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Engineering Services Report

(October, 2011)



LOTS 635, 739 & 740 BALDIVIS ROAD, BALDIVIS.

ENGINEERING SERVICES REPORT. REF PRO519

1 General

This report covers proposals for earthworks, retaining walls, roads, drainage. Ground water, water supply, power supply, gas, telecommunications, sewerage and the APT gas pipeline safety procedures as required for current urban development standards for some 850 lots - as shown on the Roberts Day Group plan.

2 Executive Summary

The land the subject of this report is located some 3 kilometers south of Safety Bay Road on the western side of Baldivis Road. The land is sparsely vegetated, mainly hosting residual trees, after being used as grazing land for many years. The basic land form is undulating sand hills of free draining sand underlain in parts by some pinnacle limestone.

The Environmental Geology map of the Geological Survey of Western Australia classifies this site as being suitable for urbanization.

The land can be connected to all services, either by extension from new neighbouring subdivision developments, or by extension along Baldivis Road. The Water Corporation has given advice that the land can be serviced with reticulated water to a level of RL 30m AHD, meaning the higher parts of the land above this level will be cut down to this level. Sewer services are available either from the neighbouring developments, or by installation of a new "permanent" pumping station at or about the intersection of Baldivis Road and Serpentine Road.

Experience with this land form in developments north of the site shows the soils to be free draining, meaning that all storm water will be retained on site by soakage in swales in line with current best practice as outlined in the "Liveable Neighbourhoods" policy. Ground water levels are a minimum of 2.5m below the lowest part of the land at the south east corner on Baldivis Road.

The site is traversed by the Australian Pipeline Trust (APT) high pressure gas pipeline and the adjacent Water Corporation Stirling Trunk Water Main, both located within a large easement. The easement land is available for use as POS, drainage and road crossings under strict guidelines as set out in the report below. Road crossings will need special attention to clearances and protection.

3 Site

The land, comprising lots 635, 739 and 740 is situated on the west side of Baldivis Road, opposite Serpentine Road, Baldivis, approximately 3 kilometers south of Safety Bay Road. The land occupies an area of approximately 88.6 ha.

The land is undulating, with elevation varying from a high point on the middle of the site at RL 39m AHD. The site has a central ridge running north east - south west, with low points at RL 15m AHD in the north western corner, RL 18m AHD at the mid point along the northern boundary, and RL 6m AHD in the south eastern corner adjacent to Baldivis Road. Baldivis Road along the eastern boundary falls from RL 10m AHD at the north east corner of the site to RL 5.5m AHD at the south east corner of the site.

The geology of the land is described by the Environmental Geology Map of the Geological Survey of WA, as being the most part "S7, sand derived from Tamala Limestone", except for the south east corner,

where a small area of Bassendean Sand is located at the low area. Both soil types are described as suitable for urbanization.

The site has previously been used for grazing, and is parkland cleared, with houses and sheds located in the centre. Each site is connected to telephone and power.

Across the eastern half of the land, within an easement, there are existing trunk water, the water Corporation's 1400mm Stirling Trunk Main, and the High pressure natural gas pipeline of APT. A cross section across the easement is attached showing the approximate location of each service within the easement.

Baldivis Road, abutting the land along the eastern boundary, is constructed as a good standard rural road with bitumen seal without any formal drainage.

4 Development Proposal

It is proposed to develop the land as a residential subdivision of around 850 lots, with all normal services, with links to abutting developments (existing and proposed) for sewer, water, power, roads, gas and phone services, with all drainage to be retained on site, using best management practices. Two road connections are planned to Baldivis Road, each of which will traverse the pipeline easement.

The development will entail substantial earthworks to provide level building blocks from the undulating land form, with all lots having retaining walls to allow this, plus substantial sand export opportunities because of the Water Corporation's service level limitation of RL 30m AHD in this area. Three low areas will be retained in as natural a condition as possible, including trees, for use as POS with included drainage swale soakage.

