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CAMBRAY CONSULTING

TRAFFIC ENGINEERING + TRANSPORT PLANNING



Wyaralong Transfer System
TRAFFIC IMPACT ASSESSMENT REPORT

Prepared For Seqwater

25th February 2019

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1.0 Introduction

Cambray Consulting was engaged by Seqwater to provide traffic engineering advice and a traffic impact assessment in relation to a proposed Water Treatment Plant (WTP) to be located at Bushland Road north of the Logan River and Cedar Grove Weir.

The proposed development site layout is included in **Appendix A**.

1.1 Development Overview

The site is located on Bushland Road which currently connects to Teviot Road to the north. The development is located within the Greater Flagstone Priority Development Area (PDA) and the Logan City Council (Council) local government area.

The Wyaralong WTP is to be constructed in multiple stages commencing in 2019 with the Wyaralong Transfer System (WTS), followed by staged construction of upgrades / expansions projected to occur up until 2055.

The infrastructure associated with the WTS consists of:

- A 3 km long pipeline (called Bushland Road section) connected to the existing Logan City Council (Council) transfer system (at Flagstone) to the Wyaralong WTP site. This pipeline serves as the initial connection to the Bulk Water Supply grid via the existing New Beith offtake to Council's Round Mountain service reservoir. Subsequently, this pipe will be used to transfer Wyaralong WTP water back to Council's Round mountain reservoir;
- Two (2) 18ML storage reservoirs located at the Wyaralong WTP site, initially to receive water via the Bushland Road pipe and then provide network storage to transfer south to Beaudesert and north to Round Mountain and then the Southern Regional Water Pipeline (SRWP). The master planning for the future pipe size and direction is being undertaken by the South West Pipeline (SWP) team in conjunction with Council;
- Two transfer pumps (duty / standby) at the Wyaralong WTP site, to transfer water from the two 18ML storage reservoirs into the new SWP and onwards to the new Seqwater Beaudesert storages;
- A nominal 25kL hydro-pneumatic tank immediately downstream transfer pumps to protect the new SWP against surge events;
- Sodium hypochlorite (and potentially ammonia) storage and dosing facilities;
- Power supply, backup generator, and control systems to operate the Wyaralong WTP site assets, and potentially for communication and control of the Helen Street storages;
- Road access from Teviot Road to the Wyaralong WTP site (approximately 2.7km) and any necessary services installation in the road reserve;
- Road access within the site for maintenance vehicles and chemical delivery vehicles; and
- A 23km SWP delivering treated water from the Wyaralong WTP to the two 5.1ML storages at Helen Street in Beaudesert. This includes four (4) significant river crossings and the concurrent installation in the SWP Cedar Grove Weir crossing to provide raw water to Wyaralong WTP from Cedar Grove Weir. A number of pipes, power cables, communication cables are required in this crossing.

Once the WTS is operational, large service vehicles will regularly need to access the site to deliver chemicals, and perform maintenance activities.



1.2 Scope of Works

The scope of work considers the WTS Site Layout as the preliminary design of the proposed WTP will be subject to material changes in the future phases of design and therefore a road design and traffic assessment of the WTP will be undertaken at a time when site layout is further developed.

As part of preparing this report, we undertook the following scope of works:

- A compliance review with regard to relevant road design standards and guidelines;
- Swept path assessment and road geometry for the vehicles that are proposed to use the site;
- Review of the compliance of the site entry design;
- Review of recommended road design specifications and design requirements;
- A road safety assessment and recommendations of road furniture to protect vehicles and also plant and equipment (e.g. guardrails and bollards);
- Provision of input into the Bushland Road access road design, which would include:
 - Suggestions for design changes required to GHD 2010 design to accommodate access to site during Q200 flood events; and
 - Provision of advice regarding a minimum pavement standard that can initially be constructed to enable WTS construction, and then restored for operational access through two further construction phases before a final finished pavement standard is installed.
- Distribution of construction and operational phase traffic across the road network, based on vehicle generation estimates provided by Seqwater.

The results of the above activities are outlined in the following sections.

1.3 Limits of Report

This report takes into account the particular instructions and requirements of Seqwater. Cambray Consulting has taken care in the preparation of this report, however it neither accepts liability nor responsibility whatsoever in respect of:

- Any use of this report by any third party;
- Any third party whose interests may be affected by any decision made regarding the contents of this report; and/or
- Any conclusion drawn resulting from omission or lack of full disclosure by Seqwater, or the Seqwater's consultants.

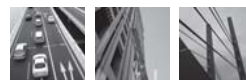
1.4 Safety in Design

Within our scope, we have identified safety in design issues and potential hazards, whenever reasonably practicable within our field of expertise. It is not considered reasonably practicable to identify all potential hazards which may occur throughout the life of a project, including during detailed design and construction activities. It is strongly recommended that safety in design issues be reviewed during all ensuing design and construction stages of the project.

1.5 Qualifications

This report was prepared by:

- Andrew Douglas, Director – BE Civil (Hons), MSc Env Man, FIEAust, CPEng, **RPEQ 6691**;
- Brian Schapel, Principal Transport Engineer – MEngSc (Transport Engineering), MAITPM; and
- John Dollisson, Transport Engineer – BE Civil.



2.0 Context

2.1 Site Location

The subject site is located as shown in **Figure 2.1** below, and is formally described as Part Lot 141 on S312748.

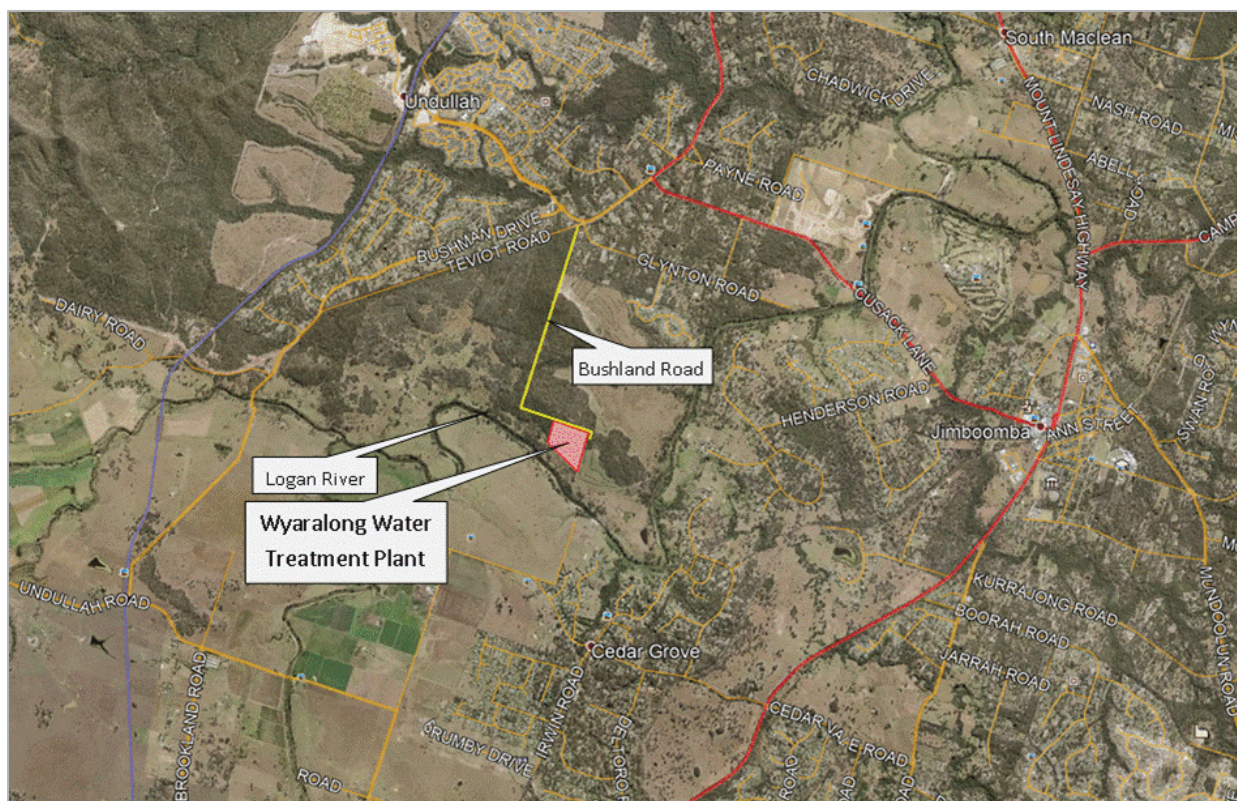


Figure 2.1 Wyaralong Water Treatment Plant Locality Plan

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2.2 Surrounding Transport Network

A site inspection was conducted on 16th March 2018 to review the operation and configuration of the existing transport network surrounding the site. Key characteristics of the road network surrounding the site are summarised in **Table 2.1**.

Table 2.1 Road Network Overview

Road	Jurisdiction	Hierarchy	Existing Cross Section	Speed Limit
Teviot Road (East of Glynton Road)	Council	Urban Arterial	Two Lane, Undivided, Sealed	70km/h
Homestead Drive		Urban Arterial	Two Lane, Undivided, Sealed	70km/h
Bushman Drive		Urban Collector	Two Lane, Undivided, Sealed	60km/h
Cusack Lane		Rural Arterial	Two Lane, Undivided, Sealed	80km/h
Glynton Road		Urban Arterial	Two Lane, Undivided, Sealed	70km/h
Teviot Road (West of Glynton Road)		Urban Arterial	Unformed track	Unsigned
Bushland Road		Rural Access	Unformed/unsealed track	Unsigned



2.3 Road Network Access Arrangements

2.3.1 Teviot Road (East of Glynton Road)

Teviot Road east of Glynton Road runs north-south providing connectivity to localities to the west of Mt Lindesay Highway, linking Boronia, North MacLean, South MacLean and Flagstone.

2.3.2 Homestead Drive

Homestead Drive is an east-west primary arterial route providing connectivity to the Flagstone area and linking to Teviot Road to the east.

2.3.3 Bushman Drive

Bushman Drive provides connectivity from Flagstone to localities to the south including Kagaru, Allenvue, Gleneagle and Bromelton.

2.3.4 Cusack Lane

Cusack Lane provides an east-west connection from Jimboomba on the Mount Lindesay Highway to the east meeting Teviot Road to the west.

2.3.5 Glynton Road

Glynton Road provides access to rural properties between Jimboomba and Flagstone as well as the River Bend residential estate.

2.3.6 Teviot Road (West of Glynton Road)

This section of Teviot Road to the west of Glynton Road, whilst classified as an Urban Arterial road, is currently a narrow unsealed track and has a “Road Closed” sign in place approximately 100m from the intersection with Bushland Road. However it is planned as a four-lane divided sub-arterial to service the future Celestino development to the south of Flagstone. A photograph illustrating the condition of Teviot Road (west) is provided in **Figure 4.2**.

2.3.7 Bushland Road

Bushland Road is currently an unsealed track running north-south connecting Teviot Road to the proposed Wyaralong Water Treatment plant, and will require upgrading works to provide adequate access to the plant.

2.4 WTP Site Surrounds

The site is generally surrounded to the north by an approved residential land development known as Celestino, Jimboomba. The development is shown on the Master Plan in **Figure 2.2**.

The Celestino development is planned to be staged over several years and may be altered by subsequent application. Based on our understanding of the planned scheduling of the Celestino development, the WTS will be completed prior to any significant development works associated with the Celestino development.

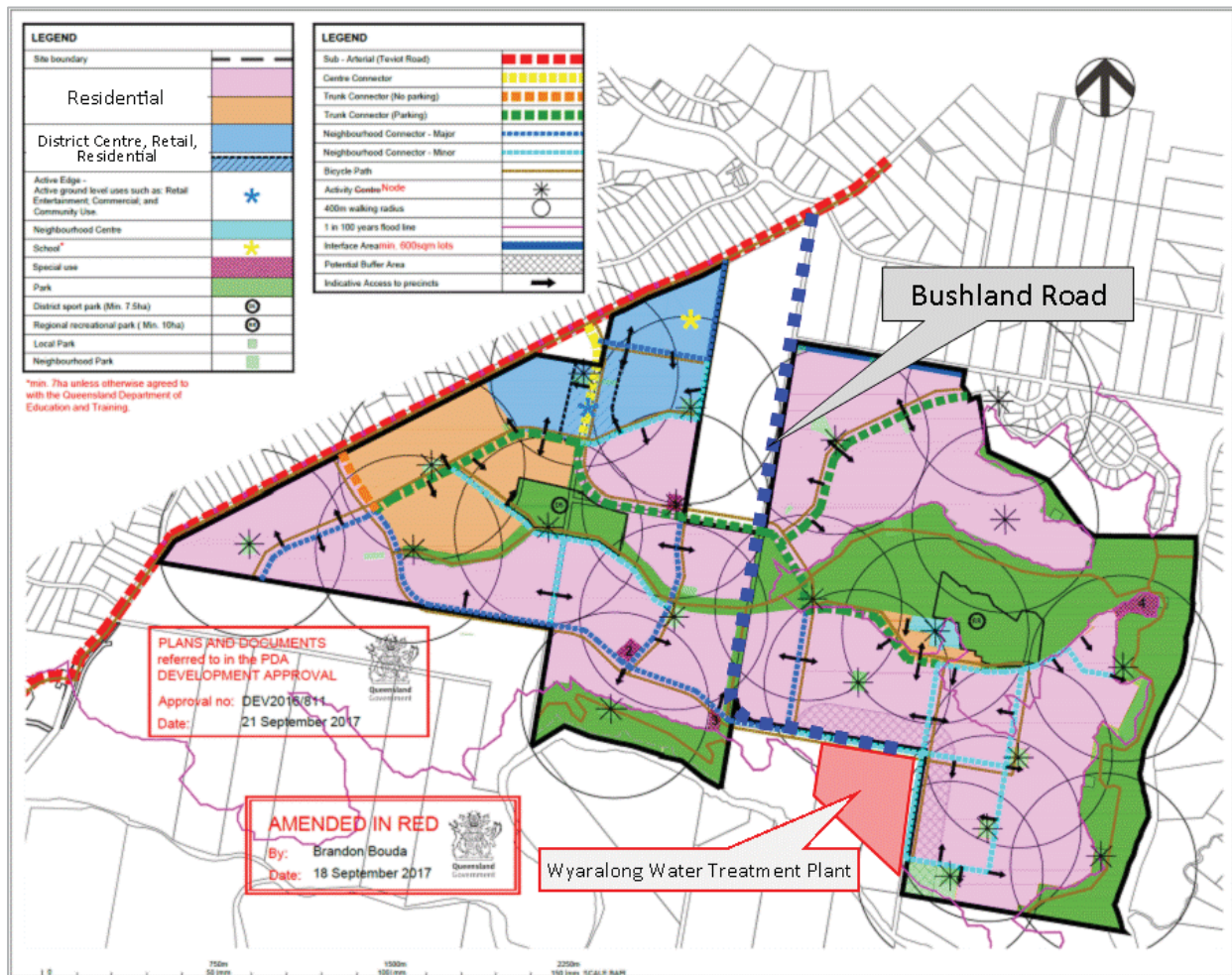


Figure 2.2 Celestino Master Plan, Jimboomba

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2.5 Proposed Access to the Site

Following a previous comprehensive assessment of alternative routes to the WTP site, it was recommended that the proposed site access be from Teviot Road (west of Glynton Road) along Bushland Road to the site location north of the Logan River and Cedar Grove Weir.

When the proposed Celestino development takes place in the vicinity of Bushland Road, it is intended that Bushland Road will be access-controlled for use only by Seqwater vehicles and local residents on Bushland Road. Options will be explored to provide access control infrastructure such as boom / security gates where Bushland Road crosses roadways of the Celestino development.

2.6 Bushland Road Description

Bushland Road is a two-way, one-lane, unsealed and in parts unformed track contained in a 20m road reserve that is otherwise heavily vegetated. Its horizontal alignment consists of two (2) straight sections and a 90 degree bend, and the vertical alignment is undulating with a maximum grade of approximately 8%. Lot 801 on SP247625, on the inside corner of the 90 degree bend, is owned by the Queensland Bulk Water Authority (Seqwater).



The approximate road alignment allows for a horizontal curve radius of approximately 100m, which will accommodate truck speeds of approximately 50-60km/h. It is Seqwater's intention that this Lot is transferred into the Bushland Road reserve. Seqwater is engaging with Council regarding this. The approximate alignment of the proposed access route is shown in **Figure 2.3** and its condition is illustrated in **Figure 4.4**.

