LOCAL WATER MANAGEMENT STRATEGY

Project Name:	Lot 311 Fifty Road, Baldivis
Project Nº:	PC14057
Client:	ALLERDING & ASSOCIATES
Date:	October 2014

Cnr Goodwood Pde & Vivian St
Burswood WA 6100

PO Box 134
Burswood WA 6100

T 08 6336 9299
F 08 6336 9288

E enquire@peritasgroup.com.au
www.peritasgroup.com.au

Prepared by:	Enzo Biagioni-Froudist
Position:	Principal, Civil
Signed:	
Date:	01/10/2014

Approved by:	Enzo Biagioni-Froudist
Position:	Principal, Civil
Signed:	
Date:	01/10/2014

Revision	Description	Author	Checked	Approved	Date
0	First issue	EBF	EBF	EBF	1/10/2014

Recipients are responsible for eliminating all superseded documents in their possession.

Peritas Group Pty Ltd
ABN: 56 165 417 407
74 Goodwood Parade
Burswood WA 6100

PO Box 134,
Burswood WA 6100

Telephone: +61 8 63369299

Facsimile: +61 8 63369288
Internet: www.peritasgroup.com.au

EXECUTIVE SUMMARY

This document details the Local Water Management Strategy (LWMS) for the development of lot 311 Fifty Road.

The subject land is bounded by Fifty Road to the north Eighty Road to the east and undeveloped land to the remaining borders and is zoned Development under the City of Rockingham Town Planning Scheme No 2 (the Scheme).

The subject land is within an endorsed structure plan area which provides for more than 200 residential dwellings. That structure plan was endorsed by the City of Rockingham in December 2013 and is presently being considered by the Western Australian Planning Commission.

The land presently contains vegetation and does not have any known historic land use. The proposed structure plan provides for future urban residential development to a density of R20 with pockets of higher density and grouped housing, public open space and drainage areas and a commercial site.

The abutting land is similarly zoned Development and is also subject to recent submission of structure plans for urban development and local water management strategies. The Spires Estate surrounds the subject land to the east, west and south. A local water management strategy and structure plan for the Spires Estate has recently been approved by the Western Australian Planning Commission.
The Local Water Management Strategy (LWMS) for Lot 311 follows similar principles and provides an appropriate mechanism to ascertain broad level designs and management measures for flood mitigation and stormwater management at structure planning level and is a key support document for the Local Structure Plan for Lot 311. It has been devised with the intention of providing a structure within which subsequent development can occur, consistent with an integrated urban water (total cycle) management approach. It also intends to provide overall guidance to stormwater management, to incorporate appropriate Best Management Practices (BMPs) that consider environmental constraints and to guide future Urban Water Management Plans (UWMPs) in support of subdivision approval. Finally it has been compiled to gain support from the Department of Water, the City of Rockingham and the Western Australian Planning Commission for the proposed method to manage and treat stormwater flows.
This section provides a summary of the design strategy with details on how the design objectives are to be achieved. As such it describes briefly the critical elements particularly at the control points and highlights key management practices. A number of site-specific assessments into various aspects were undertaken. In summary, the investigations concluded that:

- The site is well graded and gently slopes from a high point at the north closer to Fifty Road to its surroundings. The lowest point of the site is located on the southwest corner of the site along Eighty Road. Elevations vary between 6.0M AHD and 15.0m AHD (Australian Height Datum).
- Urban residential developments surround Lot 311 which is zoned *Urban* under the Metropolitan Region Scheme and "Development" under the City of Rockingham Town Planning Scheme No 2 but comprises a predominantly rural residential land use.
- The geology is predominantly Bassendean sands over Tamala Limestone formation.
- There are no contaminating land uses within Lot 311.
- The northern portion of the site is identified as no known risk of Acid Sulphate Soils and the southern portion of the site is identified as moderate to low risk. The immediate surrounds do not contain any high risk acid sulphate soils.

The ever increasing demands for potable water sources necessitate consideration of water conservation and efficiency measures. Demand can be managed by minimizing consumption, maintenance of public open spaces and net use of water by maximising surface infiltration. However, the largest contribution to water savings can be made at lot level by using water efficient devices and appliances by creating water wise gardens.
The stormwater management strategy and design concepts for Lot 311, consistent with the principles of Water Sensitive Urban Design as well as the design principles and objectives detailed in this document, entail:

- There will be no lot drainage connections to the road drainage network. Lots will infiltrate roof runoff via onsite soak wells to retain the 1-year 1-hour ARI event at lot level to reduce direct runoff to the street conveyance system; this will increase detention periods and minimise peak flow rates.

- Provide pipes within the road reserve to convey runoff from storm events up to the 5-year ARI event discharging to the infiltration basins. Larger events will be conveyed to the basins as overland flow within the road reserves in addition to the pipe drainage.
- Provide adequate storage to store the attenuate post-development flows to pre-development conditions.
- Discharge to receiving environment via soakage basins ensuring that flow rates and water qualities are within the design limits.

This treatment train will ensure that the stormwater that reaches the contained catchments within Lot 311 will be of a high standard. Structural and non-structural best management practices (BMP's) are employed in combination to achieve the required stormwater treatment outcomes:

Scale	Ownership	Best Management Practice: Water Quantity and Quality
Lot	Lot owner	Soakwells, waterwise gardens and amended soils
Street	Local Authority	Sediment traps
Catchment		Compensating and storage basins in POS with waterwise landscaping

To develop a relevant stormwater management strategy for Lot 311, hydrological modelling was undertaken. Preliminary hydrological calculations using the Urban Rational Method were undertaken to calculate pre-development flows. These calculations were subsequently used to calibrate the hydrological model.
Lot 311 has been subdivided into five distinct catchments using the Local Structure Plan, topographic elevations and locations:

- Catchments 1, 2, and 3 all drain via a conventional pipe and road drainage system into infiltration basins designed to contain and infiltrate up to the 1 in 100 year ARI rainfall event.
- The Nairn Road Catchment is contained within central median swales and below ground storage.
- A small catchment in the north-eastern corner of the site is catered for in the Spires LWMS but is shown as contained within the Lot 311 precinct via soakage swales and below ground storage located within the Eighty Road reserve area.

Post development catchment and basin infiltration areas are in similar proximity to areas where pre-development infiltration would have occurred, hence pre and post conditions are maintained. All storm events from the major catchments will be contained within the infiltration basins hence there will be no post development discharge from these catchments other than via infiltration.
All basin inverts are significantly greater than 0.3m separation distance requirements from groundwater.

The volumes of runoff that are to be retained are:

Catchment	Catchment Gross Area (ha)	POS Area Containing Basin (m2)	ARI	TWL (mAHD)	Storage Volume (m^3)	Surface Area at TWL (m^2)	Basin Details	
							Base Level (m AHD)	Side Slope (v:h)
1	8.355	12,300	1-yr	RL8.73	291	1248	RL8.50	1:6
			5-yr	RL9.00	619	1248		
			100-yr	RL9.30	1,502	1,845		
2	3.423	560	1-yr	RL5.80	136		RL5.55	1:6
			5-yr	RL6.07	292			
			100-yr	RL7.00	711	560		
3	1.046	1,038 (Below grd cells)	1-yr	RL5.74	33	240	RL5.60 (base of cells)	N/A
			5-yr	RL5.92	77	240		
			100-yr	RL6.41	194	240		
4 - Eighty RD (NE)	0.698	Below ground storage in road verge	1-yr	N/A	16	250	Varies	1:6
			5-yr	N/A	42	250		
			100-yr	N/A	114	250		
Nairn Rd	1.588	Below ground storage in median and swales	1-yr	N/A	21	N/A	Varies	N/A
			5-yr	N/A	71	N/A		
			100-yr	N/A	218	N/A		

In view of the above it may be concluded that the stormwater management design for Lot 311 meets the objectives of WSUD and is consistent with *Better Urban Water Management*. It demonstrates proof of concept in accordance with the design criteria set for Lot 311.

A minimum separation distance of 1.2m between finished lot surface levels and the AAMGL is to be provided. Based on current site levels the minimum separation distance to groundwater available is greater than 5.0m.

Whilst strategies have been devised that address planning for stormwater management, several areas have been identified that will require additional more detailed investigation to ensure that subdivision designs are realistically achievable. The main areas that will require further detail within the future UWMP include:

- Demonstrate compliance with design objectives and criteria to the satisfaction of City of Rockingham and DoW to be achieved through appropriate assessment tools, calculations and assessments.
- Detailed agreed/approved methodologies for implementation of water conservation strategies.
- Detailed geotechnical investigations including determination of the Phosphorus Retention Index (PRI) and *in situ* permeabilities of the soils.
- Detailed ground water monitoring to ascertain the validity of the preliminary AAMGLs.

- Detailed earthworks and stormwater management design including the size, location and design of public open space areas and integrated flood management capability.
- The existing ground water abstraction licence allocations to be maintained for both construction and irrigation water for the POSs.
- The landscape concept is to be developed to take due cognisance of water conservation strategies and stormwater management.
- Acid Sulfate Soil and Dewatering Management Plans are to be submitted to the DEC and the DoW for the necessary approvals and license applications prior to construction.
- Detailed monitoring and evaluation programs, targets for ground and surface water quality, flows and levels that are to be maintained post development.
- Construction management and management of subdivisional works (to ensure no impact on the regional drainage system, management of soil treatment, dewatering, dust, hazardous materials and waste).
- Ongoing management and maintenance requirements including the roles and responsibilities of each stakeholder should be negotiated.
- Implementation of the UWMP including roles, responsibilities, funding and maintenance arrangements.

This document provides a framework to assist in establishing stormwater management methods that have been based upon site-specific investigations and are consistent with relevant State and Local Government policies. The responsibility for working within the framework rests with the individual landowners and the Proponent although it is anticipated that the UWMP will be developed in consultation with the DoW and City of Rockingham.

CONTENTS

Appendix

Attachments

1. APPROVED STRUCTURE PLAN
2. ADJACENT LAND USES
3. CONTOUR PLAN ON AERIAL
4. TOPOGRAPHY, SOILS AND LANDFORM
5. ACID SULPHATE SOILS
6. WETLAND MAPPING
7. GROUND WATER CONTOURS
8. GROUND WATER LICENSE

1. INTRODUCTION

This Local Water Management Strategy addresses water usage, groundwater and stormwater management for this site.

This has been prepared in accordance with the design objectives outlined in "*Better Urban Water Management*" (2008) and seeks to:

- Maximise water conservation by minimising the amount of potable water used outside of homes and buildings to achieve efficient use of scheme water;
- Provide water quality management by seeking to maintain post development annual discharge volumes and peak flows to predevelopment conditions and seeking to maintain the surface water and ground water quality to pre development levels; and
- To ensure the development does not introduce a health risk from mosquitoes in stagnant water

This site is identified in the North Baldivis District Structure Plan as an area for future urban growth. The District Structure Plan was adopted by Council on 2000.

The site is zoned "Urban" under the Metropolitan Region Scheme and "Development" under the City of Rockingham Town Planning Scheme No 2.

The Baldivis (North) District Structure Plan identified the site as predominantly residential, with public open space along Eighty and some commercial land.

2. PROPOSED DEVELOPMENT

The subject land is zoned Development under the City of Rockingham Town Planning Scheme No 2 (the Scheme). In accordance with clause 4.2 of the Scheme, a structure plan was prepared for lot 311 Fifty Road, Baldivis to guide future development. The structure plan provides for more than 200 residential dwellings. That structure plan was endorsed by the City of Rockingham in December 2013 and is presently being considered by the Western Australian Planning Commission.

A copy of the Structure Plan endorsed by the City of Rockingham is included as Attachment 1.

The land presently contains vegetation and does not have any known historic land use. The proposed structure plan provides for future urban residential development to a density of R20 with pockets of higher density and grouped housing, public open space and drainage areas and a commercial site.

The abutting land is similarly zoned Development and is also subject to recent submission of structure plans for urban development and local water management strategies. The Spires Estate surrounds the subject land to the east, west and south. A local water management strategy and structure plan for the Spires Estate has recently been approved by the Western Australian Planning Commission.

