DEVELOPMENT
ENGINEERING
CONSULTANTS

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LOT 746 - 750 & 545 BALDIVIS ROAD, BALDIVIS

ENGINEERING SERVICES REPORT - REF BDVMIR01

1 General

This report has been prepared to demonstrate the availability of service infrastructure to support the Local Structure Plan on the above land as outlined in the CLE plan.

It is proposed to develop the land into some 530 urban lots and associated POS, with an entry access from Baldivis Road.

The investigations in this report have involved consultation with the various service authorities and Council and a desk top study of the available information over the site to establish the opportunities and constraints to development of the area.

2 Executive Summary

The land the subject of this report is located immediately east of Baldivis Road, west of the Kwinana Freeway and located centrally opposite Pemberton Boulevard. It occupies an area of 36 98 hectares.

The basic land form is in the main low level Guildford Formation soils, with a narrow strip of Bassendean Sands along the Baldivis Rd frontage.

The land is almost completely cleared and used as grazing land. It has an old open drain running south to north located approximately along the centre of the site in a slightly zig - zag configuration, which discharges into an open channel on the abutting property to the north and thence into the MRWA Kwinana Freeway reserve and culvert system to The Peel Main Drain on the east side of the Freeway.

The site accommodates a residence and associated garage on lot 545 and vacant land on the remainder. It varies in elevation from approximately RL 8 metres AHD along Baldivis Rd down to RL 4m AHD at a distance of 150 metres into the site, which level continues to the eastern boundary.

Because the development will be influenced by the 1 in 100 year flood level of the adjacent Peel Main Drain, the final level of the development is set at 500mm above this level at RL 6.1m AHD, thus necessitating over two metres of sand fill in places to attain this level.

The land can be connected to all services, either by extension from neighbouring subdivision developments west and north of the site, or by extension along Baldivis Road. In the case of sewer connection, the northern half of the site can be connected by gravity into an existing scheme, but the southern half is to be connected to a future permanent Water Corporation Waste Water Pumping Station (WWPS) which will be located in the proposed neighbouring development by others. Access to the East Rockingham Waste Water treatment Plant (ERWWTP) has been approved by the Water Corporation.

Some upgrading and construction of Baldivis Road will be required, with the access to the site being located centrally along the frontage of the site from Baldivis Road.

The site will be filled to provide both drainage and class “A” building foundation classification. Because some two thirds of the site is underlain by silty clay soils, ground remediation work is required prior to filling. The filling for the 1 in 100 year flood far exceeds the WAPC required clearance of 1.2m above the AAMGL, which is at approximately RL 3.5m AHD across the site.

3 Site

The site covering an area of 36.98 hectares is located on the east side of Baldivis Road and Tramway Reserve, across to the western boundary of the Kwinana Freeway, and is south of the new development of Australand on its northern boundary and north of the proposed Perron development on its southern boundary. Pemberton Boulevard is located opposite the middle of the Baldivis Road frontage of the site. The site has been completely cleared and used for grazing for some years. It is generally low lying and has the potential to be inundated by the 1 in 100 year flood of the Peel Main Drain, which is located immediately east of the Freeway. It is traversed by a man made agricultural open drain flowing south to north, exiting at the existing Water Corporation drain flowing east into the Freeway reserve and the culvert under the Freeway.

Baldivis Road has been recently been upgraded to current urban standard as part of the new urban development on the west side of the road.

The Environmental Geology map of the Geological Survey of Western Australia classifies this site as "S8" Bassendean Sands on the western edge along Baldivis Road, and S10 "Guildford Formation" across the balance of the site, both being deemed "suitable for urbanisation. However, Geotechnical site investigations have revealed the existence of deep silty clay across the eastern two thirds of the land, being an old flood plain, needing remedial works as detailed in the following earthworks section of this report.

