forever Area' identification do not prevent the approval of any use or development on the airport site.

Current land use zoning and reservations in the area surrounding Jandakot Airport, as depicted in the Metropolitan Region Scheme, include:

- Public Purposes – Special Uses;
- Urban;
- Rural;
- Parks & Recreation;
- Industrial; and
- Rural – Water Protection.

2.8.4 *Infrastructure*

The Jandakot Airport estate contains substantial existing and proposed aviation infrastructure (Figure 14) as well as associated roads and services infrastructure necessary to support aviation and mixed business land uses.

Wastewater

A reticulated sewerage network is present within the Jandakot Airport estate, connected to the local municipal sewerage system. This system currently services all new developments within Precincts 4 and 5, as well as some of the established areas of the airport. The sewer is a reticulated gravity system to the main internal pump station located on Marriott Road which is connected via a pressure main to the Bibra Lake main sewer. All proposed future developments within Precinct 6/6A will be connected to reticulated sewer.

Older, established areas of the airport will be progressively linked to sewer in coming years. A small number of pre-existing tenants continue to operate septic tanks. Larger pre-existing tenants have aerobic treatment units (ATUs). Existing ATU's and septic tanks will be decommissioned and removed in accordance with the existing procedure which requires approval by the Department of Infrastructure, Transport, Regional Development, Communications, and the Arts (DITRDCA); Airport Building Controller.

As outlined within the Masterplan 2020, JAH intends to connect all facilities to the sewer system by 2024 where feasible. However, due to the ongoing issues regarding budgets and time constraints following on from the COVID-19 pandemic, this will likely be extended until 2028. Caffeine testing at groundwater monitoring bores up-gradient and down-gradient of existing septics and ATU systems will provide assurance that the current arrangements continue to protect groundwater. The monitoring regime is outlined in Section 4.1, with these bores shown on Figure 7.

Figure 12: Metropolitan Region Scheme Zones and Reserves

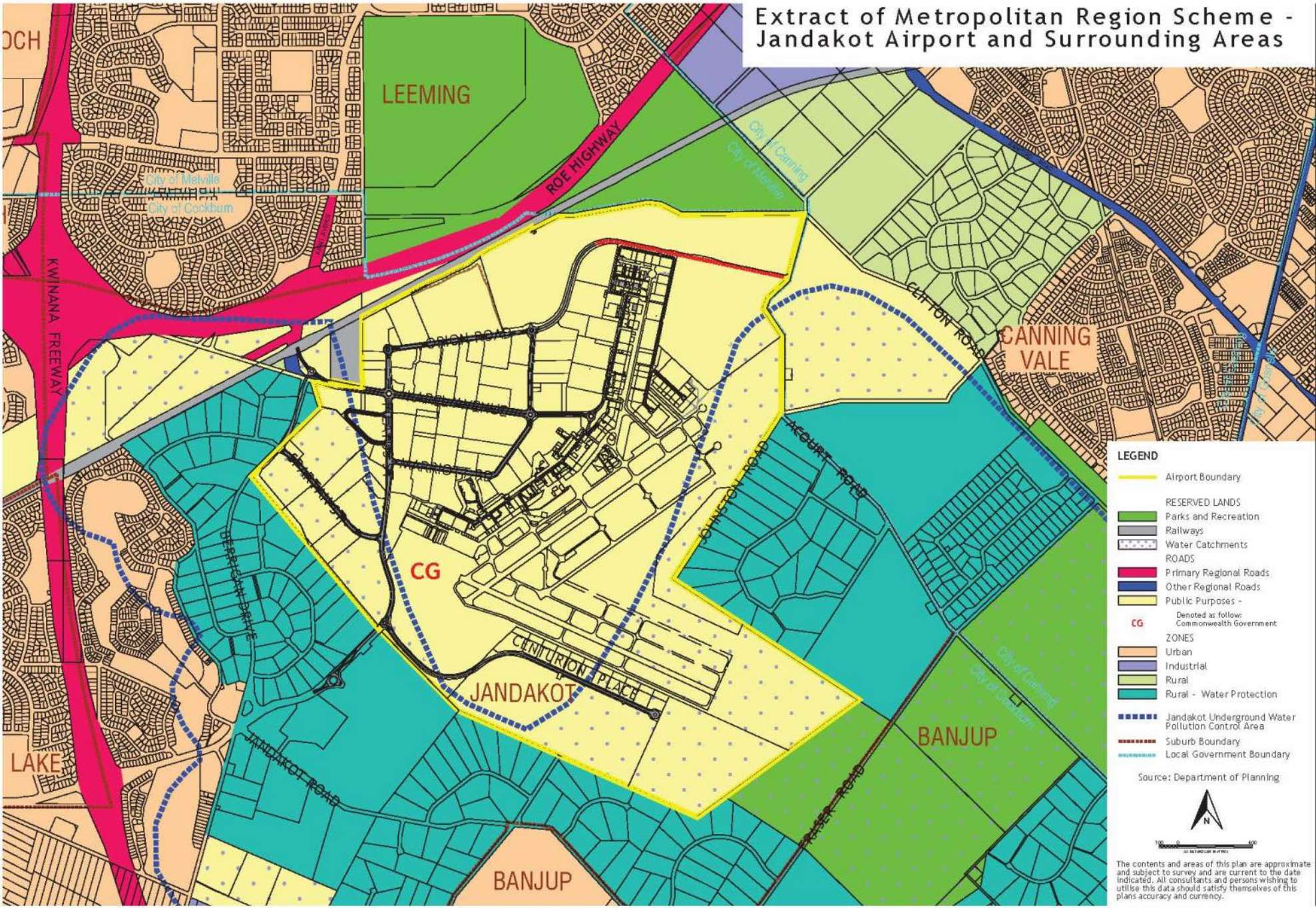
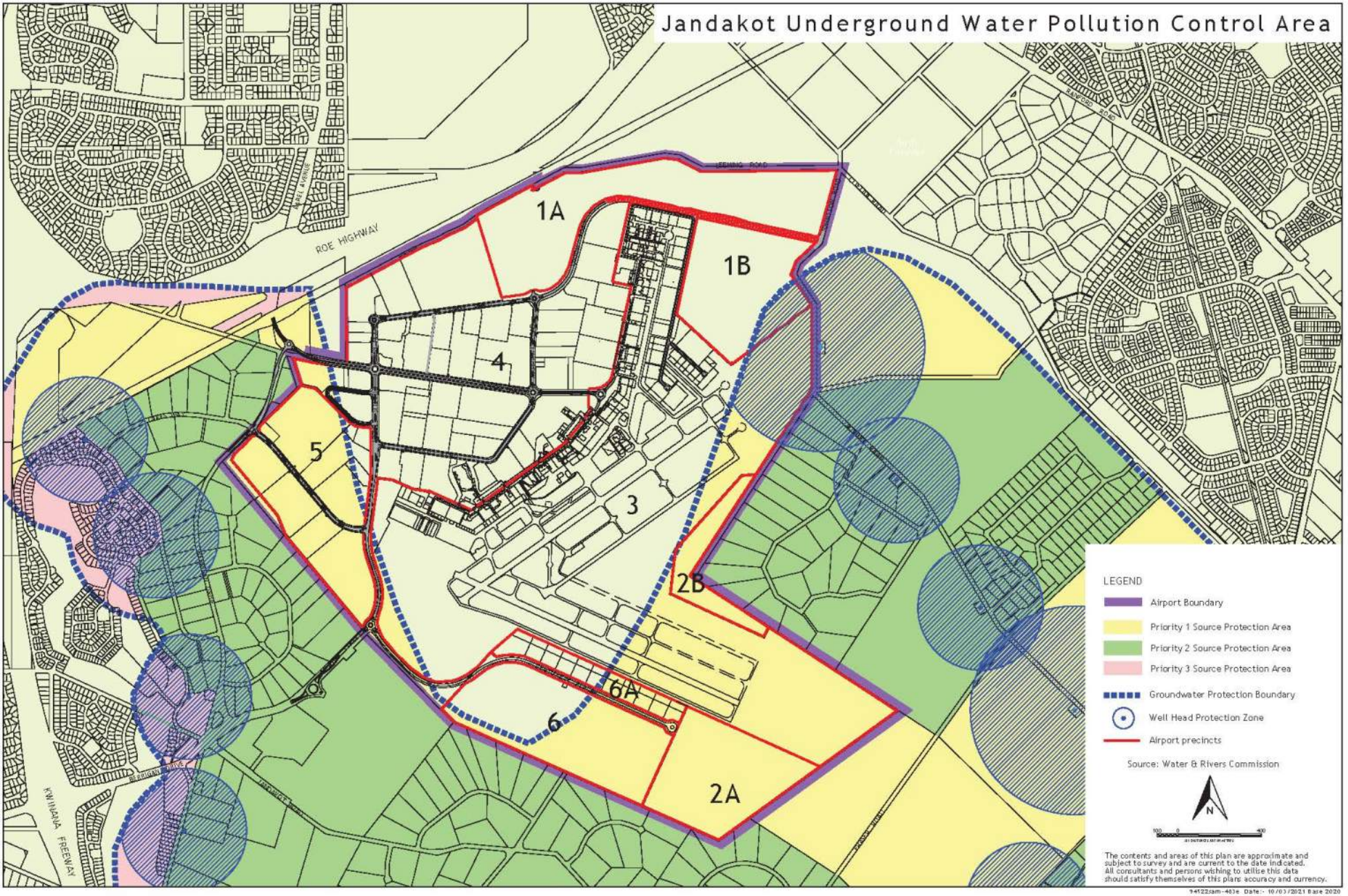
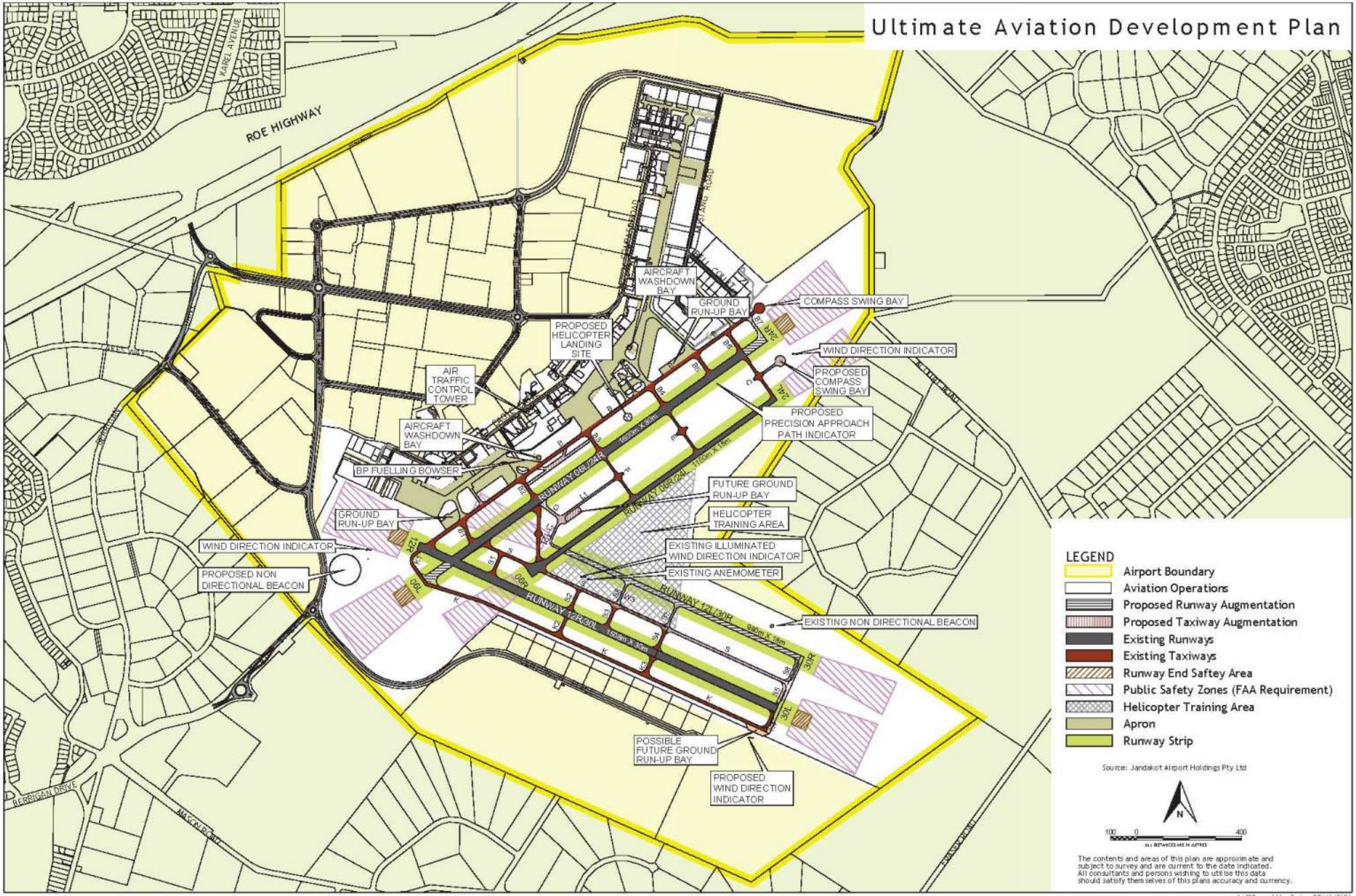


Figure 13: Jandakot Underground Water Pollution Control Area



Jandakot Airport - Local Water Management Strategy
Figure 14: Aviation Development Plan



Potable water

Jandakot Airport estate is connected to the Water Corporation's Integrated Water Supply System (IWSS) via two metered connections at the northern and southern boundaries of the airport. Both metered connections are fed directly into storage tanks fitted with booster pumps which are subsequently connected to the internal main line. The booster pumps have been installed to maintain and regulate the internal mains reticulation pressure during peak demand periods and fluctuating Water Corporation service pressures/flows.

Well Head Protection Zones

The Jandakot Airport estate contains part of a Well Head Protection Zone (WHPZ) associated with Water Corporation drinking water production bores J150 and J160. The WHPZ extends into precincts 1 and 3, is largely vegetated and contains no significant infrastructure.

Drainage

The prevailing soil conditions of highly permeable sands lend themselves to on-site stormwater disposal. Additionally, it is desirable to maximise recharge of the Jandakot groundwater system through promotion of infiltration at source wherever possible.

All existing lots within the Jandakot Airport estate manage stormwater on-site through provision of onsite retention of 5% annual exceedance probability event (AEP) storm events without ponding through use of soakwells or small infiltration areas within their respective lots. Developments are also required to attenuate the 1% exceedance probability event (AEP) storm event although some short duration ponding is accepted in these events. Larger storm events discharge into road reserves and are directed to open drains/swales and/or drainage basins.

Roads and aviation areas of the Jandakot Airport estate are served by a combination of open and piped drains connected to a small number of stormwater infiltration basins. Ponding within these basins rarely occurs even during large storm events with all existing stormwater basins observed to hold water for short periods after sustained rainfall of high intensity, avoiding the creation of habitats that might otherwise attract water birds (JAH 2014).

Treatment of stormwater run-off from paved areas, including runways and taxiways is provided through adjacent grassed areas or 'buffer strips' prior to discharge into the piped drainage system. The existing underground pipe network discharges to an open drain between the central and southern aprons, which directs flows to the basin at the northeastern end of the airport.

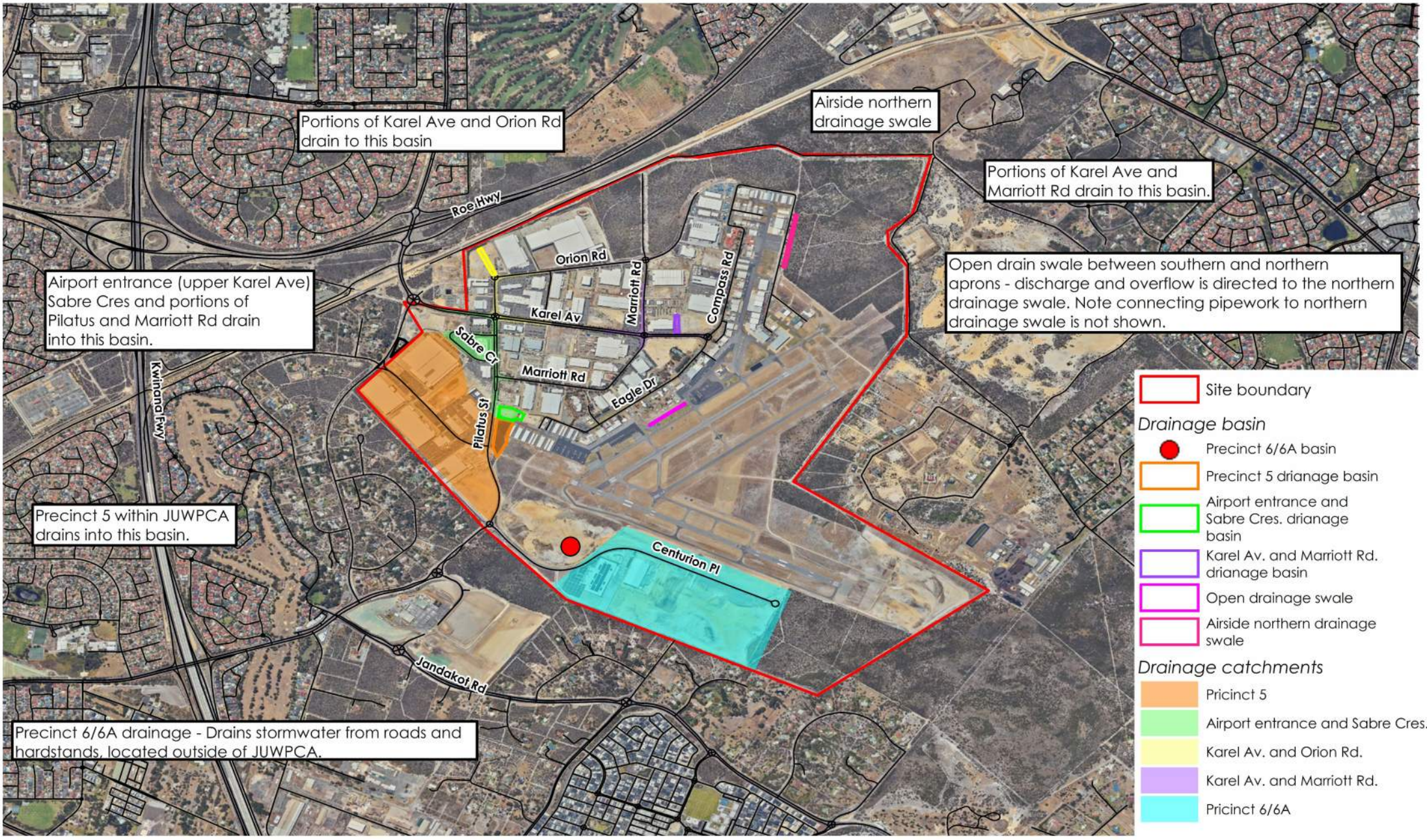
Drainage from aircraft wash bays is managed consistent with the Jandakot Airport Equipment and Washdown Policy, which requires appropriate treatment and disposal of water including the use of approved interceptors and/or separators. Similarly, stormwater drainage from fixed refuelling areas is captured and discharged via purpose-built plate separators or interceptor pits.

Within the JUWPCA stormwater management aims to promote infiltration at source for all stormwater collected from clean roof surfaces within all lots except where rainwater tanks are used. Stormwater from all roads, carparks and external hardstands within the JUWPCA is discharged via piped drainage networks into drainage basins located outside of the JUWPCA boundary and sized to cater for the 1:100 year/24hr ARI storm event.

Existing stormwater infiltration basins and their catchment areas are presented in Figure 15.

Jandakot Airport - Local water management strategy

Figure 15: Drainage catchment areas



Data source: Landgate, Jandakot Airport. Created by: RM Projection: MGA: zone 50.

0 1,000

metres

Scale 1:25,000

urbaqua

land and water solutions

2.8.5 Spill Avoidance and Contamination Management

Spill management is a critical tool in the prevention of soil and groundwater contamination and is addressed within the GMP as well as a suite of tenant resources, including JAH Policies, available on the JAH website.

Spill management encompasses awareness and training of stakeholders as to spill prevention and control, and the provision of materials and practical skills to attend to spills as and when they occur. Regular communication with tenants and contractors regarding spills, including advice on spill clean-up and training suppliers is undertaken through audits, environmental bulletins, and on-site tenant/contractor meetings.

Clearing under EPBC Act approvals (2009/4796 and 2013/7032) and civil construction activities are managed via the current approved version of the Construction Environment Management Plan (JAH 2015) and includes a Hazardous Materials Management Plan and Environmental Emergency Response Procedures. Examples of specific spill avoidance measures undertaken include, but are not limited to:

- Providing a contractor spill control plan to JAH EM.
- Ensuring fully stocked spill kit is available on refuelling truck(s) and (if applicable) in the vicinity of hazardous material storage area(s).
- Providing a designated bunded storage area.
- Labelling and storing containers holding hazardous substances in an upright position with lids closed in designated bunded storage areas when not in use.

Airport tenants who store chemicals or undertake activities that have the potential to result in environmental harm (including soil or groundwater contamination) are required to develop site-specific CEMPS and OEMPs that include emergency response procedures. Examples of applicable spill avoidance mitigation measures undertaken include, but are not limited to:

- Liquid chemicals, including hydrocarbons, of a volume 205L (44 gallons) or greater, must be stored within impervious bunding designed to contain 110% of the volume of the largest storage vessel (e.g., self-bunded spill pallet).
- If the storage area is not located in a covered area, bunding must have the capacity to allow for heavy rainfall events, preferably with overhead protection to restrict the entry of water.
- Suitably designed drip trays or other containment must be used for volumes less than 205L.
- Appropriate licensing must be obtained where required under legislation (e.g., Dangerous Goods Licence).
- A spill kit that is appropriate for the volume and type of substances stored must be kept on site.

Incidents, Emergencies and Audits

JAH staff, tenants and contractors are required to report all environmental incidents to JAH for investigation. This includes all spills that have the potential to cause environmental harm (i.e., soil and/or groundwater contamination), regardless of volume.

Sites are inspected by JAH staff (or their consultants) for evidence of unreported spills during tenant audits, formal and informal site inspections and Environmental Site Assessments. Suspected spills are then reported and subsequently investigated as environmental incidents.

The Aerodrome Emergency Plan (AEP) has been developed to ensure effective and efficient arrangements for the response to, and recovery from, an emergency at Jandakot Airport. This

includes emergency response plans for potentially polluting events such as 'fuel and oil spills' and 'hazardous materials'.

JAH reviews tenant auditing/inspection findings on a regular basis to determine if a tenant's environmental risk profile has changed. In accordance with the Jandakot Airport Tenant Environmental Risk Allocation and Auditing Frequency Criteria, potential changes to a tenant's environmental risk profile may result in a change to their audit frequency.

Outcomes and details of incidents, tenant audits and inspections are presented in the JAH Annual Environmental Reports and EPBC Compliance Reports each year. The compliance reports are available on the Jandakot website.

3 WATER MANAGEMENT STRATEGY

Limited future land use change is expected within the Jandakot Airport estate. Existing developed areas of the Jandakot Airport estate will retain their current Airport and mixed business land uses.

The Jandakot Airport Master Plan 2020 identifies Precinct 6 for additional mixed business use development (approximately 43 ha) and Precinct 6A for aviation related development (approximately 10 ha).

This water management strategy has been developed to provide a consolidated approach to water management that is applicable to the ongoing development within Precincts 5, 6 and 6A that continues to be undertaken in accordance with the current 2020 Master Plan and the Jandakot Airport and city leasing and development guidelines.

Water management strategies providing protection to wetland habitats at the Airport have been in place at the Airport since 2015. The change in classification from Resource Enhancement to Conservation Category at wetland 1A (and potentially 2A following more detailed review) (DBCA, 2023) indicates that wetland health has improved since they were last evaluated supporting the conclusion that these strategies have been successful. Therefore, no substantial changes to management strategies are proposed in response to this change.

3.1 Objectives for water management

Water management objectives for the site have been developed with consideration of site-specific issues identified in Section 2. The objectives identified are also informed by statutory requirements, relevant policies, by-laws and guidelines including overarching objectives from the draft *Planning for Water Guidelines* (WAPC, 2021).

The site-specific water management objectives are focussed on protection of public drinking water resources within the JUWPCA and maintaining the economic sustainability of Jandakot Airport into the future. Water management objectives are identified as follows:

- Prevent pollution of groundwater within the JUWPCA;
- Contribute to improving the health and sustainability of the Jandakot groundwater system and the wetland habitats it supports;
- Provide a local drainage system with an appropriate level of amenity and safety during storm events; and
- Ensure the efficient use and re-use of water resources.

3.2 Prevent pollution of groundwater within the JUWPCA

Key strategies are identified that are appropriate to achieve this objective are as follows:

- Implementation of the Local Water Management Strategy and Groundwater Management Plan.
- No bulk storage of potentially polluting chemicals within the JUWPCA.
- Development of Construction Environmental Management Plans (CEMPs), Demolition Environmental Management Plans and Operational Environmental Management Plans (OEMPs) to reduce the risk of pollution on tenant sites.
- Undertaking tenant audits and inspections.
- Training and awareness programs (e.g., Site inductions, Tenant Environmental Handbook, spill response training, etc.).

- Mandatory reporting of all spills greater than 2L and all spills that have the potential to result in environmental harm (regardless of volume).
- Prior to the expiry, transfer or termination of a tenant lease or licence, an environmental site assessment is undertaken if the activities of the tenant are determined to have resulted in possible soil or groundwater contamination.
- All new developments are to be connected to reticulated sewerage. Caffeine testing will detect sewerage contamination to groundwater, as detailed in Section 4.1.
- All existing buildings to be connected to reticulated sewerage by end of 2028 (excluding facilities where connection to reticulated sewerage is not feasible).

All lots within precincts 6 and 6A will be connected to reticulated sewerage via a local precinct gravity sewer network discharging to a new sewer pump station, to be located on the eastern boundary of Precinct 6. This Precinct 6 pump station will discharge the sewer via a pressure main into the existing gravity sewer within Orion Road. Once within the existing Orion Road gravity sewer network, it will discharge into the existing Wastewater Pump Station.

3.3 Contribute to improving the health and sustainability of the Jandakot groundwater system and the wetland habitats it supports

Key strategies are identified that are appropriate to achieve this objective are as follows:

- Any construction activity expected to require temporary or permanent dewatering requires consideration and investigation of acid sulfate soils.
- Maximise local recharge to the superficial groundwater aquifer through the use of distributed stormwater infiltration systems.
- Adopt a risk management approach to stormwater management for each land use:
- Infiltrate uncontaminated stormwater runoff from roofs, paths and landscaped areas at source using soakwells, permeable paving or through direction of runoff to adjacent pervious areas.
- Provide treatment of stormwater runoff from low-risk areas of roads and hardstand areas in vegetated swales and buffer strips.
- Manage stormwater quality from higher risk areas through appropriate treatment devices such as interceptors and/or separators.
- Street sweeping is to be implemented when warranted to reduce entrainment of contaminants via stormwater and to improve the efficiencies of the retention systems.
- Reduce groundwater demand through waterwise (preferably locally native) species selection, improved irrigation efficiency and hydro-zoning, and use of alternative water sources wherever possible.
- Minimise the use of fertilisers and pesticides in public and private open spaces.

3.4 Provide a local drainage system with an appropriate level of amenity and safety during storm events

The design of on-site drainage systems will be undertaken applying the following strategies:

- Provide a minimum of 300 mm clearance for habitable floors from flooding in the 1:100-year Average Recurrence Interval (ARI) event in roads and the drainage system.
- All lots to provide of onsite retention of 1:20 year ARI storm events without ponding through use of soakwells or infiltration areas within their respective lots.
- All lots to provide onsite attenuation of the 1:100 year/24 hr ARI storm event with overflows directed to road reserves and open drains/swales and/or drainage basins.
- Design developments such that roads are trafficable during the 1:20 year ARI flood event.

- Minimise ponding in all areas to avoid the creation of habitats that might attract water birds.
- Wherever applicable incorporate adjacent grass areas or buffer strips for stormwater discharge into the design of paved areas.
- Manage drainage from wash bays consistent with the Jandakot Airport Equipment and Washdown Policy, which requires appropriate treatment and disposal of water including the use of approved interceptors and/or separators.
- Design stormwater drainage from fixed refuelling areas to capture and discharge via purpose-built plate separators or interceptor pits.

Additionally (or alternatively if applicable), within the JUWPCA:

- Promote infiltration at source for all stormwater collected from clean roof surfaces within all lots except where rainwater tanks are used.
- Collect and convey stormwater from all roads, carparks and external hardstands within the JUWPCA via piped drainage networks into drainage basins located outside of the JUWPCA boundary.
- Stormwater from taxiways and runways will be discharged in adjacent swales and grassed verges.

All lots within Precincts 5, 6 and 6A are required to promote at source infiltration consistent with these stormwater management strategies. A new drainage basin was constructed in 2017 (Figure 15) and sized to cater for the 1:100 year/24hr ARI storm event in Precinct 6 and 6A.

Engineering designs for Precinct 5, 6 and 6A are provided in Appendix 3.

3.4.1 Mosquito control

Consistent with the need to avoid creation of areas of standing water within the Airport vicinity that might attract birds and thereby increase bird-strike risks, the study area does not contain mosquito breeding sites. However, mosquito breeding sites can occur in relatively small areas of standing water that may not be large or long-lived enough to attract birds. In the context of the development mosquito breeding can be controlled in the future urban environment by ensuring:

- Shallow areas of standing water drain within three days of filling;
- Areas of standing water are free from depressions, potholes and related irregularities;
- Bank gradients are steep enough not to trap pockets of stagnant water;
- Weeds are controlled in open drains and areas of standing water; and
- Drainage infrastructure and public open space areas will be designed to avoid the creation of new mosquito breeding sites.

The key strategy for the development is the prevention of standing water in drainage swales and treatment areas.

Where possible the inverts of open drains and culverts will be designed to be free draining with a minimum longitudinal grade of 1:1000. Where it is necessary to provide water storage below the invert of downstream stormwater infrastructure for water quality management or hydraulic controls then subsoil drainage will be provided no more than 500mm below the invert of the storage area to ensure drainage of the area will occur within a reasonable timeframe.

Regular inspections and maintenance (culvert and swale clearing) to avoid blockages and ponding should ensure adequate drainage and prevent occurrences of standing water.

3.5 Efficient use and re-use of water resources

The following targets and strategies are proposed:

- Groundwater use for irrigation should not exceed 7,500 kl/ha of irrigated open space.
- Promotion of water efficiency actions and appliances to existing and future tenants including the use of rainwater tanks for non-potable water demands where feasible.
- Water efficient appliances, fixtures and fittings to be promoted for use in all buildings.
- Waterwise landscaping and irrigation to be promoted in landscaped areas, consistent with the Jandakot Airport Landscape Design Guidelines.

3.5.1 Potable water

All lots within precincts 6 and 6A will be connected to the Water Corporation's Integrated Water Supply System via DN200 water mains which are to be connected into the existing Pilatus Street water reticulation network. It is not considered useful to undertake a potable water demand assessment for existing or proposed parts of the Jandakot Airport estate since the demand is highly variable and dependent on individual lot tenants and their businesses.

3.5.2 Non-Potable water

Non-potable water demand within the Jandakot Airport estate is restricted to areas of landscaping which are irrigated using groundwater abstracted under JAH current groundwater licence (GWL95741(5)). The license is held for 225,000 Kl of groundwater from the superficial aquifer based on a rate of 7,500 Kl/ha of irrigated lawn/garden area.

Groundwater abstraction was 151,793 Kl in 2021/22 which is within the licensed allocation limit. and is a 6.56% decrease from 2020/21 (162,453 Kl). Both airside and landside irrigation met the 7,500 kL/ha target rate in 2021/22 but commercial irrigation exceeded the target significantly and so the total groundwater use for irrigation was above the target 8,336 Kl/ha. Therefore, in future it will be necessary to focus on improving irrigation efficiency in commercial areas.

To address the objectives outlined in Section 3.1 and site-specific constraints Jandakot Airport Holdings will implement the following strategies and commitments specifically in relation to groundwater demand management:

- Engagement of turf/landscaping professionals for soil testing and advice on matters such as wetting agents, irrigation design and watering rates, and fertilisers.
- Ongoing review and improvement in order to
- abstract within the licenced limit; and
- work towards achieving an irrigation rate of 7,500Kl/ha.
- Recording of monthly meter readings from all metered bores.
- Compliance with the winter sprinkler ban (1 June to 31 August each year) except for the use of water required for construction purposes, bore testing and the establishment of new lawns and gardens.
- Implement a water quality sampling program to ensure abstracted water is suitable for irrigation purposes.

4 IMPLEMENTATION

The success of the water management strategies outlined in this document depends on their implementation.

4.1 Monitoring

4.1.1 Surface water

As there are no natural drainage channels or defined areas of surface water, surface water monitoring is unachievable.

Monitoring to capture potential water quality impacts from stormwater infiltration systems is undertaken by positioning groundwater monitoring bores at locations down gradient from the points of discharge/infiltration.

4.1.2 Groundwater

The purpose of the groundwater monitoring program is to:

- Establish baseline groundwater conditions against which future changes/trends can be measured.
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

Groundwater monitoring is undertaken by suitably qualified professional consultants.

Monitoring Bore Locations

Nine groundwater monitoring bores were installed at Jandakot Airport in February 2012. Following consultation with DWER, a further two bores (JAMB10 and JAMB11) were installed in December 2013 to monitor groundwater quality immediately downgradient to stormwater infiltration basins located to the east of the JUWPCA boundary in the eastern portion of Precinct 5 with JAMB2 and JAMB3 providing additional coverage. Following construction of the Precinct 6/6A stormwater infiltration basin and based on its currently proposed location, it is considered that JAMB4 will provide suitable downgradient monitoring coverage. These groundwater monitoring bores (11 in total) are shown in Figure 7.

Caffeine monitoring has been added to five key locations across the site for future events as an additional assurance to detect any seepage from septic tanks or ATU systems. Caffeine samples will be taken at five bores located up-gradient and down-gradient of existing septics and ATU systems. Up-gradient bores (JAMB6 and SWB001) and downgradient bores (JAMB2B, ADC1, and Aero 2) are shown on Figure 7.

Additional bores may be installed if warranted in future, depending on the infrastructure developed and the activities undertaken. Similarly, where existing bores are determined by the groundwater monitoring consultant to be immaterial or irrelevant in their contribution towards the purpose of the groundwater monitoring program, those bores may be omitted from the groundwater monitoring program or sampled at an amended frequency.

Sampling Frequency

To establish baseline groundwater conditions JAMB1-JAMB9 were sampled quarterly for two years (i.e., a minimum of 8 sampling events during 2012 and 2013). Urbaqua (previously Essential

Environmental) reviewed these monitoring results and determined there were no issues that warranted ongoing quarterly investigation, changing to biannually from 2014 onwards.

Ongoing monitoring occurs biannually in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels.

The addition of bores JAMB10 and JAMB11 were sampled concurrently with the established sampling regime, and any additional monitoring bores installed from here on will also be sampled biannually, unless results (any significant exceedances of the appropriate guidelines) warrant further investigation as deemed critical by the environmental consultant and JAH.

Suite of Analytes and Assessment Levels

The suite of analytes and relevant assessment levels that will be applied to the groundwater sampling program are detailed in Table 6.

Under the *Airports (Environmental Protection) Regulations 1997*, the accepted statutory limits of water pollution are defined in Schedule 2. Whilst Schedule 2 remains the statutory document, assessment levels (or 'trigger values') have been developed for the monitoring program to consider local and site-specific baseline conditions when interpreting and reporting groundwater monitoring results.

When developing trigger values for water quality, *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG, 2018) recommend the use of the 90th percentile of an observed control site where the aim is to maintain water quality.

The data collected facilitated a review of assessment levels to adopt more appropriate, revised assessment levels for a number of analytes based on observed control upgradient sites. This is particularly relevant for nutrients and electrical conductivity since none of the previously applied targets have considered the typical range of concentrations found in Swan Coastal Plain shallow aquifer groundwater systems.

Revised assessment levels have been adopted for Total Nitrogen, Total Phosphorous, pH, Electrical Conductivity, Aluminium, Cadmium, Zinc, Lead and Iron based on the 90th percentile of collected groundwater data from ten monitoring events (March 2012 to September 2014) at bores JAMB5, 6, 7, 8 & 9 which are all located upgradient of infrastructure and operations on the Jandakot Airport estate and may therefore be considered 'observed control sites' consistent with the recommendations of ANZG 2018.

Under Part 5 Division 1 of the Regulations, the airport-lessee company (i.e., JAH) may propose a substitute standard that is applicable to the site if the existing standard defined in a Schedule to the Regulations is inappropriate, thereby establishing a 'local standard'. Whilst JAH does not intend to formally establish a local standard in the immediate future (noting it is lengthy process and rarely undertaken), it will consider the possibility at a future time and determine, following liaison with DITRDCA, if warranted.

QA/QC

All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g., AS 5667). Analysis of samples should be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed.

Reporting

Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e., within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented.

Where an exceedance of assessment level is reported, JAH will advise the DITRDCA Airport Environment Officer (AEO) within 14 days. The AEO (in consultation as necessary with JAH and the consultant undertaking groundwater monitoring) will determine if the nature of contamination is of a level that requires further action or for other agencies to be notified prior to the distribution of the Annual Report.

Groundwater monitoring results will be maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event. Note that an interim GME report is not warranted if the draft Annual Report, as detailed below, is provided to the JAH Environment Manager within 8 weeks of the final GME of the Financial Year.

Consultants undertaking the Annual Groundwater Monitoring Program will prepare an Annual Report, which details the results of monitoring undertaken as described within this plan.

The Annual Monitoring Report will be submitted by 28 October each year to DCCEEW, DITRDCA, DWER and the Water Corporation and contain the following:

- An Executive Summary.
- An Introduction.
- Methodology.
- Results, including interpretation, tabular and graphical reporting of results, analysis of long-term trends and comparison with any other relevant regional data that is available from DWER and/or Water Corporation.
- Conclusions and Recommendations, including recommended changes to the sampling plan and/or assessment levels.
- QA/QC, including a validation of the analytical data by a critical review of all QA/QC processes.

Amendment of Groundwater Sampling Program

The bores sampled, sampling frequency and/or suite of analytes may be reviewed and amended from time to time when warranted.

Changes that increase the sampling frequency or suite of analytes may occur at any time based on the recommendation of the groundwater consultant engaged to undertake the groundwater monitoring program.

Any proposed changes in sampling frequency, suite of analytes or assessment levels will be proposed and justified within either a GME interim report or the Annual Groundwater Monitoring Report. Key stakeholders will be asked to comment on proposed changes prior to the changes being implemented.

Auditing of Groundwater Monitoring

The Annual Groundwater Monitoring Reports are provided to key stakeholders and regulators annually for review and comment. This process allows for expert peer review, which may result in changes and/or improvements to the monitoring program.

Independent auditing of the groundwater monitoring program (including results and reports) will be undertaken every five years. Previous audits were conducted by GreenCap in November 2017 and June 2023, respectively. Upcoming five yearly independent audits are planned for 2027 and 2032.

The audit report will be provided to key stakeholders for review and comment. Table 5 below provides information on previous audits undertaken by an independent auditor and a proposed schedule for future independent audits of the groundwater monitoring program.

Table 5: Audit Schedule

Audit	Auditor/Timing
Past audit of: • Annual Groundwater Monitoring Report, August 2013 (Pendragon Environmental Solutions) • 2013-2014 Annual Groundwater Monitoring Report, Jandakot Airport, WA, 20 October 2014 (Coffey Environments Australia Pty Ltd) • 2014-2015 Annual Groundwater Monitoring Report, Jandakot Airport, WA, 30 September 2015 (Coffey Environments Australia Pty Ltd) • 2015-16 Annual Groundwater Monitoring Report, September 2016 (Essential Environmental [now Urbaqua]) • 2016-17 Annual Groundwater Monitoring Report, September 2017 (Essential Environmental [now Urbaqua])	GreenCap, November 2017
Past audit of Urbaqua monitoring reports: • 2017-2018 Annual Monitoring Report • 2018-2019 Annual Monitoring Report • 2019-2020 Annual Monitoring Report • 2020-2021 Annual Monitoring Report • 2021-2022 Annual Monitoring Report	GreenCap, June 2023
Audit of future groundwater monitoring reports	Every 5 years, next due 2027 following the 2026-27 annual groundwater monitoring report

Table 6: Ground Water Assessment Levels

Parameter	Unit	A(EP)R 1997 Schedule 2	Adopted assessment Level
On Site Field Measurements			
Rainfall	mm	n/a	n/a
Depth to Groundwater Level	mtoc	n/a	n/a
Groundwater Level	mAHD	n/a	n/a
pH	Units	6.5-9.0	3.5-9.0
Temperature	˚C	>2 above seasonal mean	>2 above seasonal mean
Electrical Conductivity (EC)	µS/cm	1,000	120-440
Dissolved Oxygen (DO)	%	>80	>80
	mg/L	>6	>6

Parameter	Unit	A(EP)R 1997 Schedule 2	Adopted assessment Level
Laboratory Analysis			
Electrical Conductivity (EC)	µS/cm	n/a	120-480
Total Dissolved Solids	mg/L	<1000 or 5% increase	<1000 or 5% increase
Total Acidity (as CaCo3)	mg/L	n/a	60
Net Acidity (Tacid-Talk as CaCo3)	mg/L	n/a	60
Chloride (Cl)	mg/L	n/a	250
Sulphate (SO4)	mg/L	n/a	500
Hardness (as CaCo3)	mg/L	n/a	n/a
Caffeine	mg/L	n/a	An increase at down-gradient bores JAMB2B, ADC1 or Aero 2 compared to up-gradient bores
Nutrients			
Phosphorus (P)	mg/L	0.01	0.12
Nitrogen (N)	mg/L	0.1	6.39
Heavy Metals			
Aluminium	mg/L	0.1	3.34
Arsenic	mg/L	0.05	0.05
Cadmium	mg/L	0.0002	0.0002
Chromium	mg/L	0.01	0.01
Copper	mg/L	0.002	0.003
Iron	mg/L	1	1.45
Lead	mg/L	0.001	0.003
Nickel	mg/L	0.015	0.015
Zinc	mg/L	0.005	0.019
Total Petroleum Hydrocarbons			
Fuel (C6-C9 fractions)	mg/L	0.15	0.15
Mineral Oil (>C9 fractions)	mg/L	0.6	0.6
Monocyclic Aromatic Compounds			
Benzene	mg/L	0.3	<0.001
Toluene	mg/L	0.3	0.025
Ethylbenzene	mg/L	0.14	0.003
Xylene	mg/L	n/a	0.02

- *Values in RED are assessment levels adopted based on the 90th percentile of collected groundwater data (March 2012 – September 2014) at observed control sites consistent with the recommendations of ANZG 2018*
- *Values in BLUE adopted from ADWG as requested by the WA Department of Health*
- *On site measurements are to be undertaken with appropriately calibrated equipment (certificates to be provided within AGMR)*

4.2 Delivery

Key tasks, roles and responsibilities relating to delivery of urban water management objectives are outlined in Table 7.

Table 7: Summary of roles and responsibilities

Task		Responsibility	Timing
01	Implementation of the LWMS and GMP.	JAH	Ongoing
02	Development and implementation of Construction Environmental Management Plans (CEMPs), Demolition Environmental Management Plans and Operational Environmental Management Plans (OEMPs) to reduce the risk of pollution on tenant sites.	All relevant tenants and contractors, facilitated by JAH	Ongoing
03	Undertaking tenant audits and inspections.	JAH	Ongoing
04	Training and awareness programs (e.g., Site inductions, Tenant Environmental Handbook, spill response training, etc.).	JAH	Ongoing
05	Reporting of all spills greater than 2L and all spills that have the potential to result in environmental harm (regardless of volume).	All relevant tenants and contractors, facilitated by JAH	Ongoing
06	Environmental site assessment where the activities of the tenant are determined to have resulted in possible soil or groundwater contamination.	All relevant tenants and contractors, facilitated by JAH	Prior to expiry, transfer or termination of a tenant lease or licence,
07	Connection of new developments to reticulated sewerage.	JAH	Ongoing
08	Connection of existing buildings to reticulated sewerage by end of 2028 (excluding facilities where connection to reticulated sewerage is not feasible).	All relevant tenants, facilitated by JAH	Ongoing
09	Investigate Acid Sulfate Soils in line with DWER guidelines and triggers.	Proponent, facilitated by JAH	Prior to any action that triggers a requirement for investigation.
10	Design and construction of lot scale drainage systems consistent with the LWMS.	Proponent, facilitated by JAH	Ongoing
11	Design and construction of lot scale landscaping and irrigation systems consistent with the LWMS.	Proponent, facilitated by JAH	Ongoing
12	Design and construction of precinct drainage systems consistent with the LWMS.	JAH	Ongoing
13	Provide an annual groundwater abstraction report, containing abstraction volumes obtained from monthly meter readings, to DWER.	JAH	Annually, ongoing
14	Provide an annual groundwater monitoring report, containing abstraction volumes obtained from monthly meter readings, to DCCEEW, DITRDCA, DWER and the Water Corporation.	JAH	Annually, ongoing

4.3 Review

This Local Water Management Strategy has been prepared in support of Jandakot Airport developments within the JUWPCA.

The document should be revised and updated in the future should development vary significantly from that proposed within Master Plan 2020 or the development of additional precincts be proposed.

5 REFERENCES AND RESOURCES

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6 ACRONYMS AND ABBREVIATIONS

A(EP)R	Airports (Environment Protection) Regulations 1997
AHD	Australian Height Datum
AEO	Airport Environment Officer: a statutory office holder appointed by the Secretary of DITRDCA and is responsible for the day-to-day administration of the Airports (Environment Protection) Regulations 1997.
AER	Annual Environment Report: annual report outlining the performance of Jandakot Airport Holdings in the environmental management of the estate.
AL	Assessment Levels (relating to criteria defined in the Jandakot Airport Groundwater Management Plan)
ANZG 2018	Updated version of Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Formerly ANZECC & ARMCANZ (2000))
ASS	Acid Sulfate Soils
BTEX	An acronym that stands for benzene, toluene, ethylbenzene, and xylenes. These compounds are some of the volatile organic compounds (VOCs) found in petroleum derivatives.
CEMP	Construction Environmental Management Plan: a document to be submitted by a proponent to an operator of undertaking prior to the construction of major and minor projects on the estate.
CMP	Conservation Management Plan
DBCA	WA Department of Biodiversity, Conservation and Attractions (Previously DPAW, DEC and CALM).
DITRDCA	Department of Infrastructure, Transport, Regional Development, Communications and the Arts (Formerly DIRDC, DIRD and DIT), the Commonwealth department that administers domestic and international aviation legislation and policies and is responsible for developing and implementing the regulatory regime for federally leased airports. The DITRDCA is responsible for appointing and overseeing the role of the AEO.
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Formerly DoE, DoEE, DAWE and DEWHA)
DWER	WA Department of Water and Environmental Regulation (Formerly DER and DoW).
EMP	Environmental Management Plan: a procedure that identifies potential impacts and methodologies necessary to prevent or mitigate environmental impacts.
EMS	Environmental Management System: a system of implementation to support the Environmental Management Framework.
EPBC	*Environment Protection and Biodiversity Conservation Act, (1999):* Commonwealth Act that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.
ESR	Environmental Site Register: In accordance with Section 6.02 of the Airports (Environment Protection) Regulations 1997, JAH maintains a written record

	of the environmental condition of the estate and its general environmental management.
GME	Groundwater Monitoring Event
GMP	Groundwater Management Plan
JUWPCA	Jandakot Underground Water Pollution Control Area
LOR	Limit of Reporting
LWMS	Local Water Management Strategy
OEMP	Operational Environment Management Plan: a document that identifies the environmental risks (and legal obligations) associated with day-to-day operations of a business and specifies the actions to mitigate environmental risks.
TPH	Total Petroleum Hydrocarbons: measure of the concentration or mass of petroleum hydrocarbon constituents present, in a given amount of soil or water.

Appendix 1 Conditions of Approval Reference Table

The table below summarises compliance with EPBC 2009/4796 and EPBC 2013/7032 conditions of approval during the 2021/22 reporting period.

