

C Preliminary Engineering & Infrastructure Assessment

Noonamah Ridges

Residential Development



Utility Services, Roads and Stormwater Drainage

Final Report

Utility Services, Roads and Stormwater Drainage. Preliminary Report

REV	DESCRIPTION	AUTHOR	REVIEWER		BDD APPROVAL		DATE
0.1	Draft	Norberto Ayala-Samalea	Norberto Ayala-Samalea		Simon Byrne		29/08/2013
0.2	Version 2	Susannah Boer	Norberto Ayala-Samalea		Simon Byrne		09/09/2013

DISCLAIMER

This report has been prepared on behalf of and for the exclusive use of INTRAPAC Projects Pty Ltd and is subject to and issued in accordance with the agreement between the INTRAPAC Projects Pty Ltd and Byrne Design. Byrne Design accepts no liability or responsibility whatsoever for this report in respect of any use of or reliance upon this report by any third party.

EXECUTIVE SUMMARY

This report has been prepared with the purpose of detailing different servicing options for the development of the Noonamah Ridge residential subdivision. It also looks at the advantages and disadvantages of different servicing options given the site and existing conditions. The report has been prepared to cover the following disciplines: traffic, stormwater and drainage, water, sewer, power supply and communications. A cost estimate and drawing set is also included.

Several specialists and subcontractors have been contacted in the compiling of the report. In addition, an in house desktop study has been undertaken to ensure that as many variables as possible have been considered.

The major thesis of the report is that as services to the site are limited, initial servicing costs could be significant if head works are adopted. The report includes alternatives that reduce the need for a high initial investment and are more in line with the servicing adopted by other developers in the area.

The site is ideally located near both the Stuart Hwy and Arnhem Hwy, providing excellent access routes to Darwin major areas and is well serviced with existing connector roads. The topography of the site, and proposed lower density will allow for innovative stormwater management and landscaping options which will enhance the liveability of the development.

Finally, the vision for the project is to provide the development with a rural character by combining allotments of different sizes depending on capability of the land, and by integrating the road and drainage system with the natural environment.

TABLE OF CONTENTS

INTRODUCTION.....	3
WATER SUPPLY.....	4
Existing conditions.	4
Future plans	4
Proposed works	4
Option 1 (Town Water Supply)	4
Option 2 (Bore water)	5
Location of ground water tanks	5
SEWER.....	7
Existing conditions.	7
Future external works.....	7
Proposed works	7
Option 1 KEWT treatment systems.....	7
Option 2 (Combination of septic & KEWT treatment systems)	8
Proposed size of land required for irrigation.....	8
POWER SUPPLY	8
Existing conditions	8
Proposed works	9
Option 1	9
Option 2	10
COMMUNICATIONS	10
Existing conditions	10
Proposed works	11
STORMWATER MANAGEMENT STRATEGY	11
Existing conditions	11
Climate	11
Topography and drainage	11
Receiving ecosystems	12
Proposed works	12
Stormwater quality	12
Water conservation.	13
ROAD NETWORK	13

Existing Conditions.....	13
Site context	13
Existing road network	13
Future external works.....	14
Proposed works	16
Impact on existing road network	16
Bus route.....	16
APPENDIX A: DRAWING SET.....	17
APPENDIX B: EXPECTED TRAFFIC GENERATION.....	18
APPENDIX C: COST ESTIMATES	19
APPENDIX D: LAND REQUIREMENTS.....	20

TABLE OF FIGURES

Figure 1 NBN rollout plan for development site as of 3/10/2013	11
Figure 2 – Greater Darwin Plan Litchfield Concept Plan with overlay of proposed development and access routes.....	14
Figure 3 – Noonamah Area Plan (Preliminary Draft) with overlay of proposed development and access routes.....	15

INTRODUCTION

Byrne Design has been commissioned to prepare this report to review the servicing options for the proposed Noonamah Ridge Development in Noonamah NT. The existing site is made up of lots 4574, 3476 and 3477 and bounded by Redcliffe Rd, Mocatto Rd and Townend Rd. The site is expected to be developed into an estimated 3000 individual residences with the inclusion of a small town village/commercial area, recreational areas and a school.

This report covers a description of the overall strategy for the provision of utility services to the development including Power, Communications, Sewer and Potable Water. It also describes elements of the Stormwater Management Strategy and the proposed Road Network Management. The report also provides cost estimates and land requirements.

While every effort has been made to ensure the report is as accurate as possible, some variables are present which may result in some changes to servicing costs and most viable options.

WATER SUPPLY

Power and Water Corporation (PWC) are responsible for approving the water infrastructure works required to service the development.

Existing conditions.

There is no water infrastructure within the property boundaries. Residential allotments in the vicinity of the site are serviced with individual bore holes.

There are one DN1050MSCL and one DN300/DN375MSCL pipes running along the Stuart Hwy five km west of the development, these pipes have almost reached their capacity.

Future plans

A new Water Treatment Plant one kilometre west of Stuart Hwy off Alverly Road is planned by PWC to treat water from Manton Dam. The plans also include a proposed elevated water tank within the boundaries of the proposed development

It is understood that Power and Water Corporation are planning to build a water tank at the intersection between Stuart Hwy and Alverly Rd to service Weddell.

Depending on time of construction of these water tanks and progress at the Noonamah development it may be possible for these water tanks to service some part of the development.

Proposed works

As in most large development projects the release of land in Noonamah Ridges will be staged over an estimated 20 years. The development process will be impacted by severely limited existing infrastructure in the vicinity of the site, resulting in high initial development costs.

It is envisaged that the first stages of the development could include the release of allotments that are not serviced with the ultimate water supply solution. Instead, these lots could be provided with water bore holes.

Two alternatives are proposed for the servicing of the development. They are summarised below.

Option 1 (Town Water Supply)

- Option 1A
 - Ultimate servicing via existing mains and existing booster pump station (both located on Stuart Hwy). Rising mains to be DN450 (mild steel), and to either run down Elizabeth Valley Rd, or Alverly Rd. Proposal is to relocate pump station to the intersection of either Stuart Hwy/Elizabeth Valley Rd or Stuart Hwy/Alverly Rd. Relocating the existing booster pump will save length of mains required, and ultimately reduce costs. There is a risk with this option, that there could be insufficient head to service lots in higher ground.
 - Water will be pumped to one or more ground level tanks from existing mains. Three possible locations have been suggested, and are summarized below in Table 1.

- Finally an elevated tank may need to be constructed at a later stage to service lots on higher ground. To reduce costs, alternatively the elevated tank could be eliminated and the outstanding lots could be serviced via onsite storage or bore holes. The higher level ground could be used for recreation instead so that the water demand is minimal.
- Option 1B
 - Same as Option 1A, except preceded by initial temporary servicing of first 300 lots by connecting to existing mains off Stuart Hwy. PVC rising main and smaller size ground level water tank can be used to reduce cost subject to the approval of PWC.
- Both options 1A and 1B require the upgrading of existing pump station.

Option 2 (Bore water)

- Several larger bore holes could be drilled and the then water pumped to a ground level tank and then reticulated to homes. At some stage an elevated water tank may need to be employed for the same reasons as in Option 1 above.
- When PWC upgrades the existing head works/infrastructure and existing mains, reticulated town water could then be supplied to the development. However, this is dependent on timing of the upgrade and completion of the development.
- Individual bore holes could be drilled for properties over 2Ha, and for lots over 4000sqm where reticulated sewer is provided.
- This option is dependent on sufficient groundwater. Preliminary data shows a high yield, high quality aquifer with no other existing bore holes east of the development.

As mentioned above, external water tanks and future upgrading works by PWC and others may also provide part of the ultimate solution for either option employed depending on availability, timing and existing infrastructure.

An estimate of the costs of the upgrading works, tank installation, rising main and internal reticulation is provided in Appendix C: Cost Estimates. Note that the costs are subject to change based on contractors, suppliers, inflation, geological conditions, lot layout, chosen servicing option (i.e. number, type and location of tanks, booster upgrade chosen etc.)

Location of ground water tanks

Three locations for the ground water tank(s) have been considered, these are summarised in Table 1 below with advantages and disadvantages of each. It may be worthwhile employing two ground level water tanks in order to maintain more uniform pressure. This however is subject to cost and approval. The tank is required to achieve agreed storage volumes and pressure parameters across the whole site with initial calculations showing it will require the capacity to store 15 ML of water. PWC Supplement to WSA require two Ultimate Peak Day Storage but will most probably accept one day storage only. Appendix A: Drawing Set (drawing numbers 1315-SK06 & SK07) shows ground level water tank proposed location option 2.

Table 1 Ground level water tank location options

	Location 1	Location 2	Location 3
Location	Highest point close to the northern edge of Lot 3477	80 contour at the eastern edge of Lot 3476	Second highest points within northern edge of Lot 3476.at 78 contour level
Level	80-81m	80m	78m
Advantages	Located centrally between eastern and southern parts of the subdivision If pump station is relocated to Alverly Rd, DN450 rising main length could be reduced	Centrally between northern and southern parts of the subdivision	Closer to the high density development If pump station is relocated to Elizabeth Valley Rd Intersection, DN450 rising main can be reduced by approximately 1km
Disadvantages	Only possible if PWC permit the relocation of the existing booster pump station to Alvery Rd May not be economical if Lot 4574 is developed as the initial stage. Longer distribution main has to be built from Lot 3477 to Lot 4574 at the initial stage.	Total length of the proposed DN450 would be longer.	Filling would be recommended in order to increase from 78m.