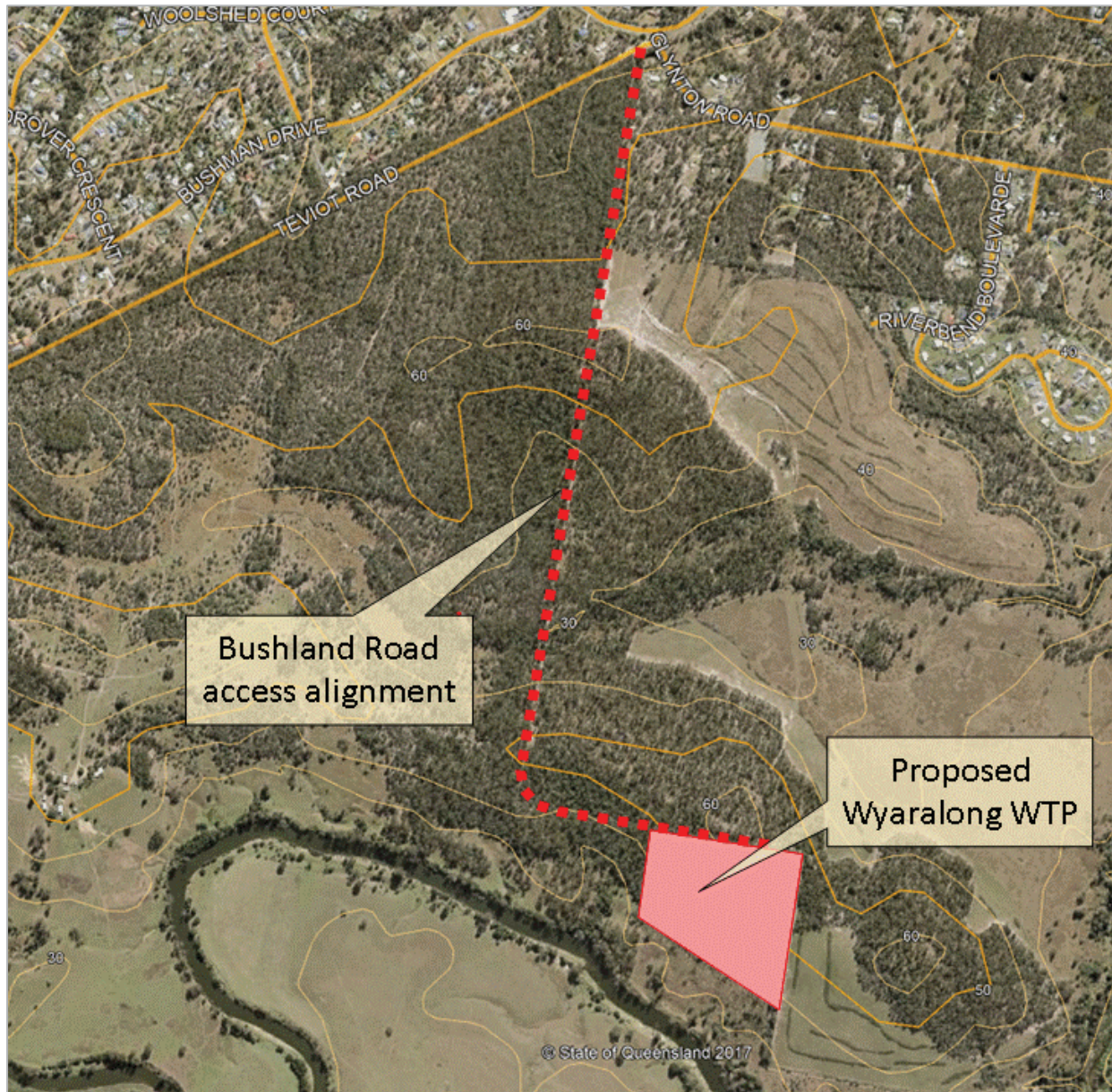
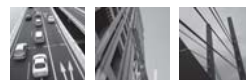


Figure 2.3 Bushland Road Access Alignment to Wyaralong

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3.0 Traffic Review – Inputs

3.1 Overview

We undertook a review of the potential impacts development traffic may have on the existing transport network surrounding the site.

The inputs which form the basis of our review are outlined in the following sections.

3.2 Background Traffic Volumes

3.2.1 Teviot Road East and Homestead Road

Existing traffic volumes for Teviot Road and Homestead Road in the vicinity of Bushland Road were sourced from traffic survey data collected on 13th June 2017. A summary of the intersection count is attached as **Appendix B**.

A summary of the recorded traffic volumes are provided in **Table 3.1**.

Table 3.1 Traffic Count Data for Teviot Road East and Homestead Road

Road Section	AM Peak Hour 08:00 – 09:00	% of HV	PM Peak Hour 16:15 – 17:15	% of HV
Teviot Road East	984	2.4%	832	2.2%
Homestead Road	987	2.1%	830	2.2%

3.2.2 Glynton Road

Existing traffic volumes for Glynton Road in the vicinity of Bushland Road were sourced from traffic survey data collected on 13th June 2017.

A summary of the recorded traffic volumes are provided in **Table 3.2**.

Table 3.2 Traffic Count Data for Glynton Road

Road Section	AM Peak Hour 08:00 – 09:00	% of HV	PM Peak Hour 16:15 – 17:15	% of HV
Glynton Road	29	10.3%	28	0.0%

The relatively high percentage of heavy vehicles (HV) in the AM peak hour on Glynton Road is not considered to be significant as it represents only three (3) HVs, which is equivalent to one (1) movement every 20 minutes.

3.2.3 Teviot Road West

Teviot Road West is currently an unsealed track and the traffic counts at the intersection with Glynton Road revealed that there were no vehicles accessing Teviot Road West in the AM peak hour and only three (3) vehicles accessing it in the PM peak hour.



3.3 Development Traffic Volumes

Seqwater estimated the number of vehicles required during the construction stages leading to the ultimate development. This traffic assessment addresses only the WTS in detail, primarily due to the uncertainty of detail associated with the future stages. However, summaries of the highest approximate vehicle uses for future stages are reported in **Section 3.3.2**.

3.3.1 WTS Construction Phase Traffic Estimate

Seqwater estimated construction traffic volumes based on a comprehensive breakdown of construction vehicle types, quantities and timeframes. A copy of the relevant portions of the breakdown is attached as **Appendix C**. This information was used to estimate traffic volumes for the construction phase. The information considered as part of our traffic review is summarised below.

An overview of the expected type of construction vehicles and their use is provided below:

- 25t Excavator;
- Haulage Truck with Trailer;
- Haulage Truck without Trailer;
- Utility (Ute);
- Concrete Mixers;
- Concrete Pump;
- Semi-Trailers;
- 50-100 Tonne Cranes;
- Franna Crane;
- Flatbed Truck;
- Roller Compactor;
- Asphalt Distributor;
- Miscellaneous Construction Machinery;
- Trench Roller;
- Water Truck;
- 12t Excavator;
- Grader; and
- Possi-Track / Tracked Loader.

Based on the information provided, we estimated a high-level schedule of works primarily assuming activities are conducted sequentially. We believe this is a reasonable assumption due to the nature of the works requiring the completion of essential infrastructure before other works can commence.

Figure 3.1 provides a graph of the number of vehicles accessing the site per day during the construction phase. The information provided by Seqwater includes data that refers to “round trips”, and other information refers to vehicle numbers.

Therefore, in our assessment of the construction phase traffic impacts we specified the estimated number of vehicles accessing the site for consistency. Other than the “round trips” generally associated with activities such as concrete trucks and dump trucks carting excess fill off-site, our assumption was that other vehicles will access the site as their worksite destination in the morning and origin in the afternoon.

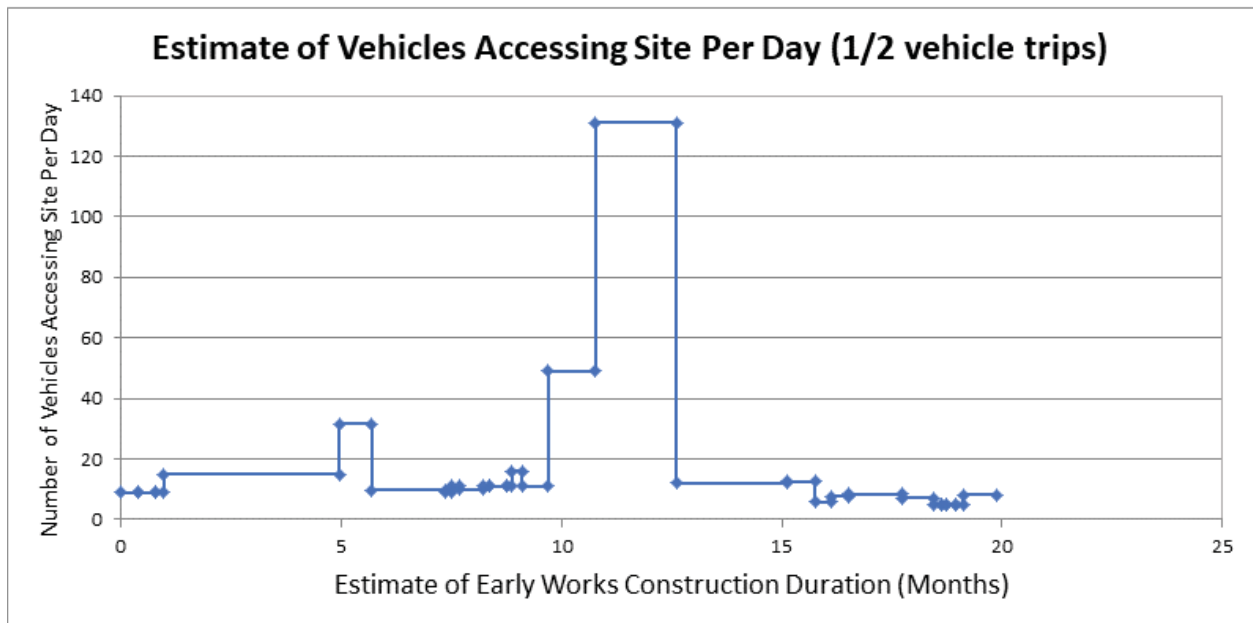


Figure 3.1 Estimate of Vehicles Accessing the Site during Construction

For the majority of the construction phase, the number of vehicles accessing the site is below approximately 20 vehicles per day. The higher values are:

- Preparation of internal road base for approximately three (3) weeks – Approximately 32 vehicles per day;
- Concrete pour for binding layer for approximately one (1) week – Approximately 49 vehicles per day; and
- Concrete pour of walls and floor for approximately eight (8) weeks – approximately 131 vehicles per day.

This considers a six (6) day work week and no substantial delays due to weather. In any one block of work, we conservatively assumed the higher value of vehicular traffic.

3.3.2 Construction Phase Traffic Estimate – Ultimate WTP Development

Vehicle use during the construction stages leading to the ultimate development of the WTP was estimated by Seqwater. We understand that these figures, whilst comprehensive, may be modified if planned operations and site layout changes for the future stages.

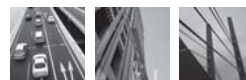
The highest approximate vehicle uses for future stages are:

- WTP Stage 1 – Maximum of 28 vehicles per day (vpd) with an average of nine (9) vpd;
- WTP Stage 2 – Maximum of 27 vehicles per day (vpd) with an average of 11 vpd; and
- WTP Stage 3 – Maximum of 21 vehicles per day (vpd) with an average of six (6) vpd.

3.3.3 WTS Construction Phase Traffic Summary

In order to estimate the traffic impact on the surrounding road network we made the following assumptions:

- Where on-site works are to be contained within the site, 80% of the estimated number of vehicles will arrive and depart the site during the morning and afternoon peak distributed as 80% / 20% in / out of the site in the AM peak hour and 20% / 80% in / out of the site in the PM peak hour; and
- “Round Trip” construction traffic will be more evenly spread throughout the day.



3.3.4 WTS Operational Phase

Seqwater advised that during the operational phase following completion of the WTS, the storage tanks will be accessed by service vehicles for chemical dosing and occasional checking or servicing of equipment.

3.3.5 Ultimate Water Treatment Plant Operational Phase

Assessments of the potential number of trucks required for ongoing chemical maintenance were provided by Seqwater and these figures appear in **Table 3.3**.

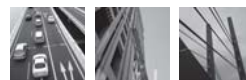
From the table it can be seen that following completion of the WTS in 2019 there is less than two (2) trucks (1.89) expected to access the site per week. Based on forecasts of ultimate ongoing maintenance (after year 2055) there may be approximately one (1) truck per day (7.27 per week). Therefore, the operational phase following the WTS and ultimate ongoing maintenance will have a negligible effect on the surrounding road network.

Table 3.3 Estimated number of trucks required for storage tank maintenance

Average Day Demand			11.2 ML/day	14.4 ML/day	25.4 ML/day	43 ML/day
Truck Type	Chemical	Dose Rate (mg/L)	Average Trucks Per Week			
			2019	2022	2036	2055
Flatbed (Medium Rigid Vehicle – MRV)	Potassium Permanganate (Crystals)	0.5	0.01	0.01	0.01	0.03
	Polymer (Filter Aid / Clarifier)	0.15	0.00	0.00	0.00	0.01
	Polymer (Dewatering)	21	0.27	0.35	0.60	1.05
	Sodium Fluorosilicate	2.7	0.03	0.04	0.08	0.13
	Ammonia (35% W/W)	2.9	0.04	0.05	0.08	0.14
	Sulfuric Acid (98% W/W)	30	0.39	0.50	0.86	1.51
20kL Tanker (AV)	Aluminium Sulphate (47% W/W)	140	0.46	0.59	1.00	1.76
	Hydrogen Peroxide (25% W/W)	12	0.04	0.05	0.09	0.15
	Sodium Hypochlorite (12.5% W/W Cl ₂)	40	0.13	0.17	0.29	0.50
	Sulfuric Acid (98% W/W)	30	0.10	0.13	0.21	0.38
	Sodium Hydroxide (30% W/W)	105	0.34	0.44	0.75	1.32
Truck and Dog	Dewatered Solids Disposal	37.5	0.08	0.10	0.17	0.30
Total			1.89	2.43	4.14	7.27

3.3.6 External Traffic Distribution

The external traffic distribution we adopted for both the construction and operational phases was based on a review of trip attractors and generators surrounding the development and is summarized in **Table 3.4**.

**Table 3.4 Adopted External Traffic Distribution**

Direction	%
North-east (towards Brisbane)	95%
South (towards Bromelton)	5%

3.3.7 Directional Traffic Distribution

Adopted directional traffic distribution splits for the various trip types are outlined in **Table 3.5**.

Table 3.5 Adopted Directional Traffic Distribution Splits

Traffic Type	AM Peak (8:00am to 9:00am)			PM Peak (4:15pm to 5:15pm)		
	In	Out	Total	In	Out	Total
Construction Phase	80%	20%	100%	20%	80%	100%
Operational Phase	50%	50%	100%	50%	50%	100%

Based on the estimates provided by Seqwater, there is to be a maximum of 32 personnel on site during the concrete pour of the storage tank walls and floor slab. This is expected to last for a period of approximately 48 days (eight (8) weeks based on six (6) days per week). Excluding that period, the estimated maximum number of site personnel is 20 for approximately one (1) week duration. The average number of personnel on site for the duration of the entire construction phase is approximately nine (9).

During the period planned for the concrete pour of the storage tank walls and floor slab, it is recommended that a Construction Management Plan is prepared, together with a Traffic Management Plan to manage the traffic during this period.

In order to estimate the traffic impact during the construction phase we conservatively used the highest personnel estimate of 20 (excluding the concrete pour phase). We also assumed that each person will drive their own vehicle to site (including plant drivers). **Table 3.6** shows the calculation of trips estimated to be generated by the site during the construction period.

Table 3.6 Estimate of Trip Generation of the Site During the Construction Phase

Traffic Type	AM Peak (8:00am to 9:00am)			PM Peak (4:15pm to 5:15pm)		
	In	Out	Total	In	Out	Total
Construction Phase Split	80%	20%	100%	20%	80%	100%
Estimated Vehicles	16	4	20	4	16	20

This estimate equates to approximately less than one (1) vehicle entering the site every three (3) minutes throughout the AM and PM peak hours. This is considered to be negligible and not expected to impact the local road network.



