COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

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Attachments

UNDER SEPARATE COVER
ORDINARY COUNCIL MEETING

6:00 PM, TUESDAY, 26 October, 2021

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COOTAMUNDRA-GUNDAGAI AGRITOURISM DEVELOPMENT PLAN 2021-2023

Developed by Tilma Group
for Cootamundra-Gundagai Regional Council
November 2020

EXECUTIVE SUMMARY

The Cootamundra-Gundagai Agritourism Development Plan presents a pathway to the development of agritourism in the Cootamundra-Gundagai Shire.

This plan follows from Cootamundra-Gundagai Regional Council's (Council/CGRC) 2018 Rural Land Issues Paper: Agricultural Tourism. With bushfire relief funding Council contracted regional tourism consultancy Tilma Group to develop an agritourism development plan for the region. Council is keen to support, foster and enable agritourism, and be known to be 'open for business' for agritourism development.

Cootamundra and Gundagai regions recently merged into the Cootamundra-Gundagai Regional Council local government area. The two regions independently are quite distinct in terms of agriculture produced (more cropping in the north and more grazing in the south), highways and travel routes and landscape however when merged into one they offer an exciting opportunity for the development of a year round agritourism destination.

THE VISION

Cootamundra-Gundagai region is known for being supportive of developing new agritourism businesses, and has a sufficient concentration of agritourism experiences to support increased agritourism visitation.

THE STRATEGIC AIMS AND OBJECTIVES OF THE PLAN ARE TO:

The overarching aims of developing agritourism in Cootamundra-Gundagai are to support increased

- numbers of visitors to the region
- visitor length of stay
- visitor expenditure, especially on local products and services
- visitor satisfaction so visitors return and/or tell others.

Because there are few agritourism businesses in the region, according to the CGRC Agricultural Tourism Issues Paper, initiatives aimed at increasing agritourism in the region and achieving the strategic aims should focus on:

- promotion, support and business development for existing agritourism businesses
- support and assistance for farmers to start agritourism businesses
- providing appropriate land use zoning and streamlined planning processes to support the development of agritourism
- attracting more tourists to make agritourism a more profitable and sustainable enterprise.

A targeted and focused approach is necessary to achieve outcomes from agritourism.

1

PHASE 1: ESTABLISH FOUNDATIONS (2021-2022)

Build awareness and appeal of the region's existing agritourism product through marketing and experience development

Improve Council's planning process and LEP to be more supportive of developing new agritourism businesses

Work with partners to develop and implement an agritourism business development program that supports producers to develop their agritourism offerings

2

PHASE 2: ONGOING DEVELOPMENT (2023 ONWARDS)

Proactively attract investment into agritourism and support new product development

FACTORS CRITICAL TO SUCCESS IN ACTIVATION OF THESE PROJECTS, AND ACHIEVEMENT OF THE VISION INCLUDE:

- collaboration across the region
- supportive and enabling council outlook
- adequate resourcing
- encouraging planning department with a concierge approach to support a streamlined compliance process
- farmers and producers having necessary skills in tourism
- effective biosecurity management

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TILMA GROUP

1. THE RATIONALE FOR THE STRATEGY

In the development of Council's 2018 Rural Land Issues Paper: Agricultural Tourism, research and discussion with farmers found there are few agritourism businesses in the Cootamundra-Gundagai region. For this reason, Council determined initiatives aimed at increasing agritourism in the region should focus on:

- promotion, support and business development for existing agritourism businesses
- support and assistance for farmers to start agritourism businesses
- providing appropriate land use zoning, infrastructure and transport links to support the development of agritourism
- attracting more tourists to make agritourism a more profitable and sustainable enterprise.

This agritourism development plans outlines a clear pathway for Council to achieve these aims.

1.1 THE VALUE OF AGRITOURISM TO RURAL ECONOMIES

Tourism is one of Australia's "super-growth" sectors according to Deloitte.[1]

"As agritourism spans a variety of sectors (agriculture, wholesale trade, retail trade, accommodation and food services and recreation) it is difficult to get a precise number of its contribution to the Australian economy.

Looking at total trip expenditure for visitors that went to farms and wineries (for the whole of 2015-16) and breweries/ distilleries, farm-gates or food markets (from January to June 2016) we begin to get an idea of the sector's contribution to the economy - both directly (expenditure on these activities) and indirectly (expenditure on other trip activities such as accommodation and transport).

In 2015-16, visitors who participated in agritourism activities spent $9.4 billion on their total trip. This includes expenditure of domestic daytrip visitors ($600 million), domestic overnight visitors ($4.1 billion) and international visitors ($4.7 billion). It is important to note that these estimates reflect expenditure on the total trip, not just expenditure on food and wine activities.

For some regional economies, the expenditure by agritourists can be a major driver of economic activity. In some regions, the economic value of agritourism is likely to be bigger than the value of the primary produce. And if visitation growth continues to increase like it has over the past five years, agritourism could become an important sector in its own right.

Food tourism also provides a draw card from which other regional tourism businesses and experiences can benefit. While a precise value contribution to the economy is not easily derived – one thing is for certain, it is significant, particularly when considering the indirect and flow on benefits that agritourism provides."[2]

1 Positioning for prosperity? Catching the next wave
2 www2.deloitte.com/au/en/pages/consumer-industrial-products/articles/agritourism.html

The following comparison by the US Chamber of Commerce shows the benefit of tourism development over manufacturing development:

Annual economic impact of 100 new manufacturing jobs	Annual economic impact of 100 additional visitors a day
• Population increase of 360 • 100 new households • US$410,000 increase in personal income • US$300,000 increase in bank deposits • US$331,000 retail sales • 3 more retail outlets • 65 new industry related jobs	• Population increase of 459 • 140 new households • US$777,777 increase in personal income • US$144,000 increase in bank deposits • US$1,129,000 retail sales • 7 more retail outlets • 111 new industry related jobs

Additionally, agritourism provides valuable benefits to producers, such as

- Diverse and increased income streams, including reduced seasonality of cash flow
- Development of new markets for farm produce
- Providing additional employment to support adult children and farmers' spouses to remain on the farm
- Social contact for isolated families.

2. OUR PROJECT APPROACH

Over the project period the following methodologies were utilised:

REVIEW

An audit of existing and pipeline and potential agritourism product and experiences in the Cootamundra-Gundagai region was developed. Although the audit's development was hindered by a lack of accessible information, it provided a snapshot of the region's existing product and product gaps for analysis.
Desktop review of relevant strategic and business plans from Council and other sources, and visitor statistics.[3]

ENGAGE

Consultation consisted of meetings and workshops with a broad range of agritourism stakeholders.[4]

DISTILLATION OF FINDINGS

An initial Gaps and Opportunities Paper was developed based on analysis of the desktop research and stakeholder input, and shared with the Project Steering Group for feedback.

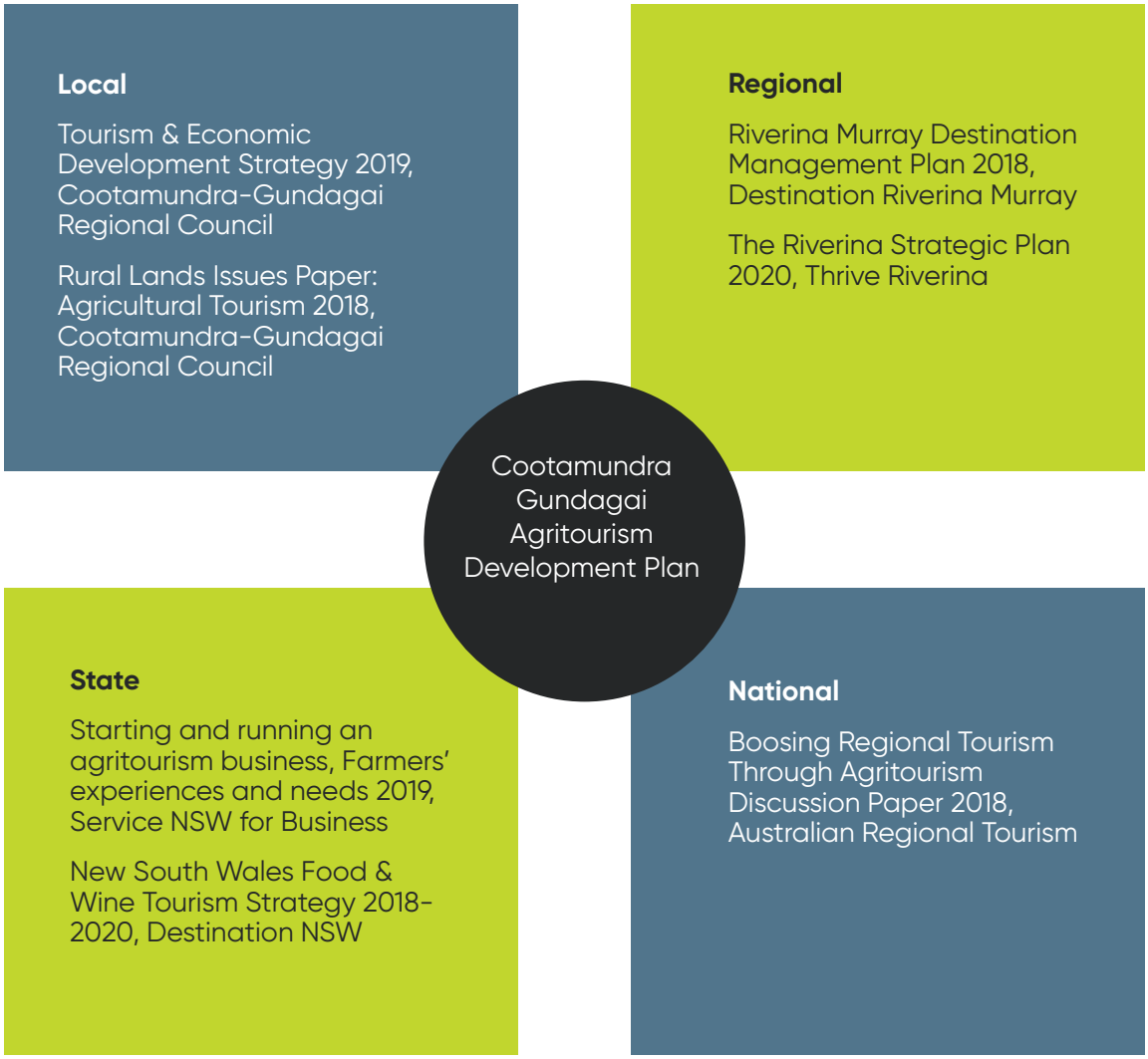
INTEGRATION OF FEEDBACK

Distillation of feedback and development of draft Agritourism Development Plan.

DELIVERY OF FINAL PLAN

3. STRATEGIC CONTEXT

In developing the Cootamundra-Gundagai Agritourism Development Plan a number of relevant strategic documents have been reviewed for alignment.



4. MACRO INDUSTRY TRENDS

Desired attributes of a food and wine region

- Being able to eat fresh, locally grown[5] food for breakfast, lunch and dinner is the number one desired attribute.
- Having the ability to buy local produce and to take short drives to places of interest nearby to the main destination being visited are important for a 'good' food and wine experience.
- Apart from distance from home, the top three factors influencing destination choice are the quality of customer service, the range of accommodation options, and the ease of organising the food and wine trip. Quality customer service refers also to destinations and attractions working together to provide food and wine visitors with a complete experience.
- Other key attributes include the range of restaurants available, and other services available such as food and wine storage and delivery, provision of drivers to take visitors around, and whether food growers allow food tasting.

Motivators for travel for food and wine experiences are

- having the opportunity to try different foods and wine
- time to interact with nature as well as experience food and wine
- indulging in a food and wine weekend
- a desire to find what was unique about the destination.

5 Food and Wine Tourism In New South Wales, Austrade, 2015

Consumer trends that provide implications and opportunities for agritourism development in the Cootamundra-Gundagai region include:

Paddock to plate	Food and agritourism experiences are a significantly expanding tourism opportunities as visitors increasingly look for local produce and paddock-to-plate experiences. Travellers are increasingly knowledgeable about and engaged in food and wine, and are seeking authentic, connective experiences. Attractive culinary tourism experiences for high value travellers include • Stories – provenance, production, craftmanship of products and personalised culinary experiences Heritage – gourmet experiences which speak of a region's heritage and highlight local produce • Wellness – balanced eating using fresh nutritious produce • Occasions – experiences where the food takes centre stage at any price point from street food to fine dining
Immersive experiences	Though restaurants, bars and cafés are the primary interface between visitors and the food and wine sector, visitors are now looking for more immersive and educational experiences. Engagement with growers, sampling fresh produce, hands-on and educational activities that give greater insights into the produce and region are important drivers for today's travellers. This trend of immersive rather than passive experiences is right across tourism such as cycling trips, experiencing life like a local, and experiencing daily farm life.
Travelling off the beaten path	Travellers are seeking out destinations that other tourists haven't discovered yet. While some are looking for unique braggable experiences to share on social media, others are going offline with JOMO, or the 'Joy Of Missing Out' - choosing to enjoy your trip instead of worrying about how it looks on social media. The JOMO Traveller is looking to escape the hustle, opting to travel off-season to alternative destinations to avoid other Aussie holidaymakers. The ability to explore a place before it gets too popular is probably why JOMO trips are recording a 31% year on year increase among Australian travellers in 2020.
Healthy and wholesome food, Slow Food	Food and coffee culture, paddock to plate experiences, and health and well-being relating to food is high on consumers' agendas. Food-motivated trips are likely to make up 11% of trips in 2020, up 23% from 2019.
Backyard vegie gardening	A trend of recent years of backyard food production surged with the COVID19 lockdown. There is great interest in learning, both about growing and about how to use the grown ingredients such as fermenting and brewing.
Transformative travel	Travellers are looking for experiences that shape and stay with them, from interacting more with locals and learning a new skill to contributing something to the place they stay. More than half of travellers value a travel experience that positively changes them on a personal level. Australia has had a 44% year on year increase in travellers interested in embarking on a personal growth trip in 2020.
Slow travel	There has been 20% year on year increase in Australian travellers wanting to slow down and prioritise quality over quantity. Slow travel emphasises connection with the destination, travel companions and au unhurried pace. Slow travel embraces long walks and unscheduled activities for those who prioritise rest over sightseeing.
Green consumers and conscious travellers	Travellers are making far more informed and ethical choices about where they go, how they travel and what they take with them. Being environmentally aware, wanting to consume environmentally-sustainable products and experiences, and wishing to contribute and give back are major consumer trends affecting destinations, as is regenerative tourism[6]: tourism that gives back to the environment and communities instead of taking as opposed to the notion that business success means we have to do harm to the planet. There is a 103% year on year increase in interest for more eco-friendly trips in 2020.

6 Similar to regenerative agriculture which aims to restore soils and sequester carbon

COVID-19 and recession

COVID-19 is expected to impact travel behaviour for many months after the virus threat has gone. Some travel trends will include:

- Consumers want something to look forward to and will be keen to plan and book a holiday.
- Consumers will seek out simple, meaningful experiences.
- People will visit family and friends for emotional support and connection.
- Travel will not be taken for granted, with greater intentions around the planning to ensure it offers what they are looking for. During recessions, impulse purchases dramatically decline and travellers seek bargains. Those who manage household budgets (typically women) will search for detailed information on activities, experiences, events, reviews and prices.
- During a recession values and behaviours change. We become more concerned for others and with collectivism and move away from individualism. Materialism and possessions become less important. Volunteering and social tourism have a higher priority in a more inclusive society.
- There will be increased requirements around health and safety.
- Grey nomads may be slow to return to travel due to safety concerns, requiring destinations dependent on these travellers to explore new markets.
- During an economic slowdown, tourists tend to travel less, stay closer to home and seek simplicity. For example: value-based holidays based on basic facilities, meeting locals, and free time. Here, tourism is about the beach or the view from the mountain, and being less plugged in.
- Cities will be the least appealing destinations

Economic necessity

The supply side factor fuelling agritourism growth: tourism is now seen as a real diversification opportunity for Australian farmers. Factors influencing the decision to diversify into agritourism include

- Drought and extreme climatic conditions
- Drop in food sale prices (the percentage of the food sale price that farmers receive has dropped from 90% in 1910 to 10% today)
- Keeping grown children on the farm with new job opportunities
- Diversification to spread risk
- Resilience
- Cash flow
- Deregulation, for example, the deregulation of dairy industry is making it harder for farmers to make money of traditional distribution channels so they need to explore other options

Digital connection

Social media uptake across all demographics, interaction and sharing, social media advertising and e-mail marketing as primary marketing tools, increasing livestreaming, smartphone responsive websites... Ease and convenience of planning and having information easily available supports trip planning – and if it's not available, travellers will visit destinations where they can find information easily.

5. GAPS ANALYSIS

CURRENT STRENGTHS

- The region has a strong agricultural base, combined with attractive rural landscapes and distinct seasons
- Three highways pass through the region and a twice daily passenger rail, and there are good coach connections - over half of Australia's population is within a 7-hour drive
- There is a mix of existing agritourism product, including regional icons
- Council is embarking on a new Local Environmental Plan (LEP) and wants to be supportive of agritourism development
- Surrounding Shires have strong agritourism product and experiences that can be leveraged
- Large developments are in the pipeline that will result in hero agritourism experiences
- Strong existing entrepreneurs and business groups are actively driving growth and development
- New destination brands and good online presence exists for the region
- There is strong support from the State Government to grow regional tourism

GAPS IDENTIFIED

- Limited collaboration across the region (particularly across the two main towns)
- Lack of funds available locally to invest into projects and resources (heavy reliance on grants)
- The region is primarily made up of fewer landholders managing large properties, with a lack of smaller land holdings
- Paid agritourism experiences are sparse - no wineries open to the public, recent closure of agritourism businesses across the region, insufficient density of product
- Existing brand and marketing do not integrate or feature the agritourism story of the region, with limited bundling or packaging
- There is a lack of brand awareness for the region in general
- Lack of knowledge amongst farmers around how to diversify into tourism, and how to manage concerns around bio security and insurance
- Food outlets that feature local produce and open all weekend to cater for the travelers
- A simple and streamlined compliance process that is supported by a framework that is not impacted by staff turnover within Council

POTENTIAL IMPACTS

- Disjointed development across the region resulting in diluted brand awareness and appeal
- Inability to attract investment and to encourage further development in agritourism
- Lack of leadership and resourcing to support the activation of the plan
- Competing regions make it hard for Cootamundra-Gundagai to gain market share
- Inability to keep visitors in the region overnight and gain maximum yield
- A competitive attitude, rather than a cooperative attitude

6. THE COOTAMUNDRA-GUNDAGAI REGION

The Cootamundra-Gundagai region is halfway between Sydney and Melbourne, connected by the Olympic and Hume Highways and the Burley Griffin Way, and a Melbourne-Sydney rail line that passes through Cootamundra. Both principal towns have a visitor information centre (VIC), though the Gundagai VIC has higher visitation and paid staff as a hub for coach ticket sales for train travellers.

6.1 TOURISM IN THE REGION

Most of the region's attractions fit into the heritage, nature and arts categories. Cootamundra and Gundagai are seen to each have separate geographies, different tourism offerings, differing appeal, and attract different types of visitors, and are even disconnected from one another for many residents of the Shire being 45 minutes apart and on separate southwest-northeast highways. Gundagai is best known from the Road to Gundagai song and the Dog on the Tuckerbox, and it is on the Murrumbidgee River. Cootamundra is best known from the Cootamundra Wattle song, and it is the birthplace of the famous cricketer Donald Bradman.

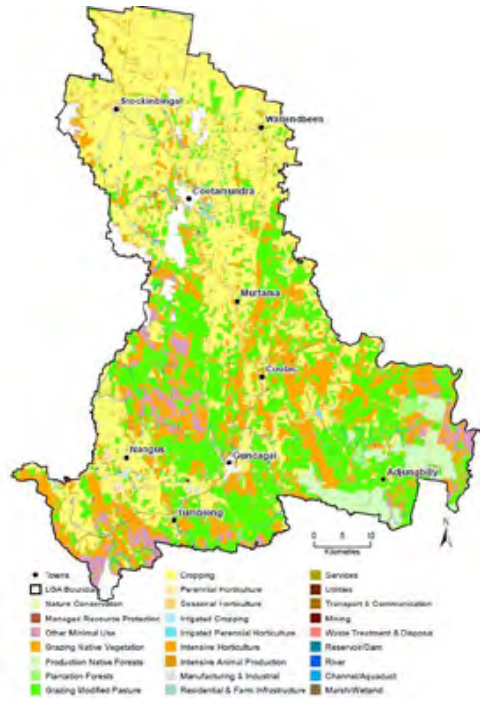
Tourism promotion is done separately with separate tourism websites, social media accounts and brands for Cootamundra and Gundagai. Both towns have separate tourism development groups. The Gundagai group has recently implemented a tourism development plan and therefore the offering is more mature in Gundagai than in Cootamundra. Currently Council has one tourism strategy for the whole Shire.

6.2 AGRICULTURE IN THE REGION

Primary production in the region includes beef, wool, fat lambs, cereal and oilseeds, hay cropping and wine grape growing, Generally, there are grazing and wineries in the south of the Shire, cropping in the north, native forests in the south east, and the terrain becomes steeper in the south. Figure 1 shows how these different forms of agriculture are distributed across the Shire.

The Cootamundra-Gundagai region is in the eastern part of the Riverina, one of Australia's major agricultural areas. It is well-known for its agricultural productivity, and agriculture is the largest industry in the Shire, with 15.3% of residents employed in agriculture. The Shire has a competitive advantage in agriculture and manufacturing compared to the rest of NSW[7]. The region includes food manufacturers, such as a meat processor and a grain mill. Agricultural, natural and other assets support the development of agritourism.

Figure 1: Agricultural production in Cootamundra-Gundagai region



7 Cootamundra-Gundagai Regional Council Tourism and Economic Development Strategy 2019

6.3 VISITORS TO THE REGION

Domestic visitors to the Cootamundra-Gundagai region[8]

- Most travellers are couples, then solo travellers
- Stay 2 nights
- Spend $276/trip or $139/night
- Travel for holiday purposes almost 50% more than for visiting friends and relatives (VFR)

Core markets for Riverina Murray[9]

- VFR
- Grey Nomads (low yield, but have highest disposal incomes)
- Families (20% of overnight visitors)
- Business (16% of overnight visitors) – an opportunity for repeat visitation for leisure
- Working holiday makers
- Educational
- Event attendees

8 Local Government Area Profile 2018 for Cootamundra Gundagai, Tourism Research Australia
9 Riverina Murray Destination Management Plan 2018

7. AGRITOURISM VISITORS FOR THE REGION

Based on an assessment of current visitors, and the region's target markets, the target market best suited to a developing agritourism sector in Cootamundra-Gundagai is laid back touring couples aged 45-65.

Profile insights
• Domestic overnight visitors from Canberra/ACT, regional Victoria and regional NSW (within approximately 250km drive) • Roadtripping through multiple destinations (8 nights on average) • Interested in nature, scenery, food and wine, heritage and culture, and relaxing and enjoying the region at leisure
Current aligned product
• Murrumbidgee River and water activities, nature reserves, scenic drives, lookouts, bushwalking, cycling • Unique accommodation and farmstays • Campgrounds, free campsites and caravan parks • Events showcasing local culture and agriculture • Experiences available in spring and autumn (when weather is not too hot or cold) • Quality food and wine experiences (Planted Cootamundra, Rusty Table, etc) • Numerous heritage attractions and antiques shops • Cultural attractions (Arts Centre Cootamundra, gallery)
Gaps to be filled
• Increase awareness of existing products (e.g. with itineraries and blog articles) • Information on how experiences are connected (e.g. with itineraries and maps of where experiences are) • Information on how the region connects with experiences beyond the Shire's borders that appeal to this market • Information on affordable and value-for-money experiences • Increase product available e.g. rail trail, Flash Jack's new restaurant, microbrewery, Old Gundagai Mill development, winery experiences, on-farm agritourism experiences and on-site food processing tourism experiences, etc

Other markets that agritourism products are suitable for include

- Daytrippers
- Short break travellers
- Visiting Friends and Relatives (VFR) (travellers visiting locals)
- Event attendees

8. EXISTING AND POTENTIAL AGRITOURISM EXPERIENCES[10]

The agritourism story of the Cootamundra-Gundagai region consists of staying on farms, discovering boutique and premium produce, and visiting boutique market farms amongst landscapes of vineyards and broadacre crops.