A plan detailing existing adjacent land uses is included in Attachment 2.

3. PRE DEVELOPMENT ENVIRONMENT

3.1. Site Topography

The subject land is currently vacant and not cleared of vegetation. It also does not appear to have been used for agricultural activities previously.

The site is well graded and gently slopes from a high point at the north closer to Fifty Road to its surroundings. The lowest point of the site is located on the southwest corner of the site along Eighty Road.

Levels across the site range from RL 15m AHD (Australian Height Datum) to RL 6m AHD. Refer to the existing contour plan based on aerial photography is attached as Attachment 3.

3.2. Geology and Soils

Whilst a formal Geotechnical investigation was not undertaken for this report, a desktop study utilising existing Geological Maps was used for a global review of general soil conditions.

Geology and Soil Description

Reference to the Rockingham Geological Survey Map series indicates that the primary soil condition for the area is classified as Sand (S7 & S8) overlaying Limestone (LS1).

The S7 Sand is classified as Cottesloe Sands, describes as pale yellowish brown, medium to coarse grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.

The S8 Sand is classified as Karrakatta Sands, being very light grey at surface, yellow at depth, fine to medium-grained sub-rounded quartz, moderately well sorted and of eolian origin. The S8 Sand layers may be found at depths ranging between RL5 to RL 45 AHD. The permeability of the sand unit (S8) is likely to be high according to the physical properties listed in

the General Features for the material. The S8 Sand is described as well drained and drainage disposal is only problematic in areas of high ground water table.

The LS1 Limestone is classified as of Tamala Limestone Sand (Qtl) and of Safety Bay Sand (Qhs) in part in origin, being pale yellowish brown, fine to course-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, and of eolian origin. The LS1 Limestone layers may be found at depths ranging between R.L.0 to R.L.60 AHD. The permeability of the sand unit (LS1) is likely to be high according to the physical properties listed in the General Features for the material. The LS1 Limestone is described as having variable bearing capacities depending on the degree of cementation. Common solution cavities and fissure could lead to severe settlement under load and also offer an easy path for pollutants to the water table.

For further reference, please refer to the Geological & Geomorphology Plan and the soil profile attached as Attachment 4.

Phosphorous Retention Index (PRI)

Phosphorous in stormwater is removed through the binding of the particles to the iron and aluminium hydrous oxides within the soil (Beek 1979). Once the upmost soil particles become saturated, phosphorous will leach through the sand to the next soil layer where they will become fixed. This method of adsorption allows for the phosphorous to be removed from the stormwater prior to infiltrating into the groundwater.

The rate of adsorption to the soil varies depending on the type of soil and depth of the soil layer. A higher PRI indicates that the soil has a higher capacity for retaining phosphorous, and the deeper the soil, the greater the fixation availability.

Lot 311 also has a minimum separation of 5m to groundwater making conditions on site ideal for nutrient removal. Based on the geology, Table 1 below suggests that lot 311 soils would have a PRI of between 2 and 20mL/g.

Table 1 Relative Permeability and Phosphorous Retention Index (PRI) for various substrates.

Substrate	Permeability (m/day)	PRI (mL/g)
Bassendean Sands	30+	0 - 0.5
Karrakatta Sands	10+	2 - 4
Cottesloe Sands	10+	5 -1 2
Crushed limestone or lime sands	2-5	5 - 20
Natural clay or loam soils	<0.4	30 - 1,000+

Source: Department of Environment and Conservation

This is further supported by the PRI Mapping of the Peel-Harvey catchment area (EPA, 200*) which indicates that the site is located within soils with a PRI 5-20mL/g. Table 2 below indicates the range and effectiveness of adsorption for varying PRI results, which demonstrates that the site is moderately adsorbing of phosphorous.

Table 2 PRI Fixation Properties

PRI (mL/g)	Description
Negative	desorbing
0–2	weakly adsorbing
2–20	moderately adsorbing
20–100	strongly adsorbing
>100	very strongly adsorbing

Source: Department of Agriculture and Food

Acid Sulphate Soils

The northern portion of the site is identified as no known risk of Acid Sulphate Soils and the southern portion of the site is identified as moderate to low risk. The immediate surrounds do not contain any high risk acid sulphate soils. Refer Attachment 5 for Acid Sulphate Soil mapping.

3.3. Environmental

The site does contain existing native vegetation and a tree survey will be undertaken prior to subdivision.

Wetlands

There are no mapped wetlands within the site. Wetland mapping showing the site and its surrounds is provided in Attachment 6.

Floodplains

The site is not located within a floodplain.

Contaminated Sites

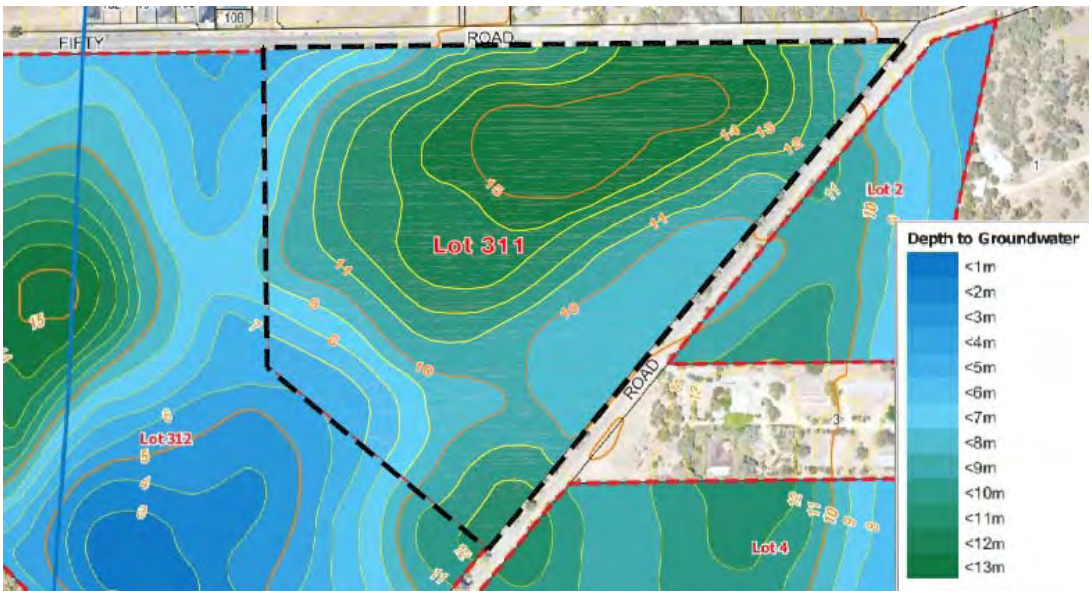
The site is not recorded as a contaminated site. Given the site contains native vegetation and has not had any historic land uses it is considered that the site is not contaminated.

3.4. Ground Water Level

Preliminary advice from the Perth Groundwater Atlas indicates that the nominal groundwater level is at RL 2m AHD with 0.5m to 3m fluctuation due to seasonal variation and flows westwards. A groundwater contour plan annotated with separation distances to groundwater is attached in Attachment 7.

Separation to groundwater on all part of the site exceeds 5.0m. Refer to the blow excerpt for the plan in appendix 7 that shows the relative depths to groundwater across the site. Finished earthworks will not dramatically reduce this separation in the lowest parts of the site and in any case would be kept to a minimum clearance of at least 1.2m

Formal geotechnical investigation will be undertaken to confirm ground water levels at the subdivision stage of development.



4. WATER SUSTAINABILITY INITIATIVES

The site will be developed as a "waterwise" project with water conservation strategies for household use, irrigation and landscaping of the public open space.

4.1. Water Efficient Measures

4.1.1. Public Open Space

The public open space will include areas of retained vegetation, passive and active open space areas as well as drainage swales and reserves. Much of the landscaping will be existing endemic and native plants. Any introduced landscaping will incorporate locally native species in order to minimise water usage. Reticulation to the active public open space areas will be in the form of irrigation spray system.

The irrigation schedule for the public open space will be based upon the monthly climatic variations, on site characteristics and vegetation type. All works associated with landscaping and irrigation of the public open space will be carried out by a contractor with experience in waterwise concepts.

A groundwater abstraction licence has been lodged for the irrigation of the public open space. That licence has now been granted by the Department of Water and a copy is provided as Attachment 8 to this report.

The total public open space across the site is 1.3487 hectares. Using the state *Guidelines for the Establishment and Maintenance of turf and Grassed Areas* as a base, a rate of 7,500 kL/Ha/annum has been assumed which equates to 10.115 kL per annum.

The Water Bore Licence that has issued is for an allocation sufficient for both for construction water and POS irrigation. A copy of the groundwater is attached in Attachment 8.

4.1.2. Household water efficiency

Households will be required to comply with the 5Star Plus Codes; Energy Use in Houses Code and Water Use in Houses Code, published by the Department of Housing. The following mandatory requirements will be the responsibility of the landowners:

- A hot water system with a minimum of 5 star WELS rating;
- Fittings and fixtures are to have a minimum of 3 or 4 WELS star rating;
- Where practicable, hot water outlets are to be located as close as possible to the hot water system;
- New homes are to be designed to enable connection to an alternative water supply; and
- New homes are to be designed to enable connection to a grey water recycling system in the future.

4.1.3. Waterwise Landscaping

All landowners will be provided with a landscape package for front gardens including waterwise species and a water conservation irrigation package. The aim of this incentive is to reduce use of potable water for irrigation purposes.

4.1.4. Water Conservation Education

The land sales office will contain information of water saving initiatives in terms of the houses but also an explanation of the local stormwater strategy such that they understand how they can help to improve water quality and minimise the use of potable water.

4.2. Water Supply

Potable water for dwellings will be supplied from the existing main along Eighty Road.

4.3. Waste Water Management

All wastewater will be disposed of via connection to the mains sewerage system. A 375mm diameter gravity sewerage main extends to the north west corner of the subject site. In addition, this 375mm pipeline will be extended through the subject site in the near future.

As detailed in Section 4.1.2 new homes are to be designed to enable connection to a grey water recycling system in the future.

5. STORMWATER MANAGEMENT STRATEGY

5.1. Existing Site Drainage

Lot 311 Fifty Road, Baldivis currently drains rainfall runoff from the highest point at the northern section of site to the southeast and southwest low points. Two smaller catchments within the proposed development area also drain towards the northwest and northeast respectively to Fifty Road roadside table drains.

Based on a desk top study and site investigations, there are no known permanent water bodies on the subject site and all overland runoff is catered for by ground infiltration to recharge the site's ground water table. During major storm events it has also been reported that the stormwater surcharge from the site overflows southwards to adjacent Lot 312 and further to the Rockingham Lakes Regional Park stormwater system.

It should be noted that the urban zoned land north of Lot 311 has a dedicated regional drainage basin which could be utilised for either minor and or major storm flow events to be directed via a piped system to the north western corner of Lot 311.

5.2. Council Requirements

Preliminary discussions with the Shire of Rockingham indicate that the design philosophy for stormwater drainage in the area is to ensure:

- Sufficient flood control freeboard to the proposed residential housing floor levels; and
- That downstream discharge from the proposed urban development is limited to predevelopment conditions. Additional stormwater that will be generated on site due to the post urban development is to be retained and managed on the site using alternative measures to an end of pipe solution.

To achieve this, and in unison with a stormwater drainage piped system, other stormwater management facilities such as gross pollutant traps, soakaways, swales and compensation basins with nutrient stripping capability will be provided to assist in the attenuation of stormwater runoff prior to discharge to downstream outlets where appropriate.

In unison with the above City of Rockingham's requirements, the Department of Environment (DOE) current urban development stormwater management policy is to encourage low frequency runoff events to be treated and stored in drainage swales/compensation basins for subsequent ground water infiltration. For maximum storm events flood routes are to be provided to stormwater drainage outfalls.

Refer to Appendix C for Stormwater Collection, Storage/Treatment Principles and Examples showing the integration of the drainage philosophy and the landscape strategy utilizing living stream systems and a treatment train approach to stormwater management.