4.0 Traffic Review

4.1 Teviot Road / Homestead Road / Glynton Road Intersection

4.1.1 Turn Warrants

The intersection of Teviot Road (East) / Homestead Road / Glynton Road is channelised with a right turn lane from Homestead Road into Glynton Road and has a left auxiliary lane from Teviot Road (east) into Glynton Road. The current intersection layout is shown in **Figure 4.1**.



Figure 4.1 Existing intersection layout of Teviot Road / Homestead Road / Glynton Road

The primary traffic movements to and from the development site are indicated on **Figure 4.1**. Whilst we understand Teviot Road (west) is ultimately planned to be developed to a four-lane sub-arterial road, during the construction and operational phases of the WTS, Teviot Road (west) is currently closed and will most likely remain as an unsealed track as it currently is throughout the construction period. However widening of Teviot Road (west) between Glynton Road and Bushland Road will be required in accordance with the layout plans prepared by GHD, attached as **Appendix D**.

All operational and construction phase traffic to the site will be left-in and right-out of Bushland Road onto Teviot Road (west). A swept path assessment to demonstrate the capability of Articulated Vehicles (AVs) to perform the manoeuvres required to access Teviot Road (west) is included in **Appendix G**.

Figure 4.2 shows a photograph of the typical condition of Teviot Road (west).



Figure 4.2 Teviot Road (west) Typical Existing Condition

A turn warrant assessment was undertaken at the Teviot Road (west) and Glynton Road intersection in accordance with Austroads *Guide to Road Design Part 4A* and the Department of Transport and Main Roads' (DTMR's) *Road Planning and Design Manual*. Primarily because the traffic volumes on Glynton Road are low, there is no warrant to upgrade this intersection to provide turn lanes. Major road traffic volume (Q_M) traffic volume on Glynton Road is 29 vehicles in the AM peak hour and 36 vehicles in the PM peak hour. The development traffic is estimated to be 16 vehicles in both the AM and PM peak hour.

The result of the turn warrant assessment is demonstrated in **Figure 4.3**.

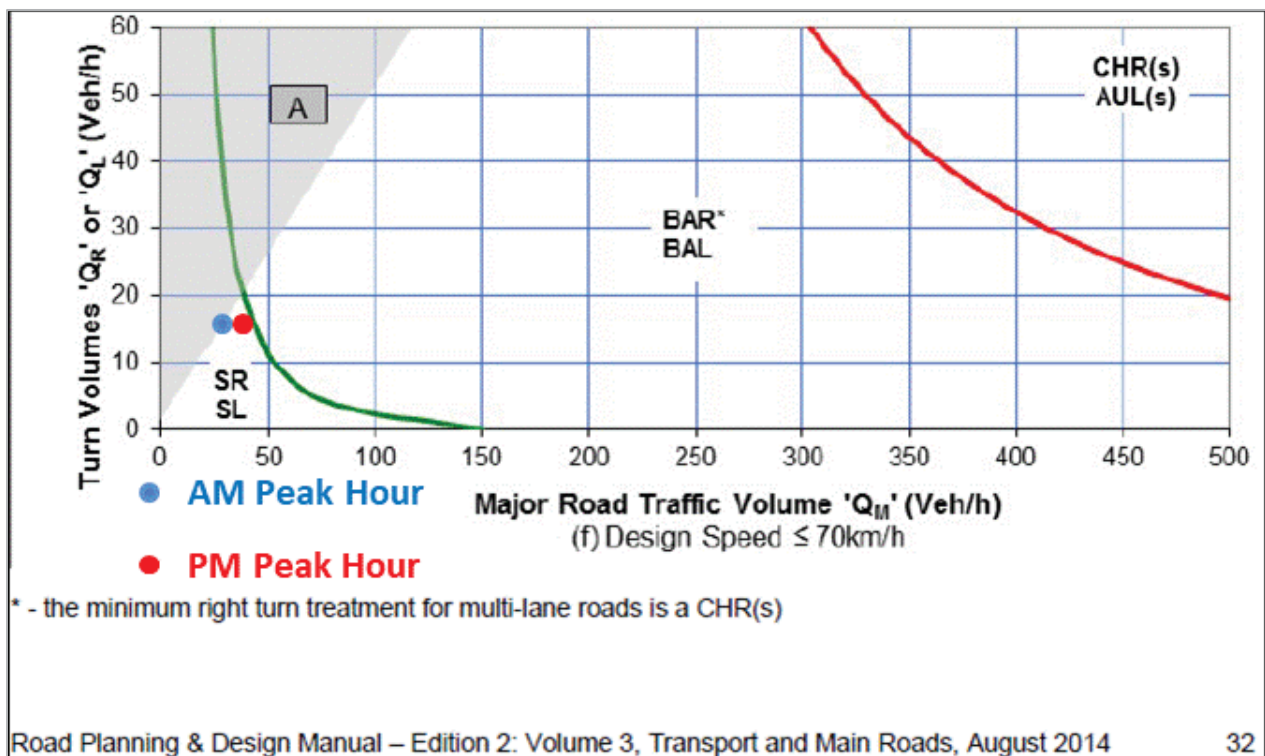


Figure 4.3 Turn Warrant Assessment for Teviot Road (west) / Glynton Road



The results of the Turn Warrant assessment concluded that simple left (SL) and simple right (SR) turn provision is adequate for the intersection of Teviot Road (west) with Glynton Road.

Once the construction period is completed, estimated to be towards the end of 2020, there will be negligible trips generated during the operational phase.

4.1.2 Sight Distance

A review of required sight distances at the intersections of Teviot Road (west) with Glynton Road and Glynton Road with Teviot Road (east) / Homestead Road was undertaken in accordance with Austroads *Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections*. It is noted that 'Safe Intersection Sight Distance' (SISD) is the distance which should ideally be achieved from accesses / side roads.

The SISD requirements based on road conditions at the intersection are summarised in **Table 4.1**.

Table 4.1 SISD Sight Distance Requirements

Posted Speed Limit	Adopted Design Speed	Reaction Time	Grade	SISD
70 km/h	80 km/h	2 seconds	Generally Flat	181 m

A review of available sight distances, based on a site inspection on the 3rd July 2018 is summarised in **Table 4.2**.

Table 4.2 SISD Sight Distance Review

Driver Location	Intersection	Direction	SISD	Available Sight Distance	Compliant
Teviot Road (west)	Glynton Road	South	181m	> 200m	✓
Glynton Road	Teviot Road / Homestead Road	East	181m	> 200m	✓
Glynton Road	Teviot Road / Homestead Road	West	181m	200m	✓

The results indicated that SISD can be achieved to / from both Teviot Road (west) and Glynton Road based on a design speed of 80km/h on Glynton Road, Homestead Road and Teviot Road (east).

4.2 Bushland Road Existing Condition and Pavement Review

An overview of existing Bushland Road attributes is provided below:

- Two-way, unsealed;
- Unsealed pavement width of approximately 3m-4m with heavily grassed shoulders and vegetated verge;
- Drainage – Basic side table drains; and
- Estimated existing daily traffic volumes – less than 10. The traffic counts recorded a total of four (4) trips (two-way) during the 3-hour AM period and 3-hour PM period.

The existing condition of Bushland Road is illustrated in **Figure 4.4**.

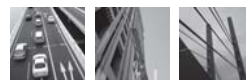


Figure 4.4 Typical View of Existing Condition of Bushland Road

We undertook a high level review of the potential impacts of development traffic on the existing Bushland Road pavement.

Austroroads does not categorically define strict traffic parameters for unsealed rural pavements, as application can vary depending on geographical location and other considerations such as topography, road length, desired speed environment, traffic volumes and heavy vehicle mix.

However, the ARRB *Unsealed Roads Manual – Guidelines to Good Practice (3rd Edition, March 2009)* provides a useful classification system. The service function and road type descriptions under the ARRB Roads Classification System (ARRB Table 4.1) are reproduced here in **Table 4.3**.

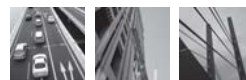
**Table 4.3 Reproduction of ARRB Table 4.1: Unsealed Roads Classification System**

Road Class	Class Type	Service Function Description	Road Type Description
4A	Main road > 150 ADT	This type of road is used for major movements between population centres and connection to adjacent areas. High traffic volumes occur and the road can carry large vehicles.	- All weather road predominantly two-lane and unsealed. Can be sealed if economically justified - Operating speed standard of 50–80 km/h according to terrain - Minimum carriageway width is 7 m
4B	Minor road 150–50 ADT	This type of road is used for connection between local centres of population and links to the primary network. Roads may or may not be sealed depending on the importance and function of the road.	- All weather two-lane road formed and graveled or single-lane sealed road with gravel shoulders - Operating speed standard of 30–70 km/h according to terrain - Minimum carriageway width is 5.5 m.
4C	Access road 50–10 ADT	Provides access to low use areas or individual rural property sites and forest areas. Caters for low travel speed and a range of vehicles and may be seasonally closed.	- Substantially a single lane two-way generally dry-weather, formed (natural materials) track/road - Operating speeds standard of < 20–40 km/h according to terrain - Minimum carriageway width is 4 m - May be restricted to four-wheel drive vehicles
4D	Tracks < 10 ADT	Provides primarily for four-wheel drive vehicles. Mainly used for fire protection purposes, management access and limited recreational activities.	- Predominantly a single-lane two-way earth track (unformed) at or near the natural surface level - Predominantly not conforming to any geometric design standards - Minimum cleared width is 3 m

4.2.1 Pavement Design

In accordance with Council's *Sc6.2.5 Planning Scheme Policy 5 – Infrastructure 3.4 Movement Infrastructure Standards*, (Sc6.2.5), we provided the following assessment of Council's pavement design requirements. The road pavement design should comply with *Austrroads Guide to Pavement Technology Part 2: Pavement Structural Design*.

Bushland Road is classified as a Rural Access road by Council. The ARRB guide discussed above suggests that for a class 4B road, "roads may or may not be sealed depending on the importance and function of the road." Council's pavement design standards require a Rural Access road pavement to accord with the information contained in *Sc6.2.5, Table 3.4.8.2.1-Pavement design standards for a road*, an extract of which is shown in **Table 4.4**. From the table it can be seen that Council's pavement design standards require a sealed pavement. Depending on project scheduling it may be necessary to consider staging the construction of Bushland Road where the asphalt wearing course is constructed following the completion of the WTS. However, there are several factors (including economic, drainage and safety) that need to be taken into account prior to this decision being made. These are itemised in Section 3.5 of the *Austrroads Guide to Pavement Technology Part 2: Pavement Structural Design*.

**Table 4.4 Pavement design standards for Rural Access road**

Road Type	Pavement Surface Type	Primer Type	ESA	Minimum Pavement Thickness (mm)	Minimum AC Thickness (mm)	Quality of Material for Base Course Pavement (CBR)	Quality of Material for Sub-Base Course Pavement (CBR)
Rural access road	AC	Prime	8.3×10^4	250	35mm of 10mm mix	80	45

4.3 Bushland Road Concept Design

4.3.1 Cross Section

Seqwater and Council intend to use the Bushland Road corridor to locate services including water (including bulk water pipeline), sewer, power and communications. The bulk water pipeline referred to on Seqwater plans is the Flagstone pipeline and a track is required in the long term for maintenance.

Following a previous study investigating options for the preferred cross section of Bushland Road, Council's standard Rural Access cross section (Standard Drawing 8/00376) was adopted, shown in **Figure 4.5**.

The proposed location of services is consistent with Seqwater's Design Intent and Safety Aims and in particular aims to:

- Maximise the distance between Energex overhead power lines and Seqwater's underground steel pipes;
- Keep the Energex overhead power lines to the west and south of Bushland Road to allow for construction and delivery vehicle movements;
- Allow separation between successive pipe construction to reduce the risk of trench collapse; and
- Maximise the separation between water pipes and sewer pipes.

It is noted that the quantum of services and their precise location, including potentially undergrounding power, may be modified as detailed design progresses, and we would recommend that the road carriageway is centrally located within the road reserve, unless it needs to avoid significant trees or other constraints.

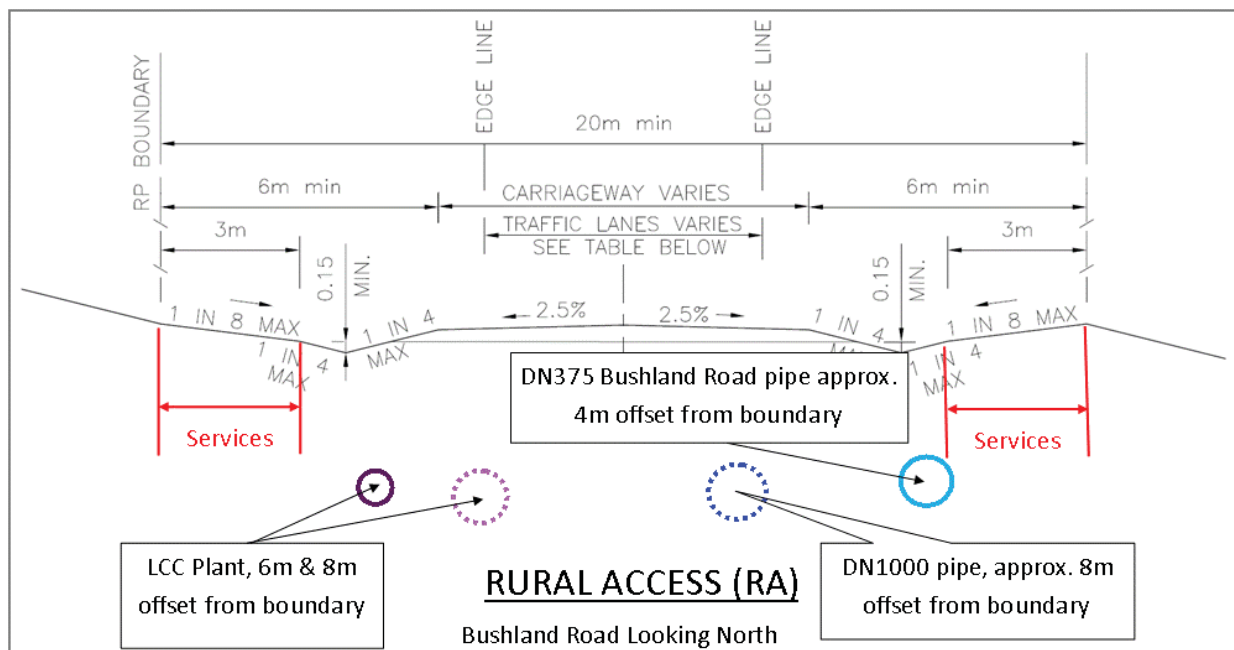


Figure 4.5 Proposed typical cross section based on Council's standard Rural Access cross section

This cross section:

- Can accommodate all infrastructure required for all future stages of the WTP development;
- Can be constructed in stages to cater for the level of use required; and
- Because of the low traffic volumes expected for future use, allows for maintenance of the pipeline using a combination of a temporary access track and half of the carriageway to allow for passing traffic.

The suggested location of services, which will allow for underground LV and overhead HV Energex power, is in accordance with Council's Standard Drawings 8/00392 and 8/00393. It is noted that these standards suggest that trunk water mains greater than 200mm diameter are located under and 1m from the edge of carriageway.

Whilst the estimated numbers of heavy vehicles accessing the WTP site during construction and operation are relatively low, it is recommended that the depths of services are determined to allow for the required pavement depths in accordance with the pavement design recommendations contained in Council's pavement design standards.

4.3.2 Bushland Road Alignment Concept Design

Road design for Bushland Road was previously undertaken by GHD in 2010. The design drawings were prepared "For Construction" and include:

- A general arrangement plan;
- An intersection layout plan for the intersection of Bushland Road and Treviot Road; and
- Plan and Longitudinal Section (Working Plan) along Bushland Road.

The GHD drawings are attached as **Appendix D**.



The proposed posted speed limit is 60km/h with a reduction to 50km/h on the approaches to a bend located at chainage 2200. The horizontal and vertical road design for Bushland Road and the intersection treatment for Bushland Road with Teviot Road (west), prepared by GHD, is generally supported. However, there is a road section where the design levels are below Council's 1:100 AEP RL of 32.45m. Based on a review of contour plans, it appears that this section would be impacted if the Logan River was to flood.