SEWER

Power and Water Corporation (PWC) are responsible for approving the sewer infrastructure works required to service the development.

Existing conditions.

There is no sewer infrastructure within the property boundaries. Residential allotments in the vicinity of the site are serviced with septic tanks.

Future external works

Reticulated municipal sewer services are not proposed for the area in the foreseeable future.

Proposed works

Option 1 KEWT treatment systems

The proposed treatment plants are KEWT systems, supplied and maintained by GBG Wastewater Management and similar to those used at the Coolalinga Shopping Centre. These systems have been approved by PWC and are a community scale onsite treatment solution which allows the risks of treating and disposing of wastewater to remain in the low to medium risk category for public and environmental health. KEWT systems can be managed and operated under the direct oversight of the regulating authorities PWC and NT Health.

If KEWT treatment systems are to be used to service the development, it is suggested three separate systems is used throughout the development in combination with a gravity fed pipe reticulation. There are a number of advantages of installing three separate systems;

- The size can vary in order to best cater for topographic catchments or construction schedule
- The investment in the system can be staged along with the progress of the development to reduce the initial capital outlay required, and minimise the land lost.

Additionally a small treatment plant will be required to treat the school and the small business centre. Wastewater from schools is typically 3 to 4 times higher in nitrogen than domestic wastewater and has very low flows per student. Consequently, these flows should be treated separately.

Each system will comprise a number of tank and channel assemblies with a central tertiary treatment facility and a recycled water storage that can service the recycling needs in the associated catchment. Central to the GBG approach to wastewater treatment is the implementation of a SCADA system that will allow access and control from any computer with an internet connection. These systems will be placed on a cloud server and operators can then work with the systems as single or multiple systems from a central point via a VPN pipeline. Access can also be provided for other stakeholders as specialised software is not needed for viewing and control. Inadvertent or malicious control actions are controlled by password protection. GBG already has local representatives in the area who will be engaged to be the “eyes and ears on the ground”.

Where possible the beneficial reuse of treated water is encouraged in a bid to improve the sustainability of any treatment system. With this aim the project proposes that five hectares of amenities facilities of certain categories of public open space within the development are

irrigated with recycled water, no third pipe system is proposed for public use. Excess treated water could also be used for cropping systems. Lucerne, dry forage and bamboo are some potential crop options. A hybrid of amenity and crop irrigation could be used throughout the development depending on what is most suitable in each location. See Appendix A: Drawing Set (drawings 1315-SK06 & SK07) for possible locations for the treatment plants.

The following issues are yet to be fully considered or determined and will impact the design. Firstly, site topography should be considered prior to further design to allow for gravity flow to the sewer where possible and the presence of rock in the area will be an important factor during trenching. Secondly, there are three areas identified where natural ephemeral wetland areas are present, these areas will also not be used for construction. In addition heritage and cultural sites, and a quarry site will not be used for construction. Thirdly, while a school and commercial zone are proposed, the size of these facilities is yet to be determined. The size of the school and commercial zone will impact the size and cost of the treatment facility. Lastly, a disposal strategy of treated water needs to be considered.

An estimate of the quantities of sewer treatment systems, irrigation and internal reticulation is provided in Appendix C: Cost Estimates.

Option 2 (Combination of septic & KEWT treatment systems)

The topography of the site and the staging of the development mean the optimal solution to sewer the area may be to combine different sewer solutions. There is the potential to provide septic tanks for the larger allotments and sewer treatment plants for the smaller lots. In addition, the first 300 lots could be provided with septic tanks. This option will still provide aquifer protection. It will reduce or eliminate the required reticulation, land requirements, overall cost of infrastructure installation, maintenance and running costs.

Proposed size of land required for irrigation

As stated earlier, the proposed development will be 3000 lots. Current best practice assumes 3.5 Equivalent Person (EP) per residence giving a total of 10,500 EP for the site.

Initial modelling suggests the required treatment area is 5Ha/1000 EP. However, this is a very conservative estimate, and most likely could be reduced to around 3Ha/1000 EP. Consequently, between 52.5 and 31.5Ha will be required for treatment if option 1 is employed. Land requirements will be less for option 2.

POWER SUPPLY

Power and Water Corporation (PWC) are responsible for approving the electrical infrastructure works required to service the development.

Existing conditions

The existing PWC network in the rural area is 22kV (overhead). There is minimal spare capacity in the existing PWC network in the area of the proposed subdivision and as such is not adequate to service the proposed subdivision.

Proposed works

PWC were consulted to obtain information on existing electrical infrastructure and possible interconnection requirements with existing reticulation.

The estimate load allocations across the site are classified as basic supply which is the loads to be used as part of the subdivision design for lot servicing.

PWC load allocations standards are as follows:

- Single Dwelling (SD) lot : 4.5kVA
- Rural Residential (RR) lot : 10 kVA
- Rural Living (RL) lot : 25kVA

Based on above, the load allocations are estimated as follows:

- RR lots (2000 lots) - 20MVA
- SD lots (1150 lots) - 5.2MVA
- Multiple Dwelling (MD) lots (50 lots) - 1.7MVA
- School/Commercial precinct – 2.5MVA

Based on the above load allocations the total basic supply equates to approximately 29.4MVA. This includes substation sizing. For sizing of feeders to the subdivision, diversity is used.

The following will also impact the design:

- Lot zoning and lot zone distribution
 - Urban areas will require underground 22kV and rural overhead 22kV.
 - The load allocations are based on an estimate of the lot zone distribution. If this estimate changes, the power requirements will change
 - Street lighting will need to be provided in urban areas, but not in rural (this is subject to change due to new Litchfield Council requirements currently in draft form).
- Size of school & commercial precinct
 - Currently, only an estimate is available, more or less power may be required.

While some cost estimates for each option are provided below, further analysis is provided in Appendix C: Cost Estimates.

There are two options to provide the additional capacity as summarised below:

Option 1

This option includes the provision of two dedicated feeders (one overhead and one underground) from McMinns Zone Substation (adjacent to Stuart Hwy-Arnhem Hwy intersection). The proposed dedicated feeders will have the following approximate ratings:

- 22kV Overhead (Neon): 6.2MVA based on 15km route - \$3M plus 10% GST
- 22kV Underground (Aluminium 400sqmm): 14.6MVA based on 12.5km route - \$5M plus 10% GST

PWC have advised that McMinns Zone Substation is to be upgraded and that there will be capacity to allow for above two feeders to be connected. This option is preferred by PWC and would provide the required capacity for the proposed subdivision. Due to the higher cost of the underground feeder, it is recommended that the overhead feeder is provided before the underground and the underground feeder to be provided once the load on the overhead feeder reaches a maximum acceptable level to PWC as a single dedicated feeder. It is expected that the underground feeder would be required in the second or third year of development. PWC are to review the network in this area in the next few years and there may be the possibility of interconnecting with either Weddell or Manton Zone Substations. The proposed reticulation within the subdivision may consist of a combination of 22KV underground and overhead supply. See Appendix A: Drawing Set, drawings 1315-SK06 and 1315-SK07 for option 1 and 2 respectively.

Option 2

The establishment of a Zone Substation which would be interconnected to existing PWC 66kV transmission line via new 66kV transmission line extension. The Zone Substation would ideally be located close to the main/high load area, with a recommended location being in the vicinity of Alverly Rd/Redcliffe Rd intersection. The Developer would be required to provide the land allocation (100mx100m: 1Ha) required. The associated costs of the Zone Substation (\$12-13M approx.) and 66kV transmission line extension/interconnection would need to be further discussed with PWC to determine/confirm cost contribution (if any) the developer would be required to make.

The issue with the establishment of a Zone Substation is timeframe. PWC have advised that the timeframe currently is between 2-3 years from when planning begins to when a Zone Substation is commissioned. Therefore this option is not considered viable at this stage by PWC. Until the Zone Substation is constructed, a temporary solution could be provided.

COMMUNICATIONS

Telstra and NBN Corporation are responsible for approving the telecommunication infrastructure works required to service the development.

Existing conditions

An existing underground Telstra cable runs along Alverly Rd and services the Jorn Radar. Fixed wireless is already available in part of the development already, as seen in the NBN status map below. However, the rest of the site is not even mentioned in the 3 year rollout plan.