The site has an AAMGL generally varying from RL 4.4m at Baldivis Rd down to RL 3.6 through the centre of the site, and rising to RL 3.8m AHD along the Freeway boundary. The minimum required clearance to this level will be greatly exceeded by the requirements to provide freeboard of 500mm to the 1 in 100 year flood level of the Peel Main Drain. This level is set at RL 6.1m AHD.

4 Development Proposal

It is proposed to develop the land as a residential subdivision of around 530 urban residential lots, with all normal services being;- wastewater, water, power, roads, gas and telecommunications service.

Access to the site will initially and primarily be from Baldivis Road and in the future from other developments north and south of the site, providing permeability.

The existing residence, sheds, septic tanks etc on lot 545 will be demolished as part of the development. The remainder of the site is vacant land.

All drainage is proposed to be detained on site for the 1 in 100 year design storm, with outflow limited to pre-development flows. All drainage will be designed to incorporate best management practices. There will be four drainage basins to accept site stormwater flows, all located within POS areas. Outflow from the basins is to the Peel Main Drain via the Kwinana Freeway reserve drainage.

The urban development area will entail substantial earthworks to provide level building blocks, with lots having retaining walls as required to allow this.

The site filling will enable lots to be sewered from the existing WWPS located north of the site and a proposed WWPS south of the site.

5 Earthworks & Retaining Walls

The site requires filling to at least 6.1m AHD to meet the requirements of the 1 in 100 year flood level of the Peel Main Drain. Some fill will be placed in excess of this level in order to achieve drainage and sewer construction. Thus the site will be generally flat, with small differences caused by road design plus sewer and drainage design.

Because of the nature of underlying soils across some two thirds of the site, which are unsuitable for development without some remedial works prior to filling operations, it is proposed to utilize a method

of deep dynamic compaction to stabilize these soils, rather than excavating and carting the unsuitable soils off site to a tip, with associated dewatering, ASS remediation and replacement with expensive imported fill, and then importing and placing extra fill to attain the RL 6.1m finished ground level. The developer is desirous of attaining "A" site foundation classification for the finished lots, and the above deep dynamic compaction method is the only available method which will provide this. Minimal disturbance of the soil and ASS remediation is required for this method. We are advised that such methods are also being used for adjacent site developments.

Each lot will be finished level, with installation of low retaining walls to suit, except where lots back onto POS, where it is likely retaining walls may be up to 1.5m in height. Retaining walls will be constructed using reconstituted limestone blocks.

All fill will be imported to the site, via Baldivis Road from approved sand pits. It will be free draining to meet the geotechnical specifications and site drainage and building requirements. There is an embargo on site earthworks during the spring and summer, from October to March inclusive, due to easterly and south westerly winds causing dust and sand blows. The site will be fenced with appropriate wind fencing along all boundaries to minimize this, and watering down of stockpiles, stripped areas and filling operations. A Dust Management Plan will be provided by the Contractor at each stage of development, such to be approved by the City of Rockingham prior to starting site works.

Where roads or lots join between land holdings with separate ownership, levels on the roads and lot boundaries will be either matched to existing level or co-ordinated to ensure that a staged development approach can be accommodated. Walls may be required along boundaries if agreement cannot be reached with the adjoining owner. This may require retaining walls on a temporary basis within the road reserve.

6 Roads

All roads will be constructed to City of Rockingham standards and design approvals.

Baldivis Road along the frontage of the site has recently been upgraded to Boulevard standard. The development plan shows a central local connector road traversing the site from north to south, thus connecting with similar roads planned for developments north and south of the site.

The entry road to the site will connect with the new roundabout on Baldivis Road at the intersection with Pemberton Boulevard. This road traverses the Tramway reserve, where clearing will be minimized to allow road construction as approved by the City of Rockingham.

7 Drainage

A LWMS has been carried out over the site by RPS Consultants. The site falls within the Mundijong Drainage District and has a restricted outflow to the Peel Main Drain.

Generally stormwater runoff from roads will be collected by pits and conveyed by pipes to designated basins, which will attenuate volumes to pre-development levels for discharge into the outfall channels along the Kwinana Freeway reserve.