5 Earthworks & Retaining Walls

The site is restricted to a water supply servicing level of RL 30m AHD by the Water Corporation, and subsequently it is planned to cut the high areas to this maximum level, meaning a cut of some 10 metres at the existing high point. Some of this sand will be used on site where fill is required, but the majority will need to be exported off site.

Each lot will be finished level, with installation of retaining walls to suit. The retaining wall height is proposed to be restricted to 1.5m (4 blocks) in height on side boundaries, with a maximum of 3m heights to rear boundaries in order to provide the maximum amenity to lots without shading. Retaining walls will be constructed using reconstituted limestone blocks.

The earthworks will be designed to start the cut at the 28m contour, to allow road design grades to determine lot levels up to the maximum height.

The attached earthwork and lot level plan, **PRO519 EW-1 Revision B**, shows preliminary road centerline levels as well as the finished lot levels, overlaying the natural contours. As far as possible, lots and roads meeting abutting boundaries have been designed to match existing ground levels, except where the RL 30m level is reached. At such points, if the abutting development has not proceeded, it is likely lots will be left undeveloped and battered to the boundary. About 5 lots plus a group housing site, and 4 roads are so affected.

Lots on the southern boundary have been designed to match existing ground levels, so that when the adjacent land, which contains a sand quarry, is developed, those lots will need to match. It is planned to put the footings to the boundary walls at least 1 block lower than ground level to facilitate future lots levels south of the boundary. Perusal of the ground contours in this area shows ground levels matching with lot 740. Any future road joining from the south will similarly need to match up in terms of grade and elevation. We do not have any plans showing lot or road levels to the south of lot 740.

We have level plans from the development along the western boundary, and have matched levels in consultation with the Engineering Consultant for that project.

Along the northern boundary, in the absence of any level information, we have assumed a wall and fill height in the central low area, of a maximum of 3.5m to the RL 22m AHD level, assuming future lots backing on to this development will also be filled to approximately this level.

6 Roads

All roads will be constructed to City of Rockingham standards. The main central road is designed as a main artery from Baldivis Road to the proposed neighbourhood centre, school, retirement village and the central POS, and beyond to provide access to the western POS/ playing field area. The design of this road reaches a peak at approximately RL 29m AHD at a central round-a-bout.

The road levels are generally shown on the earthworks plan.

We have road design information on the western boundary, and have matched those levels. Elsewhere, we have made educated guesses as to the boundary road levels.

Where the two east- west roads off Baldivis Road cross the pipeline easement, the profile of the road will be lifted as shown on the levels, so that the required minimum cover over the pipelines is maintained at 1 metre. Previous experience in constructing roads across this easement north of Safety Bay Road have given us the background to forecast required levels. We have attached a diagram of the proposed road showing approximate location of the pipelines. The actual position of each pipeline will be located by survey prior to detailed design.

It is envisaged that Baldivis Road will be upgraded to urban standard during the development, including kerbing, sheeting and drainage, plus underground services as required for the development.

7 Drainage

The soil characteristics of the site are conducive to site soakage according to the Geological Survey plan. Therefore all stormwater drainage will be retained on the site via soakage swales, including the 1 in 100 year event.

The land falls into 5 drainage catchments as shown on the attached drainage strategy and catchment plan **PRO 519 D-04-Revision B**. This sets out the drainage catchments as determined by the preliminary road design, and shows diagrammatically the swale locations. The pipeline easement land has been utilized as much as possible for drainage swales to minimize flows to Baldivis Road.

The site has been divided into 5 main catchments which are sized as follows.