8.1 Existing agritourism product and experiences

Cootamundra	Other northern towns	Gundagai	Other southern towns
Farmstays[11]			
• Killcare Cottage	• Wallendbeen Park Farm	• Kimo Estate [12] (incl. weddings) • Highfield Farm and Woodland • Hillview • Tarrabandra Fishing Retreat • Nimbo Fork Lodge[13] • Borambola Winery (+ cider + beer) [14]	• Rabbits Hut (Coolac) • White Horse Farm (Coolac) • Coolac Cabins • Shearer's Quarters (Nangus) • Brooklyn Springs Farm Escape[15]
Dining			
• Planted Cootamundra (local produce) • Rusty Table Dusty Roads coffee roastery		• Coffee Pedlar (not a focus on local produce) • Dog on the Tuckerbox café sells local produce	
Local produce			
• Cootamundra Butchery (meat + condiments) • Buronga Organics • Texel lamb • Billabong Beef Jerky • Pride of Pennington salad dressings • Cootamundra Oil Seeds • Honey • Cereals • Beef, lamb • Conqueror Milling • Outback Bakery (sourdough)	• Mirrool Creek Lamb (Riverina brand) • Stockinpiggle pork (Stockinbingal) • Cereals • Beef, lamb	• Wineries (not open to the public) (A. Retief cellar door is in Sydney) • The Food Plot (CSA) • Highfield Farm (mixed) • Beef, lamb • Gundagai Butcher • Fig and Co (retail)	• Beef, lamb

10 Although significant effort was invested in developing an audit of the region's agritourism product, information on existing experiences is quite inaccessible to a researcher, highlighting how inaccessible information on the region's agritourism experiences is for visitors
11 Many are Airbnb listings
12 The region's key agritourism product with 117,00 followers on social media
13 In Tumut Shire on the border with CGRC
14 In Wagga Wagga Shire but uses Gundagai and Dog on the Tuckerbox branding
15 In Tumut Shire

Events			
• Sunday markets (monthly) • Dog show • Wattle Time Barn Dance • B&S Ball • Cootamundra Show • Vintage machinery and tractor show	• Village Fair Markets (Stockinbingal) • Wallendbeen Markets • Wired Open Day Festival	• Popped up at Kimo • Sundy in Gundy Market (monthly) • Show • Rodeo • Tractor Pull • Battle on the Bidgee Stockman's Challenge	
Other			
• Wattle Cottage - seedlings sold at markets • Milestones sculptures – tribute to wheat • Damasque Rose Oil Farm – tours in summer • Sustainable carbon farming tours • Cootamundra Heritage Centre (museum) • Conundrum Horse Handling • Orana Horse Riding	• The Yard Studio (Stockinbingal) – on-farm art studio • The Wired Lab (Muttama)[16] - 'agri(culture)' project • Wallendbeen Silo Art mural • Dark Horse Stables	• Gundagai Historical Museum – farm machinery • Gundagai Old Mill (ruin) – historical mill • Blessed Bowen (wellness) • Somerville Natural Therapies (wellness)	• Highfield Farm and Woodland (Mt Adrah) – farm tours and sells produce at markets

8.2 Pipeline and potential agritourism products and experiences

Cootamundra	Other northern towns	Gundagai	Other southern towns
• Buronga Organics accommodation • Farm retreat for mental health treatment • Distillery • Conqueror Mill tours	• Wallendbeen station masters residence development • Wallendbeen silo mural • Cootamundra to Tumblong via Gundagai rail trail (opens possibilities for en route agritourism experiences) • Thomson sheep farm (Muttama) (wool dying)	• Flash Jacks restaurant • Kimo Estate expansion (microbrewery, boutique hotel in homestead, market garden, stalls, schools program) • Kimo Estate food and wine festival (either spring or autumn) • Gundagai Old Mill redevelopment • Borambola Wines multi-function events venue (weddings, conferencing) • Tumblong Hills cellar door • Rail trail • Farm gate stall for The Food Plot • On farm corporate retreats • Paddock to plate restaurant • Farm with edible and ornamental gardens • Additional farmstays • Wedding/reception venue • Kayak tours	• Dog on the Tuckerbox new tourism attraction • Valley Vista (Coolac) – farm tours • Highfield – farm stay

16 Wired Lab's 'agri(culture)' project has contemporary artists collaborating with farmers and rural communities to produce arts experiences exploring agrarian culture
17 It is currently uncertain if this will be an agritourism product, but quite likely (e.g. incorporating local food and beverages)

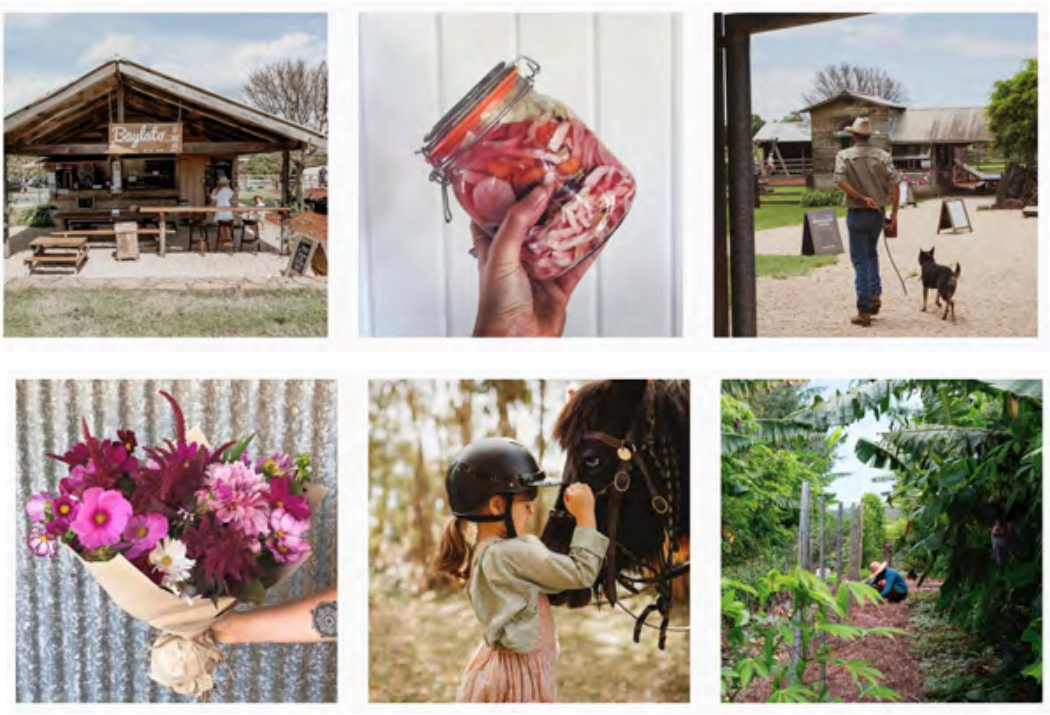
8.3 RECOMMENDED AGRITOURISM PRODUCT AND EXPERIENCE DEVELOPMENT

Following the strategic review and analysis of the existing tourism and agriculture product in the Cootamundra-Gundagai region, along with an analysis of regional, state and national agritourism reports and papers, a series of gaps were revealed. The following recommended product and experience development opportunities will help the region realise its potential as an agritourism destination.

It is recommended that an investment attraction or grant funding applications focus on these developments and opportunities over the coming 3-5 years.

1. DOG ON THE TUCKERBOX REGIONAL FOOD HUB

This attraction is currently part of an existing major development taking place, though inclusions have not been established yet. A showcase of produce from Cootamundra, Gundagai, Snowy Valleys and Hilltops would add value to this development and provide a gateway to a major food-producing region in NSW. Inclusion of a regional produce café/ food outlet and Visitor Information Centre to promote the agritourism across the region is recommended.



"This Food Hub on the Hume Highway will provide an anchor point and a hook to draw more visitors off the highway and into these destinations."

Location:
Hume Hwy (8km north of Gundagai)

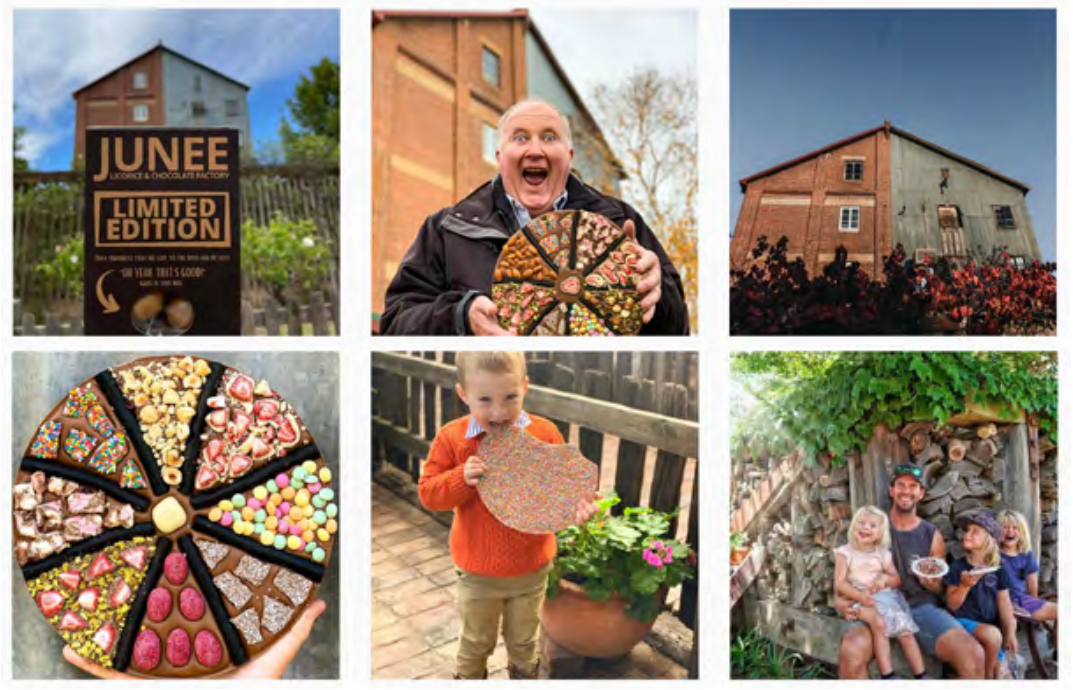
Benchmark examples:
The Farm, Byron Bay NSW

2. THE OLD MILL REDEVELOPMENT

Council has commenced the process of calling for expressions of interest for the development of this site. Based on the review and analysis that has taken place with this plan it is strongly recommended that this development includes an immersive experience that connects visitors to local produce and agriculture. There is opportunity for this mill site to link in with the Coolamon Cheese Factory and Junee Licorice & Chocolate Factory, to create another iconic repurposed building that provides a quality hero tourism attraction.

Some suggested uses of the site include one or a combination of the following:

- Artisan bakery using local produce
- Winery cellar door - wine collective to showcase all wine from the region
- Craft beverage manufacture
- Tourism facilities (accommodation, function centre, etc)
- Destination dining with a focus on local produce
- Special events celebrating and promoting local produce



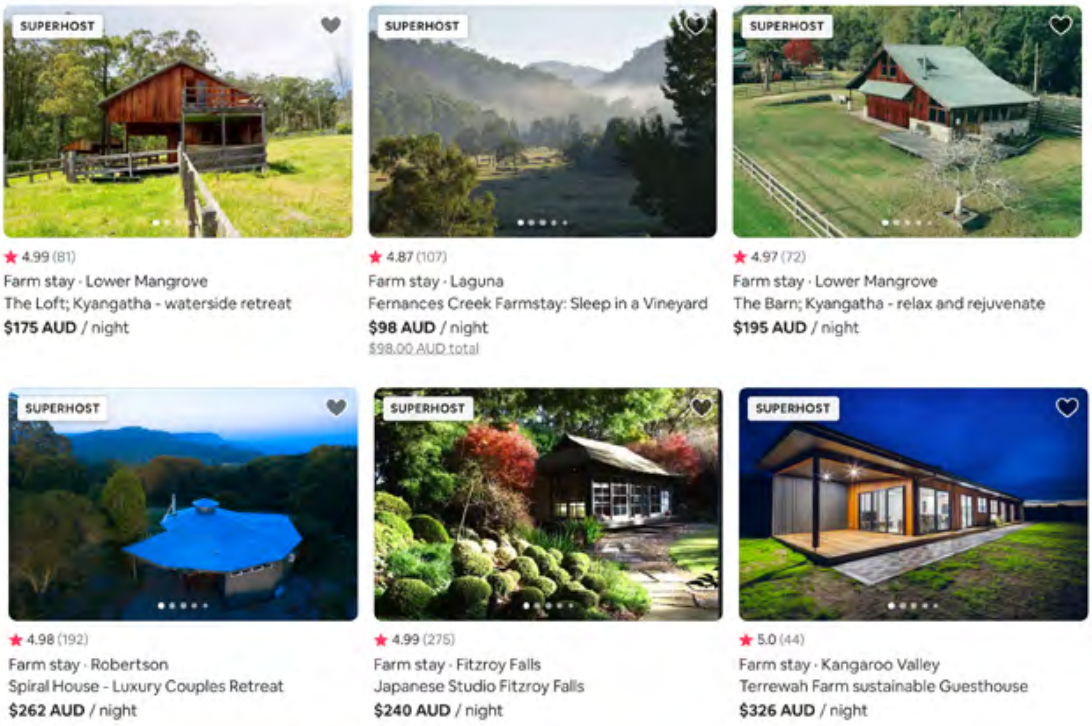
Location:
Gundagai

Benchmark examples:
Coolamon Cheese Factory,
Coolamon NSW
Junee Licorice & Chocolate Factory,
Junee NSW

3. FARM STAYS

Farm stays are popular accommodation types and with the creation of Airbnb and Hipcamp, there is now enhanced opportunity for farmers to enter this sector with minimal fuss. Council is encouraged to support farmers in renovating old shearing sheds and workers quarters to create tourism accommodation, or riverside campsites on their land. This support could be in the form of waiving development application fees and by making permitting straight-forward.

Note: Australian Regional Tourism is currently working in partnership with Airbnb to support agritourism development across regional Australia - learn more here



Location:
Region wide

Benchmark examples:
Scenic Rim QLD on Hipcamp
Aussie Farm Stays on Airbnb

4. COOLAC/WALLENDBEEN PROVIDORES AND HARVEST TRAILS

Develop a master plan for Coolac and/or Wallendbeen to encourage small farm providore and farm gate development, creating an agritourism hotspot just off the Hume, Burley Griffin and Olympic Highways, which provides produce direct to consumers and suppliers.

Council is encouraged to re-zone a section of land to allow for small titles and providores, enabling tree changers from Canberra, Sydney and Melbourne (in addition to locals) to invest in land to develop value add premium agricultural products that can be sold directly to consumers and suppliers with farm gate sales, pick your own sales and harvest trails.

Location:

Coolac and/or Wallendbeen

Benchmark examples:

Harvest Trails

Northern Rivers NSW

Freeman's Organic Farm, Currumbin QLD, who have successfully diversified into tourism

5. SEASONAL FESTIVALS

Further developing existing events such as Cootamundra Wattle Time, it is recommended to develop and host two larger-scale spring and autumn seasonal 'harvest' events (on a long weekend where possible) of food produced within 100km of the Shire. Include tasting plates, product/wine tasting, showcases of local chefs and produce, and associated events such as farm tours and on-farm meals. Use the event to build networking and collaboration between producers, and to trial new products, such as short term PR collaborations (e.g. Wagga's strawberry beer collaboration between a strawberry farm and a microbrewery).

Location:

Cootamundra and Gundagai

Benchmark examples:

Harvest Festival, Northern Rivers NSW

Orange FOOD Week, Orange NSW

Scenic Rim Eat Local Week, Scenic Rim QLD

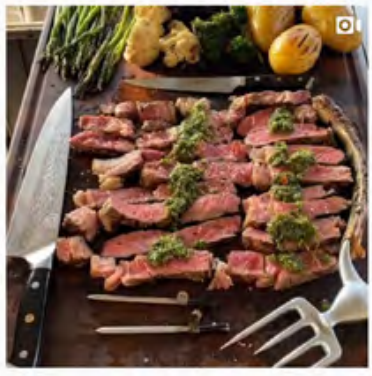
6. TOUR OPERATORS

There is opportunity to attract tour companies or local entrepreneurs to develop and deliver new tours that bring together and showcase the agritourism across the region.

Tour suggestions include:

- Tour of wheat farm and mill
- Conqueror Mill tours
- Tour combining meatworks and sheep farm
- Regenerative farming
- Region wide farm tours i.e. visit multiple farms for half or full day

Tap into the new tour company opening in Temora focused on the 55+ market[17] and Riverina Agricultural Tours.



Location:
Region wide

Benchmark examples:

Cotton Farm & Gin Tour, Moree NSW

Yakult, Dandenong South VIC - tour of working factory

Agricultural Tours Riverina , NSW

Southern Forests Regional Tours, WA

Creative Tours & Events, Maroochydore QLD - private tour operator bundles product

17 Contact Wayne Fountain 0419 771 038 waynef@ilovecruising.com.au

7. BREWERY/DISTILLERY/CELLAR DOOR

Unique boutique drink experiences are a growing trend, with opportunity for the region to attract investment into a brewery, distillery or cellar door (or all of these). This provides an opportunity to use local produce to create distinctive drinks connected to the agricultural story of the region, whether that be beer, wine, gin, whiskey, cider or something completely different.

Note: there are some existing operators that are exploring these opportunities, with Council encouraged to support their developments.

Location:
Region wide

Benchmark examples:

Whitton Malt House, Whitton NSW (field to glass)

Barellan Beer, Barellan NSW

Husk Distillers, Northern Rivers NSW (paddock to bottle)

Silos Estate, Berry NSW - cellar door with accommodation and functions

Heifer Station, Orange NSW - family friendly cellar door and wedding venue

9. STRATEGIC PRIORITIES

9.1 VISION

Cootamundra-Gundagai region is known for being supportive of developing new agritourism businesses and has a sufficient concentration of agritourism experiences to support increased agritourism visitation.

9.2 AIMS AND OBJECTIVES

The overarching aims of developing agritourism in Cootamundra-Gundagai are to support increased

- numbers of visitors to the region
- visitor length of stay
- visitor expenditure, especially on local products and services
- visitor satisfaction so they return and/or tell others

Because there are few agritourism businesses in the Cootamundra-Gundagai region, according to Council's Agricultural... Agricultural Tourism Issues Paper, initiatives aimed at increasing agritourism in the region and achieving the strategic aims should focus on:

- Promotion, support and business development for existing agritourism businesses
- Support and assistance for farmers to start agritourism businesses
- Providing appropriate land use zoning and streamlined planning processes to support the development of agritourism
- Attracting more tourists to make agritourism a more profitable and sustainable enterprise.

A targeted and focused approach is necessary to achieve outcomes from agritourism.

9.3 IMPLEMENTATION

These objectives should be implemented in two phases:

1

PHASE 1: ESTABLISH FOUNDATIONS (2021-2022)

Build awareness and appeal of the region's existing agritourism product through marketing and experience development

Improve Council's planning process and LEP to be more supportive of developing new agritourism businesses

Work with partners to develop and implement an agritourism business development program that supports producers to develop their agritourism offerings

2

PHASE 2: ONGOING DEVELOPMENT (2023 ONWARDS)

Proactively attract investment into agritourism and support new product development

10. PRIORITY PROJECTS

Objectives			
Support existing agritourism operators	Support new product development	Provide land use zoning and streamline planning processes	Attract more tourists
Phase 1: ESTABLISH FOUNDATIONS - Marketing and experience development			
Work with partners to develop an agritourism business development program that supports producers to develop their agritourism offerings		Make necessary amendments to the LEP to increase opportunities for agritourism development Develop and implement an efficient streamlined approvals process for agritourism development	Create agritourism brand story Develop experiences by bundling existing products into itineraries and a map Hire a PR agency to capture and promote stories of producers, and build a content bank of images, videos and stories Create an alliance with Hilltops and Snowy Valleys Councils (along a corridor between Canberra and Wagga Wagga) to collaborate on marketing and product development projects[19]
Support existing agritourism operators		Support new product development	Attract more tourists
Phase 2: ONGOING DEVELOPMENT - Investment attraction and product development			
'Secure funding and implement the Agritourism Business Development Program in collaboration with industry partners			Invest in strategic, targeted marketing Secure a destination attraction at the Gundagai Old Mill Host a spring and an autumn food festival
		Proactively seek to attract targeted investment with an agritourism investment prospectus to develop new agritourism products to fill identified gaps	

19 The Brindabella Road upgrade will create a loop to Canberra and an opportunity to leverage Canberra Airport's domestic international visitors

11. PARTNERS IN THE ACTIVATION OF THE PLAN

Organisation	Role
Gundagai-Cootamundra Regional Council	• Facilitate and enable: Ease the painful and off-putting process of developing a new agritourism business with a concierge - one contact at Council for all new agritourism product development. This concierge will also run a business development program to support farmers to develop and finesse agritourism products • Develop and implement the agritourism business development program • Strategic activation of the plan and advocacy to state and federal government to attract funding and investment support • Supporting the development of new agritourism product and experiences (including events) across the region • Destination marketing • Experience development (trails, itineraries, map) It is recommended that Council seek funding for a human resource to focus on agritourism development and to implement this plan's priority projects.
On the Road to Gundagai	• Industry collaboration • Industry marketing and cross promotion
Cootamundra Development Corporation (CDC)	• Support the implementation of the agritourism business development program
Gundagai Regional Enhancement Group (GREG)	• Support the implementation of the agritourism business development program • Run events to draw visitation, including high-quality spring and autumn local produce/ foodie events
Gundagai Tourism Action Committee and Cootamundra Tourism Action Group	• May support agritourism development with an agritourism development working group comprised of members of both groups It is recommended that the two tourism action groups are merged into one Section 355 Committee of Council to assist whole of Shire product development, promotion and capacity building.
Destination Riverina Murray	• Marketing • Industry development • Funding support
Service NSW	• Regulatory and compliance support

12. CRITICAL SUCCESS FACTORS AND MEASURES OF SUCCESS

In order to ensure success in the activation of the plan, a series of critical success factors have been identified.

1. collaboration across the region
2. supportive and enabling council outlook
3. adequate resourcing
4. encouraging planning department with a concierge approach to support a streamlined compliance process
5. farmers and producers having necessary skills in tourism
6. effective biosecurity management

The performance of Council and its partners in the implementation of this plan will be monitored and assessed against the following measures of success[20].

Measures of success	Targets for 2023
Collaboration	• Industry and community and business groups working as one collective across Cootamundra and Gundagai • Alliance with Snowy Valleys and Hilltops formed and active • Increased bundling and packaging of product and experience taking place
Satisfaction with compliance process	• Council implements new streamlined compliance process which is supported by a concierge/case management approach • Industry satisfaction levels increased • An all-round supportive and encouraging mentality is adopted across Council
Brand reputation	• Increased year-round visitation • Increased digital engagement • Media exposure around agritourism in the region • Increased enquiry for agritourism experiences in the Visitor Information Centres
Increased agritourism product and experiences	• A minimum of one new major development as per the recommended development projects • Farmers across the region joining in on business development program and diversifying into tourism • Existing operators introducing new experiences across the region based on identified gaps and opportunities
Increased industry capability	• Farmers across the region actively participating in business development program

20 Standard overnight visitation and visitor spend targets are assumed; however, targets have not been set as baseline visitor data is not available.

13. ACTIVATION PLAN

13.1 DEVELOP AN AGRITOURISM BUSINESS DEVELOPMENT PROGRAM

This program will provide local producers with clear information to help them understand the tourism industry and how they can diversify into this industry to support and supplement their agricultural enterprise. It will build their skills and provide opportunity to learn from others who have gone before them.