5.3. Proposed Stormwater Management System

The stormwater management system for Lot 311 Fifty Road, Baldivis will consist of:

1. Optimised layout of sub catchment drainage areas within Lot 311;
2. Road side kerb guttering to collect surface runoff;
3. Road side kerb entry gullies that will direct surface runoff to a dedicated gravity drainage system;

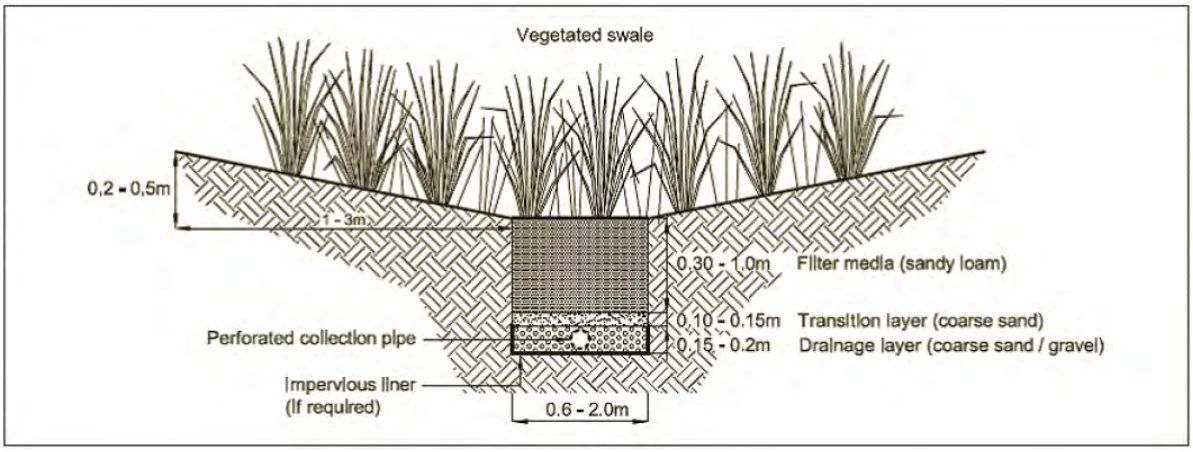
4. Construction of a drainage pipe network which will convey storm flows to a dedicated swale or compensation basin on the site ;

5. Gross pollution traps will be strategically located prior to the swales/compensation basins to capture screenings and plastics;

6. Bubble Up structure to allow stormwater entry from the drainage pipes to dedicated swales in the road reserves and compensation basins within the POS and drainage reserve (both the road reserve swales and compensation basins shall consider urban sensitive design and are to incorporate appropriate landscaping to promote nutrient stripping and bio filtration- i.e. treatment train); and

7. Any extreme storm event overflows within the Lot will be directed overland to either Lot 312 / Rockingham Lakes Regional Park stormwater system and to the dedicated regional drainage basin in the north west corner.

Figure 1. Proposed Design of Bio-retention swale. After DoW (200%)



5.4. Proposed Catchments Drainage Layout

The Stormwater Management Plan for the site showing the proposed development and proposed drainage catchments are shown in Appendix D. The plan has been prepared following consideration of the proposed development and proposed stormwater treatment measures.

The proposed stormwater management sub catchments within Lot 311 consist of:

- Catchment 1 (Eastern catchment – 8.355 hectares)
- Catchment 2 (Western catchment- 3.423 hectares)
- Catchment 3 (North west catchment & group housing-1.046 hectares)
- Catchment 4 (North eastern catchment- 0.698 hectares)
- Nairn Road Reserve Catchment – 1.588ha

5.5. Design Concept

The main objective of the design approach to be adopted for Lot 311 is to minimise stormwater conveyance after collection, and maximise the amount of stormwater which can be locally recharged and managed by direct infiltration to the superficial aquifer, in accordance with Department of Water (DOW) urban water management objectives. This in turn reduces the potential for entrained contaminants to be exported from the site in surface runoff to receiving water bodies, thereby reducing the risk of poor water quality in the downstream systems.

The urban development's roof runoff will generally infiltrate on site on individual allotments that have sufficient sand fill or collected and piped to street drainage. Allowance has been made in the stormwater infiltration swale and basin sizing for these additional contributing flows.

The drainage system upstream of the stormwater treatment train will consist of:

- Concrete drainage pipe network. The drainage pipes and pits will be designed and constructed in accordance with Local authority standards (typically to contain 1 to 5 year ARI flows)
- Overland flow paths for major flows during severe storms. These flows will generally travel along roads and will convey peak flows up to 100 year ARI storm event.

All storm flows up to and including the 1 in 100 year storm will be directed to either the compensation basins and /or swales located throughout the site. The on-site retention and infiltration basin/swales will include an acceptable treatment train to strip nutrients which will help to limit the impact of the development upon the surrounding catchments water quality.

5.6. Proposed Stormwater Conveyance System

All roads within the development area shall be kerbed and provided with a conventional pipe drainage network consisting of collector gullies, manholes, drainage pipes and controlled outfalls to convey rainfall runoff to either compensation basins and/ or swales in accordance with the Australian Rainfall & Runoff Guidelines and the City of Rockingham's design criteria and standards.

Where utilised, the stormwater piped network will terminate into a bubble-up arrangement within the proposed swales or dry compensation (soakage) basins which shall be located within either the Public Open Space or drainage reserves being provided within the development area. The proposed stormwater retention and infiltration basin /swales that will be incorporated within the development area will be landscaped where feasible to encourage nutrient stripping and natural filtration of the stormwater drainage. These swales/basins will also incorporate water sensitive design and quality principles.

Any surcharge beyond the major storm event not contained within the proposed swales/soakage basins shall be directed and overflow into the adjacent Lot 312 and further into the Rockingham Lakes Regional Park system. Where feasible, any major storm event which cannot be contained within the north western portion of Lot 311 will be directed to the dedicated regional storage basin.

5.6.1. Storage /Infiltration Basins

A combination of swale/ compensation basin designs will be adopted for the specified drainage sub catchment areas within the proposed development area.

For the north eastern catchment it is proposed to build a shallow vegetated stormwater infiltration swale adjacent to north-eastern road reserve corridor along Fifty Road and Eighty road (Catchment 4) or alternatively below ground storages by way of stormtech cells or equivalent. The storage will be designed to contain up to the 1-in-100 year ARI event associated with runoff from streets and verges within the site. Side slopes in each swale will be a maximum of one vertical in four horizontal for safety and ease of maintenance. The maximum depth of water in each swale is planned not to exceed 0.6 metres.

Compensation basins are planned for catchment 1 and catchment 2 respectively and will be located within the public open spaces being provided. Depths within the compensation basins will generally be no deeper than 0.6 metres and side slopes ranging from 1 to 4 and 1 to 6.

For catchment No 3 a dedicated underground storage system (similar to the Atlantis cells design) shall be used due to limited space being available.

5.6.2. Proposed Treatment Train System

The proposed treatment train systems that take surface water from roads may include gross pollution traps such as sedimentation ponds at entry zones, storage ponds, drop structures and riffle zones to ultimately discharge into recharge/soakage basins at low points in the POS design. These will be landscaped to ensure sustainable efficiency and have a secondary passive recreation use.

The location of these features is shown on the Stormwater Master Plan / Stormwater Management Plan in Appendix D

5.6.3. Storage Volumes

The post development stormwater runoff will be contained on site for all storm events up to the 1 in 100yr storm. Table 1 below summarises the storage volumes required in each sub catchment and are based on a ground infiltration rate of 0.0005m/s per square metre. The ground infiltration rate will need to be verified by detailed geotechnical investigations which are planned for the design development phase.

Table 1: Capacity of Detention Swales /Basins -				
LOCATION	STORAGE MAXIMUM PER EVENT (m^3)			STORMWATER QUALITY IMPROVEMENT DEVICE PROPOSAL
	1:1 years	1:5 years	1:100 years	
Eastern Catchment (Catchment 1)	291	619	1502	GPT, Swales and/or Dry Soakage Basins
Western Catchment (Catchment 2)	136	292	711	GPT, Swales and /or Dry Soakage Basins
North Western Reserve (Catchment 3)	33	194	208	Below ground storage within Mixed use site (within easement)
North Eastern Catchment (Catchment 4)	16	42	114	Roadside swales and/or below ground storages where feasible
Nairn Road Reserve Catchment	21	71	218	Swales or below ground storages designed to 1 in 10 year events

The design incorporates aspects of water sensitive design through the use of dry infiltration swales and basins & potentially flush-kerbed roads adjacent to areas of public open space.

As discussed in previous sections, the existing development to the north of Fifty Road has incorporated a regional drainage basin within their public open space.

The small catchment (Catchment 4) in the north-west corner of subject land parcel can be accommodated on the land by use of "Atlantis Cell" or stormtech cells below ground storage systems.

Alternately this could be discharged to the regional open space as the amount of storage required from the area is relatively small.

5.7. Stormwater Summary

In conclusion the proposed Stormwater Management Plan for Lot 311 Fifty Road, Baldivis to meets all of the design criteria, including:

- The proposed stormwater system consists of a network of piped drains and landscaped overland flow paths draining through a stormwater treatment system consisting of GPTs, sedimentation ponds, wetland and water features;
- Stormwater treatment will exceed Best Practice objectives for reductions in pollutants;
- Water Sensitive Urban Design (WSUD) integrates the stormwater system into the proposed development;
- The local street drainage system will be constructed to Local authority standards;
- There will be sufficient flood freeboard to housing floor levels as prescribed in section 2.0 of this report.
- Maintenance, lifecycle and safety issues have been considered in the design of the stormwater system;
- Flows above the retained maximum flood events will be controlled by careful placement of outlets from the site to existing downstream drainage systems (natural or installed by other development);
- External catchments have not been included in stormwater treatment analysis; and

- Flood flows from external catchments have not been considered in this report other than to recognise that they exist and will be considered in the final development analysis design

6. GROUNDWATER MANAGEMENT STRATEGY

6.1. Ground Water Levels

The ground water level is expected to well below natural surface (as illustrated on the plan in Attachment 6). Site drainage will therefore be effectively disposed of by infiltration across the site and as described previously herein this report. A geotechnical investigation will be required to confirm actual soakage rates but from local information and the geological mapping it is clear that permeability will be high and with the separation distances to ground water exceeding 5 metres, we see no issues with this method of disposal.

The proposed finished ground levels for the site are shown in Appendix D.

All proposed residential lots will exceed the 1.2m separation distance between groundwater and finished lot levels.

Given that the site prior to development and post development will exceed the 5 metre separation between the groundwater and existing and proposed levels, groundwater monitoring has not been proposed.

Where fill is required, on site soils will be used where possible and any imported fill will be clean and will achieve a minimum class “A” site.

The area does not require sub soil drainage given the separation distance to the ground water.

6.2. Ground Water Quality

Downstream water regimes will not receive surface water runoff and ground water originating at the development. It is still important, however, that the quality of the water entering the basins and other infiltration features is comparable to the pre-development environment, including upstream ground water, and where possible improved such that the development does not trigger assessment levels and does not contribute to a decline in water quality.
This document aims to encourage infiltration at source where possible. This infiltrated water will enter underlying ground waters and may ultimately emerge and/or discharge further downstream in surface waters. Whilst the soil profile may treat the infiltrated water and remove some nutrients through natural process, the use of amended soils and bio-retention pockets should be investigated in the UWMP.
The locations or possible sources of nutrients are lot gardens, the detention basins and POS areas. The following measures can be implemented to ensure that the infiltrating water is treated to an acceptable water quality:

6.2.1. Basins

Final treatment will occur in the downstream vegetated portion of the infiltration basins. Since all surface water runoff ultimately reports to vegetated portions of the detention basins resulting in a concentrated nutrient load, these locations should provide a greater degree of treatment. The vegetation species should be native, have a high nutrient uptake and should be able to survive in dry conditions. Vegetation should be trimmed and/or harvested routinely to encourage growth and continual nutrient uptake.