1. Catchment 1. This catchment of 6.05 ha impervious road area includes includes 1.33 ha impervious area of the Baldivis Road reserve at 20 metres width This catchment flows to the POS in the south west corner of the site, where the major event (100 year) storm will be stored.
2. Catchment 2. This catchment of 1.36ha impervious road area will flow to swales located within the Pipeline Easement. Any major event storm will have overland flow to the POS located on Baldivis road.
3. Catchment 3. This catchment of 1.36 ha impervious area will flow to the swales located in the POS adjacent to the Group Housing and the swale in the pipeline easement.
4. Catchment 4. This catchment of 2.06 ha impervious area will drain to the swale located in the POS south of the primary school site.
5. Catchment 5: This catchment consists of the majority of the area on the western side of the ridge. Consisting of some 8.31 ha impervious area the basin is located in the existing low point and will be constructed to accommodate the 5 year ARI stome with the 100 year inundating greater areas beyond this on rare occasions.

Generally the low points in each catchment have been designated as infiltration swales for the 1 in 100 year design storm, with detention swales located along road and POS reserves to hold flow from storms up to the 1 in 5 year return period.

A separate **Local Water Management Strategy (LWMS)** has been carried out and has been reviewed by the DoW with minimal comments. The LWMS is currently being adjusted to suit the recent changes to the planning and adjusted to suit the DoW comments.

The proposed drainage system for the subdivision will also include accommodating drainage flows from Baldvis Road, with swales proposed along Baldvis Road, with the 1 in 100 year flow ending up in the swale basin proposed within the P.O.S. site at the south east corner of the site.

This proposed basin on Baldvis Road will be approximately 1.5m deep, giving a clearance over the Average Ground Water Level of at least 1 metre.

8 Groundwater

The groundwater level at the site appears to be approximately 3m AHD along Baldvis Road, according to extrapolation from the Perth Ground Water Atlas 2004. Groundwater levels as measured in September 2009 show a level of RL 3.47m AHD at the south east corner of the site, and 2.48m AHD at the north east corner of the site.

The measured groundwater levels have been compared against DoW bores in the area and the long term levels have been adjusted to suit the longer term records of the DoW bores. The AAMGL contours have been shown on the **catchment Plan D-04**.

The lowest ground level on the site is approximately RL6.1m AHD at the P.O.S. / drainage swale basin site located in the south east corner of the site. The lowest basin level is in the same location which is some 0.6m above AAMGL.

9 Power

It appears that sufficient power supply exists in the area to supply the development

- A low voltage aerial line is located in Baldvis Road south of Serpentine Road and fed from Serpentine Road adjacent to the site. This line services lot 740.
- A second high voltage (HV) aerial line serves lots 635 and 739 from across Baldvis Road opposite their common boundary. This line is extended from the HV feeder line situated east of Baldvis Road.
- In both cases the feeder lines continue into the lots to serve existing house and farm buildings.
- The main feeder line for both these connections is a high voltage aerial line located approximately 100 metres east of Baldvis Road, running north – south.

All aerial lines along Baldvis Road will be relocated underground in line with current WAPC approval policy at the cost of the developer. The existing aerial service lines inside the lots will be removed as part of the development.

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

10 Water Supply

At present there is no reticulated water supply to the site. The Water Corporation's 1400mm Stirling Trunk Water Main is located within the pipeline easement, but cannot be connected to. Any service or road crossing of this main will need to meet specified clearances. The exact position and level of the trunk main will be picked up by site survey prior to starting detailed design.

- The Water Corporation has advised that the site falls into two supply areas; Tamworth and Karnup, and that the southern portion, ie lots 739 and 740, (the Karnup Water supply Scheme) has not been fully planned, although finalization of the planning should happen within the next twelve months.
- The Corporation has also advised that any development in this southern area prior to the Karnup Scheme being finalized, that temporary service may be possible by an extension from the Tamworth Supply Scheme which will service the northern portion of the site, ie lot 635.
- Water Corporation also advises that the limit of supply is the 30m contour.

At this stage, servicing is proposed via an extension along Baldivis Road from the north. A development on the western boundary of the site will connect to this development when it reaches that area.