DRIVER:

Council - Manager Community and Culture

PURPOSE:

- Build critical mass of agritourism product offering by supporting new product development
- Fill current gaps in offering
- Add stories that can be told about the region
- Demonstrate the value of agritourism to a business owner, and how easy it can be to add a lucrative element to their business which is a source of pride and stable income
- Establish strong foundations to permit the development trade-ready agritourism packages in the future.

RECOMMENDED PROGRAM INCLUSIONS:

- Destination Riverina Murray's annual six-month Destination Inspiration tourism business development and mentoring program – promote to local producers and operators
- Factsheets on how to develop several types of agritourism products, such as Hipcamp camp sites[21], farm stays, cellar doors, event venues[22] (e.g. a fact sheet that outlines the process for turning a shearers quarters into accommodation). Survey local producers and operators to find out what products they would like to develop, and develop factsheets for the most common one.
- A pack/webpage/booklet which outlines all the necessary requirements across all departments of Council, along with contacts of all consultants' applicants need to engage with, examples of what is correct (e.g. what a sign has to say) and templates such as for a biosecurity plan.
- A grant opportunities calendar (grants that are relevant to agritourism development).
- Smooth DA process (per Section 13.3).
- Mentoring program[23], including one on one mentoring[24] on developing new appealing agritourism products, improving the visitor experience, and product marketing and distribution; and discussing development possibilities with Destination NSW's Industry Development team on experiences that would appeal to desired target markets, focused on the unique offerings of producers' brands.
- Training program[25] with inclusions such as
  - How to develop an on-trend agritourism experience that fits around farming commitments
  - Assessing and analysing a business opportunity
  - Developing a business plan

21 Previously Youcamp
22 Based on a survey of which developments are of most interest to the region's producers/business owners
23 Consider modelling on Women in Business Wagga Wagga program
24 Such as by agritourism development agency Regionality
25 Use existing resources such as Destination NSW's NSW First Program and Box Hill's micro credentialed short course, 'Promote and develop agritourism'

- Establishing risk management processes including for staff, biosecurity and emergency management
- How to allow visitors to take part in or observe food production processes
- Improving the visitor experience
- Running events such as dinners that showcase local produce
- Storytelling: food/wine production, where ingredients come from, how ingredients can be used, sustainable practices
- Providing high quality customer service; providing a social and educational experience
- Having frontline staff such as wait staff knowledgeable about local produce
- Storytelling, effective digital marketing, collaborative marketing and channels of distribution for tourism products
- How to list your agritourism experiences on the Australian Tourism Data Warehouse (ATDW), TripAdvisor and Google My Business
- Managing customer safety, risk and insurance
- Small business management

- Provide bite-size training by the Destination Network (if possible) (on tourism) and Council (on regulations) where and when producers gather e.g. at agricultural association meetings.
- Networking program (combining provision of information, training and networking) to bring together those with drive, passion, and vision, and those who can be inspired by them. Leverage gatherings that producers already attend where possible.
- A digital marketing audit of each existing agritourism business in the region with improvement instructions.[26]
- Regular communication e.g. a quarterly agritourism development newsletter.
- An annual agritourism forum with guest speakers and successful agritourism operators from other regions.
- An interagency agritourism group meeting biannually, bringing together different departments and external stakeholders to review agritourism developments in the pipeline and discuss new ones to keep agritourism on the radar and ensure all stakeholders are working collectively to support developments.
- An annual business awards program to reward excellence in agritourism (run through an existing business awards program if possible or as part of the annual forum).

26 Such as by Tourism Tribe

- A sister-region relationship with a successful agritourism region for producers e.g. Scenic Rim in QLD.
- An inspirational familiarisation tour of the sister region for producers and Council's planning and tourism staff.

ACTIVATION STEPS:

1. Build on this plan's agritourism audit to create and maintain a database of existing and potential agritourism operators. Include how to reach them, details on producers' interest in agritourism, and the time of year they can serve visitors.

2. Lobby Destination Riverina Murray to increase the number of networking events they run, and develop an agritourism network to help agritourism operators feel connected and to support collaborative activities. If unsuccessful, use the alliance with Hilltops and Snowy Valleys Councils (see Section 13.7) to run a collaborative program.

3. Leverage the support of Southern Harvest near Canberra which

    - facilitates networking (quarterly gatherings)
    - can connect producers with supporting organisations and agritourism mentors
    - facilitates connections between growers and consumers
    - runs a CSA of multiple producers
    - runs workshops for producers and the public
    - runs Bungendore Harvest Festival and a weekly farmers market
    - runs a public education component

4. Have the development program shovel ready for grant applications.

5. Secure funding to implement the program.

TIMELINE:

2021 (and ongoing)

13.2 AMEND LEP TO INCREASE OPPORTUNITIES FOR AGRITOURISM DEVELOPMENT

An amended LEP will support and encourage increased agritourism product development, increasing the opportunity for producers to develop new products. An LEP that is agritourism friendly and aligns with this plan is critical to ensure successful development of the region as an Agritourism destination.

DRIVER:

Council - Manager Development, Building & Compliance

PURPOSE:

- Support income diversification for producers by permitting land usage for agritourism
- Streamline Council requirements to allow and be supportive of agritourism development
- Cater for the needs of small-scale producers/ providores as well as large-scale producers

ACTIVATION STEPS:

1. Seek input from producers, existing and potential agritourism operators.
2. Include changes in Council's LEP that are relevant to and supportive of agritourism development, such as those as outlined in Council's Rural Lands Strategy 2020:
    - 1.1 Minimum lot size
    - 1.2 Dwelling entitlements
    - 1.3 Dual occupancies
    - 1.4 Agricultural subdivision
    - 1.6 Innovation and enterprise support
    - 2.1 "Open" zones
    - 2.2 Miscellaneous permissible uses
3. Similarly, create a subsection of the Development Control Plan under business and industrial development which deals with agritourism and artisan food/providore businesses (Action 2.3 of the Rural Lands Strategy).
4. Use clear, plain language in LEP or provide an interpretive version for agritourism development that is in clear, plain language.
5. Provide for a variety of smaller, more affordable lots in the LEP and proactively promote to attract tree changers from the ACT and Sydney.

TIMELINE:

2021

BUDGET:

(Internal)

13.3 DEVELOP AN APPROVALS PROCESS FOR AGRITOURISM DEVELOPMENT

A smoother process with fewer frustrations for business owners will reduce one of the biggest barriers to new product development in the region, and a cause of stress and frustration with Council.

DRIVER:

Council - Manager Development, Building & Compliance

PURPOSE:

- Reduce the major barrier to new and expanded agritourism product of development approvals (DA) and frustration with the DA process

EXAMPLE:

- Scenic Rim Regional Council (QLD) uses a case manager approach to new agritourism development. The Council is proactively supportive of new agritourism development, in part because they want new stories to use in PR promotion of the region.

ACTIVATION STEPS:

1. Have a resolution by or instructions from the Councillors to the planners to find a way to support new agritourism development (without frustrating applicants) (i.e. change an attitude of strict interpretation of rules to a supportive interpretation of rules; incorporate flexibility). Measure and follow up on this over time.

2. Provide a pack/webpage/booklet at the start of the DA process, which outlines all the necessary requirements across all departments of Council, along with contacts of all consultants' applicants need to engage, examples of what is correct (e.g. what a sign has to say) and templates such as for a biosecurity plan.

3. Permit a trial of tourism activities before submission of a DA.

4. Implement the recommendations of Service NSW:[27]
   - Provide mentoring for and supervision of less-experienced planning staff around projects that don't fit in the box. Connect planning staff with senior planning staff mentors in agritourism destinations who have successfully smoothed the path for new agritourism development.
   - Use a case management approach to new agritourism development – have one point of contact at Council for producers to contact to facilitate the development application and other needs within Council. This person is available to be called on for help with Council obstacles. This will ensure advice from the Economic Development and Tourism staff does not contradict advice from the planning staff.
   - Provide all planning information all in one location in clear, plain language – everything operators need to consider when developing and expanding an agritourism business, including clear information about exempt development. Provide examples of what is correct e.g. what a sign has to say.
   - Provide all planning requirements up-front, before the applicant begins the DA process.

27 See Appendix 14.4

- Provide clear communication about rules and expectations.
- Provide pragmatic assistance before and during the DA process.
- Council's planner should always visit the site at the beginning of the DA process.
- Align fees with the number of customers, not with the size of a building.
- Consider fee waivers for agritourism developments to support a sufficient concentration of product in the region to attract visitation

TIMELINE:

2021

BUDGET:

(Internal)


Carrots
(orange)

13.4 CREATE AN AGRITOURISM BRAND STORY FOR THE REGION

The brand story will be the framework for the promotion of the region's agritourism experiences (the focus is on the story that the region tells, and how it is told, not on a logo). In order to be recognised as an agritourism destination a strong brand story that captures the essence of the region and the distinctive difference/s is essential.

DRIVER:

Council - Manager Community and Culture

PURPOSE:

- Communicate to potential visitors the appeal of the destination in marketing tactics
- A framework for agritourism operators to align their story within

INCLUSIONS:

- Brand story
- Supporting marketing copy and key messages
- Photo library, video content
- Producer stories

ACTIVATION STEPS:

1. Secure funding
2. Hire a marketing agency to develop the story, copy and key messages (see Section 13.6 re photo library and stories)
3. Hire a photographer and videographer to build a content bank of images and videos (concurrently with the development of the story bank to capture imagery for the producer stories. See Section 13. 6)
4. Use the brand elements in marketing the region's agritourism products

TIMELINE:

2022

BUDGET:

$120,000

13.5 BUNDLE PRODUCTS INTO ITINERARIES AND A MAP

To overcome the region's low concentration of agritourism experiences, and the lack of easily accessible information available online on what does exist, the bundling of existing products and experiences will clearly show potential visitors that the region is worth their effort to visit.

DRIVER:

Council - Manager Community and Culture

PURPOSE:

- Provide visitors with compelling reasons to visit the region
- Provide visitors with easily-accessible information to help them see the concentration of experiences in the region, and support trip planning

INCLUSIONS:

- Agritourism micro-website
- Itineraries - seasonal (e.g. what to do in winter; what to do in summer), demographic-specific (e.g. itineraries for families) and niche-interest options. Include both paid attractions and attractions to support extended length of stay such as picnic, swimming and fishing spots, dump points, and river access points.
- A back roads scenic drive map highlighting attractions, farm stays, picnic spots, where to buy local produce for a picnic hamper, rail trail, fishing spots, and seasonal farming activities. Promote the seasonal farming activities that can be seen via this map. This will provide visitors with multiple attractions that can provide 1-2 days of activities, which is necessary to inspire food and wine trips.

EXAMPLE:

The Canola Trail includes itineraries themed by interests such as antiques shopping, for foodies, and for nature lovers.

ACTIVATION STEPS:

1. Use the agritourism audit and knowledge of the region's tourism products to bundle experiences into itineraries for the target markets' interests.
2. Have a graphic designer map the itineraries to brand.
3. Load the itineraries and map to a new agritourism micro website which will focus on the region's agritourism story, local produce, and stories of producers ('meet the growers'). Link to the agritourism microsite from each tourism website to provide easily accessible, up to date information on the region's agritourism experiences[28]. Necessary online information includes websites that help visitors plan their trip including places to visit along the way. The 'journey' to a destination is increasing in importance so information on things to see and do along the way, and tools such as trip planners on websites enables travellers to plan and maximise their food and wine experience. Important information to share online includes[29]

    - where/how to eat fresh, locally grown food for breakfast, lunch and dinner
    - where to buy local produce in its various forms
    - arts/crafts shops/markets
    - short drives to places of interest near the main destination
    - 'interest' stops on the way on the journey from travellers' homes to the region
    - where to talk with local growers about their produce
    - where to indulge (day spa or massage)
    - where to learn something new
    - entertainment and nightlife
    - where to experience nature and outdoor activities

TIMELINE:

2022

BUDGET:

$15,000 (graphic design and development of micro site)

28 An example is www.victoriashighcountry.com.au/food-wine-beer/produce-farm-gates
29 Food and Wine Tourism in NSW, 2015, Tourism Research Australia

13.6 CAPTURE AND SHARE THE REGION'S STORIES

Rather than advertising, the region will focus promotional activity on connecting potential visitors with locals, and life as a local; both strong trends in what captures people's attention, and inspires them to travel, and to share their experience with friends. Using storytelling to promote the region will help make the emotional connection and provide a rich marketing message for potential visitors.

DRIVER:

Council - Manager Community and Culture

PURPOSE:

- Cost-effective and 'word of mouth' publicity about the region's agritourism attractions

INCLUSIONS:

- A content bank of images and stories
- Media database

EXAMPLE:

South Burnett (QLD) hired a PR agency to compile 20 stories on producers, wineries, tourism operators, events and local characters, and pitch them to relevant media. The stories were used to develop media releases, and were available for ongoing use in social media, on the tourism website as content pages and blog articles, and for future media pitches. Some stories were bundled (e.g. of all the wineries) and sent as a kit to relevant media. Of the pitches made in just four months, the estimated AVE (advertising value equivalent i.e. ad rate x 4) for published articles was over a million dollars, which did not include radio interviews, online news articles, monthly event listing distribution, or long lead media articles. Close to 870,000 in source markets were reached.

ACTIVATION STEPS:

1. Secure funding for the project
2. Hire a PR agency to capture and promote stories of the region's producers and agritourism experiences, including events. Have the agency provide legacy benefits such as a targeted media database (long and short lead media viewed and read in target source markets).
3. Host a media familiarisation tour. Have the visiting journalists and targeted influencers provide legacy benefits such as imagery.

TIMELINE:

2022

BUDGET:

$70,000 (PR agency and media famil)

13.7 DEVELOP AN ALLIANCE WITH HILLTOPS AND SNOWY VALLEYS COUNCILS

This collaboration will build a density of experiences in a corridor between the source markets of Wagga Wagga and Canberra, both increasing the number of experiences available for visitors, and connecting with two main source markets.

Taking a collective approach to destination development and marketing provides a competitive edge for regions and gives a more compelling reason for visitors to visit.

DRIVER:

Council - Manager Community and Culture

STEPS:

- Create a competitive and compelling proposition as a regional agritourism destination
- Collaborate on marketing and product development projects to reduce costs and maximise outcomes
- Leverage Thrive Riverina activity

ACTIVATION STEPS:

1. Facilitate an initial meeting of the three councils (tourism and/or economic development managers) to determine interest and commitment
2. Develop a Memorandum of Understanding that fosters a positive and collaborative approach to developing the 'corridor' as a strong agritourism destination
3. Schedule quarterly meetings to discuss projects and collaborative initiatives.
4. In the future there is scope to consider a more formal arrangement similar to Northern Rivers Food that could be the key industry group to drive agritourism projects across all three LGA's (with close support from each council)

TIMELINE:

2021 (and ongoing)

BUDGET:

(internal) + some of the marketing budget allocation can be used for collaborative activity

13.8 SECURE FUNDING AND IMPLEMENT THE AGRITOURISM BUSINESS DEVELOPMENT PROGRAM IN COLLABORATION WITH INDUSTRY PARTNERS

Once developed, this program will be rolled out to producers to support skill and knowledge development that will assist the decision to develop new agritourism products.

DRIVER:

Council - Manager Community and Culture

ACTIVATION STEPS:

1. Based on the recommended inclusions in section 13.1 roll out the desired elements of the business development program.
2. Use the PR stories to build local awareness of agritourism products and community pride, and educate local producers, businesses, retailers, Councillors, and the general community about what agritourism is, the value of agritourism, and how to start to engage in developing an agritourism offering.
3. Facilitate an annual agritourism forum. Have presentations by diverse successful agritourism operators and by regions that have successfully developed agritourism, and have participants each share what they are working on, want to work on, challenges they are facing, etc, to make Council aware of issues or collaborative opportunities. Celebrate new agritourism developments in the region by sharing the stories of how they were developed (to inspire new development). Have a clear desired outcome to achieve to ensure producers feel there is value in the forum.
4. Encourage producers to always speak with Council planning and tourism staff at the earliest of stages of considering a new tourism business.
5. Have a project for agritourism operators and others to work on together, such as the spring and autumn harvest festivals

TIMELINE:

2022

BUDGET:

Approximately $100,000 to deliver all elements of the program (this will vary depending on extent of program)

30 See Section 13.12
31 A second phase of the program could include an accredited locavore program, using 'regional heroes' such as wine makers, food producers and chefs.

13.9 ATTRACT AGRITOURISM INVESTMENT

Council will proactively try to draw new private and public investment into the region to fill strategic product and experience gaps in the region's agritourism offering

DRIVER:

Council - Manager Community and Culture

PURPOSE:

- Inspire investors and tree changers to invest in developing new agritourism products and experiences in the region.

INCLUSIONS:

- Business cases
- Investment prospectus

STEPS:

1. Secure funding to engage an economist/ consultant to develop robust business cases for the recommended agritourism product and experience developments (see Section 8.3).
2. Develop an agritourism investment prospectus based on filling identified product gaps (the recommended developments in Section 8.3). Ensure projects are shovel ready for future investment attraction and government funding support
3. Use the prospectus to proactively seek to attract targeted investment and new businesses.
4. Council to pursue a targeted development approach to fill identified gaps, such as by opening a parcel of land for development (e.g. 20 acre lots) to attract food businesses and tree changers.

TIMELINE:

2022 (and ongoing)

BUDGET:

$250,000 (business cases)

13.10 INVEST IN STRATEGIC MARKETING

Strategic, targeted marketing will build on the development of an agritourism brand story, website content, stories, and itineraries.

Sharing stories and content to help build brand awareness and appeal is critical to building the region as an agritourism destination.

DRIVER:

Council - Manager Community and Culture

PURPOSE:

- Promote the region to target markets to inspire them to visit
- Support owners of existing agritourism products with distribution and marketing

INCLUSIONS:

- If there is interest amongst producers, have a co-operative Cootamundra-Gundagai stall at nearby markets, particularly in source markets such as Capital Region Farmers Market and Southside Farmers Market in Canberra and the Riverina Producers Market in Wagga, to promote the region's produce and agritourism experiences This could be done in collaboration with Thrive Riverina and could use the Taste Riverina brand.

STEPS:

1. Improve visitor statistics collection by organising Council assets (visitor information centres, museums, popular attractions and nature reserves) and tourism operators to collaboratively gather visitor statistics: demographics, motivations for visiting, and preferred experiences[32] using opt-in GDPR/privacy-compliant QR codes with a link to a short survey; and for accommodations to join STR for regular region-wide accommodation occupancy reports. This will fine-tune target market identification, supporting more effective marketing campaigns and aligned product development.
2. Secure funding for destination marketing and brand activation (aim for three years of funding to allow for consistency).
3. Develop and implement a strategic and targeted marketing plan in collaboration with Hilltops and Snowy Valleys Councils. Focus on building the day trip and weekend holiday market from Wagga Wagga (1h), Canberra (2h), and Victoria (2h to the border), particularly strategic and targeted activity into the ACT, using day trips from Gundagai as the key message. Measure and review effectiveness of all marketing activities, and adjust to improve ROI over time.
4. Look for opportunities to leverage collaborative marketing
    - Collaborate with producers to jointly fund an LGA wide premier food/agritourism products marketing campaign[33]
    - Use the regional tourism brands or Taste Riverina to promote local produce
    - Jointly fund a marketing campaign of the region's premier food and agritourism products
    - Leverage nearby agritourism events to give a reason to stay an extra day such as Young cherry season for an excursion to Cootamundra
    - Increase local recommendations and cross promotion
    - Leverage/buy in to Thrive Riverina's collaborative marketing campaigns in Canberra market and Visit Riverina social media, email database/seasonal newsletters,

32 As per the CGRC Tourism & Economic Development Strategy 2019
33 From the CGRC Tourism and Economic Development Strategy 2019

and media famils.

- Collaborate across regions for destination marketing campaigns

5. Integrate food and wine content and agritourism experiences into the broader destination story.
6. Ensure agritourism experiences are listed on the Australian Tourism Data Warehouse (ATDW), TripAdvisor and Google My Business
7. Promote the Delicious award and similar products (and where they can be bought and experienced).
8. Leverage the Taste Riverina brand and the Riverina Food Directory website. Have representation on the Taste Committee (a Council officer or an industry representative).
9. Leverage Tourism Australia's Restaurant Australia activities when and where relevant
10. Provide training and development in tourism promotion for Cootamundra VIC's volunteers (including famil trips to agritourism businesses).

TIMELINE:

2022 (and ongoing)

BUDGET:

$15,000 minimum per annum (this can be part of the overall destination marketing budget)

13.11 SECURE A DESTINATION ATTRACTION AT THE GUNDAGAI OLD MILL

It is recommended that the new development that Council accepts for the Old Mill site includes an immersive experience that connects visitors to local produce and agriculture. There is opportunity for this site to link in with the Coolamon Cheese Factory and Junee Licorice & Chocolate Factory to create another iconic repurposed building that provides a quality hero tourism attraction.

DRIVER:

Council - Manager Community and Culture

PURPOSE:

Connect visitors to local produce and agriculture and local agritourism experiences

INCLUSIONS:

Some suggested uses of the site include one or a combination of the following:

- Artisan bakery using local produce
- Winery cellar door to showcase wine from the region
- Craft beverage manufacture
- Tourism facilities
- Destination dining with a focus on local produce
- Special events celebrating and promoting local produce

STEPS:

Council has made necessary updates to the building, and put out a call for EOIs for a development in the Mill. The attached product development recommendation one-pager can support pitching for a new tourism business to use this site.

13.12 DEVELOP A SPRING AND AN AUTUMN FOOD FESTIVAL

Two region-wide foodie/harvest/local produce festivals held in spring and autumn when the weather is most suitable for an event (on a long weekend where possible). An umbrella festival name will encompass a range of events run by agritourism operators, producers, community groups and others. These festivals would replace the fortnightly farmers markets.

DRIVER:

On the Road to Gundagai, GREG and CDC will lead the event development and event marketing.
Council's role is as enabler: to assist with compliance and help make it easy for events to take place, and support event promotion.

PURPOSE:

- Attract visitation
- Increase destination awareness
- Increase collaboration
- Trial new products such as short term PR collaborations (e.g. Wagga's strawberry beer collaboration between a strawberry farm and a microbrewery)

INCLUSIONS:

- Two region-wide foodie/harvest/local produce festivals[34]
- Food produced within 100km of the region
- Elements such as tasting plates, product/wine tasting, showcases of local chefs and produce, farm tours and on farm meals

EXAMPLE:

The fast-growing Eat Local Week in the Scenic Rim attracts 40,000 people to the region and contributes more than $2 million to the local economy (not including expenditure by locals).

ACTIVATION STEPS:

1. Bring together the main potential players to feel out interest, and flesh out the event's inclusions across the region, such as GREG, CDC, major tourism operators and existing event holders such as Cootamundra Wattle Time Fair & Street Parade
2. Engage an event expert to develop event development plans an marketing plans for each event, highlighting the governance model, budget, program, brand, etc.
3. Establish working groups for each event and determine a key coordinator to lead each event
4. Commence event planning by sending out a request for EOIs for events for the festival (Example: Eat Local Week event application)

TIMELINE:

Commence planning in 2022, with the events to be launched in 2023

BUDGET:

$40,000 to engage consultant to do event development plans and marketing plans

Seed funding of $50,000 per event will be required with the future budget dependent on size and scale of events

34 Kimo Estate is intending to develop a food and wine festival that could be leveraged for one of these

14. APPENDICES

14.1 DESKTOP RESEARCH AND CONSULTATION

In developing this report, Tilma Group reviewed the following:

- Rural Lands Issue Paper: Agricultural Tourism 2018, Cootamundra-Gundagai Regional Council
- Tourism and Economic Development Strategy 2019, Cootamundra-Gundagai Regional Council
- Community Strategic Plan 2018, Cootamundra-Gundagai Regional Council
- Brand Strategy Cootamundra, Gundagai & Villages presentation
- Boosting Regional Australia Through Agritourism Discussion Paper 2018, Australian Regional Tourism
- Agritourism – An industry skills gap scoping study, Box Hill Institute
- Riverina Murray Destination Management Plan 2018
- The Riverina Strategic Plan 2020, Thrive Riverina
- Starting and running an agritourism business, Farmers' experiences and needs 2019, Service NSW for Business
- An inquiry into the development of agritourism survey results snapshots 2020, Australian Regional Tourism
- NSW Food and Wine Tourism Strategy 2018, Destination NSW
- Food and Wine Tourism in New South Wales 2015, Tourism Research Australia
- Food Tourism to NSW 2018, Destination NSW
- Wine Tourism to NSW 2018, Destination NSW
- Riverina Research Key Insights (target market research), Destination NSW
- Gundagai Visitor Information Centre recent visitor statistics
- Local Government Area Profile 2018 for Cootamundra Gundagai, Tourism Research Australia
- Regional NSW Visitor Profile 2019, Destination NSW
- Community Donations Policy 2020, Cootamundra-Gundagai Regional Council
- Business Connect Agritourism webinar with Regionality
- Scenic Rim Locavore Program

An audit of agritourism and tourism experiences was developed via desktop research.