6.2.2. Basins

POS areas should enhance the local environment by utilising native vegetation consistent with the local setting and minimum turf. Whilst natural vegetation will not require fertilizers, turf will require some which can be reduced by using

species with low water and nutrient requirements such as *Cynodon dactylon, Cynodon x, Cynodon transvaalensis, Paspalum vaginatum, Stenotaphrum secundatum or Pennisetum clandestinum* (Water Corporation, 2008).

7. THE NEXT STAGE

7.1. Urban Water Management Plan

An urban water management plan, as required, will be completed at the subdivision stage.

7.2. Monitoring

No site specific pre-development monitoring was required for the site as part of the Local Water Management Strategy.

Site specific monitoring will be required for those areas that will have post development levels with less than 5 metres to groundwater as part of the Urban Water Management Plan, if required, at the subdivision stage.

8. POST DEVELOPMENT MONITORING

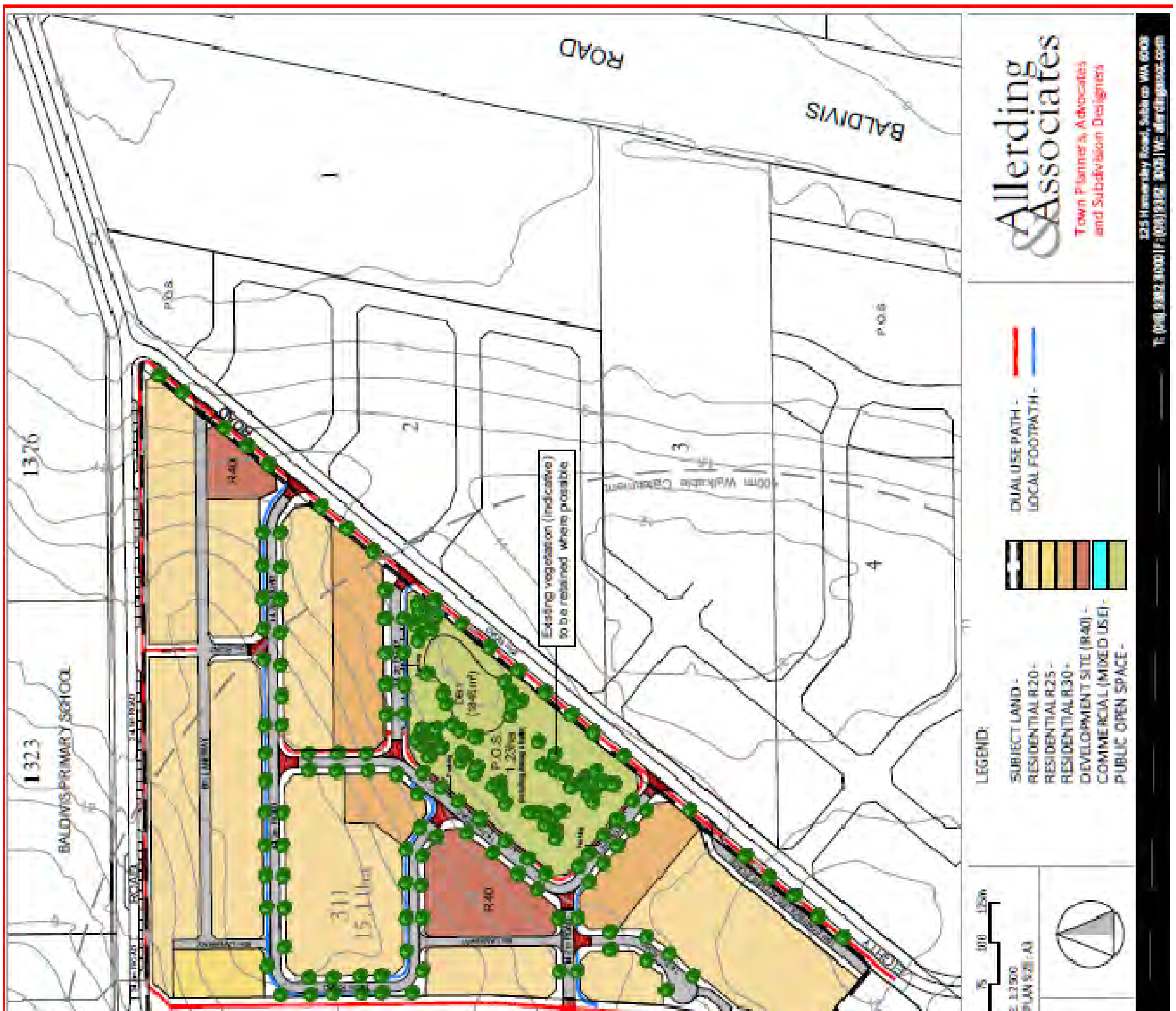
Given the separation distances to the groundwater at the post development stage, no further pre development monitoring, prior to the Urban Water Management plan (if required) or post development monitoring is proposed.

9. IMPLEMENTATION

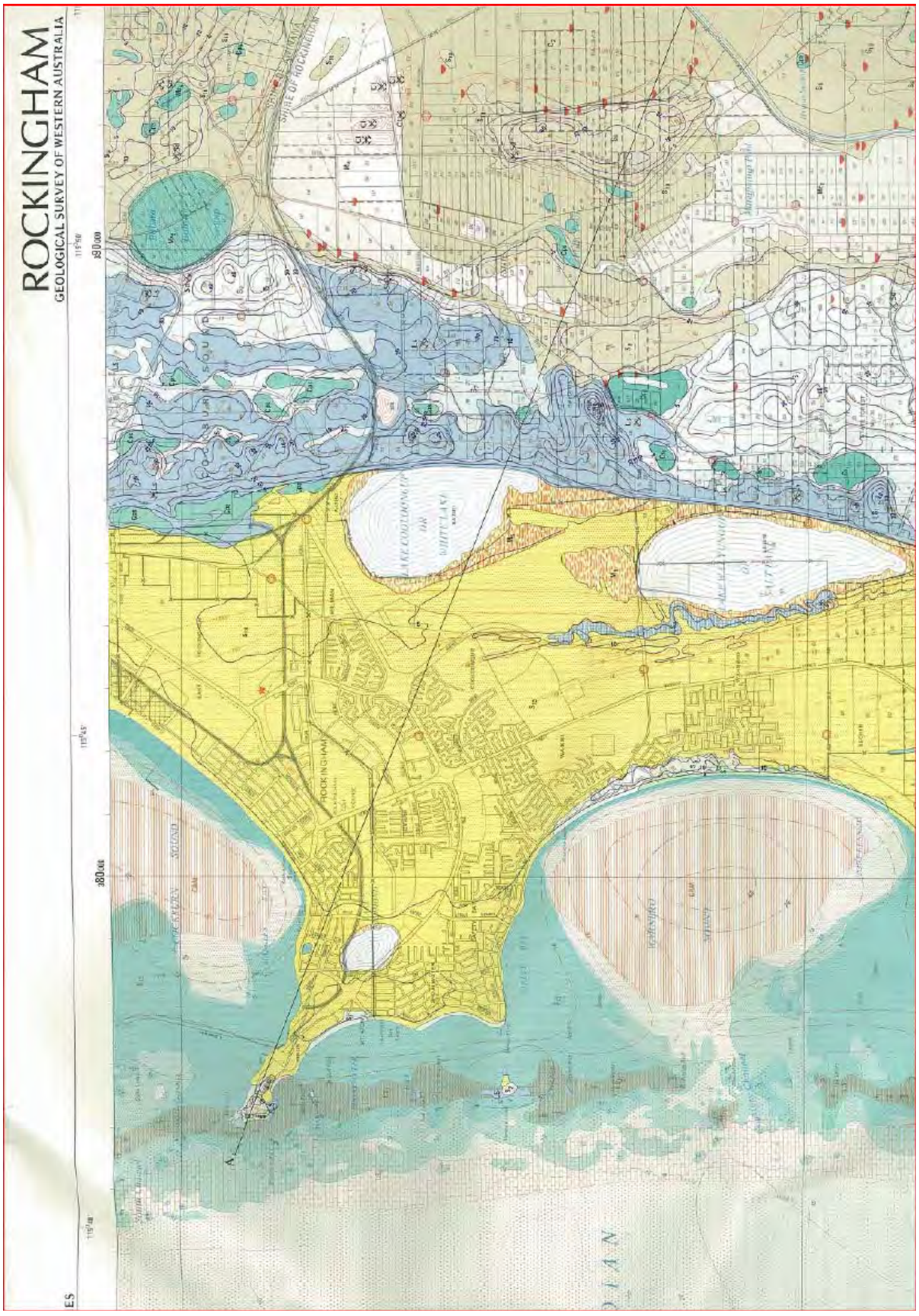
The following table summarises the commitments, roles and responsibilities and funding

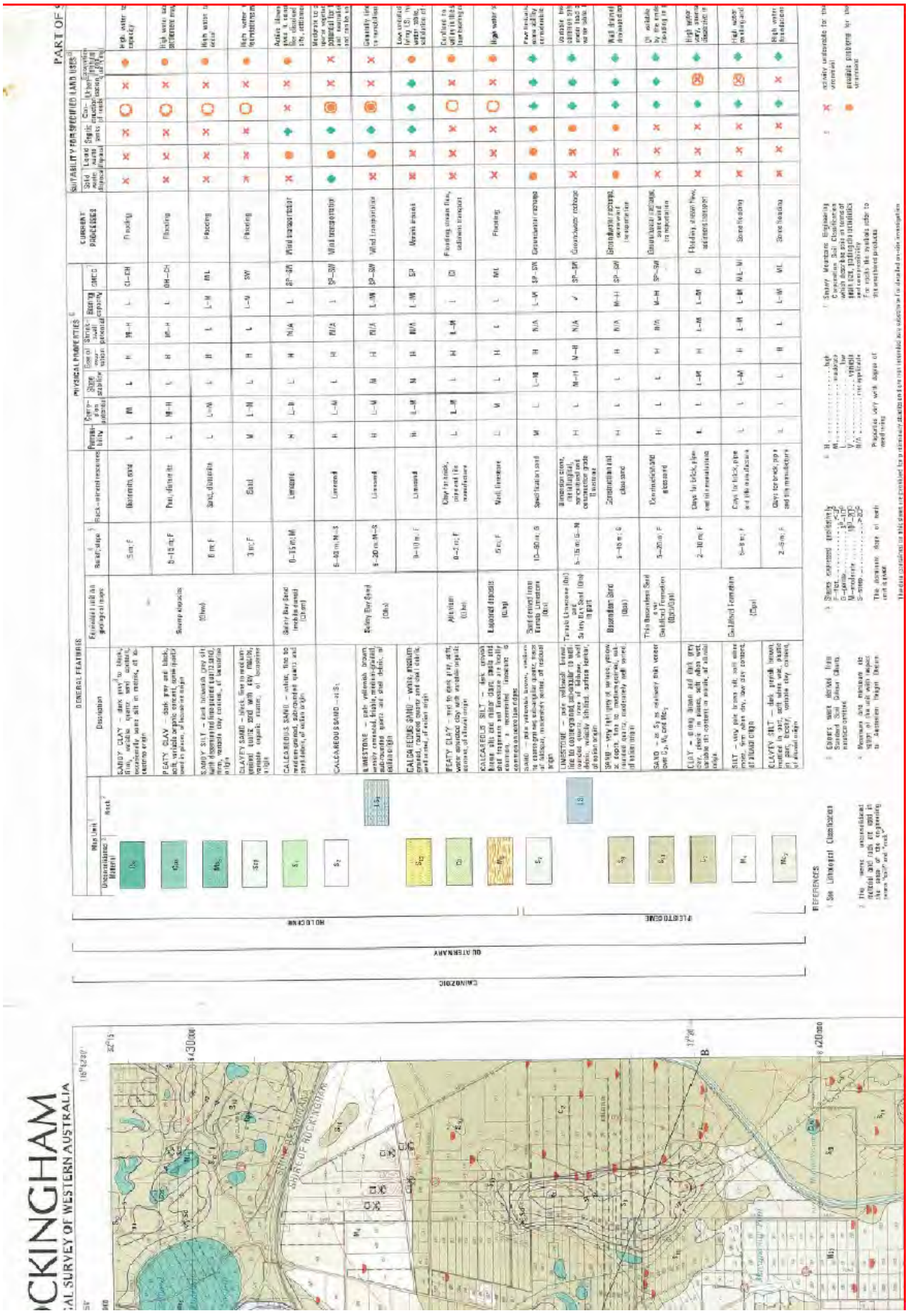
Item	Description	Responsibility	When
Water Efficiency	Educational information to purchasers	Subdivider	During lot sales, house design and construction.
	Front landscaping package	Subdivider	During lot sales, house design and construction.
Stormwater Management	Stormwater infrastructure	Subdivider	After the City approves the detailed engineering design drawings.
	Public Open Space and drainage basins	Subdivider	Subdivider until Council takes care and control
Further work	Urban Water Management Plan	Subdivider	If required at the subdivision stage