11 Sewer

The site is currently remote from sewer services for the eastern section of the site. The sewer strategy has been carried out with advice from the Water Corporation and neighbouring developers. The whole site is to be sewered by gravity sewers from either newly built sewers, or future sewers into a new pump station east of Baldivis Road.

The site is divided into three sewer catchments the western catchment, the northern catchment and the eastern catchment. The eastern catchment will be served by a pumping station.

- The new development proceeding along the western boundary of the site will provide future connection for the **western catchment** of some 28.9 ha. Arrangements have been made with the consulting engineers for the sewer infrastructure for that development to construct inlets as required for linking to this development. The sewer infrastructure is now built.
- The **northern catchment** of some 11.3 ha will connect to future development infrastructure to be constructed in the abutting land along the northern boundary of the site. It is expected this infrastructure will be in place when this area of the catchment is to be developed.
- The **eastern catchment** of some 48.9 ha is, for convenience, all included as one catchment contributing to a future “permanent” sewer pump station as per Water Corporation sewer planning. The current planning by the Corporation shows two western catchments, but as all the land, once roads are constructed, will fall to the south, we have assumed the gravity sewer will follow the finished fall of the land.
- Water Corporation planning shows the **permanent pump station** to be located approximately 100 metres east of the site on Serpentine Road. This land is not owned by the developer, and provision has been made to locate this station or a temporary sewer pump station on the site within the POS opposite Serpentine Road. Discussion will be required with the Corporation to confirm the permanent site location.

The Corporation also advises that this station will probably need “prefunding”. The pressure main from the station will extend approximately 1 km to the north to connect to existing infrastructure.

12 APT Pipeline Easement

This is a 67 metre wide affected area skewed across the western half of the site, which contains the 375mm Australian Pipeline Trust (APT, originally WANG) natural gas pipeline in its centre, plus the Water Corporation’s 1400mm Stirling Trunk Water main located on the eastern side of the gas pipeline.

The development setbacks from the pipeline must be in accord with the requirements of Planning Bulletin 87 – High pressure Gas Transmission Pipelines in the Perth Metropolitan Region (PB 87).

Prior to commencement of subdivision works, the subdivider shall prepare and implement a Pipeline management Plan detailing measures to ensure public safety and the protection of the high pressure natural gas pipeline, including completion of a risk assessment in accordance with AS2885 and implementation of measures required to ensure that the level of risk of future inhabitants of the subdivision is as low as is reasonable practicable.

This risk management assessment has been carried out and it has been agreed with APT that higher risk land uses such as aged housing, schooling and neighborhood centres will be removed from the higher risk locations.

Although this has now been resolved from a planning perspective, at the time of construction the developers and their consultants will need to approach APT to resolve a further pipeline management plan to ensure that the construction of the works in close proximity to the pipeline are properly managed to ensure the safety of the construction personnel. It is at that time that the matter of the road crossings, the levels thereof and the required management measures for the job will be required to be resolved.

13 Telephone

Telstra services exist in the area along the west verge of Baldivis Road, and will most likely to be able to be extended to service this proposed development. Some upgrading may be required.

A Telstra Fibre Optic cable is also located on the west verge of Baldivis Road across and beyond the frontage of the site. This FO cable is located approximately on the 4m alignment.

Telstra normally require twelve months notice of development starting to ascertain any upgrading requirements.

14 Gas

There is no gas infrastructure in Baldivis Road, but gas services are currently being installed in developments to the north and east of the site, and will most likely be able to be extended to adequately service this proposed development.

WestNet Energy on behalf of WAGAS networks has supplied their gas reticulation plan of the area and it is attached to this report with the other servicing plans.

15 Attachments

Drawings referred to above are attached as follows;

- PRO 519 E-01 Rev B Earthworks Overall plan.
- PRO 519 D -04 Rev 4 Post Development Drainage Catchment Plan.

DEVELOPMENT ENGINEERING CONSULTANTS PTY LTD

THIS REPORT IS DATED 1ST OCTOBER 2011.