Consultation was conducted by Tilma Group with the following stakeholders:

- Mayor Abb McAlister, Tourism and Economic Development Officer Jeana Bell, Manager Community and Culture Miriam Crane, Manager of Development, Building & Compliance Sharon Langman, and Tourism Administration Trainee Casey Polsen, Cootamundra-Gundagai Regional Council
- Members of the Gundagai Tourism Action Committee and Cootamundra Tourism Action Group
- David Ferguson, Kimo Estate
- Rachel Whiting, RDA Riverina
- Arcadia Addams, Small Business Commission

- Richie Robinson, Destination Riverina Murray
- Brent Lawrence, Thrive Riverina
- Leah Sutherland and Gwen Norman, Cootamundra Development Corporation
- Louise Freckelton, Highfield Farm and Woodland
- Rose de Belin, Planted Cootamundra
- Annie Jacobs, Wallendbeen Park Farm
- Jamie, Rusty Table
- Nina Piotrowicz
- Ali Betts, formerly of Muddy Pigs
- Kerenza Brown, Southern Harvest
- Miriam Hewson Destination Marketing Officer, Snowy Valleys Council
- Melanie Whitechurch, Tourism and Events Manager, Hilltops Council
- Fiona Hamilton Visitor Economy & Events Coordinator, Wagga Wagga City Council and tourism staff
- Craig Sinclair Economic Development Manager, Temora Shire Council

Additionally, an online survey was distributed to Cootamundra-Gundagai producers and agritourism operators and the wider community via Coota Local and Gundagai Local and direct mail with 14 responses.

Due to COVID-19 travel restrictions no site visits were undertaken by Tilma Group.

14.2 HOW LOCAL GOVERNMENT CAN SUPPORT THE DEVELOPMENT AND GROWTH OF AGRITOURISM BUSINESSES

This report by Service NSW for Business explores the experience of farmers in NSW who are trying to start, run and grow agritourism businesses, and provides insights into their pain points and how to resolve them: Starting and running an agritourism business; Farmers' experiences and needs.

14.3 FUNDING OPPORTUNITIES FOR PRIORITY PROJECTS

Agritourism industry group Northern Rivers Food secured $240,000 over three years from a State MP (their previous Lower House Member, now in the Upper House). The MP's staff member advises that Cootamundra-Gundagai Regional Council or an agritourism industry group should approach the region's state and federal members of parliament and the State Minister for Tourism to ask how the region can work with government to secure financial support for agritourism development.

Grant opportunities for each project requiring funding include the following:

Project	Grant Name	Description	Who can apply	Rounds
1.8 Implement the Agritourism Business Development Program	FRRR Strengthening Rural Communities	Supports organisational capacity building	Not-for-profit, community-based organisation	4/year
	FRRR Tackling Tough Times Together	Supports projects with one of these aims: 1. Building community resilience 2. Developing organisational resilience and capacity 3. Enhancing environmental sustainability 4. Fostering cultural vibrancy 5. Lifelong learning and education 6. Economic strength 7. Improving community health and social wellbeing	Community groups and not-for-profit organisations in drought-affected regions	Always open

1.12 Develop a spring and an autumn food festival	Building Better Regions Fund	Up to $20,000 unmatched (or double budget) for new or expanded events	Not-for-profit organisations and Councils	1/year (November)
	FRRR Strengthening Rural Communities	A broad range of charitable projects are considered under this program, including: • Delivering, or providing activities, events, programs and services; • Purchasing or hiring equipment and materials; • Community infrastructure projects; • Organisational capacity building; • Community resource development.	Not-for-profit, community-based organisation	4/year
	Destination NSW Regional Event Fund	It is not clear if DNSW will support new events in the future as they did in the past.	Not-for-profit organisations	

Grants do not typically fund destination marketing projects, such as

- 1.4 Create agritourism brand story
- 1.5 Bundle products into itineraries and a map
- 1.6 Hire a PR agency
- 1.10 Invest in strategic marketing

However, it may be possible to secure funding from drought or bushfire related grants for destination marketing activities.


COOTAMUNDRA-
GUNDAGAI REGIONAL
COUNCIL

COOTAMUNDRA-GUNDAGAI REGION - RECOMMENDED NEW AGRITOURISM PRODUCT OR EXPERIENCE DEVELOPMENT

DOG ON THE TUCKERBOX REGIONAL FOOD HUB

This attraction is currently part of an existing major development taking place, though inclusions have not been established yet. A showcase of produce from Cootamundra, Gundagai, Snowy Valleys and Hilltops would add value to this development and provide a gateway to a major food-producing region in NSW. Inclusion of a regional produce café/ food outlet and Visitor Information Centre to promote the agritourism across the region is recommended.





"This Food Hub on the Hume Highway will provide an anchor point and a hook to draw more visitors off the highway and into these destinations."

Location:
Hume Hwy (8km north of Gundagai)

Benchmark examples:
The Farm, Byron Bay NSW

COOTAMUNDRA-GUNDAGAI REGION - RECOMMENDED NEW AGRITOURISM PRODUCT OR EXPERIENCE DEVELOPMENT

THE OLD MILL REDEVELOPMENT

Council has commenced the process of calling for expressions of interest for the development of this site. Based on the review and analysis that has taken place with this plan it is strongly recommended that this development includes an immersive experience that connects visitors to local produce and agriculture. There is opportunity for this mill site to link in with the Coolamon Cheese Factory and Junee Licorice & Chocolate Factory, to create another iconic repurposed building that provides a quality hero tourism attraction.

Some suggested uses of the site include one or a combination of the following:

- Artisan bakery using local produce
- Winery cellar door - wine collective to showcase all wine from the region
- Craft beverage manufacture
- Tourism facilities (accommodation, function centre, etc)
- Destination dining with a focus on local produce
- Special events celebrating and promoting local produce

Location:
Gundagai

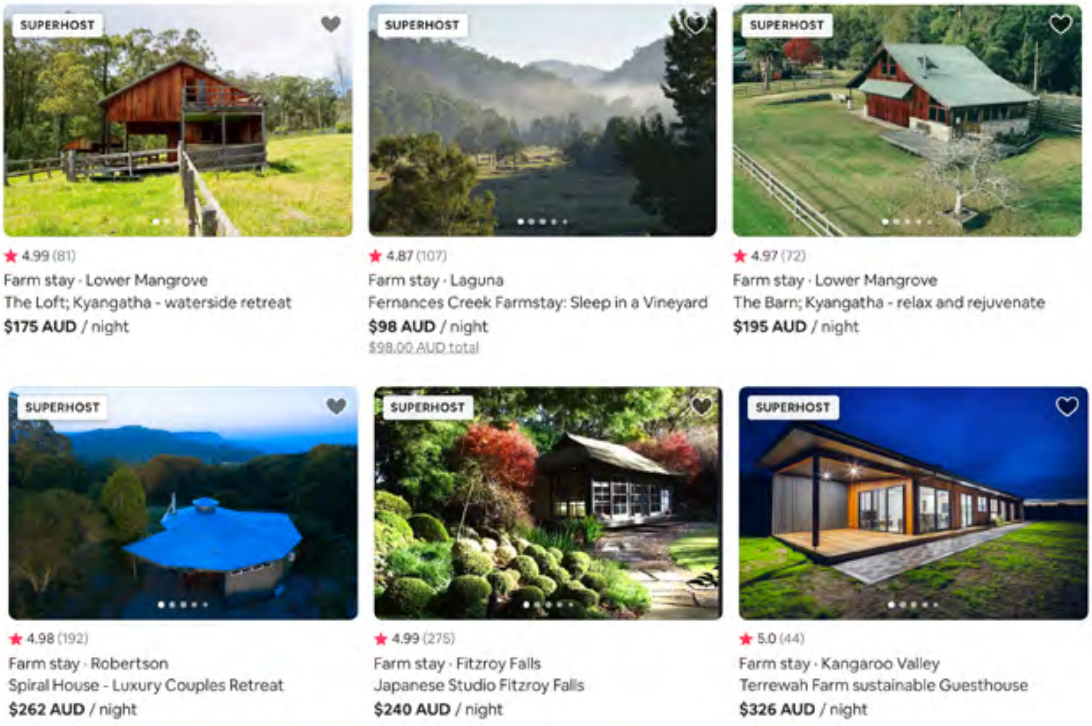
Benchmark examples:
Coolamon Cheese Factory,
Coolamon NSW
Junee Licorice & Chocolate Factory,
Junee NSW

COOTAMUNDRA-GUNDAGAI REGION - RECOMMENDED NEW AGRITOURISM PRODUCT OR EXPERIENCE DEVELOPMENT

FARM STAYS

Farm stays are popular accommodation types and with the creation of Airbnb and Hipcamp, there is now enhanced opportunity for farmers to enter this sector with minimal fuss. Council is encouraged to support farmers in renovating old shearing sheds and workers quarters to create tourism accommodation, or riverside campsites on their land. This support could be in the form of waiving development application fees and by making permitting straight-forward.

Note: Australian Regional Tourism is currently working in partnership with Airbnb to support agritourism development across regional Australia - learn more here



Location:
Region wide

Benchmark examples:
Scenic Rim QLD on Hipcamp
Aussie Farm Stays on Airbnb

COOTAMUNDRA-GUNDAGAI REGION - RECOMMENDED NEW AGRITOURISM PRODUCT OR EXPERIENCE DEVELOPMENT

COOLAC/WALLENDBEEN PROVIDORES AND HARVEST TRAILS

Develop a master plan for Coolac and/or Wallendbeen to encourage small farm providore and farm gate development, creating an agritourism hotspot just off the Hume, Burley Griffin and Olympic Highways, which provides produce direct to consumers and suppliers.

Council is encouraged to re-zone a section of land to allow for small titles and providores, enabling tree changers from Canberra, Sydney and Melbourne (in addition to locals) to invest in land to develop value add premium agricultural products that can be sold directly to consumers and suppliers with farm gate sales, pick your own sales and harvest trails.

Location:
Coolac and/or Wallendbeen

Benchmark examples:

Harvest Trails

Northern Rivers NSW

Freeman's Organic Farm, Currumbin QLD, who have successfully diversified into tourism

COOTAMUNDRA-GUNDAGAI REGION - RECOMMENDED NEW AGRITOURISM PRODUCT OR EXPERIENCE DEVELOPMENT

SEASONAL FESTIVALS

Further developing existing events such as Cootamundra Wattle Time, it is recommended to develop and host two larger-scale spring and autumn seasonal 'harvest' events (on a long weekend where possible) of food produced within 100km of the Shire. Include tasting plates, product/wine tasting, showcases of local chefs and produce, and associated events such as farm tours and on-farm meals. Use the event to build networking and collaboration between producers, and to trial new products, such as short term PR collaborations (e.g. Wagga's strawberry beer collaboration between a strawberry farm and a microbrewery).

Location:

Cootamundra and Gundagai

Benchmark examples:

Harvest Festival, Northern Rivers NSW

Orange FOOD Week, Orange NSW

Scenic Rim Eat Local Week, Scenic Rim QLD

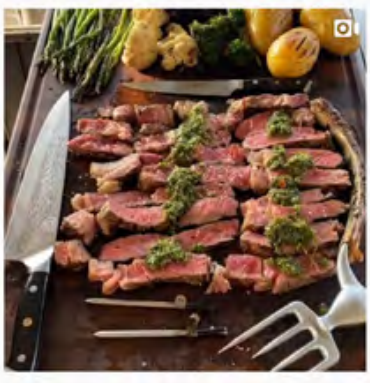
TOUR OPERATORS

There is opportunity to attract tour companies or local entrepreneurs to develop and deliver new tours that bring together and showcase the agritourism across the region.

Tour suggestions include:

- Tour of wheat farm and mill
- Conqueror Mill tours
- Tour combining meatworks and sheep farm
- Regenerative farming
- Region wide farm tours i.e. visit multiple farms for half or full day

Tap into the new tour company opening in Temora focused on the 55+ market[17] and Riverina Agricultural Tours.



Location:
Region wide

Benchmark examples:

Cotton Farm & Gin Tour, Moree NSW

Yakult, Dandenong South VIC - tour of working factory

Agricultural Tours Riverina , NSW

Southern Forests Regional Tours, WA

Creative Tours & Events, Maroochydore QLD - private tour operator bundles product

17 Contact Wayne Fountain 0419 771 038 waynef@ilovecruising.com.au

COOTAMUNDRA-GUNDAGAI REGION - RECOMMENDED NEW AGRITOURISM PRODUCT OR EXPERIENCE DEVELOPMENT

BREWERY/DISTILLERY/CELLAR DOOR

Unique boutique drink experiences are a growing trend, with opportunity for the region to attract investment into a brewery, distillery or cellar door (or all of these). This provides an opportunity to use local produce to create distinctive drinks connected to the agricultural story of the region, whether that be beer, wine, gin, whiskey, cider or something completely different.

Note: there are some existing operators that are exploring these opportunities, with Council encouraged to support their developments.

Location:
Region wide

Benchmark examples:

Whitton Malt House, Whitton NSW (field to glass)

Barellan Beer, Barellan NSW

Husk Distillers, Northern Rivers NSW (paddock to bottle)

Silos Estate, Berry NSW - cellar door with accommodation and functions

Heifer Station, Orange NSW - family friendly cellar door and wedding venue

NSW GOVERNMENT Public Works Advisory

Stockinbingal Sewerage Scheme

Business Case

Report Number: ISR21004

September 2021

Prepared for:

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

Report Number: ISR21004

Document control

Version	Author(s)	Reviewer	Approved for issue	
			Name	Date
Final	Heleen Lindeque	Brett Douglas	Brett Douglas	22/9/21

Key Proposal Details

Proposal Information	
Proposal name	Stockinbingal Sewerage Scheme
Lead proponent (e.g. Council)	Cootamundra Gundagai Regional Council
Lead proponent ABN	46 211 642 339
Proposal partners	
Name	Ganesh Ganeshamoorthy
Position	Manager Assets
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Fax	
Address	255 Sheridan Street, Gundagai NSW 2722
Proposal summary for publication *Please provide 150 words or less*	
Proposal address	Stockinbingal
Local government area	Cootamundra Gundagai Regional Council
NSW electorate	Cootamundra
Federal electorate	Riverina
Attachments *Please list out all supporting information provided*	

Executive Summary

This Business Case has been prepared by Public Works Advisory (PWA) to form part of a detailed application by Cootamundra Regional Council to seek funding for a new sewerage scheme in Stockinbingal.

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales with a population of approximately 250.

Reticulated sewerage is not available in Stockinbingal, with the majority of residents utilising a septic system. With a number of quarter acre lots in single ownership with dwellings constructed, concern is held for the effectiveness and compliance of absorption trench septic systems. Additionally, Stockinbingal is mapped as being flood prone throughout the residential area and groundwater is believed to be close to the surface in some areas.

Therefore, a reticulated sewerage system is proposed to replace the existing individual property based on-site wastewater systems. This will address environmental concerns and is essential to support future growth.

The total project cost is estimated to be **$6.7 million**. Council is seeking for 50% funding for the project from the funding program.

The cost benefit analysis was based on the beneficial impact of better sewerage management systems for the existing Stockinbingal. The saved cost of replacing on-site sewerage systems has also been included. Due to the small population size, the cost benefit ratio is below 1 however this is expected for such schemes.

Contents

Tables

Figures

Abbreviations

Abbreviation	Description
ABS	Australian Bureau of Statistic
ADWF	average dry weather flow
AWTS	aerated wastewater treatment system
ARTC	Australian Rail Track Corporation
BCR	benefit cost ratio
CBA	cost benefit analysis
CGRC	Cootamundra Gundagai Regional Council
DPIE	Department of Planning Industry and Environment
EP	equivalent population
EPA	Environment Protection Authority
EPL	Environment Protection Licence
IDEA	Intermittently Decanted Extended Aeration
LGA	Local Government Area
MABR	membrane aerated biofilm reactor
MBBR	moving bed bioreactor
MBR	membrane bioreactor
OSSMS	on-site sewage management system
POEO	Protection of the Environment Operations (Act)
PSS	Pressure Sewerage System
PWA	Public Works Advisory
REF	Review of Environmental Factors
STP	sewage treatment plant
WHS	Work Health and Safety

1. Case for Change

1.1 Background

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales. Stockinbingal is 388 km south west of Sydney and 102 km north east of Wagga Wagga (Figure 1-1).

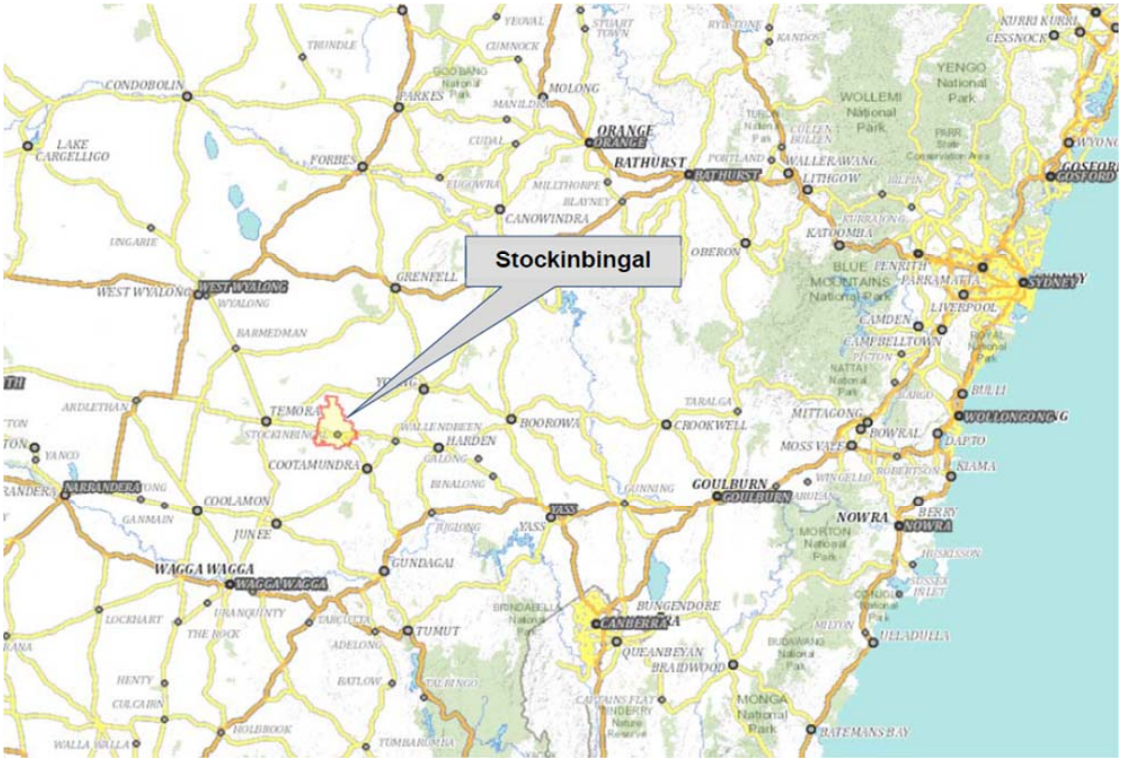

Figure 1-1: Location Map of Stockinbingal in Relation to Sydney (Six Maps)

Stockinbingal is located on the combined floodplain of Bland and Dudauman Creeks. Dudauman Creek joins Bland Creek downstream of the village, at which point the combined catchment is some 210 km^2.

There are 127 registered on-site sewage management systems (OSSMS) in the Stockinbingal Village area. The majority of the OSSMSs in the village are believed to be conventional septic systems with absorption trenches, but Council also receives Service Reports for 13 aerated wastewater treatment systems (AWTS) and one approved reed bed system.

The majority of the systems in use within the village are historical conventional septic systems and absorption trenches. The effluent is primary treated and discharged at a level where soil is believed to be predominately light to medium clay (at 400-600mm) and poorly drained.

1.2 Rationale for Investment

1.2.1 Existing Infrastructure

Council has recorded 6 failing systems in recent years:

- One failing AWTS which discharged to the creek (due to oversaturation of the land available for irrigation)
- Four overflowing septic tanks (system failure - sludge build-up or trench failure)
- One overflowing septic tank (inflow of surface water)

In addition, Council reports that there are anecdotal reports that "the village of Stockinbingal has overflows from septic tanks during wet weather". Overflowing septic systems has an adverse impact on human health and the environment.

Effective and safe effluent disposal from the OSSMSs in the village are impacted by three main factors: available effluent area, soil type and flood impacts. The majority of OSSMSs in the village area have been assessed as high risk due to lot size, soil type or possible flood impacts. Table 1-1 provides a summary of the OSSMSs in Stockinbingal.

Table 1-1: OSSMS Assessment of Stockinbingal

Parameter	OSSMS Requirement	Risk if requirement not met	Details
Lot Size	Minimum 4,000 to 5,000 m^2	Public health risk (human contact), Environmental contamination (insufficient area for sustainable disposal)	Of the properties listed on the Council OSSMS register: ▪ 23 properties are less than 1200 m^2 ▪ 53 properties are less than 2200 m^2 ▪ 74 properties are more than 2200 m^2
Buffer distance to permanent surface water	Minimum 100 m	Contamination of surface water.	The creeks are ephemeral, town is flood prone. 4 properties are in close proximity to a watercourse or dam.
Flood zones	OSSMS to be above the 1 in 100 year probability flood contour	Transport of wastewater off site, system failure, and for AWTS systems with electrical components – system failure and electrocution hazard.	Of the properties listed on the Council OSSMS register: ▪ 60 properties are fully impacted by flood mapping ▪ 16 properties are partially impacted by flood mapping
Site Drainage	Well drained	Resurfacing hazard – Public health risk (human contact)	Soil is clay loam with poor drainage which is not ideal for conventional trench systems.

The small lot sizes are an issue as buffer distances between OSSMs and dwellings cannot be maintained.

Access to Land Application Areas should be restricted (not be used for active recreational purposes) to ensure public health and there can be limited safe areas for outdoor space and living. Land application areas need to comply with performance requirements set by the standard for clearance from groundwater, coping with flooding and avoiding pollution of any watercourse.

The existing systems are not conforming to the required standards, and it is not possible to replace the existing on site systems with new systems due to the location and size of plots. Therefore, an off-site sewage treatment system and a reticulation system is required.

1.2.2 Future growth

Stockinbingal has been identified as an area for potential growth. Providing the infrastructure and amenity to achieve this is a priority.

The location of Stockinbingal, being 15 minutes to Cootamundra, 25 minutes to Temora, 40 minutes to Young and 30 minutes to Harden Murrumburrah, affords Stockinbingal potential as a lifestyle alternative for young families and workers in these larger localities. Additionally, Stockinbingal is an easy drive or destination for cyclists from these localities.

In the short to medium term, opportunities can be created to allow for residential infill growth in Stockinbingal and support the service and amenity industry. Economic activity which is suited to short stay visitors such as cafes, bakeries, pubs, unique experiences and amenities will ensure that opportunistic visitors will plan all future trips to include a rest stop and/or stopover in Stockinbingal.

1.2.3 Inland Rail

The proposed Inland Rail is a freight route which will connect regional areas to the ports of Brisbane and Melbourne. For the Cootamundra Gundagai Regional Council area this means that primary producers and value add industries will have rail access to the ports of Brisbane, Sydney and Melbourne.

Stockinbingal has the capacity to establish an intermodal facility which could service the proposed Inland Rail, Lake Cargelligo Branch line (connecting to Griffith via Temora – Roto Line) and Burley Griffin Way.