EPBC 2013/7032 Cond.	**EPBC 2009/4796 Cond.**	**Plan reference**	**Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements**
2. To mitigate the impacts to the environment from an action on Commonwealth land, in particular the Jandakot Groundwater Mound, the person taking the action must prepare and submit a revised Groundwater Management Plan to the Minister for approval. The revised plan must be submitted at least 3 months prior to commencement of the action. The revised plan must include, but not limited to:	7. The person taking the action must develop and submit a Jandakot Groundwater Mound Management Plan which must include but not be limited to:	All sections	Compliant The Jandakot Airport Groundwater Management Plan had already been submitted and approved by the Minister. Minor amendments (v4 3/7/12) were approved by the Minister in 2012. The GMP was further reviewed and amended in early 2014 and submitted to DOEE for approval in July 2014. Following approval of EPBC 2013/7032, JAH made further amendments to the GMP (including reviewing and amending the local water management strategy) to address the requirements of both EPBC 2009/4796 and EPBC 2013/7032 within a single document. This GMP (v5.4) was submitted 4/3/15 and approved 24/7/15, with the DOEE confirming that it satisfied the requirements of condition 7. A minor amendment (raised with DOEE 21/10/15) to the GMP (v5.5) was submitted 1/2/16 and approved 14/3/16, with the DOEE confirming that it satisfied the requirements of condition 7. The GMP was reviewed and amended in 2018 and submitted to DOEE 21/12/18. The amended GMP (v5.6) was approved by DOEE 19/7/19.
a) the introduction of a sewerage system;	f) The introduction of a sewerage system	Sections 2.8.4 and 3.2	
b) provision of groundwater monitoring reports to the Western Australian Department of Water[2] and Water Corporation;	b) provision of groundwater monitoring reports to the Western Australian	Section 4.1	

[2] Note, now Department of Water and Environmental Regulation

	Department of Water and Water Corporation;		The approved GMP (v5.6) that addresses condition 7 of EPBC 2009/4796 and Condition 2 of EPBC 2013/7032 is published on the JAH website: http://www.jandakotairport.com.au/environment/environment-plans.html
c) a water management strategy, specifically designed for precincts 6 and 6A;		Entire LWMS (or specifically Section 2.8.5)	
	c) Address all relevant measures included in the Local Water Management Strategy;	All sections	
d) schedules for the independent audit of groundwater monitoring results and reports;	d) schedules for the independent audit of groundwater monitoring results and reports;	Section 4.1.2, subheading 'Auditing'	
e) spill avoidance, management and rehabilitation measures and procedures;	e) spill avoidance, management and rehabilitation measures and procedures;	Section 3.2	
f) groundwater monitoring; and	a) groundwater monitoring and reporting;	Sections 2.4 and 4.1	
g) acceptable development types.		Section 1.5.1	

Appendix 2 2021-2022 Annual Groundwater Monitoring Report Results

September 2021

	Parameter	Unit	LoR	Trigger*	Assessment levels**	JAMB1	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6	JAMB7B	JAMB8	JAMB9	JAMB10	JAMB11
	sample date					22/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021	21/09/2021	21/09/2021	21/09/2021	22/09/2021
In-situ field measurements	depth to water	m toc	-	-	-	3.97	10.74	8.87	4.63	2.655	6.44	2.8	3.745	3.505	3.63	4.135
	TOC	mAHD	-	-	-	28.756	34.709	32.500	29.739	28.433	32.530	28.754	29.282	28.064	28.713	29.114
	Water level	mAHD				24.786	23.969	23.630	25.109	25.778	26.090	25.954	25.537	24.559	25.083	24.979
	pH		-	6.5-9.0	3.5-9.0	4.77	4.4	5.28	5.4	4.23	6.61	3.84	3.58	4.32	5.51	5.68
	temp	°C	-	-	-	21.8	20.4	19.9	20.7	19.3	19.9	19.9	20	18.6	16.2	26.3
	EC	µS/cm	-	1000	120-440	219.3	285.5	98.2	555	227.6	387.8	611	311.7	464	122.7	121.3
	DO	mg/L	-	>6	>6	0.24	0.56	8.09	2.7	0.32	6.11	0.47	1.93	0.39	4.28	5.42
	TDS	mg/L	-	-	-	142.35	185.9	63.7	357.5	148.2	252.2	396.5	202.8	301.6	79.95	78.65
	Redox potential	mV	-	-	-	127	99.2	139.7	129.1	91.3	140	161	143.8	100.6	121.1	160.2
Laboratory analysis	EC	µS/cm	10	-	120-480	**230**	**300**	**100**	**570**	**240**	**390**	**630**	**320**	**480**	**130**	**130**
	TDS	mg/L	5	<1000 or 5% increase	<1000 or 5% increase	**140**	**180**	**60**	**320**	**140**	**230**	**280**	**190**	**290**	**78**	**78**
	total acidity	mgCaCO3/L	5	-	60	**100**	**140**	**10**	**88**	**120**	**19**	**85**	**110**	**60**	**27**	**22**
	Alkalinity	mgCaCO3/L	5	-	-	**20**	**11**	**6**	**64**	**6**	**120**	<5	<5	<5	<5	**25**
	net acidity	mgCaCO3/L	5	-	60	**80**	**130**	<5	**24**	**110**	<5	**85**	**110**	**60**	**26**	<5
	chloride	mg/L	5	-	250	**37**	**42**	**20**	**48**	**34**	**25**	**160**	**86**	**96**	**18**	**19**
	sulfate	mg/L	1	-	500	**18**	**41**	**4**	**78**	**37**	**25**	**47**	**10**	**96**	**5**	**3**
	hardness	mg/L	5	-	-	**32**	**74**	**25**	**170**	**32**	**150**	**65**	**35**	**100**	**20**	**32**
Nutrients	TN	mg/L	0.2	0.10	6.39	**1.1**	**1.1**	**0.4**	**17.0**	**1.9**	**3.7**	**1.1**	**2.4**	**0.3**	**0.6**	**0.4**
	TP	mg/L	0.01	0.01	0.12	**0.09**	**0.07**	**0.49**	**0.10**	**0.13**	**0.07**	**0.1**	**0.12**	**0.58**	**0.04**	**0.03**
Dissolved Metals	aluminium	mg/L	0.01	0.1	3.34	**0.43**	**0.18**	<0.01	**0.28**	**1.4**	<0.01	**1.2**	**0.5**	**0.32**	<0.01	**0.12**
	arsenic	mg/L	0.001	0.05	0.05	**0.001**	<0.001	<0.001	<0.001	<0.001	<0.001	**0.002**	<0.001	<0.001	<0.001	<0.001
	cadmium	mg/L	0.0001	0.0002	0.0002	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	chromium	mg/L	0.001	0.01	0.01	**0.001**	<0.001	<0.001	**0.003**	**0.001**	<0.001	<0.001	**0.001**	<0.001	<0.001	**0.001**
	copper	mg/L	0.001	0.002	0.003	<0.001	<0.001	<0.001	**0.001**	<0.001	<0.001	**0.002**	**0.001**	<0.001	<0.001	<0.001
	iron	mg/L	0.01	1.00	1.45	**0.18**	**0.78**	<0.01	**0.07**	**0.31**	<0.01	**0.56**	**0.16**	**0.07**	<0.01	<0.01
	lead	mg/L	0.001	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.001**	**0.001**	<0.001	<0.001	<0.001
	nickel	mg/L	0.001	0.015	0.015	<0.001	**0.001**	<0.001	**0.002**	**0.001**	<0.001	**0.006**	**0.001**	<0.001	<0.001	<0.001
	zinc	mg/L	0.005	0.005	0.019	<0.005	<0.005	<0.005	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
TPH Fractions	TPH C6-C9	mg/L	0.02	0.15	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	TPH C10-C14	mg/L	0.02	0.6	0.6	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	TPH C15-C28	mg/L	0.04	0.6	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
	TPH C29-C36	mg/L	0.04	0.6	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
	TPH >36	mg/L	0.04	0.6	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
BTEX	Benzene	mg/L	0.001	0.3	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Toluene	mg/L	0.001	0.3	0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Ethyl benzene	mg/L	0.001	0.14	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Xylene	mg/L	0.003	-	0.02	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

***A(EP)R (1997) Schedule 2 Water pollution - accepted limits**

**** Site specific adopted assessment levels of the Jandakot Groundwater Management Plan v5.6**

1	Values highlighted indicate values reported above Laboratory LOR
1	Values highlighted indicate exceedances of A(EP)R (1997) Schedule 2
2	Values highlighted indicate exceedances of Interim Assessment Levels (JA GMP v5.6, 2019)

March 2022

	Parameter	Unit	LoR	Trigger*	Assessment levels**	JAMB1	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6	JAMB7B	JAMB8	JAMB9	JAMB10	JAMB11
	sample date					16/03/2022	16/03/2022	16/03/2022	18/03/2022	17/03/2022	17/03/2022	17/03/2022	18/03/2022	18/03/2022	16/03/2022	16/03/2022
In-situ field measurements	depth to water	m toc	-	-	-	4.63	11.2	9.23	5.205	3.22	7.04	3.52	4.335	4.18	4.37	4.86
	TOC	mAHD	-	-	-	28.756	34.709	32.500	29.739	28.433	32.530	28.754	29.282	28.064	28.713	29.114
	Water level	mAHD				24.126	23.509	23.270	24.534	25.213	25.490	25.234	24.947	23.884	24.343	24.254
	pH		-	6.5-9.0	3.5-9.0	5.33	4.86	5.52	5.87	4.8	6.16	4.44	4.05	4.85	6.04	6.27
	temp	°C	-	-	-	24.6	23	22.7	23.4	21.9	24.5	24	22.7	20.2	22.5	21.9
	EC	µS/cm	-	1000	120-440	303.3	295.2	269.7	565	211.3	446	516	302.2	226.2	128.6	171.4
	DO	mg/L	-	>6	>6	4.56	1.12	5.29	2.71	4.18	3.4	3.48	2.95	4.43	1.36	3.78
	TDS	mg/L	-	-	-	196.9	191.75	175.6	370.5	137.15	289.9	338	196.3	146.9	83.85	111.15
	Redox potential	mV	-	-	-	32.9	-13.3	57.7	-61.7	-17.3	31.9	17.3	-1.8	-9.3	42	44.9
Laboratory analysis	EC	µS/cm	10	-	120-480	**300**	**290**	**260**	**570**	**210**	**440**	**510**	**300**	**220**	**130**	**170**
	TDS	mg/L	5	<1000 or 5% increase	<1000 or 5% increase	**180**	**170**	**160**	**340**	**130**	**260**	**310**	**180**	**130**	**78**	**100**
	total acidity	mgCaCO3/L	5	-	60	**73**	**130**	**33**	**130**	**110**	**33**	**66**	**76**	**41**	**27**	**23**
	Alkalinity	mgCaCO3/L	5	-	-	**23**	**14**	**19**	**130**	**10**	**52**	<5	<5	**24**	**38**	**52**
	net acidity	mgCaCO3/L	5	-	60	**50**	**116**	**14**	<5	**100**	<5	**66**	**76**	**17**	<5	<5
	chloride	mg/L	5	-	250	**72**	**49**	**53**	**72**	**39**	**88**	**130**	**63**	**30**	**18**	**18**
	sulfate	mg/L	1	-	500	**22**	**54**	**25**	**22**	**29**	**16**	**39**	**19**	**46**	<1	**7.4**
	hardness	mg/L	5	-	-	**39**	**70**	**37**	**140**	**32**	**76**	**39**	**36**	**55**	**32**	**48**
Nutrients	TN	mg/L	0.2	0.10	6.39	**3**	**1.1**	**1.8**	**10.0**	**1.9**	**2.5**	**1.3**	**2.4**	**0.3**	**3.4**	**1.2**
	TP	mg/L	0.01	0.01	0.12	**0.34**	**0.13**	**0.26**	**0.05**	**0.13**	**0.1**	**0.09**	**0.1**	**0.35**	**0.05**	**0.08**
Dissolved Metals	aluminium	mg/L	0.01	0.1	3.34	**0.76**	**0.28**	**0.05**	**0.43**	**1.4**	**0.06**	**0.84**	**0.4**	**0.05**	**0.11**	**0.09**
	arsenic	mg/L	0.001	0.05	0.05	**0.001**	<0.001	<0.001	**0.001**	<0.001	<0.001	**0.003**	<0.001	<0.001	<0.001	<0.001
	cadmium	mg/L	0.0001	0.0002	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	chromium	mg/L	0.001	0.01	0.01	**0.002**	<0.001	<0.001	**0.003**	**0.002**	**0.001**	**0.001**	**0.002**	**0.001**	<0.001	<0.001
	copper	mg/L	0.001	0.002	0.003	**0.018**	**0.003**	**0.015**	**0.006**	**0.005**	**0.012**	**0.008**	**0.008**	**0.008**	**0.016**	**0.014**
	iron	mg/L	0.01	1.00	1.45	**0.21**	**0.86**	<0.01	**0.21**	**0.34**	**0.02**	**0.36**	**0.14**	**0.05**	**0.02**	**0.04**
	lead	mg/L	0.001	0.001	0.003	**0.001**	<0.001	<0.001	**0.003**	<0.001	<0.001	**0.001**	**0.003**	**0.003**	<0.001	<0.001
	nickel	mg/L	0.001	0.015	0.015	**0.003**	**0.004**	**0.003**	**0.005**	**0.004**	**0.002**	**0.005**	**0.003**	**0.003**	**0.003**	**0.003**
	zinc	mg/L	0.005	0.005	0.019	**0.007**	**0.007**	<0.005	<0.005	**0.008**	<0.005	**0.006**	**0.01**	**0.008**	<0.005	<0.005
TRH Fractions	TPH C6-C9	mg/L	0.02	0.15	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	TPH C10-C14	mg/L	0.05	0.6	0.6	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	TPH C15-C28	mg/L	0.1	0.6	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
	TPH C29-C36	mg/L	0.1	0.6	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
	TPH >36	mg/L	0.04	0.6	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
BTEX	Benzene	mg/L	0.001	0.3	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Toluene	mg/L	0.001	0.3	0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Ethyl benzene	mg/L	0.001	0.14	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Xylene	mg/L	0.003	-	0.02	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

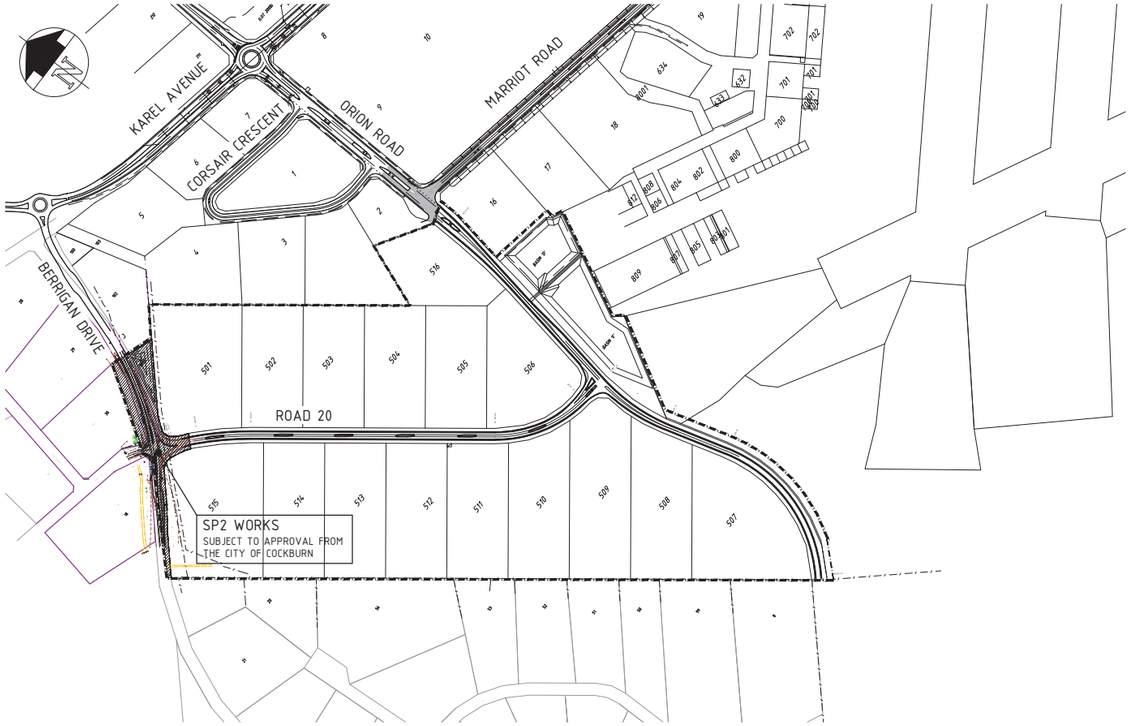
***A(EP)R (1997) Schedule 2 Water pollution - accepted limits**

**** Site specific adopted assessment levels of the Jandakot Groundwater Management Plan v5.6**

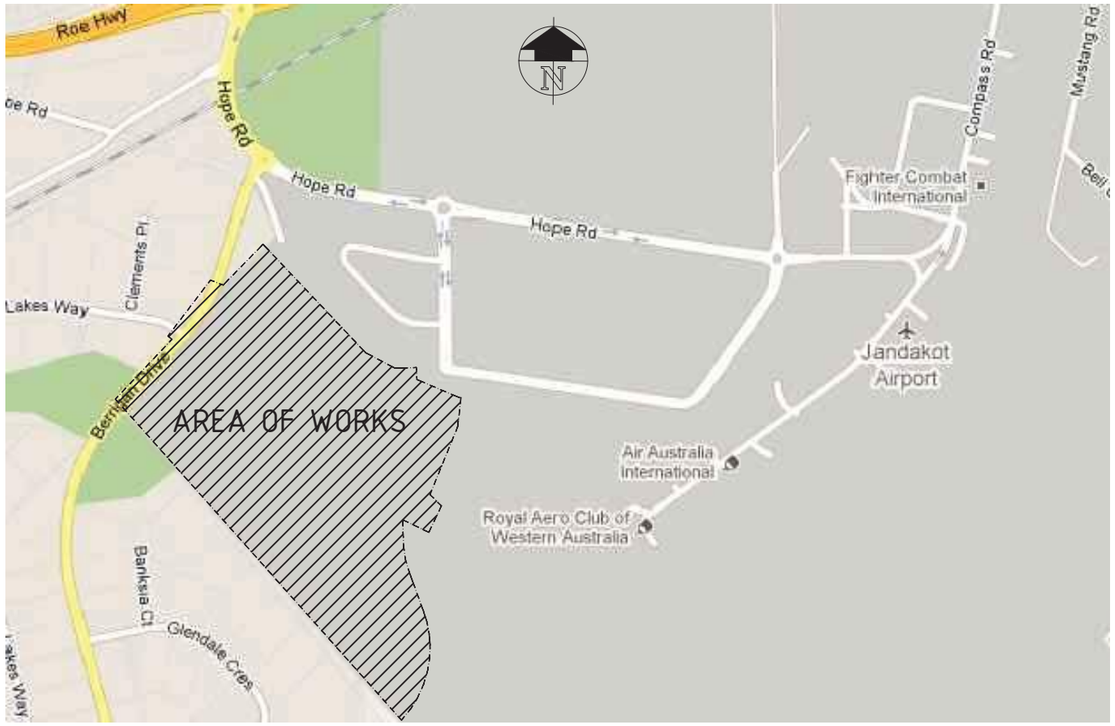
1	Values highlighted indicate values reported above Laboratory LOR
1	Values highlighted indicate exceedances of A(EP)R (1997) Schedule 2
2	Values highlighted indicate exceedances of Interim Assessment Levels (JA GMP v5.6, 2019)

Appendix 3 Engineering designs

JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 5
DRAWING INDEX, SITE PLAN & LOCALITY PLAN



SITE PLAN
1:5000



LOCALITY PLAN
N.T.S.

DRAWING LIST

DRAWING No.	TITLE
05-C-001	SITE PLAN, LOCALITY PLAN & DRAWING INDEX
05-C-010	GENERAL ARRANGEMENT
05-C-100	PLAN & PROFILE ORION ROAD CH. 0 TO CH. 500
05-C-101	PLAN & PROFILE ORION ROAD CH. 500 TO END
05-C-102	PLAN & PROFILE ROAD 20 CH. 0 TO CH. 400
05-C-103	PLAN & PROFILE ROAD 20 CH. 400 TO END
05-C-200	ROAD LAYOUT PLAN, ORION ROAD - SHEET 1
05-C-201	ROAD LAYOUT PLAN, ORION ROAD - SHEET 2
05-C-202	ROAD LAYOUT PLAN, ORION ROAD - SHEET 3
05-C-203	ROAD LAYOUT PLAN, ORION ROAD - SHEET 4
05-C-204	ROAD LAYOUT PLAN, ROAD 20 - SHEET 1
05-C-205	ROAD LAYOUT PLAN, ROAD 20 - SHEET 2
05-C-206	ROAD LAYOUT PLAN, ROAD 20/BERRIGAN DRIVE - SHEET 1
05-C-300	TYPICAL CROSS SECTIONS
05-C-310	TYPICAL SECTIONS KERB PROFILES
05-C-320	FENCING LAYOUT
05-C-321	TYPICAL FENCING DETAIL - SHEET 1 OF 2
05-C-322	TYPICAL FENCING DETAIL - SHEET 2 OF 2
05-C-400	LINEMARKING AND SIGNAGE - SHEET 1 OF 4
05-C-401	LINEMARKING AND SIGNAGE - SHEET 2 OF 4
05-C-402	LINEMARKING AND SIGNAGE - SHEET 3 OF 4
05-C-403	LINEMARKING AND SIGNAGE - SHEET 4 OF 4
05-C-410	LINEMARKING AND SIGNAGE

DRAWING No.	TITLE
05-C-500	DRAINAGE PLAN - SHEET 1 OF 4
05-C-501	DRAINAGE PLAN - SHEET 2 OF 4
05-C-502	DRAINAGE PLAN - SHEET 3 OF 4
05-C-503	DRAINAGE PLAN - SHEET 4 OF 4
05-C-504	DRAINAGE BASIN PLAN, ORION ROAD
05-C-505	DRAINAGE BASIN SECTIONS AND DETAILS - SHEET 1 OF 2
05-C-506	DRAINAGE BASIN PLAN, BERRIGAN DRIVE
05-C-507	DRAINAGE CATCHMENT PLAN
05-C-508	DRAINAGE BASIN SECTIONS AND DETAILS - SHEET 2 OF 2
05-C-510	DRAINAGE SCHEDULE
05-C-600	SEWER RETICULATION SITE PLAN
05-C-601	SEWER RETICULATION DESIGN DATA PLAN
05-C-602	SEWER RETICULATION - SHEET 1 OF 2
05-C-603	SEWER RETICULATION - SHEET 2 OF 2
05-C-610	WATER RETICULATION - SHEET 1 OF 2
05-C-611	WATER RETICULATION - SHEET 2 OF 2
05-C-620	W-POWER FIBRE OPTIC PROPOSED RELOCATION
05-C-622	SPARE COMMS RETICULATION
05-C-623	TELSTRA RETICULATION
05-C-630	GAS RETICULATION PLAN. PLAN LAYOUT DETAILS
05-C-631	TELSTRA PIT RELOCATION PLAN LAYOUT

DRAWING No.	TITLE
05-C-701	PAVEMENT PLAN - SHEET 1
05-C-702	PAVEMENT PLAN - SHEET 2
05-C-703	PAVEMENT PLAN - SHEET 3
05-C-800	EARTHWORKS PLAN - SHEET 1 OF 4
05-C-801	EARTHWORKS PLAN - SHEET 2 OF 4
05-C-802	EARTHWORKS PLAN - SHEET 3 OF 4
05-C-803	EARTHWORKS PLAN - SHEET 4 OF 4
05-C-810	CONTRACTORS SITE AREA SITE PLAN
05-C-900	ORION ROAD CROSS SECTIONS - SHEET 1 OF 7
05-C-901	ORION ROAD CROSS SECTIONS - SHEET 2 OF 7
05-C-902	ORION ROAD CROSS SECTIONS - SHEET 3 OF 7
05-C-903	ORION ROAD CROSS SECTIONS - SHEET 4 OF 7
05-C-904	ORION ROAD CROSS SECTIONS - SHEET 5 OF 7
05-C-905	ORION ROAD CROSS SECTIONS - SHEET 6 OF 7
05-C-906	ORION ROAD CROSS SECTIONS - SHEET 7 OF 7
05-C-907	ROAD 20 CROSS SECTIONS - SHEET 1 OF 8
05-C-908	ROAD 20 CROSS SECTIONS - SHEET 2 OF 8
05-C-909	ROAD 20 CROSS SECTIONS - SHEET 3 OF 8
05-C-910	ROAD 20 CROSS SECTIONS - SHEET 4 OF 8
05-C-911	ROAD 20 CROSS SECTIONS - SHEET 5 OF 8
05-C-912	ROAD 20 CROSS SECTIONS - SHEET 6 OF 8
05-C-913	ROAD 20 CROSS SECTIONS - SHEET 7 OF 8
05-C-914	ROAD 20 CROSS SECTIONS - SHEET 8 OF 8
05-C-915	BERRIGAN DRIVE CROSS SECTIONS - SHEET 1 OF 2
05-C-916	BERRIGAN DRIVE CROSS SECTIONS - SHEET 2 OF 2

DRAWING No.	TITLE
E-01	SITE PLAN AND DETAILS
E-02	STREET LIGHTING
E-03	INFRASTRUCTURE LAYOUT
E-04	HV SINGLE LINE DIAGRAM

AS CONSTRUCTED DRAWING LIST
(FROM PREVIOUS STAGE OF WORK)

94522AS-070A	WATER RETICULATION PLAN
94522AS-126A	FIRE RING RETICULATION PLAN
JCE06061-E01	HV/LV CONDUIT LAYOUT
JCE06061-E03	STREET LIGHTING LAYOUT
JCE06061-E08	BLOWN FIBER CONDUITING LAYOUT
2880-8/31	SEWER RETICULATION PLAN - SHEET 2
2880-8/32	SEWER RETICULATION PLAN - SHEET 3
CW4-95376111-212387-00002_3	SERVICE EASEMENT PLAN

REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	25.02.2013	ISSUED FOR CONSTRUCTION; SHEET 05-C-508 ADDED	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV | DATE | DESCRIPTION | RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	A.P

DATUM	GRID	SCALE	
AHD	PCG	AS SHOWN	AT A1 SIZE

TITLE: DRAWING INDEX, SITE PLAN & LOCALITY PLAN

PROJECT No. P10268.01 | DRAWING No. 05-C-001 | REV. 2

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-001_SITE& LOCALITY.DWG
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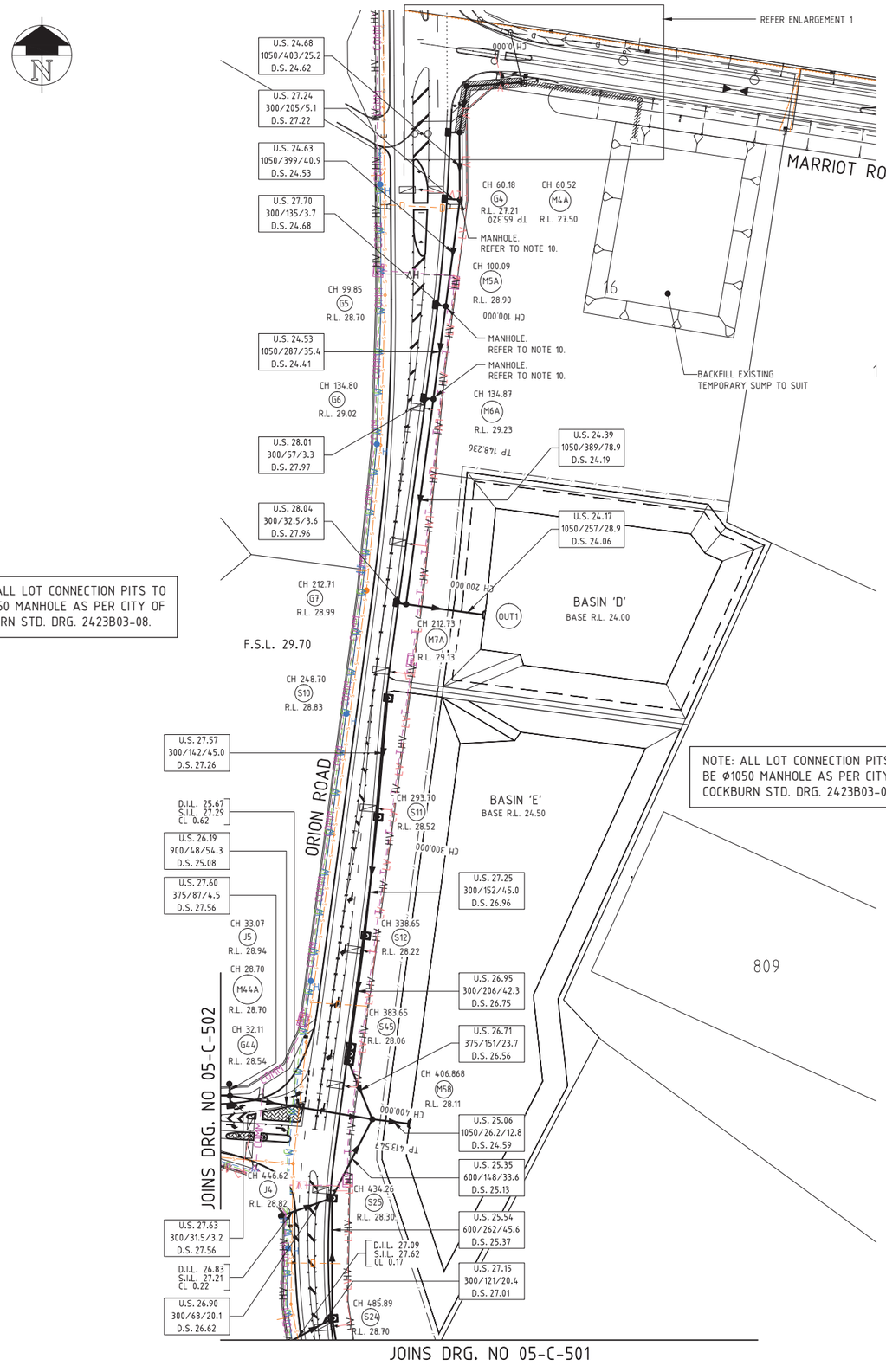


NOTE: ALL LOT CONNECTION PITS TO BE Ø1050 MANHOLE AS PER CITY OF COCKBURN STD. DRG. 2423B03-08.

NOTE: ALL LOT CONNECTION PITS TO BE Ø1050 MANHOLE AS PER CITY OF COCKBURN STD. DRG. 2423B03-08.

NOTES

1. SERVICE LOCATION DIAGRAMMATIC ONLY - CONTACT SERVICE AUTHORITIES FOR EXACT IN GROUND LOCATIONS PRIOR TO COMMENCEMENT OF WORK.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
3. ALL PIPES SHALL BE SPIGOT AND SOCKET TYPE WITH RUBBER RING JOINTS, RCP CLASS 2 UNLESS OTHERWISE NOTED.
4. CONSTRUCTION PLANT SHALL NOT BE PERMITTED TO TRAVEL OVER COMPACTED PIPELINE UNTIL A MINIMUM THICKNESS OF COMPACTED BACKFILL HAS BEEN PLACED TO PROVIDE ADEQUATE PROTECTION.
5. MATERIALS FOR BEDDING, HAUNCH AND SIDE ZONES SHALL COMPLY WITH WITH THE RELEVANT REQUIREMENTS OF TABLE 3 & 4 OF AS3725 FOR HS3 SUPPORT CONDITIONS.
6. BEDDING AND BACKFILL MATERIAL TO BE PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATION.
7. UNSUITABLE IN SITU BEDDING MATERIAL SHALL BE TREATED IN ACCORDANCE WITH THE SPECIFICATION.
8. CONTRACTOR TO EXERCISE EXTREME CARE IN THE VICINITY OF THE U/GROUND POWER, TELSTRA CONDUITS AND FIBRE OPTIC CABLES.
9. ALL ROAD GULLIES SHALL BE CLASS D BICYCLE FRIENDLY TYPE.
10. ALL MANHOLE DRAINAGE PITS AS PER MAIN ROADS STANDARDS. REFER TO DRAWING 200231-084 FOR SELECTION GUIDE.

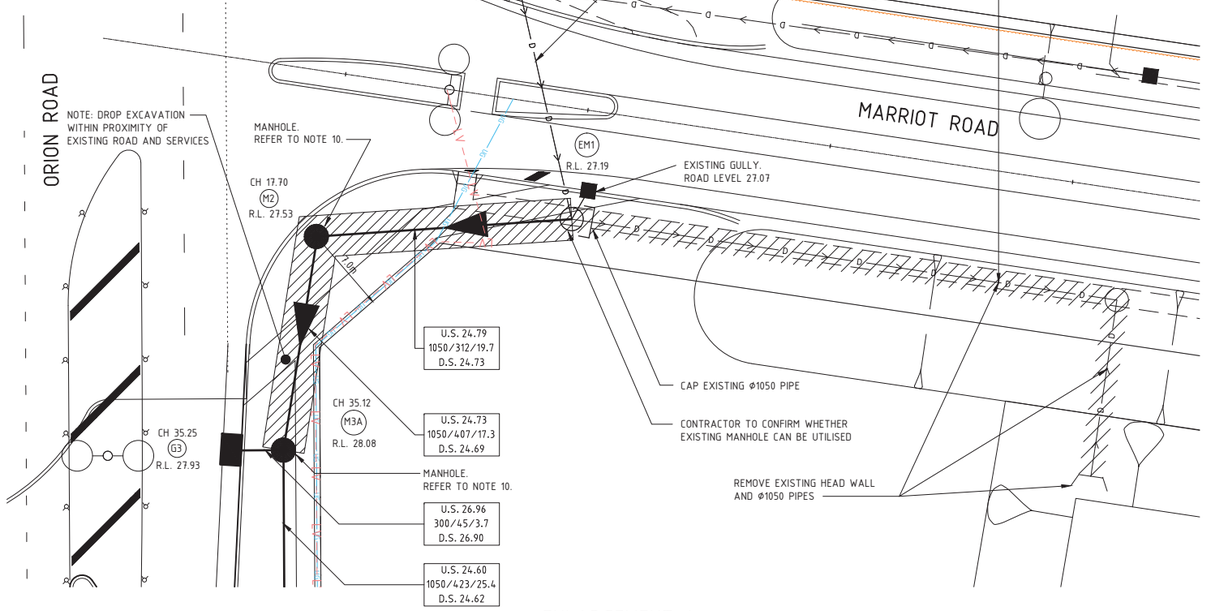
TABLE - PIT LINER SIZES

PIPE SIZE MAX	NOM. DIA CLASS '2' R.C. LINER
375	1050
600	1200
750	1500*
900	1800*
1050	2250*

* CONVERSION SLABS REQUIRED WITH Ø1050 SHAFT LINER

LEGEND

- PROPOSED DRAINAGE LINE & FLOW DIRECTION
- EXISTING DRAINAGE LINE & FLOW DIRECTION
- EXISTING DRAINAGE LINE TO BE REMOVED
- PROPOSED MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED DOUBLE SIDE ENTRY PIT
- (12) DRAINAGE STRUCTURE NUMBER - J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT.
- U.S. 24.90 / 750/833/50.0 / D.S. 24.84 — UPSTREAM INVERT LEVEL, DIA/GRADE/LENGTH OF PIPE, DOWNSTREAM INVERT LEVEL
- SEWER MAIN
- D.I.L. 26.05 / S.I.L. 27.18 / CL 0.23 — DRAINAGE INVERT LEVEL, SEWER INVERT LEVEL, CLEARANCE
- GULLY GRATE
- F.S.L. FINISH LOT DESIGN SURFACE (APPROXIMATE ONLY)



ENLARGEMENT 1
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REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	19.04.2012	ADJUSTED DESIGN TO SUIT NEW LOT LEVELS	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: DRAINAGE PLAN SHEET 1 OF 4

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-500	2

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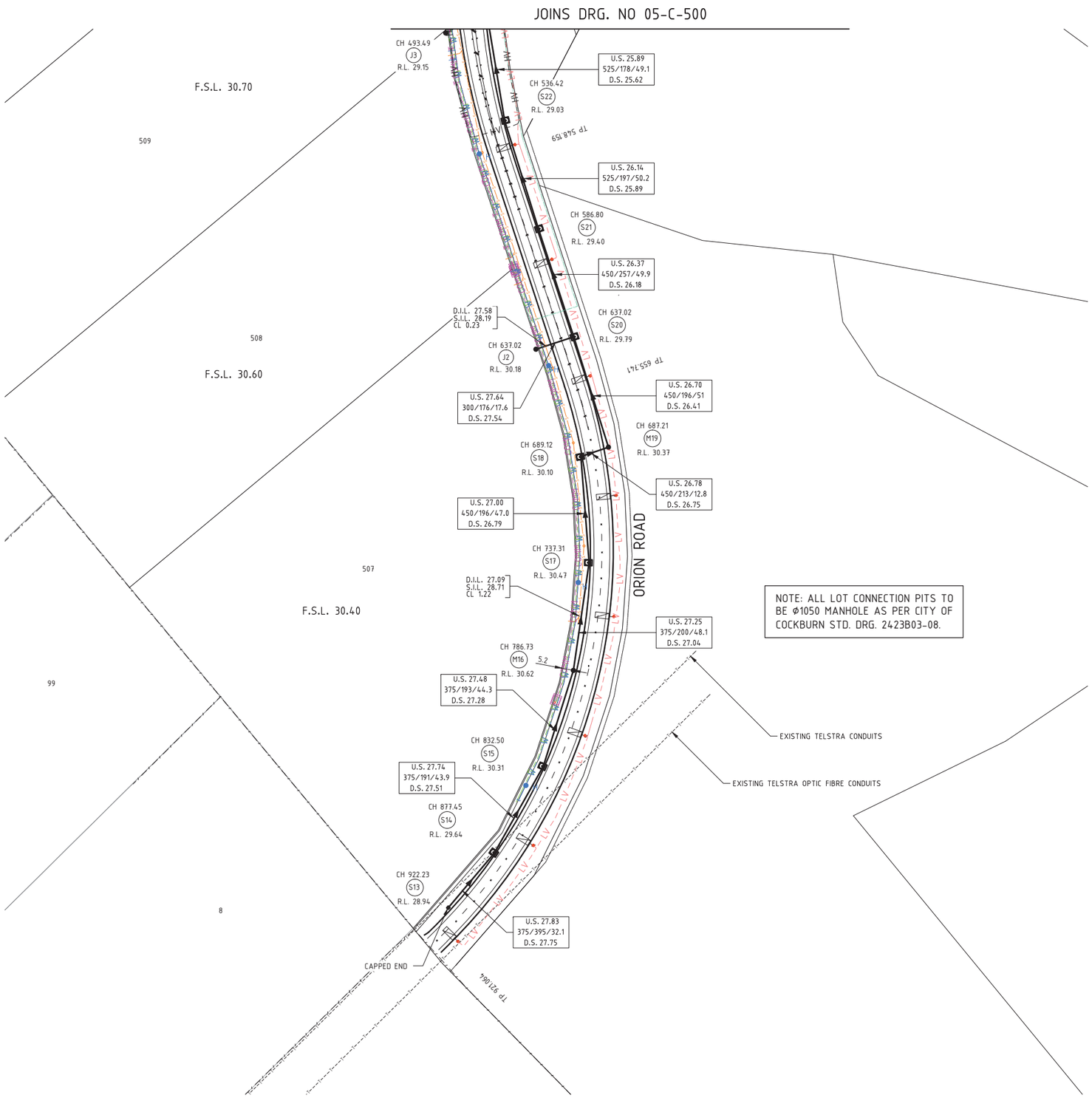

NOTE: ALL LOT CONNECTION PITS TO BE ⌀1050 MANHOLE AS PER CITY OF COCKBURN STD. DRG. 2423B03-08.

LEGEND

- PROPOSED DRAINAGE LINE & FLOW DIRECTION
- EXISTING DRAINAGE LINE & FLOW DIRECTION
- PROPOSED MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED DOUBLE SIDE ENTRY PIT
- (12) DRAINAGE STRUCTURE NUMBER – J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT.
- U.S. 24.90 / 750/833/50.0 / D.S. 24.84 — UPSTREAM INVERT LEVEL, DIA/GRADE/LENGTH OF PIPE, DOWNSTREAM INVERT LEVEL
- SEWER MAIN
- D.I.L. 26.05 / S.I.L. 27.18 / CL 0.23 — DRAINAGE INVERT LEVEL, SEWER INVERT LEVEL, CLEARANCE
- F.S.L. — FINISH LOT DESIGN SURFACE (APPROXIMATE ONLY)

NOTES

1. SERVICE LOCATION DIAGRAMMATIC ONLY – CONTACT SERVICE AUTHORITIES FOR EXACT IN GROUND LOCATIONS PRIOR TO COMMENCEMENT OF WORK.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
3. ALL PIPES SHALL BE SPIGOT AND SOCKET TYPE WITH RUBBER RING JOINTS, RCP CLASS 2 UNLESS OTHERWISE NOTED.
4. CONSTRUCTION PLANT SHALL NOT BE PERMITTED TO TRAVEL OVER COMPACTED PIPELINE UNTIL A MINIMUM THICKNESS OF COMPACTED BACKFILL HAS BEEN PLACED TO PROVIDE ADEQUATE PROTECTION.
5. MATERIALS FOR BEDDING, HAUNCH AND SIDE ZONES SHALL COMPLY WITH WITH THE RELEVANT REQUIREMENTS OF TABLE 3 & 4 OF AS3725 FOR HS3 SUPPORT CONDITIONS.
6. BEDDING AND BACKFILL MATERIAL TO BE PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATION.
7. UNSUITABLE IN SITU BEDDING MATERIAL SHALL BE TREATED IN ACCORDANCE WITH THE SPECIFICATION.
8. CONTRACTOR TO EXERCISE EXTREME CARE IN THE VICINITY OF THE U/GROUND POWER, TELSTRA CONDUITS AND FIBRE OPTIC CABLES.

TABLE - PIT LINER SIZES

PIPE SIZE MAX	NOM. DIA CLASS '2' R.C. LINER
375	1050
600	1200
750	1500*
900	1800*
1050	2250*

* CONVERSION SLABS REQUIRED WITH ⌀1050 SHAFT LINER

REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	19.04.2012	ADJUSTED DESIGN TO SUIT NEW LOT LEVELS	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: DRAINAGE PLAN SHEET 2 OF 4

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-501	2

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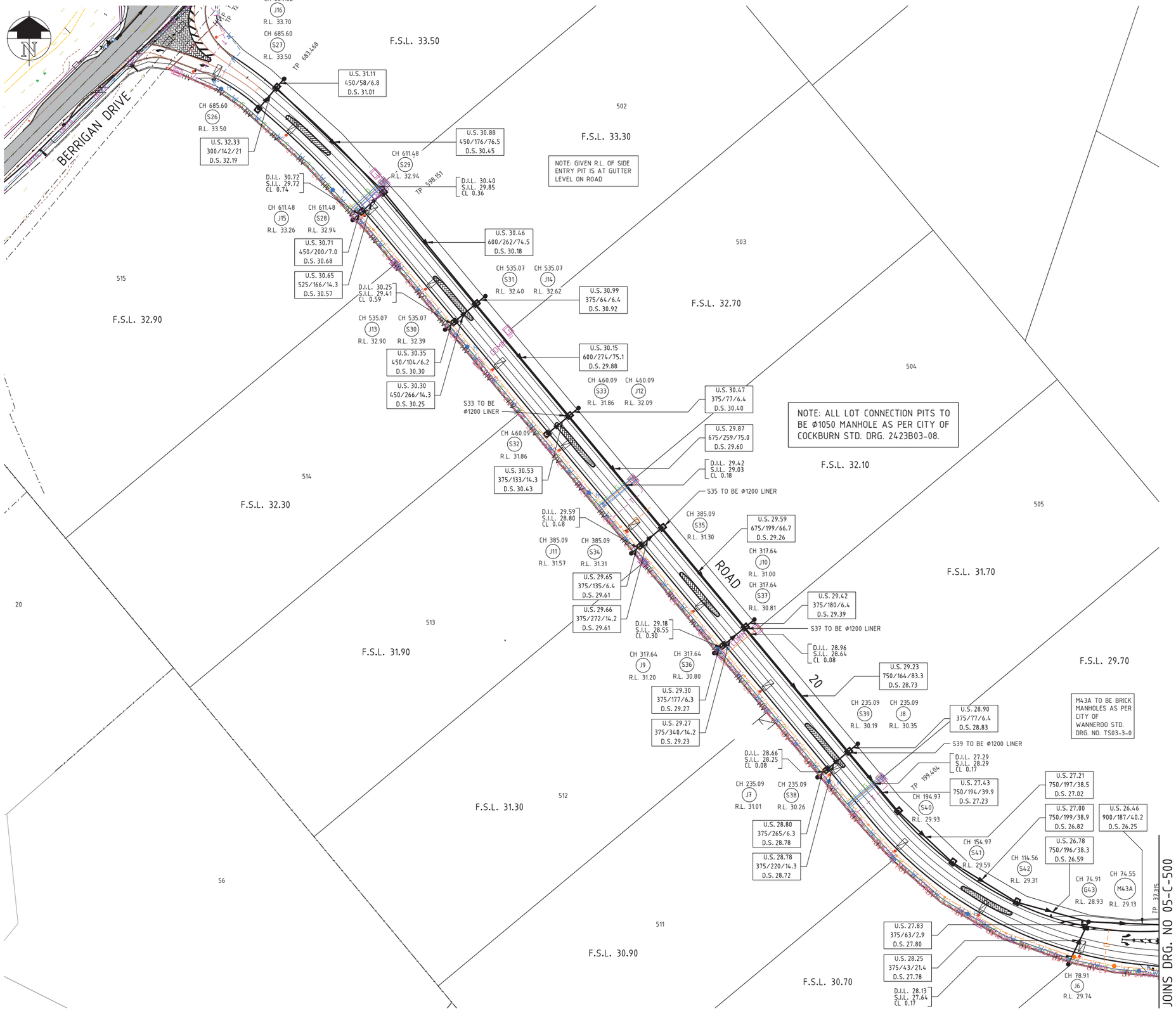

LEGEND

- PROPOSED DRAINAGE LINE & FLOW DIRECTION
- EXISTING DRAINAGE LINE & FLOW DIRECTION
- PROPOSED MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED DOUBLE SIDE ENTRY PIT
- (12) DRAINAGE STRUCTURE NUMBER – J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT.
- U.S. 24.90 / 750/833/50.0 / D.S. 24.84 — UPSTREAM INVERT LEVEL, DIA/GRADE/LENGTH OF PIPE, DOWNSTREAM INVERT LEVEL
- SEWER MAIN
- D.I.L. 26.05 / S.I.L. 27.18 / CL 0.23 — DRAINAGE INVERT LEVEL, SEWER INVERT LEVEL, CLEARANCE
- F.S.L. FINISH LOT DESIGN SURFACE (APPROXIMATE ONLY)

NOTES

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7. UNSUITABLE IN SITU BEDDING MATERIAL SHALL BE TREATED IN ACCORDANCE WITH THE SPECIFICATION.
8. CONTRACTOR TO EXERCISE EXTREME CARE IN THE VICINITY OF THE U/GROUND POWER, TELSTRA CONDUITS AND FIBRE OPTIC CABLES.

TABLE - PIT LINER SIZES

PIPE SIZE MAX	NOM. DIA CLASS '2' R.C. LINER
375	1050
600	1200
750	1500*
900	1800*
1050	2250*

* CONVERSION SLABS REQUIRED WITH ø1050 SHAFT LINER

REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	19.04.2012	ADJUSTED DESIGN TO SUIT NEW LOT LEVELS	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

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PERTH - MELBOURNE - SYDNEY - DUBAI - ABU DHABI

PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: DRAINAGE PLAN SHEET 3 OF 4

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-502	2

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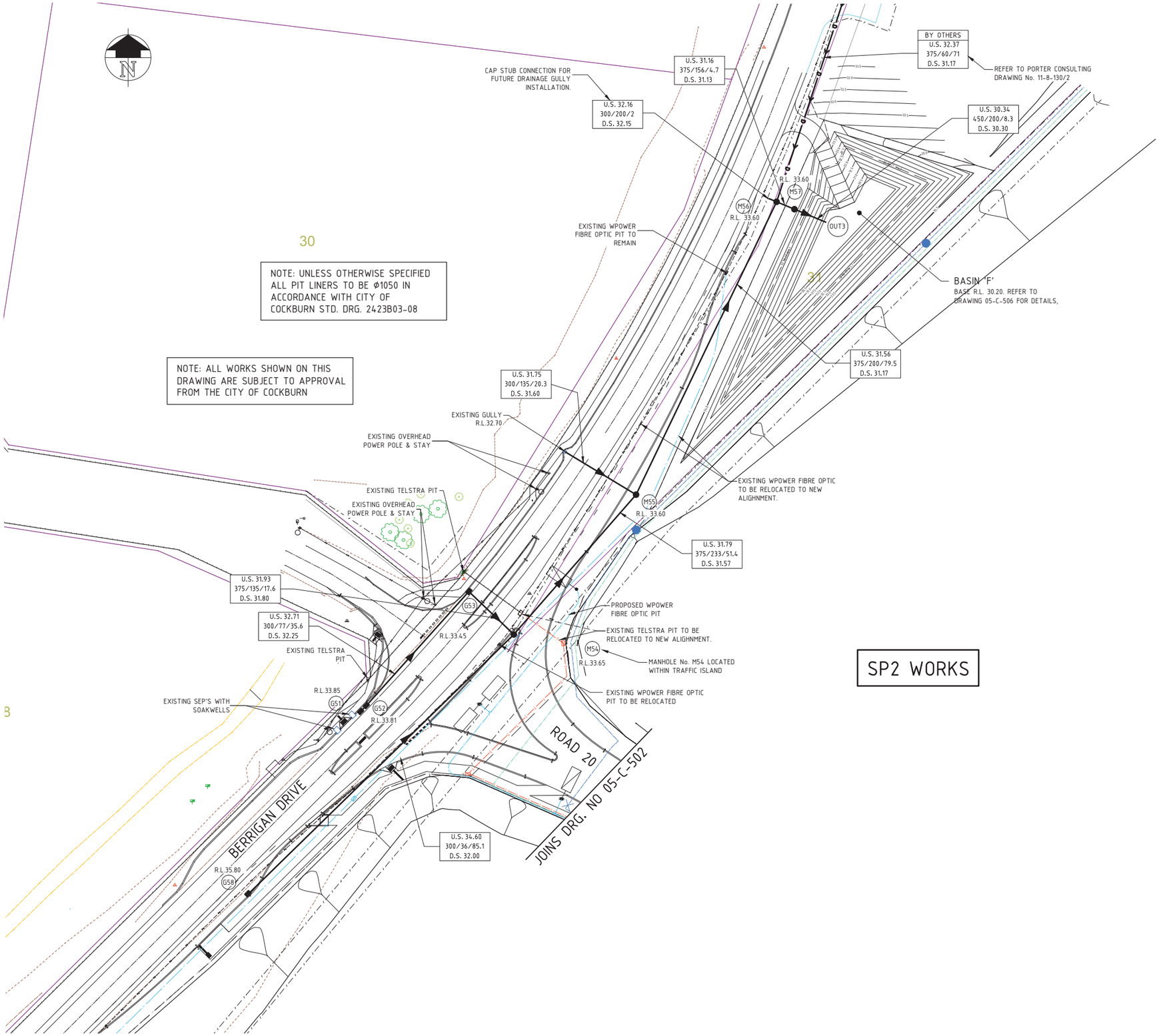

LEGEND

- PROPOSED DRAINAGE LINE & FLOW DIRECTION
- EXISTING DRAINAGE LINE & FLOW DIRECTION
- PROPOSED MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED DOUBLE SIDE ENTRY PIT
- (12) DRAINAGE STRUCTURE NUMBER - M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT.
- U.S. 24.90 / 750/833/50.0 / D.S. 24.84 — UPSTREAM INVERT LEVEL, DIA/GRADE/LENGTH OF PIPE, DOWNSTREAM INVERT LEVEL
- EXISTING WESTERN POWER FIBRE OPTIC
- EXISTING TELSTRA
- EXISTING OVERHEAD POWER

NOTES

1. SERVICE LOCATION DIAGRAMMATIC ONLY - CONTACT SERVICE AUTHORITIES FOR EXACT IN GROUND LOCATIONS PRIOR TO COMMENCEMENT OF WORK.
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3. ALL PIPES SHALL BE SPIGOT AND SOCKET TYPE WITH RUBBER RING JOINTS, RCP CLASS 2 UNLESS OTHERWISE NOTED.
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6. BEDDING AND BACKFILL MATERIAL TO BE PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATION.
7. UNSUITABLE IN SITU BEDDING MATERIAL SHALL BE TREATED IN ACCORDANCE WITH THE SPECIFICATION.
8. CONTRACTOR TO EXERCISE EXTREME CARE IN THE VICINITY OF THE U/GROUND POWER, TELSTRA CONDUITS AND FIBRE OPTIC CABLES.

TABLE - PIT LINER SIZES

PIPE SIZE MAX	NOM. DIA CLASS '2' R.C. LINER
375	1050
600	1200
750	1500*
900	1800*
1050	2250*

* CONVERSION SLABS REQUIRED WITH ⌀1050 SHAFT LINER

SP2 WORKS

REV	DATE	DESCRIPTION	RVD
1	03.08.2012	AMENDED AS PER RSA	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
E	22.02.2012	MINOR DRAINAGE AMENDMENTS	AC
D	20.12.2011	ADDITIONAL DRAINAGE AS SHOWN	JB
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD
3	12.09.2013	AS CONSTRUCTED	DP
2	29.08.2012	BASIN 'F' UPDATED	GC

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN SHEET 4 OF 4

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-503	3

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-503 DRAINAGE.DWG
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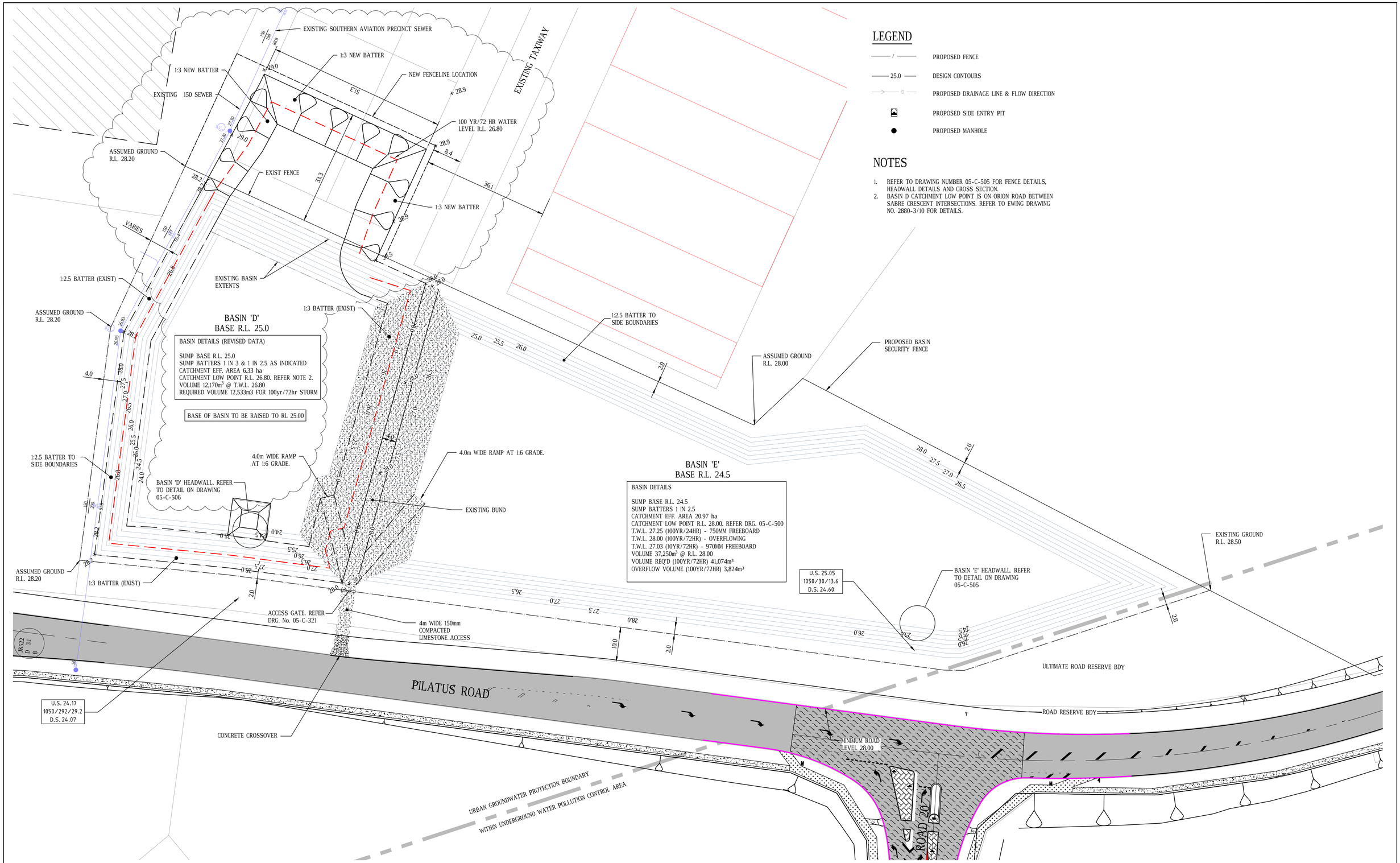

REV	DATE	DESCRIPTION	RVD
3	25.02.2013	BASIN D BATTER MODIFIED	AP
2	18.06.2012	BASINS MODIFIED, OVERFLOW SWALE ADDED	AP
1	12.06.2012	BASINS ALTERED DUE TO CADASTRAL CHANGES	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD
6	26/04/2018	REVISED ISSUED FOR CONSTRUCTION	AP
5	17.06.2016	ISSUED FOR CONSTRUCTION	AP
4	12.09.2013	AS CONSTRUCTED	DP

REVISIONS

CLIENT
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PROJECT
JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS
AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE
AHD	PCG	1:500 AT A1 SIZE

TITLE
DRAINAGE BASINS PILATUS STREET PLAN

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-504	6

P:\P14327 JANDAKOT AIRPORT PRECINCT 6\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-504 DRAINAGE.DWG
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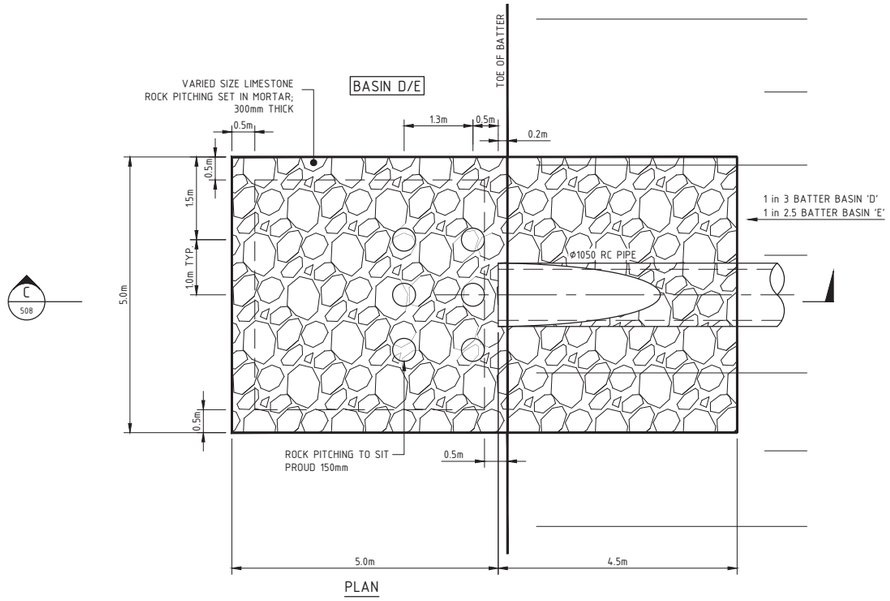
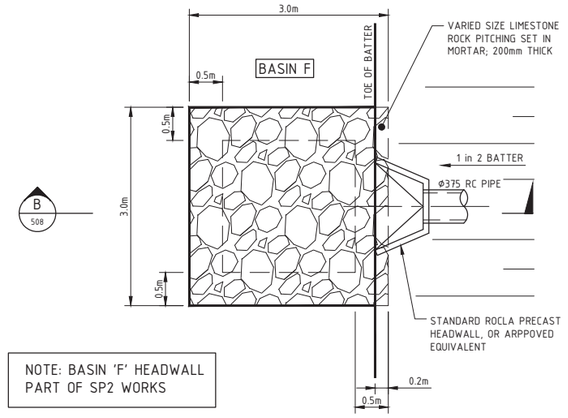


PLAN

BASINS 'D' AND 'E' DISCHARGE HEADWALL DETAIL

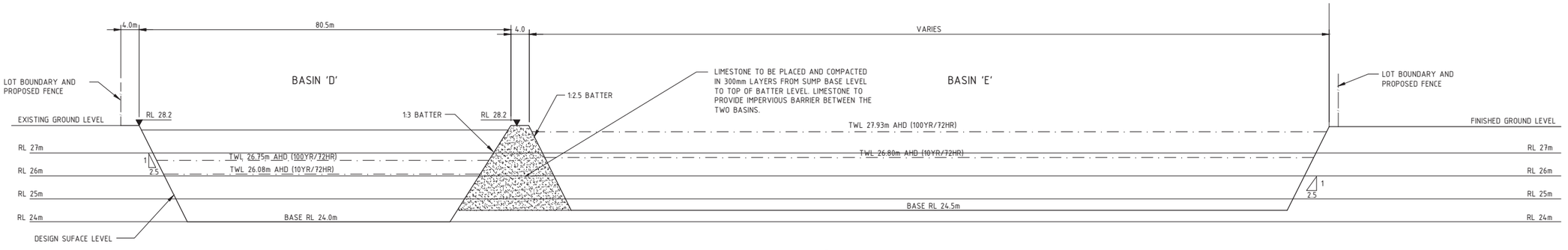
N.T.S.



PLAN

BASIN 'F' DISCHARGE HEADWALL DETAIL

N.T.S.