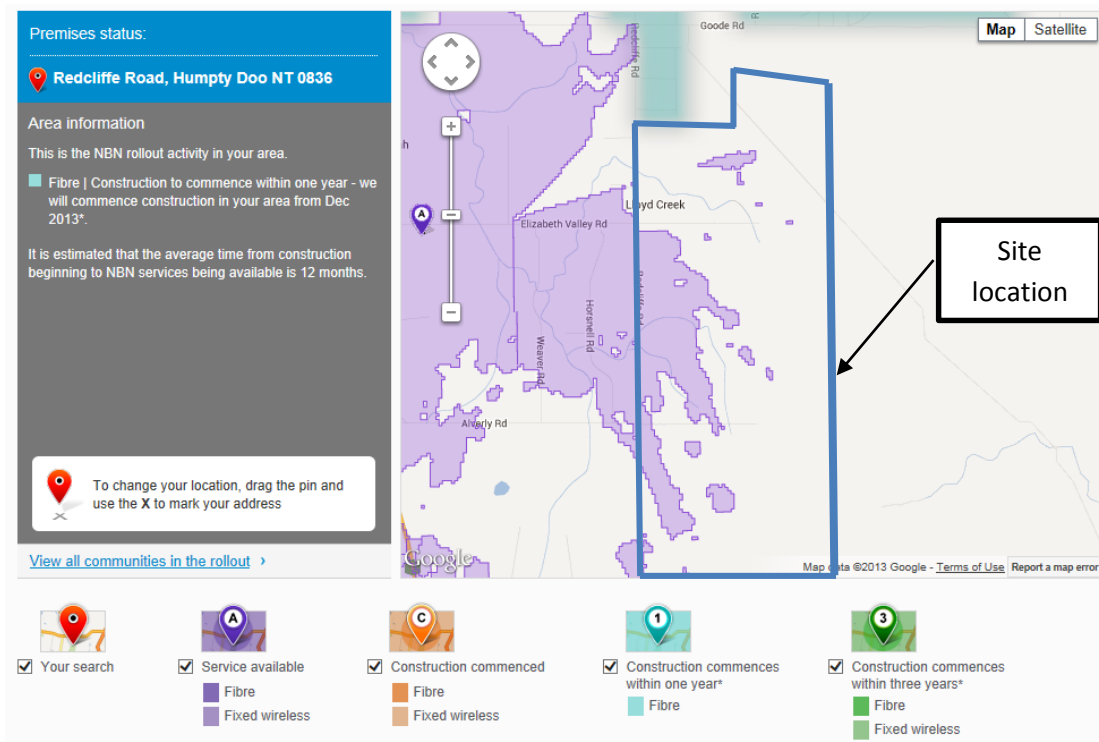


Figure 1 NBN rollout plan for development site as of 3/10/2013

Proposed works

The project will coordinate with the authorities to provide a system of pipe and pit throughout the subdivision area to enable NBN Corporation to pull through fibre optic cable as part of individual stage of works. Applications to NBN should be made as soon as the layout of the development is confirmed.

STORMWATER MANAGEMENT STRATEGY

Litchfield Council and the Land Resources Department are responsible for approving the Stormwater Management Plan for this development.

Existing conditions

Climate

The climate in Noonamah is highly seasonal and dominated by an extreme wet season from December to March. During this period vegetation growth is significant, soils become saturated, groundwater recharge fills local aquifers and stream flows may be formed in low areas. The dry season runs for the rest of the year in which local streams cease to flow and irrigation of landscape areas is required. The average annual rainfall is 1700 mm per year.

Topography and drainage

The proposed development is located in a green field area that covers approximately 2400 hectares with some areas showing relative soft gradients between 0.1 and 2.0 per cent and others steep slopes of up to 5 per cent, except for the ridge line which crosses the property through the middle running north to south. Valleys can be identified all across the site and some localised low areas can be found along Redcliff Rd. Appendix A: Drawing Set

(Drawing 1315-SK08&SK09) includes sketches showing the catchment areas, valleys, areas subject to flooding, the receiving ecosystems and existing culverts.

Along Redcliffe Rd six culverts have been constructed as part of the drainage works in the area, two of which have been provided with flood plain rock protection. Two culverts have also been surveyed on Townend Rd and two more on a dirt track inside the development.

Across the western side of the development and along Mocatto Rd reserve three low points provide overland flow path for the runoff from the site to areas outside the property boundaries.

Receiving ecosystems

The western catchments drain to three unnamed creeks located either side of Elizabeth Valley Rd. To the north the creek crosses the road and runs along an area marked as conservation zone on the NT Land Zoning maps. All these creeks run for approximately one kilometre before they converge into a larger system which finally drains to the Elizabeth River. South of Alverly Rd there are also signs of small valleys draining to the same system. The eastern part of the developments drains to Lloyds Creek and Acacia Creek which flow to the Adelaide River 15 kilometres to the east. This can be seen in Appendix A: Drawing Set (drawing 1315-SK09).

Proposed works

Stormwater quality

In order to protect the unnamed creeks and Lloyds Creek the development proposes the implementation of a drainage strategy plan in line with the Darwin Harbour Strategy.

The Darwin Harbour Strategy (Darwin Harbour Advisory Committee 2010) includes the following guidelines:

- 1.4 Water quality and ecological health of the marine, freshwater and terrestrial catchment environments in the region are to be maintained or, if quality and health have been negatively affected through human activity, improved where possible
- 1.10 Stormwater collection systems are to be designed and managed to minimise pollution of receiving waters , protect the structure of waterways , optimise the protections of property, and where and when possible provide grey water for reuse and ensure public health and safety.

The development will introduce a drainage management system aiming to reduce the discharge of pollutants into the receiving system; stormwater infrastructure will be incorporated to remove a proportion of the total suspended soils, nitrogen, phosphorous and gross pollutants. Integration of landscaping spaces with conservations corridors, stormwater systems and recreational facilities is a key principle of the stormwater strategy. Drainage features such as swales, silt traps, permeable paving and retarding basins can be integrated across the site in accordance with best environmental practices.

For the duration of construction phase including roads, drainage, utilities and buildings, the project will implement an erosion control plan for the protection of the receiving systems, these measures include retarding basins and silt traps located at critical location within the drainage system.

Water conservation.

The water strategy will also include consideration to wastewater minimisation, potable water conservation, and stream stability.

Potable water conservation will include reducing the garden irrigation demand of potable water by adopting low water use landscaping in public parks, encouraging low water use garden in private allotments and use of recycled water for irrigation.

The development will aim to minimise the wastewater and reduce the outflow by using sewer treatment plants where feasible.

Qualitative stream stability will be achieved by maintaining natural sediment supply rates to the receiving watercourses and the preservation of dry and wet season flow regimes.

ROAD NETWORK

Litchfield Council is responsible for approving the road network for this development. Road Network NT is responsible for the road reserves and approving the impact of the development on the existing arterial roads.

Existing Conditions

Site context

The Noonamah Development is located within the Lichfield Council Municipality. The main access to the site is from the west via Stuart Hwy and from the north via Arnhem Hwy. The area around the development is mainly rural subdivisions with large lots and wide roads with minimum traffic.

Existing road network

Redcliffe Rd is a two-way two-lane sealed functioning as a collector road which runs along the east boundary of the property from north to south and connects to the Arnhem Hwy to the north.

Goode Rd is a two-way two-lane sealed road from Redcliffe Rd to the east with no connection to the west.

Elizabeth Valley Rd is two-way two-lane sealed functioning as a collector road running in the east-west direction from the Stuart Hwy to the eastern boundary of the development. The connection with the Stuart Hwy is a channelised intersection.

Alverly Rd is an unsealed track that passes through the development in the east-west direction. Outside the development it is a sealed road from Redcliffe Rd to the Stuart Hwy, there is currently no formalised access from Alverly Rd to the Stuart Hwy.

Townend Rd is a two-way two-lane sealed road running in the east west direction at the southern end of the development with access to the Stuart Hwy via a T intersection.

Future external works

The future road network for roads in the vicinity of the development site can be determined from the following two strategic plans:

- The Greater Darwin Plan and its associated Litchfield Concept Plan; and
- The Noonamah Area Plan (Preliminary Draft for Discussion) contained within the Rural Village Development Discussion Paper

Alverly Rd reserve is a 100m wide corridor that crosses the site connecting Stuart Hwy with Arnhem Hwy. Along the reserve there is also a 100m utility corridor which is expected to accommodate gas, power and water infrastructure. Both reserves have been combined into a 200m wide corridor. As traffic increases in the area and in the long term Alverly Rd is expected to become a heavy vehicle arterial road between the two highways.

Goode Rd reserve is a 60 meter road reserve which is identified as a possible road network connector between Stuart Highway and Arnhem Highway in the future.

Overlays of the proposed development with the Greater Darwin Plan Litchfield Concept Plan and the Noonamah Area Plan are shown in Figure 2 and Figure 3 respectively.

The layout of the development and its connections with the existing road network is consistent with the road networks shown in the Greater Darwin Plan and Noonamah Area Plan.