Subsoil drains will be used extensively to control any rise in groundwater, but will not be placed any lower than the agreed AAMGL for the site. All drainage pipes will be bedded on crushed rock to help with the control of groundwater.

Currently the site is drained by a man made agricultural open drain which falls south to north, exiting the site at the Water Corporation undeclared main drain in lot 545 immediately north of the site. This Main Drain discharges to the Kwinana Freeway reserve and ultimately via culverts under the Freeway, to the Peel Main Drain.

For this development, the site has been divided into four drainage catchments, three of which accept the majority of site stormwater drainage, exiting the site via a controlled overflow in the north east corner

via an overflow, where the existing outfall drain within lot 545 will be formalized by means of a box culvert drain and a portion of "living Steam" at the freeway end to match the existing outfall level to the Freeway reserve..

The southern catchment basin, which is the minor catchment of the site, will discharge allowed discharge via an overflow directly to the Freeway reserve.

Each basin has a restricted outflow, as per the allowance for the Mundijong Drainage District requirement, to the Kwinana Freeway reserve.

Catchments have been established based on topography, fill and minimum road grades to ensure optimization of basin areas and minimization of impact on POS.

Generally the low points in each basin have been designated as infiltration swales to cater for stormwater flow from 2% of the connected impervious area to act as a biological treatment zone. The base of such is set at a minimum of 300mm above the control Groundwater level (CGL).

Areas of basins greater than the above requirement are a minimum of 500mm above the CGL to allow active recreational use of the areas.

All basins will have the maximum depth of water of 1.32m for the 1 in 100 year ARI storm.

The LWMS has determined the AAMGL for the site, at which level subsoil drains will be placed so that no lowering of the water table below the AAMGL will occur with the development, but any rise in groundwater will be controlled.

8 Power

Sufficient power supply exists in the area to supply the development. A high voltage line is located along Baldivis Road, from which supply will be drawn.

All internal power reticulation lines and transformer installations will be constructed at the cost of the developer. Transformer and switch station sites will be determined at the detailed subdivision design stage to Western Power approval.

9 Water Supply

At present there is a 300mm water main past the site in Baldivis Road. Some augmentation to this supply will be required via a connection from Eighty Rd and Fifty Rd. This augmentation is expected to be made either by the Water Corporation or prefunded by other developers, and is not a pre-requisite to the development of the site.

Internal reticulation mains will be designed to Water Corporation approval to complete links through the site to developments north and south of the site.

10 Sewer

The site falls into two sewer catchments, each discharging to a Waste Water Pump Station (WWPS) as determined by Water Corporation sewer planning.

The northern half of the site falls within the catchment of the existing Baldivis North (WWPS') "I" located adjacent to Baldivis Road north of the adjacent Australand Development. Sewers to the site will be constructed by Australand to their southern boundary, from where Mirvac will extend the sewer into their site.

According to current Water Corporation sewer planning, the southern half of the site falls within the catchment of the proposed WWPS "C", which is now to be located and constructed within the Perron land development immediately south of the site by Perron. Sewers from the Perron development will be

extended to the site by their development. This WWPS will discharge into a 225mm sewer extended through the Australand and the Mirvac (this development) land.

It is expected that the first stages of the development will be within the existing WWPS catchment, thus allowing some time for the proposed WWPS to be constructed.

Fill required by the 1 in 100 year flood of the Peel Main drain is generally sufficient to allow each WWPS to serve the development.

The Water Corporation has now achieved approval for the linking sewer mains to the East Rockingham Waste Water Treatment Plant (ERWWTP), and as a result they are agreeing to new developments in this area.

11 Telephone

The new urban development will be served by the NBN or another provider for broadband and telephony. Capacity exists off Baldivis Road and the adjacent development which may require minor extensions to facilitate connection.

12 Gas

Gas services are located in Baldivis Road and the adjacent development and have sufficient capacity to serve the area with minimal augmentation.

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THIS REPORT IS DATED 21 AUGUST 2014.