Appendix A – Local Structure Plan Layout (with Existing Topography)


PROPOSED STRUCTURE PLAN
LOT 311 FIFTY ROAD BALDIVIS
CITY OF ROCKINGHAM
Allerding & Associates
Town Planners, Advocates and Subdivision Designers
LEGEND:
SUBJECT LAND -
RESIDENTIAL R20 -
RESIDENTIAL R25 -
RESIDENTIAL R30 -
DEVELOPMENT SITE (R40) -
COMMERCIAL (MIXED USE) -
PUBLIC OPEN SPACE -
DUAL USE PATH -
LOCAL FOOTPATH -
JOB CODE: LIL BAL GE
DATE: 31.05.2013
BALDIVIS ROAD
BALDIVIS PRIMARY SCHOOL
FIFTY ROAD
PROPOSED NAIRN ROAD
311 15.11ha
312
Existing vegetation (indicative) to be retained where possible
Indicative verge treatments
Drainage Reserve
Commercial 2040m²

Appendix B – Geological Mapping Plan




PART OF
ROCKINGHAM
CAL SURVEY OF WESTERN AUSTRALIA
GENERAL FEATURES
PHYSICAL PROPERTIES
CURRENT PROCESSES
SUITABILITY FOR SPECIFIED LAND USES
REFERENCES
CAINOZOIC
QUATERNARY
HOLOCENE
PLEISTOCENE
SHORE OF ROCKINGHAM

Appendix C – Stormwater Collection, Storage/Treatment Principles and Examples

WSUD Estate Drainage - Implemented Examples

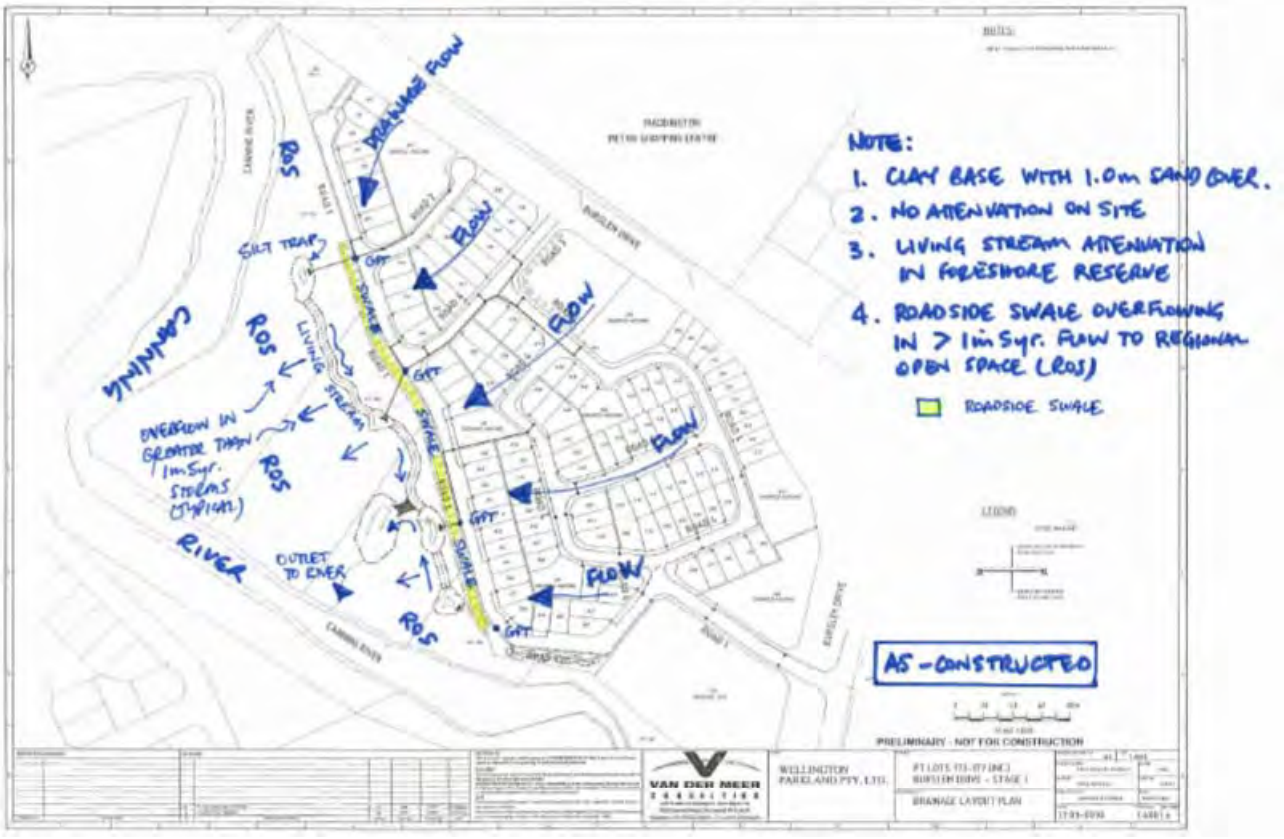
Examples of constructed swales and stormwater storage structures:-

Waterhall Estate Guildford

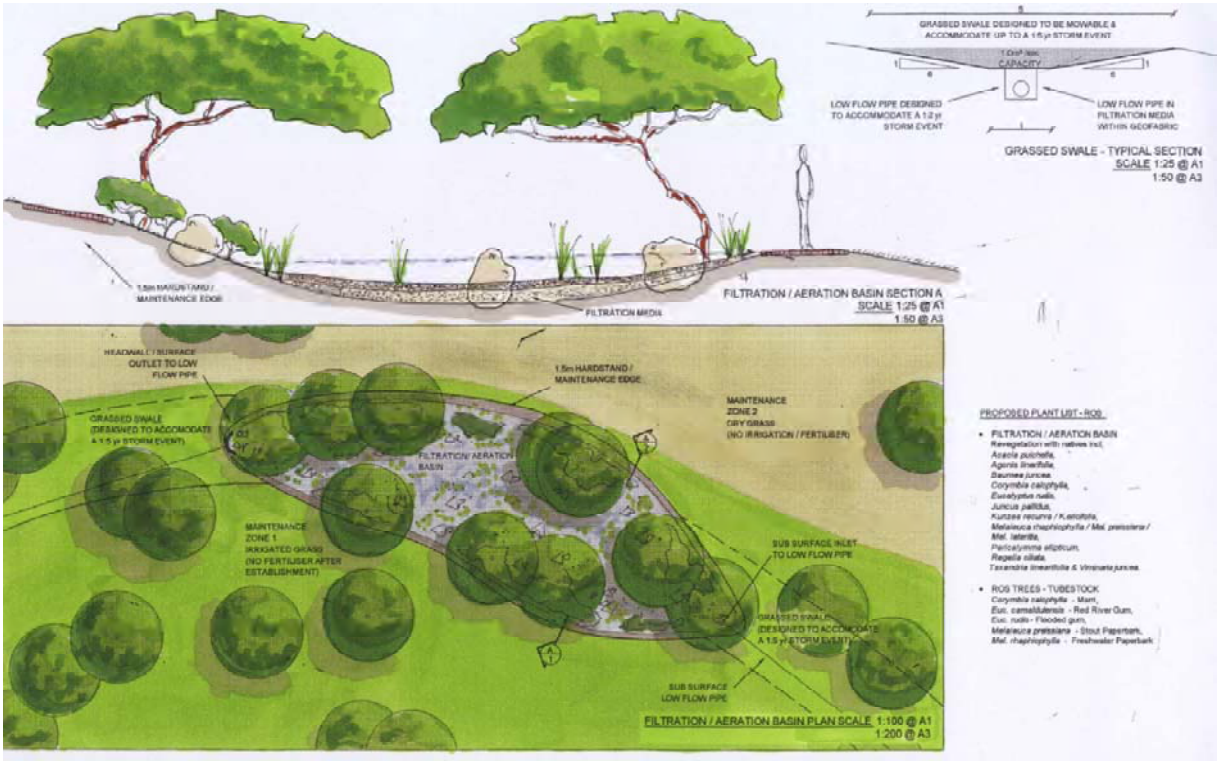
Maddington Riverside Estate

Below are typical details layout plans and photos demonstrating the typical features that will be incorporated in the Lot 311 Fifty Road Baldivis design.

EXAMPLE OF ESTATE DRAINAGE UTILISING SWALES AND STORAGE/DETENTION SYSTEMS. EXAMPLE BELOW IS MADDINGTON RIVER ESTATE, MADDINGTON.



FILTRATION / AERATION BASIN DETAIL AND INTERCONNECTING LOW FLOW PIPE DETAIL

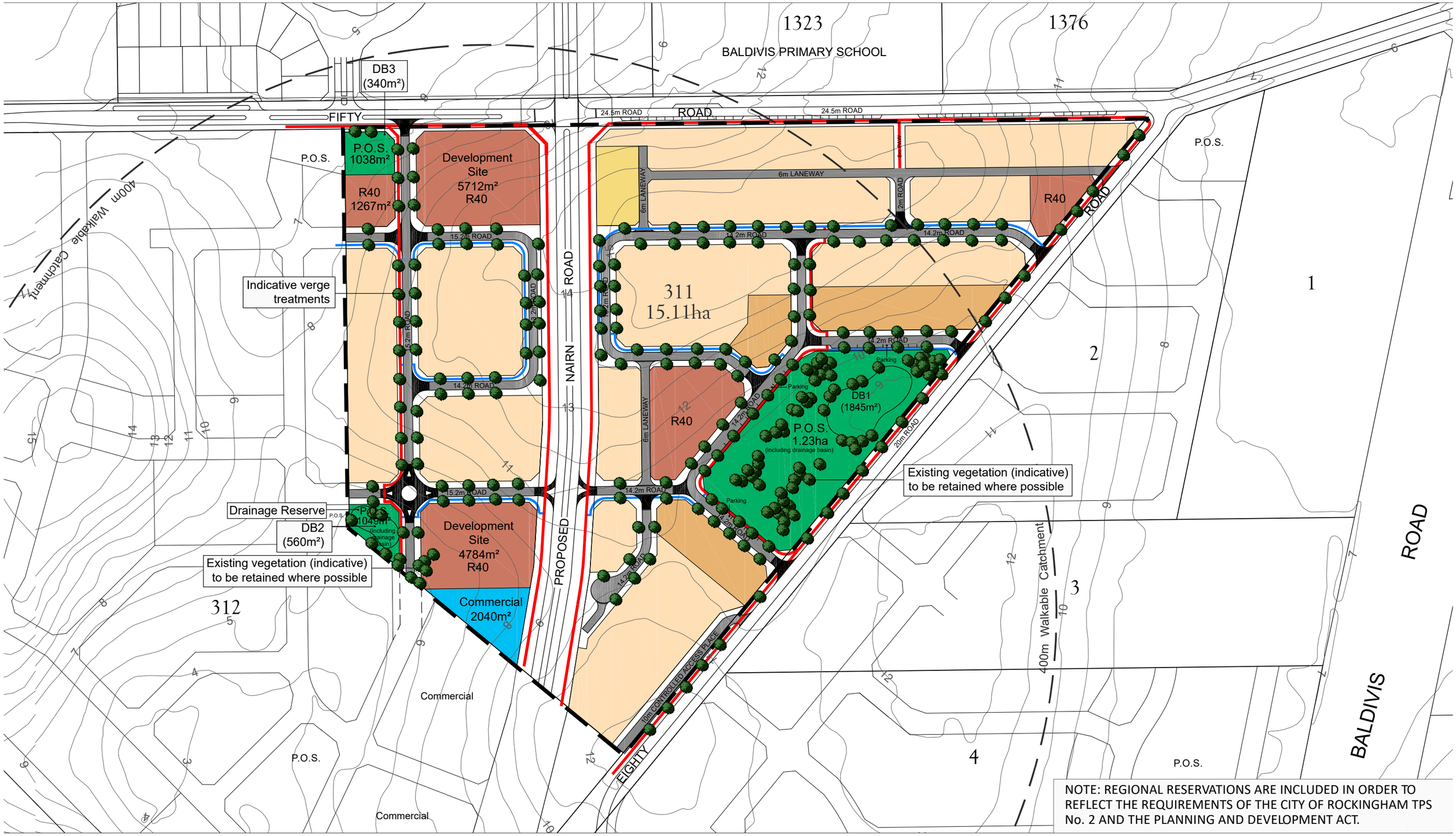


TYPICAL DETAIL DRAINAGE SWALE & BIOFILTRATION SYSTEM

Appendix D – Lot Drainage Catchment Plan

ATTACHMENT 1

APPROVED STRUCTURE PLAN



NOTE: REGIONAL RESERVATIONS ARE INCLUDED IN ORDER TO REFLECT THE REQUIREMENTS OF THE CITY OF ROCKINGHAM TPS No. 2 AND THE PLANNING AND DEVELOPMENT ACT.