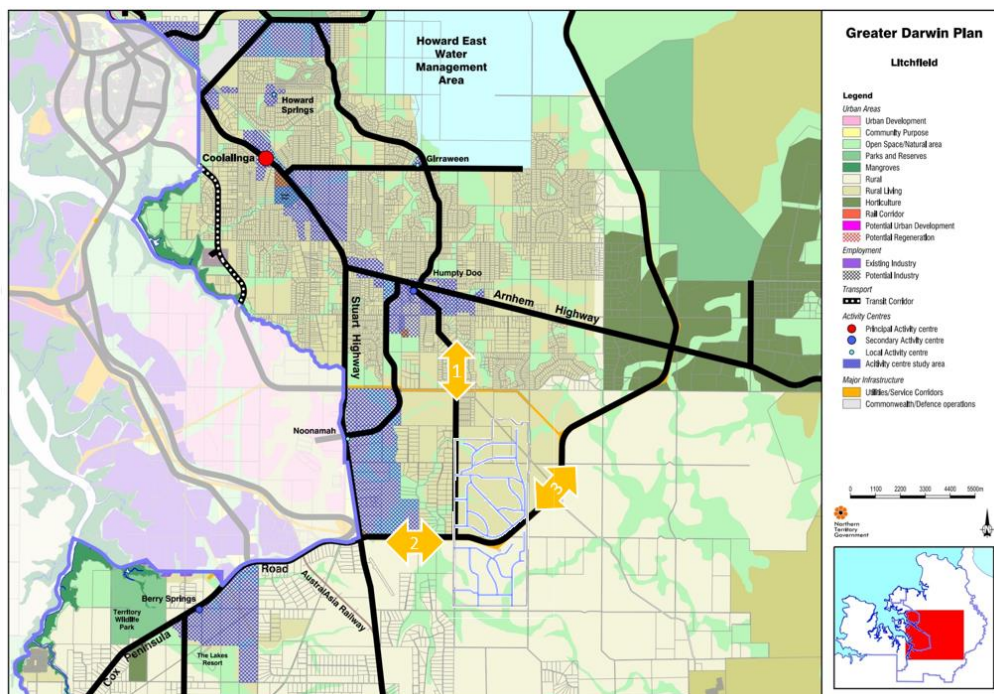


Figure 2 – Greater Darwin Plan Litchfield Concept Plan with overlay of proposed development and access routes

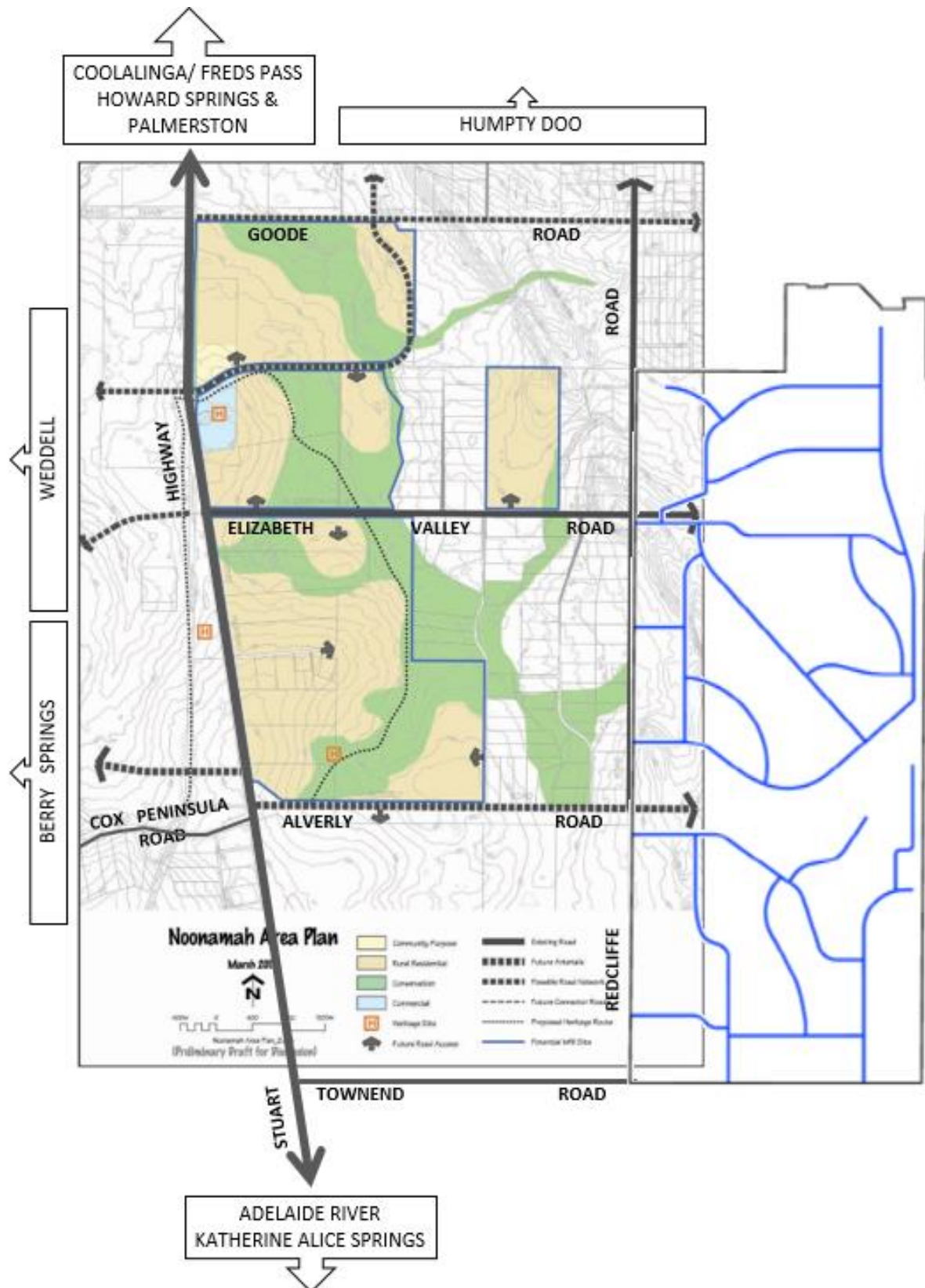


Figure 3 – Noonamah Area Plan (Preliminary Draft) with overlay of proposed development and access routes

Proposed works

Vehicular traffic on site will be supported by a new internal road network arranged to maximise travel interconnectivity within the site and to provide safe access to the existing and proposed Arterial and Collector roads. Internal roads will be constructed to give the area rural attractiveness incorporating swales, silt traps and other drainage features; localised areas with small lots will require different road treatment with the incorporation of kerbs and asphalt pavement. Proposed example cross sections are provided in Appendix A: Drawing Set (drawings 1315-SK03&04).

One of the key objectives on the project is to provide an environment to discourage speeding on the roads and keep the operating speed between 60 and 80 Kph depending on the road classification; this will be achieved by limiting the length of straight roads, narrowing cross sections, staggering intersections and the incorporation of traffic calming features.