However, Seqwater requires designs to accommodate a 1:200 AEP RL of 34.0m and the vertical road alignment will need to be raised by approximately 2.5m above the existing design level at the gully crossing, which will be in approximately 4.0m of fill. This will require a redesign of the vertical alignment for an approximate length of 560m between chainages 1280 to 1840 and will require retaining walls and additional drainage / culvert design and to accommodate these works.

Figure 4.6 shows the approximate extent of inundation in 1:100 and 1:200 AEP events.

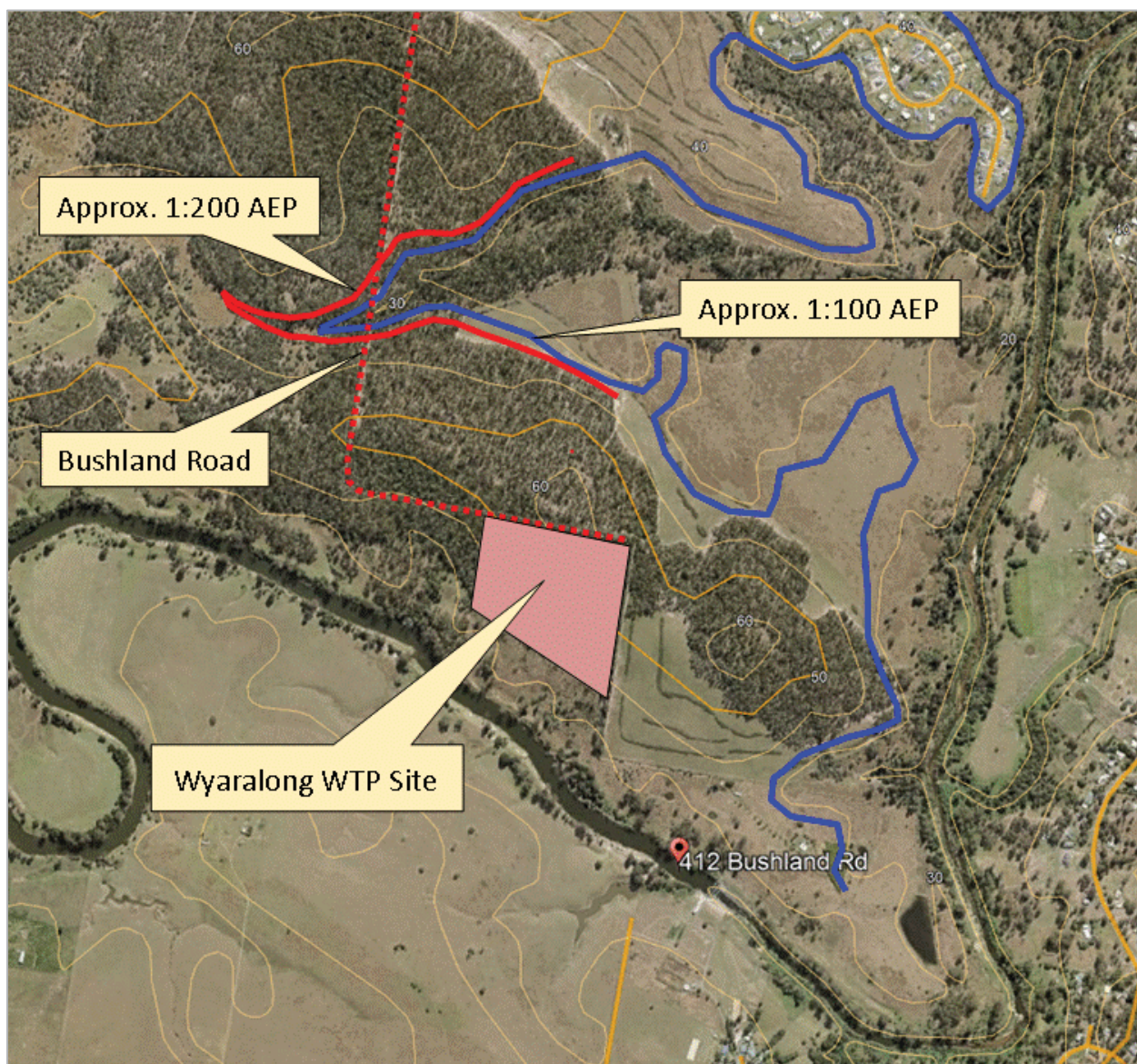


Figure 4.6 Approximate 1:100 and 1:200 AEP Inundation Extent



We revised the longitudinal section of the GHD plan to show conceptually what the approximate modifications to the vertical geometry of the road will be required to keep the road surface above the 1:200 AEP level of 34.0m. The maximum height of fill will be approximately 4.0m between approximate chainage 1700 to 1720.

For an approximate length of 420m between chainage 1370 and 1790, where the height of fill is greater than 1.5m, earthworks may be contained within the existing 20.0m road reserve by constructing retaining walls. Conceptual typical cross sections were prepared to demonstrate that incorporating retaining walls, earthworks can be accommodated within the road reserve. The conceptual long section and typical cross section are attached as **Appendices E and F**.

4.3.3 Bushland Road Construction

It is assumed the first construction activity will be clearing and grading of the Bushland Road reserve to provide access to the site for on-going construction activity. As the road reserve is heavily vegetated, it is assumed that vegetation will need to be cleared, cut and mulched on-site and carted. It is understood that construction of the Flagstone pipeline to be located in the Bushland Road reserve will be done as part of Scope 1 works to be completed in 2019, which will require construction access and formation of a service track.

We estimate that works in Bushland Road will require access by the following heavy vehicles:

- Two (2) bulldozers;
- Two (2) excavators;
- Two (2) front-end loaders;
- Two (2) dump trucks;
- Two (2) graders; and
- Flat-bed Semitrailer.

As most of the works required for the construction of Bushland Road will be sequential, the trip generation is not expected to be high. Consistent with all roadworks projects, we recommend the preparation and adherence to a Construction Management Plan and Traffic Management Plan to manage traffic throughout this phase.

4.4 Internal Site Layout

4.4.1 Traffic Operations and Circulation

During the operational phase, Flat-bed Medium Rigid Vehicles (MRV), Articulated Vehicles (AV) and Truck and Dog rigs will be used to deliver chemicals for treating the water supply in the storage tanks as previously shown in **Table 3.3**. The vehicle type that has the largest swept path is the AV, which is the template type that we used in our assessment of the swept path for these vehicles to manoeuvre around the site. A swept path assessment is contained in **Appendix G**. The only other vehicles accessing the site are expected to be utilities and vans for occasional equipment maintenance.

4.4.2 Traffic Accommodation

Dedicated parking areas will not be required as service vehicles are the delivery tankers, which will park on the circulating road to deliver chemicals to the storage tanks. Other than that, there will be occasional light vehicles entering the site for maintenance checks. These vehicles can park on the circulating roadway, which in the rare occasion that another vehicle will be on site at the same time, can pass as the circulating roadway width is 7.0m



5.0 Summary

Key findings are summarised below:

- Swept path analyses using Auto Track software demonstrates that safe access and turning manoeuvres are achieved for design articulated vehicles (AV) at the intersection of Teviot Road / Homestead Road / Glynton Road, access from Teviot Road (west) to Bushland Road, site access from Bushland Road and internal circulation;
- The Teviot Road / Homestead Road / Glynton Road intersection is adequate in its current form to facilitate expected construction traffic and operational traffic;
- Based on planned scheduling, the WTS will be completed prior to development works associated with the Celestino development and should therefore not interfere with the Celestino development;
- It is planned to provide access control infrastructure such as boom / security gates where Bushland Road crosses roadways of the Celestino development in the future;
- For the majority of the construction phase, the number of vehicles accessing the site is below approximately 20 vehicles per day;
- During the operational phase there is less than two (2) trucks expected to access the site per week. Therefore the operational phase following the WTS will have a negligible effect on the surrounding road network;
- During the construction phase, there will be approximately less than one (1) vehicle entering the site every three (3) minutes throughout the AM and PM peak hours. This is considered to be negligible and not expected to impact the local road network;
- A Turn Warrant assessment concluded that simple left (SL) and simple right (SR) turn provision is adequate for the intersection of Teviot Road (west) with Glynton Road;
- SISD can be achieved to / from both Teviot Road (west) and Glynton Road based on a design speed of 80km/h on Glynton Road, Homestead Road and Teviot Road (east);
- The horizontal and vertical road design for Bushland Road prepared by GHD is generally supported, but will require a redesign of the vertical alignment for an approximate length of 560m between approximate chainages 1280 to 1840 and will require retaining walls over sections of high fill;
- High-level assessment of cross sectional elements along Bushland Road demonstrates that incorporating retaining walls can be accommodated within the road reserve without the need to acquire land; and
- During the period of concrete pouring of the storage tank walls and floor slab, when higher traffic volumes are expected, we recommend the preparation and adherence to a Traffic Management Plan and Construction Management Plan.

In light of the above, we recommend that the development be approved with reasonable and relevant conditions as set out above. Please do not hesitate to contact the undersigned on 07 3221 3503 if you have any queries regarding the above.

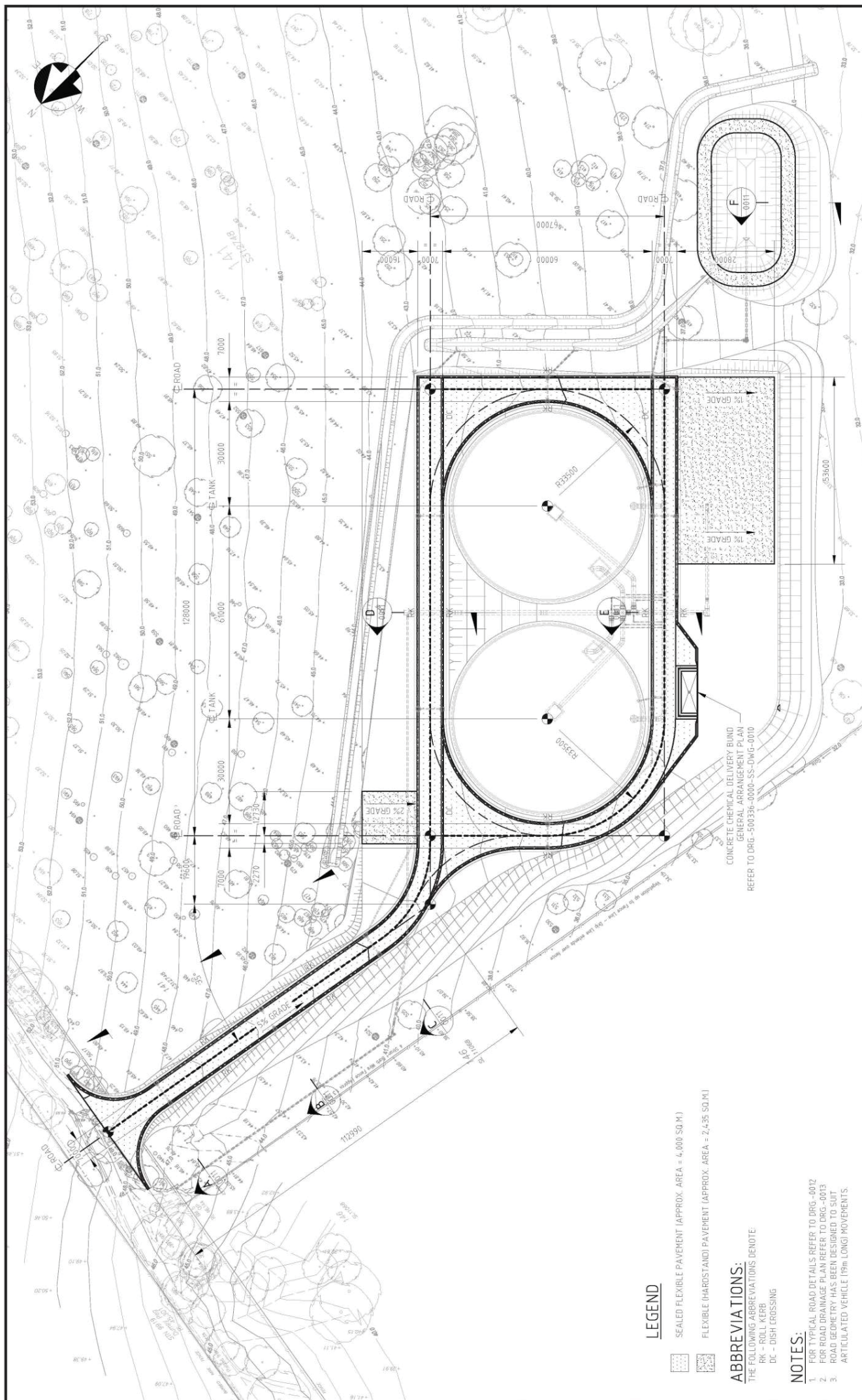
Yours faithfully,

Andrew Douglas

Director | Cambray Consulting Pty Ltd
BECivil (Hons) | MSc (Env Man)
FIEAust | CPEng | RPEQ 6691

APPENDIX A

Development Site General Arrangement Plan



LEGEND

SEALED FLEXIBLE PAVEMENT (APPROX. AREA = 4,000 SQ. M.)

FLEXIBLE (HAROSTAND) PAVEMENT (APPROX. AREA = 2,435 SQ.M.)

ABBREVIATIONS:

THE FOLLOWING ABBREVIATIONS DENOTE:

ARK - ROLL KERB

DOC - DISH CROSSING

NOTES:

1. FOR TYPICAL ROAD DETAILS REFER TO DRG.-0012
2. FOR ROAD DRAINAGE PLAN REFER TO DRG.-0013
3. ROAD GEOMETRY HAS BEEN DESIGNED TO SUIT ARTICULATED VEHICLE (19m LONG) MOVEMENTS.

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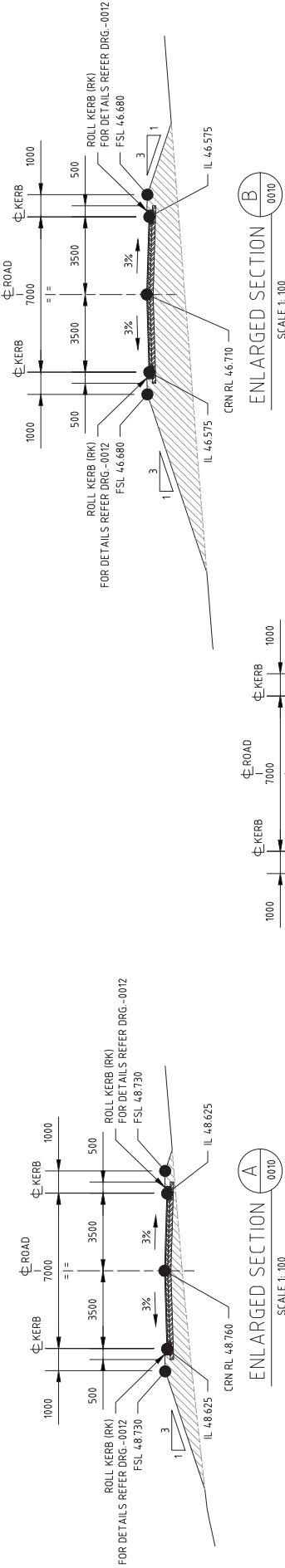
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WATER FOR LIFE

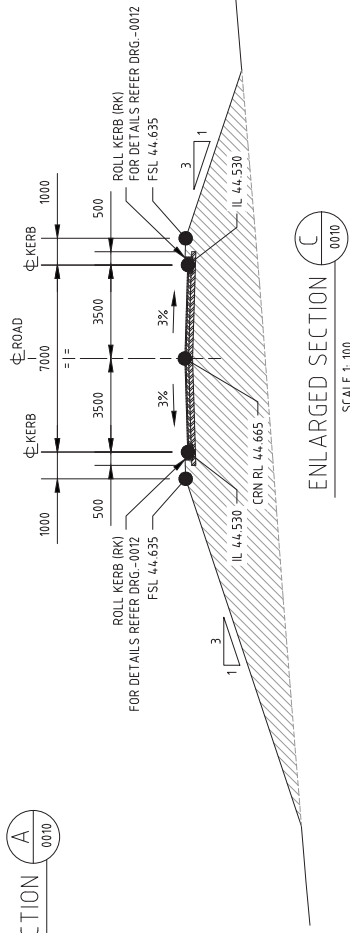
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TWO EARLY WORKS
ROADWORKS
GENERAL ARRANGEMENT PLAN