SECTION A
504

SCALE HOR. 1:500
VER. 1:100

REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	25.02.2013	REISSUED FOR CONSTRUCTION	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE
AHD	PCG	1:1000 AT A1 SIZE

TITLE: DRAINAGE BASIN SECTIONS AND DETAILS SHEET 1 OF 2

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-505	2

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-505 DRAINAGE.DWG
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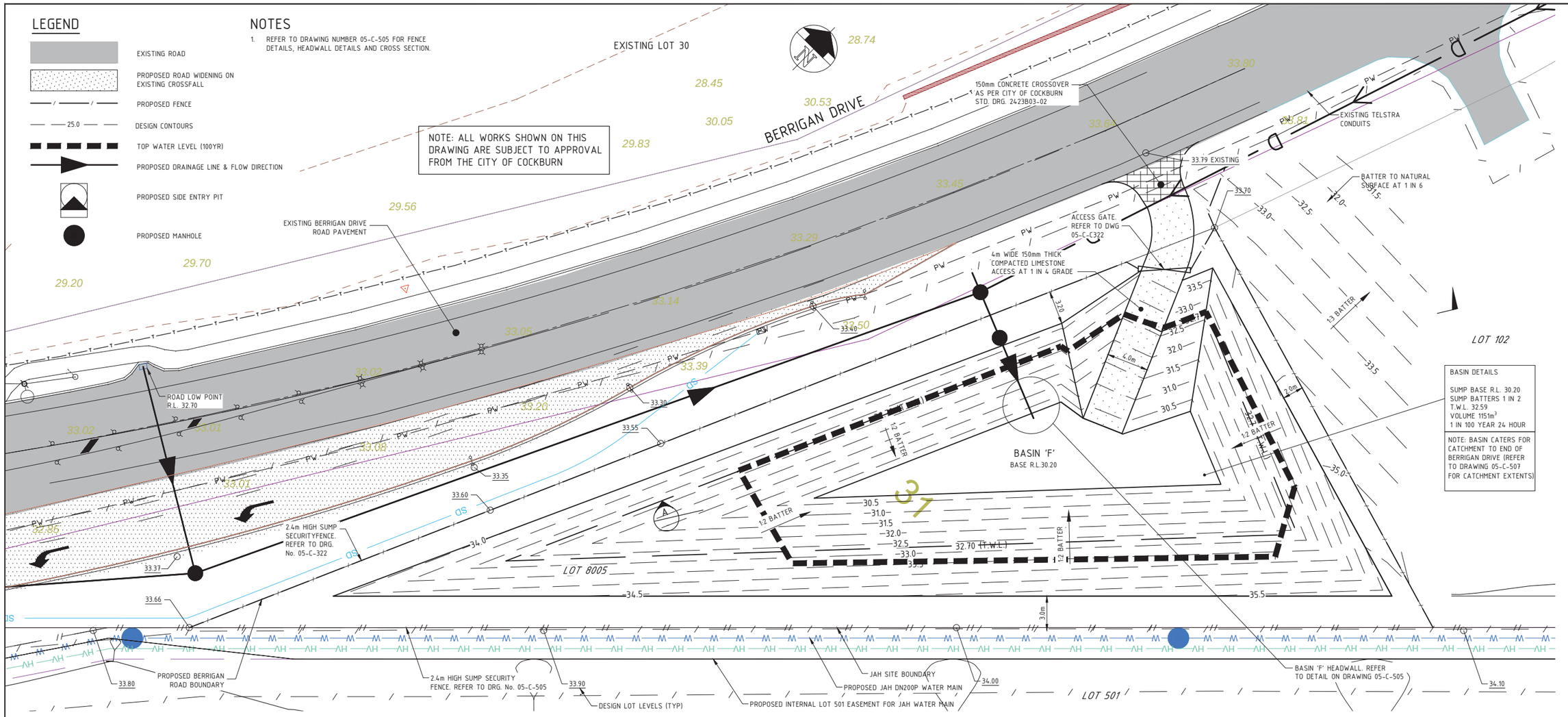
LEGEND

- EXISTING ROAD
- PROPOSED ROAD WIDENING ON EXISTING CROSSFALL
- PROPOSED FENCE
- 25.0 DESIGN CONTOURS
- TOP WATER LEVEL (100YR)
- PROPOSED DRAINAGE LINE & FLOW DIRECTION
- PROPOSED SIDE ENTRY PIT
- PROPOSED MANHOLE

NOTES

1. REFER TO DRAWING NUMBER 05-C-505 FOR FENCE DETAILS, HEADWALL DETAILS AND CROSS SECTION.

NOTE: ALL WORKS SHOWN ON THIS DRAWING ARE SUBJECT TO APPROVAL FROM THE CITY OF COCKBURN

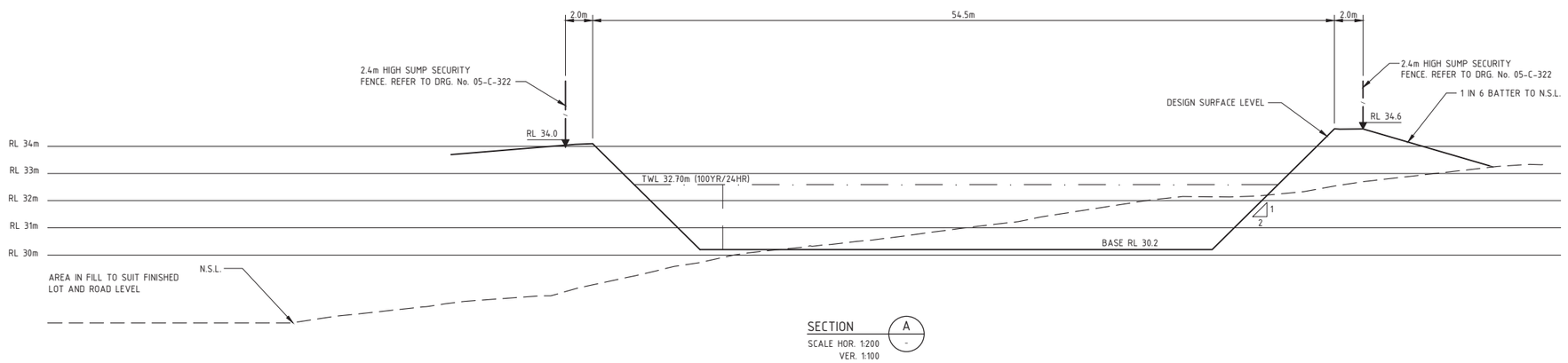


BASIN DETAILS

SUMP BASE R.L. 30.20
SUMP BATTERS 1 IN 2
T.W.L. 32.59
VOLUME 1151m³
1 IN 100 YEAR 24 HOUR

NOTE: BASIN CATERS FOR CATCHMENT TO END OF BERRIGAN DRIVE (REFER TO DRAWING 05-C-507 FOR CATCHMENT EXTENTS)

SP2 WORKS



SECTION A
SCALE HOR. 1:200
VER. 1:100

REV	DATE	DESCRIPTION	RVD
2	29.08.2012	BASIN 'F' UPDATED	GC
1	03.08.2012	AMENDED AS PER RSA	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
D	30.11.2011	BASIN TWL AND VOLUMES CHANGED	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD
3	12.09.2013	AS CONSTRUCTED	DP

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE
AHD	PCG	1:200 AT A1 SIZE

TITLE: DRAINAGE BASIN 'F' BERRIGAN DRIVE PLAN AND SECTION

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-506	3

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-506 DRAINAGE.DWG
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LEGEND

- BASIN 'D' LOTS CATCHMENT AREA (ASSUMED 50% IMPERVIOUS AREA) = 79,886m²
- BASIN 'E' LOTS CATCHMENT AREA (ASSUMED 50% IMPERVIOUS AREA) = 362,276m²
- BASIN 'D' ROAD CATCHMENT AREA (ASSUMED 80% IMPERVIOUS AREA) = 31,739m²
- BASIN 'E' ROAD CATCHMENT AREA (ASSUMED 80% IMPERVIOUS AREA) = 35,651m²
- BASIN 'F' ROAD CATCHMENT AREA (ASSUMED 80% IMPERVIOUS AREA) = 17,461m²

REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	29.08.2012	REVISED LOT BOUNDARIES	GC
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
D	30.11.2011	CATCHMENTS CHANGED	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV | DATE | DESCRIPTION | RVD

REVISIONS

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: DRAINAGE CATCHMENT PLAN

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-507	2

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-507 DRAINAGE.DWG
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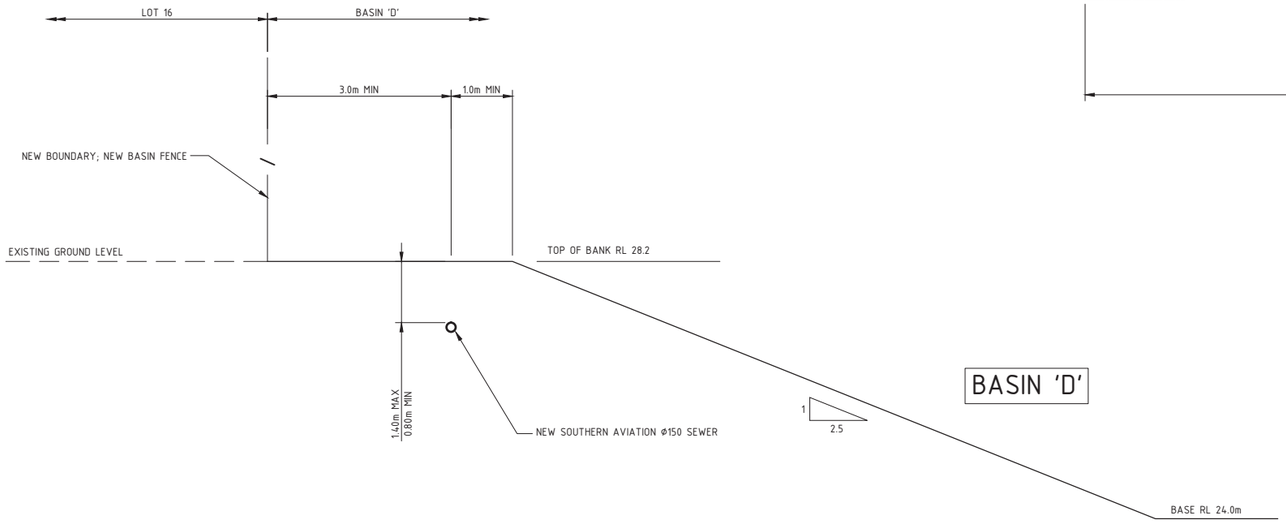
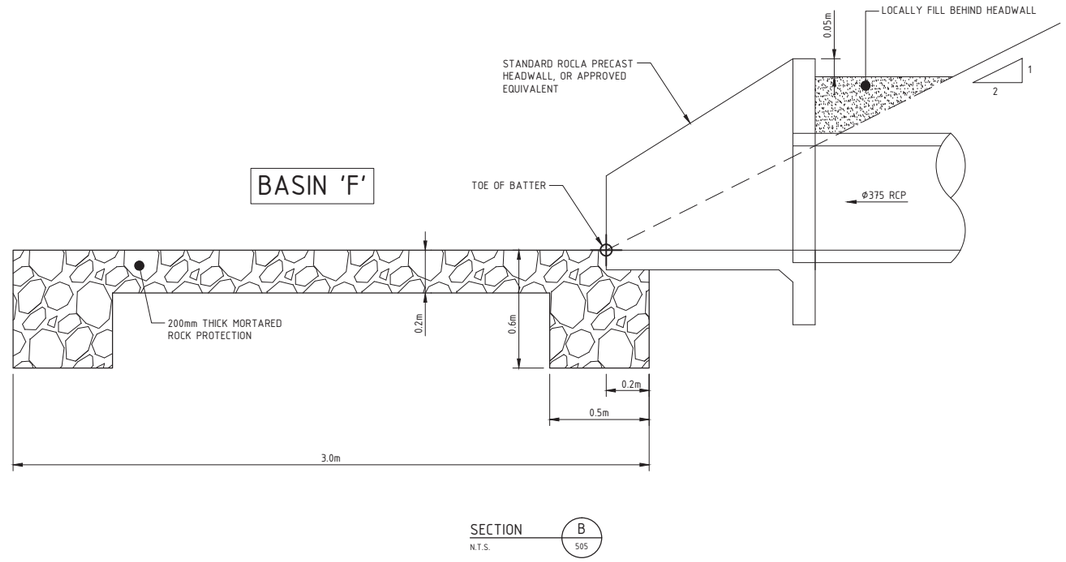


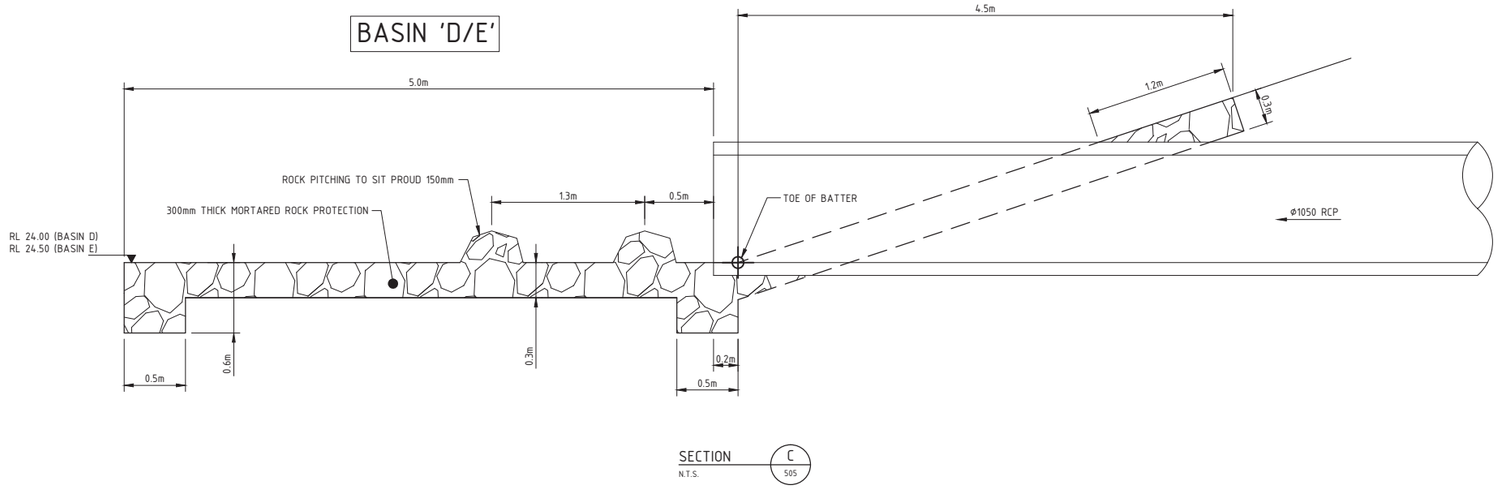
BASIN 'D'

BASIN 'D' BATTER DETAIL - LOT 16 SIDE BOUNDARY

SCALE 1:50



SECTION B
N.T.S. 505



SECTION C
N.T.S. 505

REV	DATE	DESCRIPTION	RVD
1	12.09.2013	AS CONSTRUCTED	DP
0	25.02.2013	ISSUED FOR CONSTRUCTION	AP

REVISIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: DRAINAGE BASIN SECTIONS AND DETAILS SHEET 2 OF 2

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-508	1

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12/09/2013 3:16:46 PM

DRAINAGE STRUCTURES ON DRAWING 05-C-500					
STRUC No.	STRUC TYPE	CO-ORDINATES		REF PT. ELEV.	COMMENTS
		EASTING	NORTHING		
EM1	-	54923.223	247675.896	27.19	EXISTING MANHOLE
M2	-	54902.366	247674.485	27.60	MANHOLE
M3A	SRN	54899.678	247657.049	28.14	MANHOLE
G3	TGT	54896.237	247657.029	27.93	GULLY
M4A	DRN	54899.829	247631.629	28.47	MANHOLE
G4	TGT	54894.935	247631.959	28.23	GULLY
M5A	DRN	54894.496	247591.488	28.91	MANHOLE
G5	TGT	54891.392	247591.901	28.70	GULLY
M6A	DRN	54889.841	247556.457	29.23	MANHOLE
G6	TGT	54886.873	247556.851	29.03	GULLY
M7A	DRN	54879.560	247479.091	29.17	MANHOLE
G7	TGT	54876.584	247479.495	28.97	GULLY
S10	TEN	54871.938	247443.811	28.75	SIDE ENTRY PIT
S11	TEN	54868.151	247398.928	28.43	SIDE ENTRY PIT
S12	TEN	54863.452	247354.212	28.12	SIDE ENTRY PIT
S45	TEN	54857.518	247309.604	28.00	3 x SIDE ENTRY PITS
S24	SEN	54851.127	247209.661	28.58	SIDE ENTRY PIT
S25	SEN	54850.858	247255.211	28.18	SIDE ENTRY PIT
G44	TGT	54813.371	247290.811	28.54	GULLY
M44A	SRN-B	54813.136	247293.684	28.81	MANHOLE
J4	SRN	54832.392	247248.349	28.80	MANHOLE
J5	SWN	54812.894	247298.177	28.81	MANHOLE
M58	-	54866.839	247284.878	28.21	MANHOLE

DRAINAGE STRUCTURES ON DRAWING 05-C-501					
STRUC No.	STRUC TYPE	CO-ORDINATES		REF PT. ELEV.	COMMENTS
		EASTING	NORTHING		
J1	SWN	54821.870	246808.569	29.24	MANHOLE
S13	TEN	54827.561	246803.640	28.94	SIDE ENTRY PIT
S14	SEN	54855.803	246837.121	29.58	SIDE ENTRY PIT
S15	SEN	54877.403	246875.404	30.20	SIDE ENTRY PIT
M16	BRT	54890.218	246918.157	30.74	MANHOLE
S17	SEN	54897.767	246965.765	30.37	SIDE ENTRY PIT
S18	SEN	54894.123	247012.812	30.02	SIDE ENTRY PIT
M19	DRN	54905.700	247016.770	30.50	MANHOLE
J2	SRN	54873.656	247060.061	30.17	MANHOLE
S20	SEN	54889.812	247065.352	29.71	SIDE ENTRY PIT
S21	SEN	54874.206	247113.004	29.34	SIDE ENTRY PIT
S22	SEN	54859.262	247160.877	28.97	SIDE ENTRY PIT
J3	SRN	54833.779	247199.835	29.15	MANHOLE

DRAINAGE STRUCTURES ON DRAWING 05-C-502					
STRUC No.	STRUC TYPE	CO-ORDINATES		REF PT. ELEV.	COMMENTS
		EASTING	NORTHING		
S26	TEN	54346.119	247714.593	33.45	SIDE ENTRY PIT
S27	SEN	54354.499	247724.505	33.45	SIDE ENTRY PIT
J16	SWN	54358.962	247729.541	33.71	MANHOLE
J15	SWN	54394.194	247656.850	33.20	MANHOLE
S28	SEN	54399.657	247661.838	32.91	SIDE ENTRY PIT
S29	SEN	54409.423	247670.419	32.91	SIDE ENTRY PIT
J13	SWN	54441.844	247600.387	32.63	MANHOLE
S30	SEN	54447.223	247604.866	32.35	SIDE ENTRY PIT
J14	SWN	54462.603	247617.650	32.63	MANHOLE
S31	SEN	54457.221	247613.174	32.35	SIDE ENTRY PIT
S32	SEN	54495.198	247547.204	31.79	SIDE ENTRY PIT
S33	SEN	54505.192	247555.519	31.79	SIDE ENTRY PIT
J12	SWN	54510.562	247560.009	32.08	MANHOLE
J11	SWN	54537.740	247485.129	31.52	MANHOLE
S34	SEN	54543.116	247489.612	31.24	SIDE ENTRY PIT
S35	SEN	54553.110	247497.926	31.24	SIDE ENTRY PIT
J9	SWN	54580.459	247433.785	31.02	MANHOLE
S36	SEN	54585.825	247438.280	30.75	SIDE ENTRY PIT
S37	SEN	54595.798	247446.619	30.75	SIDE ENTRY PIT
J10	SWN	54601.200	247451.072	31.02	MANHOLE
J7	SWN	54633.688	247369.810	30.42	MANHOLE
S38	SEN	54639.089	247374.261	30.14	SIDE ENTRY PIT
S39	SEN	54649.053	247382.612	30.14	SIDE ENTRY PIT
J8	SWN	54654.447	247387.074	30.42	MANHOLE
S40	SEN	54674.689	247351.875	29.85	SIDE ENTRY PIT
S41	SEN	54702.859	247325.390	29.55	SIDE ENTRY PIT
S42	SEN	54736.046	247304.901	29.26	SIDE ENTRY PIT
J6	SWN	54762.843	247273.504	29.65	MANHOLE
G43	TGT	54772.194	247292.997	28.92	GULLY
M43A	SRN-B	54773.286	247295.353	29.11	MANHOLE

DRAINAGE STRUCTURES ON DRAWING 05-C-503					
STRUC No.	STRUC TYPE	CO-ORDINATES		REF PT. ELEV.	COMMENTS
		EASTING	NORTHING		
ESS0	-	-	-	-	EXISTING SOAKWELL
ESS1	-	-	-	-	EXISTING SOAKWELL
G58	TGT	54245.727	247705.583	35.80	GULLY
G51	TGT	54272.697	247750.775	33.85	GULLY
G52	TGT	54274.092	247752.209	33.81	GULLY
G53	TGT	54299.231	247780.156	33.45	GULLY
M54	SRN	54310.549	247769.327	33.65	MANHOLE
M55	SRN	54340.495	247803.582	33.60	MANHOLE
M56	SRN	54374.928	247875.324	33.60	MANHOLE
M57	SRN	54379.291	247873.522	33.60	MANHOLE

REV	DATE	DESCRIPTION	RVD
1	12.09.2013	AS CONSTRUCTED	DP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
D	22.02.2012	PIT No. M59 REMOVED, PIT No. M54 RELOCATED	AC
C	12.12.2011	PITS ADDED	JB
B	22.11.2011	ISSUED FOR TENDER	AP
A	11.11.2011	ISSUED FOR TENDER REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: DRAINAGE
DRAINAGE SCHEDULE

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-510	1

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-510 DRAINAGE.DWG
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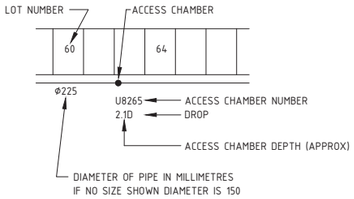
LEGEND

- EXISTING SEWER PIPE AND ACCESS CHAMBER.
- EXISTING SEWER PRESSURE MAIN
- PROPOSED SEWER PIPE AND ACCESS CHAMBER.
- FUTURE SEWER PIPE
- RETICULATION AREA BOUNDARY.
- CATCHMENT AREA BOUNDARY.
- ø225 — DIAMETER OF PIPE IN MILLIMETRES IF NO SIZE SHOWN DIAMETER IS 150
- AREA OF LOT NOT SEWERED

NOTATION



QUANTITIES

LOCAL AUTHORITY: CITY OF COCKBURN

LENGTH OF SEWERS	ø225	1488m
TOTAL No. OF MAINTENANCE SHAFTS:		15
TOTAL No. OF ACCESS CHAMBERS:		5
NUMBER OF LOTS SERVED		16

REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	29.08.2012	REVISED LOT BOUNDARIES	GC
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV | DATE | DESCRIPTION | RVD

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:2000	AT A1 SIZE

TITLE: SEWER RETICULATION SITE PLAN

PROJECT No. P10268.01 | DRAWING No. 05-C-600 | REV. 2

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REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	29.08.2012	REVISED LOT BOUNDARIES	GC
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	-	ISSUED FOR REVIEW	AP

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:2000	AT A1 SIZE

TITLE: SEWER RETICULATION DESIGN DATA PLAN

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-601	2

P:\P10268.01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-601 SEWER.DWG
12/09/2013 3:41:14 PM

SEWER STRUCTURES			
STRUC No.	CO-ORDINATES		REF PT. ELEV.
	EASTING	NORTHING	
JK500	54404.906	247651.818	33.00
JK501	54468.313	247575.608	32.25
JK502	54532.272	247498.736	31.54
JK503	54596.231	247421.865	30.80
JK517	54852.359	247392.168	28.81
JK518	54864.614	247484.305	29.39
JK519	54869.979	247539.061	29.55
JK520	54871.652	247595.657	29.22
JK521	54871.124	247666.626	29.89

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH NOTE SHEET FOR RETICULATION PLANS. STANDARD WATER CORPORATION DRAWING AA01-3-1.
2. MAXIMUM GROUND WATER LEVEL R.L. 24.5m.
3. CONTRACTOR IS RESPONSIBLE TO LOCATE AND PROTECT ALL EXISTING SERVICES AND IMPROVEMENTS ON SITE AND TO MEET THE COST OF PROTECTION, REPAIRS AND REINSTATEMENT WHERE DAMAGE IS CAUSED BY THE CONTRACTOR.
4. ALL ACCESS CHAMBERS TO BE ON THE FOLLOWING ALIGNMENTS UNLESS SHOWN OTHERWISE:
   a) WITHIN LOTS - 1.0m
   b) WITHIN ROAD RESERVE - 3.5m
5. BACKFILL TO BE COMPACTED TO 95% M.M.D.D.

LEGEND

- PROPOSED SEWERS (PIPE SIZE, GRADE, I.L., LENGTH)
- EXISTING SEWERS
- EXISTING PRESSURE MAIN
- FUTURE SEWERS
- US 37.50 / 150 - 14.6 / D = 12.5m / DS 37.40 — UPSTREAM SEWER INVERT LEVEL; PIPE SIZE - GRADE; DISTANCE; DOWNSTREAM SEWER INVERT LEVEL
- X0000 D 1.2 1 D — PROPOSED ACCESS CHAMBER (ACCESS CHAMBER NUMBER; LID CLASS, ACCESS CHAMBER DEPTH TYPE, D IF DROP)
- X0000 D 1.2 1 D — EXISTING ACCESS CHAMBER (ACCESS CHAMBER NUMBER; LID CLASS, ACCESS CHAMBER DEPTH TYPE, D IF DROP)
- RETICULATION AREA BOUNDARY
- 30 — FINISHED CONTOUR LEVEL
- FSL — FINISHED DESIGN SURFACE LEVEL LOT LEVEL
- FFL — FINISHED FLOOR LEVEL (DESIGN)
- * — LOTS TO BE SERVED BUT NOT RELEASED
- AREA OF LOT NOT GRAVITY SEWERED
- IS 23.0 U2.1 — LOT CONNECTION

JOINS DRG. NO 05-C-603

REVISIONS			
REV	DATE	DESCRIPTION	RVD
2	12.09.2013	AS CONSTRUCTED	DP
1	19.04.2012	ADJUSTED DESIGN TO SUIT NEW LOT LEVELS	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AC
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS (REV | DATE | DESCRIPTION | RVD)

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE
AHD	PCG	1:1000 AT A1 SIZE

TITLE: SEWER RETICULATION SHEET 1 OF 2

PROJECT No. P10268.01 | DRAWING No. 05-C-602 | REV. 2

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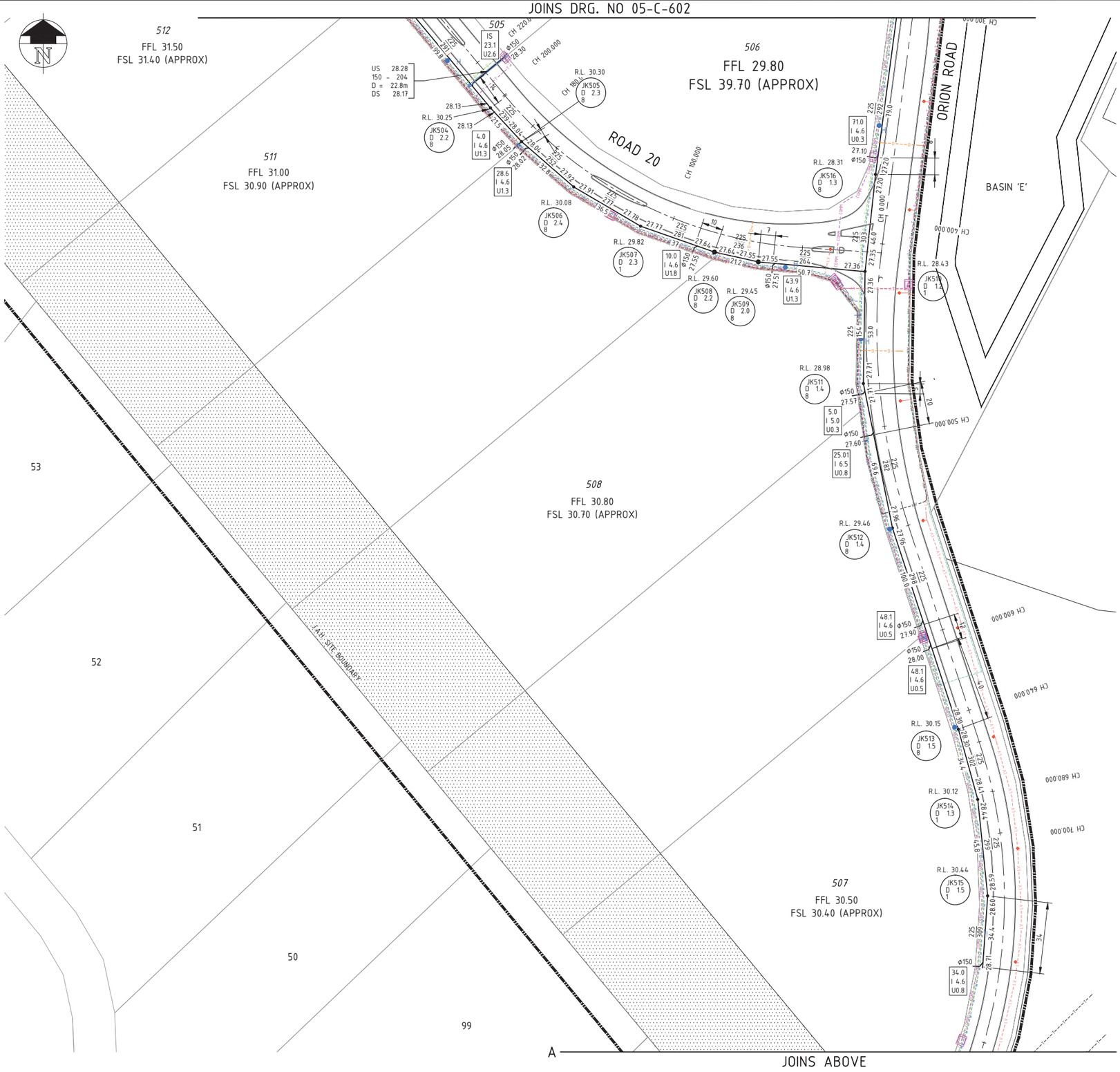
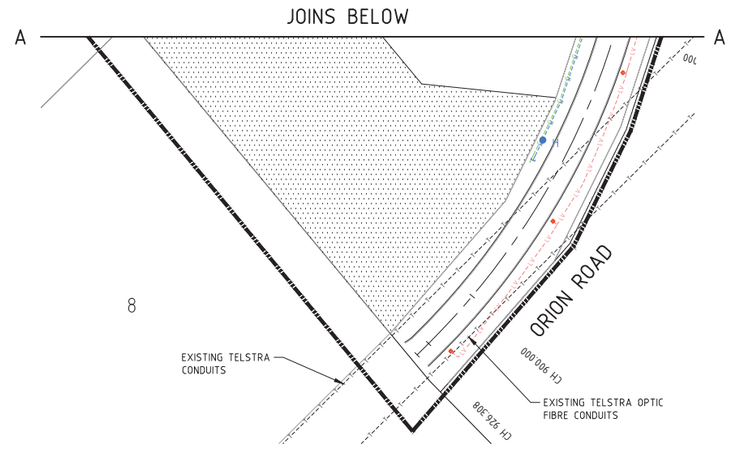
JOINS DRG. NO 05-C-602





SEWER STRUCTURES			
STRUC No.	CO-ORDINATES		REF PT. ELEV.
	EASTING	NORTHING	
JK504	54659.935	247345.299	30.25
JK505	54674.632	247329.384	30.30
JK506	54699.265	247308.022	30.34
JK507	54730.889	247289.443	30.10
JK508	54765.803	247277.236	29.84
JK509	54786.501	247272.604	29.41
JK510	54836.974	247268.104	28.45
JK511	54836.170	247215.133	28.96
JK512	54849.952	247146.903	29.46
JK513	54881.084	247051.825	30.09
JK514	54890.228	247018.687	30.20
JK515	54894.919	246973.132	30.50
JK516	54841.946	247313.882	28.31

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH NOTE SHEET FOR RETICULATION PLANS STANDARD WATER CORPORATION DRAWING AA01-3-1.
   MAXIMUM GROUND WATER LEVEL R.L. 24.5m.
2. CONTRACTOR IS RESPONSIBLE TO LOCATE AND PROTECT ALL EXISTING SERVICES AND IMPROVEMENTS ON SITE AND
3. TO MEET THE COST OF PROTECTION, REPAIRS AND REINSTATEMENT WHERE DAMAGE IS CAUSED BY THE CONTRACTOR.
   ALL ACCESS CHAMBERS TO BE ON THE FOLLOWING ALIGNMENTS UNLESS SHOWN OTHERWISE:
   a) WITHIN LOTS - 1.0m
4. b) WITHIN ROAD RESERVE - 3.5m
   BACKFILL TO BE COMPACTED TO 95% M.M.D.D.
5.

LEGEND

- PIPE SIZE / I.L. GRADE I.L. / LENGTH — PROPOSED SEWERS
- EXISTING SEWERS
- EXISTING PRESSURE MAIN
- FUTURE SEWERS
- US 37.50 / 150 - 14.6 / D = 12.5m / DS 37.40 — UPSTREAM SEWER INVERT LEVEL; PIPE SIZE - GRADE; DISTANCE; DOWNSTREAM SEWER INVERT LEVEL
- X0000 / D 1.2 / 1 D — PROPOSED ACCESS CHAMBER; ACCESS CHAMBER NUMBER; LID CLASS, ACCESS CHAMBER DEPTH; TYPE, D IF DROP
- RETICULATION AREA BOUNDARY
- 30 — FINISHED CONTOUR LEVEL
- FSL — FINISHED DESIGN SURFACE LEVEL LOT LEVEL
- FFL — FINISHED FLOOR LEVEL (DESIGN)
- * — LOTS TO BE SERVED BUT NOT RELEASED
- AREA OF LOT NOT GRAVITY SEWERED
- IS 23.0 U2.1 — LOT CONNECTION

REV	DATE	DESCRIPTION	RVD
3	12.09.2013	AS CONSTRUCTED	DP
2	29.08.2012	REVISED LOT BOUNDARIES	GC
1	19.04.2012	ADJUSTED DESIGN TO SUIT NEW LOT LEVELS	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AC
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: SEWER RETICULATION SHEET 2 OF 2

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-603	3

P:\P10268-01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-603 SEWER.DWG
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CORSAIR CRESCENT

MARRIOT ROAD

ORION ROAD

ROAD 20

BERRIGAN DRIVE

JOINS DRG. NO 05-C-611

3.0m SERVICE CORRIDOR EASEMENT

Ø100 HYDRANT

200P

150

38.24

1:50

80.31

180.17

19.68

CONNECTION DETAIL "A"
SCALE 1:200

EXIST. 150P

REMOVE EXISTING 90° BEND AND INSTALL 150 x 150 TEE CONNECTION.

LOCATE 45°BENDS TO AVOID EXISTING SERVICES.

PROPOSED 200P

200SV

150 X 200 REDUCER BETWEEN TEE AND 45°BEND

CAUTION: HV UNDERGROUND POWER

EXISTING SEWER MAIN

EXISTING 150P WATER

EXISTING GAS MAIN

EXISTING TELSTRA

CONNECTION DETAIL "B"
SCALE 1:500

EXISTING 150P

EXIST. 150P

EXISTING GAS

200SV

200Ø STRAIGHT CONNECTION TO EXISTING MAIN WITH 150x200 REDUCER

PROPOSED 200P

TP 65.320

TP 148.336

100.01

45°x3

54.81

Ø150P-12

DP

REFER TO DRG. NO. 05-C-611 FOR TYPICAL PROPERTY SERVICES CONNECTION DETAILS

TP 683.468

TP 751.449

TP 598.151

TP 199.404

81.03

43.28

51.24

49.27

51.17

48.79

501 502 503 504 505 506 511 512 513 514 515 516

4

LEGEND

- EXISTING PIPEWORK/HYDRANT/VALVE
- FUTURE PIPEWORK
- PRELAID LONG SERVICE
- PROPOSED PIPEWORK
- HYDRANT
- CAPPED END
- VALVE (RESILIENT SEAT TYPE)
- CHANGE IN PIPE SIZE OR MATERIAL.
- AREA TO BE SERVED
- LOTS TO BE SERVED BUT NOT RELEASED
- (DP) DENOTES DEFLECT PIPES
- (1) DENOTES 11¼° BEND
- (2) DENOTES 22½° BEND
- (3) DENOTES 45° BEND
- (4) DENOTES 90° BEND
- LOTS WHERE SERVICES LAID IN PREVIOUS STAGE

GENERAL NOTES

1. PROPOSED PIPEWORK TO BE : UPVC CLASS 12 BLUE
2. CONSTRUCTION PROCEDURES TO BE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS FOR THE RELEVANT PIPE.
3. HYDRANTS NOMINALLY LOCATED ONLY. FINAL LOCATION TO BE DETERMINED IN CONJUNCTION WITH LOCAL FIRE BRIGADE AND WATER CORPORATION PROCEDURES.
5. THRUST BLOCKS SHALL BE POSITIONED AND FORMED IN ACCORDANCE WITH PIPE FITTING MANUFACTURER'S INSTRUCTIONS AND TECHNICAL SPECIFICATIONS.
6. ALIGNMENT OF PIPES SHALL BE NOMINALLY 2.1m AT CENTRELINE IN ACCORDANCE WITH SPECIFICATION.
7. ALL FITTINGS FOR PIPES TO CONFORM TO AS 2544
8. CONNECTION TO EXISTING MAINS TO BE CARRIED OUT LAST AND SHOULD BE SCHEDULED TO MINIMISE ANY DISRUPTION TO PROPERTIES.
9. FR & FL INDICATES THE SIDE OF THE LOT WHEN VIEWED FROM THE ROAD FRONTAGE ON WHICH THE PRELAID SERVICES ARE TO BE LAID.
10. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CO-ORDINATE THE INSTALLATION OF ALL SERVICES WITHIN THE SUBDIVISION. THE CONTRACTOR SHOULD CHECK TO ENSURE THAT THERE IS NO CONFLICT BETWEEN THE POSITION OF FULLY PRELAID WATER SERVICES AND ANY OTHER SERVICES OR SITE FACILITIES. THESE MAY INCLUDE WESTERN POWER UNDERGROUND POWER CONNECTION PILLARS, RETAINING WALLS, DRAINAGE MANHOLES AND SEWER ACCESS CHAMBERS.
11. THE CONTRACTOR SHALL ALLOW FOR THE SUPPLY AND INSTALLATION OF ANY ADDITIONAL FLUSHING POINTS NECESSARY FOR PRESSURE TESTING AT HIS OWN EXPENSE.

REV	DATE	DESCRIPTION	RVD
1	12.09.2013	AS CONSTRUCTED	DP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV | DATE | DESCRIPTION | RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: WATER RETICULATION SHEET 1 OF 2

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-610	1

P:\P10268.01 JANDAKOT AIRPORT PRECINCT 5\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-610_WATER.DWG
12/09/2013 3:41:58 PM

JOINS DRG. NO 05-C-610

JOINS DRG. NO. 05-C-610

ORION ROAD

BASIN 'E'

ROAD 20

200P

ø100 HYDRANT

506

511

510

509

508

507

TP 199.404

TP 373.15

TP 413.547

TP 655.741

TP 921.064

ø150P-12

55.71

34.56

32.65

52.01

45.54

97.27

93.76

6.00

200P TEE

200SV

FLUSHING POINT

LIMIT OF JAH
SITE BOUNDARY

ENLARGEMENT
1:250

ø150 FLANGED BLANK END

ø150 PVC

ø150 SV

WATER MAIN

FLANGED TEE

TYPICAL PROPERTY SERVICE DETAIL
N.T.S.

LENGTH OF PIPES

ø 200P	——	1973m
ø 150P	——	171m

GENERAL NOTES

1. PROPOSED PIPEWORK TO BE : UPVC CLASS 12 BLUE
2. CONSTRUCTION PROCEDURES TO BE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS FOR THE RELEVANT PIPE.
3. HYDRANTS NOMINALLY LOCATED ONLY. FINAL LOCATION TO BE DETERMINED IN CONJUNCTION WITH LOCAL FIRE BRIGADE AND WATER CORPORATION PROCEDURES.
5. THRUST BLOCKS SHALL BE POSITIONED AND FORMED IN ACCORDANCE WITH PIPE FITTING MANUFACTURER'S INSTRUCTIONS AND TECHNICAL SPECIFICATIONS.
6. ALIGNMENT OF PIPES SHALL BE NOMINALLY 2.1m AT CENTRELINE IN ACCORDANCE WITH SPECIFICATION.
7. ALL FITTINGS FOR PIPES TO CONFORM TO AS 2544
8. CONNECTION TO EXISTING MAINS TO BE CARRIED OUT LAST AND SHOULD BE SCHEDULED TO MINIMISE ANY DISRUPTION TO PROPERTIES.
9. FR & FL INDICATES THE SIDE OF THE LOT WHEN VIEWED FROM THE ROAD FRONTAGE ON WHICH THE PRELAID SERVICES ARE TO BE LAID.
10. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CO-ORDINATE THE INSTALLATION OF ALL SERVICES WITHIN THE SUBDIVISION. THE CONTRACTOR SHOULD CHECK TO ENSURE THAT THERE IS NO CONFLICT BETWEEN THE POSITION OF FULLY PRELAID WATER SERVICES AND ANY OTHER SERVICES OR SITE FACILITIES. THESE MAY INCLUDE WESTERN POWER UNDERGROUND POWER CONNECTION PILLARS, RETAINING WALLS, DRAINAGE MANHOLES AND SEWER ACCESS CHAMBERS.
11. THE CONTRACTOR SHALL ALLOW FOR THE SUPPLY AND INSTALLATION OF ANY ADDITIONAL FLUSHING POINTS NECESSARY FOR PRESSURE TESTING AT HIS OWN EXPENSE.

LEGEND

- EXISTING PIPEWORK/HYDRANT/VALVE
- FUTURE PIPEWORK
- PRELAID LONG SERVICE
- PROPOSED PIPEWORK
- PROPOSED 350 HDPE MAIN. REFER DRG. NO. P10268-610
- HYDRANT
- CAPPED END
- VALVE (RESILIENT SEAT TYPE)
- CHANGE IN PIPE SIZE OR MATERIAL.
- AREA TO BE SERVED
- LOTS TO BE SERVED BUT NOT RELEASED
- (DP) DENOTES DEFLECT PIPES
- (1) DENOTES 11¼° BEND
- (2) DENOTES 22½° BEND
- (3) DENOTES 45° BEND
- (4) DENOTES 90° BEND
- LOTS WHERE SERVICES LAID IN PREVIOUS STAGE

REV	DATE	DESCRIPTION	RVD
1	12.09.2013	AS CONSTRUCTED	DP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE	
AHD	PCG	1:1000	AT A1 SIZE

TITLE: WATER RETICULATION SHEET 2 OF 2

PROJECT No.	DRAWING No.	REV.
P10268.01	05-C-611	1

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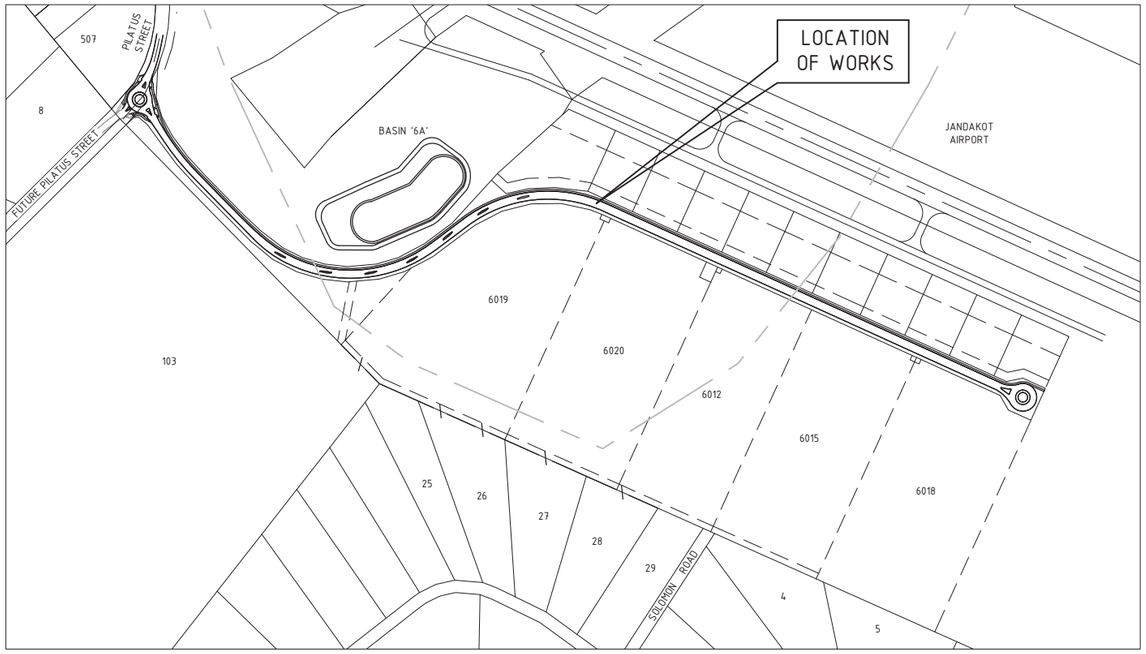
JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6



KEY PLAN

SCALE NTS

LOCALITY PLAN

SCALE N.T.S.

DRAWING INDEX

CIVIL DRAWINGS

C-0001	LOCALITY PLAN AND DRAWING INDEX
C-0010	GENERAL ARRANGEMENT PLAN
C-0100	PLAN AND PROFILE - CHA 0 TO CHA 600
C-0101	PLAN AND PROFILE - CHA 600 TO CHA 1200
C-0102	PLAN AND PROFILE - CHA 1200 TO CHA 1713
C-0200	ROAD LAYOUT PLAN - CHA 0 TO CHA 150
C-0201	ROAD LAYOUT PLAN - PILATUS STREET
C-0202	ROAD LAYOUT PLAN - CHA 150 TO CHA 300
C-0203	ROAD LAYOUT PLAN - CHA 300 TO CHA 475
C-0204	ROAD LAYOUT PLAN - CHA 475 TO CHA 600
C-0205	ROAD LAYOUT PLAN - CHA 600 TO CHA 750
C-0206	ROAD LAYOUT PLAN - CHA 750 TO CHA 960
C-0207	ROAD LAYOUT PLAN - CHA 960 TO CHA 1260
C-0208	ROAD LAYOUT PLAN - CHA 1260 TO CHA 1580
C-0209	ROAD LAYOUT PLAN - CHA 1580 TO CHA 1713
C-0220	INTERSECTION PLAN - PILATUS STREET / ROAD 6-1
C-0230	TURN ANALYSIS - ORION ROAD / ROAD 6-1
C-0231	TURN ANALYSIS - TURN AROUND ROUNDABOUT
C-0300	TYPICAL ROAD CROSS SECTIONS
C-0320	FENCING PLAN - SHEET 1
C-0321	FENCING PLAN - SHEET 2
C-0400	PAVEMENT MARKING AND MINOR SIGNAGE PLAN - CHA 0 TO CHA 290
C-0401	PAVEMENT MARKING AND MINOR SIGNAGE PLAN - CHA 290 TO CHA 560
C-0402	PAVEMENT MARKING AND MINOR SIGNAGE PLAN - CHA 560 TO CHA 1090
C-0403	PAVEMENT MARKING AND MINOR SIGNAGE PLAN - CHA 1090 TO CHA 1713
C-0500	DRAINAGE PLAN - CHA 0 TO CHA 290 - SHEET 1
C-0501	DRAINAGE PLAN - CHA 290 TO CHA 560 - SHEET 2
C-0502	DRAINAGE PLAN - CHA 560 TO CHA 1090 - SHEET 3
C-0503	DRAINAGE PLAN - CHA 1090 TO CHA 1713 -SHEET 4
C-0504	DRAINAGE PLAN - SHEET 5
C-0505	DRAINAGE PLAN - SHEET 6
C-0515	DRAINAGE CATCHMENT PLAN - SHEET 1
C-0516	DRAINAGE CATCHMENT PLAN - SHEET 2

DRAWING INDEX

CIVIL DRAWINGS

C-0600	SEWER RETICULATION - SITE AND DESIGN DATA PLAN
C-0601	SEWER RETICULATION - SHEET 1
C-0602	SEWER RETICULATION - SHEET 2
C-0610	SEWER RISING MAIN - SITE PLAN
C-0611	SEWER RISING MAIN - PLAN AND PROFILE - CHA 0 TO CHA 650
C-0612	SEWER RISING MAIN - PLAN AND PROFILE - CHA 650 TO CHA 1253
C-0630	PUMP STATION - PLAN
C-0631	PRESSURE MAIN CHARACTERISTIC CURVE
C-0670	WATER RETICULATION PLAN - OFFSITE - SHEET 1
C-0671	WATER RETICULATION PLAN - ONSITE - SHEET 1
C-0672	WATER RETICULATION PLAN - ONSITE - SHEET 2
C-0680	SERVICES PLAN - SPARE COMMS
C-0681	SERVICES PLAN - TELSTRA
C-0800	BULK EARTHWORKS PLAN - SHEET 1
C-0801	BULK EARTHWORKS PLAN - SHEET 1
C-0805	BULK EARTHWORKS SECTIONS - SHEET 1

REV	DATE	DESCRIPTION	RVD
A	31.03.2015	ISSUED FOR 50% REVIEW	AP

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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484 Murray St, Perth WA 6000
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bgeeng.com—

PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 6

STATUS: ISSUED FOR INFORMATION — NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	NTS	AT A1 SIZE

TITLE: LOCALITY PLAN AND DRAWING INDEX

PROJECT No.	DRAWING No.	REV.
P14327	C-0001	A

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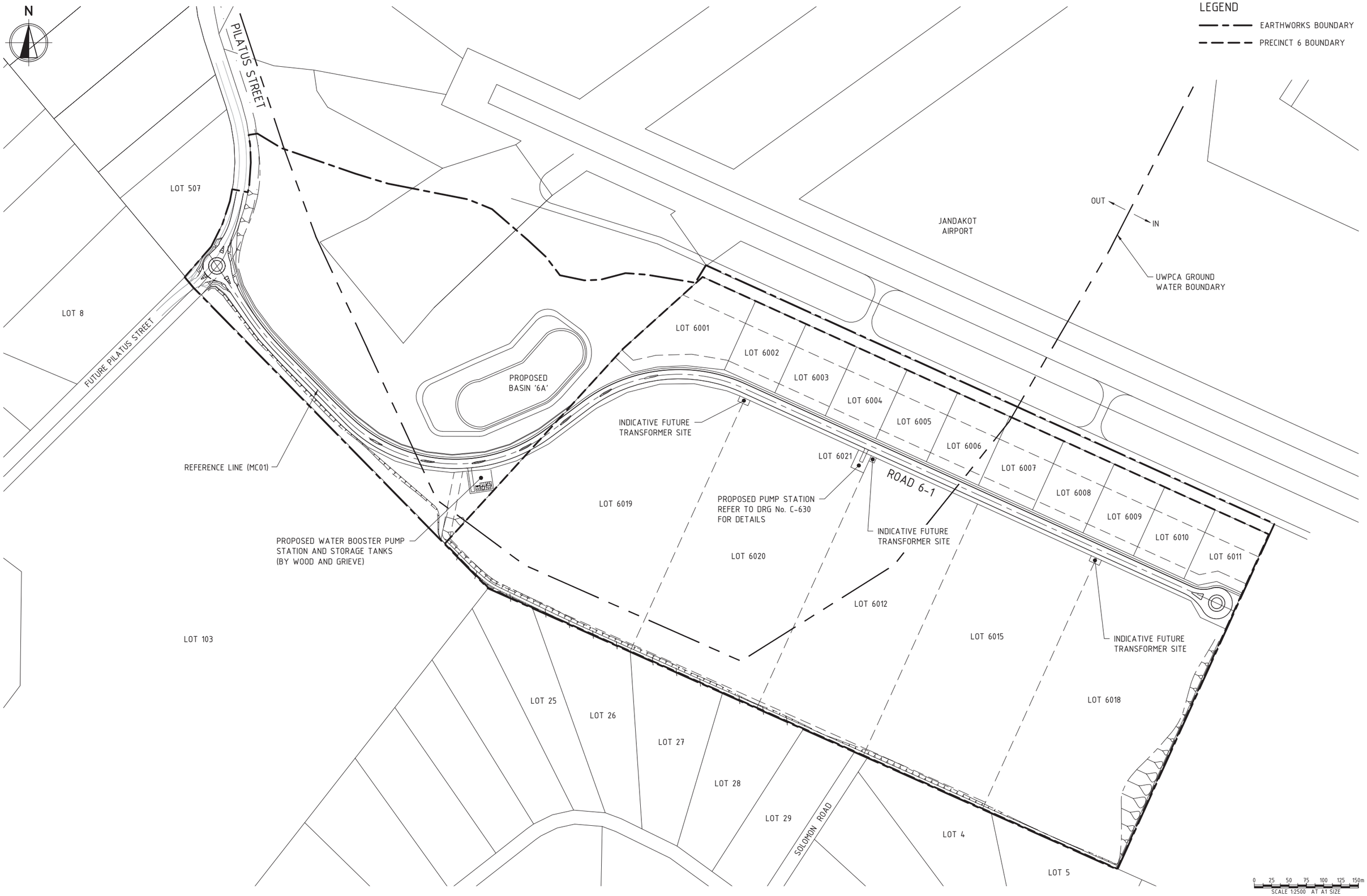

REV	DATE	DESCRIPTION	RVD
A	31.03.2015	ISSUED FOR 50% REVIEW	AP

REVISIONS

REVISIONS

CLIENT
JANDAKOT AIRPORT HOLDINGS PTY. LTD.