The existing grain depots at Stockinbingal could be further enhanced with opportunities for access to two more ports to be available through the proposed Inland Rail.

The construction of the inland rail between Stockinbingal and Illabo, offers a significant opportunity for growth in the village with employment opportunities. Industrial and commercial development as well as additional residential development will contribute significantly to the environmental risk already posed at Stockinbingal and so a sewer network will be required before these growth opportunities can be realised.

1.3 Strategic Alignment

This section assesses the alignment of the Stockinbingal Sewerage Scheme with current NSW Government and Council policies, strategies and initiatives.

Table 1-2: Strategic Alignment for Infrastructure Investment

Policy	Alignment
The NSW **Regional Development Framework** is the overarching document that "*provides a scaffold for better coordination, decision making and effort on the ground*" for coordinating investment throughout regional NSW. The framework highlights the NSW Governments commitment to regional NSW towns and the infrastructure required to support economic growth. Throughout the NSW **Regional Development Framework** document there are many themes, commitments and initiatives which both support water safety and security by mentioning: ▪ "We want to ensure that the people of regional NSW have the best access to **essential services** and infrastructure in regional Australia." ▪ "All people in regional NSW should and will have access to **essential services** and infrastructure including hospitals, schools, roads, **water**, police and emergency services. This is our commitment to ensuring that no one in regional NSW should have to choose between where they live and work and having access to the most essential services." ▪ "The NSW Government is committed to supporting the development of strong, diverse and innovative regional communities across NSW and making those communities appealing places to live, work and invest."	The Project by nature aligns itself with the themes, commitments and initiatives by: ▪ Providing regional NSW residents with essential services and infrastructure by improving sanitation services. ▪ Providing a baseline service for enabling the community to continue to attract investment and growth.
The Infrastructure NSW **State Infrastructure Strategy Update 2018** identified the following strategic objective: *"Support the growth, productivity and liveability of metropolitan and regional communities by ensuring that water security, quality and wastewater services protect public health and the environment"*	The Project contributes to the delivery of the objective by: ▪ Preventing environmental incidents from on-site systems. ▪ Ensuring that all sewage is treated to an improved effluent quality which will deliver a better outcome for the environment. ▪ Allowing residents and businesses to have more available land for outdoor space and living.

Policy	Alignment
The **CGRC Villages Strategy 2018** provides clear, strategic indicators for the development of the villages of the LGA over the next 30 years and beyond. The document notes the importance of replacing high risk on site systems stating that: "*sewer is assessed as a priority for Stockinbingal currently, but also a necessity to support future growth*". **Action 3.30:** Connect existing and future buildings to a sewer	The Project directly addresses Action 3.30 by replacing the OSSMSs with a reticulated sewerage scheme.
Council's Integrated Water Cycle Management Issues Report identified Public Health Issues which fails to meet the OSSMS compliance: ▪ OSSMs are not inspected ▪ Lot sizes in Stockinbingal are insufficient to meet the buffer areas distances for OSSMs	Replacing the OSSMSs with a reticulated sewerage scheme will address these issues.

1.4 Expected Outcomes

The primary outcome of this project will be a robust and reliable sewerage scheme for the Stockinbingal community.

Table 1-3: Issues, Objectives and Key Success Indicators

Key problem/issue	Key proposal objective	Key success indictor
Failing OSSMSs	A reticulated sewerage scheme and centralised sewage treatment plant to replace OSSMs	No environmental sewage overflows
Septic tanks on properties in flood prone land overflows during wet weather		
Some properties are too small for safe effluent disposal from absorption trenches		More private land available for recreation
Many existing properties cannot be subdivided as the lot sizes will be too small for conforming OSSMSs		Sewage management is not a major growth inhibitor for long term growth plans.
Undeveloped properties cannot be developed as the lot sizes are small for conforming OSSMSs		

1.5 Project Timing

The actual start date is dependent on the funding and regulatory approvals.

1.6 Stakeholder and Community Support

The following stakeholders have been identified as having a direct interest in the planning and development of the Stockinbingal Sewerage Scheme. They will need to be consulted throughout all stages of the augmentation.

Community: The project will provide the following social benefits to the community:

- Less health risks due to inadequate sewage disposal
- More property space to use for development and enjoyment
- A major new asset for the community.

Cootamundra Gundagai Regional Council (CGRC): Council supports the project as it will ensure that the regulatory requirements are met.

Department of Planning, Industry & Environment (DPIE) Water: DPIE Water is a key stakeholder in this process and will be involved with the Section 60 approval of the STP upgrade.

NSW Environment Protection Authority: (EPA), has an approval role prior to commencement of construction and licensing role before commissioning and in operation of the sewage treatment plant, treated effluent and waste sludge management systems.

1.6.1 Community Consultation

Council has undertaken community consultation for the Villages Strategy where the importance of a reliable sewerage scheme was highlighted.

Council will further engage with the community once the scheme is funded and development of the detailed design has commenced. Every property to be connected to sewer, residential and business, will need to be individually surveyed. The affected owners will be consulted throughout this process. As the project progresses, community information sessions will be held to inform the community of the details of the scheme.

2. Analysis of the Proposal

2.1 The Base Case

The base case for this proposal would be a "do nothing" approach where the current OSSMSs are kept. However, as several of these systems are non-conforming this is not a viable option.

Due to the lot sizes and because several properties are within the flood zone, it is not possible to upgrade existing systems to conform to Council's OSSMS Policy. Therefore the investigated options are for a reticulated sewerage network with a centralised sewage treatment plant.

2.2 Other Options Considered

2.2.1 Options Assessment - Reticulation and Treatment

An Options Assessment (Appendix A) was completed by PWA in 2019 which evaluated options for reticulation and treatment systems.

Reticulation system options

The following reticulation options were assessed:

- Pressure sewer system
- Conventional gravity sewer system

The cost estimate is shown in Table 2-1. The pressure sewer system has the lowest capital and lifecycle cost and was chosen as the preferred technology.

Table 2-1: Reticulation system options cost ($000s)

Item	Pressure Sewer System	Conventional Gravity Sewer System
Total Capital Cost	$3,165	$3,768
Total Annual Cost	$53	$18.3
NPV (7%)	$3,519	$3,716

Sewage treatment and effluent management options

The following treatment and effluent management options were assessed:

- Oxidation Pond with evaporation
- Oxidation Pond with irrigation
- Package type STP and release
- Package type STP and municipal irrigation

As shown in Table 2-2 the oxidation pond STP with an irrigation system is the lowest cost system as long as an appropriate site outside of the flood zones and away from nearby residents can be purchased by Council at a reasonable cost. The package STP option has a marginally higher capital costs but is more expensive on an NPV basis due to the higher operating cost but it also has the following potential benefits:

- Reduced potential for odour. Weather conditions such as temperature inversions and wind directions can cause odours to travel beyond the 400 m buffer of an oxidation pond STP.
- Potential use of effluent for irrigation of public areas (parks, recreation area etc.).

- Community satisfaction in having a "modern" treatment system in line with surrounding communities.
- Eliminating the need for the irrigated area with its attendant supervision, operation and maintenance issues (if the predominant effluent management strategy is release).

Table 2-2: STP Options Cost ($000s)

Item	Oxidation Pond with Evaporation	Oxidation Pond with Irrigation	Package Type STP and Release	Package Type STP and Municipal Irrigation
Total Capital Cost	$3,545	$2,829	$2,400	$2,542
Annual Cost	$30	$38	$140	$140
NPV (7%)	$3,631	$3,046	$3,726	$3,859

2.2.2 Concept Design - Secondary Treatment Technology Options

The Concept Design (Appendix B) was completed in 2020. To provide better costing for the package type treatment plants, direct supplier quotes were obtained for different technologies.

Several secondary treatment options were investigated:

- Option 1: Conventional Activated Sludge (CAS) Treatment
- Option 2: Membrane Aerated Biofilm Reactor (MABR)
- Option 3: Membrane Bioreactor (MBR)
- Option 4: Moving Bed Bio Reactor (MBBR)
- Option 5: Intermittently Decanted Extended Aeration (IDEA) reactor

Options 1-4 are for package type systems. Currently no one is offering an IDEA based package treatment plant. Therefore, for Option 5, a concrete tank IDEA option, which has advantages in terms of longevity, were investigated.

A concrete IDEA construction was recommended for this design to provide a more permanent solution and easy to operation. This type of STP will meet the quality requirements, is cost effective to provide and operate, has no propriety equipment and requires a low level of operator skill.

Table 2-3: Comparison of Secondary Treatment Options

Criteria	1 - CAS	2 - MABR	3 - MBR	4 - MBBR	5 – IDEA
Effluent quality	Good w/ Proper Design	Very Good	Very Good	Good w/ Proper Design	Good w/ Proper Design
Additional filtration required for Phosphorus removal	Yes	Yes	No	Yes	No
Footprint	Large	Very Small	Small	Small	Intermediate
Sludge Production	High	Average	Average	Very Low	Average
Complexity in operation	Low	Complex	Complex	Higher than Average	Low
Proven performance	Proven for small, medium to large STPs	Proven in other than Australia	Proven for medium to large STPs	Proven for medium STPs	Proven for small, medium to large STPs
Operator skill required	Low	Higher than average	Higher than average	Higher than average	Average
Proprietary technology	No	Yes	No	No	No
Capital Cost (whole STP)	$2.4	$2.0mil	$1.9mil	$2.2	$2.4
25-year present value cost (7%)	$4.3	$2.6	$4.5	$3.6	$3.2

2.2.3 Further Consideration

The pressure sewer network for the Concept Design included 16 properties to the east of the village boundary. Expanding the sewer network to these properties will contribute to a significant part of the capital, due to the long reticulation lines. The total cost of expanding the network beyond the village network is around $800,000.

The individual lot sizes are 4,000 m^2 and more, however, due to the poor drainage, these lot sizes might not be sufficient for safe and effective effluent disposal. Therefore, these properties have been kept in the scope. Most of these properties also span over several lots so may in the future be subject to further development. This reinforces the decision to retain these properties within the scheme.

2.3 Information about the Proposal

2.3.1 Serviced Population

A total of 127 properties have been identified for servicing including:

- 92 residential properties within the village zone boundary (land zoned RU5)
- 6 non-residential properties (2 churches, 1 school, 2 public toilets and a bowling club) within the village zone
- 8 commercial properties (7 shops and one hotel) within the village zone
- 5 properties adjoining the village zone boundary
- 16 properties to the east of the village

The average daily wastewater flow for the developed properties within and adjoining the village area is estimated to be 67 kL/day. This includes the non-residential properties such as churches, schools etc. The estimated total daily wastewater flow for the additional 16 properties (with a dwelling) outside the village area is 6 kL/day.

2.3.2 Pressure Sewer System

The proposed Pressure Sewerage System consists of small grinder pumps located on each property which macerates the sewage into a fine slurry and pumps it through a pressurised sewerage network directly or indirectly to a wastewater treatment facility.

2.3.3 STP Design

The pressure sewer modelling results were used as the input to the design flow rate and balancing requirement for the STP. Flow balancing was be used to minimise the size of the treatment plant. The inlet works was sized for 7.2 L/s, based on the daily peak inflow and the rest of the STP was designed for a maximum of 1.2 L/s based on the high daily inflow.

As there is not currently an STP, the values in Table 2-4 have been assumed, based on typical domestic strength sewage, while the effluent values are based upon typical requirement values from the EPA for modern technology STPs and discharge to inland waterways.

For reuse requirements in the future, additional chlorination and a recycled water management plan will be required to conform with the Australian Recycled Water Guidelines.

Table 2-4: Inflow and Effluent Values

Parameter	Inflow values	Effluent Values
Biochemical Oxygen Demand (BOD_5)	325-360 mg/L	10-15 mg/L
Faecal Coliforms		200 CFU/100 mL
Suspended Solids (SS)	275-300 mg/L	15 -20 mg/L
Ammonia		2-5 mg/L
Total Nitrogen (TN)	60-70 mg/L	10-15 mg/L
Total Phosphorus (TP)	13-15 mg/L	0.5 – 1 mg/L

2.3.4 Proposed New Infrastructure

The new infrastructure to be delivered as part of this proposed scheme includes:

A Pressure Sewerage network consisting of:

- 121 simplex pump units, control/alarm panels and associated electrical/control wiring
- 5 duplex pump units, control panels and associated electrical wiring (Elwood Hall, Bowling Club, School and public toilets)
- 1 quadraplex pump unit, control panel and associated electrical wiring (Commercial Hotel)
- 3,800m of DN40 property discharge pipework from the collection tank to the street network
- Street reticulation network 6,300 m long consisting of DN50-DN125 polyethylene pipes
- Network storage of about 16,500 L
- 4 air valves and vent pipes
- 14 flushing and 11 isolation valves.

A new STP which will include:

- An inlet screen
- A 50kL emergency storage tank
- A concrete IDEA reactor and balance tank
- Alum and caustic dosing facilities
- A UV disinfection unit and an effluent pump to Dudauman Creek (provisional)
- A sludge tank and geobag sludge drying system
- Interconnecting pipework and pumping
- Electrical Switchboard with HMI (Touch Screen)
- Provision for remote monitoring via a telemetry system
- A new power supply
- A containerised amenities building which will include a control room and a laboratory.

Figure 2-1 provides an aerial overview of the sewerage scheme.

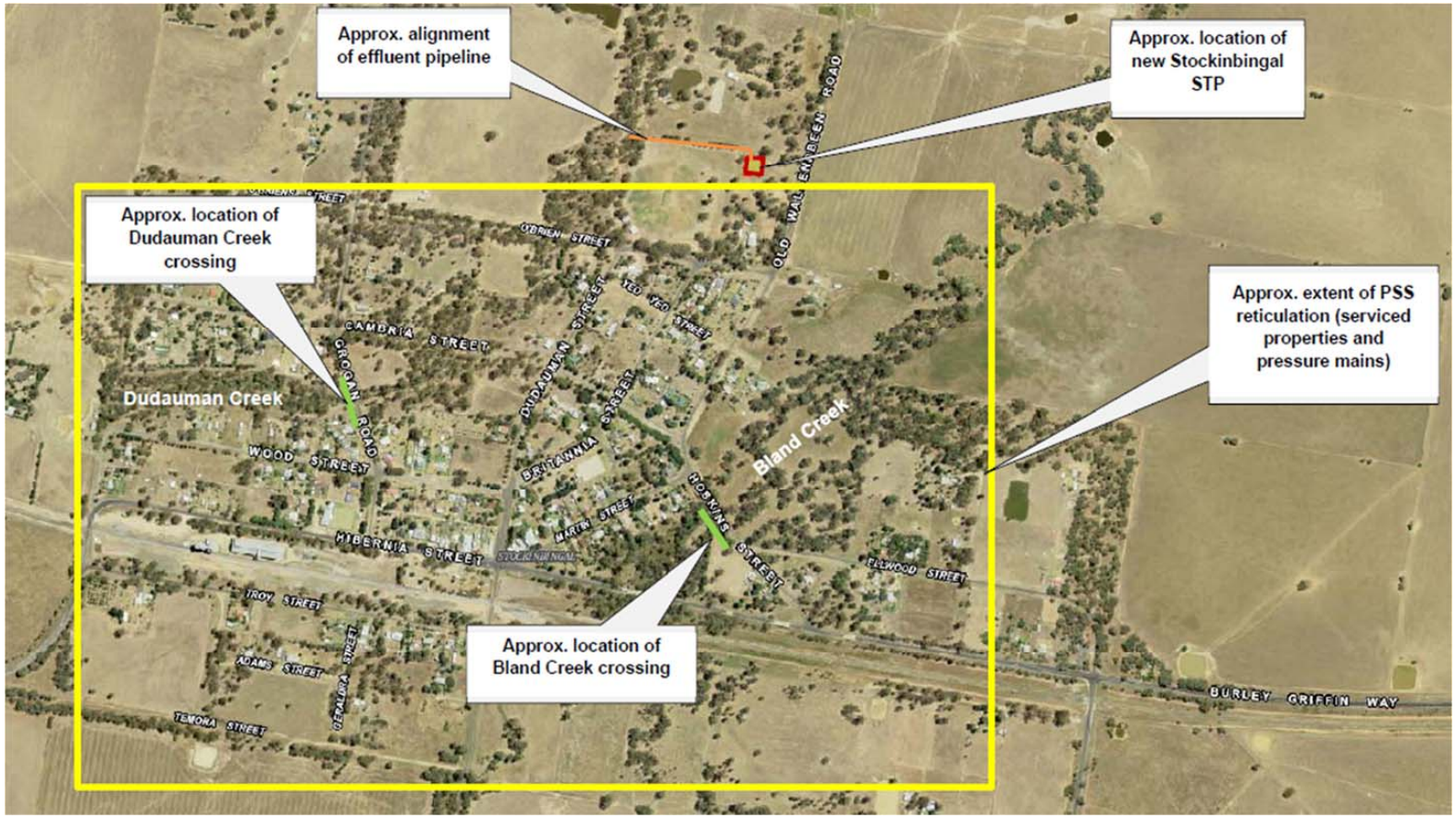

Figure 2-1: Aerial view of the proposed sewerage scheme area (Six Maps)

2.4 Projected Costs

The capital cost has been determined based on the following:

1. Industry experience and comparison to similar projects and tender prices
2. Actual quantities of materials required
3. Actual supplier quotes with added contractor margins

Table 2-5 and Table 2-6 show the summaries of the estimated project costs for the reticulation and STP. The total project cost is: **$6,7 Million**. The cost breakdown is included as an Appendix in the Concept Design Report.

Table 2-7 shows a breakdown of the estimated operation and maintenance cost for the project. The power cost for each individual pressure pump will be carried by the residents. Table 2-8 shows the total expected cost of the project.

Table 2-5: Pressure Sewerage Network – Estimated Cost Summary

	Cost Item	Cost (includes GST)
1.	Site Establishment	$110,000
2.	Pressure Units	$1,373,200
3.	Reticulation	$1,365,000
4.	Miscellaneous	$44,000
	Sub Total – Direct Construction Costs	**$2,892,200**
	Contractor Indirect Costs	$144,610
	Total Construction Costs	**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)	$682,800
	Survey, Investigation, Design and Project Management	$289,220
	Total Estimated Project Cost[1]	**$4,008,830**

Note: 1 – Total Estimated Project Costs do not include client costs such as community consultation and client liaison by the project manager.

Table 2-6: Sewage Treatment Plant – Estimated Cost Summary

Item No	Description	Cost (includes GST)
1.	Site Establishment	$108,000
2.	Roadworks and Site Drainage	$90,000
3.	Emergency Balance Tank	$25,200
4.	Inlet Works	$90,000
5.	Concrete IDEA reactor and balance tank	$728,471
6.	Sludge Tank	$18,200
7.	Sludge Dewatering	$83,700
8.	Chemical Dosing	$20,000
9.	Disinfection	$30,000
10.	Treated effluent outfall pump	$9,000
11.	Amenities Building	$200,000
12.	Pipework, Valves and Fittings	$72,500
13.	Installation/Testing/Commissioning	$145,000
14.	Electrical Works	$364,100
15.	Potable water connection to STP	$10,000
16.	Miscellaneous	$90,000
	Subtotal	**$2,084,171**
	Project Contingency (20%)	$416,834
	Survey, investigation, design and project management (10%)	$208,417
	Total Estimated Capital Cost	**$2,709,422**

Table 2-7: O&M Costs

	Cost Item	Cost (includes GST)
1.	Power (residents)	$3,175
2.	Pump replacement (5% per annum)	$65,000
	Sub Total – Pressure Sewer O&M	**$68,175**
3.	Power	$25,000
4.	Maintenance	$50,000
5.	Operation (labour)	$65,000
	Sub Total – STP O&M	**$140,000**
	Annual Cost	**$208,175**

Table 2-8: Summary of Total Project Cost Calculation

Data Input	Net Present Value (7%)	2020-2021	2021-2022	2022-2023
		Year 0	***Year 1***	***Year 2***
Design and Project Management	$465,081		$497,637	
Total Direct Construction Cost	$4,472,863			$5,120,981
Contingency	$960,463			$1,099,634
	Net Present Value	***Year 0***	***Year 1***	***Year 2***
Project Capital Costs Total	$5,898,407	$0	$497,637	$6,220,615
				Annual Total
Operation and Maintenance Costs	$2,791,427			$208,175
NPV for 30 Year Project Life	**$8,689,835**			

2.5 Cost Benefit Analysis

2.5.1 Benefits from the new Sewerage Scheme

The Population for Stockinbingal as a locality had 374 inhabitants in the 2016 census with an average of 2 people per household. Table 2-9 shows the quantifiable benefits which apply for the Sewerage scheme.

Table 2-9: Input Values for Cost Benefit Analysis

Benefit	Unit	2020 Adopted Value
Avoided Cost of Pump Out Sewerage System Servicing	$/Household/Year	$3,480
Avoided Cost of Septic System Maintenance	$/Household/Year	$414
Avoided Cost of AWTS Servicing	$/Household/Year	$394
Social Cost of Water Borne Disease	$/Person/Year	$330
Improved Environmental Water Quality (Significant Impacts)	$/Household/Year	$411
Improved Riverine Habitat	$/Household/Year	$9

2.5.2 Benefit Cost

The following table shows a summary of the benefits for the current population over a 30-year period for a 7% discount rate. The benefits also include a once off residual value based on an average asset lifespan of 45 years. The asset lifespan is based on 50 years for civil structures (highest capital cost) and 20 years for mechanical equipment and 70 years for the mains.

Table 2-10: Cost of Benefits

Benefit	Quantity	30 year total benefit cost
Avoided Cost of Onsite Wastewater Pump out	6 failed systems	$204,302
Avoided Cost of Septic Servicing and Maintenance	114 septic systems to be replaced	$461,753
Avoided Cost of AWTS Servicing	13 AWTS to be replaced	$50,076
Social Cost of Water Borne Disease	374 people	$1,207,155
Improved Environmental Water Quality (Significant Impacts)	187 households	$752,239
Improved Riverine Habitat	187 households	$16,055
Residual Value	45 year average asset lifespan	$195,862
Total		**$2,887,442**

2.5.3 Benefit/Cost Ratio (BCR)

Using the cost and benefits from the previous section, a BCR of above 1 was calculated. Table 2-11 shows a sensitivity analysis for various discount rates.

Table 2-11: Sensitivity Analysis

Rate	Total Costs	Total Benefits	Net Benefits	BCR
3%	$10,635,166	$4,809,452	-$5,825,714	0.45
7%	$8,689,835	$2,887,442	-$5,802,393	0.33
10%	$7,764,024	$1,909,070	-$5,854,954	0.25

2.6 Proposed Funding Arrangements

Council is requesting 50% funding.

Table 2-12: Proposed capital funding contributions ($000s)

Stage	2019-20	2020-21	2021-22	2022-23	2023-24	Remaining Years	Total
Proposal capital costs		498	6,221				
Funding sources							
NSW Government (subject of this request)		249	3,110				**3,359**
Council contributions		249	3,110				**3,359**
Industry contributions							
Community contributions							
Other government contributions							
Other funding sources (please detail)							
Sub-total		**498**	**6,221**				**6,718**

2.7 Financial Appraisal

The scheme is not specifically noted in the long-term (30-year) financial plan (LTFP). If funding is provided, then it would be included. As with the other villages within the Council area, customer charges would be levied, and Council would provide the operation and maintenance of the scheme.

The scheme has not had a specific financial appraisal at this stage.

3. Implementation Case

Cootamundra Gundagai Regional Council is busy with the $15 Million upgrades of the Gundagai STP, showing their capacity, capability, resources and project management experience to deliver major capital projects.

The Concept Design for the STP and PSS was completed in 2020. Two project packages will be undertaken for the next project stages, one for the new STP and one for the PSS. These projects will run in parallel and be implemented in such a way that the STP will be completed before the properties are connected to the new reticulation.

3.1 Sewage Treatment Plant

Council will engage suitably qualified consultants to complete a detail design for the new STP. This phase involves the development of civil, structural, mechanical, electrical and process detailed design drawings for the new STP. The development of the technical specification and supporting documentation for the construction tender will also be included.