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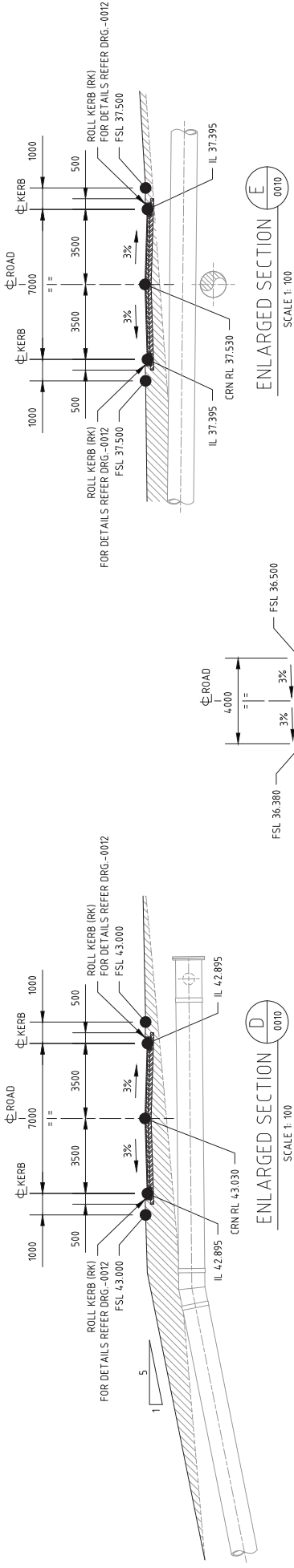


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ENLARGED SECTION C
SCALE 1: 100



ENLARGED SECTION D
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SCALE 1: 100

ENLARGED SECTION F
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seqwater
WATER FOR LIFE

TITLE
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TWY EARLY WORKS
ROADWORKS
GENERAL ARRANGEMENT SECTIONS
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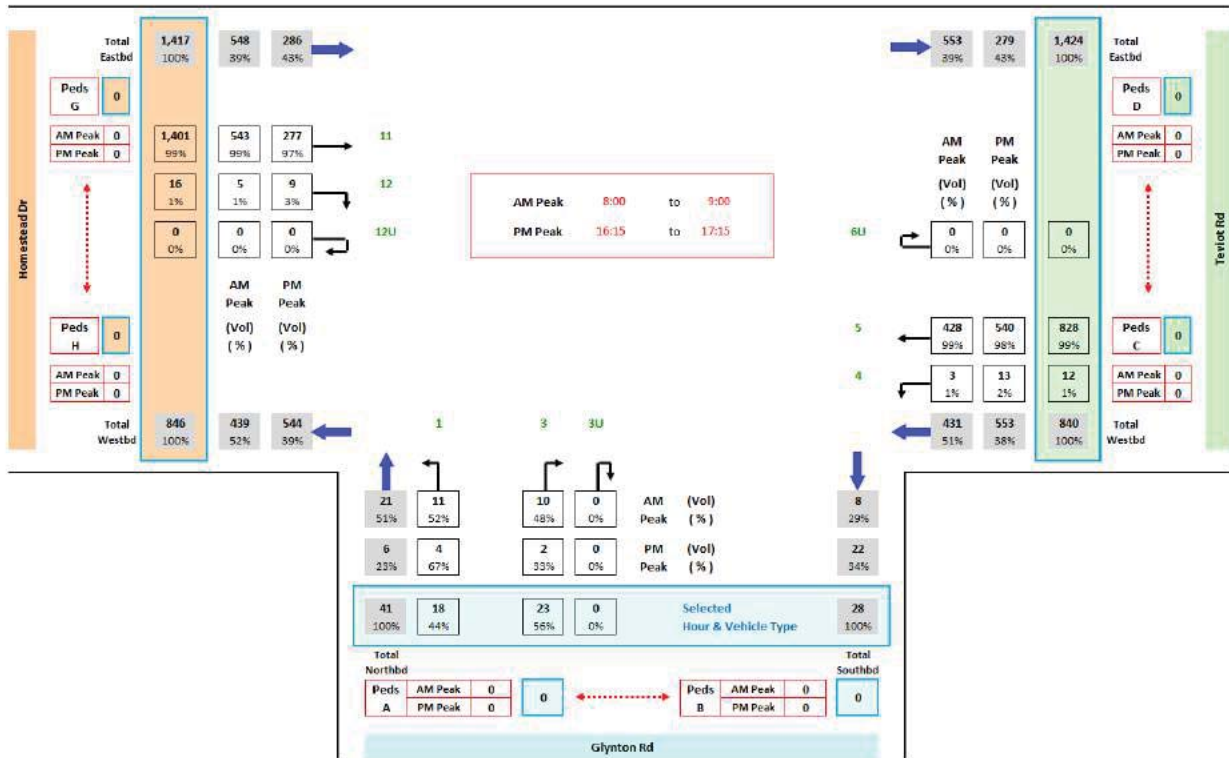
APPENDIX B

Traffic Count Survey Data

Job No. : Q1926
 Client : ARUP
 Suburb : Jimboomba
 Location : 1. Teviot Rd / Glynton Rd / Homestead Dr

Day/Date : Tue, 13th June 2017
 Weather : Fine
 Description : Classified Intersection Count
 : Intersection Diagram

Hour Starting: AM Totals
 Vehicle Type: All Vehicles

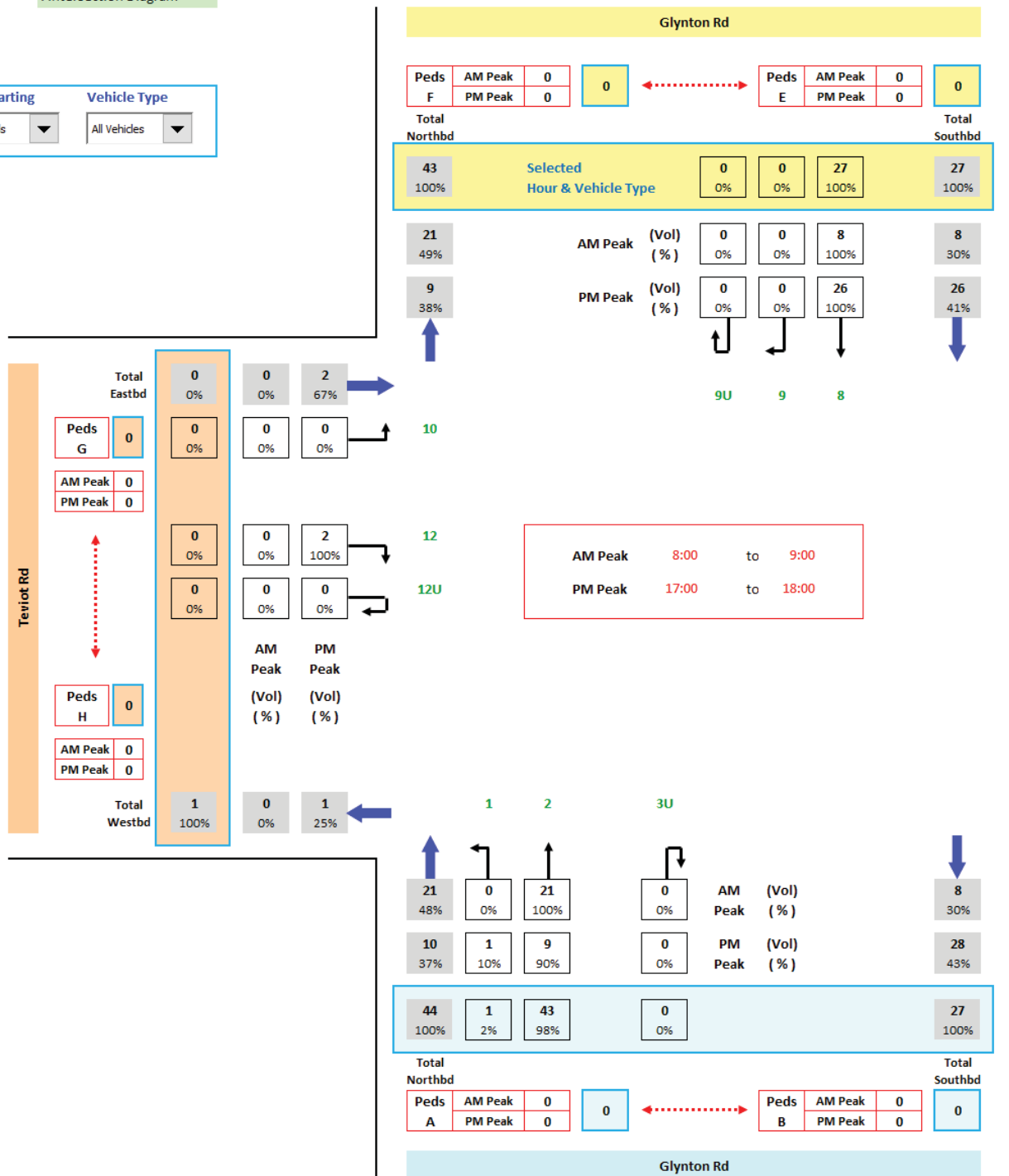


Job No. : Q1926
 Client : ARUP
 Suburb : Jimboomba
 Location : 1. Teviot Rd / Glynton Rd

Day/Date : Tue, 13th June 2017
 Weather : Fine
 Description : Classified Intersection Count
 : Intersection Diagram



Hour Starting	Vehicle Type
AM Totals ▼	All Vehicles ▼



APPENDIX C

Construction Traffic Generation Estimates

Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant	Stay onsite	Daily onsite
SITE WIDE SERVICES								
Preliminary and General Items								
Site mobilisation & Demobilisation	0.383386581	10	9	9	4	Semi-trailers x 3 Frane Crane -1 Flat-bed delivery - 1	Electricians, Plumbers	
Bulk Earth Works								
Clear and Grub	0.383386581	10	9	9	2	Tree clearers - excavator, chipper, 2 x trucks, 2 x utes - 6 25t excavator - 1		
Top soil clear & Stockpile	0.191693291	5	9	9	2	Grader - 1 25t Excavator x 2 - 2	2 x trucks - 2 water truck - 1	2 x utes - 2
Total Cut	4		9	9		6 x trucks - 6 Rollers x 2 (Padfoot & Smooth drum) - 2	Water truck - 1	
Total Fill	4		6	6	2	4 x trucks (min 4 rounds per day) - 16 Excavation from cut activity, trenching, etc - 1		
Off-site disposal (unsuitable material)		ongoing	17	5		Placement in other items		
Import general fill		ongoing	30	10				
Roads, Drainage and General Civils								
Roads								
Excavation		ongoing	11	11	2	25t Excavator x 2 - 2	water truck - 1	
Flexible Pavement (Hardstand)	0.191693291	5	22	12	2	Grader - 1 5 x truck& dogs (min 3 rounds per day) - 15	Rollers x 2 (Smooth drum & multi-tire) - 2	Water truck - 1
Sealed Flexible pavement	0.383386581	10	20	10	2	Grader - stay on site 5 x truck& dogs (min 3 rounds per day) - 15	Rollers x 2 (Smooth drum & multi-tire) - 2	Water truck - 1
Asphalt						Asphalt Trucks x 5 - 5 Bitumen Seal crew - Sprayer with dog, 2 spreader trucks, 2 rollers, broom trailer, crew truck and 2 utes - 9		
	0.15354633	4	20	20				
Road Drainage								
RC drainage pipework DN300	0.575079872	15	11	11	6	12t excavator	Trench-roller	Possi-track* - 1
RC drainage pipework DN375	0.076677316	2	11	11	6	12t excavator	Trench-roller	Possi-track* - stay on site
RC drainage pipework DN450	0.076677316	2	11	11	6	12t excavator	Trench-roller	
Kerb inlet and lintel	0.153354633	4	9	9	6	12t excavator		
Kerb precast pit	0.268370607	7	9	9	6	12t excavator		
Discharge headwall								
Grass Swale (90m) and Diversion Bank (370m)	Inconjunction with RCP install		7	7	6	12t excavator		
Grass Swale and batters grassing	0.191693291	5	4	4		12t excavator	Trench-roller	
Self-Binding Gravel 50mm thk (min)	0.115015974	3	4	4		25t excavator	Roller (CC10)	3 x truck& dogs (min 3 rounds per day)
Self-Binding Gravel 50mm thk (min)	0.115015974	3	16	16	2	Possi-track*	Water Truck	3 x truck& dogs (min 3 rounds per day)
	0.115015974	3	16	16	2	Possi-track*	Water Truck	

Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant			Stay onsite	Daily onsite
Storm Water Bioretention Basin										
DN450 outlet pipe	0.038338658	1	9	9	6	12t excavator	Truck		Possi-track*	
HDPE Liner	0.038338658	1	6	6	4	Possi-track*	Truck			
Egress Matting	0.038338658	1	6	6	4	Possi-track*	Truck			
Security Fencing										
Fencing Length	0.191693291	5	11	11	6	Fencing Contractor - 3t excavator, possi-track, crew truck, 2 utes				
Transfer Pipelines										
Round Mountain - BRP1 Transfer Pipeline										
DN375 BRP1 MSCL Pipeline	0.536741214	14	10	10	6	12t excavator (already on site)	trucks x 2	Trench-roller	Possi-track*	
DN375 bend fittings										
DN375 bend fittings										
DN375 Gate Valve										
DN375 Gate Valve										
Flow Control Valve										
Flow Control Valve Actuator										
Flow Control valve installation and commissioning										
DN375 Flow meter										
DN375 Flow meter installation and commissioning										
CCT to Transfer Storage Tank Pipeline										
Treated Water Tank Inlet Pipework - DN1200 MSCL (60m)	0.153354633	4	11	11	6	12t excavator	trucks x 2	Trench-roller	Possi-track*	
Treated Water Tank Inlet Pipework Blank Flange										
Treated Water Tank Inlet Pipework Fittings 22 Bend										
Transfer Storage Tank Overflow Pipeline										
Treated Water Tank Overflow Pipework - DN1200 MSCL (115m)	0.306709265	8	11	11	6	25t excavator	trucks x 2	Trench-roller	Possi-track*	
Treated Water Tank Overflow Pipework Fittings DN1200 Tee										
Treated Water Tank Overflow Pipework Blank Flange										
Treated Water Tank Overflow Pipework Fittings 90 Bend										
Treated Water Tank Overflow Pipework Fittings Bellmouth										
Treated Water Tank Overflow Pipework - DN450 DI/CL (34m)	0.076677316	2	11	11	6	12t excavator	trucks x 2	Trench-roller	Possi-track*	

Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant	Stay onsite	Daily onsite
Treated Water Tank Overflow Pipework Headwall (precast RC)								
Precast 1050mm pit								
Transfer Storage Tank Valve Pit to Pump Station								
Treated Water Tank Outlet Pipework - DN1200 MSCL (9m)	0.038338658	1	11	11	6	25t excavator	trucks x 2	Possi-track*
Treated Water Tank Outlet Pipework Fittings DN1200-DN750 Reducer								
Treated Water Tank Outlet Pipework Fittings DN1200 Tee								
Treated Water Tank Outlet Pipework Blank Flange								
Treated Water Tank Outlet Pipework - DN750 MSCL (31m)	0.076677316	2	11	11	6	12t excavator	trucks x 2	Possi-track*
Treated Water Tank Outlet Pipework Fittings								
Transfer Storage Tank Pipework								
DN1200 MSCL Outlet Pipework to valves - See Piping Tab	0.115015974	3	11	11	6	25t excavator	trucks x 2	Possi-track*
DN1200 MSCL Pipework from tank edge to valves - See Piping Tab								
Outlet Pipework Concrete Encasement	0.038338658	1	16	16	6	Concrete boom pump	Concrete Mixers x 9	
DN1200 Gate Valves								
DN1200 Gate Valves								
DN1200 Gate Valves (Actuated)								
DN1200 Gate Valves (Actuated)								
DN1200 Tee								
DN1200 Tee								
DN1200 4-way connector								
DN1200 4-way connector Supply + Installation								
DN1200 45° Bends								
DN1200 45° Bends								
DN1200 90° Bends								
DN1200 90° Bends								
DN300 gate Scour valves								
DN300 gate Scour valves								
Tanks inlet & outlet sample valves - 12mm								
Inlet & Outlet pipe scour valves - 75mm								
Inlet & Outlet pipe scour pipework in valve pit								
Scour pipework - DN300 DI/CL	0.076677316	2	8	8	6	12t excavator	Possi-track*	
SWP Transfer Pipeline								

Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant			Stay onsite	Daily onsite
Discharge pipeline (nominal allowance to reach termination of Route K (180m))	0.460063898	12	11	11	6	12t excavator	trucks x 2	Trench-roller	Possi-track*	
Surge Vessel	0.019169329	0.5	6	6	6					
Access platform	0.115015974	3	4	4	4					
Pressure Transmitter										
Pressure Transmitter										
Bladder Conductivity probe										
Bladder Conductivity probe										
DN450 Discharge Pipeline Flowmeter										
DN450 Discharge Pipeline Flowmeter Installations										
PROCESS PLANT										
100t Crane for construction of Reservoirs and Process Facilities (Mobilisation and Demobilisation)	7		7	7	2	100t Crane	2 x Semi-trailers with equipment for crane establishment	2 x tles for operator and dogman		
Treated Water Storage										
Treated Water Reservoirs		Each								
Localised Backfill	0.536741214	14	7	7	2	12t excavator	trucks x 2	Trench-roller	Possi-track*	
Foundation Layer	0.383386581	10	26	11	2	5 x truck& dogs (min 4 rounds per day)	Grader	Rollers x 1 (Smooth drum)	Water truck	Possi-track*
Blinding Layer	0.153354633	4	49	14	8	Concrete boom pump	Concrete Mixers x 5 per 8 rounds			
Concrete Walls	1.073482428	28	131	32	20	Concrete boom pump x 3	Concrete Mixers x 9 per 12 rounds			
Concrete Floor Slab	0.766773163	20	131	32	20	Concrete boom pump x 3	Concrete Mixers x 9 per 12 rounds			
Inlet chamber walls	0.230031949	6	11	11	6	Concrete boom pump	Concrete Mixer x 4			
Inlet chamber floor	0.230031949	6	8	8	6	Concrete boom pump	Concrete Mixer x 1			
Inlet pit mass fill concrete	0.076677316	2	11	8	4	Concrete boom pump	Concrete Mixers x 3 x 2 rounds			
Outlet chamber walls	0.230031949	6	10	10	6	Concrete boom pump	Concrete Mixers x 3			
Outlet chamber floor	0.230031949	6	8	8	6	Concrete boom pump	Concrete Mixer x 1			
Hydrostatic testing	0.153354633	4	4	4	4					
Alumadome Roof (both Tanks)	0.766773163	20	12	12	8	4 x Semi-trailers				
Mechanical Ventilators			1	1		1 x Delivery truck				
Vortex Control Device										
Vermín proofing	0.076677316	2	5	5	4	1 x Delivery Truck				
Access stairs	0.460063898					6 x Semi-trailers				
Roof Platform and Walkway										
Access Walkway between tanks		12	16	16	8	2 x Semi-trailers				

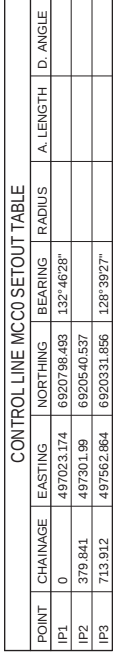
Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant	Stay onsite	Daily onsite
Ladders into tanks								
Davit post for entry	0.076677316							
Davit for entry								
Fall arrest anchor point		2	9	9	Same time as above structural components	1 x Delivery Truck		
Boat hatch								
Access hatch								
Electrical								
Tank Level Transmitters			1	1	With other electrical	1 x Delivery Truck		
Tank level switches								
Treated Water Storage Valve Pit								
Excavation	0.153354633	4	4	4	1	12t excavator	trucks x 2	
Localised Backfill	0.076677316	2	7	7	2	12t excavator	trucks x 2	Possi-track*
Foundation Layer	0.076677316	2	11	11	2	5 x truck& dogs	Grader	Water truck
Blinding Layer	0.076677316	2	13	13	4	Concrete boom pump	Concrete Mixers x 8	Possi-track*
Concrete Walls	0.115015974	3	14	14	6	Concrete boom pump	Concrete Mixers x 7	
Concrete Floor Slab	0.115015974	3	12	12	6	Concrete boom pump	Concrete Mixers x 5	
Round Mountain Flowmeter, Chem Dosing and Mixing Pit								
Excavation	0.038338658	1	4	4	1	12t excavator	trucks x 2	
Localised Backfill	0.038338658	1	6	6	2	12t excavator	truck	Possi-track*
Foundation Layer	0.038338658	1	7	7	2	Truck& dogs	Grader	Water truck
Blinding Layer	0.038338658	1	6	6	4	Concrete boom pump	Concrete Mixer	Possi-track*
Concrete Walls	0.115015974	3	6	6	4	Concrete boom pump	Concrete Mixer	
Concrete Floor Slab	0.115015974	3	6	6	4	Concrete boom pump	Concrete Mixer	
SWP & RM Pumping Station								
Switchroom, Comms & Ops Building								
Building Slab	0.076677316	2	8	8	4	Concrete boom pump	Concrete Mixer x 3	
Roof Frame & Cladding	0.076677316	2	5	5	4	1 x Semi-trailers		
Wall Fabric and Blockwork	0.076677316	2	9	9	6	2 x Semi-trailers	Bricklayer Contractor Truck	
Ceiling (Suspended, Fire Rated)	0.153354633					1 x Semi-trailers		
Internal Roofing & Plumbing		4	8	8	4	1 x Semi-trailers		
Raised Access Computer Flooring						1 x Semi-trailers		
PA Doors						1 x Delivery Truck		

Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant	Stay onsite	Daily onsite
SWP Pump Station								
Building Slab	0.115015974	3	15	15	4	Concrete boom pump		
Inlet supply channel walls	0.076677316	2	9	9	4	Concrete boom pump		
Inlet supply channel floor	0.076677316	2	7	7	4	Concrete boom pump		
Discharge channel walls	0.076677316	2	8	8	4	Concrete boom pump		
Discharge channel floor	0.076677316	2	7	7	4	Concrete boom pump		
Channel Floor Grating	0.575079872	15	7	7	6	1 x Semi-trailers		
Industrial building (precast tilt panels cladding)								
PA Doors								
Roller Door								
Concrete Aprons	0.076677316	2	6	6	4	Concrete boom pump		
DN750 DI/CL Inlet Pipework	0.153354633							
DN750 TEE								
DN375 DI/CL Inlet Pipework								
DN375 Tees								
DN375 Gate Valves								
DN375 Reflux Valves								
DN375 90 Bend								
Pumps								
Flow Switches								
Pressure Gauges & isolation valves								
Chemical Dosing, Mixing and Storage								
Sodium Hypochlorite								
Delivery Bund Concrete	0.076677316	2	9	9	4	Concrete boom pump		
Dosing Tank Slab	0.076677316	2	6	6	4	Concrete boom pump		
20KL Self Bunded Storage Tank			1	1		1 x Semi-trailers		
Dosing Cabinet			1	1		1 x Delivery Truck		
Dosing equipment Installation	0.076677316	2	3	3	3			
<i>Electrical</i>								
Dosing pipework	0.460063898					1 x Delivery Truck		
Dosing conduit						1 x Delivery Truck		
SWP Discharge chlorine analyser - AE017								
Sample Flowmeter - FE017								
SWP Discharge pH analyser - AE016								
Sample Flowmeter - FE016								
Instrument pipework								
Installation & calibration								

Description	Estimated Months	Estimated Days	Est Vehicles / Day Accessing the Site (1/2 total trips)	Personnel on Site	Labour Personnel	Plant	Stay onsite	Daily onsite
SWP Discharge sample pump		12			4	1 x Delivery Truck		
Round Mountain supply chlorine analyser - AE051								
Sample Flowmeter - FE051								
Round Mountain pH analyser - AE050								
Sample Flowmeter - FE050								
Instrument pipework								
Installation & calibration								
Dosing mechanical inline mixer								
Site Wide Electrical								
Main Electrical Switch Room								
Switchroom at Pump Station	0.191693291	5	5	5	4	1 x Delivery Truck		
Transformers - (EW - Item 2)								
Transformer Area	0.115015974	3	5	5	4	1 x Delivery Truck		
Bulk reticulations								
Site electrical	0.191693291	5	5	5	4	1 x Delivery Truck		
Area Lighting								
Site electrical	0.191693291	5	5	5	4	2 x Delivery Truck		
Site Wide Control System								
SCADA	0.766773163					2 x Delivery Truck		
Network Hardware		20	8	8	6			
Control System Hardware								
Control System Commissioning								
Average			12.2	8.8				

APPENDIX D

GHD Design Drawings – Bushland Road

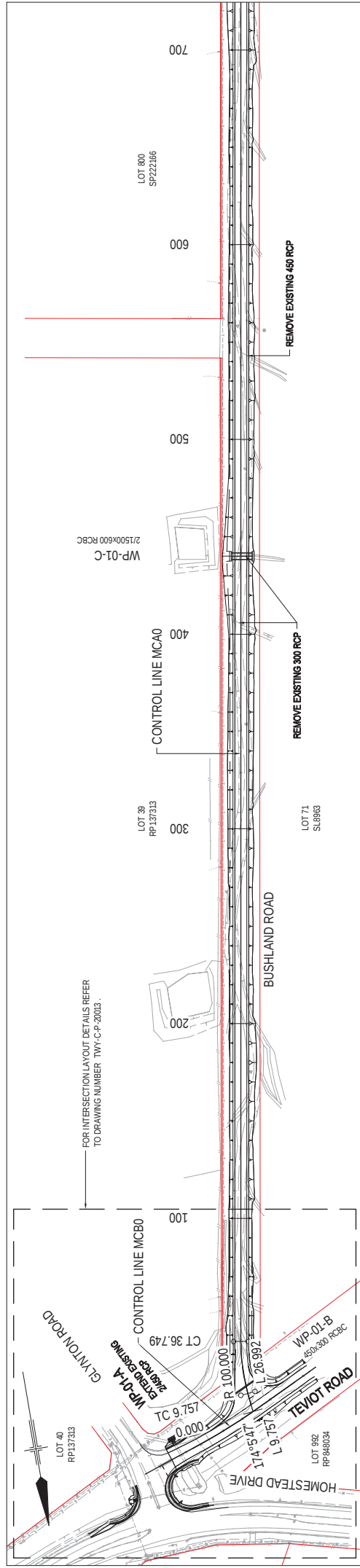


CONTROL LINE MCCO SETOUT TABLE						
POINT	CHANGAGE	EASTING	NORTHING	BEARING	RADIUS	A LENGTH
IP1	0	497023.174	6920798.493	132°46'28"		
IP2	379.841	497301.99	6920540.537			
IP3	713.912	497562.884	6920331.886	128°39'27"		

LEGEND:

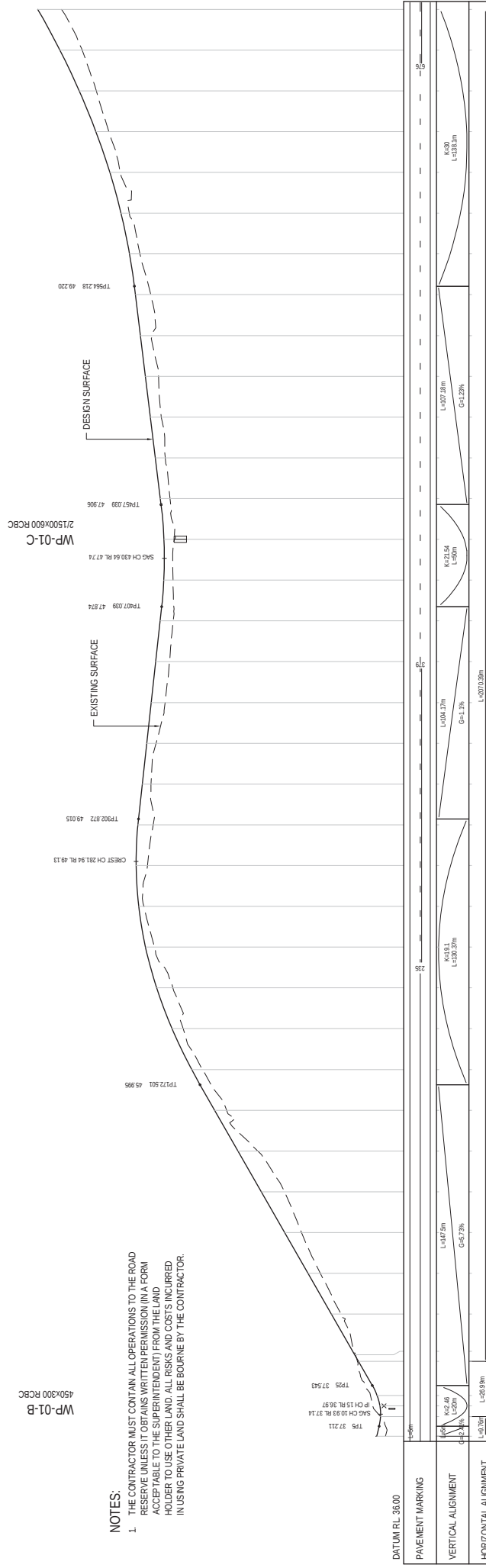
PROPERTY BOUNDARY

   Client Sub-Consultant										   CLIENTS PEOPLE PERFORMANCE Level 4, 201, Chifley St, Brisbane QLD 4000 Australia GPO Box 688 Brisbane QLD 4001 Tel: +61 (0)7 3221 4000 E: enquiries@ghd.com W: www.ghd.com										   DO NOT SCALE Conditions of Use: This document may only be used by GHD client (and any other person who has been authorised in writing by GHD) for the purposes for which it was prepared and may not be used for any other purposes or for any other project.										   Drawn ACARTER Checked M.HUGHES Design *C BERRY Date 17.12.10 Scale AS SHOWN										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										   Client N. WILSON Project *C KLAPROTH Title This Drawing is made in accordance with the conditions of use agreed as approved										 									
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WP-01-B
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NOTES:

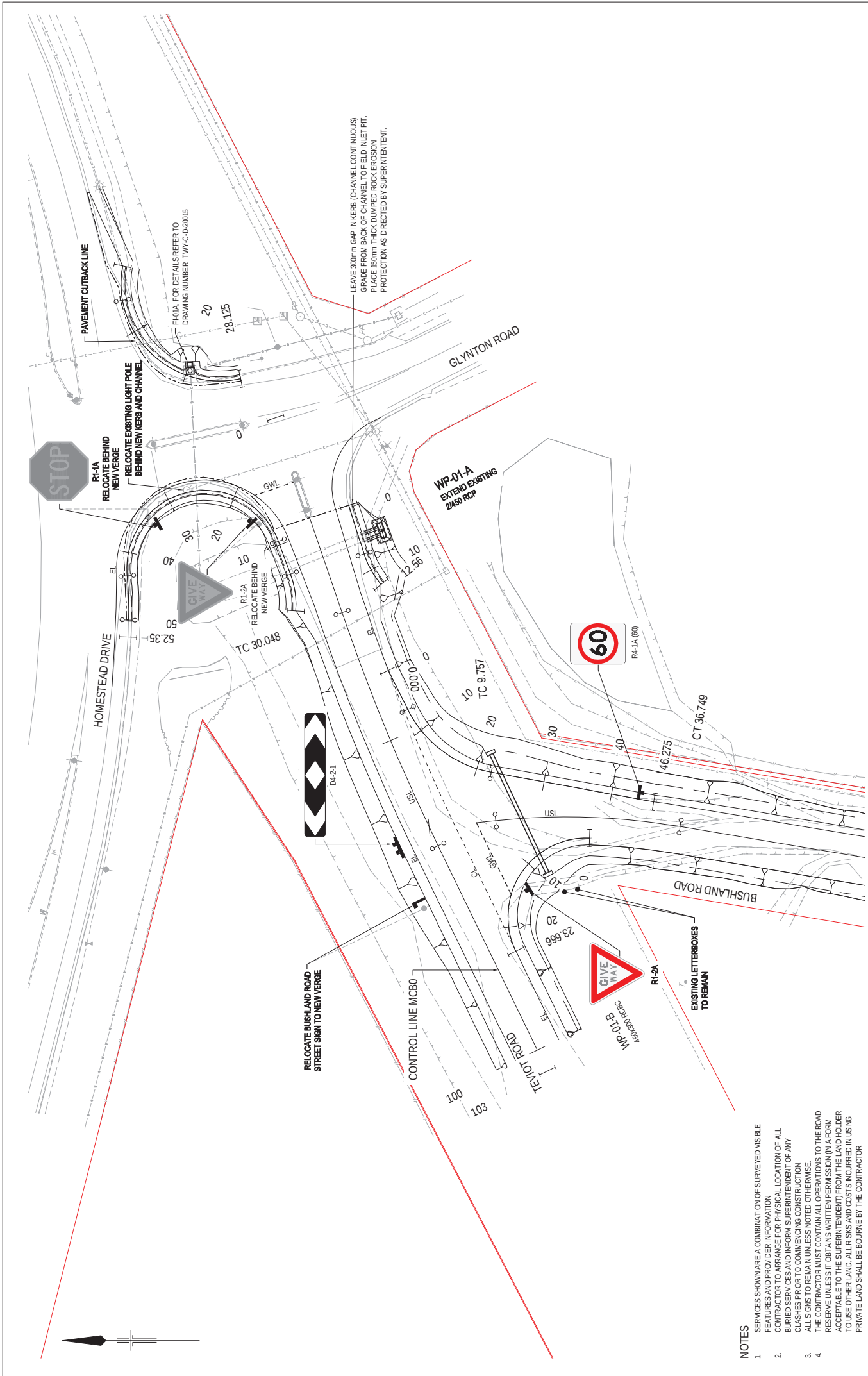
1. THE CONTRACTOR MUST CONTAIN ALL OPERATIONS TO THE ROAD RESERVE UNLESS IT OBTAINS WRITTEN PERMISSION (IN A FORM ACCEPTABLE TO THE SUPERINTENDENT) FROM THE LAND HOLDER TO USE OTHER LAND. ALL RISKS AND COSTS INCURRED IN USING PRIVATE LAND SHALL BE BOURNE BY THE CONTRACTOR.