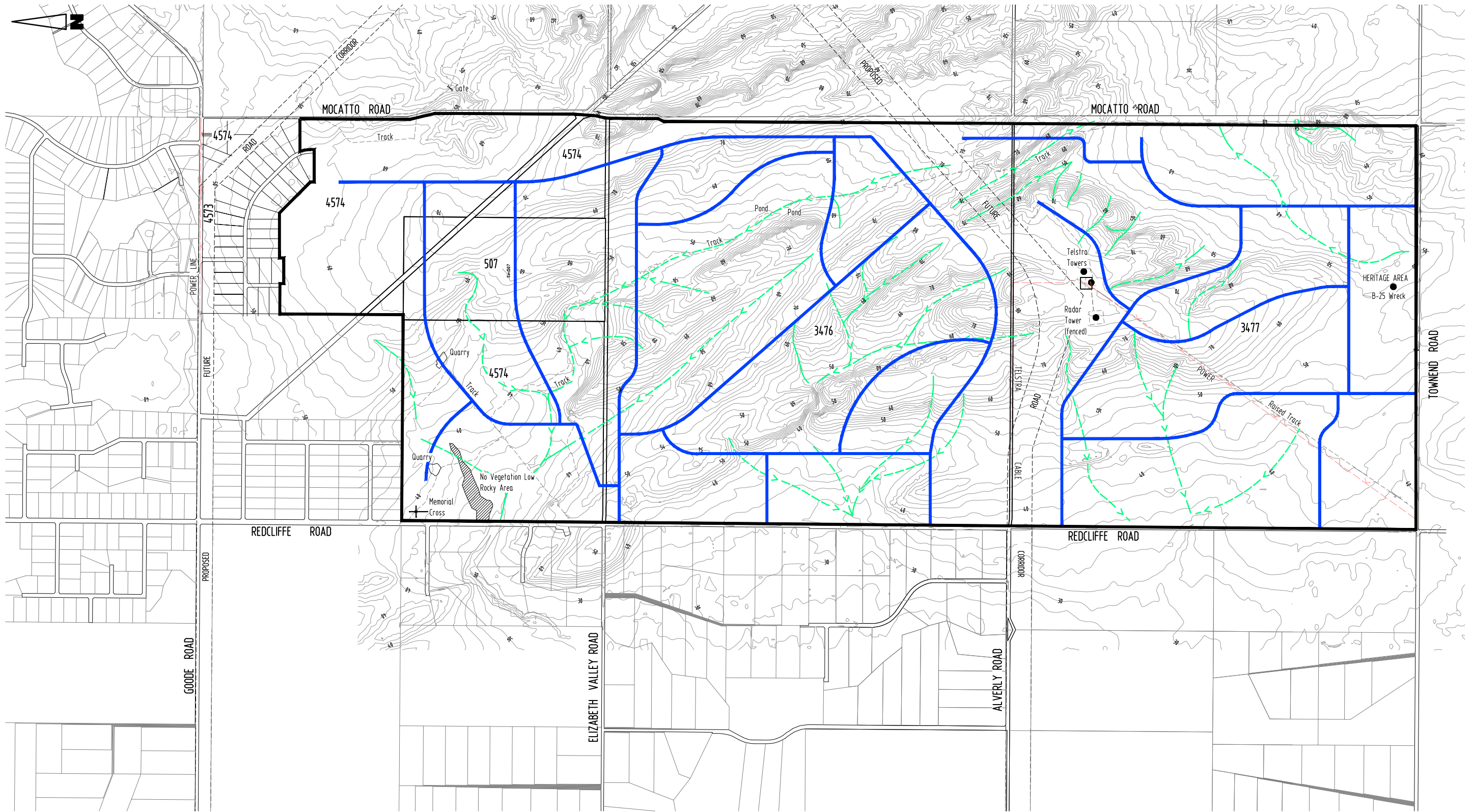
Impact on existing road network

Based on the provision of 3,000 dwellings, the development is expected to generate approximately 23,700 trips per day, 1,860 trips in the morning peak hour and 2,400 trips in the afternoon peak hour. 88% of journey to work trips are expected to be by car and 2.5% by public transport (i.e. bus). This is based on the latest census data for the Litchfield and Greater Darwin areas. A preliminary assessment of forecast trips is provided in Appendix B: Expected Traffic Generation. Not all of this traffic will be external to the development site. The extent of external traffic cannot be determined until the nature, location and size of internal attractors and generators such as shops and schools has been determined.

Bus route

Bus route 440 currently has 2 stops along Elizabeth Valley Rd and one stop on Redcliffe Rd. New road works will take into account the presence of buses along this section and accessibility to areas inside the development.

APPENDIX A: DRAWING SET



PRELIMINARY

Scale 1:15000 A1 0 150 300 450 600 750 Metres

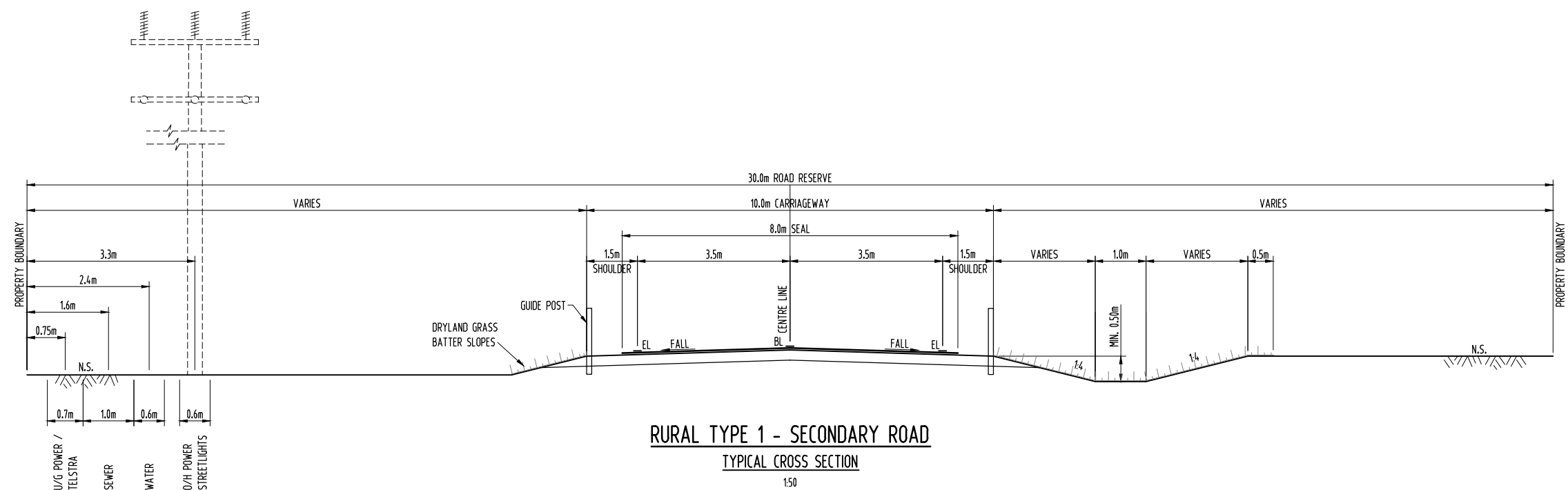
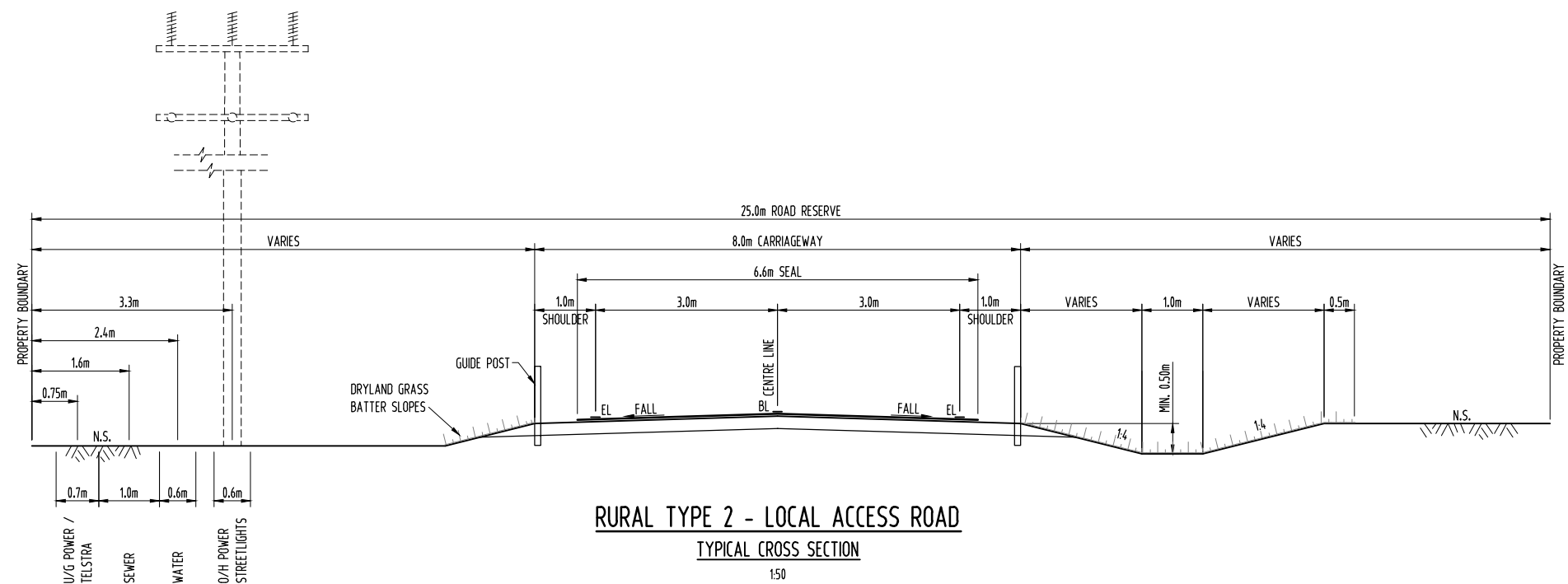
																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					</
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----



TYPE	ROAD CLASSIFICATION	ROAD DESCRIPTION	CARRIAGEWAY WIDTH (BETWEEN INVERTS)	VERGE WIDTH
2	LOCAL ACCESS	CUL-DE-SAC AND LOOPS LESS THAN 200m	6000	4500
1	LOCAL / SECONDARY COLLECTOR	LOOPS GREATER THAN 200m OR ANY LOOP SERVING HIGH DENSITY	8000	4500