Perth *Office*—
484 Murray St, Perth WA 6000
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bgeeng.com—

PROJECT
JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS
ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:2500	AT A1 SIZE

TITLE
GENERAL ARRANGEMENT PLAN

PROJECT No.	DRAWING No.	REV.
P14327	C-0010	A

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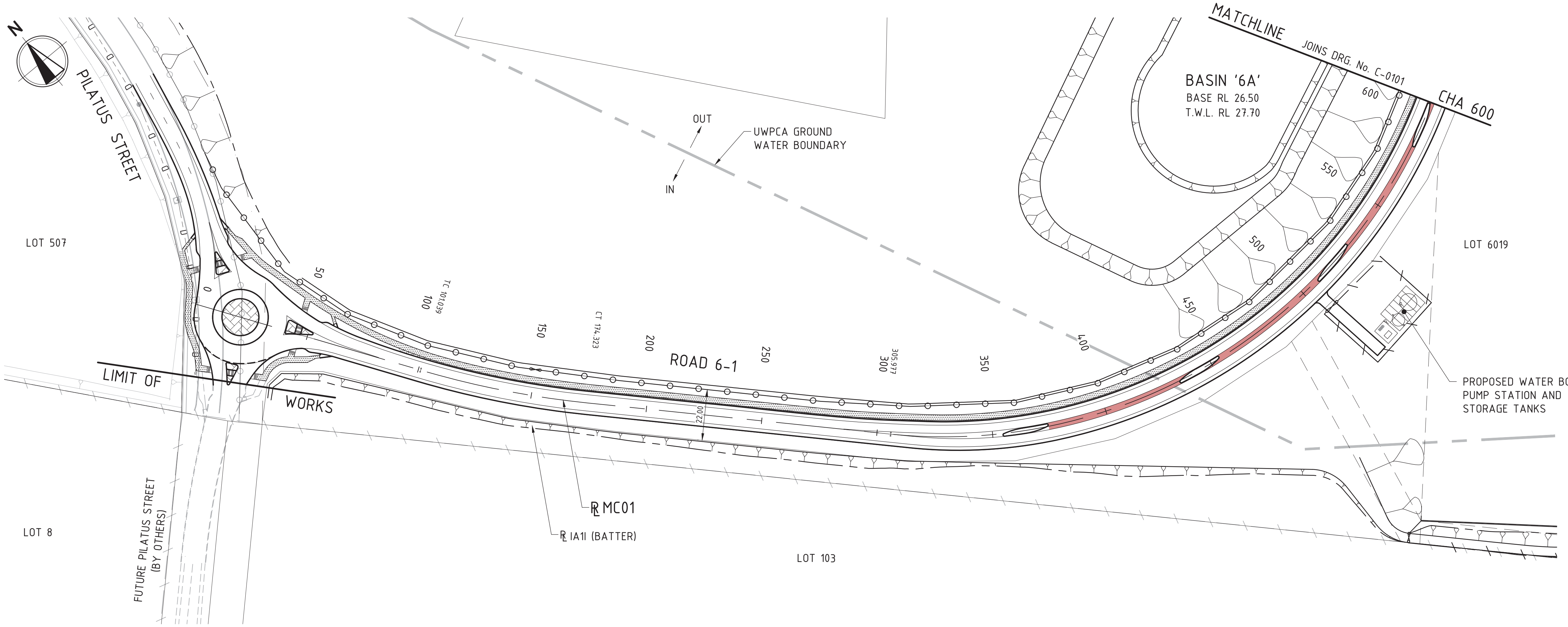
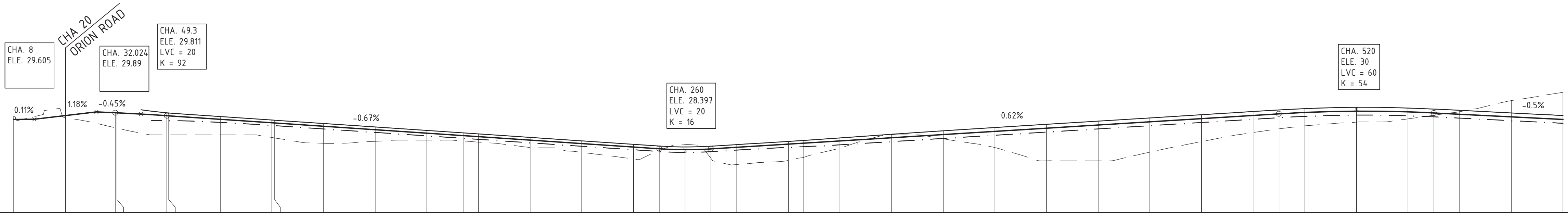


PLAN

SCALE 1:1000



CHAINAGE	+CUT/-FILL	DESIGN MC01	EXISTING GROUND
0	0.115	29.597	29.711
20	-0.074	29.748	29.674
39.3	-0.579	29.857	29.278
40	-0.591	29.854	29.262
59.3	-0.744	29.744	29
60	-0.739	29.739	29
80	-0.605	29.605	29
100	-0.57	29.471	28.901
101.04	-0.58	29.464	28.884
120	-0.66	29.337	28.677
140	-0.452	29.202	28.75
160	-0.271	29.068	28.798
174.32	-0.209	28.972	28.763
180	-0.214	28.934	28.72
200	-0.289	28.800	28.51
220	-0.34	28.665	28.325
240	-0.463	28.531	28.068
250	-0.068	28.464	28.397
260	0.207	28.429	28.636
270	-0.361	28.459	28.098
280	-0.666	28.520	27.854
300	-0.628	28.644	28.015
305.98	-0.547	28.680	28.134
320	-0.278	28.767	28.489
340	0.11	28.890	29
360	-0.163	29.014	28.85
380	-0.625	29.137	28.511
400	-1.26	29.260	28
420	-1.383	29.383	28
440	-1.172	29.507	28.334
460	-0.888	29.630	28.742
480	-0.662	29.753	29.092
490	-0.58	29.815	29.236
500	-0.516	29.867	29.351
520	-0.422	29.916	29.494
540	-0.27	29.891	29.621
550	-0.089	29.850	29.761
560	0.099	29.800	29.899
580	0.627	29.700	30.327
600	1.046	29.600	30.646

HORIZ. ALIGN MC01: D=20 | D=81.04 | R=-400, L=73.28 | D=131.65 | R=-225, L=323.49

VERT. ALIGN MC01: G=0.11%, L=8 | G=1.18%, L=24.02 | G=-0.45%, L=7.28 | K=92.47, L=20 | G=-0.67%, L=190.7 | K=15.53, L=20 | G=0.62%, L=220 | K=53.74, L=60 | G=-0.5%, L=110

SUPERELEVATION: RHS 3% / LHS -3%

PROFILE

SCALE 1:1000H, 1:100V

NOTES

1. REFER TO DRG No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.

LEGEND

- CADASTRAL
- PROPOSED KERBING
- PROPOSED LINEMARKING
- PROPOSED BRICKPAVING
- PROPOSED 2.5m WIDE RED ASPHALT SHARED PATH
- PROPOSED RED ASPHALT
- PROPOSED AIRSIDE FENCE
- PROPOSED 1.8m HIGH SECURITY FENCE
- PROPOSED GATE

0 1 2 3 4 5 6m — SCALE 1:100 AT A1 SIZE

0 10 20 30 40 50 60m — SCALE 1:1000 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A	31.03.2015	ISSUED FOR 50% REVIEW	AP

REVISIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

Perth *Office*—
484 Murray St, Perth WA 6000
P /+61 8 6364 3300
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bgeeng.com—

PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 6

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE
AHD	PCG94	1:1000H, 1:100V AT A1 SIZE

TITLE: PLAN AND PROFILE CHA 0 TO CHA 600

PROJECT No.	DRAWING No.	REV.
P14327	C-0100	A

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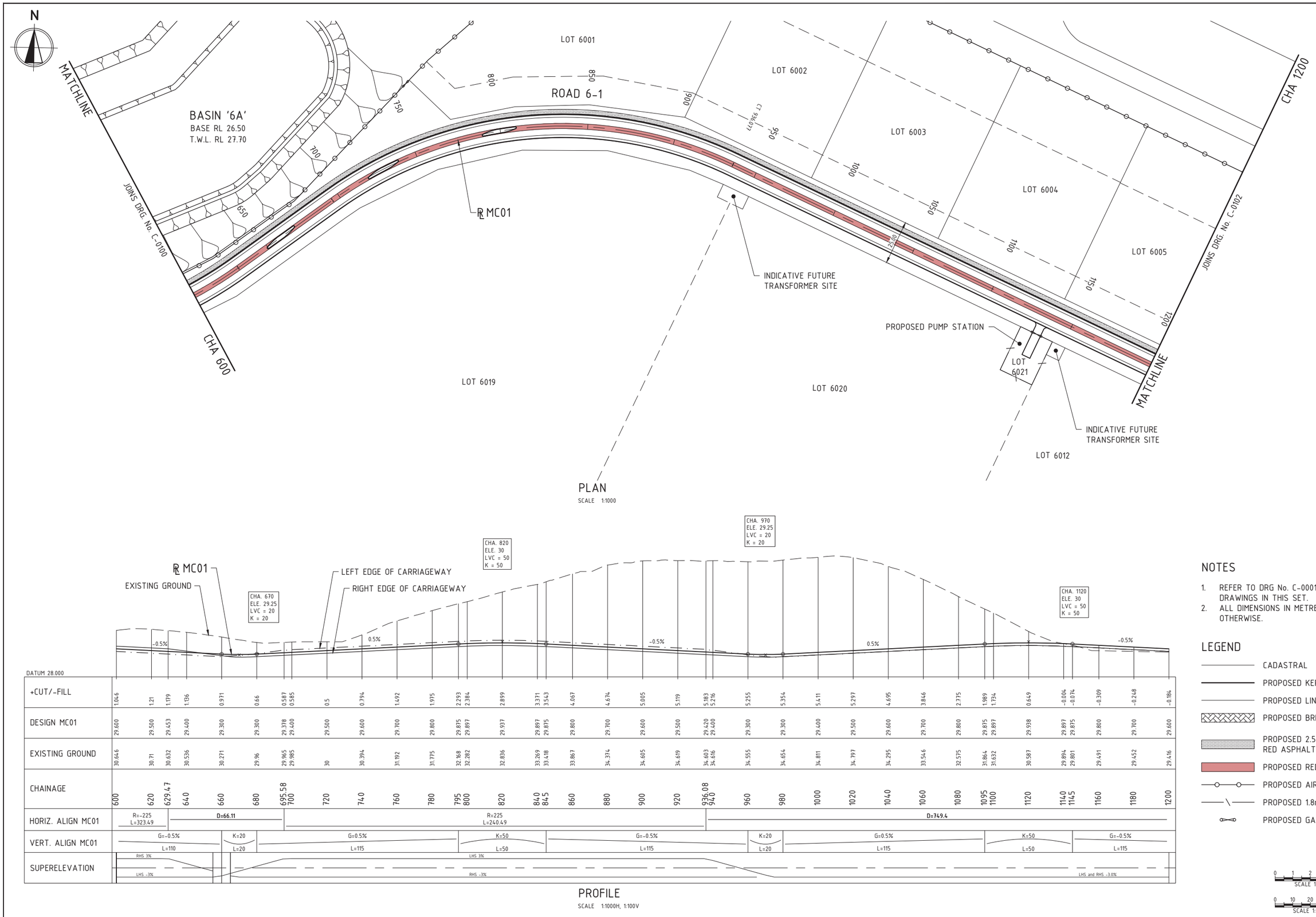

PLAN
SCALE 1:1000

DATUM 28.000

CHAINAGE	+CUT/-FILL	DESIGN MC01	EXISTING GROUND
600	1.046	29.600	30.646
620	1.21	29.500	30.71
629.47	1.179	29.453	30.632
640	1.136	29.400	30.536
660	0.971	29.300	30.271
680	0.66	29.300	29.96
695.58	0.587	29.378	29.965
700	0.585	29.400	29.985
720	0.5	29.500	30
740	0.794	29.600	30.394
760	1.492	29.700	31.192
780	1.975	29.800	31.775
795	2.293	29.875	32.168
800	2.384	29.897	32.282
820	2.899	29.937	32.836
840	3.371	29.897	33.269
845	3.543	29.875	33.418
860	4.067	29.800	33.867
880	4.674	29.700	34.374
900	5.005	29.600	34.605
920	5.119	29.500	34.619
936.08	5.183	29.420	34.603
940	5.216	29.400	34.616
960	5.255	29.300	34.555
980	5.354	29.300	34.654
1000	5.411	29.400	34.811
1020	5.297	29.500	34.797
1040	4.695	29.600	34.295
1060	3.846	29.700	33.546
1080	2.775	29.800	32.575
1095	1.989	29.875	31.864
1100	1.734	29.897	31.632
1120	0.649	29.938	30.587
1140	-0.004	29.897	29.894
1145	-0.074	29.875	29.801
1160	-0.309	29.800	29.491
1180	-0.248	29.700	29.452
1200	-0.184	29.600	29.416

HORIZ. ALIGN MC01	R=-225 L=323.49; D=66.11; R=225 L=240.49; D=749.4
VERT. ALIGN MC01	G=-0.5% L=110; K=20 L=20; G=0.5% L=115; K=50 L=50; G=-0.5% L=115; K=20 L=20; G=0.5% L=115; K=50 L=50; G=-0.5% L=115
SUPERELEVATION	RHS 3%; LHS -3%; LHS 3%; RHS -3%; LHS and RHS -3.0%

PROFILE
SCALE 1:1000H, 1:100V

NOTES
1. REFER TO DRG No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.

LEGEND
- CADASTRAL
- PROPOSED KERBING
- PROPOSED LINEMARKING
- PROPOSED BRICKPAVING
- PROPOSED 2.5m WIDE RED ASPHALT SHARED PATH
- PROPOSED RED ASPHALT
- PROPOSED AIRSIDE FENCE
- PROPOSED 1.8m HIGH SECURITY FENCE
- PROPOSED GATE

0 1 2 3 4 5 6m
SCALE 1:100 AT A1 SIZE

0 10 20 30 40 50 60m
SCALE 1:1000 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A			

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

Perth *Office*—
484 Murray St, Perth WA 6000
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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:1000H, 1:100V	AT A1 SIZE

TITLE: PLAN AND PROFILE CHA 600 TO CHA 1200

PROJECT No.	DRAWING No.	REV
P14327	C-0101	A

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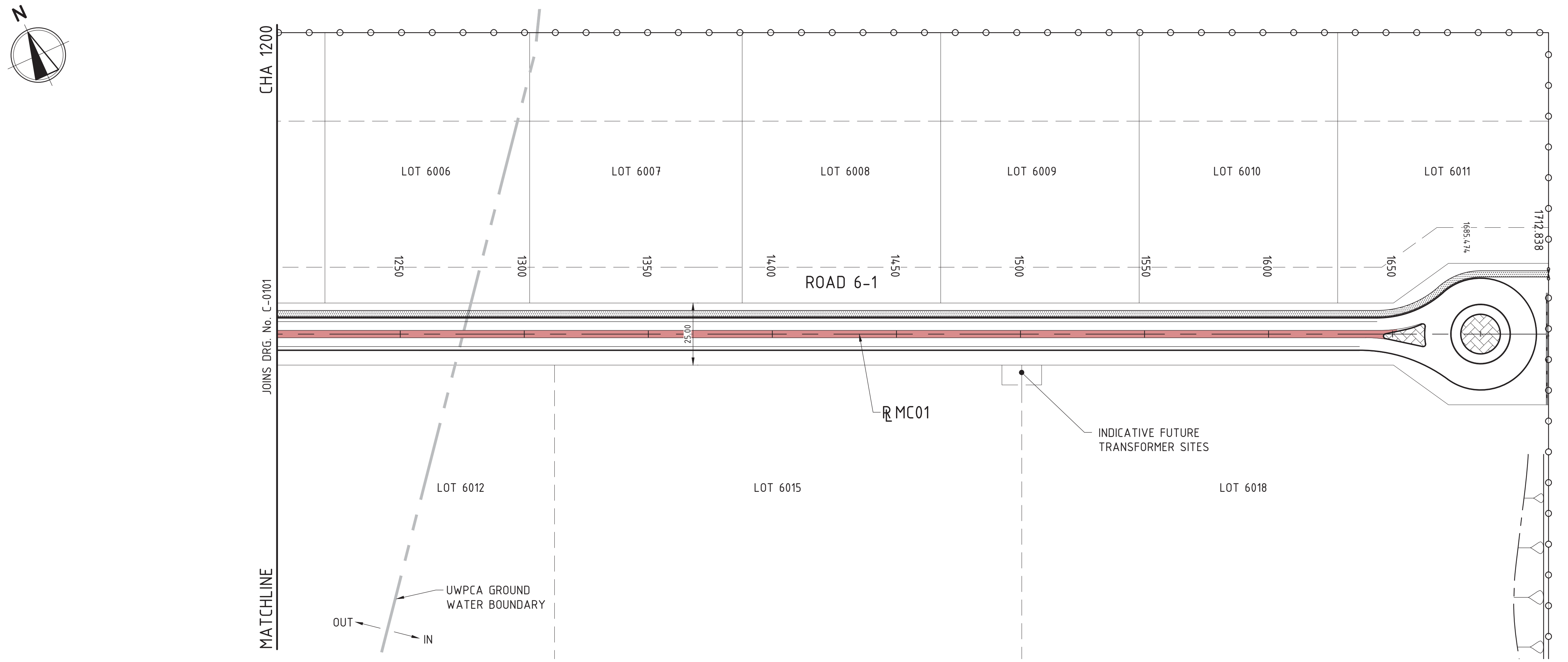
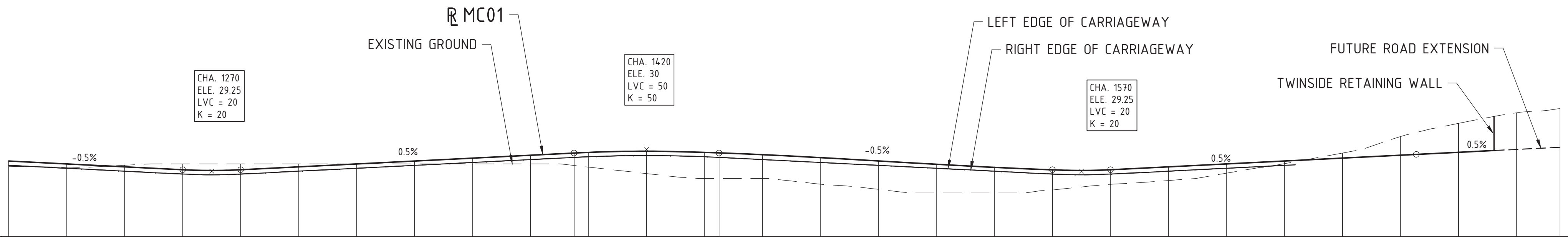


PLAN

SCALE 1:1000



DATUM 27.000

CHAINAGE	+CUT/-FILL	DESIGN MC01	EXISTING GROUND
1200	-0.184	29.600	29.416
1220	-0.112	29.500	29.388
1240	0.053	29.400	29.453
1260	0.2	29.300	29.5
1280	0.2	29.300	29.5
1300	0.1	29.400	29.5
1320	0	29.500	29.5
1340	-0.1	29.600	29.5
1360	-0.2	29.700	29.5
1380	-0.3	29.800	29.5
1395	-0.43	29.875	29.445
1400	-0.508	29.897	29.39
1420	-0.771	29.937	29.167
1440	-0.897	29.897	29
1445	-0.875	29.875	29
1460	-0.8	29.800	29
1480	-0.901	29.700	28.799
1500	-0.978	29.600	28.622
1520	-1	29.500	28.5
1540	-0.9	29.400	28.5
1560	-0.7	29.300	28.6
1580	-0.502	29.300	28.798
1600	-0.472	29.400	28.928
1620	-0.319	29.500	29.181
1640	-0.093	29.600	29.507
1660	0.175	29.700	29.875
1680	0.643	29.800	30.442
1700	0.999	29.900	30.899
1720	1.261	30.000	31.261
1735.01			31.404

HORIZ. ALIGN MC01	
1200–1700	D=749.4
1700–1735.01	D=49.53

VERT. ALIGN MC01	
1200–1260	G=-0.5% L=115
1260–1280	K=20 L=20
1280–1395	G=0.5% L=115
1395–1445	K=50 L=50
1445–1560	G=-0.5% L=115
1560–1580	K=20.01 L=20
1580–1700	G=0.5% L=105.47
1700–1735.01	G=0.5% L=49.53

SUPERELEVATION: LHS and RHS -3%

PROFILE

SCALE 1:1000H, 1:100V

NOTES

1. REFER TO DRG No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.

LEGEND

- CADASTRAL
- PROPOSED KERBING
- PROPOSED LINEMARKING
- PROPOSED BRICKPAVING
- PROPOSED 2.5m WIDE RED ASPHALT SHARED PATH
- PROPOSED RED ASPHALT
- PROPOSED AIRSIDE FENCE
- PROPOSED 1.8m HIGH SECURITY FENCE
- PROPOSED GATE

0 1 2 3 4 5 6m — SCALE 1:100 AT A1 SIZE

0 10 20 30 40 50 60m — SCALE 1:1000 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD	REV	DATE	DESCRIPTION	RVD
A							

REVISIONS | REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

Perth *Office*—
484 Murray St, Perth WA 6000
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bgeeng.com—

PROJECT: JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:1000H, 1:100V	AT A1 SIZE

TITLE: PLAN AND PROFILE
CHA 1200 TO CHA 1713

PROJECT No.	DRAWING No.	REV.
P14327	C-0102	A

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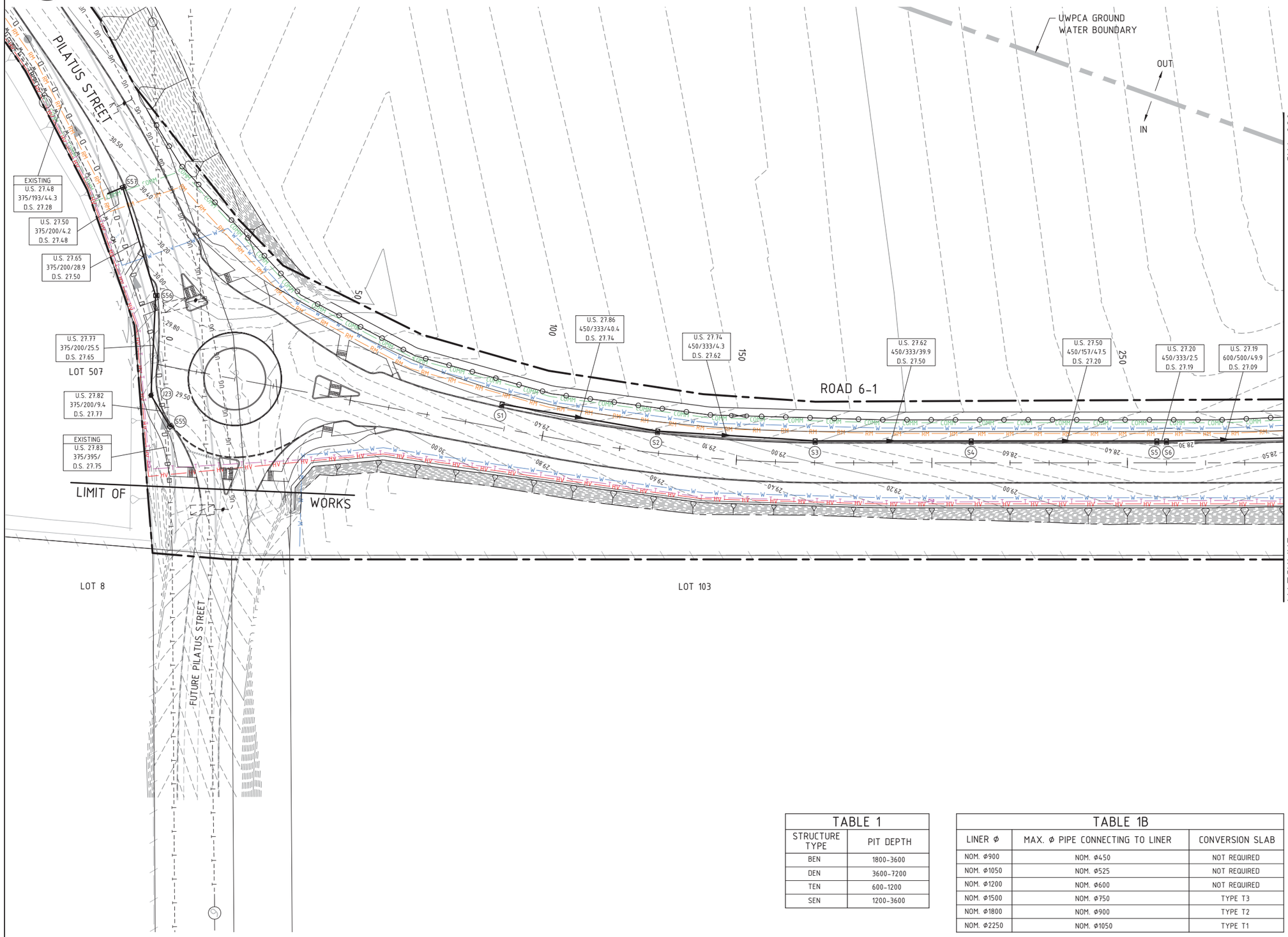

NOTES

1. REFER TO DRG. No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. REFER TO MAIN ROAD STANDARD DRAWINGS 200231-091 AND 200231-093 FOR SIDE ENTRY PITS.
3. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
4. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ACCURATELY LOCATE ALL SERVICES AND CARRY OUT ANY SERVICE PROTECTION WORKS DEEMED NECESSARY PRIOR TO WORK COMMENCING ON SITE.
5. ALL PIPES SHALL BE SPIGOT AND SOCKET TYPE WITH RUBBER RING JOINTS, RCP CLASS 2 UNLESS OTHERWISE NOTE.
6. CONSTRUCTION PLANT SHALL NOT BE PERMITTED TO TRAVEL OVER COMPACTED PIPELINE UNTIL A MINIMUM THICKNESS OF COMPACTED BACKFILL HAS BEEN PLACED TO PROVIDE ADEQUATE PROTECTION.
7. MATERIALS FOR BEDDING, HAUNCH AND SIDE ZONES SHALL COMPLY WITH WITH THE RELEVANT REQUIREMENTS OF TABLE 3 & 4 OF AS3725 FOR HS3 SUPPORT CONDITIONS.
8. BEDDING AND BACKFILL MATERIAL TO BE PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATION.
9. UNSUITABLE IN SITU BEDDING MATERIAL SHALL BE TREATED IN ACCORDANCE WITH THE SPECIFICATION.
10. CONTRACTOR TO EXERCISE EXTREME CARE IN THE VICINITY OF THE U/GROUND POWER, TELSTRA CONDUITS AND FIBRE OPTIC CABLES.
11. PITS ARE NOT DRAWN TO SCALE.

LEGEND

- PROJECT BOUNDARY
- EXISTING DRAINAGE PIPE
- EXISTING DRAINAGE PIT
- EXISTING PIPE TO BE REMOVED
- PROPOSED DRAINAGE PIPE
- PROPOSED DRAINAGE MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED HEADWALL
- PROPOSED MAJOR CONTOUR (1.0m INTERVALS)
- PROPOSED MINOR CONTOUR (0.1m INTERVALS)
- (S1) DRAINAGE STRUCTURE NUMBER J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT
- U.S. 12.42 / 300/100/12.00 / D.S. 12.30 — UPSTREAM PIPE INVERT LEVEL / PIPE DIA(mm)/GRADE/LENGTH(m) / DOWNSTREAM PIPE INVERT LEVEL

SERVICES LEGEND

EXISTING	PROPOSED	
--W---W--	W W	WATER MAIN
	F F	FEEDER PIPE
	W W	WATER (MAINS EXTENSION)
--S---S--	S S	SEWER
RM	RM	SEWER RISING MAIN
--G---G--	G G	HIGH PRESSURE GAS PIPE
UG		POWER (UNDERGROUND)
HV	HV	POWER (HV UNDERGROUND)
--T---T--	T T	TELSTRA CABLES
COMM	COMM	COMMUNICATIONS CONDUIT
		ELECTRICAL PIT (ACO P66 OR SIM.)
		COMMS PIT (ACO P66 OR SIM.)

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0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

TABLE 1

STRUCTURE TYPE	PIT DEPTH
BEN	1800-3600
DEN	3600-7200
TEN	600-1200
SEN	1200-3600

TABLE 1B

LINER Ø	MAX. Ø PIPE CONNECTING TO LINER	CONVERSION SLAB
NOM. Ø900	NOM. Ø450	NOT REQUIRED
NOM. Ø1050	NOM. Ø525	NOT REQUIRED
NOM. Ø1200	NOM. Ø600	NOT REQUIRED
NOM. Ø1500	NOM. Ø750	TYPE T3
NOM. Ø1800	NOM. Ø900	TYPE T2
NOM. Ø2250	NOM. Ø1050	TYPE T1

REV	DATE	DESCRIPTION	RVD
A	20.03.2015	ISSUED FOR 50% REVIEW	AP

REVISIONS

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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bgeeng.com—

PROJECT: JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN CHA 0 TO CHA 290 SHEET 1

PROJECT No.	DRAWING No.	REV
P14327	C-0500	A

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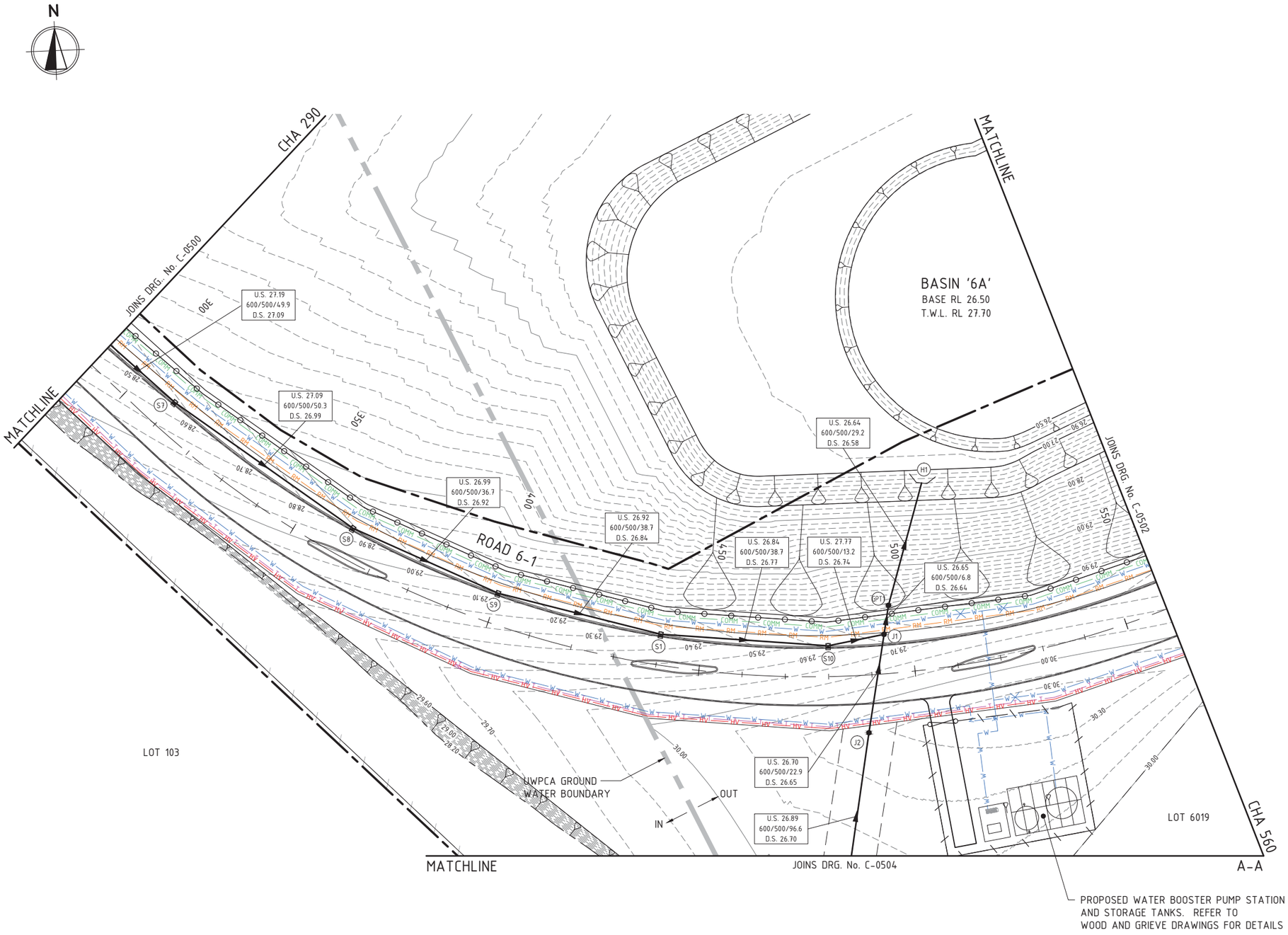

NOTES

1. REFER TO DRG. No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. REFER TO MAIN ROAD STANDARD DRAWINGS 200231-091 AND 200231-093 FOR SIDE ENTRY PITS.
3. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
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11. PITS ARE NOT DRAWN TO SCALE.

LEGEND

- PROJECT BOUNDARY
- EXISTING DRAINAGE PIPE
- EXISTING DRAINAGE PIT
- EXISTING PIPE TO BE REMOVED
- PROPOSED DRAINAGE PIPE
- PROPOSED DRAINAGE MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED HEADWALL
- 14.50 PROPOSED MAJOR CONTOUR (1.0m INTERVALS)
- PROPOSED MINOR CONTOUR (0.1m INTERVALS)
- (S1) DRAINAGE STRUCTURE NUMBER J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT
- U.S. 12.42 / 300/100/12.00 / D.S. 12.30 — UPSTREAM PIPE INVERT LEVEL; PIPE DIA(mm)/GRADE/LENGTH(m); DOWNSTREAM PIPE INVERT LEVEL

SERVICES LEGEND

EXISTING	PROPOSED	
--W---W--	W W	WATER MAIN
	F F	FEEDER PIPE
	W W	WATER (MAINS EXTENSION)
--S---S--	S S	SEWER
-- RM --	RM	SEWER RISING MAIN
--G---G--	G G	HIGH PRESSURE GAS PIPE
-- UG --		POWER (UNDERGROUND)
-- HV --	HV	POWER (HV UNDERGROUND)
--T---T--	T T	TELSTRA CABLES
-- COMM --	COMM	COMMUNICATIONS CONDUIT
		ELECTRICAL PIT (ACO P66 OR SIM.)
	PIT	COMMS PIT (ACO P66 OR SIM.)

DIAL BEFORE YOU DIG www.1100.com.au

0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A	31.03.2015	ISSUED FOR 50% REVIEW	AP

REVISIONS

CLIENT: JANDAKOT AIRPORT HOLDINGS PTY. LTD.

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bgeeng.com—

PROJECT: JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN CHA 0 TO CHA 290 SHEET 1

PROJECT No. P14327 | DRAWING No. C-0500 | REV. A

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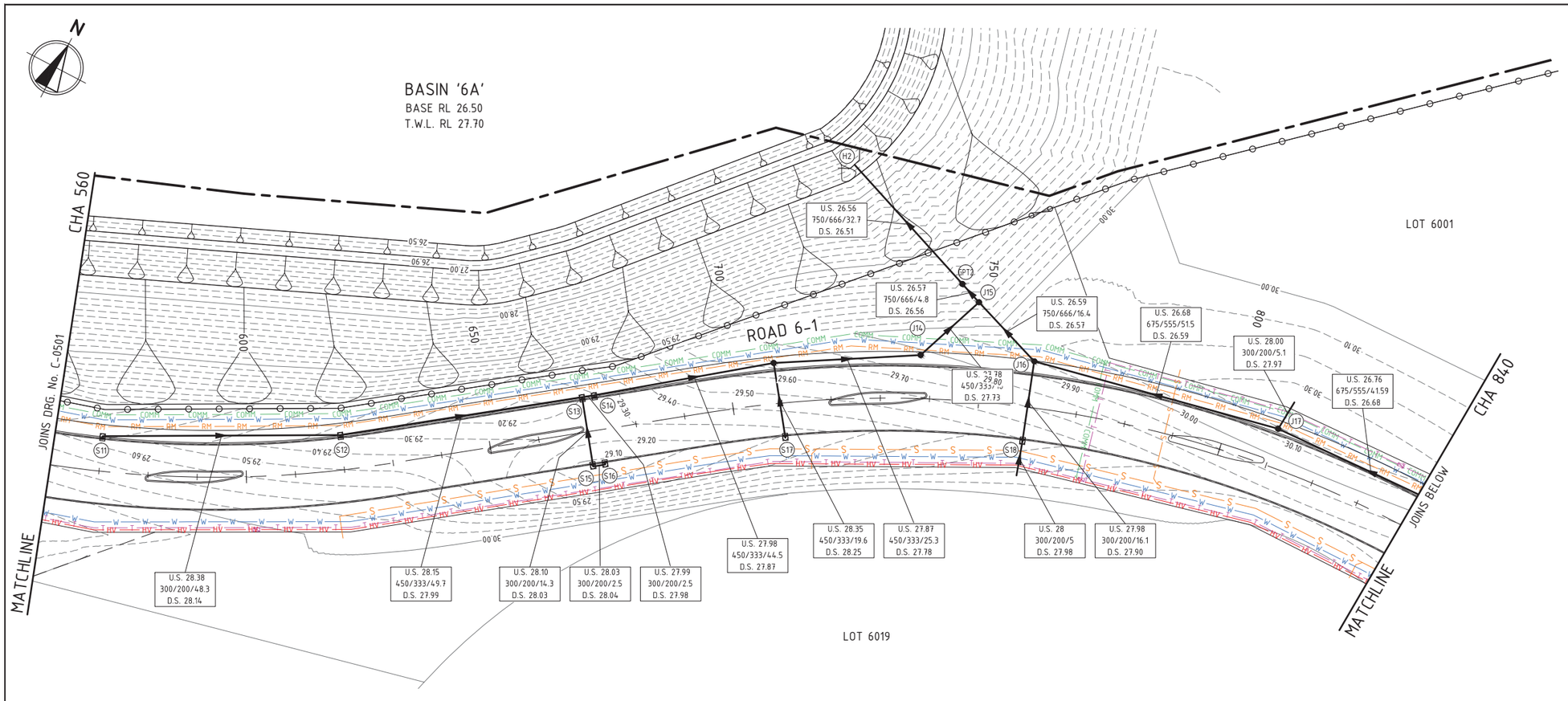

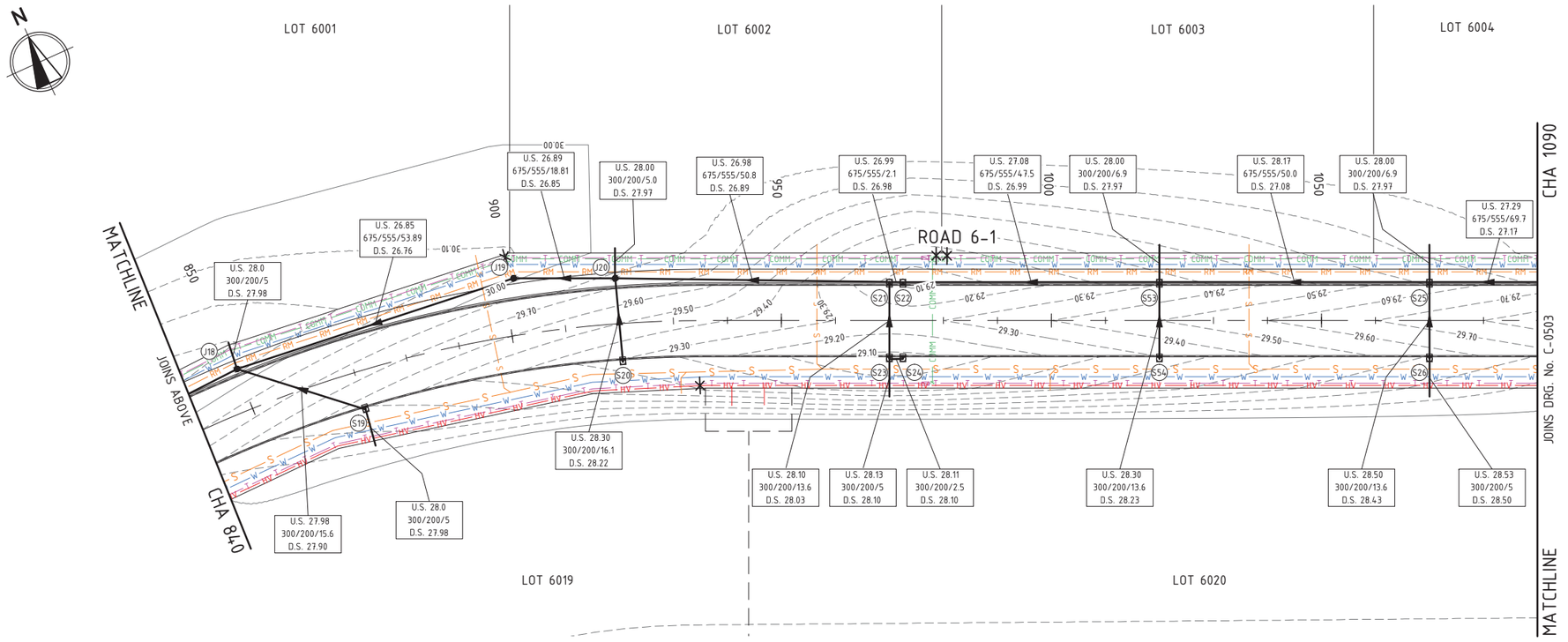

NOTES

1. REFER TO DRG. No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. REFER TO MAIN ROAD STANDARD DRAWINGS 200231-091 AND 200231-093 FOR SIDE ENTRY PITS.
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11. PITS ARE NOT DRAWN TO SCALE.

LEGEND

- PROJECT BOUNDARY
- EXISTING DRAINAGE PIPE
- EXISTING DRAINAGE PIT
- EXISTING PIPE TO BE REMOVED
- PROPOSED DRAINAGE PIPE
- PROPOSED DRAINAGE MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED HEADWALL
- 14.50 PROPOSED MAJOR CONTOUR (1.0m INTERVALS)
- PROPOSED MINOR CONTOUR (0.1m INTERVALS)
- (S1) DRAINAGE STRUCTURE NUMBER J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT
- U.S. 12.42 / 300/100/12.00 / D.S. 12.30 — UPSTREAM PIPE INVERT LEVEL / PIPE DIA(mm)/GRADE/LENGTH(m) / DOWNSTREAM PIPE INVERT LEVEL

SERVICES LEGEND

EXISTING	PROPOSED	
--W---W--	W W	WATER MAIN
	F F	FEEDER PIPE
	W W	WATER (MAINS EXTENSION)
--S---S--	S S	SEWER
RM	RM	SEWER RISING MAIN
--G---G--	G G	HIGH PRESSURE GAS PIPE
UG		POWER (UNDERGROUND)
HV	HV	POWER (HV UNDERGROUND)
--T---T--	T T	TELSTRA CABLES
COMM	COMM	COMMUNICATIONS CONDUIT
		ELECTRICAL PIT (ACO P66 OR SIM.)
		COMMS PIT (ACO P66 OR SIM.)

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0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A	20.03.2015	ISSUED FOR 50% REVIEW	AP

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REV	DATE	DESCRIPTION	RVD

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PRECINCT 6

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SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN CHA 560 TO CHA 1090 SHEET 3

PROJECT No.	DRAWING No.	REV.
P14327	C-0502	A

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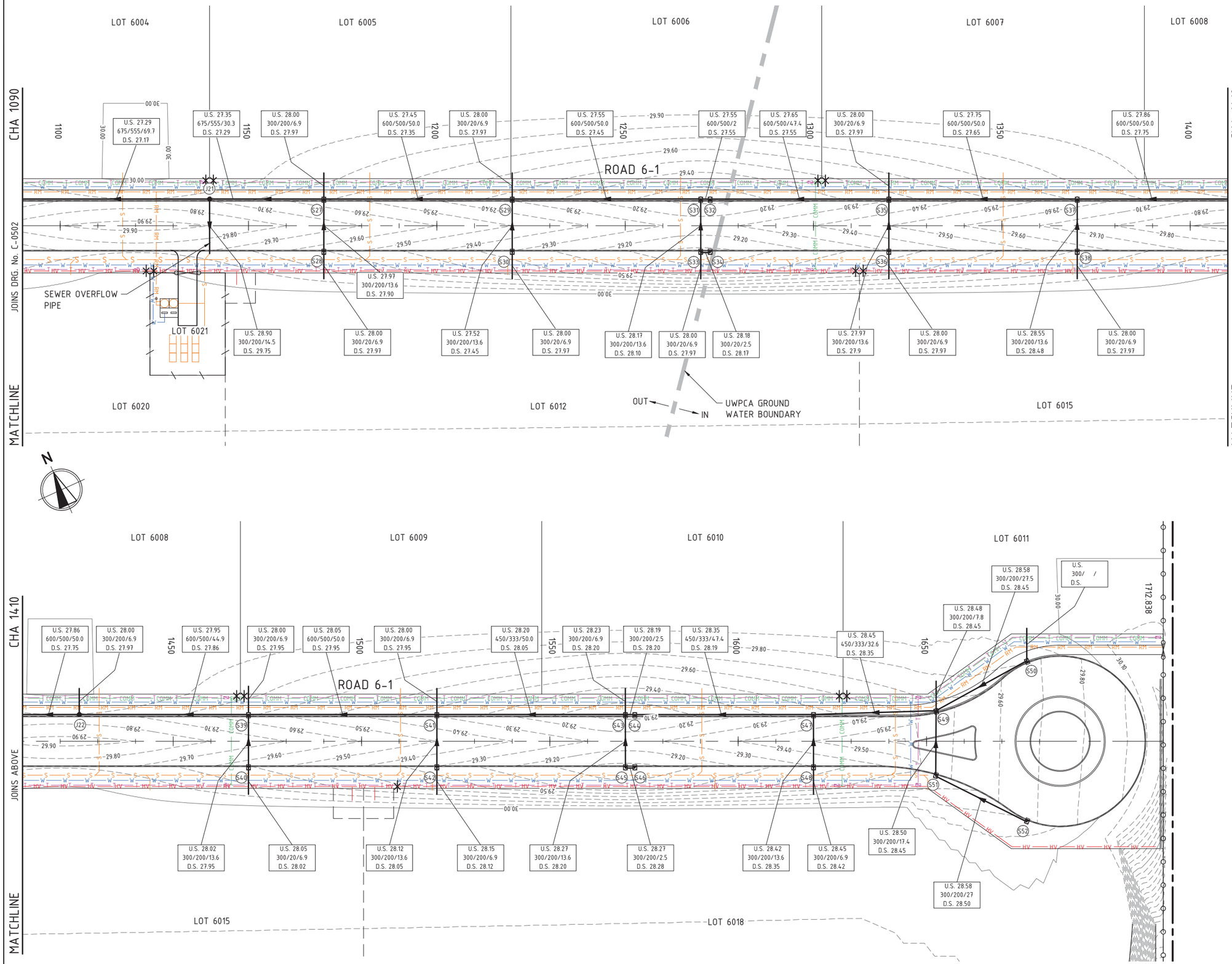

NOTES

1. REFER TO DRG. No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. REFER TO MAIN ROAD STANDARD DRAWINGS 200231-091 AND 200231-093 FOR SIDE ENTRY PITS.
3. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
4. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ACCURATELY LOCATE ALL SERVICES AND CARRY OUT ANY SERVICE PROTECTION WORKS DEEMED NECESSARY PRIOR TO WORK COMMENCING ON SITE.
5. ALL PIPES SHALL BE SPIGOT AND SOCKET TYPE WITH RUBBER RING JOINTS, RCP CLASS 2 UNLESS OTHERWISE NOTE.
6. CONSTRUCTION PLANT SHALL NOT BE PERMITTED TO TRAVEL OVER COMPACTED PIPELINE UNTIL A MINIMUM THICKNESS OF COMPACTED BACKFILL HAS BEEN PLACED TO PROVIDE ADEQUATE PROTECTION.
7. MATERIALS FOR BEDDING, HAUNCH AND SIDE ZONES SHALL COMPLY WITH WITH THE RELEVANT REQUIREMENTS OF TABLE 3 & 4 OF AS3725 FOR HS3 SUPPORT CONDITIONS.
8. BEDDING AND BACKFILL MATERIAL TO BE PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATION.
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10. CONTRACTOR TO EXERCISE EXTREME CARE IN THE VICINITY OF THE U/GROUND POWER, TELSTRA CONDUITS AND FIBRE OPTIC CABLES.
11. PITS ARE NOT DRAWN TO SCALE.

LEGEND

- PROJECT BOUNDARY
- EXISTING DRAINAGE PIPE
- EXISTING DRAINAGE PIT
- EXISTING PIPE TO BE REMOVED
- PROPOSED DRAINAGE PIPE
- PROPOSED DRAINAGE MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED HEADWALL
- PROPOSED MAJOR CONTOUR (1.0m INTERVALS)
- PROPOSED MINOR CONTOUR (0.1m INTERVALS)
- DRAINAGE STRUCTURE NUMBER J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT
- U.S. 12.42 / 300/100/12.00 / D.S. 12.30 — UPSTREAM PIPE INVERT LEVEL; PIPE DIA(mm)/GRADE/LENGTH(m); DOWNSTREAM PIPE INVERT LEVEL

SERVICES LEGEND

EXISTING	PROPOSED	
--W---W--	W W	WATER MAIN
	F F	FEEDER PIPE
	W W	WATER (MAINS EXTENSION)
--S---S--	S S	SEWER
RM	RM	SEWER RISING MAIN
--G---G--	G G	HIGH PRESSURE GAS PIPE
UG		POWER (UNDERGROUND)
HV	HV	POWER (HV UNDERGROUND)
--T---T--	T T	TELSTRA CABLES
COMM	COMM	COMMUNICATIONS CONDUIT
	E	ELECTRICAL PIT (ACO P66 OR SIM.)
	C	COMMS PIT (ACO P66 OR SIM.)

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PRECINCT 6

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SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN CHA 1090 TO CHA 1713 SHEET 4

PROJECT No.	DRAWING No.	REV.
P14327	C-0503	A

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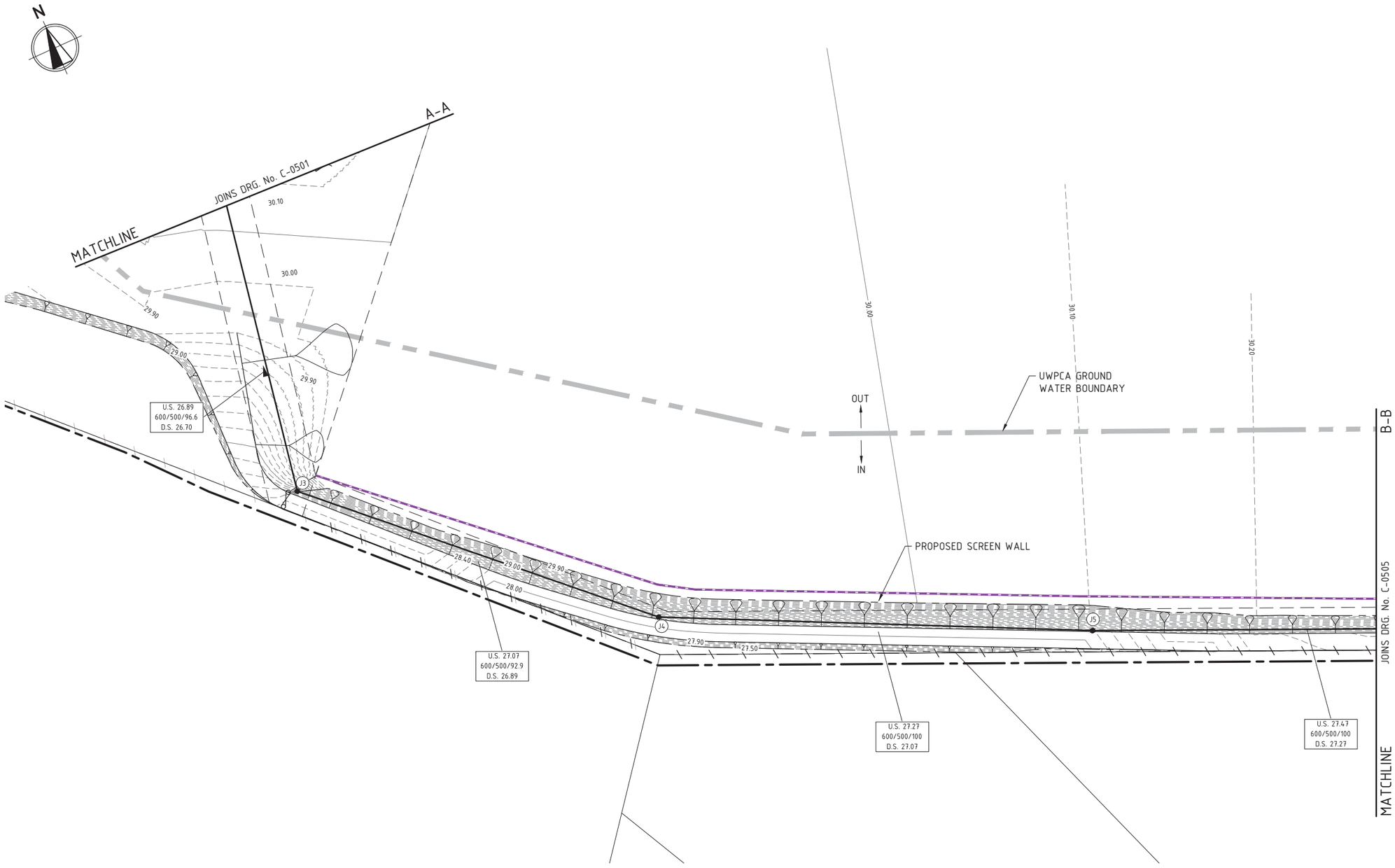

NOTES

1. REFER TO DRG. No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
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11. PITS ARE NOT DRAWN TO SCALE.

LEGEND

- PROJECT BOUNDARY
- EXISTING DRAINAGE PIPE
- EXISTING DRAINAGE PIT
- EXISTING PIPE TO BE REMOVED
- PROPOSED DRAINAGE PIPE
- PROPOSED DRAINAGE MANHOLE
- PROPOSED SIDE ENTRY PIT
- PROPOSED HEADWALL
- 14.50 PROPOSED MAJOR CONTOUR (1.0m INTERVALS)
- PROPOSED MINOR CONTOUR (0.1m INTERVALS)
- (S1) DRAINAGE STRUCTURE NUMBER J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT
- U.S. 12.42 / 300/100/12.00 / D.S. 12.30 — UPSTREAM PIPE INVERT LEVEL; PIPE DIA(mm)/GRADE/LENGTH(m); DOWNSTREAM PIPE INVERT LEVEL

SERVICES LEGEND

EXISTING	PROPOSED	
--W---W--	W W	WATER MAIN
	F F	FEEDER PIPE
	W W	WATER (MAINS EXTENSION)
--S---S--	S S	SEWER
-- RM --	RM	SEWER RISING MAIN
--G---G--	G G	HIGH PRESSURE GAS PIPE
-- UG --		POWER (UNDERGROUND)
-- HV --	HV	POWER (HV UNDERGROUND)
--T---T--	T T	TELSTRA CABLES
-- COMM --	COMM	COMMUNICATIONS CONDUIT
		ELECTRICAL PIT (ACO P66 OR SIM.)
	PG	COMMS PIT (ACO P66 OR SIM.)

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SCALE 1:500 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS: ISSUED FOR INFORMATION
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SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN SHEET 5

PROJECT No.	DRAWING No.	REV.
P14327	C-0504	A

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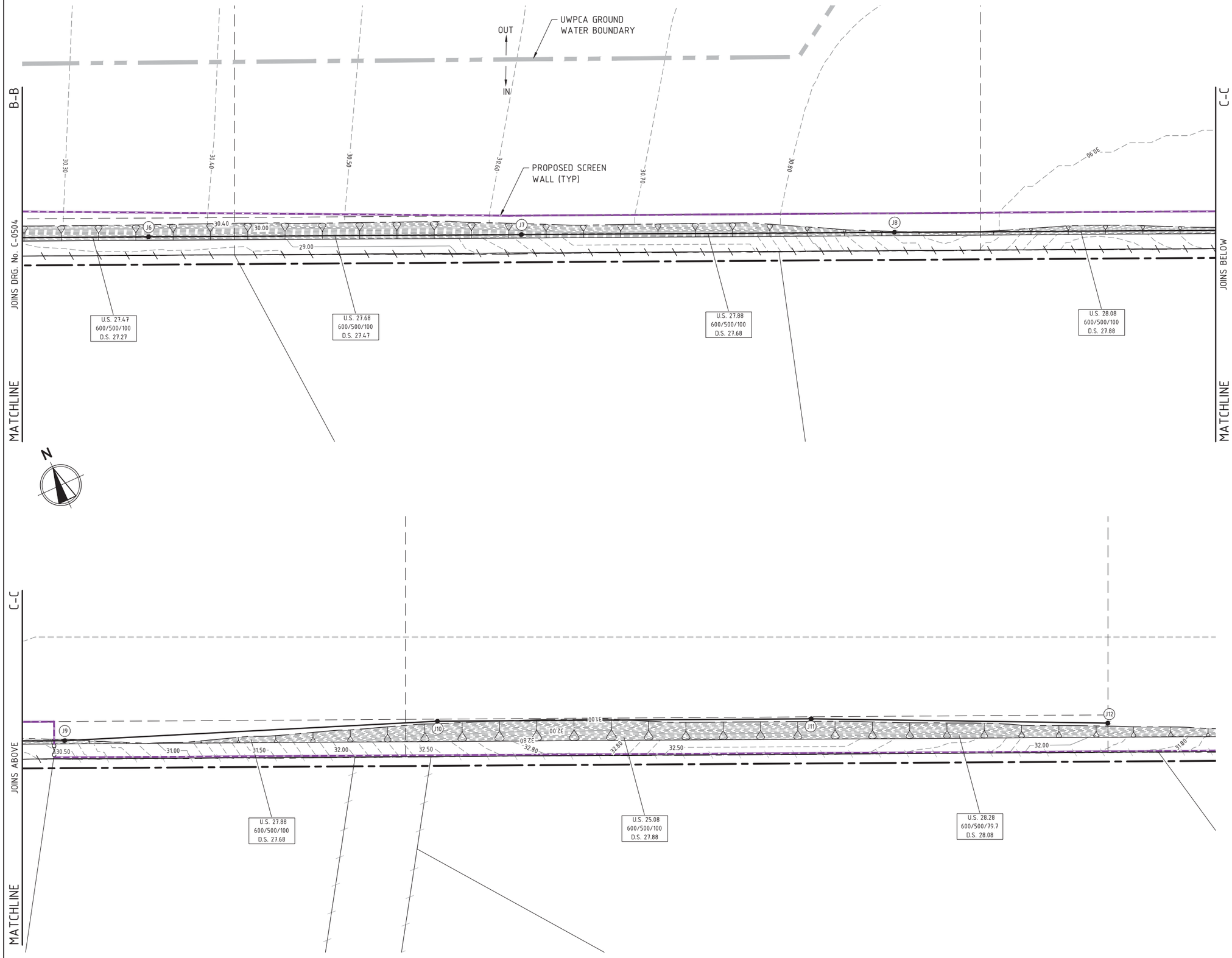

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LEGEND

- PROJECT BOUNDARY
- EXISTING DRAINAGE PIPE
- EXISTING DRAINAGE PIT
- EXISTING PIPE TO BE REMOVED
- PROPOSED DRAINAGE PIPE
- PROPOSED DRAINAGE MANHOLE
- PROPOSED SIDE ENTRY PIT
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- (S1) DRAINAGE STRUCTURE NUMBER J = LOT CONNECTION PIT, M = MANHOLE, S = SIDE ENTRY PIT, G = GULLY PIT
- U.S. 12.42 / 300/100/12.00 / D.S. 12.30 — UPSTREAM PIPE INVERT LEVEL / PIPE DIA(mm)/GRADE/LENGTH(m) / DOWNSTREAM PIPE INVERT LEVEL

SERVICES LEGEND

EXISTING	PROPOSED	
--W---W--	—W—W—	WATER MAIN
	—F—F—	FEEDER PIPE
	—W—W—	WATER (MAINS EXTENSION)
--S---S--	—S—S—	SEWER
—RM—	—RM—	SEWER RISING MAIN
--G---G--	—G—G—	HIGH PRESSURE GAS PIPE
—UG—		POWER (UNDERGROUND)
—HV—	—HV—	POWER (HV UNDERGROUND)
--T---T--	—T—T—	TELSTRA CABLES
—COMM—	—COMM—	COMMUNICATIONS CONDUIT
		ELECTRICAL PIT (ACO P66 OR SIM.)
		COMMS PIT (ACO P66 OR SIM.)