PROPOSED STRUCTURE PLAN

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 25 50 75 100 125m

SCALE: 1:2500
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
18.11.2013

LEGEND:

SUBJECT LAND -
RESIDENTIAL R20 -
RESIDENTIAL R25 -
RESIDENTIAL R30 -
DEVELOPMENT SITE (R40) -
COMMERCIAL (MIXED USE) -
PUBLIC OPEN SPACE -

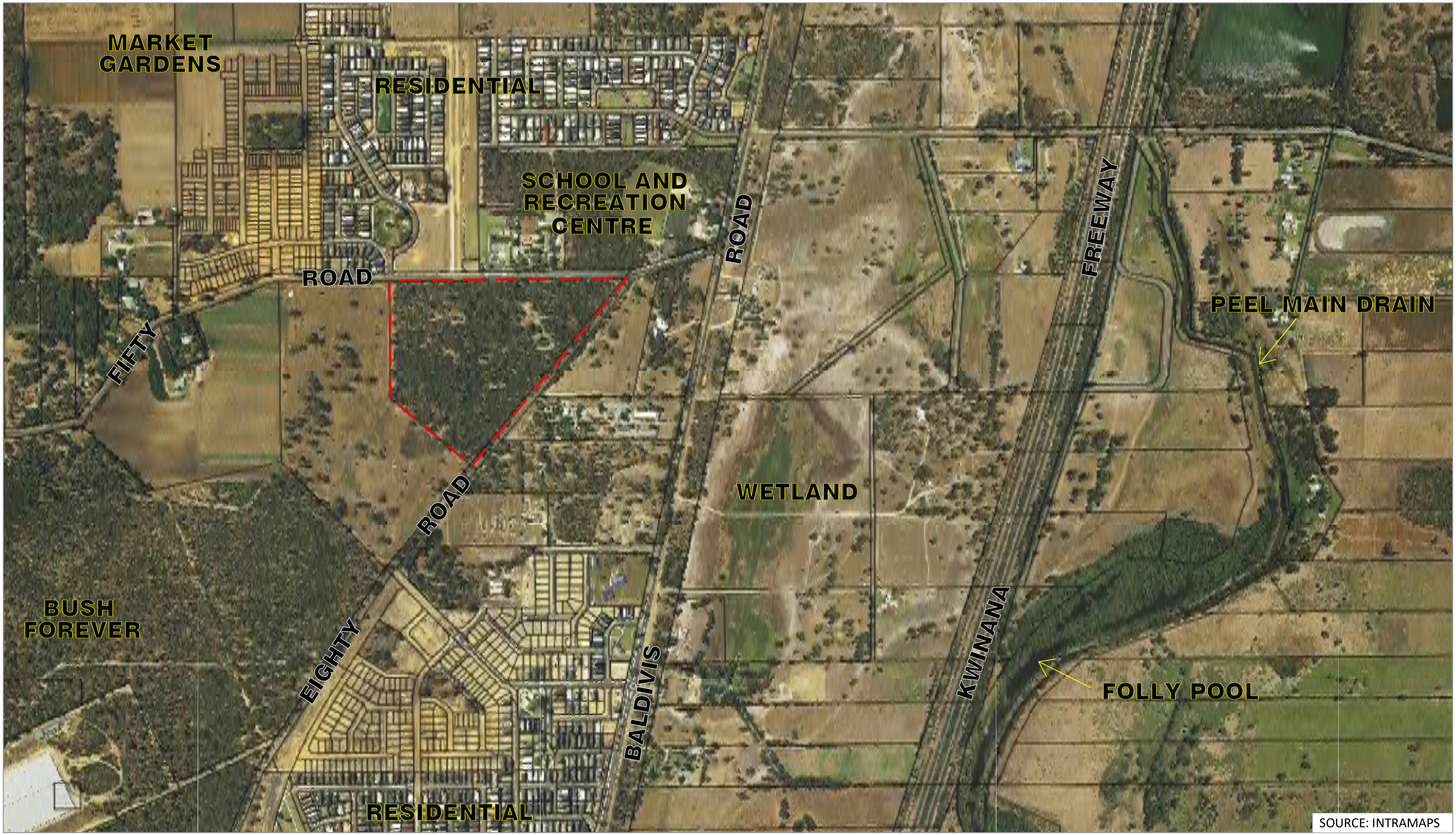
DUAL USE PATH -
LOCAL FOOTPATH -

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 |F: (08) 9382 3005 |W: allerdingassoc.com

ATTACHMENT 2

ADJACENT LAND USES



ADJACENT LAND USES

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 100 200 300 400 500m

SCALE: 1:10 000
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
26.05.2014

LEGEND:

SUBJECT LAND -

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 | F: (08) 9382 3005 | W: allerdingassoc.com

ATTACHMENT 3

CONTOUR PLAN ON AERIAL

AERIAL PHOTO & TOPOGRAPHY

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 25 50 75 100 125m

SCALE: 1:2500
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
26.05.2014

LEGEND:

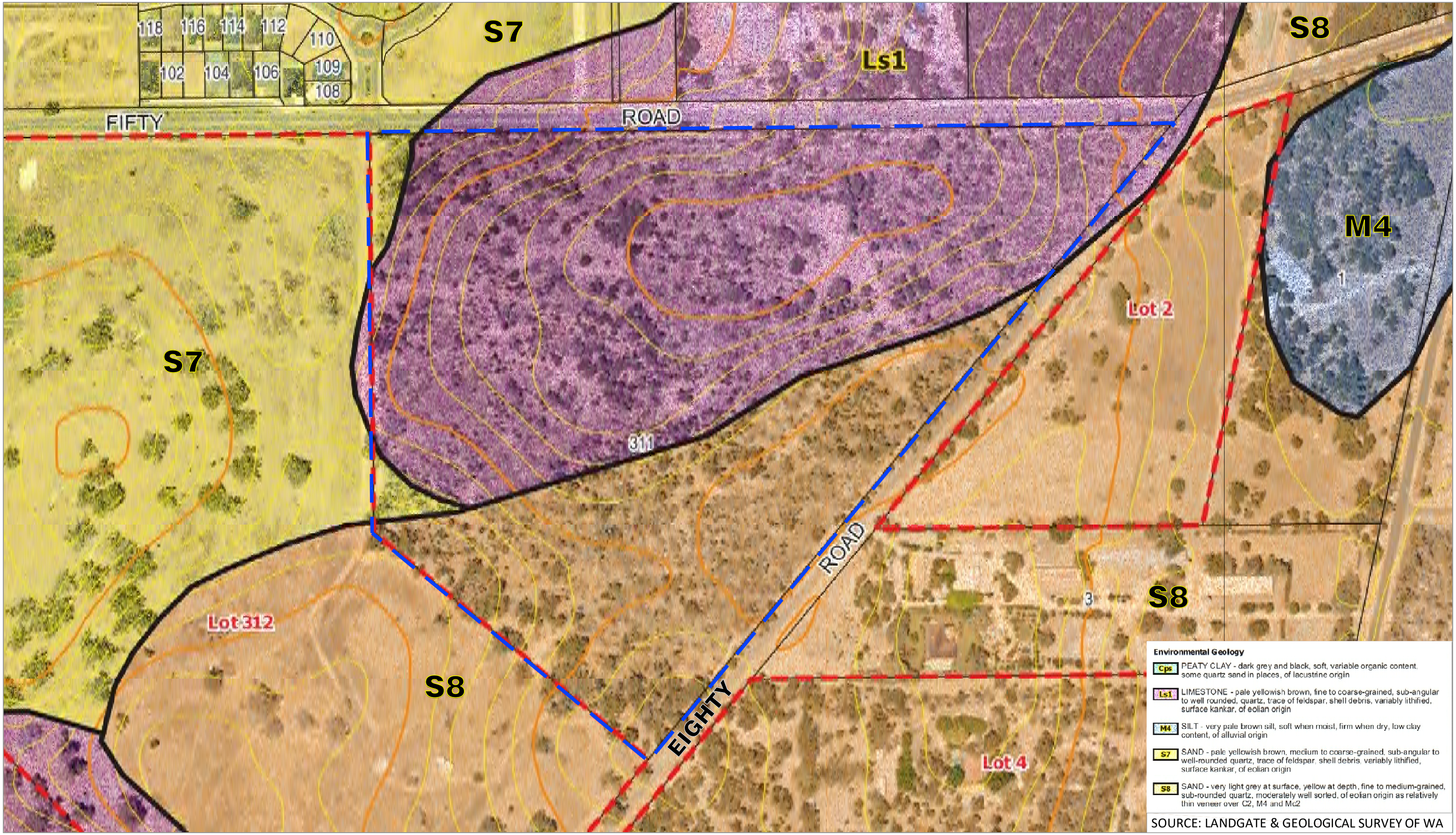
SUBJECT LAND -

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 | F: (08) 9382 3005 | W: allerdingassoc.com

ATTACHMENT 4

TOPOGRAPHY, SOILS AND LANDFORM



TOPOGRAPHY, SOILS AND LANDFORM

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 25 50 75 100 125m

SCALE: 1:2500
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
26.05.2014

LEGEND:

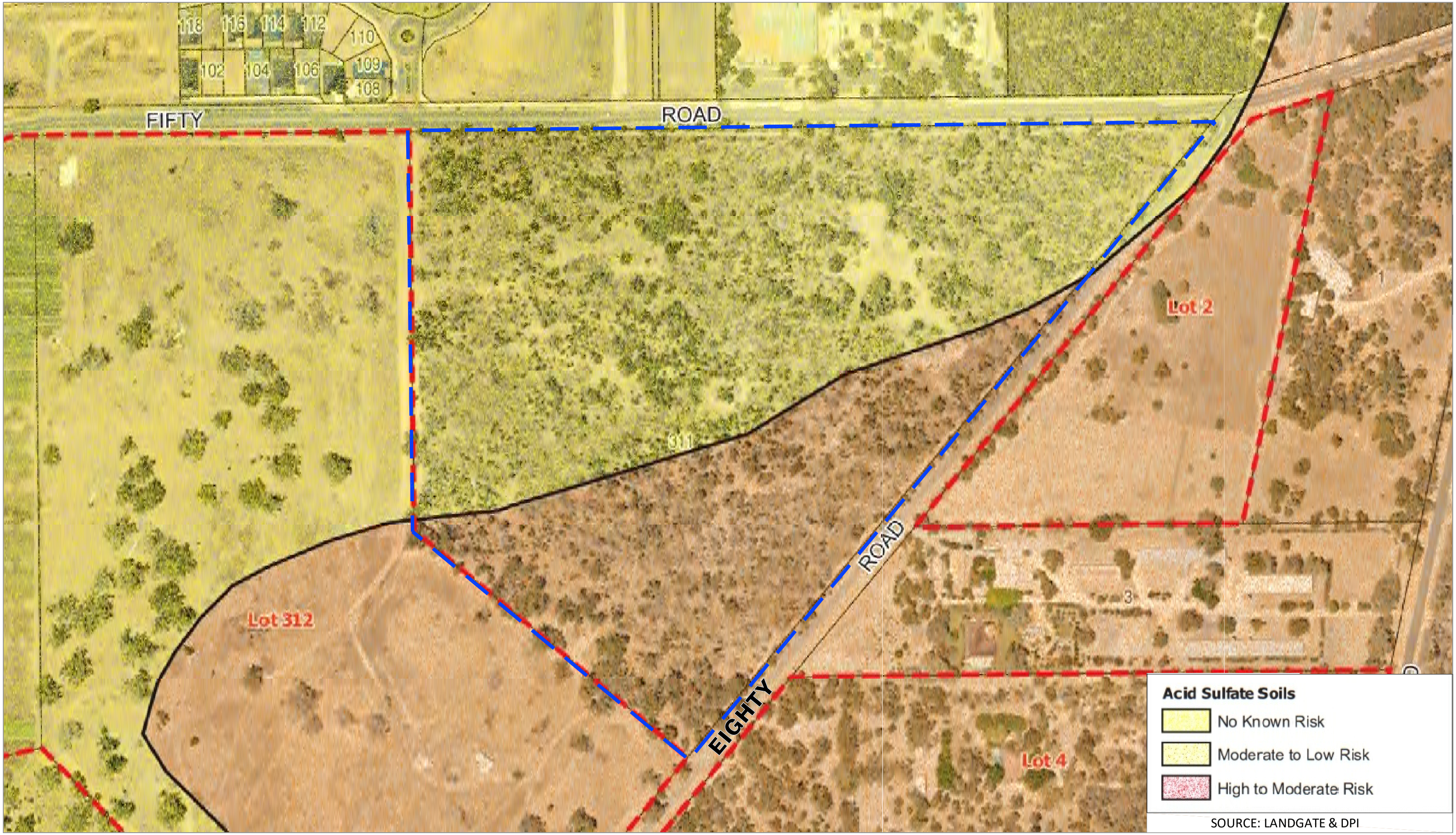
SUBJECT LAND -

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 | F: (08) 9382 3005 | W: allerdingassoc.com

ATTACHMENT 5

ACID SULPHATE SOILS



SOURCE: LANDGATE & DPI

ACID SULPHATE SOILS

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 25 50 75 100 125m

SCALE: 1:2500
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
26.05.2014

LEGEND:

SUBJECT LAND -

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 | F: (08) 9382 3005 | W: allerdingassoc.com

ATTACHMENT 6

WETLAND MAPPING

WETLAND MAPPING

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 25 50 75 100 125m

SCALE: 1:2500
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
26.05.2014

LEGEND:

SUBJECT LAND -

MULTIPLE USE WETLAND -

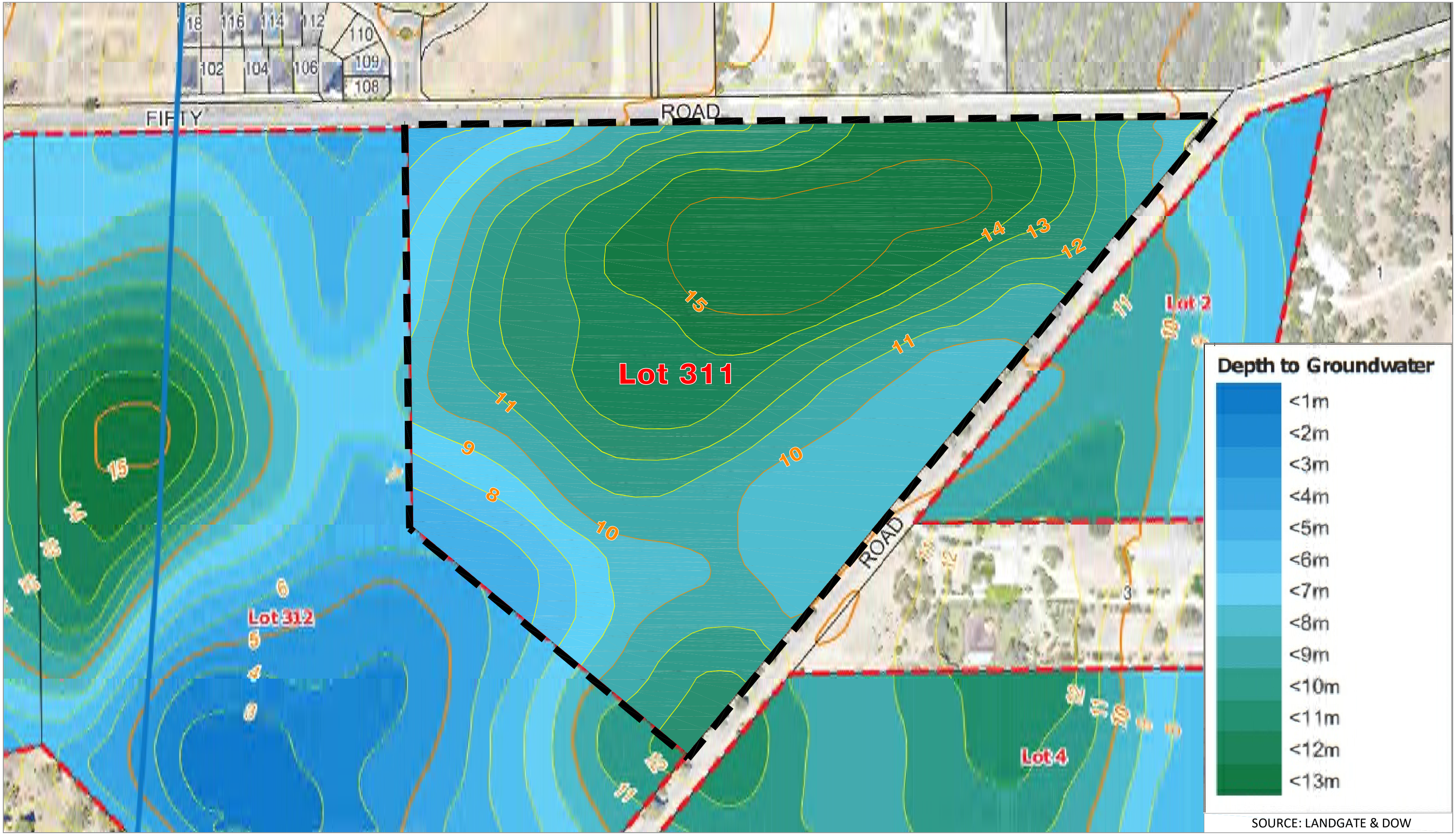
WETLAND UFI NUMBER - 15591

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 | F: (08) 9382 3005 | W: allerdingassoc.com

ATTACHMENT 7

GROUNDWATER CONTOURS



SOURCE: LANDGATE & DOW

PREDEVELOPMENT SEPARATION DISTANCES TO GROUNDWATER

LOT 311 FIFTY ROAD
BALDIVIS

CITY OF ROCKINGHAM

0 25 50 75 100 125m

SCALE: 1:2500
ORIGINAL PLAN SIZE: A3

JOB CODE:
LIL BAL GE

DATE:
26.05.2014

LEGEND:

SUBJECT LAND -

GROUNDWATER CONTOUR -

Allerding & Associates
Town Planners, Advocates and Subdivision Designers

125 Hamersley Road, Subiaco WA 6008
T: (08) 9382 3000 | F: (08) 9382 3005 | W: allerdingassoc.com

ATTACHMENT 8

GROUND WATER LICENCE

Government of **Western Australia**
Department of **Water**

looking after all our water needs

Your ref: GWL177715 & CAW177714
Our ref: RF11361
Enquiries: Alana Patterson
Tel: 95504236

Leo Anthony Tsaknis
Level 19 Allendale Square
77 St George's Terrance
PERTH WA 6000

Dear Mr Tsaknis

Re: Issue of a licence under the *Rights in Water and Irrigation Act 1914*
Property: Lot 311 Fifty Rd Baldivis

Please find enclosed the following:

- Your licence to take water *(GWL177715)*
- FAQ sheet *Your licence to take water*
- FAQ sheet *Metering your water use*
- Meter Water Use Card x 1
- Your licence to construct or alter a well *(CAW177714)*
- Form 2 "Information to be provided on completion of a non-artesian well"
- FAQ sheet *Your licence to construct a well*

Please take time to read these documents as they contain important information about your rights and responsibilities.

The above property is located in an area identified as an Aboriginal site of significance. Please contact the Department of Indigenous Affairs for further information on your responsibilities regarding this matter.

You can ask for more information about our decision in relation to your licence. On request we will provide a 'statement of reasons' for the period for which the licence is granted or the inclusion of any term, condition or restriction. The request for more information must be in writing to the department within 28 days.

You may apply to the State Administrative Tribunal (SAT) for a review of our decision. You will need to contact the SAT office directly, within 28 days.

In person State Administrative Tribunal
4th floor, 12 St Georges Terrace Perth WA 6000

In writing: State Administrative Tribunal

Kwinana Peel Region
107 Breakwater Parade Mandurah Ocean Marina Mandurah Western Australia 6210
PO Box 332 Mandurah Western Australia 6210
Telephone (08) 9550 4222 Facsimile (08) 9581 4560
www.water.wa.gov.au

GPO Box U1991
Perth WA 6845

By telephone: Metro: (08) 9219 3111
Regional: 1300 306 017 (for the cost of a local call)

By fax: (08) 9325 5099

For more information about the SAT please visit their website www.sat.justice.wa.gov.au.

If you have any queries about this or any other water licensing matter please contact Alana Patterson on telephone 95504236.

Yours faithfully

Alana Patterson
Natural Resource Management Officer
Peel Region

25 July 2014

File No: RF11361

Government of Western Australia
Department of Water

Instrument No. CAW177714(1)

LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	Tsaknis, Leo Anthony	
Description of Water Resource	Stakehill Perth - Superficial Swan	
Location of Well(s)	Volume/Folio 1170/618 - Lot 311 Fifty Rd Baldivis	
Authorised Activities	**Activity**	**Location of Activity**
	Construct 1 non-artesian well(s).	Volume/Folio 1170/618 - Lot 311 Fifty Rd Baldivis
Duration of Licence	From 25 July 2014 to 25 July 2015	

This Licence is subject to the following terms, limitations and conditions:

1 The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or equivalent certification recognised nationally by the Australian Drilling Industry Association.

2 The licensee must install an approved meter to each well, and provide evidence of the installation to the Department of Water within 30 days of completion of the well.

End of terms, limitations and conditions

LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	Tsaknis, Leo Anthony		
Description of Water Resource	Stakehill Perth - Superficial Swan	**Annual Water Entitlement**	59225 kL
Location of Water Source	Volume/Folio 1170/618 - Lot 311 Fifty Rd Baldivis		

Authorised Activities	**Taking of water for**	**Location of Activity**
	Dust suppression for earthworks and construction purposes Irrigation of up to 1.23 ha of public open space	Volume/Folio 1170/618 - Lot 311 Fifty Rd Baldivis

Duration of Licence	From 25 July 2014 to 25 July 2024

This Licence is subject to the following terms, conditions and restrictions:

1 The licensee shall not use water for public open space between 9 am and 6 pm except for the establishment of newly planted areas. For newly planted areas water may be used within these hours for a period of up to 28 consecutive days, commencing from the date of planting.

2 Between 1 June and 31 August in any year, the licence-holder must not water a lawn, garden, or grass-covered area ("turf") by reticulation, provided always that this restriction shall not apply to watering with a hand held hose; or watering, by way of reticulation: newly planted areas for a period of up to 28 days from the date of planting; for renovating turf; or for maintenance of reticulation systems.