The detail design will then be constructed through a construct only contract.

3.2 Pressure Sewer System

This contract package involves the development of a design and construct contract documentation for the provision of the PSS for the village.

Suitably qualified consultants will prepare a Technical Specification based on a design and construction delivery model. The specification will include design requirements and a construction specification to facilitate ease of delivery.

Council will also undertake the following actions:

Suitable Access to Properties

As part of the detailed design, properties will be examined to identify any potential access issues.

The need to maintain a clear and safe access to the Pressure Sewerage infrastructure will be conveyed to property owners so they understand what is required.

Compliance of the Electrical Distribution Board

Electrical distribution boards need to comply with AS3000 the National Electrical Installation Standard. In practice this means that when the electrical supply to the pressure sewer systems control alarm panel is made the electrician has a responsibility to ensure that the electrical distribution board is compliant. While the power demand from the pressure sewer pump is not significant the original electrical distribution board may not be compliant and may need to be replaced.

In order to understand the number of electrical distribution boards which are not compliant, Council will undertake an audit occur during the detailed design stage. These costs are typically borne by the resident so have not been included in the estimate.

4. Program and Milestones

Event	Start	Finish
Concept design s. 60 endorsement	Complete	
Environmental impact assessment/review of environmental factors	Complete	
Environmental, planning and development approvals obtained	Jul-21	Oct-21
Detailed design	Jul-21	Dec-21
Detailed design s. 60 approval	Dec-21	Jan-22
Develop tender documents, call for tenders	Jan-22	Feb-22
Review and award tender	Feb-22	Apr-22
Development of management plans (by contractor)	May-22	Jun-22
STP Construction	Jul-22	Mar-23
PSS and reticulation Installation	Feb-23	May-23
Commissioning	Mar-23	Jun-23
Training/handover to council/defects liability	Jun-23	Jul-23

5. Governance

5.1 Organisational Structure

The development of a governance structure for the development of the project is an important stage in the planning and construction process. An effective governance structure will ensure consistency in the decision-making process and will assign responsibility to the relevant groups for the ongoing management and delivery of the project.

Reports will be presented to Ordinary Meeting of Council for their consideration and resolution for commitment of Council funds. Tenders for construction will also be presented to Council for decision and resolution.

5.1.1 Indicative Governance Structure during Implementation

The governance arrangements during implementation of the project have yet to be finalised. The governance and project management structure will need to facilitate appropriate engagement by CGRC.

During the construction phase, the groups are anticipated to consist of the following:

- Project Sponsor, which will be responsible for the overarching delivery of the Project, including the expenditure to construct the projects. The Project Control Group (PCG) will report to the Sponsor on a monthly basis or as needed to report on progress, material issues affecting construction, and expenditure versus an established budget.
- Project Control Group, which will meet monthly to receive a report from the Project Manager on behalf of the Project Team. The PCG will be responsible for reporting to the Steering Committee and managing the Project Team. The Project Steering Group is a group of senior executive and middle level management stakeholders responsible for:
  - managing the Gate Review process
  - reviewing project progress
  - providing approval for a project to go forward to the next Phase
  - require the project manager to provide further information or re-work before a project proceeds to the next Phase
  - recommend stopping the project
  - Providing guidance on overall strategic direction and endorsing recommendations from the Project Manager.
- The Project Manager (appointed by Council) provides overall management and responsibility of the project:
  - Develops strategic project documents in conjunction with the Steering Group
  - Manage and monitor the project, budget, time and scope
  - Manages and resources the project team, its structure, roles, responsibilities and performance
  - Communicate and consult with stakeholders and the project team
  - Oversees project procurement activities
  - Facilitates hand over after project close.
- The Project Team will consist of Council staff and consultants

5.1.2 Interface with the Construction Contractor

- The contractor will be responsible for delivering the project.
- Council will act as Principal under the contract.
- The Project Manager will be appointed as the Principal's Authorised person and will undertake the contractual correspondence on behalf of Council.
- All variations and extensions of time will require the approval from Council.
- The Council will retain the role of Principal's Senior executive under the contract. This will involve supervising the performance of the Principal's Authorised person and having an active role in resolving any disputes.

The proposed governance structure is detailed in the figure below.

Figure 5-1: Proposed Governance Structure

5.2 Key Risks

The largest risk is to not upgrade the OSSMSs to conform to the current guidelines. The current risks are to property owners, the community and environment from failure of the aged and non-conforming infrastructure. As such it is Council's desire to replace the OSSMSs with a centralised sewerage scheme. Funding will speed up this project thus lowering ongoing risks.

Council will identify ongoing risks by drawing on a systematic consideration of the key elements from concept development through to post-completion reviews and maintenance operation. Risks may include aspects of environmental factors, oversight of design development, tendering availability of suitable tenderers and approach to maintenance responsibilities.

The required works has been investigated by an options assessment and developed in a concept design to ensure that the scope is clear. During the next design phase, the construction requirements will be finalised.

To eliminate most of the risks for the construction phase the following will be undertaken:

- The construction methodology will be considered during detail design.
- The Contractor will need to provide a detailed construction methodology as well as a safe work method statements which will need to be adhered to.
- Typical, multiple stage reviews for compliance, will be undertaken at the Tender stage and during construction.
- The Construction Hazard Assessment Implication Review (CHAIR) process will also be followed

As part of the Request for Tender (RFT) documentation, the Contractor will be required to provide a detailed commissioning plan. Equipment will need to be stage tested with a dry test, clean water and then a 14 day operational test before sewage cut-ins are undertaken. Standby equipment to be provided to minimise risks.

Table 5-1 shows the main risks of the project as well as the proposed mitigation.

Table 5-1: Key Project Risks

Risk	Proposed mitigation	Risk rating after mitigation		
		Likelihood	Consequence	Rating
Non-acceptance from community for new infrastructure	Council will undertake a community consultation during the design phase. Information about Pressure Sewerage Systems will be provided to property owners.	Unlikely	Moderate	Moderate
Non-Compliance of Electrical distribution boards	Audit during the design stage to identify non-compliant electrical distribution boards to be upgraded during the project delivery.	Possible	Minor	Low
Insufficient operational knowledge on PSS for council staff and property owners.	Information about Pressure Sewerage Systems will be provided to property owners. Training of maintenance staff to understand Pressure Sewerage Systems and how to respond will occur prior to project commissioning.			
Network Main Crossing of Railway	Preliminary discussions with ARTC indicate that the location is suitable. Council will continue to involve ARTC during the next design phases.	Unlikely	Minor	Low
Unable to obtain a Section 60 approval	DPIE Water has been involved in the Concept, REF and will be involved during the detail design stage.	Unlikely	Minor	Low
Proposed site location for STP is Crown Lands and part of an Aboriginal Land Claim	Council is working on resolving the land claim.	Possible	Moderate	Moderate
Increased scope due to geotechnical issues	Complete Geotechnical investigation during the concept design	Possible	Moderate	Moderate
Change to regulatory requirements	Close interaction with regulatory authorities to ensure that the augmentation will comply with requirements	Unlikely	Moderate	Moderate
Industry does not respond to procurement strategy	Alter the conditions and/or documents. Invite responses from selected contractors	Rare	Moderate	Low
Total project costs not identified	Economic appraisal completed Ensure appropriate risk apportionment, including risk of remote location loading Include statement of assumptions in tenders Include schedules for tenderers to break up their costs	Rare	Minor	Low

Risk	Proposed mitigation	Risk rating after mitigation		
Impacts on local community: • Odours • Access • Noise • Dust	Document standards to be maintained during construction in tender Comply with statutory requirements Liaise with community	Unlikely	Insignificant	Low
Consultancy/Contractor's ongoing financial viability	Assess financial capacity of Consultancy/ Contractor prior to awarding contract. Contract include termination rights and criteria in contract	Possible	Insignificant	Low
Accident during construction	The Contractor will need to provide a detailed construction methodology as well as safe work method statements (SWMS) which will need to be adhered to.	Rare	Moderate	Low
Sewage overflows during construction of PSS	The construction methodology will be considered during detail design and the Contractor will be required to develop a detailed construction methodology.	Rare	Moderate	Low
Non-compliance of effluent from STP during commissioning	As part of the RFT documentation, the Contractor will be required to provide a detailed commissioning plan. Equipment will need to be staged tested with a dry test, clean water and then a 14 day operational test before sewage cut ins are undertaken.	Unlikely	Minor	Low
Accident during commissioning	SWMS for construction tasks and ensure all safety infrastructure in place such as handrailing, emergency stops etc.	Unlikely	Minor	Low

5.3 Legislative, Regulatory Issues and Approval

The upgrade will need to conform to the following regulatory requirements:

- **DPIE Water**, which undertakes administration of government financial assistance to Local Government for the provision of water and sewerage services in NSW country. This Office has an approval role (Section 60) in the construction of sewerage works and advisory role in sewerage operations under the Local Government Act, including trade waste.
- **NSW Environment Protection Authority** (EPA), which has an approval role prior to commencement of construction and licensing role before commissioning and in operation of the sewage treatment plant, treated effluent and waste sludge management systems.
- **NSW Office of Environment and Heritage** (OEH), which has a regulatory role in relation to biodiversity, Aboriginal culture heritage, waters and rivers, wildlife management and native vegetation.
- **NSW Planning and Environment**, which has an approval role about environmental planning of the augmentation.
- **SafeWork NSW**, which has the statutory responsibility to enforce the Work Health and Safety (WHS) Act and WHS Regulations.
- **Australian Rail Track Corporation** (ARTC), which has an approval role (approval to enter the rail corridor, and approval in Principle for laying pressure mains) within the railway corridor.

5.3.1 Section 60 Approval

Any significant modification to, or development and construction of local water utility water or sewage treatment works requires approval under Section 60 of the Local Government Act 1993. The process for obtaining Section 60 approval where the construction of the works will be carried out by a contractor, comprises the following steps:

- Step 1 – Initial Consultation
- Step 2 – Options Study
- Step 3 – Concept Design
- Step 4 – Specification
- Step 5 – Tender
- Step 6 – Detailed design
- Step 7 – Approval

In undertaking the Integrated Water Cycle Management (IWCM) Strategy, a local water utility will have completed the first two steps of the process. Council has completed an Options Assessment and Concept design for the Stockinbingal Sewerage Scheme which has been submitted to DPIE Water for in Principal Approval.

5.3.2 Review of Environmental Factors

As part of the Concept Design, PWA undertook a review of environmental factors (REF). A number of temporary construction related impacts were identified due to the proposed works. This includes impacts to land use and visual amenity, increased traffic, elevated noise and waste management.

Given the implementation of appropriate mitigation measures, the proposal is not expected to result in a significant impact to the community.

By adopting the safeguards identified in the REF it is unlikely that there would be significant adverse environmental impacts associated with the proposed works. Therefore, an Environmental Impact Statement would not be required.

5.4 Project Management Activities

5.4.1 Risk Management

During the detail design phase, several risk workshops will be done to ensure that work health and safety (WHS) as well as environmental risks will be identified and mitigated before the delivery stage. These workshops will include a Safety in Design and hazard and operability (HAZOP) workshop.

The GC21 preliminaries will be followed during the delivery stage for WHS and environmental risk management.

Key risks and risk activities will be reported through the governance structure monthly i.e. to the General Manager, Steering Committee and Councillors. Should critical risks be identified by the Project Team, these risks will be escalated immediately through the governance structure.

5.4.2 Asset Management and Operations

CGRC will take the ownership of the Stockinbingal Sewerage Scheme. CGRC will also be responsible for the maintenance and operation of the new infrastructure, except for the power demand of the individual pressure pumps which would be the responsibility of each resident. A Project Handover report will be required at the end of construction.

The operational and maintenance cost will be included in Council's financial plans.

Appendix A Options Assessment

NSW GOVERNMENT Public Works Advisory

Stockinbingal Sewerage Scheme

Options Study Report

Report Number: ISR19014

February 2019

Prepared for:

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

Public Works Advisory

Options Study Report

Stockinbingal Sewerage Scheme

Report Number: ISR19014

Document control

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Executive Summary

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales. Stockinbingal is 388 km south-west of Sydney and 102 km north-east of Wagga Wagga. The town has a population of approximately 250 at present.

The town does not have a reticulated sewerage scheme and relies on onsite systems including septic tanks. Cootamundra-Gundagai Regional Council (CGRC) is looking to provide a reliable and effective reticulated sewerage scheme for Stockinbingal.

The objective of this options study is to examine and compare options for both the collection and transport systems as well as the sewage treatment and effluent management.

The constraints and challenges in Stockinbingal includes flooding, the spread out nature and relatively small number of houses and the flat topography.

Collection and Transport System Options

Pressure Sewer System

Under this system, each property is provided with a pressure pump unit in its own small tank. The pump units can be located close to the existing septic tanks. The village would be served with a network of pressure mains connecting all pump stations. With this system, the placement of pipes is very flexible and has a minimal construction impact. The system is suited to the flat terrain and large block sizes. Council would own and operate the pump units, but householders would be required to pay the power costs of running the pump, which is approximately $20 per year.

As Stockinbingal is flood prone, each pump unit would be able to be turned off when flooding occurs and restarted afterwards. The system will be protected by placing the control box and system vent above the 1 in 100 flood level and the pump station will be protected from inundation and floatation. This system has been shown to be robust and reliable with numerous installations in Australia.

Conventional Gravity Sewer System

A gravity collection system consists of gravity reticulation, pumping stations and rising mains. Sewage from individual lots flows through the gravity mains to a downstream pumping station. It is then lifted through a pressurised rising main to either another gravity main, transfer pumping station or sewage treatment plant. Ultimately it will reach a treatment plant via pressure or gravity main/s. During wet weather gravity sewers can receive inflow/infiltration of storm water which has to be accommodated in the design of the system. Flood events will also transfer stormwater to the system.

In addition, gravity sewers need sufficient flow velocity to keep pipes clean by preventing deposition of solids. These criteria lead to deep excavation and/or the need to use of pumping stations in flat areas which increases the costs and disruption to the town from the deep excavations. Some pressure units are provided to service difficult properties. This system has been shown to be robust and reliable.

Sewage Treatment and Effluent Management

The options that have been examined for the provision of a sewage treatment plant for Stockinbingal are as follows:

- A basic oxidation pond sewage treatment plant (STP) which consists of a series of ponds and has very low operational input, very low power demand but produces a basic quality of effluent.
- A modern mechanised STP based on the intermittently decanted extended aeration process. This type of STP services many towns across NSW and is proposed for the upgrade of the Gundagai STP. A smaller package type plant would be applicable for

Stockinbingal. The plant requires a reasonable level of operator input and significant power to run the mechanical systems but produces a high-quality effluent.

The options for the management of the effluent produced by the STP include evaporation in shallow basins, irrigation of pasture and/or community facilities and release to local waterways. The applicability of each option will depend on the STP type and availability of land, desire for reuse and proximity to water ways. Each has advantages and disadvantages that need to be assessed. For example, irrigation of pasture would be suitable for the effluent generated by the oxidation pond and IDEA STP. If the effluent needs to be released to a waterway, this will only be allowed from the IDEA STP as this STP will produce a high-quality effluent.

Oxidation Pond Sewage Treatment Plant with Effluent Irrigation

Oxidation ponds systems have widespread use in small to medium sized treatment plants because of their low capital costs and maintenance requirements compared to an activated sludge STP. The disadvantages can be odour generation and the relatively poor effluent quality produced which restricts uses to evaporation and rural irrigation. The STP also needs to be constructed above the 1:100 year flood levels and requires a large footprint.

The required site, around 10 ha, would need to be purchased by Council, therefore the land availability and cost is an important factor. The STP and effluent management system would consist of the following:

- an inlet structure/chamber
- two oxidation ponds 44 m x 44 m
- two maturation ponds (total of 25 day hydraulic residence time) 44 m x 21 m
- a wet weather storage pond 92 m x 31 m (5 ML)
- interconnecting pipework and overflow structure
- an irrigation system for the required irrigation area of 4 ha
- associated site services including access road and fencing

Package Treatment Plant

A package STP is a smaller version of the municipal IDEA (intermittently decanted extended aeration) reactor system which is the most commonly used secondary biological treatment process in NSW. The IDEA is a modified form of the activated sludge treatment process. The process has been developed by Public Works Advisory and is utilised at about 130 plants in NSW. The advantages of this STP is the ability to produce a high-quality effluent suitable for a range of uses or disposal and has a small footprint

Sewage will be delivered to the inlet works through the incoming rising main. Preliminary treatment is to be provided for the automatic removal and handling of gross solids, grit and rags. The secondary treatment process proposed is an intermittent decanted extended aeration (IDEA). Phosphorus removal may be achieved by either chemical or biological means. Ultraviolet irradiation is an effective disinfection method for secondary effluent of low colour, turbidity (< 5 NTU) and suspended solids. This can be provided by an artificial UV system. These are well proven and have been used extensively in STPs across NSW. The system would be designed to reliably meet the required disinfection target of 200 FC/100 mL.

A package STP is an alternative option if Council prefers a higher quality effluent for release to one of the nearby creeks (Dudauman Creek or Bland Creek) of for irrigation of municipal grounds such as the recreation ground.

Cost Estimates

The estimated costs have been detailed in Section 7. The Tables below provide a summary of the estimated capital cost for the various options.

The pressure sewer system has the lowest capital and lifecycle cost.

Table S1: Reticulation System Cost

Item	Pressure Sewer System	Conventional Gravity Sewer System
Construction Cost		
Pressure Units	$899,500	$35,000
Reticulation	$1,050,000	$1,369,250
Rising Main to STP	$485,000	$650,000
Sewage pump stations		$637,304
Construction Cost	**$2,434,500**	**$2,691,554**
Contingency	$486,900	$672,888
Survey investigation and design and project management	$243,450	$403,733
Total Capital Cost	**$3,164,850**	**$3,768,175**
Per tenement construction cost	$26,156	$31,142
Residents		
Power	$3,000	
Council		
Pump replacement (5% per annum)	$45,000	
Power		$1,300
Operation and maintenance		$12,000
Chemical Dosing	$5,000	$5,000
Total Annual Cost	**$53,000**	**$18,300**
NPV (7%)	**$3,519,286**	**$3,715,530**

As shown in Table S2 the oxidation pond STP with an irrigation system is the lowest cost system as long as an appropriate site outside of the flood zones and away from nearby residents can be purchased by Council at a reasonable cost. The package STP option has a marginally higher capital costs but is more expensive on an NPV basis due to the higher operating cost but it also has the following potential benefits:

- Reduced potential for odour. Weather conditions such as temperature inversions and wind directions can cause odours to travel beyond the 400 m buffer of an oxidation pond STP.
- Potential use of effluent for irrigation of public areas (parks, recreation area etc.).

- Community satisfaction in having a “modern” treatment system in line with surrounding communities.
- Eliminating the need for the irrigated area with its attendant supervision, operation and maintenance issues (if the predominant effluent management strategy is release).

Table S2: STP Options Cost

Item	Oxidation Pond with Evaporation	Oxidation Pond with Irrigation	Package Type STP and Release	Package Type STP and Municipal Irrigation
IDEA Based STP			$1,138,000	$1,138,000
Chlorination System				$25,000
Oxidation Ponds	$253,395	$253,395		
Evaporation Pond	$1,425,520			
Maturation/storage ponds		$536,605		
Irrigation system (pump and irrigation system)		$250,000		$80,000*
Pipework	$100,000	$100,000	$100,000	$100,000
Roadworks	$452,000	$550,400	$60,000	$60,000
Fencing	$45,200	$55,040	$6,000	$6,000
Power	$100,000	$100,000	$274,000	$274,000
Inlet structure	$150,000	$150,000	$150,000	$150,000
Land $10,000/ha	$100,000	$100,000	$50,000	$50,000
Construction Cost	**$2,626,115**	**$2,095,440**	**$1,778,000**	**$1,883,000**
Contingency 25%	$656,529	$523,860	$444,500	$470,750
Survey investigation and design and project management 10%	$262,612	$209,544	$177,800	$188,300
Total Capital Cost	**$3,545,256**	**$2,828,844**	**$2,400,300**	**$2,542,050**
Power		$8,000 (irrigation system)	$25,000 (STP)	$30,000 (STP + irrigation)
Maintenance	$5,000 (mowing)	$5,000 (mowing)	$50,000	$50,000
Operation (labour)	$25,000 (0.25 x operator)	$25,000 (0.25 x operator)	$65,000 (1 x operator or 2 x part time)	$65,000 (1 x operator or 2 x part time)
Annual Cost	**$30,000**	**$38,000**	**$140,000**	**$140,000**
NPV (7%)	**$3,631,143**	**$3,046,352**	**$3,726,433**	**$3,858,910**

* One nearby irrigation system and a small storage tank

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Abbreviations

Abbreviation	Description
ADWF	average dry weather flow
AEP	Average Exceedance Probability
CFU	colony forming units
CGRC	Cootamundra-Gundagai Regional Council
d	Day
dia	Diameter
DDWF	design dry weather flow
DO	dissolved oxygen
EP	equivalent person
EPA	Environment Protection Authority
FC	faecal coliforms
IDEA	intermittent decanted extended aeration
kg	kilogram
kL	kilolitre
km	kilometre
kW	kilowatt
L/EP/d	litres per equivalent person per day
L/s	litres per second
mg/L	milligrams per litre
ML	megalitres
NH_3–N	ammonia nitrogen
P	phosphorus
PDWF	peak dry weather flow
pH	measure of acidity/alkalinity on scale of 1 to 14 respectively
POEO	Protection of the Environment Operations Act 1997
PS	pumps station
PWWF	peak wet weather flow
SID	survey investigation and design
SPS	sewage pumping station
SS	suspended solids
STP	sewage treatment plant
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TP	total phosphorus
TWL	top water level
WHS	work health and safety

1. Introduction

1.1 General

The objective of this Options Study Report is to examine options for the provision of a reticulated sewerage scheme for Stockinbingal.

The majority of the current on-site treatment systems are septic tanks which dispose of effluent into adsorption trenches. It is suspected that the problems associated with the existing on-site systems are:

- Pollution from on-site sewage treatment systems is a risk to residents in flood prone areas, where systems are in a poor condition and due to the low permeability of the soils present which affects absorption.
- Odour generation due to relatively poor condition of the adsorption trenches and/or septic tanks.
- Ongoing maintenance requirements for residents.
- Ongoing inspection by Council.

1.2 Scope of the Study

The following has been investigated:

- Collection systems - The constraints at Stockinbingal are the small number of houses, large distances between houses and flat topography. These constraints make the provision of gravity based sewerage systems potentially expensive. The preferred system for servicing a village such as Stockinbingal is likely to be a pressure sewer system which will be investigated in detail. Conventional gravity sewerage will also be assessed for comparison.
- Sewage treatment plant and effluent management – Two treatment options and four effluent management solutions will be investigated.
    - Oxidation Pond STP – Assess the requirements for an oxidation pond treatment system with evaporation and effluent reuse options.
    - IDEA based STP - Assess the requirements for a package type IDEA based STP for discharge to a local creek. Accepted Modern Technology EPA Licence conditions would be applicable. Effluent reuse, irrigation of municipal facilities, is also an option with this STP. Basic unit sizing would be undertaken to allow costs to be estimated.

2. Population and Design Loading

2.1 General

The design of a sewage collection and transport system is based on the size of the population to be served and the number and type of dwellings and developments. Consequently, the establishment of population and tenement data is required as part of the study.

The design flows for the pressure system are different to a conventional gravity system in that the system is totally sealed. Therefore, peak flows, normally generated from stormwater that infiltrates into a sewerage system during rain events, are a lot lower. The collection and transport system components such as pipelines and transfer pumps are therefore smaller as compared to a normal gravity system.

2.2 Population and Tenements to be Serviced

Council has provided a map showing the location of the current habitable dwellings in Stockinbingal. The map shows 92 dwellings inside the village border and 21 dwellings outside the border which may also be connected to the sewerage network. The map also indicated the location of the school, churches and other tenements to be connected.