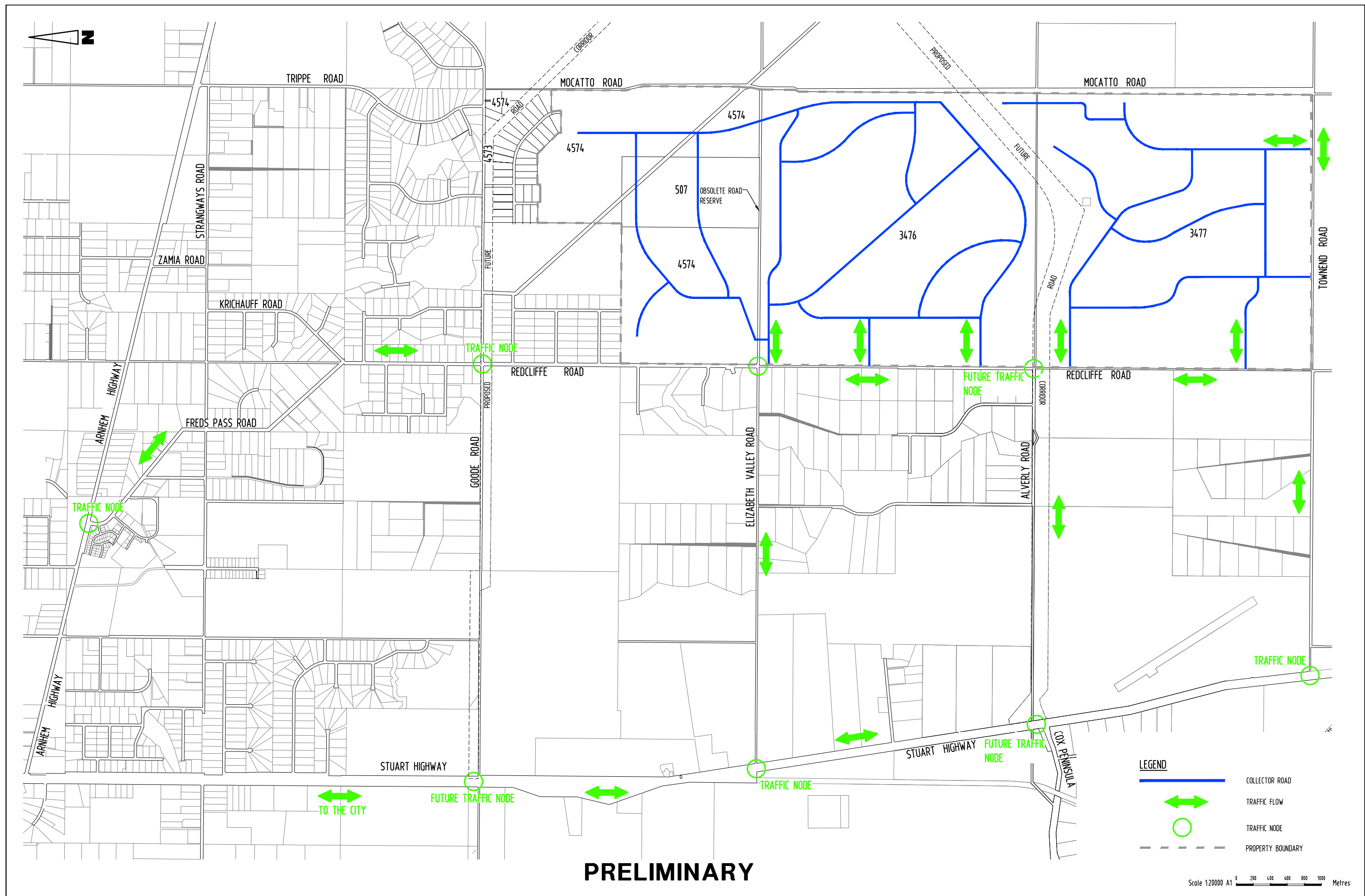
PRELIMINARY

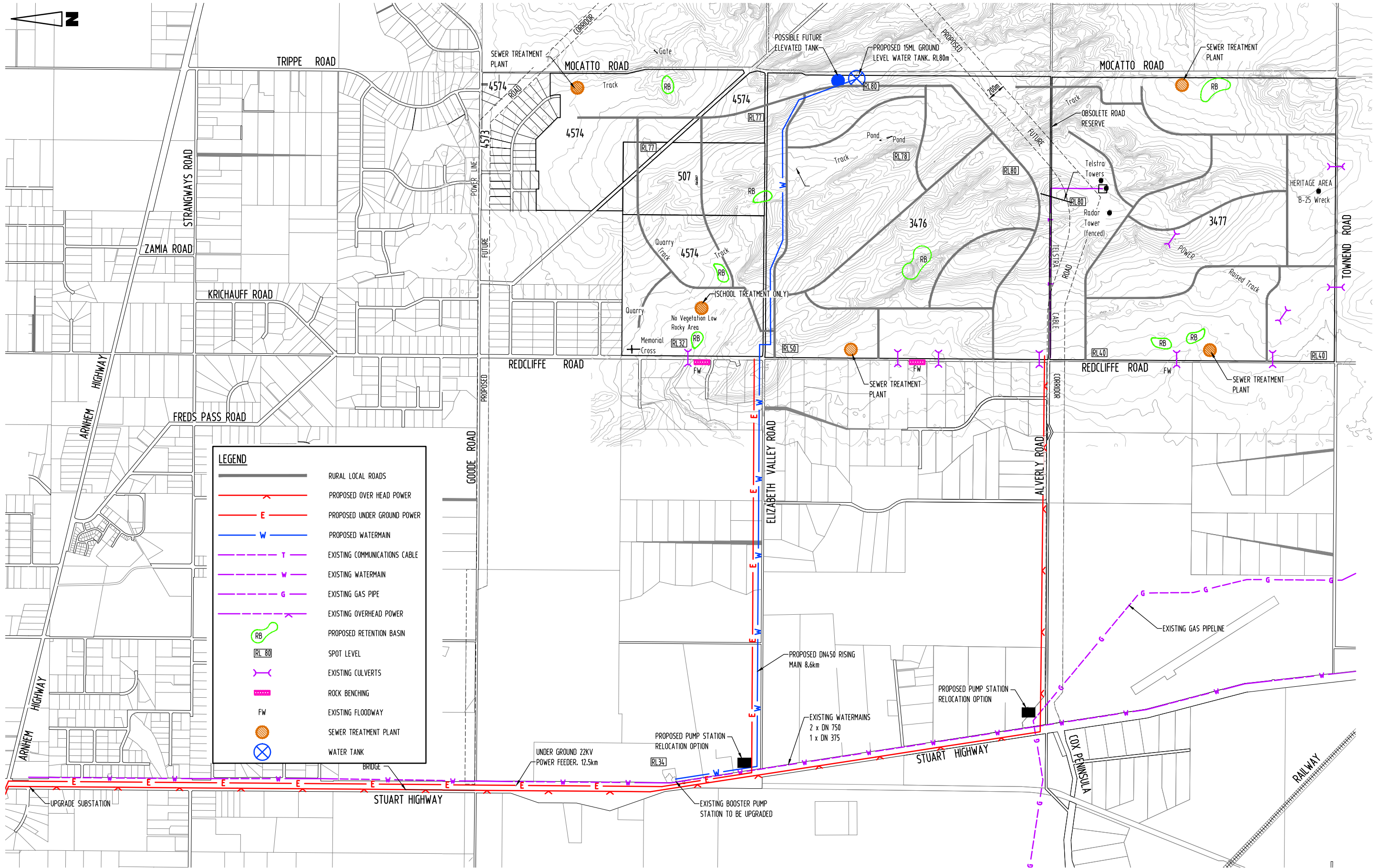
[illegible]



PRELIMINARY

				COPYRIGHT The concepts and information contained in this document are the copyright of BYRNE DESIGN. Use or copying of the document in whole or in part without the written permission of BYRNE DESIGN constitutes an infringement of copyright.		CLIENT INTRAPAC	 ABN 78 124 388 192 P.O.Box 43420 Casuarina NT 0811 Ph. 08 89418113 Fax: 08 89418201	PROJ. MANAGER NAS		TITLE NOONAMAH RIDGE ESTATE PROP. SUBDIVISION OF SEC 4574, 3476 & 3477 CONCEPT LAYOUTS TYPICAL ROAD CROSS SECTIONS - RURAL			
								DRAWN MDW	CHECKED SB				
A No				7/18/13 DATE		MDW INITIAL		DESIGNED NAS	CHECKED SB	SCALE AS SHOWN	PROJECT No 1315	DRAWING No 1315-SK04	AMDT A

[illegible]



PRELIMINARY

No	DATE	INITIAL	AMENDMENT
A	7/18/13	MDW	ISSUED FOR COMMENT

COPYRIGHT
The concepts and information contained in this document are the copyright of BYRNE DESIGN.
Use or copying of the document in whole or in part without the written permission of BYRNE DESIGN constitutes an infringement of copyright.