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0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A	20.03.2015	ISSUED FOR 50% REVIEW	AP

REVISIONS

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 6

STATUS: ISSUED FOR INFORMATION — NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	LF		

DATUM	GRID	SCALE	
AHD	PCG94	1:500	AT A1 SIZE

TITLE: DRAINAGE PLAN SHEET 6

PROJECT No.	DRAWING No.	REV.
P14327	C-0505	A

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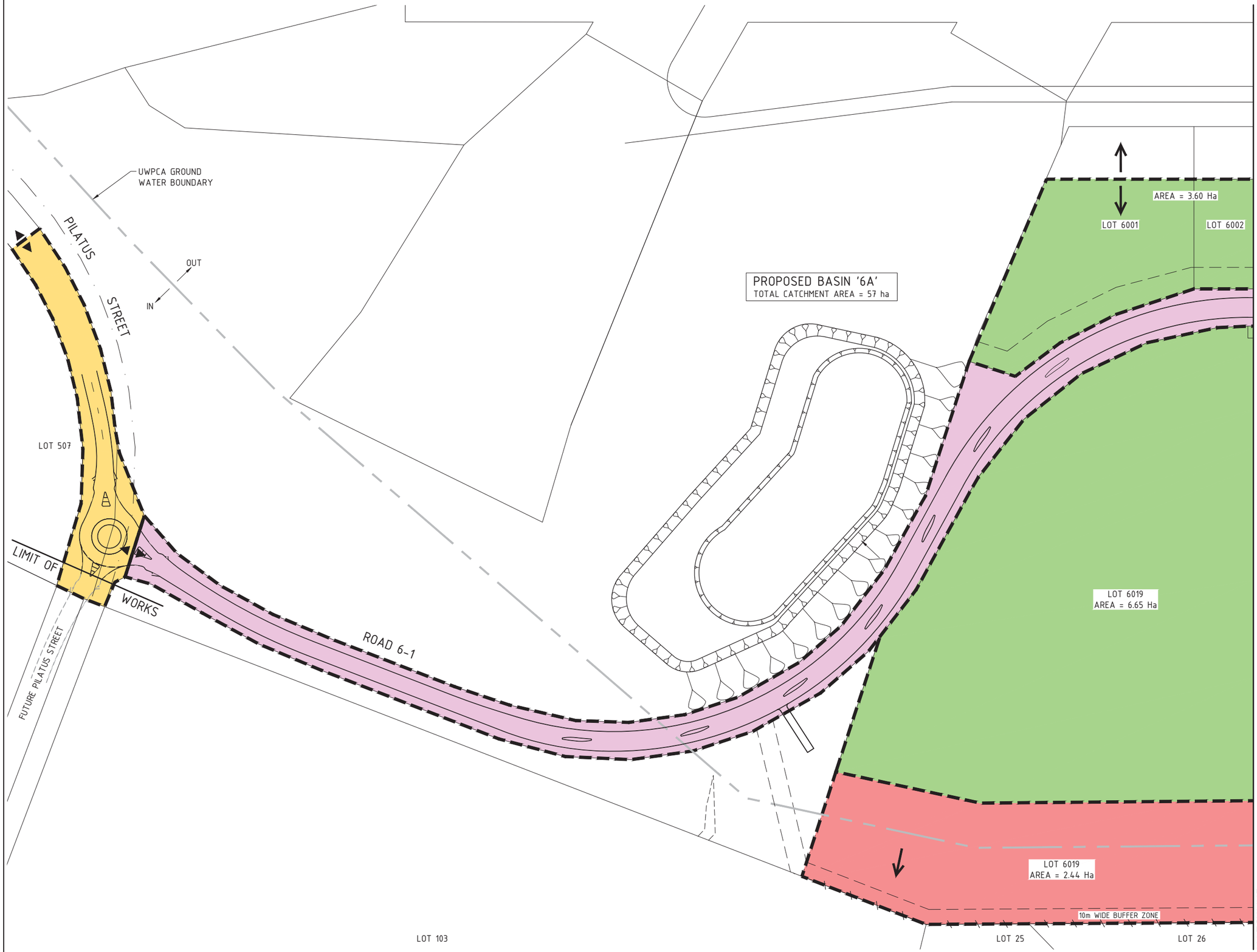

NOTES

1. REFER TO DRG No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. ALL LOTS TO STORE 150m^3 / Ha.

LEGEND

- PRECINCT 5 CATCHMENT AREA = 0.68 Ha
- LOT CATCHMENTS OUTSIDE UWPCA GROUND WATER BOUNDARY AREA = 16.29 Ha
- LOT CATCHMENTS INSIDE UWPCA GROUND WATER BOUNDARY AREA = 32.38 Ha
- ROAD RESERVE CATCHMENT AREA = 4.45 Ha

TOTAL CONTRIBUTING AREA : 38.6 Ha

EQUIVALENT IMPERVIAS AREA : 20.2 Ha

LOTS OUTSIDE UPWCA TO RETAIN ALL STORMWATER ONSITE. NO CONNECTION TO STORMWATER DRAINAGE PIT AND PIT SYSTEM

0 12.5 25 37.5 50 62.5 75m
SCALE 1:1250 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A	31.03.2015	ISSUED FOR 50% REVIEW	AP

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT
PRECINCT 6

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
SP	AH		

DATUM	GRID	SCALE
AHD	PCG94	1:1250 AT A1 SIZE

TITLE: DRAINAGE CATCHMENT PLAN BASIN '6A' - SHEET 1

PROJECT No.	DRAWING No.	REV
P14327	C-0515	A

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03-Apr-15 12:9:35 PM

A-A

UWPCA GROUND WATER BOUNDARY

OUT

IN

AREA = 3.60 Ha

AREA = 3.53 Ha

LOT 6002 | LOT 6003 | LOT 6004 | LOT 6005 | LOT 6006 | LOT 6007 | LOT 6008 | LOT 6009 | LOT 6010 | LOT 6011

ROAD 6-1

LOT 6021

LOT 6020
AREA = 6.04 Ha

LOT 6012
AREA = 4.48 Ha

LOT 6015
AREA = 4.99 Ha

LOT 6018
AREA = 5.51 Ha

LOT 6020
AREA = 1.95 Ha

LOT 6012
AREA = 2.23 Ha

LOT 6015
AREA = 2.49 Ha

LOT 6018
AREA = 2.8 Ha

10m WIDE BUFFER ZONE

JOINS DRG No. C-0515

MATCHLINE

LOT 27 | LOT 28 | LOT 29 | SOLOMON ROAD | LOT 4 | LOT 5

FUTURE PUMPED FLOW FROM AREA TO THE EAST. DEVELOPMENT TO EAST TO ALLOW MIN. 2 HOUR STORAGE PRIOR TO PUMPING INTO PRECINCT 6 CATCHMENT

NOTES

1. REFER TO DRG No. C-0001 FOR OTHER DRAWINGS IN THIS SET.
2. ALL LOTS TO STORE 150m^3 / Ha.

LEGEND

- PRECINCT 5 CATCHMENT AREA = 0.68 Ha
- LOT CATCHMENTS OUTSIDE UWPCA GROUND WATER BOUNDARY AREA = 16.29 Ha
- LOT CATCHMENTS INSIDE UWPCA GROUND WATER BOUNDARY AREA = 32.38 Ha
- ROAD RESERVE CATCHMENT AREA = 4.45 Ha

TOTAL CONTRIBUTING AREA : 38.6 Ha

EQUIVALENT IMPERVIAS AREA : 20.2 Ha

LOTS OUTSIDE UPWCA TO RETAIN ALL STORMWATER ONSITE. NO CONNECTION TO STORMWATER DRAINAGE PIT AND PIT SYSTEM

0 12.5 25 37.5 50 62.5 75m
SCALE 1:1250 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
A	20.03.2015	ISSUED FOR 50% REVIEW	AP

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STATUS: ISSUED FOR INFORMATION
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DRAWN	DESIGNED	CHECKED	APPROVED
SP	AH		

DATUM	GRID	SCALE	
AHD	PCG94	1:1250	AT A1 SIZE

TITLE: DRAINAGE CATCHMENT PLAN BASIN '6A' - SHEET 2

PROJECT No.	DRAWING No.	REV.
P14327	C-0516	A

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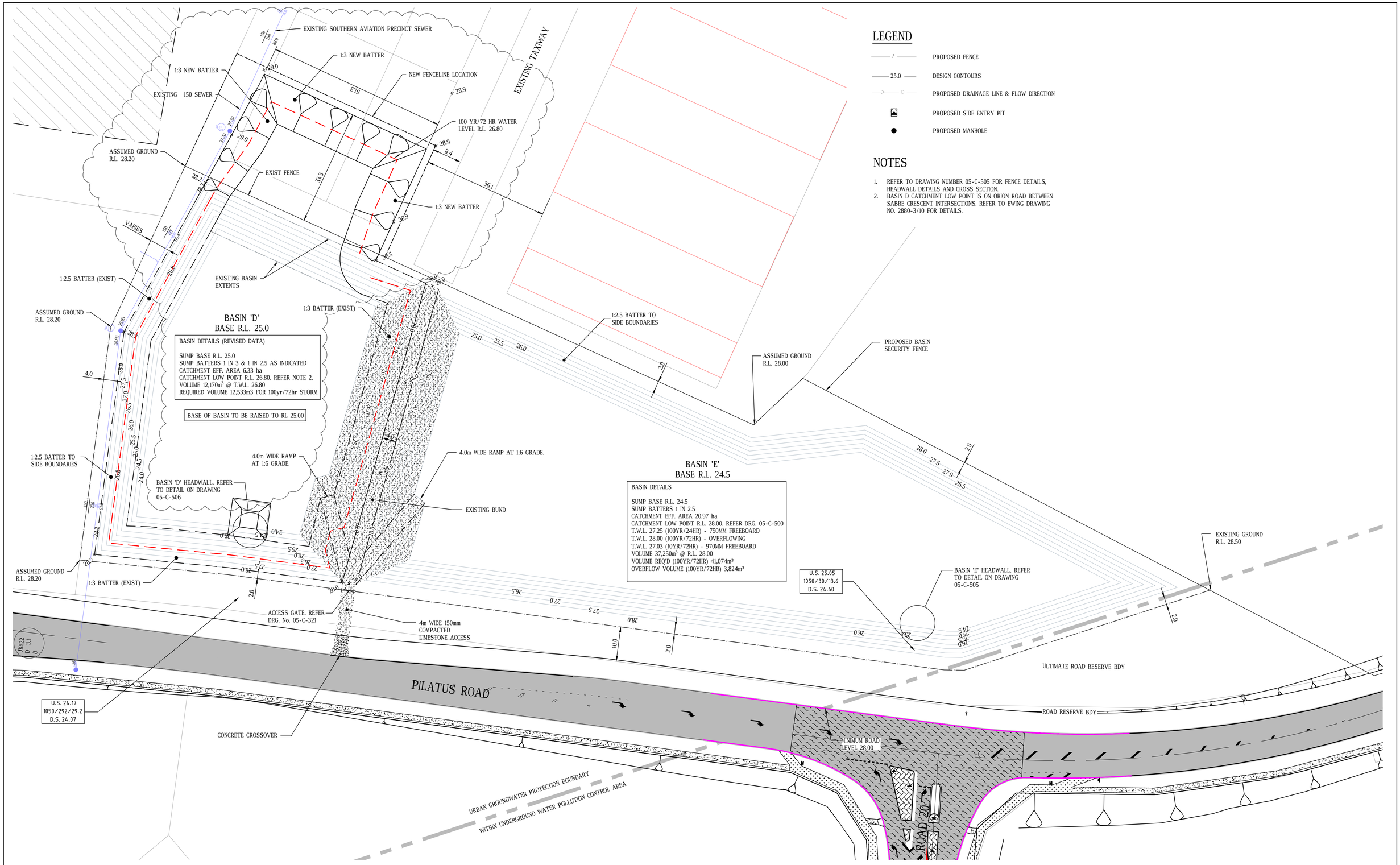

LEGEND

- PROPOSED FENCE
- 25.0 — DESIGN CONTOURS
- PROPOSED DRAINAGE LINE & FLOW DIRECTION
- PROPOSED SIDE ENTRY PIT
- PROPOSED MANHOLE

NOTES

1. REFER TO DRAWING NUMBER 05-C-505 FOR FENCE DETAILS, HEADWALL DETAILS AND CROSS SECTION.
2. BASIN D CATCHMENT LOW POINT IS ON ORION ROAD BETWEEN SABRE CRESCENT INTERSECTIONS. REFER TO EWING DRAWING NO. 2880-3/10 FOR DETAILS.

REV	DATE	DESCRIPTION	RVD
3	25.02.2013	BASIN D BATTER MODIFIED	AP
2	18.06.2012	BASINS MODIFIED, OVERFLOW SWALE ADDED	AP
1	12.06.2012	BASINS ALTERED DUE TO CADASTRAL CHANGES	AP
0	26.03.2012	ISSUED FOR CONSTRUCTION	AP
C	22.11.2011	ISSUED FOR TENDER	AP
B	11.11.2011	ISSUED FOR TENDER REVIEW	JB
A	21.10.2011	ISSUED FOR REVIEW	JB

REVISIONS

REV	DATE	DESCRIPTION	RVD
6	26/04/2018	REVISED ISSUED FOR CONSTRUCTION	AP
5	17.06.2016	ISSUED FOR CONSTRUCTION	AP
4	12.09.2013	AS CONSTRUCTED	DP

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PROJECT: JANDAKOT AIRPORT REDEVELOPMENT PRECINCT 5

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
JSB	JSB	AP	AP

DATUM	GRID	SCALE
AHD	PCG	1:500 AT A1 SIZE

TITLE: DRAINAGE BASINS PILATUS STREET PLAN

PROJECT No. P10268.01 | DRAWING No. 05-C-504 | REV. 6

P:\P14327 JANDAKOT AIRPORT PRECINCT 6\100 DRAWINGS\102 CIVIL\AUTOCAD\P10268_01_05-C-504 DRAINAGE.DWG
26/04/2018 6:50:11 PM

Appendix 4 LWMS Checklist

Local water management strategy Item	Deliverable	☑	Comments
Executive summary			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: Design elements & requirements for BMPs and critical control points	☑	
Introduction			
Total water cycle management – principles & objectives Planning background Previous studies		☑	
Proposed development			
Structure plan, zoning and land use. Key landscape features Previous land use	Site context plan Structure plan	☑ n/a	
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable)	Landscape Plan	n/a	
Design criteria			
Agreed design objectives		☑	
Pre-development environment			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		☑	
Site Conditions - existing topography/ contours, aerial photo underlay, major physical features	Site condition plan	☑	
Geotechnical - topography, soils including acid sulphate soils and infiltration capacity, test pit locations	Geotechnical plan	☑	
Environmental - areas of significant vegetation, wetlands and buffers, waterways and buffers, contaminated sites	Environmental Plan plus supporting data where appropriate	☑	
Surface Water – topography, 100-year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface Water Plan	☑	
Groundwater – topography, predevelopment groundwater levels and water quality, test bore locations	Groundwater Plan plus details of groundwater monitoring and testing	☑	
Water sustainability initiatives			
Water supply & efficiency measures – private and public open spaces		☑	
Fit-for-purpose strategy and agreed actions. If non-potable supply, support with water balance		☑	
Wastewater management		☑	
Stormwater management strategy			
Flood protection - peak flow rates, volumes and top water levels at control points,100-year flow paths and100 year detentions storage areas	100yr event Plan Long section of critical points	n/a	
Manage serviceability - storage and retention required for the critical 5-year ARI storm events Minor roads should be passable in the 5-year ARI event	5yr event Plan	n/a	

Local water management strategy Item	Deliverable	☑	Comments
Protect ecology – detention areas for the 1 yr 1 hr ARI event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	1yr event Plan Typical cross sections	n/a	
Groundwater management strategy			
Post development groundwater levels and fill requirements (including existing and likely final surface levels), outlet controls, and any subsoils	Groundwater/subsoil Plan	n/a	
Actions to address acid sulfate soils or contamination		☑	
The next stage – subdivision and urban water management plans			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design.		n/a	
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		☑	
Implementation			
Developer commitments		☑	
Roles, responsibilities, funding for implementation		☑	
Review		☑	

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft V1	V1	RF	HB	Electronic	26 July 2023
Draft V2	V2	RF	HB	Electronic	01 August 2023
Draft V3	V3	RF	HB	Electronic	30 August 2023
Draft V4	V4	RF	HB	Electronic	6 September 2023
Draft V5	V5	RM/RF	HB	Electronic	12 January 2024
Final	Rev 0	RM/RF	HB & JAH	Electronic	18 January 2024

Urbaqua
land & water solutions
Suite 4/226 Carr Place
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e: info@urbaqua.org.au
www.urbaqua.org.au

APPENDIX 4: LABORATORY REPORTS 2021-22

Job Number: 21-17277
Revision: 00
Date: 11 October 2021

LABORATORY REPORT

ADDRESS: **Urbaqua**
4/226 Carr Pl
Leederville WA 6007

ATTENTION: Alex Towler

DATE RECEIVED: 20/09/2021

YOUR REFERENCE: Jandakot Airport

PURCHASE ORDER:

WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025 - Testing

APPROVALS:

Min How	John Horwood	Sean Sangster	Leigh Bermingham
Organics Supervisor	Chemist - Organics	Inorganics Supervisor	Applications Chemist

REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM", "EDP" and "MM" are covered under NATA Accreditation Number: 2561

Method ID	Method Description
ARL No. 009	Total Petroleum Hydrocarbons (TPH) in Water
ARL No. 007	Benzene, Toluene, Ethylbenzene and Xylenes in Water
ARL No. 402/403	Metals in Water by ICPOES/ICPMS
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 305	Chloride in Water by Discrete Analyser
ARL No. 301	Sulfate in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 021	Acidity in Water
ARL No. 037	Alkalinity in Water
ARL No. 019	Conductivity and Salinity in Water
ARL No. 017	Total Dissolved Solids
ARL No. 029	Metals in Water by AAS

LABORATORY REPORT

TRH in Water		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
TRH C_{6-9}	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
TRH C_{10-14}	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
TRH C_{15-28}	0.04	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04
TRH C_{29-36}	0.04	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04
TRH $C_{>36}$	0.04	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04

TRH in Water		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	LOR	Units	Result	Result
TRH C_{6-9}	0.02	mg/L	<0.02	<0.02
TRH C_{10-14}	0.02	mg/L	<0.02	<0.02
TRH C_{15-28}	0.04	mg/L	<0.04	<0.04
TRH C_{29-36}	0.04	mg/L	<0.04	<0.04
TRH $C_{>36}$	0.04	mg/L	<0.04	<0.04

BTEX in Water		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Benzene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Xylenes (Total)	0.003	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003

BTEX in Water		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	LOR	Units	Result	Result
Benzene	0.001	mg/L	<0.001	<0.001
Toluene	0.001	mg/L	<0.001	<0.001
Ethylbenzene	0.001	mg/L	<0.001	<0.001
Xylenes (Total)	0.003	mg/L	<0.003	<0.003

Metals in Water		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Aluminium - Dissolved	0.01	mg/L	0.18	<0.01	0.28	1.4	<0.01
Arsenic - Dissolved	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium - Dissolved	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium - Dissolved	0.001	mg/L	<0.001	<0.001	0.003	0.001	<0.001
Copper - Dissolved	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001
Iron - Dissolved	0.01	mg/L	0.78	<0.01	0.07	0.31	<0.01
Lead - Dissolved	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel - Dissolved	0.001	mg/L	0.001	<0.001	0.002	0.001	<0.001
Zinc - Dissolved	0.005	mg/L	<0.005	<0.005	0.007	<0.005	<0.005

LABORATORY REPORT

Metals in Water		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**
Aluminium - Dissolved	0.01	mg/L	1.2	0.22
Arsenic - Dissolved	0.001	mg/L	0.002	<0.001
Cadmium - Dissolved	0.0001	mg/L	<0.0001	<0.0001
Chromium - Dissolved	0.001	mg/L	<0.001	<0.001
Copper - Dissolved	0.001	mg/L	0.002	<0.001
Iron - Dissolved	0.01	mg/L	0.56	1.1
Lead - Dissolved	0.001	mg/L	0.001	<0.001
Nickel - Dissolved	0.001	mg/L	0.006	0.001
Zinc - Dissolved	0.005	mg/L	<0.005	0.005

Total Nitrogen in Water		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**	**Result**
Total Nitrogen	0.2	mg/L	1.1	0.4	17	1.9	3.7

Total Nitrogen in Water		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**
Total Nitrogen	0.2	mg/L	1.1	1.1

Total Phosphorus in Water		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**	**Result**
Total Phosphorus	0.01	mg/L	0.07	0.49	0.10	0.13	0.07

Total Phosphorus in Water		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**
Total Phosphorus	0.01	mg/L	0.1	0.08

Ions by Discrete Analyser		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**	**Result**
Chloride	5	mg/L	42	20	48	37	25
Sulfate	1	mg/L	41	4	78	34	25
NOx-N	0.01	mg/L	0.02	0.13	15	0.38	3.5

Ions by Discrete Analyser		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**
Chloride	5	mg/L	160	46
Sulfate	1	mg/L	47	42
NOx-N	0.01	mg/L	0.01	0.02

LABORATORY REPORT

Physical Parameters		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**	**Result**
Acidity	5	mg $CaCO_3$/L	140	10	88	120	19
Net Acidity	5	mg $CaCO_3$/L	130	<5	24	110	<5
Alkalinity	5	mg $CaCO_3$/L	11	6	64	6	120
Conductivity	0.01	mS/cm	0.30	0.10	0.57	0.24	0.39
Total Dissolved Solids	5	mg/L	180	60	320	140	230

Physical Parameters		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**
Acidity	5	mg $CaCO_3$/L	85	120
Net Acidity	5	mg $CaCO_3$/L	85	110
Alkalinity	5	mg $CaCO_3$/L	<5	10
Conductivity	0.01	mS/cm	0.63	0.30
Total Dissolved Solids	5	mg/L	280	180

Misc. Inorganics in Water		Sample No	21-17277-1	21-17277-2	21-17277-3	21-17277-4	21-17277-5
		Sample Description	JAMB2B	JAMB3B	JAMB4	JAMB5	JAMB6
		Sample Date	20/09/2021	20/09/2021	20/09/2021	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**	**Result**
Hardness	5	mg $CaCO_3$/L	74	25	170	32	150

Misc. Inorganics in Water		Sample No	21-17277-6	21-17277-7
		Sample Description	JAMB7B	DUP
		Sample Date	20/09/2021	20/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**
Hardness	5	mg $CaCO_3$/L	65	74

Result Definitions
LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting
* Denotes test not covered by NATA Accreditation

[1]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.

FOR MICROBIOLOGICAL TESTING - The results relate only to the sample tested and may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Job Number: 21-17351
Revision: 00
Date: 1 October 2021

LABORATORY REPORT

ADDRESS: **Urbaqua**
4/226 Carr Pl
Leederville WA 6007

ATTENTION: Alex Towler

DATE RECEIVED: 21/09/2021

YOUR REFERENCE: Jandakot Airport

PURCHASE ORDER:

NATA
WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025 - Testing

APPROVALS:

Min How	John Horwood	Sean Sangster	Leigh Bermingham
Organics Supervisor	Chemist - Organics	Inorganics Supervisor	Applications Chemist

REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM", "EDP" and "MM" are covered under NATA Accreditation Number: 2561

Method ID	Method Description
ARL No. 009	Total Petroleum Hydrocarbons (TPH) in Water
ARL No. 007	Benzene, Toluene, Ethylbenzene and Xylenes in Water
ARL No. 402/403	Metals in Water by ICPOES/ICPMS
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 305	Chloride in Water by Discrete Analyser
ARL No. 301	Sulfate in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 021	Acidity in Water
ARL No. 037	Alkalinity in Water
ARL No. 019	Conductivity and Salinity in Water
ARL No. 017	Total Dissolved Solids
ARL No. 029	Metals in Water by AAS

LABORATORY REPORT

TRH in Water		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
TRH C_{6-9}	0.02	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C_{10-14}	0.02	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C_{15-28}	0.04	mg/L	<0.04	<0.04	<0.04	<0.04
TRH C_{29-36}	0.04	mg/L	<0.04	<0.04	<0.04	<0.04
TRH $C_{>36}$	0.04	mg/L	<0.04	<0.04	<0.04	<0.04

BTEX in Water		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Benzene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Toluene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Xylenes (Total)	0.003	mg/L	<0.003	<0.003	<0.003	<0.003

Metals in Water		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Aluminium - Dissolved	0.01	mg/L	0.50	0.32	<0.01	<0.01
Arsenic - Dissolved	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Cadmium - Dissolved	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium - Dissolved	0.001	mg/L	0.001	<0.001	<0.001	<0.001
Copper - Dissolved	0.001	mg/L	0.001	<0.001	<0.001	<0.001
Iron - Dissolved	0.01	mg/L	0.16	0.07	<0.01	<0.01
Lead - Dissolved	0.001	mg/L	0.001	<0.001	<0.001	<0.001
Nickel - Dissolved	0.001	mg/L	0.001	<0.001	<0.001	<0.001
Zinc - Dissolved	0.005	mg/L	<0.005	<0.005	<0.005	<0.005

Total Nitrogen in Water		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Total Nitrogen	0.2	mg/L	2.4	0.3	0.6	<0.2

Total Phosphorus in Water		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Total Phosphorus	0.01	mg/L	0.12	0.58	0.04	<0.01

Ions by Discrete Analyser		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Chloride	5	mg/L	86	96	18	<5
Sulfate	1	mg/L	10	96	5	<1
NOx-N	0.01	mg/L	0.64	0.02	0.14	<0.01

LABORATORY REPORT

Physical Parameters		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Acidity	5	mg $CaCO_3$/L	110	60	27	<5
Net Acidity	5	mg $CaCO_3$/L	110	60	<5	<5
Alkalinity	5	mg $CaCO_3$/L	<5	<5	26	<5
Conductivity	0.01	mS/cm	0.32	0.48	0.13	<0.01
Total Dissolved Solids	5	mg/L	190	290	78	<5

Misc. Inorganics in Water		Sample No	21-17351-1	21-17351-2	21-17351-3	21-17351-4
		Sample Description	JAMB8	JAMB9	JAMB10	JAMBT
		Sample Date	21/09/2021	21/09/2021	21/09/2021	21/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Hardness	5	mg $CaCO_3$/L	35	100	20	<5

Result Definitions
LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting
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Job Number: 21-17458
Revision: 00
Date: 11 October 2021

LABORATORY REPORT

ADDRESS: **Urbaqua**
4/226 Carr Pl
Leederville WA 6007

ATTENTION: Alex Towler

DATE RECEIVED: 22/09/2021

YOUR REFERENCE: Jandakot Airport

PURCHASE ORDER:

WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025 - Testing

APPROVALS:

Min How	John Horwood	Sean Sangster	Leigh Bermingham
Organics Supervisor	Chemist - Organics	Inorganics Supervisor	Applications Chemist

REPORT COMMENTS:

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ARL No. 007	Benzene, Toluene, Ethylbenzene and Xylenes in Water
ARL No. 402/403	Metals in Water by ICPOES/ICPMS
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 305	Chloride in Water by Discrete Analyser
ARL No. 301	Sulfate in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 021	Acidity in Water
ARL No. 037	Alkalinity in Water
ARL No. 019	Conductivity and Salinity in Water
ARL No. 017	Total Dissolved Solids
ARL No. 029	Metals in Water by AAS

LABORATORY REPORT

TRH in Water		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
TRH C_{6-9}	0.02	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C_{10-14}	0.02	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C_{15-28}	0.04	mg/L	<0.04	<0.04	<0.04	<0.04
TRH C_{29-36}	0.04	mg/L	<0.04	<0.04	<0.04	<0.04
TRH $C_{>36}$	0.04	mg/L	<0.04	<0.04	<0.04	<0.04

BTEX in Water		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Benzene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Toluene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Xylenes (Total)	0.003	mg/L	<0.003	<0.003	<0.003	<0.003

Metals in Water		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Aluminium - Dissolved	0.01	mg/L	0.43	0.12	<0.01	<0.01
Arsenic - Dissolved	0.001	mg/L	0.001	<0.001	<0.001	<0.001
Cadmium - Dissolved	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium - Dissolved	0.001	mg/L	0.001	0.001	<0.001	<0.001
Copper - Dissolved	0.001	mg/L	<0.001	<0.001	<0.001	0.001
Iron - Dissolved	0.01	mg/L	0.18	<0.01	<0.01	<0.01
Lead - Dissolved	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Nickel - Dissolved	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Zinc - Dissolved	0.005	mg/L	<0.005	<0.005	<0.005	<0.005

Total Nitrogen in Water		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Total Nitrogen	0.2	mg/L	1.1	0.4	<0.2	<0.2

Total Phosphorus in Water		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Total Phosphorus	0.01	mg/L	0.09	0.03	<0.01	<0.01

Ions by Discrete Analyser		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Chloride	5	mg/L	37	19	<5	<5
Sulfate	1	mg/L	18	3	<1	<1
NOx-N	0.01	mg/L	0.52	0.10	<0.01	<0.01

LABORATORY REPORT

Physical Parameters		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Acidity	5	mg $CaCO_3$/L	100	22	<5	<5
Net Acidity	5	mg $CaCO_3$/L	80	<5	<5	<5
Alkalinity	5	mg $CaCO_3$/L	20	25	<5	<5
Conductivity	0.01	mS/cm	0.23	0.13	<0.01	<0.01
Total Dissolved Solids	5	mg/L	140	78	<5	<5

Misc. Inorganics in Water		Sample No	21-17458-1	21-17458-2	21-17458-3	21-17458-4
		Sample Description	JAMB1	JAMB11	JAMBF	JAMBR
		Sample Date	22/09/2021	22/09/2021	22/09/2021	22/09/2021
ANALYTE	**LOR**	**Units**	**Result**	**Result**	**Result**	**Result**
Hardness	5	mg $CaCO_3$/L	32	32	<5	<5

Result Definitions
LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting
* Denotes test not covered by NATA Accreditation

[1]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.

FOR MICROBIOLOGICAL TESTING - The results relate only to the sample tested and may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Urbaqua
622 Newcastle Street
Leederville
WA 6007

Attention: **Alex Towler**

Report **872184-W**
Project name Jandakot Airport
Received Date Mar 16, 2022

Client Sample ID			**JAMB1**	**JAMB2B**	**JAMB3B**	**JAMB10**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L22-Ma35553**	**L22-Ma35554**	**L22-Ma35555**	**L22-Ma35556**
Date Sampled			**Mar 16, 2022**	**Mar 16, 2022**	**Mar 16, 2022**	**Mar 16, 2022**
Test/Reference	LOR	Unit				
Volatile TRH (NEPM) Water						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes (Total)	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
Naphthalene	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
TRH C6-10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-10 minus BTEX (F1)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Semi-volatiles TRH (NEPM) Water						
TRH C>10-16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C>10-16 minus Naphthalene (F2)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C>16-34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C>34-40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH (NEPM) C>10-40 Sum	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Acidity	5	mg CaCO3/L	73	130	33	27
Chloride	5	mg/L	72	49	53	18
Conductivity	10	uS/cm	300	290	260	130
NOx-N	0.01	mg/L	1.6	< 0.01	1.0	0.10
Sulfate	1	mg/L	22	54	25	< 1
Total Dissolved Solids	5	mg/L	180	170	160	78
Total Kjeldahl Nitrogen	0.2	mg/L	1.4	1.1	0.8	3.3
Total Nitrogen	0.2	mg/L	3.0	1.1	1.8	3.4
Total Phosphorus	0.01	mg/L	0.34	0.13	0.26	0.05
Aluminium (filtered)	0.01	mg/L	0.76	0.28	0.05	0.11
Arsenic (filtered)	0.001	mg/L	0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Calcium (filtered)	0.1	mg/L	12	-	-	-
Chromium (filtered)	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.018	0.003	0.015	0.016
Hardness	5	mg CaCO3/L	39	-	-	-
Iron (filtered)	0.01	mg/L	0.21	0.86	< 0.01	0.02
Lead (filtered)	0.001	mg/L	0.001	< 0.001	< 0.001	< 0.001
Magnesium (filtered)	0.1	mg/L	2.3	-	-	-
Nickel (filtered)	0.001	mg/L	0.003	0.004	0.003	0.003
Zinc (filtered)	0.005	mg/L	0.007	0.007	< 0.005	< 0.005

Client Sample ID			JAMB1	JAMB2B	JAMB3B	JAMB10
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L22-Ma35553	L22-Ma35554	L22-Ma35555	L22-Ma35556
Date Sampled			Mar 16, 2022	Mar 16, 2022	Mar 16, 2022	Mar 16, 2022
Test/Reference	LOR	Unit				
Alkalinity						
Alkalinity	5	mg CaCO3/L	23	14	19	38
Bicarbonate	5	mg CaCO3/L	23	14	19	38
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Hardness						
Calcium (filtered)	0.1	mg/L	-	6.7	11	11
Magnesium (filtered)	0.1	mg/L	-	13	2.3	1.0
Hardness	5	mg CaCO3/L	-	70	37	32

Client Sample ID			JAMB11
Sample Matrix			Water
Eurofins Sample No.			L22-Ma35557
Date Sampled			Mar 16, 2022
Test/Reference	LOR	Unit	
Volatile TRH (NEPM) Water			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
Xylenes (Total)	0.003	mg/L	< 0.003
Naphthalene	0.005	mg/L	< 0.005
TRH C6-10	0.02	mg/L	< 0.02
TRH C6-10 minus BTEX (F1)	0.02	mg/L	< 0.02
Semi-volatiles TRH (NEPM) Water			
TRH C>10-16	0.05	mg/L	< 0.05
TRH C>10-16 minus Naphthalene (F2)	0.05	mg/L	< 0.05
TRH C>16-34	0.1	mg/L	< 0.1
TRH C>34-40	0.1	mg/L	< 0.1
TRH (NEPM) C>10-40 Sum	0.1	mg/L	< 0.1
Acidity	5	mg CaCO3/L	23
Chloride	5	mg/L	18
Conductivity	10	uS/cm	170
NOx-N	0.01	mg/L	0.15
Sulfate	1	mg/L	7.4
Total Dissolved Solids	5	mg/L	100
Total Kjeldahl Nitrogen	0.2	mg/L	1.1
Total Nitrogen	0.2	mg/L	1.2
Total Phosphorus	0.01	mg/L	0.08
Aluminium (filtered)	0.01	mg/L	0.09
Arsenic (filtered)	0.001	mg/L	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	0.014
Iron (filtered)	0.01	mg/L	0.04
Lead (filtered)	0.001	mg/L	< 0.001
Nickel (filtered)	0.001	mg/L	0.003
Zinc (filtered)	0.005	mg/L	< 0.005

Client Sample ID			JAMB11
Sample Matrix			**Water**
Eurofins Sample No.			**L22-Ma35557**
Date Sampled			**Mar 16, 2022**
Test/Reference	LOR	Unit	
Alkalinity			
Alkalinity	5	mg CaCO3/L	52
Bicarbonate	5	mg CaCO3/L	52
Carbonate	5	mg CaCO3/L	< 5
Hydroxide	5	mg CaCO3/L	< 5
Hardness			
Calcium (filtered)	0.1	mg/L	17
Magnesium (filtered)	0.1	mg/L	1.3
Hardness	5	mg CaCO3/L	48

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
Volatile TRH (NEPM) Water	Welshpool	Mar 17, 2022	7 Days
- Method: ARL190 - Total Recoverable Hydrocarbons (C6-C10) in Water			
Semi-volatiles TRH (NEPM) Water	Welshpool	Mar 17, 2022	7 Days
- Method: ARL191 - Total Recoverable Hydrocarbons (>C10-C40) in Water			
Acidity	Welshpool	Mar 17, 2022	1 Day
- Method: ARL021 - Acidity in Water			
Chloride	Welshpool	Mar 17, 2022	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Conductivity	Welshpool	Mar 17, 2022	28 Days
- Method: ARL019 - Conductivity and Salinity in Water			
Sulfate	Welshpool	Mar 17, 2022	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Total Dissolved Solids	Welshpool	Mar 17, 2022	7 Days
- Method: ARL No. 017 - Total Dissolved Solids			
Total Phosphorus	Welshpool	Mar 17, 2022	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Aluminium (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Arsenic (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Cadmium (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Chromium (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Copper (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Iron (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Lead (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Nickel (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Zinc (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Alkalinity	Welshpool	Mar 17, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
NOx-N	Welshpool	Mar 17, 2022	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Mar 17, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Mar 17, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Calcium (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			
Hardness	Welshpool	Mar 17, 2022	180 Day
- Method: ARL029 - Metals in Water by AAS			
Magnesium (filtered)	Welshpool	Mar 17, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			
Hardness	Welshpool	Mar 17, 2022	180 Days
- Method: ARL No. 029 - Metals in Water by AAS			

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.

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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							
Volatile TRH (NEPM) Water							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
Xylenes (Total)	mg/L	< 0.003			0.003	Pass	
Naphthalene	mg/L	< 0.005			0.005	Pass	
TRH C6-10	mg/L	< 0.02			0.02	Pass	
TRH C6-10 minus BTEX (F1)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Semi-volatiles TRH (NEPM) Water							
TRH C>10-16	mg/L	< 0.05			0.05	Pass	
TRH C>16-34	mg/L	< 0.1			0.1	Pass	
TRH C>34-40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Acidity	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Conductivity	uS/cm	< 10			10	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Dissolved Solids	mg/L	< 5			5	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Calcium (filtered)	mg/L	1.9			0.1	Fail	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Magnesium (filtered)	mg/L	0.2			0.1	Fail	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Method Blank							
Alkalinity							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
LCS - % Recovery							
Conductivity	%	98			80-120	Pass	
Arsenic (filtered)	%	105			80-120	Pass	
Cadmium (filtered)	%	103			80-120	Pass	
Chromium (filtered)	%	108			80-120	Pass	
Copper (filtered)	%	109			80-120	Pass	
Lead (filtered)	%	110			80-120	Pass	
Magnesium (filtered)	%	117			80-120	Pass	
Nickel (filtered)	%	101			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Total Nitrogen	L22-Ma38160	NCP	%	94			70-130	Pass	
Total Phosphorus	L22-Ma38160	NCP	%	103			80-120	Pass	
Spike - % Recovery									
				Result 1					
Chloride	L22-Ma35555	CP	%	115			70-130	Pass	
NOx-N	L22-Ma35555	CP	%	120			80-120	Pass	
Sulfate	L22-Ma35555	CP	%	102			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Volatile TRH (NEPM) Water				Result 1	Result 2	RPD			
Benzene	L22-Ma39401	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	L22-Ma39401	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	L22-Ma39401	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes (Total)	L22-Ma39401	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Naphthalene	L22-Ma39401	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
TRH C6-10	L22-Ma39401	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C6-10 minus BTEX (F1)	L22-Ma39401	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Acidity	L22-Ma39397	NCP	mg CaCO3/L	33	31	5.0	30%	Pass	
Chloride	L22-Ma26869	NCP	mg/L	28000	25000	12	30%	Pass	
Conductivity	L22-Ma39396	NCP	uS/cm	210	210	<1	30%	Pass	
Total Dissolved Solids	L22-Ja13395	NCP	mg/L	51000	42000	2.0	30%	Pass	
Total Nitrogen	L22-Ma38159	NCP	mg/L	1.5	1.5	2.0	30%	Pass	
Total Phosphorus	L22-Ma38159	NCP	mg/L	0.18	0.18	2.0	30%	Pass	
Duplicate									
Alkalinity				Result 1	Result 2	RPD			
Alkalinity	L22-Ma39396	NCP	mg CaCO3/L	10	9.7	3.0	30%	Pass	
Bicarbonate	L22-Ma39396	NCP	mg CaCO3/L	10	9.7	3.0	30%	Pass	
Carbonate	L22-Ma39396	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Hydroxide	L22-Ma39396	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
NOx-N	L22-Ma35554	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Sulfate	L22-Ma35554	CP	mg/L	54	57	5.0	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	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Douglas Todd	Analytical Services Manager
Sean Sangster	Senior Analyst (WA)
Sam Becker	Senior Analyst (WA)
Paul Nottle	Senior Analyst (WA)

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

Urbaqua
622 Newcastle Street
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: **Alex Towler**

Report **872673-W**
Project name Jandakot Airport
Received Date Mar 17, 2022

Client Sample ID			**JAMB5**	**JAMB6**	**JAMB7B**	**JAMBF**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L22-Ma39396**	**L22-Ma39397**	**L22-Ma39398**	**L22-Ma39399**
Date Sampled			**Mar 17, 2022**	**Mar 17, 2022**	**Mar 17, 2022**	**Mar 17, 2022**
Test/Reference	LOR	Unit				
BTEX in Water						
Benzene	0.5	ug/L	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene	0.5	ug/L	< 0.5	< 0.5	< 0.5	< 0.5
Toluene	0.5	ug/L	< 0.5	< 0.5	< 0.5	< 0.5
Xylenes (Total)	3	ug/L	< 3	< 3	< 3	< 3
TPH in Water						
TPH C6-9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TPH C10-14	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TPH C15-28	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TPH C29-36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TPH C>36	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Sum of TPH	0.16	mg/L	< 0.16	< 0.16	< 0.16	< 0.16
Acidity	5	mg CaCO3/L	110	33	66	6.3
Chloride	5	mg/L	39	88	130	< 5
Conductivity	10	uS/cm	210	440	510	< 10
NOx-N	0.01	mg/L	0.31	2.4	0.06	< 0.01
Sulfate	1	mg/L	29	16	39	< 1
Total Dissolved Solids	5	mg/L	130	260	310	< 5
Total Kjeldahl Nitrogen	0.2	mg/L	1.6	< 0.2	1.2	< 0.2
Total Nitrogen	0.2	mg/L	1.9	2.5	1.3	< 0.2
Total Phosphorus	0.01	mg/L	0.13	0.10	0.09	< 0.01
Aluminium (filtered)	0.01	mg/L	1.4	0.06	0.84	< 0.01
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	0.003	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Calcium (filtered)	0.1	mg/L	2.5	-	-	-
Chromium (filtered)	0.001	mg/L	0.002	0.001	0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.005	0.012	0.008	< 0.001
Hardness	5	mg CaCO3/L	32	-	-	-
Iron (filtered)	0.01	mg/L	0.34	0.02	0.36	< 0.01
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	0.001	< 0.001
Magnesium (filtered)	0.1	mg/L	6.3	-	-	-
Nickel (filtered)	0.001	mg/L	0.004	0.002	0.005	< 0.001
Zinc (filtered)	0.005	mg/L	0.008	< 0.005	0.006	< 0.005

Client Sample ID			JAMB5	JAMB6	JAMB7B	JAMBF
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L22-Ma39396	L22-Ma39397	L22-Ma39398	L22-Ma39399
Date Sampled			Mar 17, 2022	Mar 17, 2022	Mar 17, 2022	Mar 17, 2022
Test/Reference	LOR	Unit				
Alkalinity						
Alkalinity	5	mg CaCO3/L	10	52	< 5	< 5
Bicarbonate	5	mg CaCO3/L	10	52	< 5	< 5
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Hardness						
Calcium (filtered)	0.1	mg/L	-	18	5.2	< 0.1
Magnesium (filtered)	0.1	mg/L	-	7.6	6.3	< 0.1
Hardness	5	mg CaCO3/L	-	76	39	< 5

Client Sample ID			JAMBT	DUP
Sample Matrix			Water	Water
Eurofins Sample No.			L22-Ma39400	L22-Ma39401
Date Sampled			Mar 17, 2022	Mar 17, 2022
Test/Reference	LOR	Unit		
BTEX in Water				
Benzene	0.5	ug/L	< 0.5	< 0.5
Ethylbenzene	0.5	ug/L	< 0.5	< 0.5
Toluene	0.5	ug/L	< 0.5	< 0.5
Xylenes (Total)	3	ug/L	< 3	< 3
TPH in Water				
TPH C6-9	0.02	mg/L	< 0.02	< 0.02
TPH C10-14	0.02	mg/L	< 0.02	< 0.02
TPH C15-28	0.04	mg/L	< 0.04	< 0.04
TPH C29-36	0.04	mg/L	< 0.04	< 0.04
TPH C>36	0.04	mg/L	< 0.04	< 0.04
Sum of TPH	0.16	mg/L	< 0.16	< 0.16
Acidity	5	mg CaCO3/L	6.4	63
Chloride	5	mg/L	< 5	140
Conductivity	10	uS/cm	< 10	510
NOx-N	0.01	mg/L	< 0.01	0.03
Sulfate	1	mg/L	< 1	34
Total Dissolved Solids	5	mg/L	< 5	310
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	1.5
Total Nitrogen	0.2	mg/L	< 0.2	1.5
Total Phosphorus	0.01	mg/L	< 0.01	0.07
Aluminium (filtered)	0.01	mg/L	< 0.01	0.81
Arsenic (filtered)	0.001	mg/L	< 0.001	0.003
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	0.001
Copper (filtered)	0.001	mg/L	< 0.001	0.009
Iron (filtered)	0.01	mg/L	< 0.01	0.36
Lead (filtered)	0.001	mg/L	< 0.001	0.001
Nickel (filtered)	0.001	mg/L	< 0.001	0.005
Zinc (filtered)	0.005	mg/L	< 0.005	0.006

Client Sample ID			JAMBT	DUP
Sample Matrix			Water	Water
Eurofins Sample No.			L22-Ma39400	L22-Ma39401
Date Sampled			Mar 17, 2022	Mar 17, 2022
Test/Reference	LOR	Unit		
Alkalinity				
Alkalinity	5	mg CaCO3/L	< 5	< 5
Bicarbonate	5	mg CaCO3/L	< 5	< 5
Carbonate	5	mg CaCO3/L	< 5	< 5
Hydroxide	5	mg CaCO3/L	< 5	< 5
Hardness				
Calcium (filtered)	0.1	mg/L	< 0.1	5.1
Magnesium (filtered)	0.1	mg/L	< 0.1	6.2
Hardness	5	mg CaCO3/L	< 5	38

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
BTEX in Water	Welshpool	Mar 20, 2022	7 Days
- Method: ARL132 - Purgeable Volatile Organic Compounds in Water by GCMS			
TPH in Water	Welshpool	Mar 20, 2022	7 Days
- Method: ARL009 - Total Petroleum Hydrocarbons (TPH) in Water			
Acidity	Welshpool	Mar 20, 2022	1 Day
- Method: ARL021 - Acidity in Water			
Chloride	Welshpool	Mar 20, 2022	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Conductivity	Welshpool	Mar 20, 2022	28 Days
- Method: ARL019 - Conductivity and Salinity in Water			
Sulfate	Welshpool	Mar 20, 2022	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Total Dissolved Solids	Welshpool	Mar 20, 2022	7 Days
- Method: ARL No. 017 - Total Dissolved Solids			
Total Phosphorus	Welshpool	Mar 20, 2022	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Aluminium (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Arsenic (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Cadmium (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Chromium (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Copper (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Iron (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Lead (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Nickel (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Zinc (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Alkalinity	Welshpool	Mar 20, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
NOx-N	Welshpool	Mar 20, 2022	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Mar 20, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Mar 20, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Calcium (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			
Hardness	Welshpool	Mar 20, 2022	180 Day
- Method: ARL029 - Metals in Water by AAS			
Magnesium (filtered)	Welshpool	Mar 20, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			
Hardness	Welshpool	Mar 20, 2022	180 Days
- Method: ARL No. 029 - Metals in Water by AAS			

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.

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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							
BTEX in Water							
Benzene	ug/L	< 0.5			0.5	Pass	
Ethylbenzene	ug/L	< 0.5			0.5	Pass	
Toluene	ug/L	< 0.5			0.5	Pass	
Xylenes (Total)	ug/L	< 3			3	Pass	
Method Blank							
TPH in Water							
TPH C6-9	mg/L	< 0.02			0.02	Pass	
TPH C10-14	mg/L	< 0.02			0.02	Pass	
TPH C15-28	mg/L	< 0.04			0.04	Pass	
TPH C29-36	mg/L	< 0.04			0.04	Pass	
TPH C>36	mg/L	< 0.04			0.04	Pass	
Sum of TPH	mg/L	< 0.16			0.16	Pass	
Method Blank							
Acidity	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Conductivity	uS/cm	< 10			10	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Dissolved Solids	mg/L	< 5			5	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Method Blank							
Alkalinity							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
LCS - % Recovery							
BTEX in Water							
Benzene	%	89			60-120	Pass	
Ethylbenzene	%	92			60-120	Pass	
Toluene	%	102			60-120	Pass	
Xylenes (Total)	%	101			60-120	Pass	
LCS - % Recovery							
TPH in Water							
Sum of TPH	%	115			60-120	Pass	
LCS - % Recovery							
Conductivity	%	95			80-120	Pass	
Arsenic (filtered)	%	105			80-120	Pass	
Cadmium (filtered)	%	102			80-120	Pass	
Chromium (filtered)	%	117			80-120	Pass	
Copper (filtered)	%	112			80-120	Pass	
Lead (filtered)	%	104			80-120	Pass	
Nickel (filtered)	%	107			80-120	Pass	
CRM - % Recovery							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Acidity			%	101			80-120	Pass	
Conductivity			%	102			80-120	Pass	
CRM - % Recovery									
Alkalinity									
Alkalinity			%	108			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Chloride	L22-Ma39400	CP	%	94			70-130	Pass	
NOx-N	L22-Ma39400	CP	%	96			80-120	Pass	
Sulfate	L22-Ma39400	CP	%	82			70-130	Pass	
Total Nitrogen	L22-Ma39400	CP	%	96			70-130	Pass	
Total Phosphorus	L22-Ma39400	CP	%	104			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Conductivity	L22-Ma39396	CP	uS/cm	210	210	<1	30%	Pass	
Total Nitrogen	L22-Ma44106	NCP	mg/L	2.8	2.9	4.0	30%	Pass	
Duplicate									
Alkalinity				Result 1	Result 2	RPD			
Alkalinity	L22-Ma39381	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Bicarbonate	L22-Ma39381	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Carbonate	L22-Ma39381	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Hydroxide	L22-Ma39381	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Acidity	L22-Ma39397	CP	mg CaCO3/L	33	31	5.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	L22-Ma39399	CP	mg/L	< 5	< 5	<1	30%	Pass	
NOx-N	L22-Ma39399	CP	mg/L	< 0.01	0.02	18	30%	Pass	
Sulfate	L22-Ma39399	CP	mg/L	< 1	< 1	<1	30%	Pass	
Total Phosphorus	L22-Ma39399	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
BTEX in Water				Result 1	Result 2	RPD			
Benzene	L22-Ma39401	CP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Ethylbenzene	L22-Ma39401	CP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Toluene	L22-Ma39401	CP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
Xylenes (Total)	L22-Ma39401	CP	ug/L	< 3	< 3	<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	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Douglas Todd	Analytical Services Manager
Sean Sangster	Senior Analyst (WA)
Sam Becker	Senior Analyst (WA)
Paul Nottle	Senior Analyst (WA)

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

Urbaqua
622 Newcastle Street
Leederville
WA 6007

Attention: **Alex Towler**

Report **873104-W**
Project name Jandakot Airport
Received Date Mar 18, 2022

Client Sample ID			**JAMBR**	**JAMB4**	**JAMB8**	**JAMB9**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L22-Ma43260**	**L22-Ma43261**	**L22-Ma43262**	**L22-Ma43263**
Date Sampled			**Mar 18, 2022**	**Mar 18, 2022**	**Mar 18, 2022**	**Mar 18, 2022**
Test/Reference	LOR	Unit				
Volatile TRH (NEPM) Water						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes (Total)	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
Naphthalene	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
TRH C6-10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-10 minus BTEX (F1)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Semi-volatiles TRH (NEPM) Water						
TRH C>10-16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C>10-16 minus Naphthalene (F2)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C>16-34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C>34-40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH (NEPM) C>10-40 Sum	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Acidity	5	mg CaCO3/L	< 5	130	76	41
Chloride	5	mg/L	< 5	72	63	30
Conductivity	10	uS/cm	11	570	300	220
NOx-N	0.01	mg/L	0.05	4.9	0.72	0.02
Sulfate	1	mg/L	< 1	22	19	46
Total Dissolved Solids	5	mg/L	6.0	340	180	130
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	5.1	1.7	0.3
Total Nitrogen	0.2	mg/L	< 0.2	10	2.4	0.3
Total Phosphorus	0.01	mg/L	< 0.01	0.05	0.10	0.35
Aluminium (filtered)	0.01	mg/L	< 0.01	0.43	0.40	0.05
Arsenic (filtered)	0.001	mg/L	< 0.001	0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Calcium (filtered)	0.1	mg/L	< 0.1	31	6.7	15
Chromium (filtered)	0.001	mg/L	< 0.001	0.003	0.002	0.001
Copper (filtered)	0.001	mg/L	< 0.001	0.006	0.008	0.008
Hardness	5	mg CaCO3/L	< 5	140	36	55
Iron (filtered)	0.01	mg/L	< 0.01	0.21	0.14	0.05
Lead (filtered)	0.001	mg/L	< 0.001	0.003	0.003	0.003
Magnesium (filtered)	0.1	mg/L	< 0.1	14	4.7	4.3
Nickel (filtered)	0.001	mg/L	< 0.001	0.005	0.003	0.003
Zinc (filtered)	0.005	mg/L	0.006	< 0.005	0.010	0.008

Client Sample ID			JAMBR	JAMB4	JAMB8	JAMB9
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L22-Ma43260	L22-Ma43261	L22-Ma43262	L22-Ma43263
Date Sampled			Mar 18, 2022	Mar 18, 2022	Mar 18, 2022	Mar 18, 2022
Test/Reference	LOR	Unit				
Alkalinity						
Alkalinity	5	mg CaCO3/L	< 5	130	< 5	24
Bicarbonate	5	mg CaCO3/L	< 5	130	< 5	24
Carbonate	5	mg CaCO3/L	< 5	< 5	< 5	< 5
Hydroxide	5	mg CaCO3/L	< 5	< 5	< 5	< 5

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
Volatile TRH (NEPM) Water	Welshpool	Mar 22, 2022	7 Days
- Method: ARL190 - Total Recoverable Hydrocarbons (C6-C10) in Water			
Semi-volatiles TRH (NEPM) Water	Welshpool	Mar 22, 2022	7 Days
- Method: ARL191 - Total Recoverable Hydrocarbons (>C10-C40) in Water			
Acidity	Welshpool	Apr 12, 2022	1 Day
- Method: ARL021 - Acidity in Water			
Chloride	Welshpool	Apr 12, 2022	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Conductivity	Welshpool	Apr 12, 2022	28 Days
- Method: ARL019 - Conductivity and Salinity in Water			
Sulfate	Welshpool	Mar 22, 2022	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Total Dissolved Solids	Welshpool	Apr 12, 2022	7 Days
- Method: ARL No. 017 - Total Dissolved Solids			
Total Phosphorus	Welshpool	Mar 22, 2022	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Aluminium (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Arsenic (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Cadmium (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Chromium (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Copper (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Iron (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Lead (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Nickel (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Zinc (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Alkalinity	Welshpool	Mar 22, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
NOx-N	Welshpool	Apr 12, 2022	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Mar 22, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Mar 22, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Calcium (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			
Hardness	Welshpool	Mar 22, 2022	180 Day
- Method: ARL029 - Metals in Water by AAS			
Magnesium (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			

Repeat Samples

Description	Testing Site	Extracted	Holding Time
Volatile TRH (NEPM) Water	Welshpool	Mar 22, 2022	7 Days
- Method: ARL190 - Total Recoverable Hydrocarbons (C6-C10) in Water			
Semi-volatiles TRH (NEPM) Water	Welshpool	Mar 22, 2022	7 Days
- Method: ARL191 - Total Recoverable Hydrocarbons (>C10-C40) in Water			
Acidity	Welshpool	Apr 12, 2022	1 Day
- Method: ARL021 - Acidity in Water			
Chloride	Welshpool	Apr 12, 2022	28 Days
- Method: ARL305 - Chloride in Water by Discrete Analyser			
Conductivity	Welshpool	Apr 12, 2022	28 Days
- Method: ARL019 - Conductivity and Salinity in Water			
Sulfate	Welshpool	Mar 22, 2022	28 Days
- Method: ARL301 - Sulfate in Water by Discrete Analyser			
Total Dissolved Solids	Welshpool	Apr 12, 2022	7 Days
- Method: ARL No. 017 - Total Dissolved Solids			
Total Phosphorus	Welshpool	Mar 22, 2022	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Aluminium (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Arsenic (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Cadmium (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Chromium (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Copper (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Iron (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Lead (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Nickel (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Zinc (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Alkalinity	Welshpool	Mar 22, 2022	14 Days
- Method: ARL037 - Alkalinity in Water			
NOx-N	Welshpool	Apr 12, 2022	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Mar 22, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Mar 22, 2022	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Calcium (filtered)	Welshpool	Mar 22, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			
Hardness	Welshpool	Mar 22, 2022	180 Day
- Method: ARL029 - Metals in Water by AAS			
Magnesium (filtered)	Welshpool	Apr 12, 2022	180 Days
- Method: ARL029 - Metals in Water by AAS			

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.