2.3 Design Criteria

2.3.1 Design Flows

Pressure System Design Flows

Stockinbingal is likely to be sewered via a pressure sewer system and will transfer loads at 4 x ADWF to the STP. Potential sewage flows from Stockinbingal are as follows:

- 113 ET @ 2.3 occupancy ratio ~ 260 EP (current)
- 20% allowance for growth ~ 50 EP
- Design population – 310 EP
- Standard ADWF allowance – 210 L/EP/d
- ADWF = 0.75 L/s
- PWWF = 3 x ADWF = 2.3 L/s (pressure sewer)

Gravity System Design Flows

- ADWF = 0.75 L/s
- PDWF = 2.3 L/s
- SA = 0.04 L/s/ET
- PWWF = 4.5 L/s

It should be noted that the adoption of a peak flow factor of 3 or 4 for a PS system is in accordance with criteria developed by the Urban Water Research Association of Australia (UWRAA). Note that for pressure systems, there should be no wet weather infiltration, other than illegal connections to the system. No specific allowance is made for wet weather flows. However, the systems are capable of pumping in excess of ADWF. The ultimate pumping rate is self-limiting, based on the cut out switch on the pumps and the rising main capacity. The final design will need to consider the maximum probable flow in these conditions. This is consistent with accepted practice in NSW.

STP annual flows are expected to be 26 ML.

2.3.2 Design Standards

The design of a pressure system is to the WSAA 07-2007 1.1 Pressure Sewerage Code of Australia. (Reference 2)

The design of the gravity collection system will follow the approach for Modified Conventional Sewerage as outline in the publication WSAA Affordable Water Supply and Sewerage for Small Communities 1999 (Reference 4)

2.3.3 Biological Loads

As there is no available data on the biological loadings for the town, unit loadings have been adopted based on standard loading allowances. The design unit loadings adopted are summarised in Table 2-1.

Table 2-1: Unit Biological Loadings

Parameter	Unit Loading
Biochemical Oxygen Demand (BOD)	70 g/EP.d
Suspended Solids (SS)	70 g/EP.d
Total Nitrogen (TN)	12.7 g/EP.d
Total Phosphorus (TP)	2.7 g/EP.d

3. Collection System Options

This section discusses the works required for the provision of a reticulated sewerage system for Stockinbingal. The components of the system including pumping stations, pressure reticulation and rising mains are discussed. Transfer options to the STP are examined later in the report.

3.1 Pressure Sewerage System Description

3.1.1 Individual Pump Units

A pressure system has a grinder pump located inside a holding tank (pump/tank unit) and a boundary kit located at every property.

The dwellings are connected to the tank inlets via conventional house drains. Each residence would have its own pump/tank unit. The pump unit would typically be located between the house and the existing septic tank and would intercept the existing household sewer line. At a pre-set level in the tank the pump activates, and any solids are ground and then pumped to the pressure sewerage reticulation system.

The sewer pressure mains would be located in the street and connected to a boundary kit, which marks out the boundary between a house service and the pressure sewer main network. This inground box will be marked 'Pressure Sewer. Do Not Bury' and will house a combination ball valve, one-way valve and inspection point. These valves provide means of isolation of the property from the network to allow maintenance to occur. A small diameter pipeline would connect the pump/tank unit on each property to it. A typical pressure sewer installation for a single dwelling is shown in Figure 3-1. Figure 3-2 shows a typical layout for an installed pressure unit.

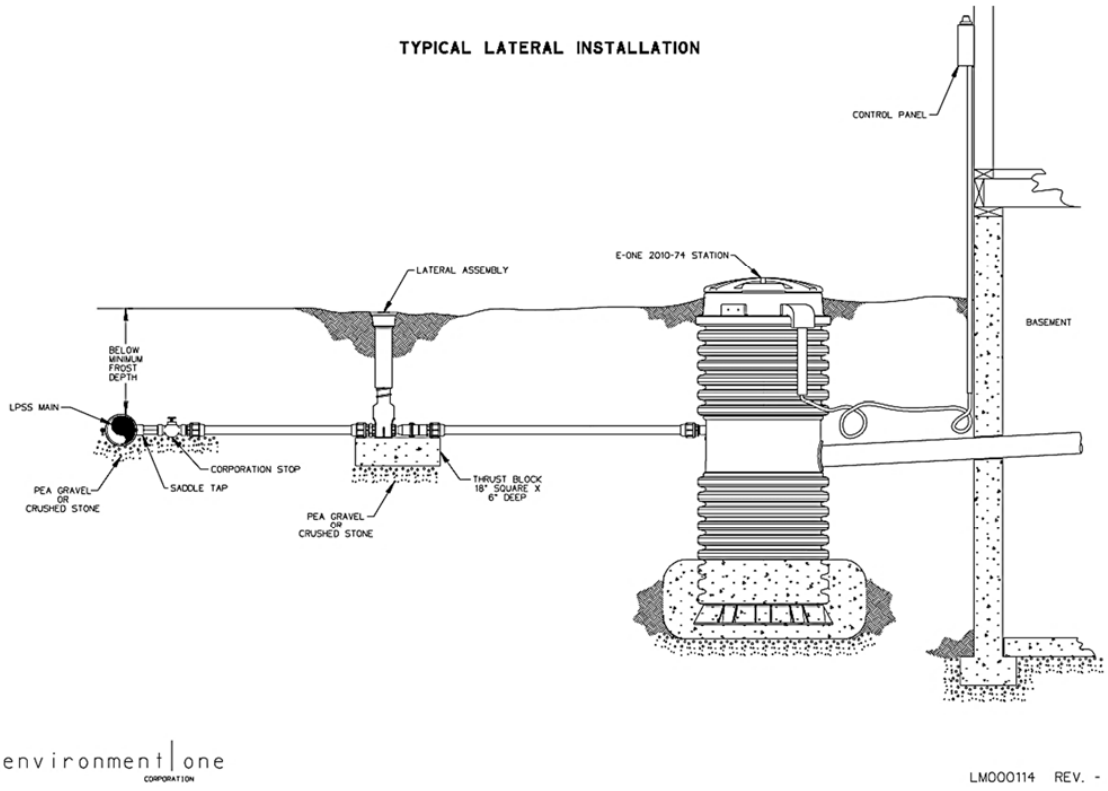
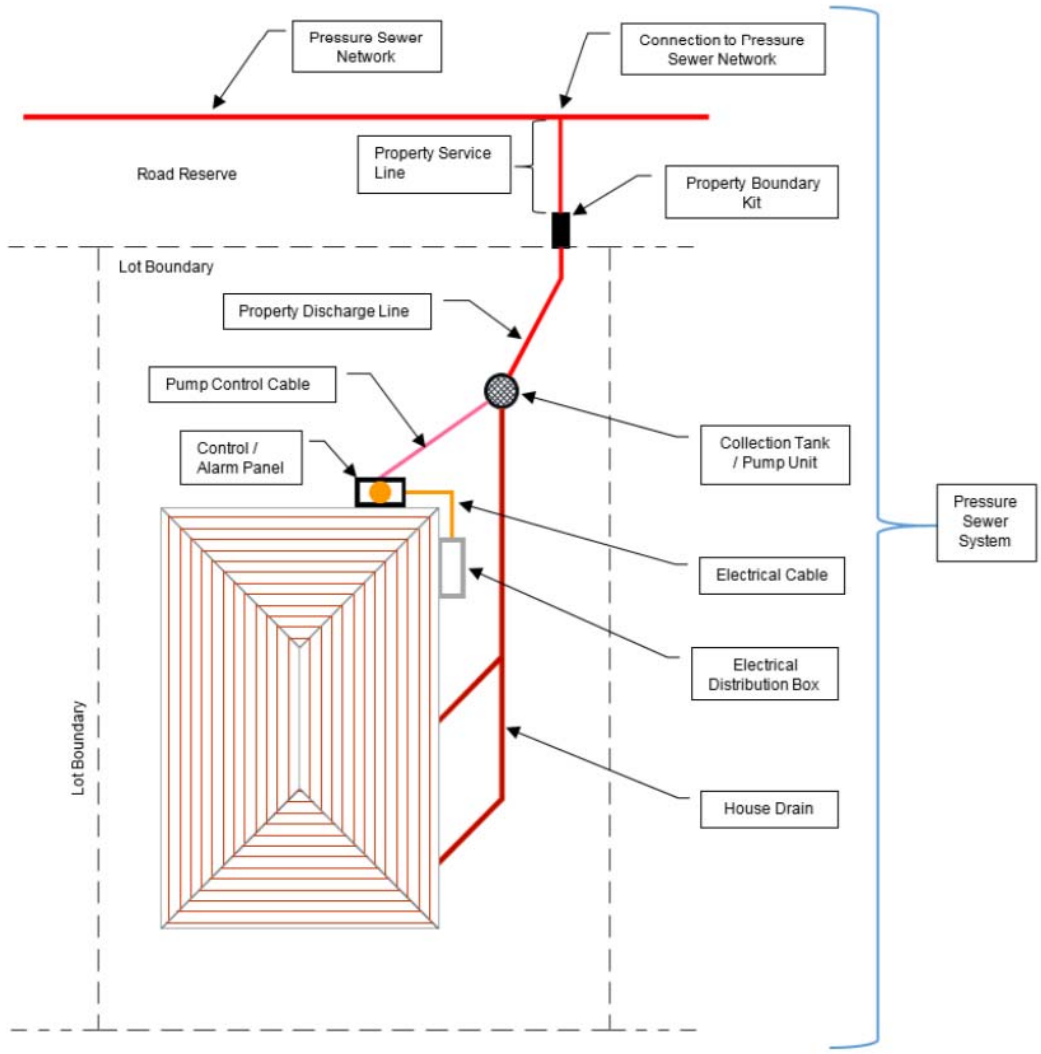


Figure 3-1: Typical Domestic Installation for a Pressure Sewer



(Source: Water NZ Pressure Sewer Guidelines)

Figure 3-2: Typical Domestic Design Layout for Pressure Sewer

Each time the grinder pump is activated, the majority of the contents of the holding tank are removed. In a completely pressurised collection system, all the piping downstream from the grinder pump (including laterals and mains) will be under pressure (45 m or less).

Each grinder pump station includes a control panel suitable for wall or pole mounting in an obvious location such as adjacent to a building switch board. An audio and/or visual alarm beacon is included to warn of failure. The pump units are wired into household switchboard. Upgrading of the existing household switchboard may be required.

Figure 3-3 and Figure 3-4 shows a typical installed unit and power installation.

Figure 3-3: Typical Installed Pressure Unit

Figure 3-4: Typical Power Installation

Flooding is an issue at Stockinbingal with some houses within the 1 in 100 yr flood zone. The best method to address this is to undertake the following:

- Pump unit, 2010iP, with a sealed lid with venting and power taken out of the side of the tank with the cables to the building, and the venting pipe to be under the eaves of the house.
- The alarm panel is mounted at a suitable height above the flood level.
- The tanks with the pumps are installed with ballasting at the base to eliminate any chance of floatation.

The system would consist of the following as shown in Table 3-1.

Table 3-1: Pressure Sewer System

Lot Type	Number	Equipment
Residential	113	1xE–One 2010iP collection well with 1xEone Extreme Grinder Pump
Non Residential (1 ET) ▪ Police Station ▪ Catholic Church ▪ Anglican Church	3	1xE–One 2010iP collection well with 1xEone Extreme Grinder Pump
Non Residential (>1 ET)		
Public School	1	2 x Quad Units with duty and standby pumps or 4 x Double Units

Lot Type	Number	Equipment
Hotel	1	1 x Quad Unit with duty and standby pumps
Bowling Club	1	1 x Quad Unit with duty and standby pumps
Recreation ground	1	1 x Quad Unit with duty and standby pumps
Total	**120**	

The main construction impact to residents will be the excavation for the installation of the pump/tank units. Figure 3-5 and Figure 3-6 show photos of typical construction of a pressure system.

Figure 3-5: Installation of a Pressure Unit

Figure 3-6: Completion of Pipe Connections

3.1.2 Reticulation System

Pressure sewerage systems can be cost effective because pipes are laid in shallow narrow trenches. This is especially the case when the ground is rocky, the water table is high, or the land is flat. In addition, since the grinder pumps can lift in excess of 45 m, lift pumping stations and transfer pumping stations can usually be eliminated with significant savings in cost. Pipelines would be laid within road reserves with one pipeline laid on one side of each street. Individual connections would be made from both sides of the street to the reticulation network. Approximately 7.5 km of pipelines would be required to collect the sewage from the village and transfer to the new nearby treatment plant (Figure 3-7), depending on the final treatment plant location.

Reticulation mains are generally 50-110 mm diameter and will be smaller than the equivalent gravity pipeline throughout the system. All pipes are arranged as branch networks without loops. The maximum pump operating pressure is around 60 m. The pipework would be as a minimum PE100 PN16 pressure HDPE pipelines. Air release points with odour control are located at high points within the system for operational purposes.

The system is watertight as it uses pressure pipes rather than gravity pipes and therefore infiltration from groundwater and stormwater in the system itself is eliminated. This reduces the flow capacity required for downstream infrastructure. This in turn reduces the sizes of pipes needed, and size of the main pump station if it is required.

There are also advantages of less disruption during construction. The installation of small diameter pressure mains at minimal depth is a lot easier than larger diameter gravity mains which may be at quite deep depths.

The construction of the reticulation system would be undertaken by open cut construction or via directional drilling. Road crossings would be undertaken via directional drilling. This will minimise the impact to residents for the installation of the reticulation system. Figure 3-8 and Figure 3-9 show photos of directional drilling for installation of a pressure system pipeline under a road and a creek crossing.

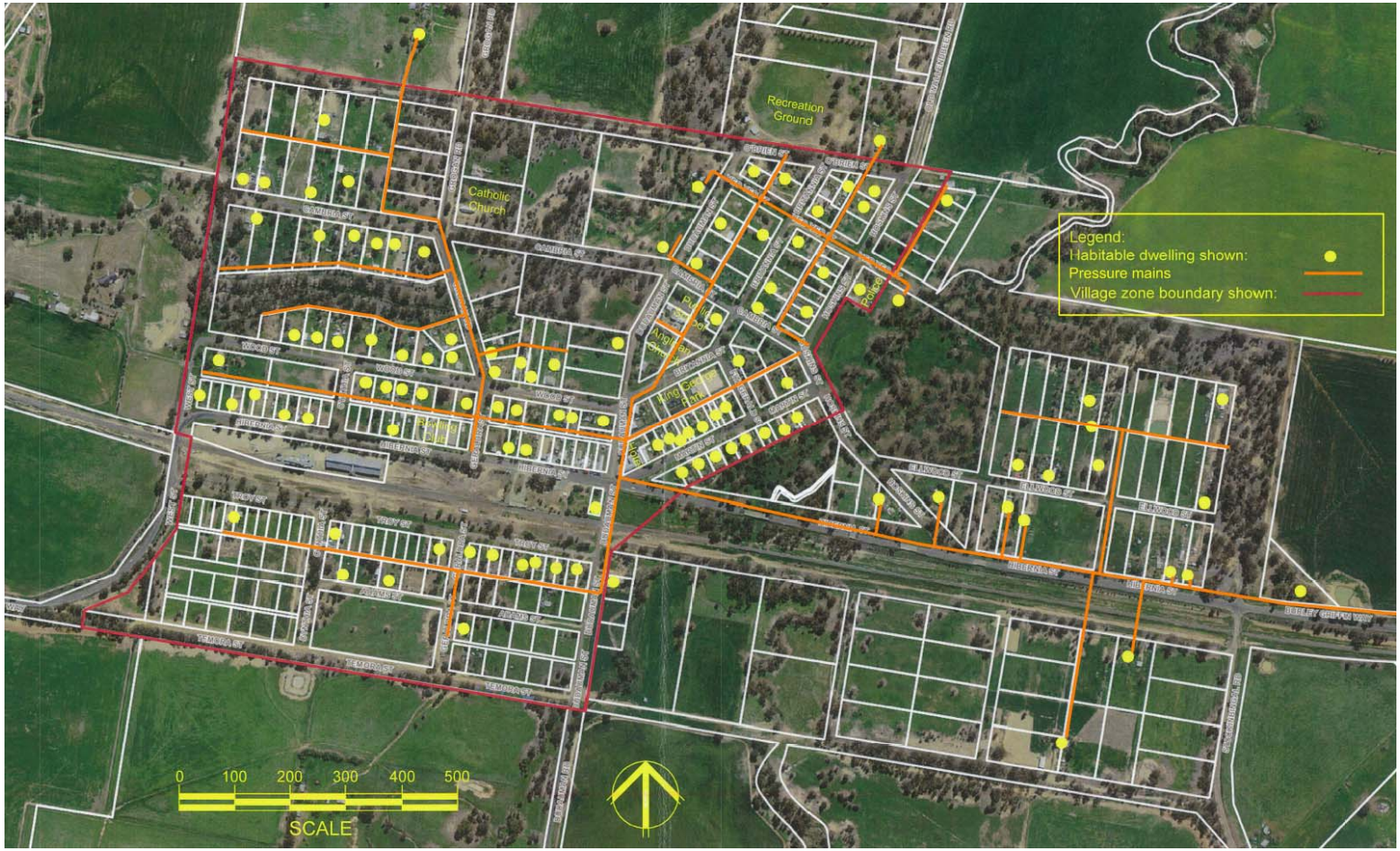


Figure 3-7: Reticulation Layout

Figure 3-8: Directional Drilling Equipment for Pressure Sewers

Figure 3-9: Pipelaying in Progress via Directional Drilling

3.1.3 System Maintenance and Operation

The main disadvantage with a pressure system is the need to maintain a large number of pumps throughout the system. Council generally takes the responsibility for the maintenance of the system either directly or through a service agreement with the pump unit supplier. The role of residents is to advise Council if there is a problem and only breakdown maintenance is required. This means that pumps are replaced if they malfunction and taken away for repair.

System failures can occur either inside a property boundary (SPS failure of pipework blockage) or within the main reticulation system (pipeline failure/burst). If the failure occurs at the pump station, residents would call Council, who would install a new pump. There is storage available in the pump well so as to prevent overflows from occurring. Households would have to limit flows from that household until the pump is replaced. It is expected that replacement would typically occur with four hours of notification to Council.

Failures in the reticulation system could allow releases of sewage from a large area or number of pump units. These failures would be addressed by Council. Releases would be limited by the appropriate location of isolation valves in the system. The location of these valves will be determined during the design of the system. Failures would generally be caused due to external damage.

Pipes would be installed with a tracer wire in a plastic marking tape above the pipe. The tracer wire will allow the pipe to be located prior to excavation, and the tape will be exposed upon excavation. The pipes are small and shallow and would be easily repaired once a break has been found.

3.1.4 Residents Operational Costs

The connection costs for residents are usually less than for other collection options as the PS unit can be placed close to the existing septic tank thus minimising the amount of work required for connection to the new system. Residents will have to pay any costs to upgrade their household drainage up to the connection point and if their existing switchboard is unsafe for connection. They will also have to pay for the power costs for the pump.

3.2 Conventional Gravity System

3.2.1 Gravity Sewerage System Description

A gravity collection system consists of a gravity reticulation, pumping stations and rising mains. Sewage from individual lots flows through gravity mains to a downstream pumping station. It is then lifted through a pressurised rising main to either another gravity main, a transfer pumping station or the sewage treatment plant. Ultimately it will reach a treatment plant via a pressure or gravity main/s.

Gravity sewers need sufficient flow velocity to keep pipes clean by preventing deposition of solids. Self-cleansing is achieved by the provision of minimum pipe diameters and minimum grades. These criteria may lead to deep excavation and/or the need to make use of multiple pumping stations in flat, upward sloping or undulating topography. In these circumstances, both excessive excavation and a high number of pumping stations may lead to significant costs especially where groundwater and/or rock is present. Gravity sewers are also designed to accommodate some wet weather inflows/infiltration that will occur by various means (illegal connections, inundation during flooding etc). The system capacity will be higher compared to the pressure system because of the need to handle increased wet weather flows.

3.2.2 Reticulation System

The use of PVC pipe is assumed and manholes would be located at the junction of lines, changes in direction, grade and pipe size in accordance with the Sewer Design Manual (Reference 5).

The proposed gravity system would comprise:

- Two catchments of sewer mains with nominal diameters of 100 and 150 mm and sewer depths to 6 m.
- Two small sewage pumping stations and associated rising mains.
- Associated sidelines for connection to residences and non-domestic properties.
- Manholes at various depths located along the sewer mains at a spacing of 120 m.
- 10 pressure units and associated rising mains to the closest manhole for houses which cannot practically connect to the gravity system.

The preliminary sewer layout for the gravity system is shown in Figure 3-10. This is a preliminary layout based on an assumption that the natural grade in the village is slightly towards the centre of the town, but mostly level. This assumption is based on the results from the flood studies. Survey information will be required to provide a more accurate layout.

The advantages of gravity sewerage systems include:

- Operation and maintenance are the responsibility of the central authority and not householders
- High reliability
- Well established design standards.

The main disadvantage with this system is cost. As the village is small and flat, the system will require at least two (possibly more) catchments and pumping stations. This will increase the capital and operational cost of the system.

Another significant disadvantage is the level of disruption to the area during construction. Sewer construction in properties, likely to be required due to the need to intercept existing household plumbing, or where there are large obstacles such as sheds and large trees add to the cost and disruption. In addition, a large corridor (generally about 3 m but up to 6 m) is required for the trench and spoil. Figure 3-11 shows an example of a gravity system being installed.

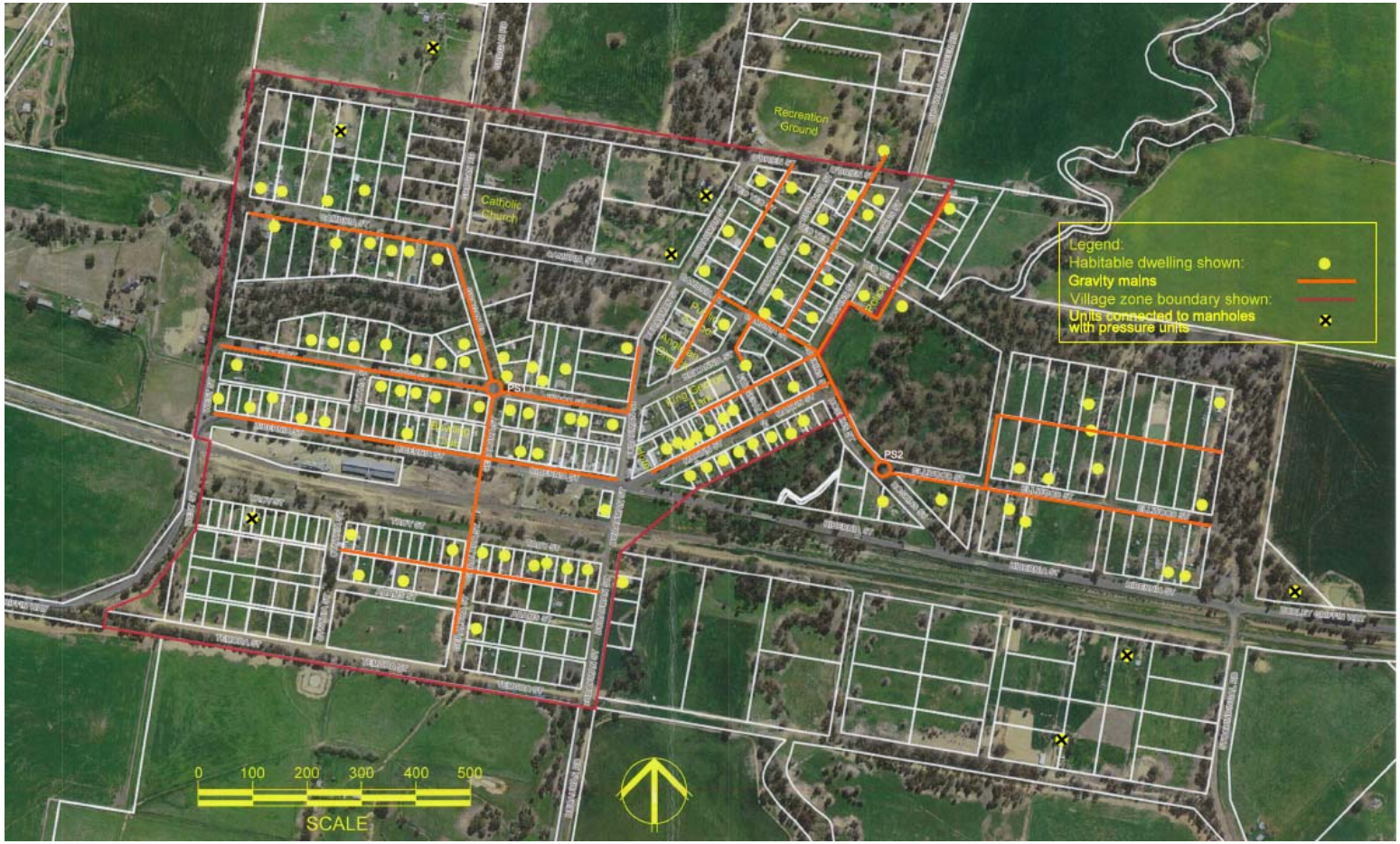


Figure 3-10: Gravity Sewer Reticulation Layout

Figure 3-11: Installation of Gravity Pipeline in a Back Yard

3.2.3 System Maintenance and Operation

System maintenance would be limited to regular inspection of the pumping station, scheduled servicing and responding to breakdowns and alarms.