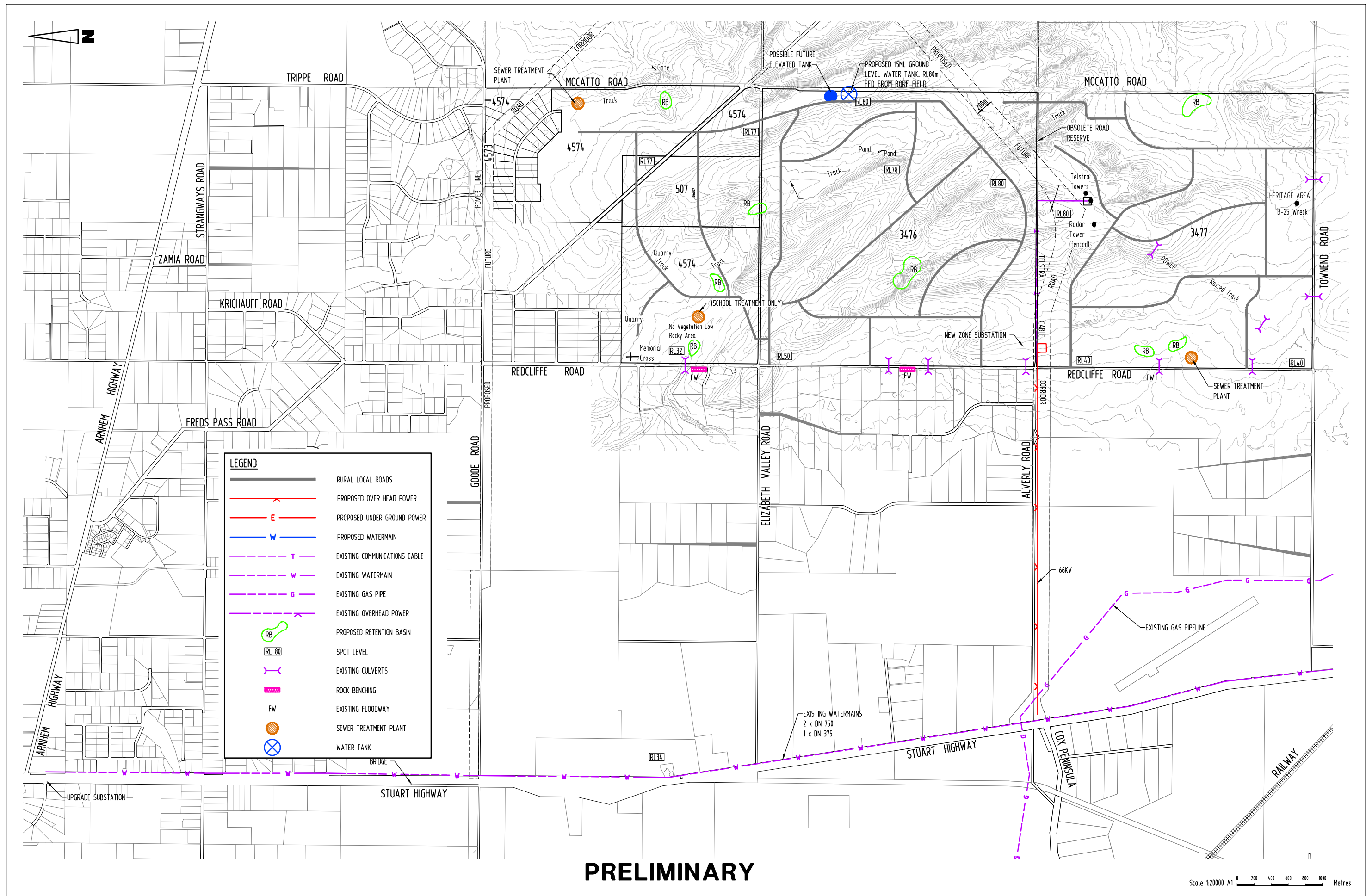
CLIENT

INTRAPAC

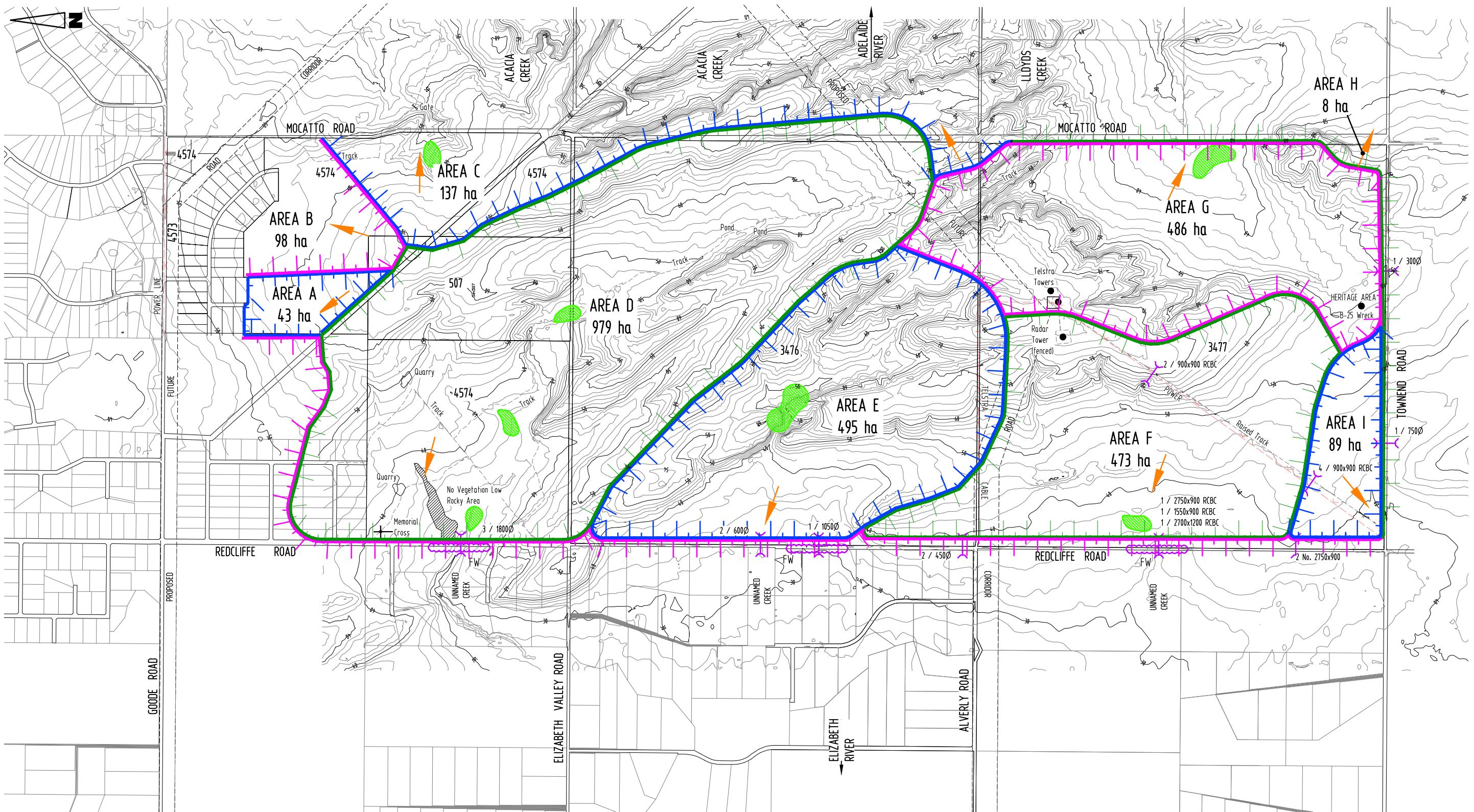
byrne design
ABN 78 124 388 192
P.O.Box 43420 Casuarina NT 0811
Ph. 08 89418113 Fax: 08 89418201

PROJ. MANAGER	NAS
DRAWN	MDW
DESIGNED	NAS

TITLE	NOONAMAH RIDGE ESTATE PROP. SUBDIVISION OF SEC 4574, 3476 & 3477			
	CONCEPT LAYOUTS			
	WATER, SEWER, AND POWER HEADWORKS - OPTION 1			
SCALE	AS SHOWN	PROJECT No	1315	DRAWING No
			1315-SK06	AMDT
				A



				COPYRIGHT		CLIENT		PROJ. MANAGER		TITLE				
				The concepts and information contained in this document are the copyright of BYRNE DESIGN. Use or copying of the document in whole or in part without the written permission of BYRNE DESIGN constitutes an infringement of copyright.		INTRAPAC		NAS		NOONAMAH RIDGE ESTATE PROP. SUBDIVISION OF SEC 4574, 3476 & 3477				
								DRAWN		CONCEPT LAYOUTS				
								DESIGNED		WATER, SEWER, AND POWER HEADWORKS - OPTION 2				
								CHECKED		SCALE AS SHOWN				
								PROJECT No		DRAWING No				
								1315		1315-SK07				
								AMDT		A				



PRELIMINARY

Scale 1:15000 A1 0 150 300 450 600 750 Metres

A	7/18/13	MDW	ISSUED FOR COMMENT
No	DATE	INITIAL	AMENDMENT

COPYRIGHT
The concepts and information contained in this document are the copyright of BYRNE DESIGN. Use or copying of the document in whole or in part without the written permission of BYRNE DESIGN constitutes an infringement of copyright.