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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							
Volatile TRH (NEPM) Water							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
Xylenes (Total)	mg/L	< 0.003			0.003	Pass	
Naphthalene	mg/L	< 0.005			0.005	Pass	
TRH C6-10	mg/L	< 0.02			0.02	Pass	
TRH C6-10 minus BTEX (F1)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Semi-volatiles TRH (NEPM) Water							
TRH C>10-16	mg/L	< 0.05			0.05	Pass	
TRH C>16-34	mg/L	< 0.1			0.1	Pass	
TRH C>34-40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Acidity	mg CaCO3/L	< 5			5	Pass	
Chloride	mg/L	< 5			5	Pass	
Conductivity	uS/cm	< 10			10	Pass	
NOx-N	mg/L	< 0.01			0.01	Pass	
Sulfate	mg/L	< 1			1	Pass	
Total Dissolved Solids	mg/L	< 5			5	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	0.003			0.001	Fail	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Method Blank							
Alkalinity							
Alkalinity	mg CaCO3/L	< 5			5	Pass	
Bicarbonate	mg CaCO3/L	< 5			5	Pass	
Carbonate	mg CaCO3/L	< 5			5	Pass	
Hydroxide	mg CaCO3/L	< 5			5	Pass	
LCS - % Recovery							
Semi-volatiles TRH (NEPM) Water							
TRH C>10-16	%	105			70-140	Pass	
TRH C>16-34	%	124			70-140	Pass	
TRH C>34-40	%	116			70-140	Pass	
LCS - % Recovery							
Conductivity	%	98			80-120	Pass	
Arsenic (filtered)	%	95			80-120	Pass	
Cadmium (filtered)	%	101			80-120	Pass	
Chromium (filtered)	%	84			80-120	Pass	
Copper (filtered)	%	100			80-120	Pass	
Lead (filtered)	%	107			80-120	Pass	
Nickel (filtered)	%	103			80-120	Pass	
CRM - % Recovery							
Total Dissolved Solids	%	95			80-120	Pass	
Arsenic (filtered)	%	92			80-120	Pass	
Cadmium (filtered)	%	97			80-120	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chromium (filtered)			%	111			80-120	Pass	
Copper (filtered)			%	118			80-120	Pass	
Lead (filtered)			%	94			80-120	Pass	
Nickel (filtered)			%	98			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Chloride	L22-Ma43460	NCP	%	100			70-130	Pass	
NOx-N	L22-Ma43460	NCP	%	107			80-120	Pass	
Sulfate	L22-Ma43460	NCP	%	99			70-130	Pass	
Total Nitrogen	L22-Ma44107	NCP	%	100			70-130	Pass	
Total Phosphorus	L22-Ma39400	NCP	%	104			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Volatile TRH (NEPM) Water				Result 1	Result 2	RPD			
Benzene	L22-Ma43260	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	L22-Ma43260	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	L22-Ma43260	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes (Total)	L22-Ma43260	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Naphthalene	L22-Ma43260	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
TRH C6-10	L22-Ma43260	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C6-10 minus BTEX (F1)	L22-Ma43260	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Acidity	L22-Ma39397	NCP	mg CaCO3/L	33	31	5.0	30%	Pass	
Chloride	L22-Ma43459	NCP	mg/L	880	900	<1	30%	Pass	
Conductivity	L22-Ma42914	NCP	uS/cm	72000	72000	<1	30%	Pass	
NOx-N	L22-Ma43459	NCP	mg/L	9.0	9.0	<1	30%	Pass	
Sulfate	L22-Ma43459	NCP	mg/L	270	270	1.0	30%	Pass	
Total Nitrogen	L22-Ma44106	NCP	mg/L	2.8	2.9	4.0	30%	Pass	
Total Phosphorus	L22-Ma39399	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Alkalinity				Result 1	Result 2	RPD			
Alkalinity	L22-Ma42914	NCP	mg CaCO3/L	170	170	<1	30%	Pass	
Bicarbonate	L22-Ma42914	NCP	mg CaCO3/L	170	170	<1	30%	Pass	
Carbonate	L22-Ma42914	NCP	mg CaCO3/L	< 5	< 5	<1	30%	Pass	
Hydroxide	L22-Ma42914	NCP	mg CaCO3/L	< 5	< 5	<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	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Douglas Todd	Analytical Services Manager
Sam Becker	Senior Analyst (WA)
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Paul Nottle	Senior Analyst (WA)

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

APPENDIX 5: GREENCAP AUDIT REPORTS

Level 1 / 503 Murray Street
Perth WA 6000
Australia

GROUNDWATER MONITORING PROGRAM: 5 YEARLY AUDIT

January 2018

J153902

Jandakot Airport Holdings
Jandakot Airport Estate

C101310:AR

Document Control

Document Quality Management Details.		
Report Name:	Groundwater Monitoring Program: 5 Yearly Audit	
Site Details:	Jandakot Airport Estate	
Project Number:	J153902	
Client Name:	Jandakot Airport Holdings	
Client Number:	C101310	
Signatures:	Prepared By:  Allan Renwick Consultant - Environment	Authorised By:  Celine Mangan Regional Practice Manager - Environment

Issue Status

Version No.	Date	Creator	Reviewer
DRAFT	19/12/2018	**Allan Renwick**	**Alex Serada**
FINAL	**23/01/2018**	**Allan Renwick**	**Sarah Nind**

Document Circulation

No of Copies	Type	Customer Name	Position & Company
1	**Electronic**	**Joanne Wann**	Environment Manager

Groundwater Monitoring Program: 5 Yearly Audit

Jandakot Airport Holdings

Jandakot Airport Estate

Executive Summary

Greencap Pty Ltd (Greencap) was commissioned by Jandakot Airport Holdings Pty Ltd (JAH) on 17 November 2017 to undertake an audit of the Groundwater Monitoring Program for the past 5 years of reporting at Jandakot Airport Estate (the Site).

The audit report will identify the following:

- Any non-conformances associated with the implementation of the groundwater monitoring program that require attention/rectification;
- Potential improvements/amendments the auditor determines appropriate for consideration by JAH and stakeholders; and
- Whether, after review by the auditor, the conclusions/findings within monitoring reports are considered valid/accurate.

The findings of each Annual Monitoring Report (AGMR) are outlined in the following tables:

Pendragon 2012-2013 Annual Monitoring Report

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Item	Result	Comments
Number of Non-Conformances	11	The audit of the Pendragon AGMR identified a number of non-conformances which were not considered to have an overall impact on the quality and/or findings of the results and interpretation. The number of non-conformances were identified due to comparison to the specific criteria outlined in the GWMP V4.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The recommendations were acceptable.
Were all GWMP objectives achieved?	3/5	Two objectives were not fully achieved within the AGMR: • The groundwater velocity and hydraulic gradient were not calculated by the consultant. • The risk to downstream receptors was not discussed within the report. The auditor notes that the consultant concluded that the results do not suggest or indicate groundwater contamination in the area.
Were the previous AMP Recommendations Incorporated?	2/3	The DoW bores were not sampled in this AGMR.

Coffey 2013-2014 Annual Monitoring Report

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Item	Result	Comments
Number of Non-Conformances	6	The audit of Coffey AGMR identified a number of non-conformances which were not considered to have an overall impact on the quality and/or findings of the results and interpretation. The number of non-conformances were identified due to comparison to the specific criteria outlined in the GWMP V4.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The recommendations were acceptable.
Were all GWMP objectives achieved?	5/5	
Were the previous AMP Recommendations Incorporated?	3/3	

Coffey 2014-2015 Annual Monitoring Report

The report was considered to be of a suitable quality with no non-conformances identified.

Item	Result	Comments
Number of Non-Conformances	0	No non-conformances.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The recommendations were acceptable.
Were all GWMP objectives achieved?	2/2	
Were the previous AMP Recommendations Incorporated?	2/2	

Essential Environmental 2015-2016 Annual Monitoring Report

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Item	Result	Comments
Number of Non-Conformances	1	The QA/QC control sampling was not considered appropriate. Further QA/QC samples were recommended.
Were the conclusions adequate?	Yes	The conclusions were acceptable, however the auditor wanted further clarification and/or discussion for one conclusion. The consultant concludes that elevated acidity and pH groundwater within JAMB1 and JAMB2B is expected to be from construction activity nearby. The auditor is unable to draw any reliable conclusion on this statement as the construction undertaken and any Acid Sulfate Soils Management Plan (ASSMP) for the development has not been supplied to Greencap. If this is the case, further assessment is recommended to determine the cause.

Item	Result	Comments
Were the recommendations adequate?	Further Required	Based on recommendation 1, this recommendation is pre-mature until further monitoring has taken place in September 2016. If acidity has increased due to construction activity then groundwater quality would have been impacted as a result of airport activities. The auditor notes that a recommendation to assess Bore 13 abstraction rates should had also been included. The auditor has assumed that the inclusion of ADC1 – ADC3 within the monitoring program was confirmed by key stakeholders prior to their implementation. No discussion of these wells were included in the 2014-2105 AGMR.
Were all GWMP objectives achieved?	2/2	
Were the previous AMP Recommendations Incorporated?	2/3	No DoW elevation data was included in the groundwater contouring.

Essential Environmental 2016-2017 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Item	Result	Comments
Number of Non-Conformances	1	The QA/QC control sampling was not considered appropriate. Further QA/QC samples were recommended.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The conclusions were acceptable.
Were all GWMP objectives achieved?	2/2	
Were the previous AMP Recommendations Incorporated?	3/3	

The following recommendations for improvement/amendment include:

1. Recently, environmental regulators have drawn significant attention to Per-Fluoroalkyl and Poly-Fluoroalkyl Substances (PFAS) which are chemicals included in firefighting foams used on many sites to suppress fires. The PFAS chemicals are toxic, very persistent and have been demonstrated to be carcinogenic. It is therefore recommended that these chemicals be included in the future monitoring program. The inclusion of PFAS in the sampling program would require changes to some groundwater sampling elements as follows:

    - High Density Polyethylene (HDPE) is to be used for low flow sampling;
    - All Teflon components of a bladder pump will need to be replaced with non-Teflon components;
    - No use of Decon 90 to be used;
    - Reusable chemical or gel ice packs are not be used;
    - No Tyvek clothing is to be worn;
    - No fast food wrappers or containers are to be used;
    - All abstracted groundwater is to be collected and transported by a licenced waste disposal contractor for appropriate disposal; and

- Compliance with all mitigation techniques discussed in the DWER (2017) Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS).

2. It is recommended to use statistical trend analysis as this is adopted by environmental regulators as a best practice tool. Typically Mann-Kendal statistical analysis tool is widely used across the practice.
3. Inclusion of the regional DoW monitoring wells within the groundwater flow contouring would be beneficial, but not necessary, in understanding the regional flow system. Pendragon (2012) report (prior to the scope of this audit) recommended this, however no action was taken with the proceeding reports.
4. In the 2015-2016 AGMR, groundwater flow has been inferred to flow in a northerly direction over much of the airport and in a north westerly direction in Precinct 5. It is recommended that further groundwater level data is obtained, where possible, within the northern region of the airport (Precinct 1, parts of Precinct 3 and parts of Precinct 4) to further constrain the groundwater contours and further determine groundwater flow.
5. At present, there are no down-gradient well/s in the northern region of the airport that are gauged and/or sampled. The inferred groundwater flow has the potential for migration of contaminants off site to the north. It is a recommendation that any available wells in this area be gauged and sampled if contamination is identified in up-gradient wells. If there are no available wells, it is also recommended that additional wells be installed.
6. The QA/QC sampling program should be elaborated within the GWMP as the terminology within Section 5.5.4 is imprecise and therefore QA/QC samples have varied since the introduction of GWMP V5.4 and V5.5. It is recommended that further QA/QC samples be taken (triplicate, rinsate (where applicable) and transport blanks) following recommendations included in the NEPM.
7. A minor recommendation would be update the GWMP to rename the DoW and DER to the Department of Water and Environmental Regulation (DWER) since their amalgamation in July 2017.

Groundwater Monitoring Program: 5 Yearly Audit

Jandakot Airport Holdings

Jandakot Airport Estate

Table of Contents

1 Introduction

Greencap was commissioned by Jandakot Airport Holdings Pty Ltd (JAH) on 17 November 2017 to undertake an audit of the Groundwater Monitoring Program which was followed for the past 5 years at Jandakot Airport Estate (the Site).

1.1 Background

Jandakot Airport is leased from the Commonwealth Government by JAH and is an important piece of state infrastructure, being Western Australia's major general aviation airport. Jandakot Airport is Commonwealth Land and is therefore subjected to Commonwealth legislation (primarily the Airports Act 1966, Airports (Environmental Protection) Regulations 1997 and the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999).

Development and implementation of the Jandakot Airport Groundwater Management Plan (GWMP) (and the groundwater monitoring program within) is a condition of EPBC approvals 2009/4796 and 2013/7032.

The GWMP states *"Independent auditing of the groundwater monitoring program (including results and reports) will be undertaken every 5 years, with the next audit scheduled for 2017. The audit report will be provided to key stakeholders for review and comment, following which the Groundwater Monitoring Program will be reviewed and if necessary, amended."*

1.2 GWMP Reviews and Amendments

Over the 5 year review period, the GWMP has been updated as follows:

- Version 3 of GMMP was issued in 2011 (outside of this audit period);
- Version 4 of GWMP was issued in 2012. Two annual reports were prepared as per requirements of this version of GWMP (as detailed in **Table 1**);
- Version 5.4 of GWMP was issued in July 2015. One annual report was prepared **(Table 1**); and
- Current Version 5.5 of GWMP was issued in January 2016. Two annual reports were prepared (**Table 1**).

1.3 Objectives of the Audit

The audit report is prepared to identify the following:

- Any non-conformances associated with the implementation of the groundwater monitoring program that require attention/rectification;
- Potential improvements/amendments the auditor (Greencap, for this 5 year review) determines appropriate for consideration by JAH and stakeholders; and
- Whether, after review by the auditor, the conclusions/findings within monitoring reports are considered valid/accurate.

1.4 Documentation Reviewed

JAH have provided Greencap with all the relevant documentation required to complete the audit. The relevant Annual Groundwater Monitoring reports (AGMR) audited within this report are listed in **Table 1**.

Table 1: Annual Groundwater Reports		
Consultancy	**Report Title**	**Groundwater Management Plan Version**
Pendragon Environmental Solutions	Annual Groundwater Monitoring Report, August 2013	GWMP V4
Coffey Environments Australia Pty Ltd	2013-2014 Annual Groundwater Monitoring Report, Jandakot Airport, WA, 20 October 2014	GWMP V4
Coffey Environments Australia Pty Ltd	2014-2015 Annual Groundwater Monitoring Report, Jandakot Airport, WA, 30 September 2015	GWMP V5.4
Essential Environmental	2015-16 Annual Groundwater Monitoring Report, September 2016	GWMP V5.5
Essential Environmental	2016-17 Annual Groundwater Monitoring Report, September 2017	GWMP V5.5

Greencap have also been provided with the following documentation/databases to aid in the audit process:

- JAH Bore Register Summary, November 2017 (Excel spreadsheet). The database presents the installation/construction details for all relevant monitoring wells included in the GWMP;
- JAH GWMP Monitoring Results – Annual Report 2017 (Excel spreadsheet). The database presents all laboratory results for all monitored wells since March 2012; and
- Interim Report and Results:
    - September 2013, December 2013, March 2014 Groundwater Monitoring Results;
    - September 2014 and March 2015 Groundwater Monitoring Results;
    - September 2015 and March 2016 Groundwater Monitoring Results; and
    - September 2016 and March 2017 Groundwater Monitoring Results.

2 Audit Methodology

To achieve the objectives outlined in **Section 1.3**, the following methodology has been used for the audit:

1. Review of the installation details of the groundwater monitoring wells to assess that they are fit for purpose.

2. Each annual monitoring report will be reviewed and compared against the groundwater monitoring plan outlined in GWMP to identify potential non-conformances / inconsistencies in the following areas:

   a. Sampling procedures undertaken and its compliance with the GWMP in the following:
   b. Sample Methodology;
   c. Appropriateness of sampling equipment/device used (e.g. pump type);
   d. Review of sampling technique(s);
   e. Monitoring of physicochemical field parameters during groundwater purging;
   f. Field filtering consistency with GWMP;
   g. Purged Groundwater Storage and disposal of;
   h. Field equipment Calibration certificates/records;
   i. Decontamination Procedures applied;
   j. Sample Collection/storage and transport Procedures; and
   k. Quality Assurance/Quality Control (QA/QC) Sample Collection.
   l. The suite of analytes / assessment levels adopted and presented in Table 1 from the GWMP and non-conformances (if any);
   m. Review of the results including tabular and graphical materials, analysis and assessment of long term trends, comparison with A(EP)R Schedule 2 to assess for inconsistencies or transcription errors. Other regional data that is relevant to the GWMP has also been reviewed (if available) to evaluate any potential for exceedances of the adopted assessment criteria outlined the GWMP;
   n. Review of the QA/QC field and laboratory results to assess for compliance with current standards and guidelines;
   o. Review of the conclusions and recommendations to determine their validity and suitability and/or if any of the recommendations were actioned; and
   p. Review of figures and appendices to assess their validity and completeness.

The above methodology is summarised in **Table 2.**

The results of each annual report review are presented in the following sections:

Section 3 2012-2013 Annual Monitoring Report
Section 4 2013-2014 Annual Monitoring Report
Section 5 2014-2015 Annual Monitoring Report
Section 6 2015-2016 Annual Monitoring Report
Section 7 2016-2017 Annual Monitoring Report

The overall Audit findings are included in Section 8 and proposed recommendations are outlined in Section 9.

Table 2: Audit Methodology			
Audit Criteria	**Documents to be Reviewed**	**Documents to be Reviewed against**	**Outcome**
Groundwater Well Installation	JAH Bore Register Summary November 2017 (Excel spreadsheet). Annual Monitoring Reports (2013-2017)	Australian Standards and other current documents (e.g. National Environment Protection (Assessment of Site Contamination) Measure, NEPM)	Determine the suitability of the wells sampled as per GWMP requirements.
Sampling Procedures	Annual Monitoring Reports (2013-2017)	Groundwater Management Plan(s) V4, V5.4 and V5.5 Australian Standard 5667.11:1998 NEPM (	Identify any non-conformances and variation from industry best practice methods.
Assessment Levels	Annual Monitoring Reports (2013-2017) JAH GWMP Monitoring Results – Annual Report 2017 (Excel spreadsheet).)	Groundwater Management Plan(s) V4, V5.4 and V5.5 Airports (Environmental Protection) Regulations 1997 Australian and New Zealand guidelines for fresh and marine water quality (ARMCANZ & ANZECC 2000)	Identify any non-conformances and non-compliances.
Tabular and Graphical Data	Annual Monitoring Reports (2013-2017)	Groundwater Management Plan(s) V4, V5.4 and V5.5 Airports (Environmental Protection) Regulations 1997 Australian and New Zealand guidelines for fresh and marine water quality (ARMCANZ & ANZECC 2000) DWER and/or Water Corporation	Inconsistencies and/ or transcription errors in analysis and assessments of trends and any other non-conformances that may influence the reported results of monitoring.
QA/QC Field and Laboratory Results	Annual Monitoring Reports (2013-2017)	Groundwater Management Plan(s) V4, V5.4 and V5.5 Australian Standard 5667.11:1998 NEPM	Identify any non-conformances and variation from best industry practice methods.
Conclusions and Recommendations	Annual Monitoring Reports (2013-2017)	N/A	Determine validity and suitability of conclusions/recommendations and whether or not they have been actioned.
Figures and Appendices	Annual Monitoring Reports (2013-2017)	Groundwater Management Plan(s) V4, V5.4 and V5.5	Assess validity and completeness

3 2012-2013 Annual Monitoring Report

3.1 Introduction

The 2012-2013 AGMR was completed by Pendragon Environmental Solutions (Pendragon). Greencap has reviewed this AGMR and the review results are presented in sections below. The summary of findings are outlined in **Data Table 1** at the end of the report.

3.2 Objectives of GWMP V4

The objective and rationale of the groundwater sampling program are outlined in the GWMP V4 for Ground Water Sampling (Appendix B). The auditor does not consider these to be objectives for groundwater quality monitoring but rather objectives of the investigation and assessment. However for the purpose of the audit related to GWMP V4 they have been used to assess the report findings against. As stated in GWMP - the objectives and rationale is to ascertain:

- Aquifer characteristics, preferential pathways and hydraulic parameters; depth to groundwater, groundwater flow direction, hydraulic gradient and velocity;
- Ground water chemistry;
- Existing (nature, extent and severity) and potential ground water contamination;
- On and off-site sources of contamination; and
- Potential impacts on and risk to human health and/or the environment and particularly to downstream receptors (including current and likely future uses/users); ground water, receiving aquatic environments and/or discharge locations.

3.3 Non-Conformances

Following a review of Pendragons AGMR, a list of the non-conformances identified are presented in **Table 3**.

Table 3: Pendragon AGMR Non-Conformances		
Audit Criteria	**GWMP Criteria**	**Auditor Comments**
Sample Methodology	Nine (9) wells to be sampled quarterly (September, December, March and June). Ground water levels will be measured and recorded prior to any purging…	Groundwater levels were not measured in all wells.
Appropriate sampling equipment/device used (e.g. pump type)	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Low flow pump with disposable LDPE tubing"*	Bailers were used during groundwater sampling instead of a low-flow pump.
Monitoring of physicochemical parameters	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Measuring and recording pH, temperature, electrical conductivity, dissolved oxygen and redox potential with sampling only occurring once field water quality parameters do not vary by more than 10%".*	The auditor is unable to review this requirement as no field sampling sheets were included in the report.
Quality Assurance/Quality Control (QA/QC) Sample Collection	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"Rinsate samples where cross contamination of samples is likely to impact on the validity of the sampling and assessment process: one for each piece of equipment used where cross contamination is possible."*	No rinsate samples taken. The auditor notes that the only piece of equipment used for each well was the water level meter. This meter was reported to be wiped clean and triple washed with Decon 90 at each location. The auditor determines that the sampling results are unlikely to be affected by this omission.
	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"Field blanks where contamination during the collection procedure is possible: one per sampling team per group of samples."*	No field blank samples taken. The auditor's opinion is that without field blanks it is not possibly to judge whether the sampling results were influenced.
	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"Transport blanks for contamination during transportation and storage: one sample per transport container (insulated cooler)."*	One transport blank sample was taken in September 2012. No samples were taken during the other monitoring rounds. It is not possible to comment whether samples quality were or were not affected during transportation.
	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"Container blanks if contamination from containers and preservation technique during storage is possible: one for every group of samples."*	No container blank samples taken. It is not possible to comment whether samples quality were or were not affected by this omission.
Field Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>On Site Measurements On site measurements analysed.	No field sampling sheets were included within the report. No measurements of temperature, turbidity or Total Acidity was carried out.

Table 3: Pendragon AGMR Non-Conformances		
Audit Criteria	**GWMP Criteria**	**Auditor Comments**
Laboratory Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis All required analytes analysed	The following analytes were not tested for in all monitoring events: Net Acidity Chlorophyll-a Ammonia Mercury Sulphide Surfactants and oil dispersants Phenol The auditor notes that in the relevant GWMP it states that "the choice of analytes is generally based on the location of the sample and the likely potential contaminants from previous potentially contaminating activities and/or future land use (refer Schedules 2 and 3)". The auditor has considered this as a non-conformance.
Appendices		The auditor notes that no field sampling sheets were included in the appendices to cross check the sampling methodology.
Quarterly reports submitted	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Reporting) *"Tabulations and graphs are to be compiled and submitted to JAH quarterly, accompanied by brief notes".*	Laboratory results were sent to JAH for the monitoring events undertaken in December 2012 and March 2013 only. No results from September 2012 and June 2013 were sent.

3.4 Pendragon AGMR Conclusions and Recommendations

3.4.1 Conclusions

> ***Section 4 Conclusions and Recommendations***
>
> *"There is generally little variability in the groundwater levels throughout the year. Groundwater levels generally increase between June and September followed by a decrease from September to June. Some analytes exceeded the compliance triggers for Fresh Water in Schedule 2 of the Airports (Environment Protection) Regulations 1997 however these do not suggest or indicate groundwater contamination. Low pH, elevated heavy metals and nutrients are within typical ranges for groundwater in the area. There have been no detections of hydrocarbons or phenolic compounds in the 2012-2013 sampling period. Hydrocarbons and phenolic compounds are not considered an issue at the site."*

Based on the results of the GMEs, the auditor does not agree that the results do not suggest or indicate groundwater contamination. Reported exceedance of the adopted assessment criteria for pH, metals and nutrients are indicative of groundwater contamination. Auditor cannot comment on this because environmental assessments conducted for the site area were not provided and were not included in the agreed scope of the audit.

3.4.2 Recommendations

> ***Section 4 Conclusions and Recommendations***
>
> *"To continue with monitoring of the bores at quarterly frequencies until two years (8 sampling events) have been completed. It is proposed that, providing there are no issues, sampling is scaled back to biannual monitoring. It is proposed that the Ground Water Management Plan will be amended to reflect this proposed future change and consultation will occur with relevant regulators and stakeholders prior to any change being made."*

The auditor agrees with this recommendation, which is in accordance with the GWMP.

> ***Section 4 Conclusions and Recommendations***
>
> *"Review the Ground Water Management Plan with special attention to the Assessment Levels and submit any amendments to DSEWPaC for approval."*

The auditor agrees with this recommendation.

> ***Section 4 Conclusions and Recommendations***
>
> *"To investigate appropriate surface water sampling strategies given that compensation basins on the airport are not designed to hold water for significant lengths of time due to the risk of aircraft bird strikes. Investigate the possibility of installing additional groundwater bore(s) down gradient to the compensation basin discharge points, thus allowing for infiltrated stormwater to be sampled. Following investigations by JAH and discussions with relevant stakeholder an amended Ground Water Management Plan will be submitted to DSEWPaC for approval."*

The auditor agrees with this recommendation.

3.5 Objectives Achieved

Based on the identified non-conformances and conclusions drawn by Pendragon, Greencap has determined that the AGMR has largely completed the objectives set out in the GWMP V4 for Ground Water Sampling, as presented in **Table 4**.

Table 4: Objectives Completed for Pendragon 2012-2013 AGMR		
Objective	**Objective Achieved?**	**Auditor Comments**
Aquifer characteristics, preferential pathways and hydraulic parameters; depth to groundwater, groundwater flow direction, hydraulic gradient and velocity	Partially	Pendragon identified the depth to groundwater and groundwater flow direction. The hydraulic gradient and velocity was not determined.
Ground water chemistry	Achieved	Note, no field sampling forms were provided
Existing (nature, extent and severity) and potential ground water contamination	Achieved	
On and off-site sources of contamination	Achieved	
Potential impacts on and risk to human health and/or the environment and particularly to downstream receptors (including current and likely future uses/users); ground water, receiving aquatic environments and/or discharge locations.	Partially	The risk to downstream receptors was not discussed within the report. The auditor notes that the consultant concluded that the results do not suggest or indicate groundwater contamination in the area.

3.6 Previous 2012 Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 5** presents the results of this assessment. It is noted that groundwater sampling of DoW bores was not actioned in this AGMR.

Table 5: 2011-2012 Recommendations Incorporated into the 2012-2013 AGMR	
Objective	**Recommendation Incorporated?**
Continue with monitoring of the bores at a quarterly frequency	✓
Obtain Department of Infrastructure and Transport and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) approval for implementing the Proposed Assessment Levels	✓
Consider undertaking water sampling at DoW Bores JM3, JM8, JM14 and JM45 to increase sampling densities	X

4 2013-2014 Annual Monitoring Report

4.1 Introduction

The 2013-2014 AGMR was carried out and completed by Coffey Environments Australia Pty Ltd (Coffey). The AGMR was to be carried out in accordance with GWMP V4. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 2** at the end of the report.

4.2 Non-Conformances

Following a review of Coffey's AGMR, a list of the non-conformances identified are presented in **Table 6**.

Table 6: Coffey AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Groundwater Well Installation	Appendix B – Field and Laboratory QA/QC (Bore Construction and Development) To be installed in line with AS/NZS 4452:1997 and AS 1726:1993 • Constructed using mud rotary technique • 150mm Class 18 PVC casings with 0.5 mm slotted screen • Washed gravel or coarse sand filter pack, bentonite seal and cement/bentonite grout • End caps • Lockable steel riser • Surveying	Three wells (JAMB10, JAMB11 and JAMB3B) were installed using Hollow Stem Auger drilling techniques. The auditor notes that this is not the technique described in the GWMP, but the technique employed is suitable for the wells intended use.
Quality Assurance/Quality Control (QA/QC) Sample Collection	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"Container blanks if contamination from containers and preservation technique during storage is possible: one for every group of samples."*	No container blank samples taken. It is considered that Coffey did not identify possible cross-contamination occurring from the sampling procedure. The auditor determines that the results are not affected by this omission.
Laboratory Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis All required analytes analysed	The following analytes were not tested for in all monitoring events: • Net Acidity • Chlorophyll-a • Ammonia • Mercury • Sulphide • Surfactants and oil dispersants • Phenol The auditor notes that in the relevant GWMP it states that "the choice of analytes is generally based on the location of the sample and the likely potential contaminants from previous potentially contaminating activities and/or future land use (refer Schedules 2 and 3)". The auditor has considered this as a non-conformance as no justification for the analytical program was provided.

Table 6: Coffey AGMR Non-Conformances		
Audit Criteria	**GMP Criteria**	**Auditor Comments**
Trends	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Review) *"all monitoring information and data are to be reviewed and reported upon annually to ensure compliance with performance criteria. The review should include a detailed statistical and trend analysis and graphically presented."*	Trend discussion is limited, with no statistical analysis undertaken.
Graphical Presentation		Limited to Graph A (Groundwater Elevation 2012-2014). Graphical presentation of trends is not included

4.3 Coffey AGMR Conclusions and Recommendations

4.3.1 Conclusions

Section 11.1 Conclusions

"Generally trends show there is little discernible difference in groundwater quality between the up-gradient, cross-gradient and section 5 monitoring wells, and no evidence of groundwater degradation within the P1 UWPCA associated with site operations."

"The results presented substantiate a reduction in the frequency of groundwater monitoring under the premise that JAH continue in the active management of environmental incidents as detailed in the Groundwater Management Plan (JAH, 2012)."

The auditor is in a general agreement with the conclusions drawn by Coffey

The auditor notes that although no detailed statistical/graphical trend analysis was undertaken, the trends were discussed for each analyte. Furthermore a Conceptual Site Model (CSM) assessment undertaken is detailed and the risk rating of low was considered satisfactory.

4.3.2 Recommendations

Section 11.2 Recommendations

"A reduction in the frequency of groundwater monitoring from quarterly to biannually. Biannual monitoring should allow for an assessment of seasonal trends e.g. GMEs should be undertaken in March/April and September/October to monitor groundwater trends during the seasonal post- winter high and post-summer low groundwater levels."

The auditor agrees with this recommendation as it does not contradict to the GWMP V4, stating that reporting (and monitoring) frequencies may be amended as circumstances require and will be reviewed annually.

Section 11.2 Recommendations

"It is recommended that the adoption of NEPM (2013) be implemented for future monitoring events to supplement the Airports (Environmental Protection) Regulations 1997."

The auditor agrees with this recommendation.

4.4 Objectives Achieved

Based on the identified non-conformances and conclusions drawn by Coffey, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V4 for Ground Water Sampling, as presented in **Table 7**.

Table 7: Objectives Completed for Coffey 2013-2014 AGMR

Objective	Objective Achieved?	Auditor Comments
Aquifer characteristics, preferential pathways and hydraulic parameters; depth to groundwater, groundwater flow direction, hydraulic gradient and velocity	Achieved	All aquifer characteristics were calculated.
Ground water chemistry	Achieved	
Existing (nature, extent and severity) and potential ground water contamination	Achieved	
On and off-site sources of contamination	Achieved	
Potential impacts on and risk to human health and/or the environment and particularly to downstream receptors (including current and likely future uses/users); ground water, receiving aquatic environments and/or discharge locations.	Achieved	All potential receptors had been discussed.

4.5 Previous 2012-2013 Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 8** presents the results of this assessment. All recommendations from the previous year's report were in included/actioned within the AGMR.

Table 8: 2012-2013 Recommendations Incorporated into the 2013-2014 AGMR

Objective	Recommendation Incorporated?
To continue with monitoring of the bores at quarterly frequencies until two years (8 sampling events) have been completed. It is proposed that, providing there are no issues, sampling is scaled back to biannual monitoring. It is proposed that the Ground Water Management Plan will be amended to reflect this proposed future change and consultation will occur with relevant regulators and stakeholders prior to any change being made.	✓
Review the Ground Water Management Plan with special attention to the Assessment Levels and submit any amendments to DSEWPaC for approval.	✓
To investigate appropriate surface water sampling strategies given that compensation basins on the airport are not designed to hold water for significant lengths of time due to the risk of aircraft bird strikes. Investigate the possibility of installing additional groundwater bore(s) down gradient to the compensation basin discharge points, thus allowing for infiltrated stormwater to be sampled. Following investigations by JAH and discussions with relevant stakeholder an amended Ground Water Management Plan will be submitted to DSEWPaC for approval.	✓

5 2014-2015 Annual Monitoring Report

5.1 3.1 Introduction

The 2014-2015 AGMR was carried out and completed by Coffey Environments Australia Pty Ltd (Coffey). The AGMR was to be carried out in accordance with GWMP V5.4. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 3** at the end of the report.

5.2 Background

In July 2015, the GWMP was updated following an audit carried out by Strategen in 2013.

Revised assessment levels had been adopted for Total Nitrogen, Total Phosphorous, pH, Electrical Conductivity, Aluminium, Cadmium, Zinc, Lead and Iron based on the 90th percentile of collected groundwater data from ten monitoring events (March 2012 to September 2014) at bores JAMB5,6,7,8 & 9 which are all located upgradient of infrastructure and operations on the Jandakot Airport estate and may therefore be considered as 'observed control sites' consistent with the recommendations of ARMCANZ & ANZECC 2000.

The previous AGMR (2013-2014) recommended the following:

- A reduction in the frequency of groundwater monitoring from quarterly to biannually. Biannual monitoring should allow for an assessment of seasonal trends e.g. GMEs should be undertaken in March/April and September/October to monitor groundwater trends during the seasonal post- winter high and post-summer low groundwater levels.
- It is recommended that the adoption of NEPM (2013) be implemented for future monitoring events to supplement the Airports (Environmental Protection) Regulations 1997.

The recommendations were adopted and included in GWMP V5.4 (Table 10).

5.3 Objectives of GWMP V5.4

The objective and rationale of the groundwater sampling outlined in the GWMP V5.4 for Ground Water Sampling are to ascertain:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

5.4 Non-Conformances

Following a review of Coffey's AGMR, no non-conformances were identified. The report appropriately addressed all requirements of the GWMP V5.4.

Coffey's report noted that "Statistical analysis identifying the significance of change within the data has not been undertaken due to the small size of the data sets". It is the Auditor's opinion that the 11 data sets available are sufficient to undertake statistical analyses. E.g. the Mann Kendall statistical tool recognised by environmental practitioners requires only 4 data sets for analysis.

5.5 Coffey AGMR Conclusions and Recommendations

5.5.1 Conclusions

> ***Section 9 Conclusions***
>
> *"Based on a review of available groundwater data (dissolved oxygen, redox, pH, electrical conductivity and calculated total dissolved solids) trends generally show there is little discernible difference in groundwater quality between the up-hydraulic gradient, cross- hydraulic gradient and Precinct 5 "*
>
> *"Based on available data, the detected on-site nutrient levels do not infer point source contamination or on-site diffuse source impacts and are likely to be a regional issue with elevated nutrient levels recorded within up hydraulic gradient wells."*
>
> *"…metal concentrations are consistent with ambient conditions and are considered present due to acidification (possibly due to acid sulphate soils) of the regional aquifer up-hydraulic gradient of Jandakot Airport (i.e. groundwater entering and moving below the site) and not correlating with on-site activities/potential sources."*

The auditor agrees with the conclusions drawn by Coffey for the AGMR.

> ***Section 9 Conclusions***
>
> *"Based on a review of available groundwater data, trends generally show there is little discernible difference in groundwater quality between the up-hydraulic gradient, cross- hydraulic gradient and Precinct 5 monitoring wells, and no evidence of groundwater degradation within the P1 UWPCA associated with site operations. Therefore, the risks to identified receptors (e.g. Jandakot Mound, onsite users and maintenance workers etc.) are considered low."*
>
> "*The operation of Bore 13 (one of the largest producer of irrigation waters in this area) has a potential to create localised water table depression when this is operating that may affect SWLs in JAMB1, JAMB10 and JAMB11*".

The auditor agrees with the conclusions drawn by Coffey for the AGMR.

Physiochemical, nutrient and metal concentrations observed within the down-gradient wells are similar to those concentrations observed in up-gradient wells. No presence of contamination from onsite activities was identified. However the auditor notes that although acidity shows seasonal variation, the overall values are increasing over time at JAMB4 and JAMB7. This could be assessed using statistical analyses.

The Conceptual Site Model (CSM) assessment undertaken is detailed and the risk rating was considered to be appropriate based on the results presented in the report.

Some groundwater level contour deflection noted in the vicinity of JAMB1, JAMB10 and JAMB11 may be influenced by groundwater abstraction from Bore 13 as indicated in Coffey's report. Changes in water level should be assessed in relation to potential acid sulfate soil impacts.

5.5.2 Recommendations

> ***Section 10 Recommendations***
>
> *"Continual biannual monitoring to allow for an assessment of seasonal trends e.g. GMEs should be undertaken in March/April and September/October to monitor groundwater trends during the seasonal post-summer low and post-winter high groundwater levels, respectively."*

The auditor agrees with this recommendation, which is in accordance with the GWMP.

Section 10 Recommendations

"Regarding DoW groundwater elevation - given data may be available from Water Information reporting website, consider including a select number of the DoW bores water elevations data plotted along with the JAMB water elevations in Section 7.2.1 to demonstrate that trends are consistent over the Jandakot Airport Monitoring Period (i.e. 2012 - Present). Consider reviewing DoW data (e.g. for JM7) to contribute to the hydrogeological information plans (Figures 3 & 4) of the site and immediate surrounds."

The auditor agrees with this recommendation.

Section 10 Recommendations

"Whilst there are a number of exceedances of the criteria, including Assessment Levels, during 2014/15 GMEs, it does not appear that these exceedances indicate the presence of contamination. Whilst further investigation outside of the planned biannual monitoring isn't currently warranted, the following in particular should be noted during the September 2015 and March 2016 GMEs to further assist interpretation and determine if trends warrant further investigation:

- *Nutrient trends for JAMB10, and to a lesser extent, JAMB2;*
- *Acidity trends in JAMB2 and JAMB10;*
- *Copper trends in monitoring bores that experienced an unusually high result in March 2015 (particularly JAMB1, JAMB3B and JAMB10); and*
- *Zinc trends for JAMB3B."*

The auditor is in general agreement with this recommendation. Further assessment should be carried out in the next annual period in terms of potential groundwater contamination.

5.6 Objectives Achieved

Based on the identified non-conformances and conclusions drawn by Coffey, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.4 for Ground Water Sampling, as presented in **Table 9**.

Table 9: Objectives Completed for Coffey 2014-2015 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	All aquifer characteristics were calculated.
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	

5.7 Previous 2013-2014 AGMR Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 10** presents the results of this assessment.

Table 10: 2013-2014 Recommendations Incorporated into 2014-2015 AGMR	
Objective	**Recommendation Incorporated?**
A reduction in the frequency of groundwater monitoring from quarterly to biannually. Biannual monitoring should allow for an assessment of seasonal trends e.g. GMEs should be undertaken in March/April and September/October to monitor groundwater trends during the seasonal post- winter high and post-summer low groundwater levels.	✓
It is recommended that the adoption of NEPM (2013) be implemented for future monitoring events to supplement the Airports (Environmental Protection) Regulations 1997.	✓

6 2015-2016 Annual Monitoring Report

6.1 Introduction

The 2015-2016 AGMR was carried out and completed by Essential Environmental. The AGMR was to be carried out in accordance with GWMP V5.5 which replaced the previous GWMP V5.4. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 4** at the end of the report.

6.2 Objectives of GWMP V5.5

The objective and rationale of the groundwater sampling outlined in the GWMP V5.5 for Ground Water Sampling are:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

6.3 Non-Conformances

Following a review of Essential Environmental AGMR, a list of the non-conformances identified are presented in **Table 11**.

Table 11: Coffey AGMR Non-Conformances

Audit Criteria	GWMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	As per NEPM, duplicates should include 1 field duplicate at a rate of 1/20 and 1 second duplicate at a rate of 1/20. This is considered to be a non-conformance

6.4 Essential Environmental AGMR Conclusions and Recommendations

6.4.1 Conclusions

Section 7 Conclusions

"With the exception of pH, physiochemical parameters vary within expected ranges across the site and there appears to be no degradation in groundwater quality due to site operations.

- *Groundwater in the area is generally somewhat acidic. Both in-situ pH and acidity were elevated during 2015/16 at wells JAMB1 and JAMB2B, possibly due to construction activity in the vicinity of these wells. It is expected that these levels will settle following completion of these works.*
- *Nutrients are quite high across the site. Historically there has been onsite sewage waste disposal, however this is being rectified and new developments placed on reticulated sewerage system. Also, the location of monitoring bores in relation to known on-site sewerage disposal sites would limit the extent that this might influence monitoring results. Nutrient levels in 2015/16 were generally consistent with the longer record indicating no degradation in groundwater quality due to current site operations.*
- *With the exception of aluminium, iron and zinc, detected concentrations of metals are below or marginally above guidelines consistent with historical trends indicating no degradation in groundwater quality due to site operations.*
- *Whilst aluminium, iron and zinc are often detected at higher concentrations exceeding the A(EP)R 1997 Schedule 2 guidelines, the adoption of Assessment Levels within Jandakot Airport GMP allows interpretation of data to be compared to local groundwater conditions. Detected metals are generally consistent with expected ranges for Western Australian groundwater systems consistent with the slightly acidic conditions.*
- *Whilst the Jandakot airport does transport, store and use petroleum hydrocarbons, the available groundwater data does not identify any adverse impacts from airport activities."*

The auditor is unable to draw any reliable conclusions regarding impacts on groundwater from construction activities. Further assessment is recommended to determine the cause of observed changes. Furthermore noted influences on groundwater level at JAMB1, JAMB10 and JAMB11 potentially due to the groundwater abstraction from the bore Bore 13 should be investigated in relation to acid sulfate soils.

The auditor in a general agreement with other conclusions.

6.4.2 Recommendations

Section 8 Recommendations

"It is expected that acidity of groundwater at JAMB1 and JAMB2B will return to background levels following completion of construction activity. However, these sites should be specifically reviewed following collection of the next round of samples in September 2016."

The Auditor agrees that further assessment is required as increased groundwater acidity may cause additional mobilisation of metals from soils into groundwater and additional groundwater contamination.

Section 8 Recommendations

"It is considered likely that elevated Iron concentrations at JAMB4 and JAMB5 are not caused or contributed to by airport operations. However, these sites should be specifically reviewed following collection of the next round of samples in September 2016."

The auditor agrees with this recommendation.

> ***Section 8 Recommendations***
>
> *"The groundwater at the site is generally of good quality and does not appear to have experienced any decline in quality as a result of airport activities. However, given the future expansion, current practices undertaken on site and sensitivity of the receiving environment, the monitoring program should not be amended at this time."*

Based on recommendation 1, this recommendation is pre-mature until further monitoring has taken place in September 2016. If acidity has increased due to construction activity then groundwater quality would have been impacted as a result of airport activities.

The auditor notes that a recommendation to assess Bore 13 abstraction rates should have also been included.

6.5 Objectives Achieved

Based on the identified non-conformances and conclusions made by Essential Environmental, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.5 for Ground Water Sampling, as presented in **Table 12**.

Table 12: Objectives Completed for Essential Environmental 2015-2016 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	Needs to be confirmed in the next AGMR

6.6 Previous 2015-2016 Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 13** presents the results of this assessment.

Table 13: 2014-2015 Recommendations Incorporated into the 2015-2016 AGMR

Objective	Recommendation Incorporated?
Continual biannual monitoring to allow for an assessment of seasonal trends e.g. GMEs should be undertaken in March/April and September/October to monitor groundwater trends during the seasonal post-summer low and post-winter high groundwater levels, respectively.	✓
Regarding DoW groundwater elevation - given data may be available from Water Information reporting website, consider including a select number of the DoW bores water elevations data plotted along with the JAMB water elevations to demonstrate that trends are consistent over the Jandakot Airport Monitoring Period (i.e. 2012 - Present). Consider reviewing DoW data (e.g. for JM7) to contribute to the hydrogeological information plans of the site and immediate surrounds.	X
Whilst there are a number of exceedances of the criteria, including Assessment Levels, during 2014/15 GMEs, it does not appear that these exceedances indicate the presence of contamination. Whilst further investigation outside of the planned biannual monitoring isn't currently warranted, the following in particular should be noted during the September 2015 and March 2016 GMEs to further assist interpretation and determine if trends warrant further investigation:	✓

Table 13: 2014-2015 Recommendations Incorporated into the 2015-2016 AGMR	
Objective	**Recommendation Incorporated?**
• Nutrient trends for JAMB10, and to a lesser extent, JAMB2; • Acidity trends in JAMB2 and JAMB10; • Copper trends in monitoring bores that experienced an unusually high result in March 2015(particularly JAMB1, JAMB3B and JAMB10); and • Zinc trends for JAMB3B.	

7 2016-2017 Annual Monitoring Report

7.1 Introduction

The 2016-2017 AGMR was carried out and completed by Essential Environmental. The AGMR was to be carried out in accordance with GWMP V5.5. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 5** at the end of the report.

7.2 Objectives of GWMP V5.5

The objective and rationale of the groundwater sampling outlined in the GWMP V5.5 for Ground Water Sampling are to ascertain:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

7.3 Non-Conformances

Following a review of Essential Environmental AGMR, a list of the non-conformances identified are presented in **Table 14**. .

Table 14: Essential Environmental AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC "All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."	As per NEPM duplicates should include 1 field duplicate at a rate of 1/20 and 1 second duplicate at a rate of 1/20. This is considered to be a non-conformance.

7.4 Essential Environmental AGMR Conclusions and Recommendations

7.4.1 Conclusions

Section 7 Conclusions

"Based on a review of 2016/17 groundwater monitoring data together with data collected at the site since 2012 the following key observations are made.

- *Physiochemical parameters across the site vary within the acceptable ranges specified in the Airports (Environmental Protection) Regulations 1997 Schedule 2, with the exception of pH and DO which have largely remained consistent with historical data at the Jandakot Airport site. There is a slight trend towards increasing acidity evident at some sites and it is thought that this may be indicative of regional trends;*
- *Nutrients are generally high across the site, with all bores recording nitrogen and phosphorous levels above the Airports (Environmental Protection) Regulations 1997 Schedule 2 acceptable limit. However, these values were consistent with historical monitoring data;*
- *JAMB10 recorded elevated nutrient concentrations. As the monitoring well is located downstream of the main Precinct 5 storage basin, these results could be from nutrient runoff associated with landscaping establishment activities in the area;*
- *Dissolved copper, lead, nickel and zinc concentrations seem to show an increase in multiple bores across the site during the September 2016 event. These trends were observed in bores both upgradient and downgradient of the airport and are therefore likely to be the result of broader environmental trends. The week prior to the September 2016 sampling event recorded 18.8 mm of rainfall which may have contributed to spikes in dissolved metal concentrations.*
- *Increases in acidity (pH) and some metals may be connected and indicative of general trends in the regional groundwater system related to changing rainfall patterns and continued drinking water abstraction upstream."*

The auditor is in the general agreement with the conclusions drawn by Essential Environmental for the AGMR. The auditor notes however that increasing groundwater acidity may be an issue, which may cause additional metal load into groundwater. This should be investigated to understand whether it is site specific and that appropriate actions are required or that this is a regional trend.

Alkalinity observed within JAMB1 and JAMB2 previously has since declined and therefore no further assessment is required at present but this needs to be "watched" during additional monitoring events.

7.4.2 Recommendations

Section 8 Recommendations

"It is possible that elevated and more variable lead, zinc and nickel concentrations at JAMB8 and other sites are related to regional trends in groundwater quality. Results from this monitoring well should be reviewed specifically following the September 2017 and March 2018 monitoring events. If the trend toward increased and more variable metals continues, consideration should be given to a comparative review of available data for the broader regional groundwater system."

The auditor agrees with this recommendation because increasing in metal concentrations may be a result of groundwater acidity and this needs to be assessed.

> ***Section 8 Recommendations***
>
> *"It is possible that the elevated total nitrogen and total phosphorous concentrations at JAMB10 are associated with landscaping establishment activities around Precinct 5. Therefore, results from this monitoring well should be reviewed specifically following the September 2017 monitoring event. Modifications to landscaping practices and/or design modifications to the basin, should be considered in response to any continuing upward trend in nutrient levels recorded at this site."*

The auditor agrees with this recommendation.

> ***Section 8 Recommendations***
>
> *"The groundwater at the site is generally of good quality and does not appear to have experienced any decline in quality as a result of airport activities. However, given the current expansion activities, current practices undertaken on the site and sensitivity of the receiving environment, the monitoring program should not be amended at this point."*

The auditor agrees with this recommendation.

> ***Section 8 Recommendations***
>
> *"In September 2017 and March 2018, record static water levels at additional monitoring bores across the airport to increase the accuracy of inferred groundwater contour modelling."*

The auditor agrees with this recommendation. The contour patterns presented in the report are generally influenced by a limited number of wells on the western boundary of the site. Gauging of additional wells would provide more certainty in inferred groundwater flow direction and in migration of contaminated groundwater.

7.5 Objectives Achieved

Based on the identified non-conformances and conclusions drawn by Essential Environmental, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.5 for Ground Water Sampling, as presented in **Table 15**.

Table 15: Objectives Completed for Essential Environmental 2016-2017 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	

7.6 Previous 2015-2016 Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 16** presents the results of this assessment.

Table 16: 2015-2016 Recommendations Incorporated into the 2016-2017 AGMR	
Objective	**Recommendation Incorporated?**
It is expected that acidity of groundwater at JAMB1 and JAMB2B will return to background levels following completion of construction activity. However, these sites should be specifically reviewed following collection of the next round of samples in September 2016.	✓
It is considered likely that elevated Iron concentrations at JAMB4 and JAMB5 are not caused or contributed to by airport operations. However, these sites should be specifically reviewed following collection of the next round of samples in September 2016.	✓
The groundwater at the site is generally of good quality and does not appear to have experienced any decline in quality as a result of airport activities. However, given the future expansion, current practices undertaken on site and sensitivity of the receiving environment, the monitoring program should not be amended at this time.	✓

8 Audit Findings

Based on the audit undertaken of the past five (5) AGMRs, the following summaries of each report are included below.

8.1 Pendragon 2012-2013 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 17: Summary of Pendragon 2012-2013 Findings

Item	Result	Comments
Number of Non-Conformances	10	The audit of the Pendragon AGMR identified a number of non-conformances which were not considered to have an overall impact on the quality and/or findings of the results and interpretation. The number of non-conformances were identified due to comparison to the specific criteria outlined in the GWMP V4.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The recommendations were acceptable.
Were all GWMP objectives achieved?	3/5	Two objectives were not fully achieved within the AGMR: • The groundwater velocity and hydraulic gradient were not calculated by the consultant. • The risk to downstream receptors was not discussed within the report. The auditor notes that the consultant concluded that the results do not suggest or indicate groundwater contamination in the area.
Were the previous AMP Recommendations Incorporated?	2/3	The DoW bores were not sampled in this AGMR.

8.2 Coffey 2013-2014 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 18: Summary of Coffey 2013-2014 Findings

Item	Result	Comments
Number of Non-Conformances	6	The audit of Coffey AGMR identified a number of non-conformances which were not considered to have an overall impact on the quality and/or findings of the results and interpretation. The number of non-conformances were identified due to comparison to the specific criteria outlined in the GWMP V4.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The recommendations were acceptable.
Were all GWMP objectives achieved?	5/5	
Were the previous AMP Recommendations Incorporated?	3/3	

8.3 Coffey 2014-2015 Audit Review Summary

The report was considered to be of a suitable quality with no non-conformances identified.