[illegible]

LONGITUDINAL SECTION - CONTROL LINE MCA0

0 ISSUED FOR CONSTRUCTION No Revision Note: * indicates signatures on original issue of design or construction drawing		JF Drawn	CL Checked/Approved	08-10-20 Date	0 Date	seqwater WATER SOLUTIONS  	 Clients People Performance Level 4, 301 Chifley St Brisbane QLD 4000 Australia Tel 07 3250 6100 Fax 07 3250 6101 T 6 7 3316 3000 F 6 7 3316 3333 E email@ghd.com W www.ghd.com	DO NOT SCALE Conditions of Use: This drawing may only be used by the client for the project and site specified on the GHD contract (see page 1 of this drawing). GHD has agreed to use this document for the project and site specified on the GHD contract (see page 1 of this drawing). This drawing is not to be used for any other purpose or for any other site.	Drawn: JFELS Design Check: "M" HUGHES Approved: "C" BERRY Date: 8.12.10 Scale: AS SHOWN	Client: SEQ WATER Project: WYRALONG WATER TREATMENT PLANT Working Plan: WYRALONG SHEET 1 OF 4	Designed: M HUGHES Design Check: "C" KLAPROTH Title:	Drawing No: TWY-C-P-20006 Drawing Issued: 08-10-20 Drawing Approved:	Rev: 0
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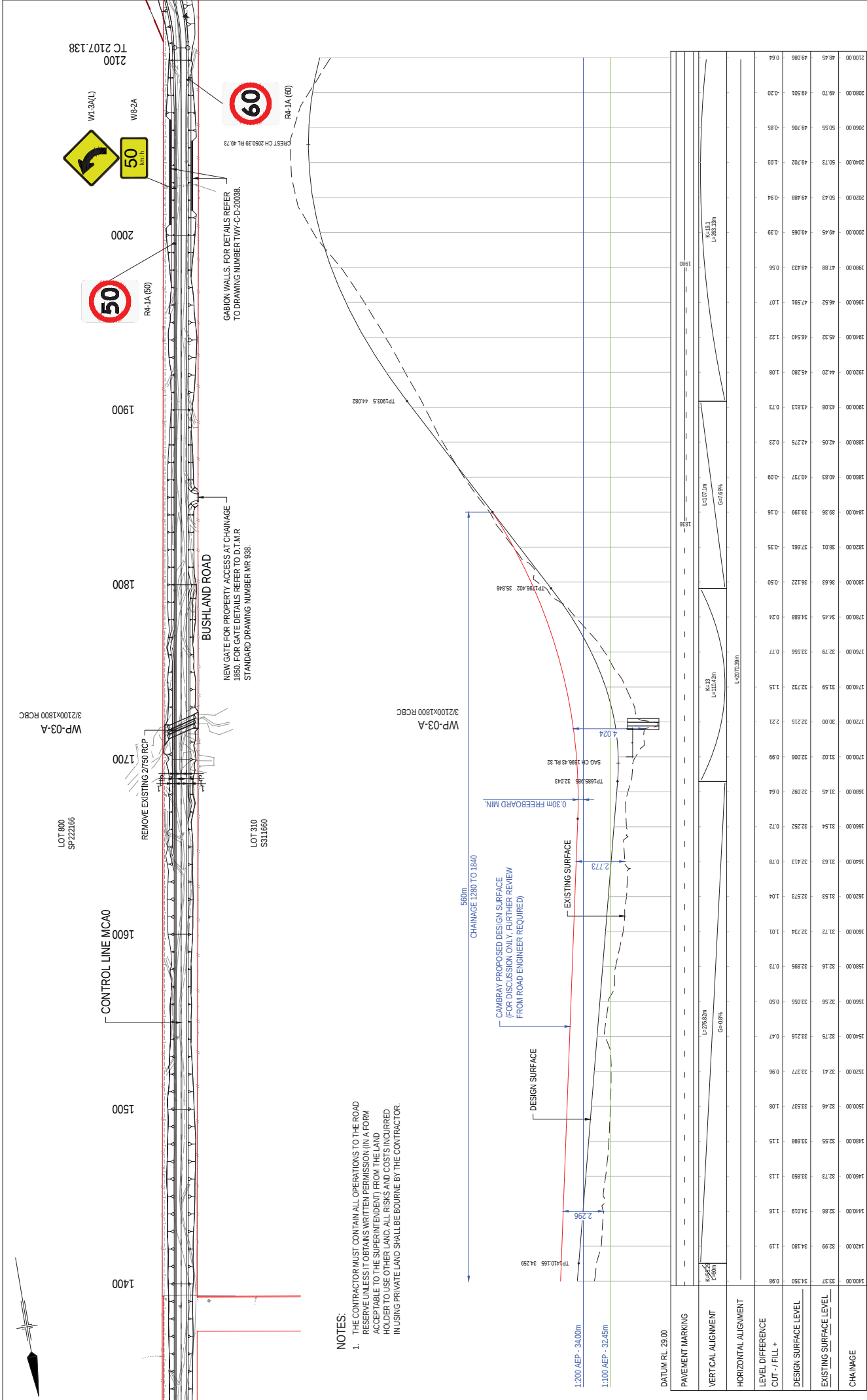


- NOTES**
- SERVICES SHOWN ARE A COMBINATION OF SURVEYED VISIBLE FEATURES AND PROVIDER INFORMATION.
 - CONTRACTOR TO ARRANGE FOR PHYSICAL LOCATION OF ALL BURIED SERVICES AND INFORM SUPERINTENDENT OF ANY CLASHES PRIOR TO COMMENCING CONSTRUCTION.
 - ALL SIGNS TO REMAIN UNLESS NOTED OTHERWISE.
 - THE CONTRACTOR MUST CONTAIN ALL OPERATIONS TO THE ROAD RESERVE UNLESS IT OBTAINS WRITTEN PERMISSION (IN A FORM ACCEPTABLE TO THE SUPERINTENDENT) FROM THE LAND HOLDER TO USE OTHER LAND. ALL RISKS AND COSTS INCURRED IN USING PRIVATE LAND SHALL BE BOURNE BY THE CONTRACTOR.

Client										Sub-Consultant										CLIENTS PEOPLE PERFORMANCE										DO NOT SCALE										Drawn J.FELS										Designed M.HUGHES										Client										Title										SEQ WATER WYARALONG WATER TREATMENT PLANT INTERSECTING LAYOUT 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APPENDIX E

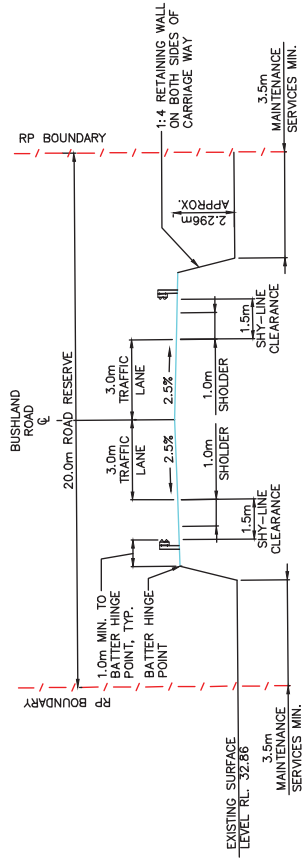
Conceptual Long Section on GHD Drawing
Cambray Consulting



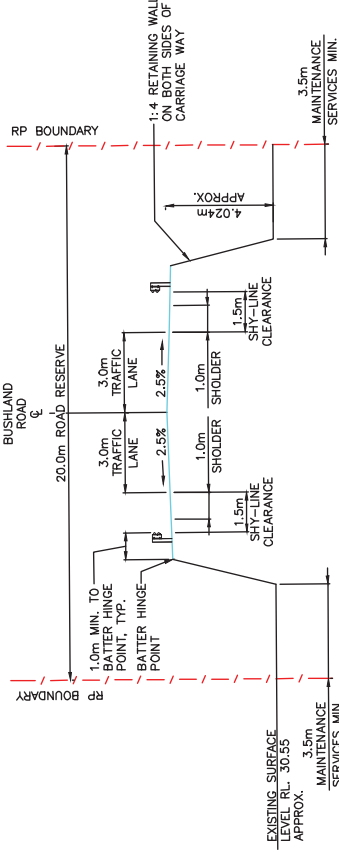
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APPENDIX F

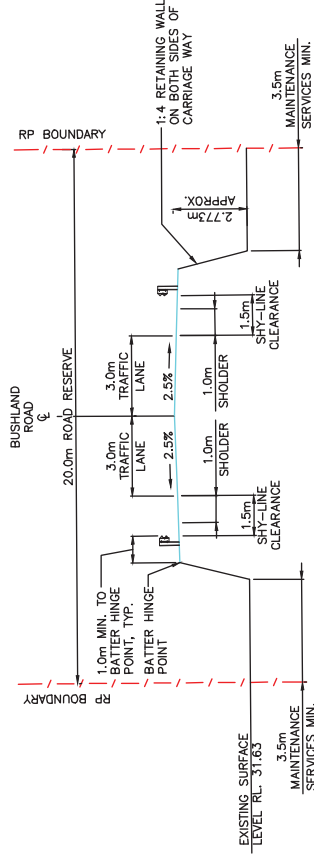
Conceptual Typical Cross Section Bushland Rd
Cambray Consulting



CONCEPT CROSS SECTION – BUSHLAND ROAD
CHAINAGE 1440



CONCEPT CROSS SECTION – BUSHLAND ROAD
CHAINAGE 1717 APPROX.



CONCEPT CROSS SECTION – BUSHLAND ROAD
CHAINAGE 1640

CONCEPT DRAWING.
FOR DISCUSSION ONLY.



 CAMBRAyconsulting Traffic Engineering and Transport Planning Suite 2601, 21 Mary Street Brisbane Q 4000 t: 07 3221 3503 e: contact@cambray.com.au	DRAWING TITLE Wyalong Water Treatment Plant Concept Cross Sections	LOCATION Lot 141 on S312748. Bushland Road, Jimboomba, QLD	REV DATE AMENDMENT / ISSUE		DWG CHK	PRELIMINARY NOT FOR CONSTRUCTION	JOB No. // DRAWING No. SEQ0117-01 // SK05	
			A 14.03.19 Traffic Impact Assessment					
DISCLAIMER This concept takes into account the instructions and requirements of our client. Cambray has taken care in preparing this concept, however it neither accepts liability nor responsibility whatsoever in respect of: any use of this concept by any third party, any third party whose interests may be affected by any decision made regarding the contents of this document and/or any condition drawn resulting from omission or lack of full disclosure by the client or the client's consultants.			DATE 14.03.2019		Scale (A3) Approx. 1:200		PREPARED FOR Seqwater	

APPENDIX G

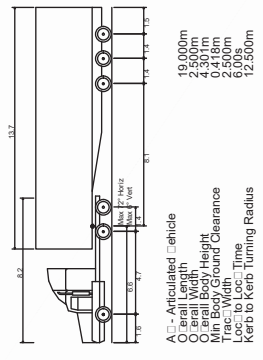
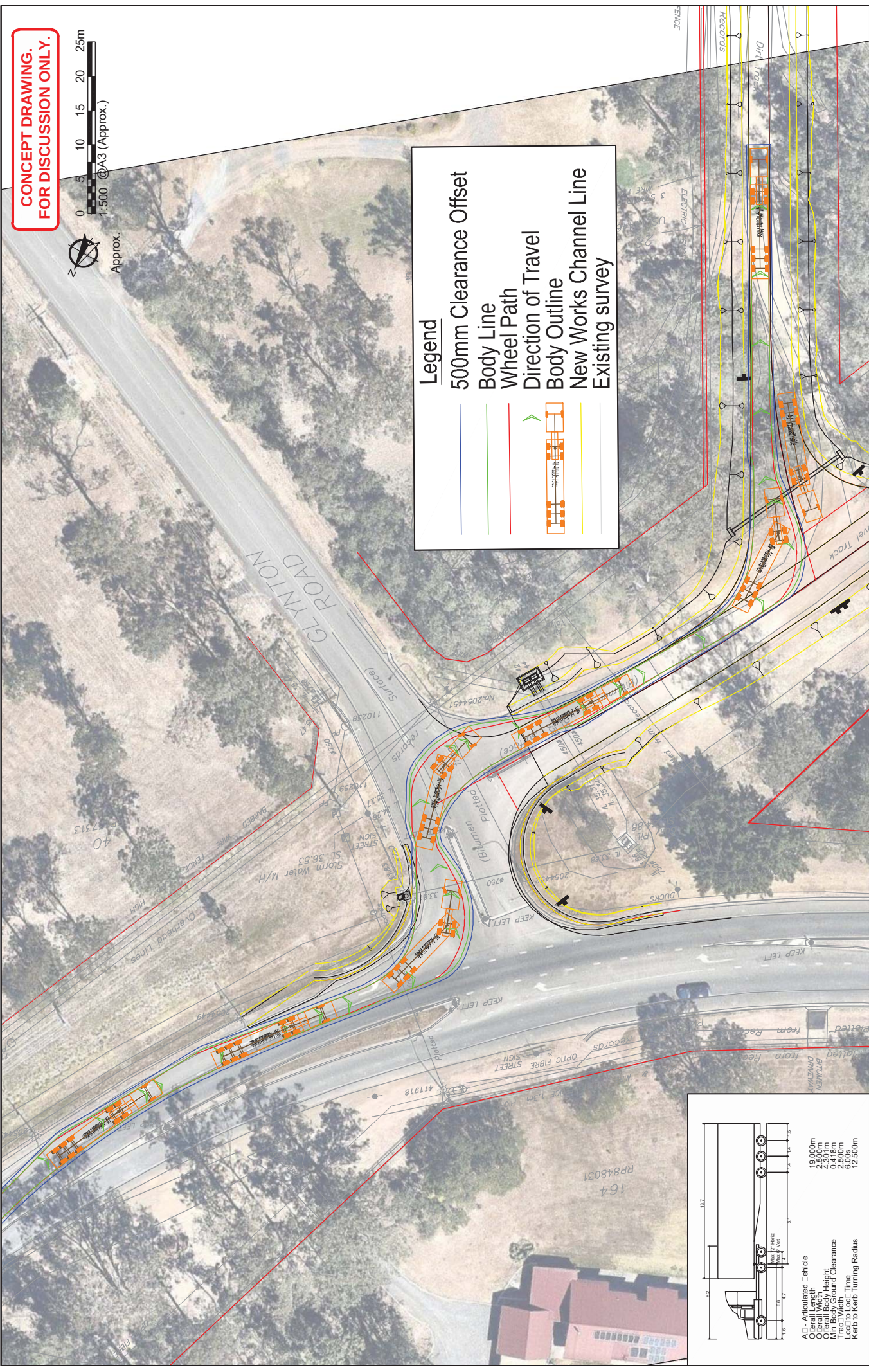
Swept Path Assessments
Cambray Consulting

CONCEPT DRAWING.
FOR DISCUSSION ONLY.