CLIENT

INTRAPAC

byrne
design

ABN 78 124 388 192
P.O.Box 43420 Casuarina NT 0811
Ph. 08 89418113 Fax: 08 89418201

PROJ. MANAGER

NAS

DRAWN

MDW

DESIGNED

NAS

CHECKED

SB

CHECKED

SB

TITLE

NOONAMAH RIDGE ESTATE PROP. SUBDIVISION OF SEC 4574, 3476 & 3477
CONCEPT LAYOUTS
STORMWATER DRAINAGE CATCHMENT AREAS

SCALE

AS SHOWN

PROJECT No

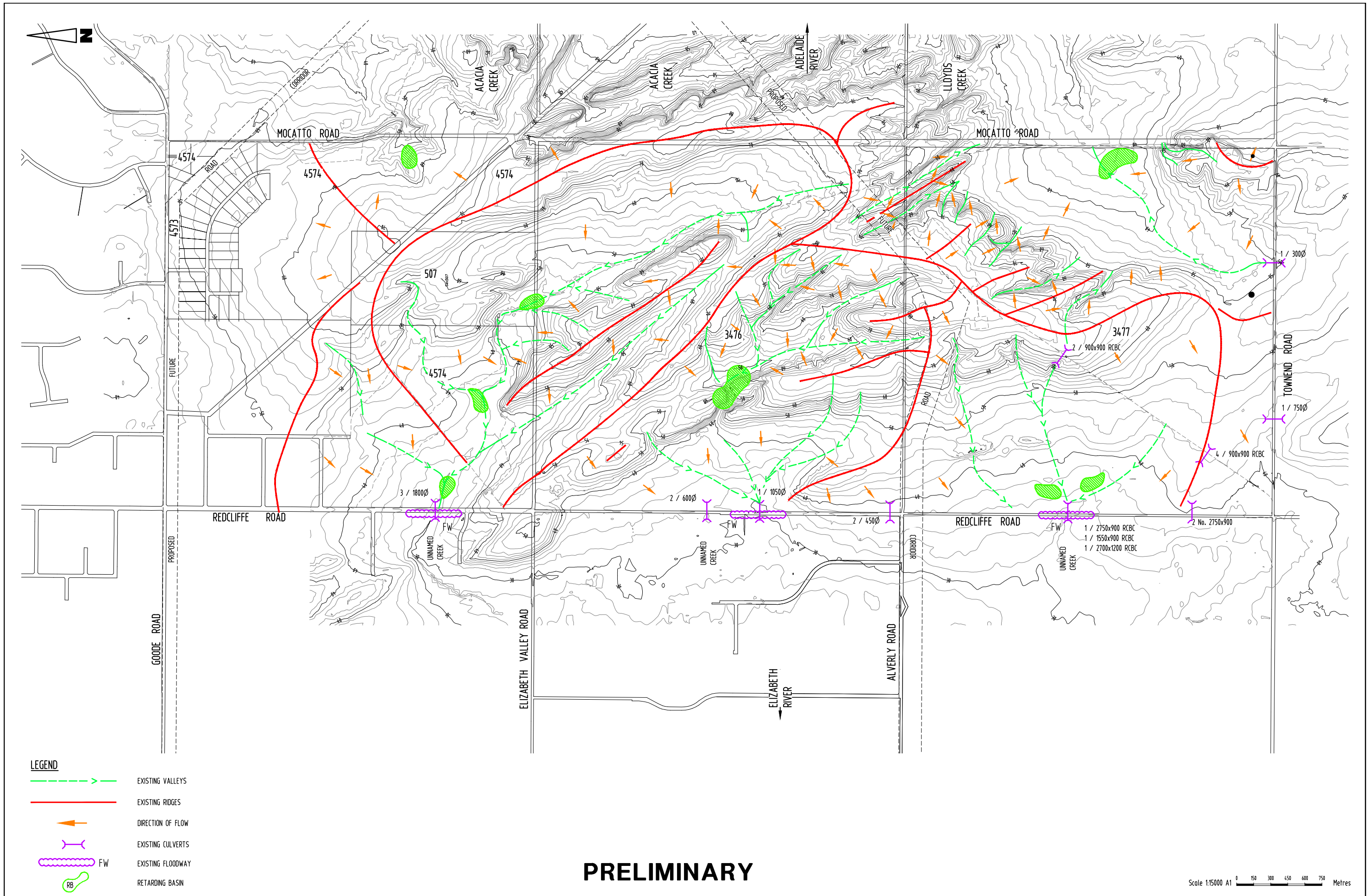
1315

DRAWING No

1315-SK08

AMDT

A



PRELIMINARY

A	7/18/13	MDW	ISSUED FOR COMMENT
No	DATE	INITIAL	AMENDMENT

COPYRIGHT
The concepts and information contained in this document are the copyright of BYRNE DESIGN.
Use or copying of the document in whole or in part without the written permission of BYRNE DESIGN constitutes an infringement of copyright.

CLIENT

INTRAPAC

byrne design
ABN 78 124 388 192
P.O.Box 43420 Casuarina NT 0811
Ph. 08 89418113 Fax: 08 89418201

PROJ. MANAGER	NAS
DRAWN	MDW
DESIGNED	NAS

TITLE	NOONAMAH RIDGE ESTATE PROP. SUBDIVISION OF SEC 4574, 3476 & 3477			
	CONCEPT LAYOUTS			
	TOPOGRAPHIC LAYOUT - RIDGES AND VALLEYS			
SCALE	AS SHOWN	PROJECT No	1315	DRAWING No
			1315-SK09	AMDT
				A

APPENDIX B: EXPECTED TRAFFIC GENERATION

Description/ITE Code	Units	ITE Vehicle Trip Generation Rates								Expected Units	Total Generated Trips			Total Distribution of Generated Trips					
		(peak hours are for peak hour of adjacent street traffic unless highlighted)									Daily	AM Hour	PM Hour	AM In	AM Out	Pass-By	PM In	PM Out	Pass-By
		Weekday	AM	PM	Pass-By	AM In	AM Out	PM In	PM Out										
Single Family Homes 210	DU	9.52	0.75	1.00		25%	75%	63%	37%	3000.0	28,560	2,250	3,000	563	1,688	0	1,890	1,110	0
Single Family Homes 210	Persons	2.55	0.21	0.28		31%	69%	66%	34%	8700.0	22,185	1,827	2,436	566	1,261	0	1,608	828	0
Single Family Homes 210	Vehicles	6.02	0.51	0.67		31%	69%	66%	34%	3600.0	21,672	1,836	2,412	569	1,267	0	1,592	820	0
Residential Planned Unit Development 270	DU	7.50	0.51	0.62		22%	78%	65%	35%	3000.0	22,500	1,530	1,860	337	1,193	0	1,209	651	0
										Average	23,729	1,861	2,427	509	1,352	0	1,575	852	0

APPENDIX C: COST ESTIMATES

Appendix C shows an opinion estimates based on the concept design presented on this documents. It has been prepared to include quantities of all utilities services, roads and drainage. It is subject to change, depending on the lot layout, geotechnical conditions encountered, etc.

In addition, please refer also to Appendix D: Land requirements. This appendix provides details on land areas required for sewers, roads and recreation areas. This land requirement has not been allowed for as part of the costs in this appendix.

	Description	Unit	Rate	Quantity	Cost (Exc GST)
Water					
Option 1A					
Booster Pump station		Unit		1	
Rising Main	DN 450 ML	lm		8500	
Water Tank		Unit		1	
Elevated tank		Allowance		1	
Internal Reticulation		lm		60000	
Subtotal					
Option 1B					
Temporary Rising Main	DN 300 PVC	lm		8500	
Booster Pump station		Unit		1	
Rising Main	DN 450 ML	lm		8500	
Water Tank		Unit		1	
Elevated tank		Allowance		1	
Internal Reticulation		lm		60000	
Subtotal					
Option 2A					
Individual bore holes		Unit		500	
Large bore holes		Unit		1	
Water Tank		Unit		1	
Internal Reticulation		lm		40000	
Subtotal					

Sewer					
Option 1					
Treatment Plants	3No+ 1No SKEW system	EP		10500	
Irrigation	35	Hec		6	
Internal reticulation		lm		60000	
Subtotal					
Option 2					
Individual septic tanks		Unit		1800	
Treatment Plants	1No+ 1No SKEW system	EP		4200	
Irrigation	10	Hec		10	
Internal reticulation		lm		20000	
Subtotal					

Power					
Option 1					
Overhead 22kV feeder	22kV (Neon) : 6.2MVA	lm		15000	
Underground 22KV feeder	22kV (Aluminium 400sqmm) : 14.6MVA	lm		12500	
Power to School		unit		1	
Internal Reticulation		lot		3000	
Street lighting		Allowance		1	
Subtotal					
Option 2					
Overhead 22kV feeder	22kV (Neon) : 6.2MVA	lm		4400	
Zone substation		Unit		1	
Power to School		unit		1	
Internal Reticulation		lot		3000	
Street lighting		Allowance		1	
Subtotal					

Communications					
Internal conduits		lot		3000	
Subtotal					

Roads and drainage					
Major intersections		unit		4	
Access to existing roads		unit		6	
Roads including drainage swale		lm		60000	
Driveways		unit		3000	
Culverts		unit		6	
Retarding basins		unit		6	
Parks and landscaping	Allowance only	unit		1	
Subtotal					
Option 1					
Option 2					

APPENDIX D: LAND REQUIREMENTS

The proposed development site is approximately 2400 Hectares. While currently it is difficult to estimate the lot layout and distribution, as well as land required for sewer irrigation and roads, the following is suggested as a guide of the land use distribution across the site.

This layout allows for 45 Hectares (1.87%) of recreation area and 35 Hectares (1.46%) for sewer irrigation.

Table 2 Land use types by area

Land use types	Area	Percentage of total area
Retarding basin (also recreation area)	20	0.83
Sewer irrigation area (also recreation area)	5	0.21
Sewer irrigation area (crops)	30	1.25
Additional recreation area	20	0.83
Easement & water tanks	5	0.21
Road allowance	240	10.00
School	5	0.21
Commercial precinct	7	0.29
Residential lots	2068	86.17
TOTAL	2400	100



www.elton.com.au