Table 19: Summary of Coffey 2014-2015 Findings

Item	Result	Comments
Number of Non-Conformances	0	No non-conformances.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The recommendations were acceptable.
Were all GWMP objectives achieved?	2/2	
Were the previous AMP Recommendations Incorporated?	2/2	

8.4 Essential Environmental 2015-2016 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 20: Summary of Coffey 2015-2016 Findings

Item	Result	Comments
Number of Non-Conformances	1	The QA/QC control sampling was not considered appropriate. Further QA/QC samples were recommended.
Were the conclusions adequate?	Yes	The conclusions were acceptable, however the auditor wanted further clarification and/or discussion for one conclusion. The consultant concludes that elevated acidity and pH groundwater within JAMB1 and JAMB2B is expected to be from construction activity nearby. The auditor is unable to draw any reliable conclusion on this statement as there is no information to support this conclusion.
Were the recommendations adequate?	Further Required	Based on recommendation 1, this recommendation is pre-mature until further monitoring has taken place in September 2016. If acidity has increased due to construction activity then groundwater quality would have been impacted as a result of airport activities. The auditor notes that a recommendation to assess Bore 13 abstraction rates should had also been included.
Were all GWMP objectives achieved?	2/2	
Were the previous AMP Recommendations Incorporated?	2/3	No DoW elevation data was included in the groundwater contouring.

8.5 Essential Environmental 2016-2017 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 21: Summary of Essential Environmental 2016-2017 Findings

Item	Result	Comments
Number of Non-Conformances	1	The QA/QC control sampling was not considered appropriate. Further QA/QC samples were recommended.
Were the conclusions adequate?	Yes	The conclusions were acceptable.
Were the recommendations adequate?	Yes	The conclusions were acceptable.
Were all GWMP objectives achieved?	2/2	
Were the previous AMP Recommendations Incorporated?	3/3	

9 Recommendations

The following recommendations for improvement/amendment include:

1. Recently, environmental regulators have drawn significant attention to Per-Fluoroalkyl and Poly-Fluoroalkyl Substances (PFAS) which are chemicals included in firefighting foams used on many sites to suppress fires. The PFAS chemicals are toxic, very persistent and have been demonstrated to be carcinogenic. It is therefore recommended that these chemicals be included in the future monitoring program. The inclusion of PFAS in the sampling program would require changes to some groundwater sampling elements as follows:
    - High Density Polyethylene (HDPE) is to be used for low flow sampling;
    - All Teflon components of a bladder pump will need to be replaced with non-Teflon components;
    - No use of Decon 90 to be used;
    - Reusable chemical or gel ice packs are not be used;
    - No Tyvek clothing is to be worn;
    - No fast food wrappers or containers are to be used;
    - All abstracted groundwater is to be collected and transported by a licenced waste disposal contractor for appropriate disposal; and
    - Compliance with all mitigation techniques discussed in the DWER (2017) Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS).
2. It is recommended to use statistical trend analysis as this is adopted by environmental regulators as a best practice tool. Typically Mann-Kendal statistical analysis tool is widely used across the practice.
3. Inclusion of the regional DoW monitoring wells within the groundwater flow contouring would be beneficial, but not necessary, in understanding the regional flow system. Pendragon (2012) report (prior to the scope of this audit) recommended this, however no action was taken with the proceeding reports.
4. In the 2015-2016 AGMR, groundwater flow has been inferred to flow in a northerly direction over much of the airport and in a north westerly direction in Precinct 5. It is recommended that further groundwater level data is obtained, where possible, within the northern region of the airport (Precinct 1, parts of Precinct 3 and parts of Precinct 4) to further constrain the groundwater contours and further determine groundwater flow.
5. At present, there are no down-gradient well/s in the northern region of the airport that are gauged and/or sampled. The inferred groundwater flow has the potential for migration of contaminants off site to the north. It is a recommendation that any available wells in this area be gauged and sampled if contamination is identified in up-gradient wells. If there are no available wells, it is also recommended that additional wells be installed.
6. The QA/QC sampling program should be elaborated within the GWMP as the terminology within Section 5.5.4 is imprecise and therefore QA/QC samples have varied since the introduction of GWMP V5.4 and V5.5. It is recommended that further QA/QC samples be taken (triplicate, rinsate (where applicable) and transport blanks) following recommendations included in the NEPM.
7. A minor recommendation would be update the GWMP to rename the DoW and DER to the Department of Water and Environmental Regulation (DWER) since their amalgamation in July 2017.

10 References

Australian and New Zealand Environment and Conservation Council (ANZECC) 1992, *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, ANZECC & National Health and Medical Research Council.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) 2000, *Australian Water Quality Guidelines for Fresh and Marine Water Quality*, ANZECC/ARMCANZ, Canberra.

Australian Government (1966), *Airports Act*, No. 42, Compilation No. 31, 01 July 2016.

Australian Government (1997), *Airport Regulations*, Compilation No. 8, 10 August 2012.

Australian Government (1999), *Environment Protection and Biodiversity Conservation Act*, No. 51, Compilation No. 51, 1 July 2016.

Australian Standard 5667.1 (1998), *Water quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.*

Australian Standard 4482.1 (2005), Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds.

Essential Environmental (2016), *2015-16 Annual Groundwater Monitoring Report*, Jandakot Airport Holdings, September 2016.

Essential Environmental (2017), *2016-17 Annual Groundwater Monitoring Report*, Jandakot Airport Holdings, September 2017.

Coffey Environments Australia Pty Ltd (2014), *2013-2014 Annual Groundwater Monitoring Report, Jandakot Airport*, 20 October 2014.

Coffey Environments Australia Pty Ltd (2015), *2014-2015 Annual Groundwater Monitoring Report, Jandakot Airport*, 20 September 2015.

DWER (2017) *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS).*

Jandakot Airport Holdings Pty Ltd (2012), *Groundwater Management Plan* (Jandakot Airport GWMP) v4.

Jandakot Airport Holdings Pty Ltd (2015), *Groundwater Management Plan* (Jandakot Airport GWMP) v5.4.

Jandakot Airport Holdings Pty Ltd (2016), *Groundwater Management Plan* (Jandakot Airport GWMP) v5.5.

Pendragon Environmental Solutions (2013), *Annual Ground Water Monitoring Report*, Jandakot Airport, Revision 3, August 2013.

GROUNDWATER MONITORING PROGRAM: 5 YEARLY AUDIT

Jandakot Airport Holdings

Jandakot Airport Estate

Tables

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Groundwater Well Installation			
Groundwater Well Installation	Appendix B – Field and Laboratory QA/QC (Bore Construction and Development) To be installed in line with AS/NZS 4452:1997 and AS 1726:1993 Constructed using mud rotary technique 150mm Class 18 PVC casings with 0.5 mm slotted screen Washed gravel or coarse sand filter pack, bentonite seal and cement/bentonite grout End caps Lockable steel riser Surveying	N/A	No groundwater wells were installed.
Sampling Procedures			
Sample Methodology	Nine (9) wells to be sampled quarterly (September, December, March and June). Ground water levels will be measured and recorded prior to any purging…	N	9 wells (JAMB-1 to JAMB-9) sampled quarterly. Auditor noted missing information as follows: No groundwater level data for JAMB-3 to JAMB-7. No groundwater level recorded for JAMB-4 in June 2013 The above was due to equipment failure as explained in the annual report. Absence of this information is considered to be a non-conformance/
Appropriate sampling equipment/device used (e.g. pump type)	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Low flow pump with disposable LDPE tubing"*	N	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Equipment and methodology) *"Bores were purged prior to sampling by bailing five bore volumes prior to sampling"* **The auditor notes that bailers are not the required sampling equipment as per GWMP V4 No justification on this variation was discussed within the report.**

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Purged volumes/low flow sampling technique;	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Five bore volumes are to be discharged prior to sampling with sampling only occurring once field water quality parameters do not vary by more than 10%. Once the bore has been satisfactorily purged, the pump will be removed and samples collected using a new, clean disposable bailer".*	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Equipment and methodology) *Bores were purged prior to sampling by bailing five bore volumes prior to sampling. New disposable bailers were used to obtain samples.* **This is generally a conformance but auditor notes that the GWMP requirement is to use a low flow pump not a bailers.**
Monitoring of physicochemical parameters	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Measuring and recording pH, temperature, electrical conductivity, dissolved oxygen and redox potential with sampling only occurring once field water quality parameters do not vary by more than 10%".*	Not Auditable	**The auditor is unable to audit this requirement as no field logs had been included. In** Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Instrument Calibration and Decontamination) it is noted that: *"Hydrolab Quanta Water Quality Meter: field measurements were not taken. Sampling equipment calibrated prior to use by Eco Environmental"* *This may be considered as non-conformance.*
Field filtering	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC samples) *"Removing/decanting floating, organic material, if present and by removing sediment, if present by using a 45 micron filter".*	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Equipment and Methodology) *"Samples were either dispensed directly into new sample containers or were filtered (using a sterile syringe and filter) into new sample containers."* Auditor noted that it was not clear in GWMP whether all samples should be filtered in the field.
Purged Groundwater Storage (If required).	No requirement.	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Equipment and Methodology) *"Any product and contaminated water are stored on site for later disposal. Purged volumes, clear of sheen, were discharged on site."* Auditor comment is that the onsite discharge should be specified as to whether water discharge on the ground away of surface water features or storm water drains etc.

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Instrument Calibration (Calibration certificates/records);	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Water quality will be measured using a calibrated……..(copies of the calibration certification are to be included in sampling reports)"*	Y	Appendix B –Data Validation and Laboratory Certificates Certificate included.
Decontamination Procedures	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – Sampling and decontamination to prevent cross contamination) *"Equipment used in the sampling process is to be decontaminated using Decon 90, a phosphate free detergent, followed by rinsing with laboratory grade distilled water (appropriate for analyte suite), on arrival at site and between sampling locations, to reduce the risk of cross contamination."*	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Instrument Calibration and Decontamination) *"The water level meter was wiped clean and triple washed with Decon 90 prior to use at each sampling location."* No other multiuse equipment was used.
Sample Collection Procedures	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC samples) *"Water samples are to be obtained with new, clean disposable bailers, subsequent to purging with a low flow bore pump fitted with disposable discharge tubing, one for each sample."*	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Equipment and methodology) *"New disposable bailers were used to remove any product, bailing and subsequent sampling."*
	"New nitrile gloves are to be worn during sampling and are to be replaced between each sample."	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Instrument Calibration and Decontamination) *"Samples were obtained, using new nitrile gloves for each sample, with the sample containers eliminating the possibility for cross-contamination: decontamination was not required therefore."*
	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – Sample labelling) *"Samples are to be clearly marked with unique identification details, sampling date, sampler initials, project name and number and analyses required."*	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Containers) *"Sample containers were clearly marked with unique identification details, sampling date and time, sampler initials, project name and number and analyses required."*

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Sample Collection Procedures (Cont.)	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – Sample storage and delivery *"Samples of water are to be obtained in sample bottles of the correct type (e.g. plastic for metals; glass for pesticides, TPH and BTEX) and with appropriate preservatives (e.g. nitric acid for heavy metals) prepared and provided by ALS."*	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sampling Containers) *"Sample containers (water: glass/plastic as appropriate) were prepared and supplied by ALS."*
	"All samples are to be placed on ice (1kg of ice per 10L of cooler to achieve 4oC) in an insulated cooler."	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Temperature) *"Temperature of samples during storage and transportation: sample integrity was maintained by keeping all samples in sealed plastic or glass bottles and in an ice-cooled, insulated cooler immediately after sampling. During temporary storage, samples were chilled and ice was present during dispatch and upon delivery to ALS."*
	"The samples are to be delivered to the analysing laboratory the same day or refrigerated overnight."	Y	Appendix B –Data Validation and Laboratory Certificates (Field Quality Control>Sample handling, storage and transportation) *"Sealed sample containers were placed in an insulated cooler filled with ice. Once all samples were collected they were submitted to the laboratory either by courier or directly by the sampler."*
Quality Assurance/Quality Control (QA/QC) Sample Collection	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"In addition to the primary samples, QA/QC samples are to be obtained to assess aspects of field protocols and laboratory performance, to assess the representativeness, precision and validity of the data set:* *Background samples (up-gradient and outside the zone affected by the land use or contaminating activity) to provide a comparison of environmental quality are to be obtained where applicable and possible. The number of samples is to be determined based upon soil type and variability; generally a minimum of two samples are to be obtained. At least one bore is to be drilled upstream of the activity or land use.*	Y	JAMB-7 is considered to be a background bore as it has been identified as an up-gradient well from the interpreted groundwater flow and it was sampled during the monitoring program.

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Quality Assurance/Quality Control (QA/QC) Sample Collection (Cont.)	*Blind replicate (field duplicate) samples to identify the variation in analyte concentrations between samples collected from the same location and/or the repeatability of laboratory analysis: one blind replicate will be collected for every twenty investigative samples (individual samples are to be marked such that there is no indication of duplication).*	Y	One blind replicate sample was taken for each monitoring round and submitted for analysis.
	Split samples to ascertain analytical proficiency of laboratories: one split sample will be collected for every twenty investigative samples and submitted to a different laboratory (secondary laboratory) for analysis.	Y	One split sample was taken for each monitoring round and submitted for analysis.
	Rinsate samples where cross contamination of samples is likely to impact on the validity of the sampling and assessment process: one for each piece of equipment used where cross contamination is possible.	N	**No rinsate samples taken. The auditor notes that the only piece of equipment used for each well was the water level meter. This meter was wiped clean and triple washed with Decon 90 at each location. The auditor determines that the results are not affected by this omission.**
	Field blanks where contamination during the collection procedure is possible: one per sampling team per group of samples.	N	**No field blank samples taken.** The auditor's opinion is that without field blanks it is not possible to judge whether the sampling results were influenced.
	Transport blanks for contamination during transportation and storage: one sample per transport container (insulated cooler).	N	**One transport sample was taken in September 2012. No samples were taken in the remaining monitoring rounds.** It is not possible to comment whether samples quality were or were not affected during transportation.
	Container blanks if contamination from containers and preservation technique during storage is possible: one for every group of samples.	N	**No container blank samples taken.** It is not possible to comment whether samples quality were or were not affected by this omission
	QA/QC samples are to be analysed for the same suite of analytes as the primary samples."	Y	Blind and split samples analysed for the same suite as the primary samples

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Laboratory Analysis			
Field Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>On Site Measurements List of the field parameters to be monitored and the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Table 3.6 Field parameters and assessment levels are summarised.
NATA Accreditation	Appendix B – Field and Laboratory QA/QC (Laboratory QA/QC) *"Samples are to be analysed by a National Association of Testing Authorities (NATA) accredited laboratory."*	Y	Appendix B –Data Validation and Laboratory Certificates *ALS (Primary): Accreditation: National Association of Testing Authorities (NATA).* *MPL (Secondary): Accreditation: National Association of Testing Authorities (NATA). Other: Accredited for compliance with ISO/IEC 17025.*
	"Laboratory QA/QC is to include, over and above internal reviews prior to finalizing the laboratory reports and further analysis to determine whether errors have been made, surrogates, duplicates, method blanks, laboratory control and matrix spikes, parameter frequencies and summaries of outliers."	Y	
Laboratory Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis List of the analytes of concern to be analysed	Y	Table 3.6 List of analytes of concern and assessment levels are summarised.
Assessment Levels	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	
Field Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>On Site Measurements On site measurements analysed	N	Appendix A – Monitoring Data **On site measurements are recorded in Appendix A. No field sampling sheets were included within the report.** **No measurements of temperature, turbidity or Total Acidity was carried out.**

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Laboratory Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis All required analytes are required to be analysed	N	The following analytes were not tested for in all monitoring events: • Net Acidity • Chlorophyll-a • Ammonia • Mercury • Sulphide • Surfactants and oil dispersants • Phenol **The auditor notes that in the GWMP V4 it is states that** "*the choice of analytes is generally based on the location of the sample and the likely potential contaminants from previous potentially contaminating activities and/or future land use (refer Schedules 2 and 3)*". ***The auditor has considered this as a non-conformance as no reasoning for the analyte selection was included.***
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Appendix B – Field and Laboratory QA/QC (Data Evaluation and Validation) *"Strict field and laboratory QA/QC programs in accordance with the requirements of AS4482.1, 2005, will be implemented prior to and adhered to throughout the Sampling and Analysis Plan (SAP). These programs will be assessed and detailed in terms of an Analytical Data Validation process for soils and water (prescribed formats) which will accompany CoC's, detailed laboratory analytical certificates and associated QA/QC reports."*	Y	Appendix B: Data Validation and Laboratory Certificates

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Data Analysis			
Results discussion	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Review) *"all monitoring information and data are to be reviewed and reported upon annually to ensure compliance with performance criteria. The review should include a detailed statistical and trend analysis and graphically presented."*	Y	3.1 Ground Water Levels No contradiction noted. 3.2 Ground Water Quality 3.2.1 pH No contradiction noted. 3.2.2 Dissolved Oxygen No contradiction noted. 3.2.3 Dissolved Metals No contradiction noted. 3.2.4 Nutrients No contradiction noted. 3.2.5 Hydrocarbons No contradiction noted. 3.2.6 Acid Sulfate Soils No contradiction noted.
Trends		N	Trends have been discussed but no statistical assessment has been carried out.
Regional data		Y	3.1 Ground Water Levels Groundwater levels discussed.
Tabular presentation		Y	Table 3.1 – Table 3.6
Graphical presentation		Y	Figure 3.1 Figure 3.4 – 3.12

Data Table 1: 2012-2013 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Conclusions and Recommendations			
Conclusions		Y	The auditor notes that Pendragon concluded that the assessment criteria should be reviewed as both the Department of Water and the Department of Transport requested consideration be given to use the ANZECC 2000 95% Species Protection Trigger Levels. The conclusions drawn are adequate. The auditor notes that JAMB-5 should be monitored more closely within the next annual monitoring due to the elevated aluminium and reducing pH indicative of acidifying conditions.
Recommendations		Y	The auditor agrees with the consultants recommendations
Figures and Appendices			
Figures		Y	
Appendices		N	**The auditor notes that no field sampling sheets were included in the appendices to cross check the sampling methodology.**
General			
Report completed date	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Reporting) *"Annual reports are to be distributed, no later than 31 August each year."*	Y	Submitted 29 August 2017
Quarterly reports submitted	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Reporting) *"Tabulations and graphs are to be compiled and submitted to JAH quarterly, accompanied by brief notes"*	N	**Laboratory results were sent to JAH for the monitoring events undertaken in December 2012 and March 2013. No results for September 2012 and June 2013 were sent.** **The information supplied by Pendragon was the laboratory results and an updated excel spreadsheet of the chemical results. Brief notes were included with the email text.** **As information was not sent on a quarterly basis, the auditor considers this as a non-conformance**

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Groundwater Well Installation			
Groundwater Well Installation	Appendix B – Field and Laboratory QA/QC (Bore Construction and Development) To be installed in line with AS/NZS 4452:1997 and AS 1726:1993 Constructed using mud rotary technique 150mm Class 18 PVC casings with 0.5 mm slotted screen Washed gravel or coarse sand filter pack, bentonite seal and cement/bentonite grout End caps Lockable steel riser Surveying	N	Section 4.1 – Groundwater monitoring well installation *"Two new groundwater monitoring bores (JAMB10 and JAMB11) were installed within the road verge of Orion Road (located in the north-north-west portion of the site).* *JAMB3B was drilled as a replacement bore for JAMB3 in the north-west corner of the site, off Berrigan Drive. JAMB3 had to be relocated due to the development of Precinct 5 which resulted in the well being unsafe to access for sampling."* **Three wells (JAMB10, JAMB11 and JAMB3B were installed using Hollow Stem Auger drilling techniques. The auditor notes that this is not the technique described in the GWMP V4, but the technique employed is suitable for the wells intended use as per industry standards.**
Sampling Procedures			
Sample Methodology	Nine (9) wells to be sampled quarterly (September, December, March and June)	N	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Date of Field Activity 27 September 2013 10 and 11 December 2013 26 and 27 March 2014 **The auditor notes that no justification is given for completing only three (3) monitoring events.**

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Appropriate sampling equipment/device used (e.g. pump type)	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Low flow pump with disposable LDPE tubing"*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."* **The auditor notes that a number of wells were sampled using a bailer due to depth to water exceeding the capability of the peristaltic pump used. The auditor notes that bailing isn't a recommended purging or sampling technique due to the difficulty of obtaining a representative groundwater sample. No justification on this variation was discussed within the report. This is not considered to be a non-conformance and is consistent with industry standards.** *"Dedicated low density polyethylene (LDPE) air and water tubing and metal filters were used."*
Purged volumes/low flow sampling technique;	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Five bore volumes are to be discharged prior to sampling with sampling only occurring once field water quality parameters do not vary by more than 10%. Once the bore has been satisfactorily purged, the pump will be removed and samples collected using a new, clean disposable bailer".*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Well Purging *"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements ± 3% or 10% depending on field parameter)."*
Monitoring of physicochemical parameters	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Measuring and recording pH, temperature, electrical conductivity, dissolved oxygen and redox potential with sampling only occurring once field water quality parameters do not vary by more than 10%".*	Y	*"Field groundwater quality data sheets are contained in Appendix D."*
Field filtering	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC samples) *"Removing/decanting floating, organic material, if present and by removing sediment, if present by using a 45 micron filter".*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Sample Preservation *"Samples collected for analysis of metals were filtered in the field using 0.45µm disposable filters."*

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Purged Groundwater Storage (If required).	No requirement.	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Waste Disposal *"Groundwater recovered during the development and purging of monitoring wells was stored in dedicated containers and removed from site to the Coffey Office and stored prior* *to off-site disposal at an appropriately licensed facility"*
Instrument Calibration (Calibration certificates/records);	Appendix B – Field and Laboratory QA/QC (Ground Water Sampling) *"Water quality will be measured using a calibrated……(copies of the calibration certification are to be included in sampling reports)"*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Sampling Method *Calibration certificates for the water quality meter used for this investigation is contained within Appendix E.*
Decontamination Procedures	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – Sampling and decontamination to prevent cross contamination) *"Equipment used in the sampling process is to be decontaminated using Decon 90, a phosphate free detergent, followed by rinsing with laboratory grade distilled water (appropriate for analyte suite), on arrival at site and between sampling locations, to reduce the risk of cross contamination."*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Decontamination Procedures *"The water sampling equipment (IP, water quality meter and low-flow pump) were decontaminated with laboratory grade detergent and rinsed with scheme water between wells……Dedicated low density polyethylene (LDPE) air and water tubing and metal filters were used."*
Sample Collection Procedures	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC samples) *"Water samples are to be obtained with new, clean disposable bailers, subsequent to purging with a low flow bore pump fitted with disposable discharge tubing, one for each sample."*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Decontamination Procedures *"Dedicated low density polyethylene (LDPE) air and water tubing and metal filters were used."* Section 8.1 Field method validation>Table L – Field method validation>Decontamination of sampling equipment *"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water"*
	"New nitrile gloves are to be worn during sampling and are to be replaced between each sample."	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Decontamination Procedures "Disposable nitrile gloves were used for each sample."

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"Equipment used in the sampling process is to be decontaminated using Decon 90, a phosphate free detergent, followed by rinsing with laboratory grade distilled water (appropriate for analyte suite), on arrival at site and between sampling locations, to reduce the risk of cross contamination."	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Decontamination Procedures *"The water sampling equipment (IP, water quality meter and low-flow pump) were decontaminated with laboratory grade detergent and rinsed with scheme water between wells……Dedicated low density polyethylene (LDPE) air and water tubing and metal filters were used."* Section 8.1 Field method validation>Table L – Field method validation>Decontamination of sampling equipment *"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water"*
	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – Sample labelling) *"Samples are to be clearly marked with unique identification details, sampling date, sampler initials, project name and number and analyses required."*	Y	Appendix F – CoC Documentation
	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – Sample storage and delivery *"Samples of water are to be obtained in sample bottles of the correct type (e.g. plastic for metals; glass for pesticides, TPH and BTEX) and with appropriate preservatives (e.g. nitric acid for heavy metals) prepared and provided by ALS."*	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Sample Preservation Samples were collected in laboratory supplied bottles containing appropriate preservatives and immediately stored in an insulated cooler chilled with ice upon sampling and ice bricks during air freight to the laboratory. Section 8.1 Field method validation>Table L – Field method validation>Sample preservation "All samples were preserved correctly and stored in insulated coolers prior to arrival at the laboratory."
	"All samples are to be placed on ice (1kg of ice per 10L of cooler to achieve 4oC) in an insulated cooler."	Y	Section 4.2 Groundwater Assessment, Table 1 – Groundwater assessment methodology>Sample Preservation *"…immediately stored in an insulated cooler chilled with ice upon sampling and ice bricks during air freight to the laboratory."*

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"The samples are to be delivered to the analysing laboratory the same day or refrigerated overnight."	Y	
Quality Assurance/Quality Control (QA/QC) Sample Collection	Appendix B – Field and Laboratory QA/QC (Field QA/QC table – QA/QC Samples) *"In addition to the primary samples, QA/QC samples are to be obtained to assess aspects of field protocols and laboratory performance, to assess the representativeness, precision and validity of the data set:Y.* *Background samples (up-gradient and outside the zone affected by the land use or contaminating activity) to provide a comparison of environmental quality are to be obtained where applicable and possible. The number of samples is to be determined based upon soil type and variability; generally a minimum of two samples are to be obtained. At least one bore is to be drilled upstream of the activity or land use.*	Y	Section 11.1 Conclusions *"JAMB6 and JAMB7 are located on the southern boundary of the site up- hydraulic gradient of any site operations, and are considered to represent background conditions of groundwater entering the site."*
	Blind replicate (field duplicate) samples to identify the variation in analyte concentrations between samples collected from the same location and/or the repeatability of laboratory analysis: one blind replicate will be collected for every twenty investigative samples (individual samples are to be marked such that there is no indication of duplication).	Y	Section 8.2 – Field and laboratory QA/QC data assessment *Field duplicates and triplicates were collected at a rate of 1 in 20 for each sampling event. A total of nine (September 2013 only) or 11 primary groundwater samples along with one duplicate/triplicate groundwater sample pair were also collected.*
	Split samples to ascertain analytical proficiency of laboratories: one split sample will be collected for every twenty investigative samples and submitted to a different laboratory (secondary laboratory) for analysis.	Y	

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	Rinsate samples where cross contamination of samples is likely to impact on the validity of the sampling and assessment process: one for each piece of equipment used where cross contamination is possible.	Y	Section 3.1.8 Optimisation of data>Table G – QA/QC Data Quality Indicators>Collection of adequate QA/QC samples *"Equipment rinsate blanks were collected at a rate of one per field day from either the IP, hand auger or low-flow pump where appropriate and submitted to the primary laboratory for analysis of COPCs."* Section 8.2 – Field and laboratory QA/QC data assessment *"…one equipment rinsate……..sample were collected for each GME event undertaken and analysed for volatile compounds."*
	Field blanks where contamination during the collection procedure is possible: one per sampling team per group of samples.	Y	Section 3.1.8 Optimisation of data>Table G – QA/QC Data Quality Indicators>Collection of adequate QA/QC samples "Field blanks were also collected at a rate of one per field day and submitted to the primary laboratory for analysis of COPCs". Section 8.2 – Field and laboratory QA/QC data assessment "…one field blank sample were collected for each GME event undertaken and analysed for volatile compounds."
	Transport blanks for contamination during transportation and storage: one sample per transport container (insulated cooler).	Y	Section 3.1.8 Optimisation of data>Table G – QA/QC Data Quality Indicators>Collection of adequate QA/QC samples "One transport (trip) blank was prepared per batch of samples sent to the laboratory and assessed against method detection limits for volatile COPC (TRH C6-C9 and BTEX)."
	Container blanks if contamination from containers and preservation technique during storage is possible: one for every group of samples.	N	**No container blank samples taken. The auditor cannot comment on cross contamination potential with containers.**
	QA/QC samples are to be analysed for the same suite of analytes as the primary samples."	Y	Section 3.1.8 Optimisation of data>Table G – QA/QC Data Quality Indicators>Collection of adequate QA/QC samples Both duplicate and triplicate samples were analysed for the same analytes as their respective primary sample.

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Laboratory Analysis			
Field Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>On Site Measurements List of the field parameters to be monitored and the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 5 – Assessment Criteria
NATA Accreditation	Appendix B – Field and Laboratory QA/QC (Laboratory QA/QC) *"Samples are to be analysed by a National Association of Testing Authorities (NATA) accredited laboratory."*	Y	Section 3.1.8 Optimisation of data>Table G – QA/QC Data Quality Indicators>NATA accredited laboratory analysis *"All samples were sent to a laboratory holding NATA accreditation for the required analysis."*
	"Laboratory QA/QC is to include, over and above internal reviews prior to finalizing the laboratory reports and further analysis to determine whether errors have been made, surrogates, duplicates, method blanks, laboratory control and matrix spikes, parameter frequencies and summaries of outliers."	Y	Section 3.1.8 Optimisation of data>Table G – QA/QC Data Quality Indicators>NATA accredited laboratory analysis *"Laboratory QA/QC acceptance limits are as follows.* *Surrogates: 70% to 130% recovery.* *Matrix Spikes: 70% to 130% recovery for organics or 80% to 120% recovery for inorganics.* *Control Samples: 70% to 130% recovery for soil or 80% to 120% recovery for waters.* *Duplicate Samples: <4PQL - +/-2PQL, 4-10PQL - 0.-25 or 50%RPD, >10PQL -0-10 or 30%RPD.* *Method Blanks: zero to <PQL."*
Laboratory Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis List of the analytes of concern to be analysed	Y	Section 5 – Assessment Criteria
Assessment Levels	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Field Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>On Site Measurements On site measurements analysed	Y	Section 6.2 Field groundwater quality parameters
Laboratory Analysis	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Monitoring>Parameters>Laboratory Analysis All required analytes analysed	N	The following analytes were not tested for in all monitoring events: • Net Acidity • Chlorophyll-a • Ammonia • Mercury • Sulphide • Surfactants and oil dispersants • Phenol **The auditor notes that in GWMP V4 it states that** "*the choice of analytes is generally based on the location of the sample and the likely potential contaminants from previous potentially contaminating activities and/or future land use (refer Schedules 2 and 3)*". ***The auditor has considered this as a non-conformance as no justification for analytical program was provided.***
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Appendix B – Field and Laboratory QA/QC (Data Evaluation and Validation) *"Strict field and laboratory QA/QC programs in accordance with the requirements of AS4482.1, 2005, will be implemented prior to and adhered to throughout the Sampling and Analysis Plan (SAP). These programs will be assessed and detailed in terms of an Analytical Data Validation process for soils and water (prescribed formats) which will accompany CoC's, detailed laboratory analytical certificates and associated QA/QC reports."*	Y	Section 8.4 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site."*
Data Analysis			

Data Table 2: 2013-2014 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Results discussion	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Review) *"All monitoring information and data are to be reviewed and reported upon annually to ensure compliance with performance criteria. The review should include a detailed statistical and trend analysis and graphically presented."*	Y	
Trends		N	**Trend discussion is limited, with no statistical analysis undertaken.**
Regional data		Y	
Tabular presentation		Y	Table 1 – Current and Historical Monitoring Results
Graphical presentation		N	Limited to Graph A (Groundwater Elevation 2012-2014). **Graphical presentations of trends is not included**
Conclusions and Recommendations			
Conclusions		Y	
Recommendations		Y	
Figures and Appendices			
Figures		Y	
Appendices		Y	
General			
Report completed date	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Reporting) *"Annual reports are to be distributed, no later than 31 August each year."*	Y	
Quarterly reports submitted	Section 7.2 Ground Water Management Plan Table 4: Ground Water Management (Reporting) *"Tabulations and graphs are to be compiled and submitted to JAH quarterly, accompanied by brief notes"*	Y	

Data Table 3: 2014-2015 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring will occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *Eleven bores to be sampled in total (JAMB-1 – JAMB-11)*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology>Date of Field Activity September 2014 (post-winter) 25th and 26th September 2014 March 2015 (post-summer) 24th and 25th March 2015
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."* *"Dedicated low density polyethylene (LDPE) air and water tubing"*
Purged volumes/low flow sampling technique;	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.2 Groundwater Assessment, Table I – Groundwater assessment methodology>Well Purging *"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements +/- 3% or 10% depending on field parameter)."* *"Field groundwater quality data sheets are contained in Appendix F and G."*
Monitoring of physicochemical parameters	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	
Field filtering	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology>Sample Preservation *"Samples collected for analysis of metals were filtered in the field using 0.45µm disposable filters."*
Purged Groundwater Storage (If required).	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology>Waste Disposal *"Groundwater recovered during the development and purging of monitoring wells was stored in dedicated containers and removed from site to the Coffey Office and stored prior to off-site disposal at an appropriately licensed facility"*

Data Table 3: 2014-2015 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Instrument Calibration (Calibration certificates/records);	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology>Sampling Method *"Calibration certificates for the water quality meter used for this investigation is contained within Appendix F and G"*
Decontamination Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology>Decontamination Procedures *"The water sampling equipment (IP, water quality meter and low-flow pump) were decontaminated with laboratory grade detergent and rinsed with scheme water between wells……Dedicated low density polyethylene (LDPE) air and water tubing and metal filters were used."*
Sample Collection Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 4.1 Groundwater Assessment, Table I – Groundwater assessment methodology
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 6 Field and laboratory analytical validation *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site."* Section 6.2 Field and laboratory QA/QC data assessment *"Field duplicates and triplicates were collected at a rate of 1 in 20 for each sampling event. A total of eleven primary samples and one duplicate/triplicate groundwater sample pair were also collected."* Section 6.3 Blank quality control samples *"One equipment rinsate and one field blank sample were collected for each GME event undertaken and analysed for volatile compounds."*
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters to be monitored and the assessment levels to be used	Y	Section 4.3 Field groundwater quality parameters

Data Table 3: 2014-2015 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 6.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ALS laboratory. Field triplicate samples were submitted to MGT Eurofins laboratory. ALS and MGT are NATA accredited for the laboratory analyses performed."*
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the analytes of concern to be analysed	Y	Section 3.2 Chemicals of Potential Concern *"The following COPC were analysed from the soil and groundwater samples collected:* *Metals: Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Nickel and Zinc;* *Nutrients: Total Nitrogen, Nitrate, Nitrite, Ammonium, Phosphate, Total Phosphorus;* *Inorganics: pH, conductivity, acidity, alkalinity, chloride, sulfate and total dissolved solids.* *Total Recoverable Hydrocarbons* *Benzene, Toluene, Ethylbenzene, Xylenes"*
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.3 Assessment Criteria
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed		Section 4.3 Field groundwater quality parameters Temperature was not analysed. The auditor determines that the results are not affected by this omission
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed	Y	Section 5 Laboratory analytical results *"All samples were analysed for electrical conductivity, total dissolved solids, total acidity, sulphate, chloride, dissolved metals (aluminium, arsenic, cadmium, chromium, copper, lead mercury, nickel, zinc and iron), nutrients (nitrate and nitrite, total nitrogen and phosphorous) TPH, TRH and BTEX"*

Data Table 3: 2014-2015 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 8.4 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site."*
Data Analysis			
Results discussion	Section 5.5.5 Reporting *"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"*	Y	
Trends		Y	**"***Statistical analysis identifying the significance of change within the data has not been undertaken due to the small size of the data sets."* **No statistical trend analysis has been undertaken due to limited data sets. The auditor notes that 11 data sets is enough to undertake a statistical assessment. The qualitative trend assessment is considered to be detailed enough.**
Regional data		Y	Section 2.5 Hydrogeology
Tabular presentation		Y	
Graphical presentation		Y	
Conclusions and Recommendations			
Conclusions Recommendations	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	Y Y	
Figures and Appendices			
Figures		Y	
Appendices		Y	
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	

Data Table 3: 2014-2015 AGMR Audit			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 4: 2015-2016 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring will occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *Eleven bores to be sampled in total (JAMB-1 – JAMB-11)*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2015 and March 2016".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Well Purging *"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."*
Monitoring of physicochemical parameters	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	
Field filtering	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."*
Purged Groundwater Storage (If required).	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Not Auditable	
Instrument Calibration (Calibration certificates/records);	Section 5.5.4 QA/QC	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Sampling Method

Data Table 4: 2015-2016 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
	"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."		*"Calibration certificates for the water quality meter used are contained in Appendix D."*
Decontamination Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 7 Field method validation>Decontamination of sampling equipment *"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."*
Sample Collection Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 7 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	N	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of 1 in 20 for each sampling event. A total of eleven primary samples and one duplicate groundwater sample pair were collected."* As per NEPM duplicates should include 1 field duplicate at a rate of 1/20 and 1 second duplicate at a rate of 1/20. Only 1 duplicate taken does not meet this criteria.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters to be monitored and the assessment levels to be used	Y	Section 3.4 Assessment Criteria>Table 4 Groundwater Assessment Levels>On Site Measurements.
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 6.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."*

Data Table 4: 2015-2016 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the analytes of concern to be analysed	Y	Section 3.3 Analytes of Potential Concern *"Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern during the 2015/16 Jandakot Airport groundwater monitoring program:* • *Metals; Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Nickel and Zinc;* Nutrients; *Total Nitrogen and Total Phosphorous;* • *Inorganics: pH, conductivity, acidity, alkalinity, chloride, sulfate and total dissolved solids;* • *Total Petroleum Hydrocarbons; and* • *Monocyclic Aromatic Compounds; Benzene, Toluene, Ethylbenzene and Xylene."*
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 4):* *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* *Jandakot Airport Holdings (2016) Groundwater Management Plan v5.5 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. The auditor determines that the results are not affected by this omission.
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed	Y	Section 4 Field and Laboratory Analytical Results 2016-2016 Section 6 Discussion of Field and Laboratory Analytical Results

Data Table 4: 2015-2016 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site."*
Data Analysis			
Results discussion	Section 5.5.5 Reporting *"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"*	Y	
Trends		Y	*"A general qualitative assessment has been undertaken based on historical data and trends."* A statistical trend analysis is not a requirement of the current GWMP. However, auditor's view is that there is sufficient data set (>3 years of monitoring) to use statistical analyses for trends as industry recognised best practice.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	
Graphical presentation		Y	
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	Y	
Recommendations		Y	
Figures and Appendices			
Figures		Y	
Appendices		Y	
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	

Data Table 4: 2015-2016 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N/NA)**	**Comments**
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 5: 2016 – 2017 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring will occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *Eleven bores to be sampled in total (JAMB-1 – JAMB-11)*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2016 and March 2017".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Well Purging *"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."*
Monitoring of physicochemical parameters	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	
Field filtering	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 3 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."*
Purged Groundwater Storage (If required).	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Not Auditable	
Instrument Calibration (Calibration certificates/records);	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Appendix E Calibration Certificate

Data Table 5: 2016 – 2017 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Decontamination Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 7 Field method validation>Decontamination of sampling equipment *"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."*
Sample Collection Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 7 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	N	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of 1 in 20 for each sampling event. A total of eleven primary samples and one duplicate groundwater sample pair were collected."* As per NEPM duplicates should include 1 field duplicate at arête of 1/20 and 1 second duplicate at a rate of 1/20. This is considered to be non-conformance.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters to be monitored and the assessment levels to be used	Y	Section 3.4 Assessment Criteria>Table 4 Groundwater Assessment Levels>On Site Measurements.
NATA Accreditation	Section 5.5.4 QA/QC "*Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed.*"	Y	Section 5.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."*
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the analytes of concern to be analysed	Y	Section 3.3 Analytes of Potential Concern *"Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern during the 2015/16 Jandakot Airport groundwater monitoring program:* • *Metals; Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Nickel and Zinc;* □ *Nutrients; Total Nitrogen and Total Phosphorous;*

Data Table 5: 2016 – 2017 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
			Inorganics: pH, conductivity, acidity, alkalinity, chloride, sulfate and total dissolved solids; *Total Petroleum Hydrocarbons; and* *Monocyclic Aromatic Compounds; Benzene, Toluene, Ethylbenzene and Xylene."*
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 4):* *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* *Jandakot Airport Holdings (2016) Groundwater Management Plan v5.5 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. The auditor determines that the results are not affected by this omission.
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed	Y	Section 4 Field and Laboratory Analytical Results 2016-2016 Section 6 Discussion of Field and Laboratory Analytical Results
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site."*
Data Analysis			
Results discussion	Section 5.5.5 Reporting	Y	

Data Table 5: 2016 – 2017 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Trends	*"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"*	Y	*"A general quantitative assessment has been undertaken based on historical data and trends."* It is a best industry practice to undertake statistical analysis for the assessment of trends. There is sufficient data collected over more than 4 years of monitoring. This is not a non-conformance but rather a recommendation.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	
Graphical presentation		Y	
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting	Y	
Recommendations	*"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	Y	
Figures and Appendices			
Figures		Y	
Appendices		Y	
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 5: 2016 – 2017 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."		

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GROUNDWATER MONITORING PROGRAM: 5 YEARLY AUDIT TO 2022

October 2022

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Jandakot Airport Holdings
Jandakot Airport Estate

C101310:DR

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1	**Electronic**	**Brigid Ward**	Environmental Coordinator, Jandakot Airport Holdings

Groundwater Monitoring Program: 5 Yearly Audit to 2022

Jandakot Airport Holdings

Jandakot Airport Estate

Executive Summary

Greencap Pty Ltd (Greencap) was commissioned by Jandakot Airport Holdings Pty Ltd (JAH) in August 2022 to undertake an audit of the Groundwater Monitoring Program for the past 5 years of reporting at Jandakot Airport Estate (the Site).

The audit report will identify the following:

- Any non-conformances associated with the implementation of the groundwater monitoring program that require attention/rectification;
- Potential improvements/amendments the auditor determines appropriate for consideration by JAH and stakeholders; and
- Whether, after review by the auditor, the conclusions/findings within monitoring reports are considered valid/accurate.

The results of each of the following annual report review are presented in the report which were all completed by Urbaqua and are:

- 2017-2018 Annual Monitoring Report
- 2018-2019 Annual Monitoring Report
- 2019-2020 Annual Monitoring Report
- 2020-2021 Annual Monitoring Report
- 2021-2022 Annual Monitoring Report

Overall, the Urbaqua reports are consistent and achieve the overarching objectives of the Groundwater Monitoring Program. Data is generally presented adequately but given the volume now available more targeted charts would assist in determining the significance of the various values.

There is a tendency to speculate about sources or reasons for changes in analyte concentrations especially with regard to nutrients. To support the hypothesis put forward there has been valid attempts at providing reasons however more in-depth assessment is required using other lines of evidence or literature sources to provide confidence in the assessment outcome.

The following recommendations for improvement/amendment include:

1. The methodology employed for rinsate sample collection needs to be clearly communicated in that DI water is passed through a component of the sampling equipment after a decontamination washdown event.

2. To assist in interpreting trend charts consideration should be given to reducing the 'noise' by splitting the charts to those upgradient and downgradient. Plotting all phyiscochemical parameters is not particularly useful given the variability arising from sampling and measurement equipment, consider reducing the time period or splitting on a seasonal basis and use rolling averages to smooth out trends and state actual relevant exceedances in the discussion.

3. As stated in the previous Audit (2018) it is recommended to use statistical trend analysis as this is adopted by environmental regulators, typically a Mann-Kendal statistical analysis tool is widely used across the practice for determining any significant trends. This would greatly assist in determining actual changes rather than graphical trends.
4. The relationship between Total P and groundwater levels should be assessed in more detail and evidence provided by way of statistical analysis such as regression analysis if appropriate. The median trend although useful does not provide a clear methodology to assist in understanding the significance of the relationship.
5. Inclusion of orthophosphate would be useful on elevated Total P detections to provide some context as to the risk posed.
6. Consider some PRI analysis of soils to confirm the phosphorous retention capabilities of typical soil types incidental to the existing monitor well network.

Groundwater Monitoring Program: 5 Yearly Audit to 2022

Jandakot Airport Holdings

Jandakot Airport Estate

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1 Introduction

Greencap was commissioned by Jandakot Airport Holdings Pty Ltd (JAH) in August 2022 to undertake an audit of the Groundwater Monitoring Program implemented during the past 5 years (2017/18 to 2021/22) at Jandakot Airport Estate (the Site). The last audit was completed in January 2018 which covered the period of the previous 5 years from 2012/13 to 2016/17 inclusive.

1.1 Background

Jandakot Airport is leased from the Commonwealth Government by JAH and is an important piece of state infrastructure, being Western Australia's major general aviation airport. Jandakot Airport is Commonwealth Land and is therefore subjected to Commonwealth legislation (primarily the Airports Act 1966, Airports (Environmental Protection) Regulations 1997 and the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999).

Development and implementation of the Jandakot Airport Groundwater Management Plan (GWMP) (and the groundwater monitoring program within) is a condition of EPBC approvals 2009/4796 and 2013/7032.

The GWMP states *"Independent auditing of the groundwater monitoring program (including results and reports) will be undertaken every 5 years, with the next audit scheduled for 2022. The audit report will be provided to key stakeholders for review and comment, following which the Groundwater Monitoring Program will be reviewed and if necessary, amended."*

1.2 GWMP Reviews and Amendments

Over the five year review period, the GWMP has been updated once in May 2019 to Version 5.6, the previous version 5.5 being valid since January 2016. On this basis the review of annual reports is against V5.5 for 2017/18 and 2018/19 and V5.6 for 2019/20, 2020/21 and 2021/22 respectively.

1.3 Objectives of the Audit

The audit report is prepared to identify the following:

- Any non-conformances associated with the implementation of the groundwater monitoring program that require attention/rectification;
- Potential improvements/amendments the auditor (Greencap, for this 5 year review) determines appropriate for consideration by JAH and stakeholders; and
- Whether, after review by the auditor, the conclusions/findings within monitoring reports are considered valid/accurate by the auditor.

1.4 Documentation Reviewed

JAH have provided Greencap with all the relevant documentation required to complete the audit. The relevant Annual Groundwater Monitoring reports (AGMR) audited within this report are listed in **Table 1**.

Table 1: Annual Groundwater Reports		
Consultancy	**Report Title**	**Groundwater Management Plan Version**
Urbaqua	2017-18. Annual Groundwater Monitoring Report, August 2018.	GWMP V5.5
Urbaqua	2018-19. Annual Groundwater Monitoring Report, August 2019.	GWMP V5.5
Urbaqua	2019-20 Annual Groundwater Monitoring Report, August 2020.	GWMP V5.6
Urbaqua	2020-21 Annual Groundwater Monitoring Report. August 2021.	GWMP V5.6
Urbaqua	2021-2022 Annual Groundwater Monitoring Report, August 2022.	GWMP V5.6

Greencap have also been provided with the following documentation/databases to aid in the audit process:

- JAH Bore Register Summary, July 2022 V4.3 (Excel spreadsheet). The database presents the installation/construction details for all relevant monitoring wells included in the GWMPs.
- JAH GWMP Monitoring Results – Annual Report 2022 (Excel spreadsheet). The database presents all laboratory results for all monitored wells since March 2012; and
- Interim Report and Results for the period 2017/18 to 2021/22.

2 Audit Methodology

To achieve the objectives outlined in **Section 1.3**, the following methodology has been adopted for the audit:

1. Review of the installation details of the groundwater monitoring wells to assess that they are fit for purpose outlined in relevant GWMPs.
2. Each annual monitoring report has been reviewed and compared against the groundwater monitoring program outlined in GWMP to identify potential non-conformances / inconsistencies in the following areas:
    - Sampling methodology inclusive of procedures undertaken and its compliance with the GWMP with reference to the following:
        - Appropriateness of sampling equipment/device used (e.g. pump type);
        - Review of sampling technique(s);
        - Monitoring of physicochemical field parameters during groundwater purging;
        - Field filtering consistency with GWMP;
        - Field equipment calibration certificates/records;
        - Decontamination procedures applied;
        - Sample Collection/storage and transport procedures; and
        - Quality Assurance/Quality Control (QA/QC) sample collection.
    - Confirm the suite of analytes/assessment levels adopted and presented in Table 1 from the GWMP and identification of any non-conformances;
    - Review of the results including tabular and graphical representation, analysis and assessment of long-term trends, comparison with A(EP)R Schedule 2 to assess for inconsistencies or transcription errors. Other regional data that is relevant to the GWMP to be reviewed (if available) to evaluate any potential for exceedances of the adopted assessment criteria outlined the GWMP;
    - Review of the QA/QC field and laboratory results to assess for compliance with current standards and guidelines;
    - Review of the conclusions and recommendations to determine their validity and suitability and/or if any of the recommendations were actioned; and
    - Review of figures and appendices to assess their validity and completeness.

The above methodology is summarised in **Table 2.**

The results of each annual report review are presented in the following sections:

Section Error! Reference source not found. 2017-2018 Annual Monitoring Report
Section Error! Reference source not found. 2018-2019 Annual Monitoring Report
Section Error! Reference source not found. 2019-2020 Annual Monitoring Report
Section Error! Reference source not found. 2020-2021 Annual Monitoring Report
Section 3 2021-2022 Annual Monitoring Report

The overall Audit findings are included in Section 8 and proposed recommendations are outlined in Section 9.

Table 2: Audit Methodology			
Audit Criteria	**Documents to be Reviewed**	**Documents to be Reviewed against**	**Outcome**
Sampling Procedures	Annual Monitoring Reports (2018-2022)	Groundwater Management Plan(s) V5.5 and V5.6 Australian Standard 5667.11:1998 NEPM (ASC NEPM 2013)	Identify any non-conformances and variation from industry recognised best practice methods.
Assessment Levels	Annual Monitoring Reports (2018-2022) JAH GWMP Monitoring Results – Annual Report 2022 (Excel spreadsheet).	Groundwater Management Plan(s) V5.5 and V5.6 Airports (Environmental Protection) Regulations 1997 Australian and New Zealand guidelines for fresh and marine water quality (ARMCANZ & ANZECC 2000)	Identify any non-conformances and non-compliances.
Tabular and Graphical Data	Annual Monitoring Reports (2018-2022)	Groundwater Management Plan(s) V5.5 and V5.6 Airports (Environmental Protection) Regulations 1997 Australian and New Zealand guidelines for fresh and marine water quality (ARMCANZ & ANZECC 2000) and DWER (Department of Water and Environmental Regulation) Groundwater Investigation Levels (GIL).	Inconsistencies and/ or transcription errors in analysis and assessments of trends and any other non-conformances that may influence the reported results of monitoring.
QA/QC Field and Laboratory Results	Annual Monitoring Reports (2018-2022)	Groundwater Management Plan(s) V5.5 and V5.6 Australian Standard 5667.1:1998 & 5667.11:1998 NEPM (2013) Schedule B2 Guidance on Data Collection, Sample Design and Reporting.	Identify any non-conformances and variation from best industry practice methods.
Conclusions and Recommendations	Annual Monitoring Reports (2018-2022)	N/A	Determine validity and suitability of conclusions/recommendations and whether or not they have been actioned.
Figures and Appendices	Annual Monitoring Reports (2018-2022)	Groundwater Management Plan(s) V5.5 and V5.6	Assess validity and completeness

3 2017-2018 Annual Monitoring Report

3.1 Introduction

The 2017-2018 AGMR was carried out and completed by Urbaqua. The AGMR was to be carried out in accordance with GWMP V5.5. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 1** at the end of the report.

3.2 Objectives of GWMP V5.5

The objective and rationale of the groundwater sampling outlined in the GWMP V5.5 for groundwater sampling are to:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the Jandakot Underground Waste Pollution Control Area (JUWPCA), are not impacting the quality of groundwater beneath the site area.

3.3 Non-Conformances

Following a review of the AGMR, a list of the non-conformances identified are presented in **Table 3**. .

Table 3: AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC "All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."	Section 5.2.3 Rinsate The presence of elevated metals in the rinsate for Mar-18 is indicative of tap water being used as the rinsate rather than deionised water. A suitable supply of laboratory prepared deionised water should be used. We do not concur with the conclusion the presence of compounds is related to a build-up of deposits based on the information provided.

3.4 AGMR Conclusions and Recommendations

3.4.1 Conclusions from Report and Auditor Comments

Section 7 Conclusions

- *Physiochemical parameters across the site vary within the acceptable ranges specified in the Airports (Environmental Protection) Regulations 1997 Schedule 2, with the exception of pH and DO which have largely remained consistent with historical data at the Jandakot Airport site. There is a very slight increasing trend in total acidity across a number of the monitoring wells, this was observed in the previous year's monitoring report and it is thought that this maybe indicative of regional trends.* Auditor is in agreement.
- *Nutrients are generally high across the site, with all bores recording total nitrogen and total phosphorous concentrations in exceedance of the Airports (Environmental Protection) Regulations 1997 Schedule 2 acceptable limit. However, these values were mostly consistent with historical data. High total phosphorous concentrations were during the March 2018 sampling event in the north-western area of the site downstream of Precincts 4 and 5. It is possible that the elevated concentrations were associated with high summer rainfall and landscaping and gardening activity within the mixed business area. It is expected that TP concentrations will decline in subsequent monitoring events.* Auditor is in partial agreement, application of fertiliser possible with reuse of Banksia woodland mulch.
- *The results do not indicate any adverse effects of on-site groundwater abstraction for irrigation and construction on the groundwater quality or groundwater levels within the Jandakot Airport.* Auditor is in agreement.
- *JAMB4 recorded elevated nutrient concentrations at both sampling events in 2017-18. The monitoring well is located along the south-west boundary of the site and therefore groundwater flow in the areas is in a north-west direction along the boundary. It is therefore unlikely that the elevated concentrations are related to airport activity.* Auditor is in agreement.
- *The Jandakot Airport Groundwater Monitoring Report 2016-17 (Essential Environmental, 2017) identified JAMB8 as a monitoring well of concern due to repeated exceedances of Jandakot Airport GMP v5.5 (JAH, 2016) assessment levels for dissolved metals. In March 2018 JAMB8 did not record any exceedances of Jandakot Airport GMP v5.5 (JAH, 2016) assessment levels for dissolved metals.* Auditor is in agreement.
- *Increases in acidity (pH) and some metals may be connected and indicative of general trends in the regional groundwater system related to changing rainfall patterns and continued drinking water abstraction upstream.* Auditor is in agreement.
- *Whilst Jandakot Airport does transport, store and use petroleum hydrocarbons, the available groundwater data does not indicate any adverse impacts from airport activities.* Auditor is in agreement.

As shown above the auditor is in general agreement with the conclusions provided by Urbaqua for the AGMR. The auditor notes that the elevated Total P attributable to summer rainfall and landscaping may be in part contributing to the elevated levels but is possibly more likely to be the addition of fertilisers.

3.4.2 Recommendations from Report and Auditor Comments

Section 8 Recommendation 1

The 2016-17 groundwater monitoring report (Essential Environmental, 2017) recommended that dissolved metal concentrations at JAMB8 be reviewed specifically after the 2017-18 monitoring program following high lead, zinc and nickel concentrations at the well. Lead, nickel and zinc concentrations at JAMB8 all returned to levels below the Jandakot Airport GMP v5.5 (JAH, 2016) assessment levels. Therefore, no changes to the monitoring program specifically related to JAMB8 are recommended at the completion of the 2017-18 monitoring program. Auditor is in agreement.

Section 8 Recommendation 2

The 2016-17 groundwater monitoring report (Essential Environmental, 2017) recommended a review of nutrient concentrations at JAMB10 following elevated total nitrogen and total phosphorus concentrations at the monitoring well; potentially associated with landscaping activities. TN and TP at JAMB10 declined in 2017-18 to concentrations below the Jandakot Airport GMP v5.5 (JAH, 2016) assessment levels. Therefore no changes to the monitoring program specifically related to nutrients at JAMB10 are recommended at the completion of the 2017-18 monitoring program. Auditor is in agreement.

Section 8 Recommendation 3

JAMB1, JAMB2B and JAMB3B recorded elevated concentrations of TP in March 2018. It is likely that the cause is a combination of unseasonably high summer rainfall and the use of Banksia mulch in the garden beds along Pilatus St. Therefore, the concentration of TP at these sites is likely to return to levels within the Jandakot Airport GMP v5.5 (JAH, 2016). A review of the nutrient concentrations at these sites is recommended after the September 2018 and March 2019 groundwater monitoring events to confirm this. Auditor is in agreement as to on-going monitoring.