Legend

- 500mm Clearance Offset
- Body Line
- Wheel Path
- Direction of Travel
- Body Outline
- New Works Channel Line
- Existing survey



DRAWING TITLE

Wyaralong Water Treatment Plant
Swept Path Assessment
Homestead Drive / Glynton Road / Bushland Road
19m Articulated Vehicle - Sheet 1 of 2

LOCATION

Lot 141 on S312748.
Bushland Road, Jimboomba, QLD

PRELIMINARY

NOT FOR CONSTRUCTION

DATE

14.03.2019

Scale (A3 Approx.)

1:500

PREPARED FOR

Seqwater

JOB No. / DRAWING No.

SEQ0117-01 // SK01

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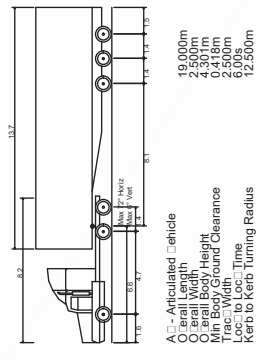
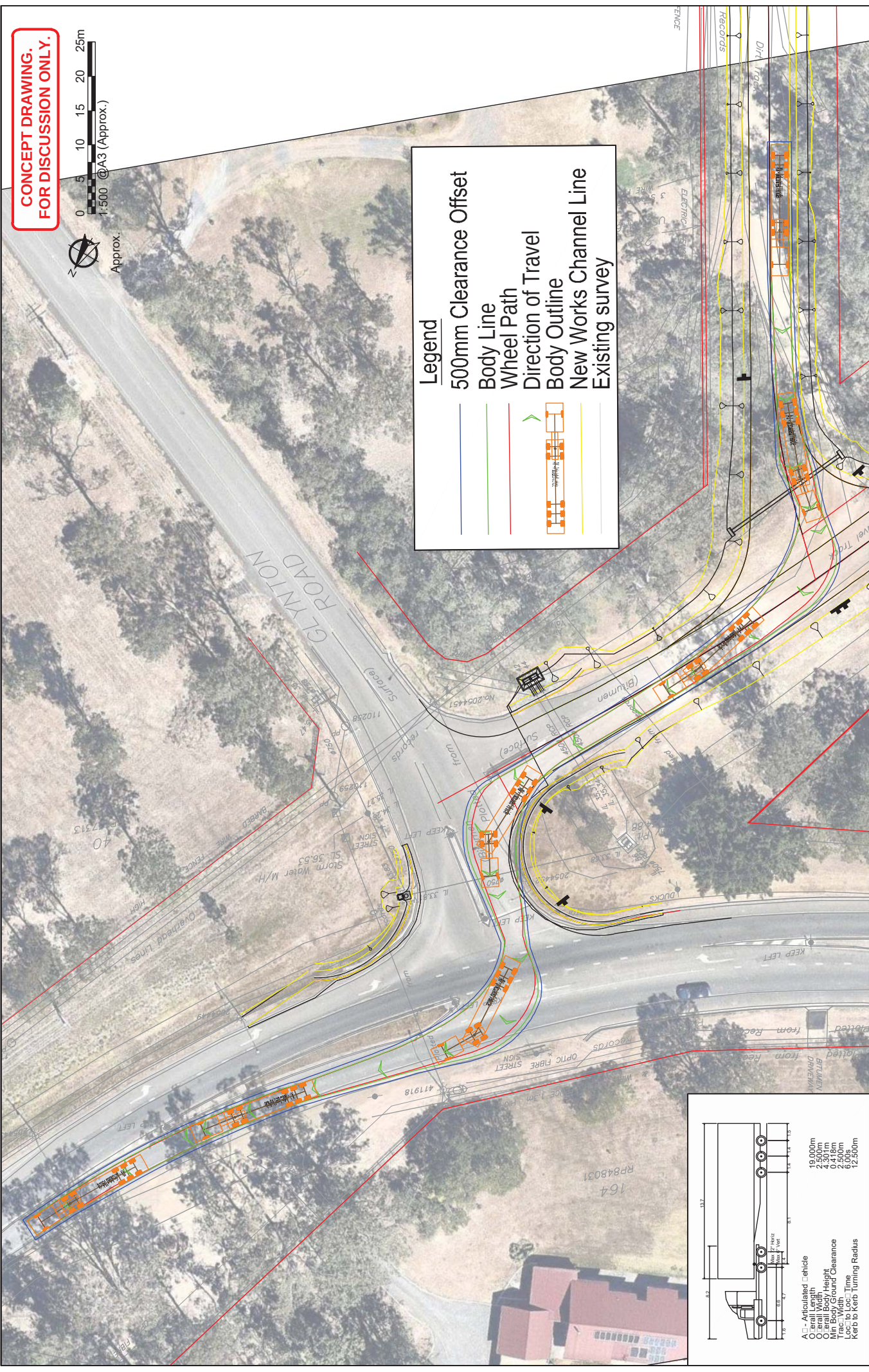
CAMBRAYconsulting
Traffic Engineering and Transport Planning
Suite 2601, 21 Mary Street Brisbane Q 4000
t: 07 3221 3503 | e: contact@cambray.com.au

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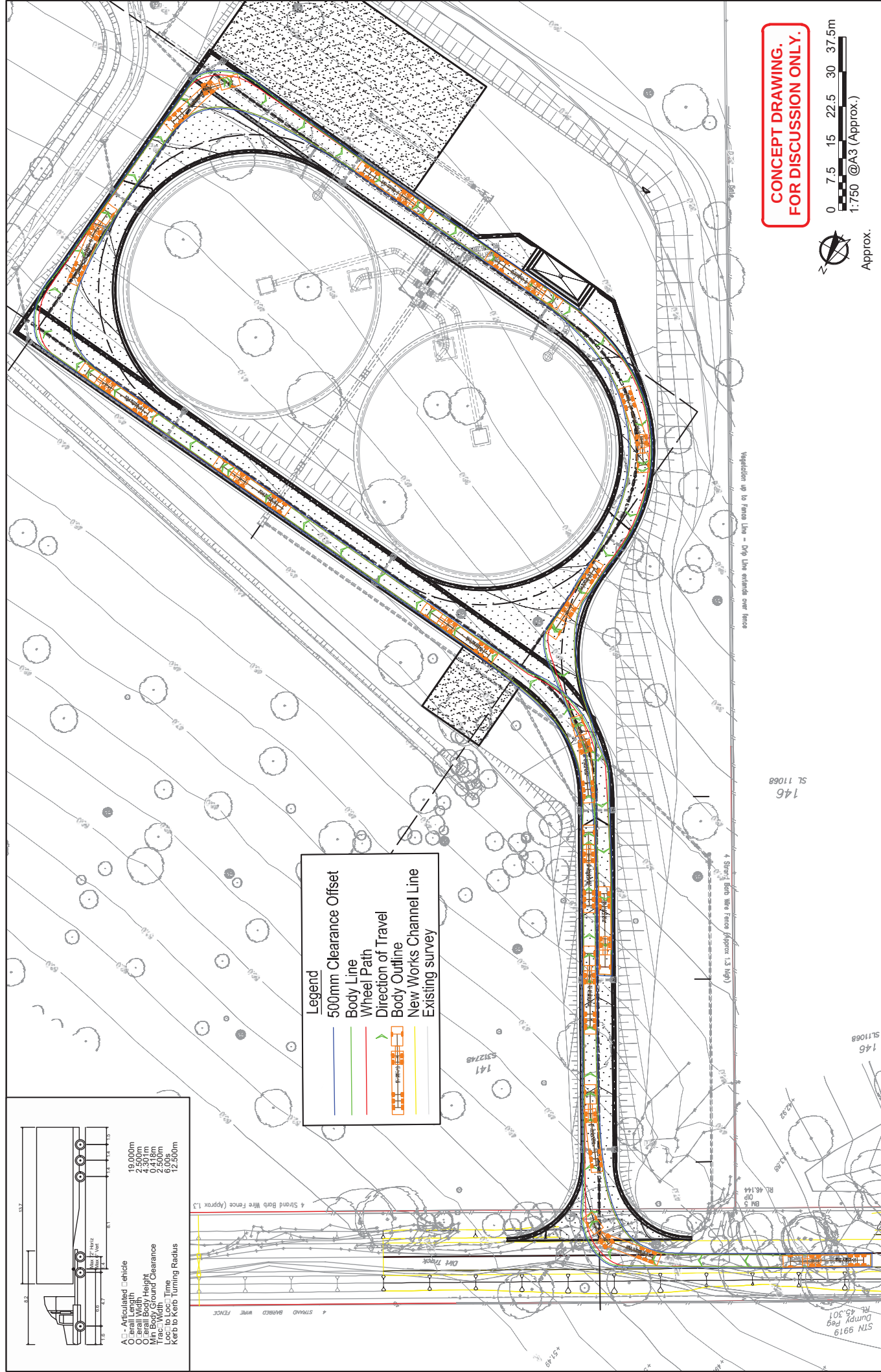
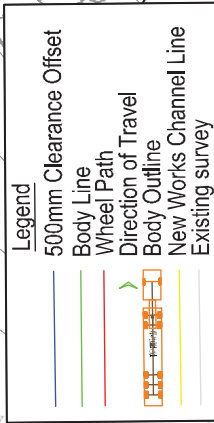
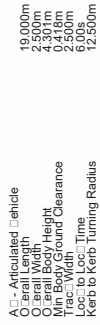


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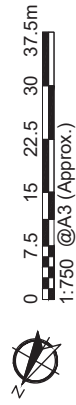
- 500mm Clearance Offset
- Body Line
- Wheel Path
- Direction of Travel
- Body Outline
- New Works Channel Line
- Existing survey



 CAMBAYconsulting Traffic Engineering and Transport Planning Suite 2601, 21 Mary Street Brisbane Q 4000 t : 07 3221 3503 e: contact@cambay.com.au	DRAWING TITLE Wyalong Water Treatment Plant Swept Path Assessment Homestead Drive / Glynton Road / Bushland Road 19m Articulated Vehicle - Sheet 2 of 2	LOCATION Lot 141 on S312748. Bushland Road, Jimboomba, QLD	PRELIMINARY NOT FOR CONSTRUCTION					JOB No. / DRAWING No. SEQ00117-01 // SK02	
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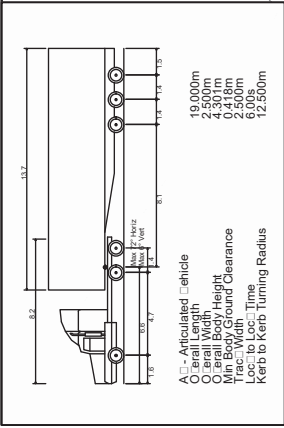
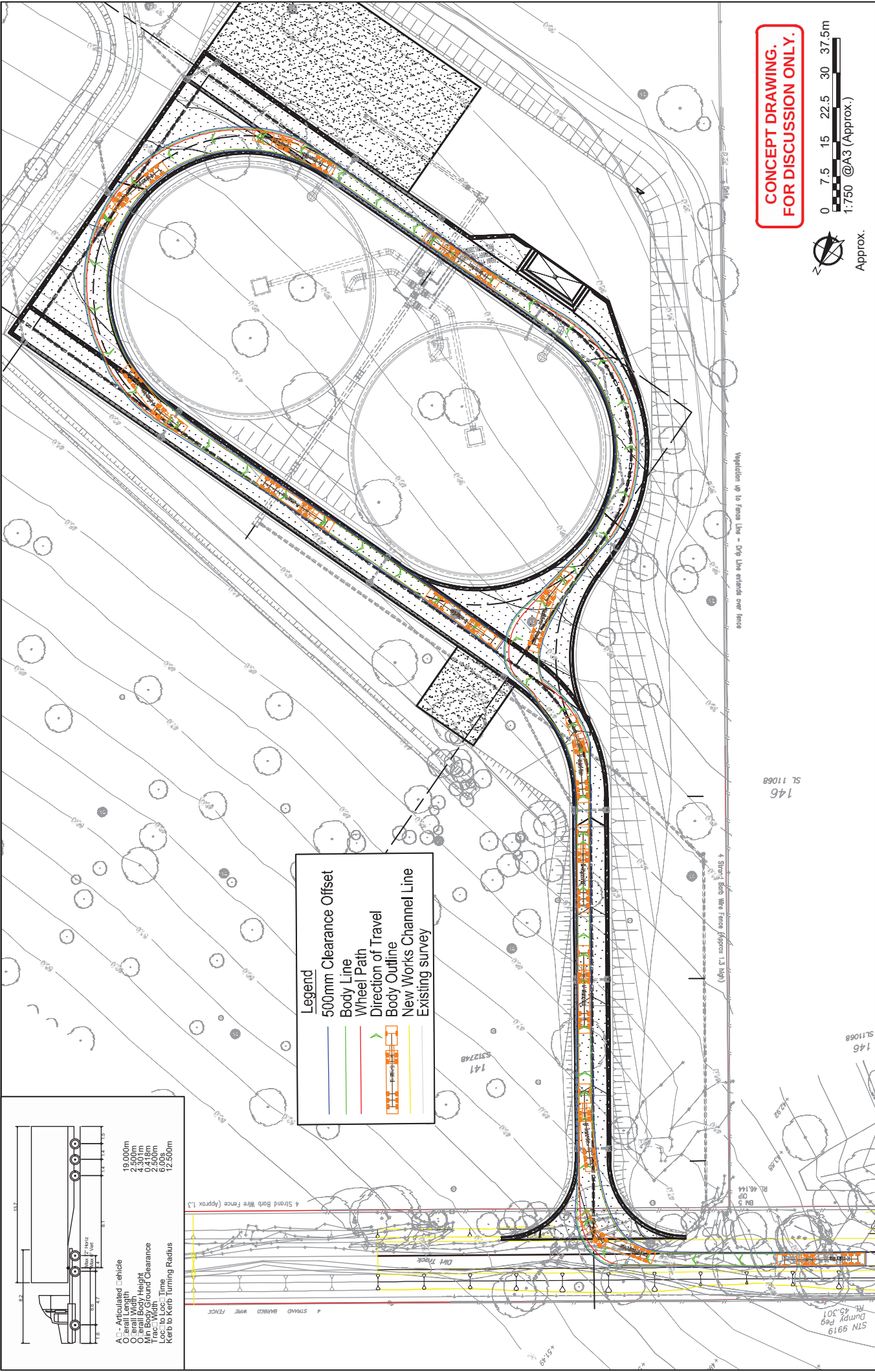


CONCEPT DRAWING.
FOR DISCUSSION ONLY.



Approx.

CAMBRAYconsulting Traffic Engineering and Transport Planning Suite 2601, 21 Mary Street Brisbane Q 4000 t : 07 3221 3503 e : contact@cambray.com.au	DRAWING TITLE Wyaralong Water Treatment Plant Swept Path Assessment Site Assessment 19m Articulated ☐ vehicle - Sheet 1 of 2		LOCATION Lot 141 on S312748. Bushland Road, Jimboomba, QLD		<table><tr><th>REV</th><th>DATE</th><th>AMENDMENT / ISSUE</th><th>DWN</th><th>CHK</th></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr></table>					REV	DATE	AMENDMENT / ISSUE	DWN	CHK																										PRELIMINARY NOT FOR CONSTRUCTION		JOB No. // DRAWING No. SEQ00117-01 // SK03	PREPARED FOR Seqwater
	REV	DATE	AMENDMENT / ISSUE	DWN	CHK																																						
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- Legend**
- 500mm Clearance Offset
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 - Wheel Path
 - Direction of Travel
 - Body Outline
 - New Works Channel Line
 - Existing survey

CAMBRAYconsulting Traffic Engineering and Transport Planning Suite 2601, 21 Mary Street Brisbane Q 4000 t: 07 3221 3503 e: contact@cambray.com.au	DRAWING TITLE Wyaralong Water Treatment Plant Swept Path Assessment Site Assessment 19m Articulated Vehicle - Sheet 2 of 2	LOCATION Lot 141 on S312748. Bushland Road, Jimboomba, QLD	REV DATE AMENDMENT / ISSUE					DWN CHK	PRELIMINARY NOT FOR CONSTRUCTION SK04	JOB No. // DRAWING No. SEQ0117-01 // SK04



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