3 The licensee must install an approved meter to each water draw-point through which water is taken under this licence.

4 The annual water year for water taken under this licence is defined as 1 July to 30 June.

5 The licensee must not, in any water year, take more water than the annual water entitlement specified in this licence.

6 The licensee must take and record the reading from each meter required under this licence at the beginning and another at the end of the water year defined on this licence.

7 The licensee must take and record the reading from each meter required under this licence, at the end of each month.

8 Unless otherwise approved, all meter readings must be recorded on the 'Meter Water Use Card' available from the Department of Water.

9 The completed Meter Water Use Card must be returned to the Department of Water every 12 month(s) commencing 14/07/2015.

10 The licensee must ensure the installed meter(s) accuracy is maintained to within plus or minus 5% of the volume metered, in field conditions.

11 The licensee must notify the Department of Water in writing of any water meter malfunction within seven days of the malfunction being noticed.

LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

This Licence is subject to the following terms, conditions and restrictions:

12 The licensee must obtain authorisation from the Department of Water before removing, replacing or interfering with any meter required under this licence.

End of terms, conditions and restrictions

Government of **Western Australia**
Department of **Water**

OFFICE USE ONLY

Form 2

Information to be provided on completion of a non-artesian well

Information to be provided to the Department of Water under the *Water Agencies (Powers) Act 1984* and Section 26E of the *Rights in Water and Irrigation Act 1914* and Regulation 39 of the *Rights in Water and Irrigation Regulations 2000*

Please note:

- All information is to be written clearly and in block letters.
- If insufficient room please use a separate piece of paper.
- It is the responsibility of the person carrying out the works to fill out this form.

Part 1: Details of any licence granted for the work under the *Rights in Water And Irrigation Act 1914* section 26D

Licence number CAW

☐ Individual ☐ Company

Licensee's full name

Part 2: Details of person carrying out the works

Company

Driller

Driller licence number (non-mandatory) **Driller classification (non-mandatory)**

Postal address

Telephone **Facsimile**

Email

Part 3: Location of well

A 26D licence will list the premises on which well construction is to occur.

If the physical address of the well is different from the property address listed on the licence, contact the Department of Water prior to the commencement of construction.

Property address of well or other tenure details

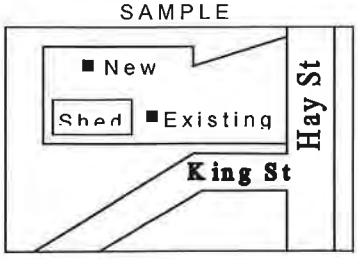
Well coordinates ☐ GPS reading ☐ Estimate

Zone **Easting/ latitude** **Northing/ longitude**

Datum (e.g. GDA94/WGS84) **GPS reliability**

Location plan – in the box below please sketch a plan showing position of well in relation to building, boundaries, road, nearest cross road and any additional information to assist in locating the well.

SAMPLE



In the box to the right, please sketch a plan showing:
- location of all wetlands / watercourses / wells / soaks (existing and proposed).
- major improvements (house, large sheds etc).
- shaded sections to indicate areas under development.

Part 4: Construction details (All measurements are to be taken from ground level)

Production casing detail					
Material	Nominal bore	Diameter O.D (mm)	Wall thickness (mm)	Depth	
				From (m)	To (m)

Screens/slots				
Screens/slot (type)	Diameter O.D (mm)	Aperture (mm)	Top of screen (m)	Bottom of screen (m)

Gravel pack details		
Gravel size (mm)	From (m)	To (m)

Annular fill		
Material type	From (m)	To (m)

Cementing detail		
☐ Pressure cement grouted ☐ Tremmie		
Casing diameter (mm O.D)	Depth	
	From (m)	To (m)

Please complete well construction diagram in box provided below. If insufficient room please attach on separate piece of paper.

Total depth drilled (from ground level) ☐

Geophysical log required as condition of licence? ☐ Yes ☐ No

Geophysical log taken? (attach log and contractor details) ☐ Yes ☐ No

From (m)	To (m)	Strata description (If insufficient room attach on separate page)

Part 5: Particulars of well

Drilling start date refers to the date drilling begins. Do not include set up date.

Drilling completion date includes well development and testing.

Well name / number

Drilling start | **Drilling completion**

Drilling method used

☐ Rotary air ☐ Cable tool ☐ Auger ☐ Rotary mud

☐ Sludge ☐ Other (specify) _____

Final status of well

☐ Ready to operate ☐ Decommissioned

☐ Other (specify) _____

Purpose (use) of well

☐ Production ☐ Investigation ☐ Monitoring

☐ Other (specify) _____

Part 6: Well development

Date (dd/mm/yy) | **Duration of development** | **hours**

Method ☐ Airlift ☐ Pump ☐ Jetting ☐ Surging

Development pump rate (e.g. L/s, m^3/day)

Part 7: Pump testing (If applicable)

Date start (dd/mm/yy) | **Date end (dd/mm/yy)** | **Duration of test** | **hours**

☐ Step test ☐ Constant rate ☐ Other

Constant rate - pump rate (e.g. m^3/day)

Pump type (e.g submersible)

Water rest level prior to test (m)

Measurements taken from ☐ top of casing (TOC) ☐ ground level (GL)

☐ other (specify) _____

Final drawdown is the distance between the static water level measured prior to the test and the water level measured at the end of the pumping test.

Elevation of measurement reference point if known (metres AHD) ☐ GPS ☐ Estimate

☐ other (specify) _____

Final drawdown | **m**

Recommended supply (e.g. m^3/day)

Comments.....

Part 8: Field samples

Specify unit measurements.

Collection method (e.g. pump test, airlift)

Conductivity (e.g. mS/m)

☐ Temperature compensated

☐ Temperature uncompensated

pH

Water temperature at test

Comments.....

.....

Part 9: Lab samples

Lab samples taken (Please attach) ☐ Yes ☐ No

TDS (e.g. mg/l)

Please submit samples separately to form if not received before the 1 month submission deadline.

Part 5: Particulars of well

Drilling start date refers to the date drilling begins. Do not include set up date.

Drilling completion date includes well development and testing.

Well name / number

Drilling start **Drilling completion**

Drilling method used ☐ Rotary air ☐ Cable tool ☐ Auger ☐ Rotary mud ☐ Sludge ☐ Other (specify) _____

Final status of well ☐ Ready to operate ☐ Decommissioned ☐ Other (specify) _____

Purpose (use) of well ☐ Production ☐ Investigation ☐ Monitoring ☐ Other (specify) _____

Part 6: Well development

Date (dd/mm/yy) **Duration of development** **hours**

Method ☐ Airlift ☐ Pump ☐ Jetting ☐ Surging

Development pump rate (e.g. L/s, m^3/day)

Part 7: Pump testing (If applicable)

Date start (dd/mm/yy) **Date end (dd/mm/yy)** **Duration of test** **hours**

☐ Step test ☐ Constant rate ☐ Other

Constant rate - pump rate (e.g. m^3/day) **Pump type (e.g submersible)**

Water rest level prior to test (m)

Measurements taken from ☐ top of casing (TOC) ☐ ground level (GL) ☐ other (specify) _____

Final drawdown is the distance between the static water level measured prior to the test and the water level measured at the end of the pumping test.

Elevation of measurement reference point if known (metres AHD) ☐ GPS ☐ Estimate ☐ other (specify) _____

Final drawdown **m** **Recommended supply (e.g. m^3/day)**

Comments.....

Part 8: Field samples

Specify unit measurements.

Collection method (e.g. pump test, airlift)

Conductivity (e.g. mS/m) ☐ Temperature compensated ☐ Temperature uncompensated **pH**

Water temperature at test

Comments.....

.....

Part 9: Lab samples

Lab samples taken (Please attach) ☐ Yes ☐ No

TDS (e.g. mg/l)

Please submit samples separately to form if not received before the 1 month submission deadline.

Part 10: Water levels

SWL (Static water level) ____ m **Water cut at** ____ m

Measurements taken from ☐ top of casing (TOC) ☐ ground level (GL)
☐ other (specify) _____

Date of reading (dd/mm/yy) ____

Comments.....

Part 11: Declaration and signature

Capacity of person making declaration:

☐ **An individual who carried out the work**

☐ **An officer who is a director or secretary of a corporation that carried out the work.**

☐ **Other (describe)**.....

I, _____(name of person making declaration) declare that the information provided on this form is true and correct.

Important information

- All information must be completed on the form unless otherwise indicated as optional for example; provision of the drillers licence number and classification fields are not mandatory and can be filled in at the drillers discretion. Provision of non-mandatory details would greatly assist the department in completion of its data set.
- Failure to complete all mandatory details and to submit the form to the department is an offence under the *Rights in Water and Irrigation Act 1914.*
- Under section 26E and regulation 39 within 1 month of completion of the construction of or deepening of the well, the person carrying out the work for a 26D licence must submit this form.
- Non-artesian wells in proclaimed areas require a licence unless exempted under the *Rights in Water and Irrigation Exemption (S26C) Order 2007.*

Where and how to submit this form

This form can be submitted by fax, post or in person to the appropriate Department of Water regional office. For assistance in completing this form contact your regional office.

Kimberley Region
Kununurra Regional Office
27 Victoria Hwy
Kununurra WA 6743
Tel: 08 9166 4100
Fax: 08 9168 3174
PO Box 625
Kununurra WA 6743

Kwinana Peel Region
Mandurah Regional Office
107 Breakwater Parade
Mandurah WA 6210
Tel: 08 9550 4222
Fax: 08 9581 4560
PO Box 332
Mandurah WA 6210

South Coast Region
Albany Regional Office
5 Bevan Street
Albany WA 6330
Tel: 08 9842 5760
Fax: 08 9842 1204
PO Box 525
Albany WA 6331

Warren Blackwood District
Manjimup Regional Office
52 Bath Street
Manjimup WA 6528
Tel: 08 9771 1878
Fax: 08 9771 4335

Midwest Gascoyne Region
Geraldton Regional Office
94 Sandford Street
Geraldton WA 6531
Tel: 08 9965 7400
Fax: 08 9964 5983
Po Box 81
Geraldton WA 6531

South West Region
Bunbury Regional Office
35-39 McCombe Road
Bunbury WA 6230
Tel: 08 9726 4111
Fax: 08 9726 4100
PO Box 261
Bunbury WA 6231

Pilbara Region
Karratha Regional Office
Lot 4608 Cherratta Road
Karratha Industrial Estate
Karratha WA 6714
Tel: 08 9144 2000
Fax: 08 9144 2610
PO Box 836
Karratha WA 6714

Carnarvon
Carnarvon District Office
211 Robinson Street
Carnarvon WA 6701
Tel: 08 9941 6100
Fax: 08 9941 4931
PO Box 81
Carnarvon WA 6701

Busselton
Busselton District Office
Suite 2, 72 Duchess Street
Busselton WA 6280
Tel: 08 9781 0188
Fax: 08 9754 4335
PO Box 269
Busselton WA 6280

Swan Avon Region
Victoria Park Regional Office
7 Ellam Street
Victoria Park WA 6100
Tel: 08 6250 8000
Fax: 08 6250 8050

Please retain a copy of this form for your records

Government of **Western Australia**
Department of **Water**

Meter water use card

Looking after all our water needs

Kwinana Regional Office
PO Box 332
Mandurah WA 6210

Telephone: 08 9550 4222
Fax: 08 9581 4560
www.water.wa.gov.au

Licensee:

Bore/Pump name:

Irrigation year: Date Month Year to Date Month Year	Licence number:
Meter serial number:	Meter make and model:
Last meter calibration service date:	Property location:

	Date	Meter reading		Monthly water consumption (kL)
		Last reading	Current reading	
June				0
July				0
August				0
September				0
October				0
November				0
December				0
January				0
February				0
March				0
April				0
May				0
June				0
			Total abstraction volume	0

Comments:

Please refer to your 5C licence for your annual water entitlement.
If you are unable to locate your licence contact the department's regional licensing office on 08 9550 4222.
Please record any unforeseen increases in water use in 'Comments' for example, ruptured irrigation mains or water used for firefighting purposes.

Signature _____ Date _____