Section 8 Recommendation 4

The addition of a rinsate sample to the QA/QC protocol in March 2018 identified a potential source of contamination in the groundwater sampling. Future monitoring events should include thorough cleaning of the rinsate container before and after each day of sampling to mitigate the potential source of contamination. Auditor is not in agreement and believes the rinsate sampling procedure or quality of rinsate water should be addressed.

Section 8 Recommendation 5

The groundwater at the site is generally of good quality and does not appear to have experienced any decline in quality as a result of airport activities. However, given the ongoing expansion activities, current practices undertaken on the site and sensitivity of the receiving environment, the monitoring program should not be amended at this point. Auditor is in I agreement.

The auditor agrees with the stated recommendations with the exception of the issue of cross contamination in the rinsate water. Further details on the rinsate collection methodology should be provided.

3.5 Objectives Achieved

Based on the identified non-conformances and conclusions provided by Urbaqua, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.5 for Ground Water Sampling, as presented in **Table 4**.

Table 4: Objectives Completed for 2017-2018 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	None
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	None

3.6 Previous 2016-2017 AGMR Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 5** presents the results of this assessment.

Table 5: 2016-2017 Recommendations Incorporated into the 2017-2018 AGMR	
Objective	**Recommendation Incorporated?**
Elevated metal concentrations noticeably at JAMB8 should be assessed in more detail as part of the next AGMR.	Yes
Possibility that elevated nitrogen and phosphorous at JAMB10 are due to landscaping activities and this well should be assessed in more detail for the next AGMR. Modifications to landscaping practices should there be an upward trend.	No
The groundwater at the site is generally of good quality and does not appear to have experienced any decline as such the monitoring program should not be amended at this time.	Yes
Expand monitoring network to measure groundwater levels and improve accuracy.	Yes

4 2018-2019 Annual Monitoring Report

4.1 Introduction

The 2018-2019 AGMR was carried out and completed by Urbaqua. The AGMR was to be carried out in accordance with GWMP V5.5. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 1** at the end of the report.

4.2 Objectives of GWMP V5.5

The objective and rationale of the groundwater sampling outlined in the GWMP V5.5 for groundwater sampling are to:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

4.3 Non-Conformances

Following a review of the AGMR, a list of the non-conformances identified are presented in **Table 6**. .

Table 6: AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC "All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."	Section 5.2.3 Rinsate The presence of elevated metals in the rinsate for Sep-18 is indicative of tap water being used as the rinsate rather than deionised water. The rinsate for Mar-19 is what would be expected for DI water or similar. A suitable supply of laboratory prepared deionised water should be used. The reason for the detection is not elucidated.
Conclusions	Section 5.5.5 Reporting "Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels."	Commentary regarding elevated Total N as a function of clearing and release of stored nutrients in the rootstock. The comment is speculative and should be backed up with scientific evidence that this could be a possibility. Commentary regarding high Total P values is inconclusive with a number of reasons provided. Speculation is provided that the source is a legacy contaminated site. Reference to Donn et al (2012) should be elaborated as to how it is relevant to the JAH site. Explanation of nutrients should be limited to factors that can be quantified and any conclusions deferred until such factors can be confirmed.

4.4 AGMR Conclusions and Recommendations

4.4.1 Conclusions from Report and Auditor Comments

Section 7 Conclusions

- *Physiochemical parameters across the site vary within the acceptable ranges specified in the Airports (Environment Protection) Regulations (1997) Schedule 2, with the exception of pH and DO which have remained consistent with historical data. There is slight increasing trend in total acidity across the site, this is potentially linked to consecutive years of high rainfall and the subsequent rise in groundwater levels*. Auditor is in agreement.
- *Nutrients are generally high across the site, all bores recorded total nitrogen concentrations in exceedance of the Airports (Environment Protection) Regulations (1997) Schedule 2 at both sampling events. However, with the exception of JAMB4 all bores were within the Jandakot Airport GMP v5.5 assessment level. JAMB4 is located on the southern boundary of the site and receives groundwater flow from off-site, it is therefore very unlikely that the high nitrogen concentrations are a result of airport activities*. Auditor is in agreement.
- *Total phosphorus concentrations have continued on an increasing trend from March 2017. JAMB3B and JAMB9 have shown the greatest increase reaching more than five times the Jandakot Airport GMP v5.5 assessment level in March 2019. The increases in total phosphorus concentration are likely related to the regional increase in groundwater levels. There are a number of mechanisms through which rising groundwater levels can affect total phosphorus concentrations, including lower soil residence time and releasing stored phosphorus from remnant rootstock in cleared land. It is anticipated that total phosphorus concentrations will decline in subsequent monitoring events*. Auditor is in partial agreement, however further evidence is required to support the statements regarding phosphorous mobility.
- *Groundwater data received from a neighbouring cross-gradient site showed highly variable TN and TP concentrations, indicating that it may be a characteristic of the groundwater in the wider Jandakot area*. Auditor is in agreement.
- *With the exception of zinc, dissolved metal concentrations at the Jandakot Airport monitoring wells were all generally within the Jandakot Airport GMP v5.5 assessment levels. The results for the entire Jandakot Airport GMP show a number of zinc concentration spikes, it is anticipated that the concentrations will decrease in September 2019*. Auditor is in agreement.
- *The results do not indicate any adverse effects of on-site groundwater abstraction for irrigation and construction on the groundwater quality or groundwater levels within the Jandakot Airport*. Auditor is in agreement.
- *Whilst Jandakot Airport does transport, store and use petroleum hydrocarbons, the available groundwater data does not indicate any adverse impacts from airport activities*. Auditor is in agreement.

The auditor is in general agreement with the conclusions provided by Urbaqua for the AGMR. The auditor notes that the commentary on phosphorous mobility should be confirmed by providing multiple lines of evidence to support the statement.

4.4.2 Recommendations from Report and Auditor Comments

Section 8 Recommendation 1

The groundwater at the site is generally of good quality and does not appear to have experienced any significant decline in quality as a result of airport activities. However, given the ongoing expansion activities, current practices undertaken on site and the sensitivity of the receiving environment, the monitoring program should not be amended at this stage. Auditor is in agreement.

Section 8 Recommendation 2

The It is noted that the 2018/19 annual report recommended that phosphate was added to the laboratory analysis parameters. The decision was subsequently made to delay the addition of phosphate to the program until the completion of the 2019/20 monitoring program. After a review of the phosphorus data from 2019/20 it is not considered necessary to undertake phosphate analysis in 2020/21; phosphorous concentrations have declined from the 2018/19 program and the fluctuations that have been observed are not considered to be related to airport activities. Auditor is in agreement; inclusion of phosphate would have been useful in assessing the ecological significance of the phosphorous levels in groundwater.

Section 8 Recommendation 3

To further investigate the observed correlation between total phosphorus concentration and groundwater level, it is suggested that advice be sought from the Department of Water and Environmental Regulation. Gaining a greater understanding of the changes in groundwater abstraction volumes from the Jandakot Mound may provide additional insight into the groundwater conditions surrounding the Jandakot Airport site. Auditor is in agreement.

The auditor agrees with the stated recommendations and that inclusion of orthophosphate would be useful to define the ecological risk posed by elevated phosphorous levels.

4.5 Objectives Achieved

Based on the identified non-conformances and conclusions provided by Urbaqua, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.5 for Ground Water Sampling, as presented in **Table 7**.

Table 7: Objectives Completed for 2017-2018 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	None
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	None

4.6 Previous 2017-2018 AGMR Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. **Table 8** presents the results of this assessment.

Table 8: 2017-2018 Recommendations Incorporated into the 2018-2019 AGMR

Objective	Recommendation Incorporated?
Perform a review of nutrient concentrations at JAMB1, JAMB2B and JAMB3B as to causes due to high summer rainfall and mulching.	Yes
Inclusion of rinsate sample to demonstrate adequate decontamination procedures from Mar-18.	Yes (methodology not stated)
The groundwater at the site is generally of good quality and does not appear to have experienced any decline as such the monitoring program should not be amended at this time.	Yes

5 2019-2020 Annual Monitoring Report

5.1 Introduction

The 2019-2020 AGMR was carried out and completed by Urbaqua. The AGMR was to be carried out in accordance with GWMP V5.6. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 1** at the end of the report.

5.2 Objectives of GWMP V5.6

The objective and rationale of the groundwater sampling outlined in the GWMP V5.6 for groundwater sampling are to:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

5.3 Non-Conformances

Following a review of the AGMR, a list of the non-conformances identified are presented in **Table 9**. .

Table 9: AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC "All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."	Section 5.2.3 Rinsate Clarification as to the rinsate methodology would be useful as it is stated *"The sample was collected directly from the rinsing water container at the end of the day of sampling…"*. Normal practice is to pour DI water over or through the sampling equipment and collect this water into sample container(s).
Conclusions	Section 5.5.5 Reporting "Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels."	The statement regarding phosphorous retention soils should be backed up with site specific data such as determining the PRI Index of JAH soils. The Department of Water Stormwater Management Manual for WA (2004-2022) states Bassendean Sands have a negligible PRI Index (<0.5). Discussion of Total P requires further evaluation.

5.4 AGMR Conclusions and Recommendations

5.4.1 Conclusions From Report and Auditor Comments

Section 7 Conclusions

- *Physiochemical parameters across the site are highly variable but generally remain within the Airports (Environment Protection) Regulations (1997) Schedule 2, with the exception of pH and DO which remain consistent with historical data and are within the Jandakot Airport GMP v5.6 (JAH, 2019) assessment levels*. Auditor is in agreement.
- *Nutrients are generally high across the site relative to the Airports (Environment Protection) Regulations (1997) Schedule 2. TN concentrations at the site were all within the Jandakot Airport GMP v5.6 assessment levels with the exception of JAMB4 which is located along the upstream boundary of the site.* Auditor is in agreement.
- *Prior to the 2019-20 monitoring period, the TP concentration at the site had been demonstrating a slight increasing trend. Despite a number of bores exceeding the Jandakot Airport GMP v5.6 assessment levels during the 2019-20 monitoring program, there are early indications that the TP concentrations across the site may be stabilising. JAMB3B and JAMB9 were highlighted in the 2018-19 annual monitoring report after recording unusually high TP concentrations. The TP concentration at JAMB3B increased further in the September 2019 monitoring event and then decreased significantly in the March 2020 event. The TP concentration at JAMB9 decreased at both sampling events in the 2019-20 monitoring period.* Auditor is in agreement.
- *TP concentration is potentially linked to groundwater levels. The overall trend in TP concentration at Jandakot Airport over the duration of the monitoring program very closely follows the trend in groundwater levels.* Auditor is in partial agreement, need to confirm explicitly the trend between water levels and TP concentrations.
- *Groundwater data received from a neighbouring cross-gradient site reflects the high variability in nutrient concentrations and likely indicative of nutrient concentrations in the groundwater of the surrounding area*. Auditor is in agreement.
- *Dissolved metal concentrations at the Jandakot Airport monitoring wells were all generally within the Jandakot Airport GMP v5.6 assessment levels.* Auditor is in agreement.
- *The results to do not indicate any adverse effects of on-site groundwater abstraction for irrigation and construction on the groundwater quality or groundwater levels at the site.* Auditor is in agreement.
- *Whilst Jandakot Airport does transport, store and use petroleum hydrocarbons, the available groundwater data does not indicate any adverse impacts from airport activities.* Auditor is in agreement.

The auditor is in general agreement with the conclusions provided by Urbaqua for the AGMR. The auditor notes that the reasons provided for phosphorous retention in soils should be investigated or confirmed with any relevant studies/investigations on the subject matter.

5.4.2 Recommendations from Report and Auditor Comments

Section 8 Recommendation 1

The groundwater at the site is generally of good quality and does not appear to have experienced any significant decline in quality as a result of airport activities. However, given the ongoing expansion activities, current practices undertaken on site and the sensitivity of the receiving environment, the monitoring program should not be amended at this stage. Auditor is in agreement.

Section 8 Recommendation 2

The It is noted that the 2018/19 annual report recommended that phosphate was added to the laboratory analysis parameters. The decision was subsequently made to delay the addition of phosphate to the program until the completion of the 2019/20 monitoring program. After a review of the phosphorus data from 2019/20 it is not considered necessary to undertake phosphate analysis in 2020/21; phosphorous concentrations have declined from the 2018/19 program and the fluctuations that have been observed are not considered to be related to airport activities. Auditor is in agreement, inclusion of phosphate would have been useful in assessing the ecological significance of the phosphorous levels.

Section 8 Recommendation 3

To further investigate the observed correlation between total phosphorus concentration and groundwater level, it is suggested that advice be sought from the Department of Water and Environmental Regulation. Gaining a greater understanding of the changes in groundwater abstraction volumes from the Jandakot Mound may provide additional insight into the groundwater conditions surrounding the Jandakot Airport site. Auditor is in agreement.

The auditor agrees with the stated recommendations but does support inclusion of orthophosphate/reactive phosphorous for the reasons explained earlier.

5.5 Objectives Achieved

Based on the identified non-conformances and conclusions provided by Urbaqua, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.6 for Ground Water Sampling, as presented in Table 10.

Table 10: Objectives Completed for 2019-2020 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	None
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	None

5.6 Previous 2018-2019 AGMR Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. Table 11 presents the results of this assessment.

Table 11: 2018-2019 Recommendations Incorporated into the 2019-2020 AGMR

Objective	Recommendation Incorporated?
Phosphate to be included in nutrient suite to assist in identifying phosphorous sources.	No
The groundwater at the site is generally of good quality and does not appear to have experienced any decline as such the monitoring program should not be amended at this time.	Yes

6 2020-2021 Annual Monitoring Report

6.1 Introduction

The 2020-2021 AGMR was carried out and completed by Urbaqua. The AGMR was to be carried out in accordance with GWMP V5.6. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 1** at the end of the report.

6.2 Objectives of GWMP V5.6

The objective and rationale of the groundwater sampling outlined in the GWMP V5.6 for groundwater sampling are to ascertain:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

6.3 Non-Conformances

Following a review of the AGMR, a list of the non-conformances identified are presented in Table 12.

Table 12: AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC "All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."	Section 5.2.3 Rinsate Clarification as to the rinsate methodology would be useful as it is stated *"The sample was collected directly from the rinsing water container at the end of the day of sampling…"*. Normal practice is to pour DI water over or through the sampling equipment.
Conclusions	Section 5.5.5 Reporting "Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels."	Well JAM3B is ~1 km downgradient of JAMB4; based on a hydraulic gradient of 0.001 (1.2m/1000m) with an estimated K value of 30m/day (Department of Water Stormwater Management Manual for WA 2004-2022) and porosity of 0.3, groundwater velocity would be 0.1m/day or 36m/year. Assuming no retardation factor groundwater would take some 30 years to travel between JAMB4 and JAM3B. On this basis the statement *"…the spike at JAM3B in March 2021 (which is likely a delayed effect downstream of JAMB4)"* is not valid.

6.4 AGMR Conclusions and Recommendations

6.4.1 Conclusions from Report and Auditor Comments

Section 7 Conclusions

- *After a period of groundwater level increase the trend appears to be downwards following consecutive years of low rainfall.* In agreement.
- *Physiochemical parameters across the site are highly variable but generally remain within the Airports (Environment Protection) Regulations (1997) Schedule 2, with the exception of pH and DO which remain consistent with historical data and are within the Jandakot Airport GMP v5.6 (JAH, 2019) assessment levels*. Auditor is in agreement.
- *Nutrients are generally high across the site relative to the Airports (Environment Protection) Regulations (1997) Schedule 2.* Auditor is in agreement.
- *TN concentrations are generally below the Jandakot Airport GMP v5.6 (JAH, 2019) assessment level with the notable exception of JAMB4 which has recorded the highest TN concentrations at all sampling events since 2017. JAMB4 is located directly downstream of a large area that was cleared of banksia woodland in 2015 and the increase in TN is likely related to the decrease in nitrogen removal from vegetation and the increase in rainfall runoff.* Auditor is in partial agreement; however it is not clear as to which mechanism is primarily responsible being mulch or clearing.
- *Dissolved metal concentrations at the Jandakot Airport monitoring wells were all generally within the Jandakot Airport GMP v5.6 assessment levels. Spikes in dissolved nickel and dissolved zinc were observed at a number of bores during the September 2020 monitoring event, in all cases the elevated concentrations decreased by the March 2021 sampling event.* Auditor is in agreement.
- *The results to do not indicate any adverse effects of on-site groundwater abstraction for irrigation and construction on the groundwater quality or groundwater levels at the site.* Auditor is in agreement.
- *Whilst Jandakot Airport does transport, store and use petroleum hydrocarbons, the available groundwater data does not indicate any adverse impacts from airport activities*. Auditor is in agreement.

The auditor is in general agreement with the conclusions provided by Urbaqua for the AGMR. The auditor notes that the reasons provided for elevated nitrogen is mentioned as mulch and/or removal of vegetation in the conclusions, the actual source is speculated rather than a definitive statement.

6.4.2 Recommendations

Section 8 Recommendation 1

The groundwater at the site is generally of good quality and does not appear to have experienced any significant decline in quality as a result of airport activities. However, given the ongoing expansion activities, current practices undertaken on site and the sensitivity of the receiving environment, the monitoring program should not be amended at this stage. Auditor is in agreement.

Section 8 Recommendation 2

There were a number of bores that recorded an unusual exceedance of the Jandakot Airport GMP v5.6 (JAH, 2019) assessment levels for various analytes during the March 2021 sampling event (Chloride at JAMB7B, TN at JAMB3B, dissolved iron at JAMB2B). While exceedances of the assessment levels are not unusual, the results at these bores should be reviewed following the September 2021 sampling event to ensure that there are no increasing trends in contaminant concentration. Auditor is in agreement.

The auditor agrees with the stated recommendations.

6.5 Objectives Achieved

Based on the identified non-conformances and conclusions provided by Urbaqua, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.6 for Ground Water Sampling, as presented in Table 13.

Table 13: Objectives Completed for 2020-2021 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	None
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	None

6.6 Previous 2019-2020 AGMR Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. Table 14 presents the results of this assessment.

Table 14: 2019-2020 Recommendations Incorporated into the 2020-2021 AGMR

Objective	Recommendation Incorporated?
The groundwater at the site is generally of good quality and does not appear to have experienced any decline as such the monitoring program should not be amended at this time.	Yes
Phosphate was initially to be included in the nutrient suite to assist in identifying phosphorous sources which was reconsidered as to be unnecessary in 2018/19.	Yes
Obtain information from DWER as to correlation between Total P concentrations and groundwater levels for the Jandakot Mound groundwater system.	No

7 2021-2022 Annual Monitoring Report

7.1 Introduction

The 2021-2022 AGMR was carried out and completed by Urbaqua. The AGMR was to be carried out in accordance with GWMP V5.6. Greencap has reviewed the AGMR and all the findings are presented in **Data Table 1** at the end of the report.

7.2 Objectives of GWMP V5.6

The objective and rationale of the groundwater sampling outlined in the GWMP V5.6 for groundwater sampling are to:

- Establish baseline groundwater conditions against which future changes/trends can be measured; and
- Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.

7.3 Non-Conformances

Following a review of the AGMR, a list of the non-conformances identified are presented in Table 15. .

Table 15: AGMR Non-Conformances

Audit Criteria	GMP Criteria	Auditor Comments
Quality Assurance/Quality Control (QA/QC) Sample Collection	Section 5.5.4 QA/QC "All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."	Section 5.2.3 Rinsate As per the last AGMR clarification as to the rinsate methodology would be useful as it is stated *"The sample was collected directly from the rinsing water container at the end of the day of sampling…"*. Normal practice is to pour DI water over or through the sampling equipment.

7.4 AGMR Conclusions and Recommendations

7.4.1 Conclusions from Report and Auditor Comments

Section 7 Conclusions

- *After a period of groundwater level increase followed by a brief downward trend from 2018 onwards, the groundwater levels increased across the site in 2021-22 after high rainfall in the 2021 winter period.* Auditor is in agreement.
- *Physiochemical parameters across the site are highly variable but generally remain within the Airports (Environment Protection) Regulations (1997) Schedule 2, with the exception of pH and DO which remain consistent with historical data and are within the Jandakot Airport GMP v5.6 (JAH, 2019) assessment levels*. Auditor is in agreement.
- *Nutrients are generally high across the site relative to the Airports (Environment Protection) Regulations (1997) Schedule 2*. Auditor is in agreement.
- *TN concentrations are generally below the Jandakot Airport GMP v5.6 (JAH, 2019) assessment level with the notable exception of JAMB4 which has recorded the highest TN concentrations at all sampling events since 2017. JAMB4 is located directly downstream of a large area that was cleared of banksia woodland in 2015 and the increase in TN is likely related to the decrease in nitrogen removal from vegetation and the increase in rainfall runoff.* Auditor is in partial agreement, however it is not clear as to which mechanism is primarily responsible being mulch or clearing.
- *TP concentrations increased across the site during the March 2022 sampling event with a number of bores recording exceedances of the Jandakot Airport GMP v5.6 (2019) assessment level. TP concentrations have been observed to increase at the site following higher rainfall periods and are expected to decline in subsequent monitoring events.* Auditor is in agreement.
- *Dissolved metal concentrations at the Jandakot Airport monitoring wells were all generally within the Jandakot Airport GMP v5.6 assessment levels. Spikes in dissolved nickel and dissolved zinc were observed at a number of bores during the September 2020 monitoring event, in all cases the elevated concentrations decreased by the March 2021 sampling event.* Auditor is in agreement.
- *The results to do not indicate any adverse effects of on-site groundwater abstraction for irrigation and construction on the groundwater quality or groundwater levels at the site.* Auditor is in agreement.
- *Whilst Jandakot Airport does transport, store and use petroleum hydrocarbons, the available groundwater data does not indicate any adverse impacts from airport activities*. Auditor is in agreement.

The auditor is in general agreement with the conclusions provided by Urbaqua for the AGMR. The auditor notes that the reasons provided for elevated nitrogen is mentioned as mulch and/or removal of vegetation in the conclusions, the actual source is speculated rather than a definitive statement.

7.4.2 Recommendations from Report and Auditor Comments

Section 8 Recommendation 1

The groundwater at the site is generally of good quality and does not appear to have experienced any significant decline in quality as a result of airport activities. However, given the ongoing expansion activities, current practices undertaken on site and the sensitivity of the receiving environment, the monitoring program should not be amended at this stage. Auditor is in agreement.

Section 8 Recommendation 2

TP concentrations increased across the site during the March 2022 monitoring event. As described in the report, this can be associated with higher rainfall periods at the site. However, TP concentrations should be reviewed after the September 2023 monitoring event to ensure that the increases are not related to any airport activities. Auditor is in agreement.

The auditor agrees with the stated recommendations.

7.5 Objectives Achieved

Based on the identified non-conformances and conclusions provided by Urbaqua, Greencap has determined that the AGMR has completed all the objectives set out in the GWMP V5.6 for Ground Water Sampling, as presented in Table 16.

Table 16: Objectives Completed for 2021-2022 AGMR

Objective	Objective Achieved?	Auditor Comments
Establish baseline groundwater conditions against which future changes/trends can be measured	Achieved	None
Ensure that development and activities on the airport estate, particularly within the JUWPCA, are not impacting the quality of groundwater.	Achieved	None

7.6 Previous 2020-2021 AGMR Recommendations

As part of the audit, a review is undertaken to determine if the previous year's recommendations have been actioned and included in the next years AGMR. Table 17 presents the results of this assessment.

Table 17: 2020-2021 Recommendations Incorporated into the 2021-20222 AGMR

Objective	Recommendation Incorporated?
The groundwater at the site is generally of good quality and does not appear to have experienced any decline as such the monitoring program should not be amended at this time.	Yes
There was an unusual exceedance for some compounds Cl (at JAMB7B), TN (at JAMB3B) and Fe (at JAMB2B) which should be considered in detail in September 2021.	Yes

8 Audit Findings Summaries

Based on the audit undertaken of the past five (5) AGMRs, the following summaries of each report are included below.

8.1 Urbaqua 2017-2018 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 18: Summary of 2017-2018 Findings

Item	Result	Comments
Number of Non-Conformances	1	The QA/QC control sampling was not considered appropriate with regard to the rinsate sample.
Were the conclusions adequate?	6/7	The conclusions were acceptable with the exception of the source of elevated TP levels.
Were the recommendations adequate?	4/5	The recommendations were acceptable with the exception of the rinsate sampling procedure and source of cross contamination.
Were all GWMP objectives achieved?	Yes	The objectives were achieved.
Were the previous AMP Recommendations Incorporated?	3/4	More detailed assessment of elevated TN and TP at location JAMB10.

8.2 Urbaqua 2018-2019 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 19: Summary of 2018-2019 Findings

Item	Result	Comments
Number of Non-Conformances	2	The QA/QC control sampling was not considered appropriate with regard to the rinsate sample. Commentary on elevated TN and TP was somewhat speculative and required more evidence to support the statements made
Were the conclusions adequate?	6/7	The conclusions were acceptable with the exception of the source of the statement regarding phosphorous mobility.
Were the recommendations adequate?	3/3	The recommendations were acceptable however inclusion of phosphate would have been useful.
Were all GWMP objectives achieved?	Yes	The objectives were achieved.
Were the previous AMP Recommendations Incorporated?	3/3	The recommendations were incorporated.

8.3 Urbaqua 2019-2020 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 20: Summary of 2019-2020 Findings		
Item	**Result**	**Comments**
Number of Non-Conformances	2	The QA/QC control sampling was not considered appropriate with regard to the rinsate sample. Commentary on phosphorous retention was not backed up with actual values or by research of similar soils.
Were the conclusions adequate?	7/8	The conclusions were acceptable however TP values compared to groundwater levels should have been assessed in more detail to confirm the statement.
Were the recommendations adequate?	3/3	The recommendations were acceptable however inclusion of phosphate would have been useful.
Were all GWMP objectives achieved?	Yes	The objectives were achieved.
Were the previous AMP Recommendations Incorporated?	1/2	The recommendations were incorporated other than phosphate was not included.

8.4 Urbaqua 2020-2021 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 21: Summary of 2020-2021 Findings		
Item	**Result**	**Comments**
Number of Non-Conformances	2	The QA/QC control sampling was not considered appropriate with regard to the rinsate sample. Commentary on groundwater flow velocity was not calculated as to the statement regarding groundwater impact between wells JAMB4 and JAM3B.
Were the conclusions adequate?	6/7	The conclusions were acceptable however the source of nitrogen should have been assessed in more detail to confirm the statement.
Were the recommendations adequate?	2/2	The recommendations were acceptable.
Were all GWMP objectives achieved?	Yes	The objectives were achieved.
Were the previous AMP Recommendations Incorporated?	2/3	The recommendations were incorporated other than sourcing information from DWER as to elevated Total P and groundwater levels.

8.5 Urbaqua 2021-2022 Audit Review Summary

The report was considered to be of a suitable quality and the non-conformances identified did not have an effect on the overall quality and/or findings of the results.

Table 22: Summary of 2021-2022 Findings

Item	Result	Comments
Number of Non-Conformances	1	The QA/QC control sampling was not considered appropriate with regard to the rinsate sample.
Were the conclusions adequate?	7/8	The conclusions were acceptable however the source of nitrogen is inconsistent as to whether it is use of mulch or removal of the vegetation.
Were the recommendations adequate?	2/2	The recommendations were acceptable.
Were all GWMP objectives achieved?	Yes	The objectives were achieved.
Were the previous AMP Recommendations Incorporated?	2/2	The recommendations were incorporated.

9 Conclusions & Recommendations

9.1 Conclusion

Overall, the Urbaqua reports are consistent and achieve the overarching objectives of the Groundwater Monitoring Program. Data is generally presented adequately but given the volume now available more targeted charts would assist in determining the significance of the various values.

There is a tendency to speculate about sources or reasons for changes in analyte concentrations especially with regard to nutrients. To support the hypothesis put forward there has been valid attempts at providing reasons however more in-depth assessment is required using other lines of evidence or literature sources to provide confidence in the assessment outcome as well as environmental implications and rectification measures where required.

9.2 Recommendations

The following recommendations for improvement/amendment include:

1. The methodology employed for rinsate sample collection needs to be clearly communicated in that laboratory provided DI water is passed through a component of the sampling equipment after a decontamination washdown event.

2. To assist in interpreting trend charts consideration should be given to reducing the 'noise' by splitting the charts to those upgradient and downgradient. Plotting all phyiscochemical parameters is not particularly useful given the variability arising from sampling and measurement equipment, consider reducing the time period or splitting on a seasonal basis and use rolling averages to smooth out trends and state actual relevant exceedances in the discussion.

3. As stated in the previous Audit (2018) it is recommended to use statistical trend analysis as this is adopted by environmental regulators, typically a Mann-Kendal statistical analysis tool is widely used across the practice for determining any significant trends. This would greatly assist in determining actual changes as well as seasonal variations rather than graphical trends.

4. The relationship between Total P and groundwater levels should be assessed in more detail and evidence provided by way of statistical analysis such as regression analysis if appropriate. The median trend although useful does not provide a clear methodology to assist in understanding the significance of the relationship.

5. Inclusion of orthophosphate would be useful on elevated Total P detections to provide some context as to the risk posed.

6. Consider some PRI analysis of soils to confirm the phosphorous retention capabilities of typical soil types incidental to the existing monitor well network.

10 References

Australian and New Zealand Environment and Conservation Council (ANZECC) 1992, Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, ANZECC & National Health and Medical Research Council.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) 2000, Australian Water Quality Guidelines for Fresh and Marine Water Quality, ANZECC/ARMCANZ, Canberra.

Australian Government (1966), Airports Act, No. 42, Compilation No. 31, 01 July 2016.

Australian Government (1997), Airport Regulations, Compilation No. 8, 10 August 2012.

Australian Government (1999), Environment Protection and Biodiversity Conservation Act, No. 51, Compilation No. 51, 1 July 2016.

Australian Standard 5667.1 (1998), Water quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.

Australian Standard 4482.1 (2005), Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds.

Department of Water Stormwater Management Manual for WA (2004-2022).

Jandakot Airport Holdings Pty Ltd (2016), Groundwater Management Plan (Jandakot Airport GWMP) v5.5.

Jandakot Airport Holdings Pty Ltd (2016), Groundwater Management Plan (Jandakot Airport GWMP) v5.6.

Urbaqua (2018), 2017-18 Annual Ground Water Monitoring Report, Jandakot Airport, August 2018.

Urbaqua (2019), 2018-19 Annual Ground Water Monitoring Report, Jandakot Airport, August 2019.

Urbaqua (2020), 2019-20 Annual Ground Water Monitoring Report, Jandakot Airport, August 2020.

Urbaqua (2021), 2020-21 Annual Ground Water Monitoring Report, Jandakot Airport, August 2021.

Urbaqua (2022), 2021-22 Annual Ground Water Monitoring Report, Jandakot Airport, August 2022.

GROUNDWATER MONITORING PROGRAM: 5 YEARLY AUDIT

Jandakot Airport Holdings

Jandakot Airport Estate

Tables

Data Table 1: 2017 – 2018 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring has since occurred (and will continue to) occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *"Any additional bores installed (including JAMB10 and JAMB11) will be sampled concurrently with the sampling regime established for JAMB1 – JAMB9 unless results warrant further investigation"*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2017 and March 2018".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Well Purging *"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."* Data sighted not checked; 4-6 data measurements per purge.
Monitoring of physicochemical parameters		Y	
Field filtering		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."*
Instrument Calibration (Calibration certificates/records);		Y	Appendix F Calibration Certificate. KASA (12/9/17) and Eco (19/3/18) certificates supplied.
Decontamination Procedures		Y	Section 5.1 Field method validation>Table 8 Field method validation>Decontamination of sampling equipment

Data Table 1: 2017 – 2018 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
			"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."
Sample Collection and Preservation Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 8 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection		Y	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of one per sampling event. A total of 11 primary samples and one duplicate groundwater sample pair were collected."* Duplicate, rinsate and trip blank were collected for both GME's.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters and analytes of concern to be monitored and the assessment levels to be used.	Y	Section 3.4 Assessment Criteria>Table 5 Groundwater assessment levels>On Site Measurements.
Laboratory Analysis		Y	Section 3.3 Analytes of Potential Concern "Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern": Metals, Nutrients, Inorganics, Total petroleum hydrocarbons, Monocyclic aromatic hydrocarbons.
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 5):* • *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* • *Jandakot Airport Holdings (2016) Groundwater Management Plan v5.5 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed.	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. This is not considered significant.

Data Table 1: 2017 – 2018 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed.	Y	Section 4 Field and Laboratory Analytical Results 2017-2018 Section 6 Discussion of Field and Laboratory Analytical Results and Trends
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 5.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."* NATA accreditation #2377 is stated on the laboratory test certificates.
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	**N**	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site.* Section 5.2.1 Duplicates RPD failures were stated for Sep-17 and Mar-18 and as they are <10 times the LoR are not significant. We concur that there is no issue. Section 5.2.2 Field and transport blanks An iron detection at the LoR is not significant. We concur that there is no issue. Section 5.2.3 Rinsate The presence of elevated metals in the rinsate for Mar-18 is indicative of tap water being used as the rinsate rather than deionised water. A suitable supply of laboratory prepared deionised water should be used. We do not concur with the conclusion the presence of compounds is related to a build-up of deposits based on the information provided.
Data Analysis			
Results discussion	Section 5.5.5 Reporting	Y	Section 6

Data Table 1: 2017 – 2018 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"		*"A general quantitative assessment has been undertaken based on historical data and trends".*
Trends		Y	Section 6.1 to Section 6.6 inclusive Discussion provided.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	Result tables have been provided.
Graphical presentation		Y	Charts have been provided. Graphical presentation of physicochemical parameters is not that important given the variability between sampling events; equipment used etc. Charts provided for other compounds is "noisy" due to the number of wells, possibly consider splitting the charts by area (ie upgradient, downgradient)
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	Y	Commentary regarding high Total P values in NW area of the site for Mar-18 attributable to high summer rainfall and landscaping/gardening. Possible if fertilisers had also been used but noted as Banksia woodland mulch in S6.4.2. Agree ongoing monitoring will confirm this.
Recommendations		Y	Generally, concur with recommendations other than 4th bullet point regarding cleaning of rinsate container. Elaboration on the rinsate procedure and source of water should be provided.
Figures and Appendices			
Figures		Y	Provided
Appendices		Y	Provided
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	
Reporting potential presence of contamination	Section 5.5.5 Reporting	N/A	No presence of contamination was noted.

Data Table 1: 2017 – 2018 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"		
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 2: 2018 – 2019 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring has since occurred (and will continue to) occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *"Any additional bores installed (including JAMB10 and JAMB11) will be sampled concurrently with the sampling regime established for JAMB1 – JAMB9 unless results warrant further investigation"*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2018 and March 2019".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Well Purging
Monitoring of physicochemical parameters		Y	*"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."* Data sighted not checked; 5-6 data measurements per purge for Sep-18 and 5-9 for Mar-19 (log form changed).
Field filtering		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."* Description of rinsate water not provided whereas field blank noted as DI water.
Instrument Calibration (Calibration certificates/records);		Y	Appendix F Calibration Certificate. Eco (21/9/18) and Eco (8/3/19) certificates supplied.
Decontamination Procedures		Y	Section 5.1 Field method validation>Table 8 Field method validation>Decontamination of sampling equipment

Data Table 2: 2018 – 2019 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
			"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."
Sample Collection and Preservation Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 8 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection		Y	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of one per sampling event. A total of 11 primary samples and one duplicate groundwater sample pair were collected."* Duplicate, rinsate and trip blank were collected for both GME's.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters and analytes of concern to be monitored and the assessment levels to be used.	Y	Section 3.4 Assessment Criteria>Table 5 Groundwater assessment levels>On Site Measurements.
Laboratory Analysis		Y	Section 3.3 Analytes of Potential Concern "Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern": Metals, Nutrients, Inorganics, Total petroleum hydrocarbons, Monocyclic aromatic hydrocarbons.
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 5):* • *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* • *Jandakot Airport Holdings (2016) Groundwater Management Plan v5.5 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed.	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. This is not considered significant.

Data Table 2: 2018 – 2019 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed.	Y	Section 4 Field and Laboratory Analytical Results 2018-2019 Section 6 Discussion of Field and Laboratory Analytical Results and Trends
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 5.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."* NATA accreditation #2377 is stated on the laboratory test certificates.
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	**N**	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site.* Section 5.2.1 Duplicates RPD failures were stated for Sep-18 and as they are <10 times the LoR are not significant. We concur that there is no issue. Section 5.2.2 Field and transport blanks A zinc detection just above the LoR in Mar-19 was noted. We consider there is no issue and that the source may have been the DI water itself. Section 5.2.3 Rinsate The presence of elevated metals in the rinsate for Sep-18 is indicative of tap water being used as the rinsate rather than deionised water. The rinsate for Mar-19 is what would be expected for DI water or similar. A suitable supply of laboratory prepared deionised water should be used. The reason for the detection is not elucidated, typo error in second paragraph should be September 2018 not 2019.
Data Analysis			

Data Table 2: 2018 – 2019 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Results discussion	Section 5.5.5 Reporting *"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"*	Y	Section 6 *"A general quantitative assessment has been undertaken based on historical data and trends".*
Trends		Y	Section 6.1 to Section 6.6 inclusive Discussion provided.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	Result tables have been provided.
Graphical presentation		Y	Charts have been provided. Graphical presentation of physicochemical parameters is not that important given the variability between sampling events; equipment used etc. Charts provided for other compounds is "noisy" due to the number of wells, possibly consider splitting the charts by area (ie upgradient, downgradient)
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	N	Commentary regarding elevated Total N as a function of clearing and release of stored nutrients in the rootstock. The comment is speculative and should be backed up with scientific evidence or additional investigations to prove that this could be a possibility. Commentary regarding high Total P values is inconclusive with a number of reasons provided. Speculation is provided that the source is a legacy contaminated site. Reference to Donn et al (2012) should be elaborated as to how it is relevant to the JAH site. Explanation of nutrients should be limited to factors that can be quantified and any conclusions deferred until such factors can be confirmed.
Recommendations		Y	Generally, concur with recommendations with the limitations noted regarding the trends with nutrients. We support the inclusion of phosphate however further elaboration as to why its inclusion will be interpretated for the next event would be useful.
Figures and Appendices			
Figures		Y	Provided
Appendices		Y	Provided
General			

Data Table 2: 2018 – 2019 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 3: 2019 – 2020 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring has since occurred (and will continue to) occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *"Any additional bores installed (including JAMB10 and JAMB11) will be sampled concurrently with the sampling regime established for JAMB1 – JAMB9 unless results warrant further investigation"*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2019 and March 2020".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Well Purging
Monitoring of physicochemical parameters		Y	*"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."* Data sighted not checked; 4-6 data measurements per purge for Sep-19 and 4-7 for Mar-20.
Field filtering		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."* Description of rinsate water not provided whereas field blank noted as DI water.
Instrument Calibration (Calibration certificates/records);		Y	Appendix F Calibration Certificate. Eco (16/9/19) and Eco (20/3/20) certificates supplied.
Decontamination Procedures		Y	Section 5.1 Field method validation>Table 8 Field method validation>Decontamination of sampling equipment

Data Table 3: 2019 – 2020 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
			"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."
Sample Collection and Preservation Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 8 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection		Y	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of one per sampling event. A total of 11 primary samples and one duplicate groundwater sample pair were collected."* Duplicate, rinsate and trip blank were collected for both GME's.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters and analytes of concern to be monitored and the assessment levels to be used.	Y	Section 3.4 Assessment Criteria>Table 5 Groundwater assessment levels>On Site Measurements.
Laboratory Analysis		Y	Section 3.3 Analytes of Potential Concern "Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern": Metals, Nutrients, Inorganics, Total petroleum hydrocarbons, Monocyclic aromatic hydrocarbons.
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 5):* • *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* • *Jandakot Airport Holdings (2019) Groundwater Management Plan v5.6 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed.	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. This is not considered significant.

Data Table 3: 2019 – 2020 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed.	Y	Section 4 Field and Laboratory Analytical Results 2019-2020 Section 6 Discussion of Field and Laboratory Analytical Results and Trends
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 5.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."* NATA accreditation #2377 is stated on the laboratory test certificates.
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	**N**	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site.* Section 5.2.1 Duplicates RPD failures were stated for both Sep-19 and Mar-20, and as they are <10 times the LoR are not significant. We concur that there is no issue. Section 5.2.2 Field and transport blanks A Total P detection just above the LoR in Mar-20 was noted. We consider there is no issue and that the source may have been the DI water itself. Section 5.2.3 Rinsate The presence of trace metals in the rinsate for Mar-20 is minor and may represent poor DI water quality. The rinsate for Sep-19 is what would be expected for DI water or similar. Clarification as to the rinsate methodology would be useful as it is stated *"The sample was collected directly from the rinsing water container at the end of the day of sampling…"*. Normal practice is to pour DI water over or through the sampling equipment.
Data Analysis			

Data Table 3: 2019 – 2020 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Results discussion	Section 5.5.5 Reporting *"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"*	Y	Section 6 *"A general quantitative assessment has been undertaken based on historical data and trends".*
Trends		Y	Section 6.1 to Section 6.6 inclusive Discussion provided.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	Result tables have been provided.
Graphical presentation		Y	Charts have been provided. Graphical presentation of physicochemical parameters is not that important given the variability between sampling events; equipment used etc. Charts provided for other compounds is "noisy" due to the number of wells, possibly consider splitting the charts by area (ie upgradient, downgradient)
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	N	Commentary regarding elevated Total N is clear and concise, we are in agreement that N is likely to be small plumes originating from adjacent lots. Commentary regarding high Total P values has been interpretated in more detail than previous GME's. Provision of Chart 12 is a useful attempt to show a correlation between groundwater levels and median Total P concentrations. The rationale should be included as to use of the median of all wells rather than those with consistent elevated P values. Elaboration of Donn et al (2012) would be helpful. The statement regarding phosphorous retention soils should be backed up with site specific data such as determining the PRI Index of JAH soils. The Department of Water Stormwater Management Manual for WA (2004-2022) states Bassendean Sands have a negligible PRI Index (<0.5). Discussion of Total P requires further evaluation. Overall, we agree with the conclusions and that nutrients are indicative of regional quality, but that further evidence is required to confirm Total P values are an artefact of rising groundwater levels.

Data Table 3: 2019 – 2020 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Recommendations		Y	Generally, concur with recommendations, inclusion of orthophosphate would assist in determining the ecological significance of elevated Total P concentrations. We support seeking advice from DWER regarding the correlation between Total P and groundwater levels.
Figures and Appendices			
Figures		Y	Provided
Appendices		Y	Provided
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 4: 2020 – 2021 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring has since occurred (and will continue to) occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *"Any additional bores installed (including JAMB10 and JAMB11) will be sampled concurrently with the sampling regime established for JAMB1 – JAMB9 unless results warrant further investigation"*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2020 and March 2021".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Well Purging
Monitoring of physicochemical parameters		Y	*"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."* Data sighted not checked; 4-7 data measurements.
Field filtering		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."* Description of rinsate water not provided whereas field blank noted as DI water.
Instrument Calibration (Calibration certificates/records);		Y	Appendix F Calibration Certificate. Eco (15/9/20) and Eco (3/3/21) certificates supplied.
Decontamination Procedures		Y	Section 5.1 Field method validation>Table 8 Field method validation>Decontamination of sampling equipment *"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."*

Data Table 4: 2020 – 2021 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sample Collection and Preservation Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 8 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection		Y	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of one per sampling event. A total of 11 primary samples and one duplicate groundwater sample pair were collected."* Duplicate, rinsate and trip blank were collected for both GME's.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters and analytes of concern to be monitored and the assessment levels to be used.	Y	Section 3.4 Assessment Criteria>Table 5 Groundwater assessment levels>On Site Measurements.
Laboratory Analysis		Y	Section 3.3 Analytes of Potential Concern "Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern": Metals, Nutrients, Inorganics, Total petroleum hydrocarbons, Monocyclic aromatic hydrocarbons.
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 5):* • *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* • *Jandakot Airport Holdings (2019) Groundwater Management Plan v5.6 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed.	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. This is not considered significant.
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed.	Y	Section 4 Field and Laboratory Analytical Results 2020-2021 Section 6 Discussion of Field and Laboratory Analytical Results and Trends

Data Table 4: 2020 – 2021 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 5.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."* NATA accreditation #2377 is stated on the laboratory test certificates.
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	N	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site.* Section 5.2.1 Duplicates RPD failure was stated for Mar-21, as it is <10 times the LoR are not significant. We concur that there is no issue. Section 5.2.2 Field and transport blanks A zinc detection at the LoR was noted for Mar-20 for both the field and transport blank. We consider there is no issue and that the source may have been the DI water itself. Section 5.2.3 Rinsate The presence of trace metals in the rinsate for Sep-20 is minor and may represent poor DI water quality. The rinsate for Mar-21 is higher than what would be expected for DI water or similar. As per the last AGMR clarification as to the rinsate methodology would be useful as it is stated *"The sample was collected directly from the rinsing water container at the end of the day of sampling…"*. Normal practice is to pour DI water over or through the sampling equipment.
Data Analysis			
Results discussion	Section 5.5.5 Reporting	Y	Section 6 *"A general quantitative assessment has been undertaken based on historical data and trends".*
Trends		Y	Section 6.1 to Section 6.6 inclusive

Data Table 4: 2020 – 2021 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"		Discussion provided.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	Result tables have been provided.
Graphical presentation		Y	Charts have been provided. Graphical presentation of physicochemical parameters is not that important given the variability between sampling events; equipment used etc. Charts provided for other compounds is "noisy" due to the number of wells, possibly consider splitting the charts by area (ie upgradient, downgradient)
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	**N**	Commentary regarding elevated Total N is different to the last AGMR with the first mention of the construction of a pump station in 2017 and that *"These significant changes in the upstream landscape coincide with the notable increase in total nitrogen concentrations at JAMB4"*. We concur that organic mulch can be a potential source of nitrogen in woodchip, the statement regarding JAM3B being part of the plume arising from JAMB4 will need to be checked following the next sampling events. Well JAM3B is ~1 km downgradient of JAMB4; based on a hydraulic gradient of 0.001 (1.2m/1000m) with an estimated K value of 30m/day (Department of Water Stormwater Management Manual for WA 2004-2022) and assumed porosity of 0.3 groundwater velocity would be 0.1m/day or 36m/year. Assuming no retardation factor groundwater would take some 30 years to travel between JAMB4 and JAM3B. On this basis the statement *"...the spike at JAM3B in March 2021 (which is likely a delayed effect downstream of JAMB4)"* is not valid. Commentary regarding high Total P values has been continued with provision of Chart 12 is a useful attempt to show a correlation between groundwater levels and median Total P concentrations. The rationale should be included as to use of the median of all wells rather than those with consistent elevated P values. Elaboration of Donn et al (2012) would be helpful.

Data Table 4: 2020 – 2021 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
			Previously information from DWER regarding the correlation between Total P was to be sourced which was not provided. Overall, we agree with the conclusions and that nutrients are indicative of regional quality, but that further evidence is required to confirm Total P values are an artefact of rising groundwater levels as postulated.
Recommendations		Y	Generally concur with recommendations and that the elevated TN and iron should be considered for the next AGMR.
Figures and Appendices			
Figures		Y	Provided
Appendices		Y	Provided
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.

Data Table 5: 2021 – 2022 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sampling Procedures			
Sample Methodology	Section 5.5.2 Sampling Frequency *"Ongoing biannual monitoring has since occurred (and will continue to) occur in March and September to coincide with the anticipated highest and lowest seasonal groundwater levels".* *"Any additional bores installed (including JAMB10 and JAMB11) will be sampled concurrently with the sampling regime established for JAMB1 – JAMB9 unless results warrant further investigation"*	Y	Section 3.2 Fieldwork procedures and quality assurance *"…undertaking fieldwork for the Jandakot Airport groundwater monitoring program September 2021 and March 2022".* *"Samples were collected from a network of eleven monitoring wells (JAMB1-11)."*
Appropriate sampling equipment/device used (e.g. pump type)	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Low-flow sampling techniques were used to obtain groundwater sample from all monitoring wells."*
Purged volumes/low flow sampling technique;		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Well Purging
Monitoring of physicochemical parameters		Y	*"Using low-flow sampling equipment, purging of each monitoring well was undertaken, until water quality parameters (pH, oxidative/reduction potential, temperature, electrical conductivity, dissolved oxygen) stabilised (i.e. three consecutive measurements with a difference of 3% or 10%, depending on field parameter)."* Data sighted not checked; 4-6 data measurements.
Field filtering		Y	Section 3.2 Fieldwork procedures and quality assurance>Table 4 Fieldwork objectives and procedures>Sampling Method *"Groundwater for analysis of dissolved metals were filtrated with 0.45um cellulose nitrate disposable filters."* Description of rinsate water not provided whereas field blank noted as DI water.
Instrument Calibration (Calibration certificates/records);		Y	Appendix F Calibration Certificate. Eco (23/9/21) and Eco (9/3/22) certificates supplied.
Decontamination Procedures		Y	Section 5.1 Field method validation>Table 8 Field method validation>Decontamination of sampling equipment *"All sampling equipment that was not disposable was decontaminated between sampling events using laboratory grade phosphate free detergent and rinsed with deionised (DI) water."*

Data Table 5: 2021 – 2022 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Sample Collection and Preservation Procedures	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	Y	Section 5.1 Field method validation>Table 8 Field method validation>Sample collection *"Dedicated disposable gloves and laboratory supplied containers were used."*
Quality Assurance/Quality Control (QA/QC) Sample Collection		Y	Section 5.2 Field and laboratory QA/QC data assessment *"Field duplicates were collected at a rate of one per sampling event. A total of 11 primary samples and one duplicate groundwater sample pair were collected."* Duplicate, rinsate and trip blank were collected for both GME's.
Laboratory Analysis			
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the field parameters and analytes of concern to be monitored and the assessment levels to be used.	Y	Section 3.4 Assessment Criteria>Table 5 Groundwater assessment levels>On Site Measurements.
Laboratory Analysis		Y	Section 3.3 Analytes of Potential Concern "Laboratory analysis was undertaken to identify and quantify the presence of the following analytes of potential concern": Metals, Nutrients, Inorganics, Total petroleum hydrocarbons, Monocyclic aromatic hydrocarbons.
Assessment Levels	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels List of the assessment levels to be used from Schedule 2, Airport Regulations 1997.	Y	Section 3.4 Assessment Criteria *"In accordance with the current Jandakot Airport GMP (JAH, 2016) groundwater quality results have been compared to the following guidelines and/or criteria (presented in Table 5):* • *Airport (Environmental Protection) Regulations (1997): Schedule 2: Water pollution – accepted limits.* • *Jandakot Airport Holdings (2019) Groundwater Management Plan v5.6 – Assessment Levels"*
Field Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>On-Site Measurements On site measurements analysed.	Y	Section 6.2 Physiochemical parameters Temperature was recorded within the field logs but not discussed in the report. This is not considered significant.
Laboratory Analysis	Section 5.5.3 Suite of Analytes and Assessment Levels>Table 1 – Ground Water Assessment Levels>Laboratory Analysis All required analytes analysed.	Y	Section 4 Field and Laboratory Analytical Results 2020-2021 Section 6 Discussion of Field and Laboratory Analytical Results and Trends

Data Table 5: 2021 – 2022 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
NATA Accreditation	Section 5.5.4 QA/QC *"Analysis of samples will be completed by laboratories which hold National Association of Testing Authorities (NATA) accreditation for the particular parameters and methodologies needed."*	Y	Section 5.2 Field and laboratory QA/QC data assessment *"Groundwater samples (including field QC samples) were submitted to ARL (WA) laboratory. ARL (WA) laboratory is a NATA accredited for the laboratory analyses performed."* NATA accreditation #2377 is stated on the laboratory test certificates.
Quality Assurance and Quality Control Results Analysis			
Field Outliers Laboratory Outliers	Section 5.5.4 QA/QC *"All monitoring is to be undertaken using the appropriate applicable field and laboratory QA/QC procedures (e.g. AS 5667)."*	N	Section 5.3 QA/QC summary *"The field method validation and laboratory QA/QC measures employed throughout the assessment have enabled the quality of field sample collection and laboratory analysis procedures to be examined. Based on the information detailed above, the data is considered of acceptable quality for interpretation and environmental assessment of the site.* Section 5.2.1 Duplicates RPD failure was stated for Sep-21 (typo dated Sep-22) is >10 times the LoR for Fe and thus significant from a QA/QC perspective. We concur that there is no issue given it is below the assessment level. Section 5.2.2 Field and transport blanks Total acidity was detected above the LoR was noted for Mar-22 for both the field and transport blank. We consider there is no issue and that the source may have been the DI water itself. Section 5.2.3 Rinsate The presence of trace metals in the rinsate for Sep-21 is minor and may represent the DI water quality. As per the last AGMR clarification as to the rinsate methodology would be useful as it is stated *"The sample was collected directly from the rinsing water container at the end of the day of sampling…"*. Normal practice is to pour DI water over or through the sampling equipment.
Data Analysis			
Results discussion	Section 5.5.5 Reporting	Y	Section 6 *"A general quantitative assessment has been undertaken based on historical data and trends".*
Trends		Y	Section 6.1 to Section 6.6 inclusive

Data Table 5: 2021 – 2022 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
	"Results, including interpretation, tabular and graphical reporting of results, analysis of long term trends and comparison with A(EP)R Schedule 2 and any other relevant regional data that is available from the DoW and/or Water Corporation"		Discussion provided.
Regional data		Y	Section 6.1.1. Groundwater Elevation
Tabular presentation		Y	Result tables have been provided.
Graphical presentation		Y	Charts have been provided. Graphical presentation of physicochemical parameters is not that important given the variability between sampling events; equipment used etc. Charts provided for other compounds is "noisy" due to the number of wells, possibly consider splitting the charts by area (ie upgradient, downgradient)
Conclusions and Recommendations			
Conclusions	Section 5.5.5 Reporting *"Conclusions and recommendations, including recommended changes to the sampling plan and/or assessment levels"*	Y	Commentary regarding high Total P values linked to the elevated groundwater level is stated as per the previous AGMR. The chart showing the relationship was not provided for this AGMR. It is noted two wells JAMB1 and JAMB9 recorded their highest P values. The reason for the significant increase in JAMB1 is not alluded to and it is downgradient of airport land rather than an offsite source such as JAMB9. Previously information from DWER regarding the correlation between Total P was to be sourced which was not provided. Overall, we agree with the conclusions and that nutrients are indicative of regional quality, but that further evidence is required to confirm Total P values are an artefact of rising groundwater levels as postulated in earlier AGMR.
Recommendations		Y	Generally, concur with recommendations and that Total P should be reviewed after the September 2023 GME.
Figures and Appendices			
Figures		Y	Provided
Appendices		Y	Provided
General			
Report completed date	Section 5.5.5 Reporting *"The Annual Monitoring Report will be submitted by 28 October each year to the Key Stakeholders…"*	Y	

Data Table 5: 2021 – 2022 AGMR Review			
Audit Criteria	**GWMP Criteria**	**Conformance (Y/N)**	**Comments**
Reporting potential presence of contamination	Section 5.5.5 Reporting *"Monitoring results (field or laboratory) that indicate the potential presence of contamination (as determined by the professional consultants engaged to undertake the monitoring program) must be reported to JAH immediately (i.e. within 72 hours of results becoming available) so as necessary action can be agreed upon and implemented"*	N/A	No presence of contamination was noted.
Groundwater monitoring results	Section 5.5.5 Reporting *"…maintained on an electronic database that will be updated by the professional consultants engaged to undertake the monitoring program. The updated electronic database will be provided to the JAH Environment Manager along with an interim GME report (summarising any exceedances or issues from the previous monitoring event) within 8 weeks of the sampling event."*	Y	Both quarterly interim reports were submitted within 8 weeks.