Wet well pumping stations would be provided with duty and standby pumps, and provide some emergency storage capacity. The system can be monitored remotely through a telemetry system. This provides a high level of reliability and environmental performance.

3.3 Pumping Stations

The SPSs required for the gravity system include SPSs in the town and a transfer SPS to the new STP. The SPSs are located as shown in Figure 3-10 with the transfer SPS located just off the Burley Griffin Way. Figure 3-12 shows the proposed transfer SPS location. The final transfer SPS location will be dependent on the STP location.

Figure 3-12: Transfer Sewage Pumping Station Site

The following works will be required for the SPS:

- A 1.8 m dia. In-ground circular concrete wet well with incoming pipework and isolating valve.
- A 6 m deep wet well (depth to suit incoming pipework levels and selected SPS site).
- The wet well is to include the requisite metalwork comprising safety mesh/ handrails - McBerns type covers for the access opening, step-irons, ladders.
- Two submersible wastewater pumps, PWWF (1- 7.5 L/s), operating on a duty/standby basis.
- The inlet isolation valve (knife gate valve) and a stilling/ drop tube installed on the discharge end of the inlet pipes.
- Switchgear and control gear assembly (SCA) housed within an outdoor switchboard enclosure, as required, and located above the 100 year ARI flood level.
- A valve pit containing reflux valves, stop valve and a flow meter, covers and safety mesh.
- Potable water supply service, protected by reduced pressure zone (RPZ) device.
- Emergency storage (optional depending on collection system).
- A canister vent carbon filter system.
- A flow relief pipeline and chamber.
- Site access for CGRC operation and maintenance vehicles.
- Restoration and landscaping consistent with the surrounding environment.

3.3.1 Electrical Switchboard

It is proposed to provide an outdoor, free-standing, form 3 type SCA to be sited adjacent to the SPS. The SCA will be rated at IP56D and incorporate metering, general and generator power supply protection/isolation, two (2) off soft starters, auto common control and telemetry sections. A three phase, 5 pin generator power outlet connection will be installed on the external skin of the SCA. The approximate size of the SCA will be 2400 mm (W) x 2000 (H) x 400 (D). The SCA will be installed on a concrete plinth that is a minimum of 300 mm above the 1 in 100 year flood level for the site. The automatic operation of the pumps will be carried out by a programmable logic controller. A typical installation is shown in Figure 3-13.

Figure 3-13: Typical SCA Installation

3.3.2 Power Supply

Power for the SPS will be obtained from a nearby 11 kV line. A pad or pole mounted transformer will be located adjacent to the pumping station to service the site power requirements. At this stage there has been no consultation with Essential Energy. As such, the upgrade requirements for the existing system, if any, are yet to be determined.

3.3.3 Instrumentation and Control

The primary level control system will be an ultrasonic or multitrode system with a back-up system of float type level regulators.

To maintain the integrity of the pump station and provide operators with a safe working environment in which to control the pump station operation, Form 3b type switchgear to AS 3439.1 will generally be used.

It is proposed to install all motor starters in a separate compartment.

The pump station control system will operate through a PLC or a RTU/PLC to control all devices on the site. Any faults detected will be transmitted to a telemetry system.

In addition to automatic PLC control, each drive will have on/shutdown/off/shutdown/auto selection, on the SCA, to allow operation of the drive in the event of a PLC failure.

3.4 Emergency Storage Requirements

NSW EPA requires such schemes to provide a high level of environmental performance. This may include the provision of appropriate system storage taking into account system reliability and sensitivity of the receiving environment.

Pressure pump units would typically have up to 24 hours storage during a power failure. Therefore, no additional storage is required.

At the SPS sufficient storage can be provided to prevent overflows should a local power failure occur or some other issue at the SPS. The 1.8 m wet well will have around 10 kL of storage. This equates to 2.5 hours ADWF @ 210 L/ET.day. The SPS would have a telemetry system for notification of CGRC staff. Assuming calls can be addressed within 2 hours then the storage would seem sufficient. Alternatively, a dedicated emergency storage tank could be provided. An additional 35 kL tank would provide 8 hours ADWF storage.

3.5 SPS Odour and Septicity

Odour and septicity is an issue with collection systems. Odour will be generated at the SPS when sewage is discharged into the SPS. As the SPS is close to houses odour control is required.

Odorous gases would be extracted from the SPS and treated to a neutral, nil, or low perceived odour prior to discharge to the atmosphere. The most common forms of treating odorous gases are:

- Scrub odorous gases with solutions of caustic or hypochlorite, or both, in packed towers.
- Pass odorous gases through towers containing activated carbon to capture odorous chemicals, and subsequent replacement of activated carbon when spent.
- Pass odorous gases through soil beds to biologically treat odours.

An activated carbon system is proposed. The system would have the following components:

- Extraction System - The fan would exhaust gases from the pump well through activated carbon deodorisation canisters and ductwork.
- Deodorisation Canisters - The system shall be installed with activated carbon deodorisation canisters, designed for a flow rate of 4 L/s when operated individually. The canister would be modular, rechargeable, prefabricated with 70 kg of special vapour phase granular activated carbon. When operating, the canisters shall remove H_2S and mercaptans from the moist sewage gases being exhausted from the pump station. The canister would be a 200 L drum fully constructed in 316 SS with inlet and outlet connections easily connected to ductwork via ‘plumb quicks’ (quickslip flexible connections) to allow easy removal.
- Pipework - Ductwork of 100 ND HDPE with a vertical discharge weatherproof cowl.

4. Sewage Treatment Plant and Effluent Management Options

4.1 General

The options for sewage treatment are as follows:

- an oxidation pond STP
- a package type STP (IDEA process)

The effluent management options are:

- evaporation
- land application for irrigation of pasture and/or municipal sites
- river release via a local creek system

The treatment system components are outlined in this section to achieve the following effluent quality conditions, as shown in Table 4-1, with a design plant capacity of 310 EP.

Table 4-1: Stockinbingal STP Effluent Quality Requirements

Parameter	Quality for Evaporation/ Irrigation	Quality for River Release and Municipal Reuse (100%ile)
Biochemical oxygen demand (BOD_5)	< 20 mg/L	< 10 mg/L
Suspended solids, SS	< 30 mg/L	< 15 mg/L
Total nitrogen (TN)		< 10 mg/L
Total phosphorus (TP)		< 1 mg/L
Oil and grease		< 2 mg/L
Faecal coliforms, FC	< 1000 CFU/100 mL	< 200 CFU/100 mL
pH	5-8.5 (for irrigation)	6.5-8.5

4.2 STP Site Options

The typical factors involved for choosing a site would be land topography, zoning, flood potential, buffer requirements, proximity to effluent management sites, available electricity and land ownership.

The STP site should be at least 400 m from the closest residence to provide a sufficient buffer for odour. The required area for an oxidation pond STP is approximately 10 ha with a package STP being considerably smaller. Based on this, there are several options around the village for an STP site which was identified using satellite images.

The identified sites are:

- off Burley Griffin Way to the east of the village
- off Stockinbingal Morang Road north of the village
- off Burley Griffin Way to the west of the village
- off Dudauman Road south of the village – an STP south of Stockinbingal might be within the flood zone or have runoff into the creeks on both sides of Dudauman road

The proposed sites are shown in Figure 4-1. Further investigation is required into the feasibility of each site.

Figure 4-1: STP Site Options

4.3 Oxidation Pond STP Option

4.3.1 Oxidation Ponds

Oxidation pond STPs have widespread use in small to medium sized treatment plants because of their low capital costs and low maintenance requirements compared to other constructed municipal plants if land is available and is inexpensive. The disadvantages can be odours and the relatively poor effluent quality produced as well as the STP being flooded during storm events.

The wastewater undergoes basic secondary treatment in this process and is generally only suited for restricted effluent reuse and evaporation disposal systems (i.e. effluent management options other than discharge direct to receiving waters).

A schematic diagram of the treatment process in an oxidation pond is shown in Figure 4-2. The settleable solids form a sludge layer on the floor. Oxidation ponds therefore comprise two separate

layers, an upper aerobic liquid layer and a shallow bottom anaerobic sludge layer. The upper liquid layer is maintained in an aerobic condition by oxygen, released from algae during photosynthesis, and by transfer from the air at the surface. There is insufficient free dissolved oxygen to maintain the lower part of the pond in an aerobic condition. Therefore, the sludge layer as well as a shallow layer of liquid just above it, remain in an anaerobic condition, i.e., devoid of free dissolved oxygen.

Odour problems in the oxidation pond may occur by either breakthrough of the bottom sludge layer to the upper layer due to organic overloading, insufficient oxygenation of the surface layer or rafting of sludge through gas generation in the anaerobic sludge. To prevent odour impacts on nearby households, a sufficient buffer is required. Additionally, recirculation facilities can be provided.

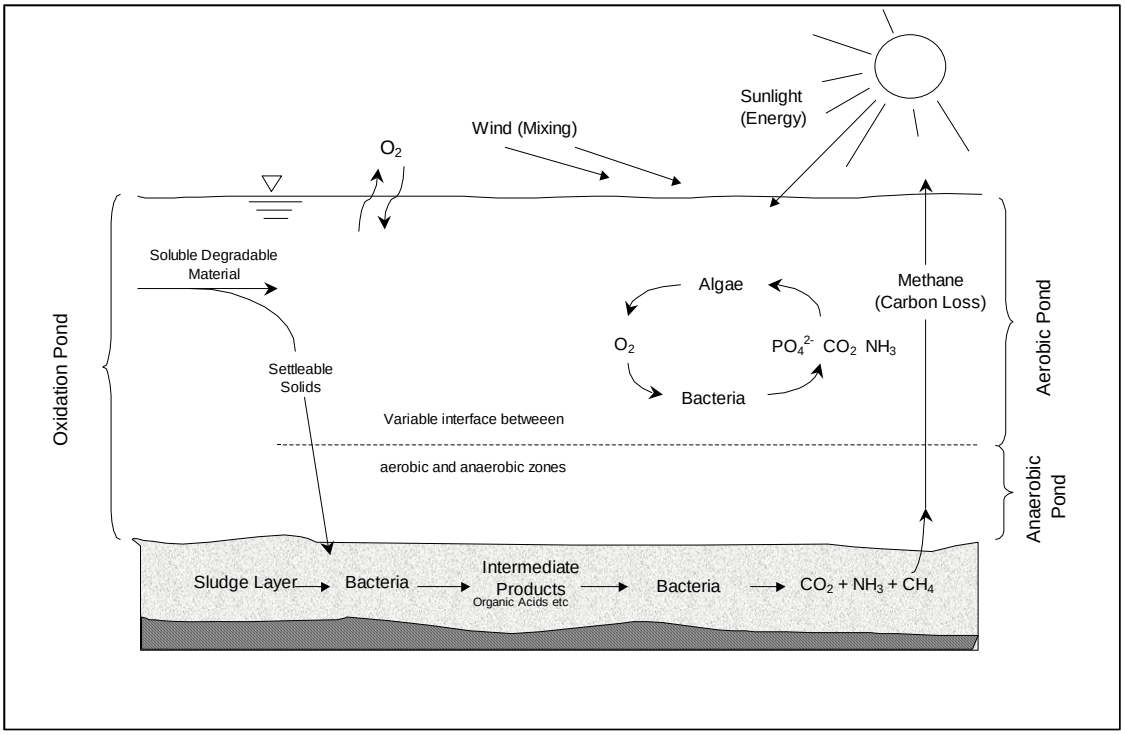


Figure 4-2: Treatment Process Schematic

The inlet chamber will comprise an in-ground, rectangular concrete box with compartments for distributing the flow through inlet pipes to the first pond.

Two oxidation ponds will be provided, each sized to achieve significant reduction in carbonaceous matter (BOD_5). The objective of providing two ponds (referred to as the primary and secondary ponds), is to improve overall treatment efficiency and minimise impacts when one pond is taken off line for periodic desludging, which is usually undertaken about every 10 to 15 years. Sewage from the inlet chamber is delivered to the primary pond, which subsequently overflows to the secondary pond (via a TWL overflow structure) after being retained for a designated detention time. The primary pond is normally provided with a deep end section adjacent to its inlet to allow for the accumulation of solids.

Sizing of the oxidation pond has been based on the paper by Bliss (1976) who presented a method for sizing oxidation ponds based on Australian climactic conditions and the assumption of complete mixing.

The surface area of the oxidation pond is calculated based on the following equation:

$A = (1/k_e)\ YQ$

where:

A = pond area (m^2)

$1/k_e$ = 9, (k_e= reaction rate constant based on the climate)

Y = pond area factor 2.8 (Y is dependent on BOD concentration and effective pond depth assumed to be 1.5 m)

Q = average daily inflow

Based on the above method, the minimum effective pond area required to treat 310 EP will be approximately 3,300 m^2 for two ponds. The first pond would have a deepened inlet, then a 1.5 m pond. The second would be a 1.5 m deep pond. Also provided would be an inlet chamber and recirculation pipework.

4.3.2 Effluent Management

Irrigation of Pasture

One of the effluent management options is effluent reuse. Table 4-2 shows the minimum treatment process requirements to achieve water quality for use of recycled water in association with pasture and livestock, according to the Australian Guidelines for Water Recycling (AGWR – Reference 6).

Table 4-2: Treatment Processes and Additional Controls

Type of reuse	Indicative treatment processes	Water quality objectives	On-site preventative measures
Pasture or fodder crop irrigation (including hay, silage and commercial fodder production). With withholding period.	Secondary treatment with helminth reduction (>25 days of lagoon detention or an equivalent filtration process) *Or* Primary treatment with >50 days of lagoon detention	Soluble BOD_5 <20 mg/l SS <30 mg/l E. coli <1000/100 mL	Exclude cattle from pastures for five days after irrigation Fodder dried or ensiled No public access during irrigation 25–30 m buffer distance to nearest public access point Spray drift control

Therefore, a lagoon with 25 days detention time is recommended for disinfection prior to irrigation. If the pond is 1.25 m deep, the total required area will be 1,730 m^2 for the maturation ponds. Disinfection occurs by exposure of micro-organisms to natural ultraviolet radiation and their detention in a “food starved” environment. A minimum of two maturation ponds in series is normally recommended to ensure effective detention without short circuiting.

The required irrigation site, will be around 4 ha. A 5 ML storage pond will be required to store additional water during the winter months when the irrigation requirement will be less, due to higher rainfall and lower temperatures.

The STP and effluent management system would consist of the following:

- an inlet structure/chamber
- two oxidation ponds 44 m x 44 m
- two maturation ponds (total of 25 day hydraulic residence time) 44 m x 21 m
- a wet weather storage pond 92 m x 31 m (5 ML)
- interconnecting pipework and overflow structure
- an irrigation system for the required irrigation area of 4 ha
- associated site services including access road and fencing
- an irrigation system to take effluent from the storage pond and spread effluent over the irrigation area.

An example of the site layout is shown in Figure 4-3.

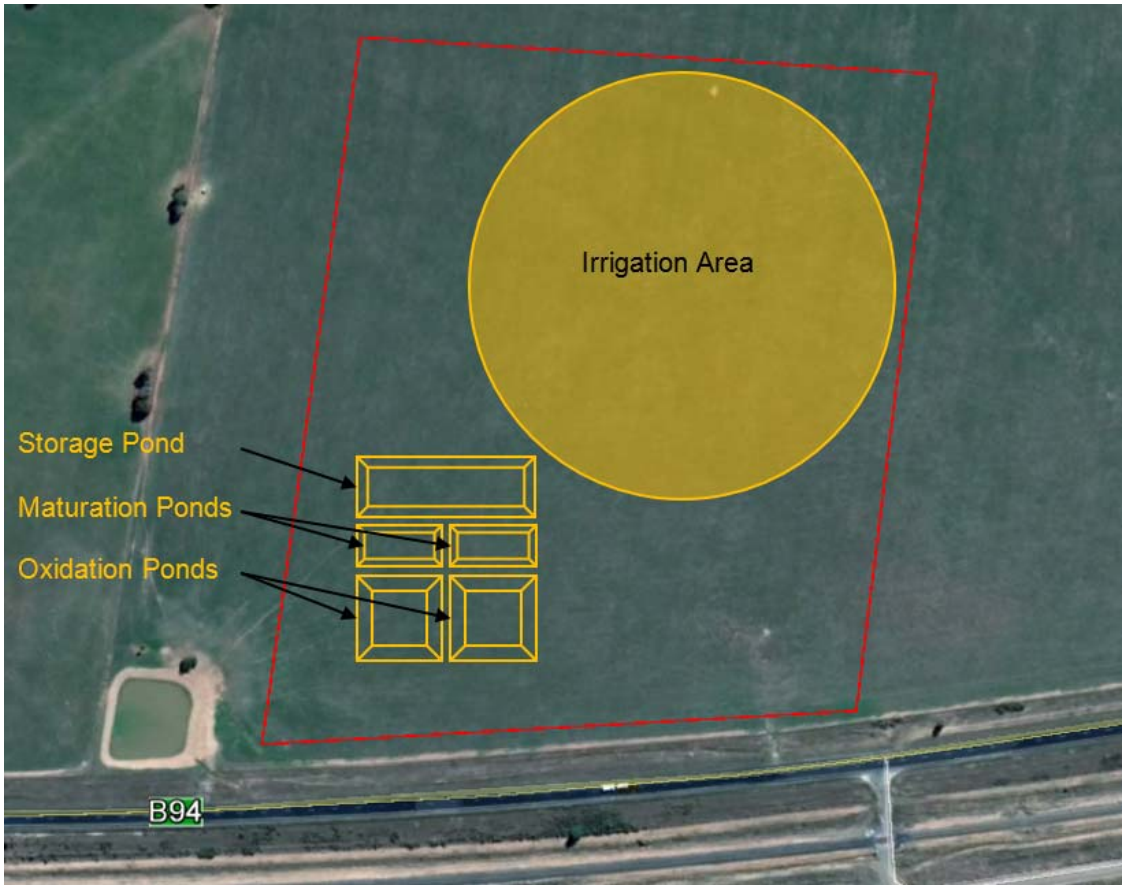


Figure 4-3: Oxidation Pond STP with Irrigation

Evaporation of Effluent

Evaporation data and rainfall data in the last 40 years has been assessed to determine the size of an evaporation pond. The required area for evaporation is 2.6 ha.

The oxidation pond and evaporation system would consist of the following:

- an inlet structure/chamber
- two oxidation ponds 44 m x 44 m
- one evaporation pond 160 m x 160 m and 1 m deep
- associated site services including access road and fencing

Figure 4-4: Oxidation Pond STP with an Evaporation Pond

4.4 Package STP

4.4.1 IDEA Description

There are a number of package STP types available in the market. PWA developed and currently operates (since 2008) an IDEA based package STP for the Department of Justice. As such, we are familiar, and confident, with this type of package STP, that it will perform to produce a high-quality effluent. This type of STP is further detailed as an option for Stockinbingal. Alternatives can be sourced; however, they need to be designed appropriately so as to provide adequate and reliable performance for Council.

The IDEA (intermittently decanted extended aeration) reactor system is the most commonly used secondary biological treatment process in NSW. The IDEA is a modified form of the activated sludge treatment process. The process has been developed by Public Works Advisory and is utilised at about 130 plants in NSW. It has the primary advantage of allowing conveyance of a significant portion of wet weather flows through the main biological reactor. This process configuration incorporates a continuous feed and intermittent aeration, settling and subsequent

decant for clarification of effluent that allows the principal treatment process to take place in a single reactor, thus reducing capital costs and simplifying the process operation and control.

An IDEA based process provides both the functions of a traditional activated sludge treatment process with aeration and secondary settling within the same tank. These two functions are separated by means of timed process cycles controlled by a PLC (programmable logic controller). This process configuration is cost effective, as primary and secondary treatment can be achieved within a single structure, in comparison to a conventional activated sludge treatment system where two or more units (i.e. at least a biological reactor and separate clarifier) are required. In an IDEA reactor, a constant volume is maintained below the bottom water level (BWL). Sewage inflow is split into two equal streams that are continuously fed to the reactor through an inlet diffuser manifold at either end of the reactor.

Activated sludge is composed of micro-organisms referred to as mixed liquor suspended solids (MLSS), which, under aerobic conditions, oxidise organic material and ammonia (NH_4^+) present in sewage, and reduce the nitrates (NO_3^-) and nitrites (NO_2^-) produced to gaseous nitrogen under anoxic conditions.

Aeration can be provided either by means of surface or diffused aeration. A cycle typically begins with the water level at the BWL when the aerators are turned on. The action of the aeration system mixes the entire contents of the reactor and provides oxygen to the MLSS for stabilisation. BOD removal and nitrification take place during this (aeration) phase.

After aeration has been completed, the aerators are switched off and the MLSS, which had previously been in suspension throughout the reactor, begins to settle. The settlement phase leaves a clear supernatant layer above the sludge blanket, which forms during settlement. After a fixed settling phase period, the decanting phase commences in which a centrally located decanting mechanism that spans across the width of the reactor is lowered, decanting the supernatant above the BWL.

Denitrification takes place under anoxic conditions during the settling and decanting phases of a cycle in the absence of aeration. Balancing both nitrogen removal and oxidation processes requires careful design of the process cycle into the aeration and non-aeration periods (settling and decant phases).

Sewage will be delivered to the inlet works through the incoming rising main. Preliminary treatment is to be provided for the automatic removal and handling of gross solids, grit and rags. Preliminary treatment will allow for:

- reception/balancing of influent sewage
- screening of influent
- measurement of influent flows
- grit removal facilities
- division of flows to downstream secondary units
- automatic bagging of gross solids, grit and rags
- emergency bypass.

The secondary treatment process proposed is intermittent decanted extended aeration (IDEA). Secondary treatment facilities are provided for the following purposes:

- biological oxidation of carbonaceous material
- nitrification (biological conversion of ammonia to nitrites then to nitrates)
- denitrification (biological conversion of nitrates to gaseous nitrogen)
- stabilisation of MLSS.

Phosphorus removal may be achieved by either chemical or biological means. A chemical dosing system is proposed and has been widely used for the removal of phosphorus due to its increased reliability and applicability.

Ultraviolet irradiation is an effective disinfection method for secondary effluent of low colour, turbidity (< 5 NTU) and suspended solids. This can be provided by maturation ponds or by an artificial UV system. These are well proven and have been used extensively in STPs across NSW. The system would be designed to reliably meet the required FC disinfection target of 200 cfu/100mL.

On-site biosolids treatment and management requirements are highly dependent on the final use or disposal of the dewatered sludge. Grade B stabilised sludge in accordance with the NSW EPA biosolids guidelines (Reference 7) is required for most reuse applications and this is the standard to be adopted for biosolids produced at the STP. This grade of biosolids will provide a very stable and odour/vector free product.

4.4.2 Packaged Type IDEA

The IDEA at the John Morony Correctional Centre (JMCC) is a container based plant. This package STP, with additional tertiary filtration and disinfection produces a high-quality effluent suitable for reuse within the jail (toilet flushing) and for irrigation of the grounds. The STP is shown in Figure 4-5 with the flow diagram shown in Figure 4-6.

Figure 4-5: John Morony STP – Package Treatment System

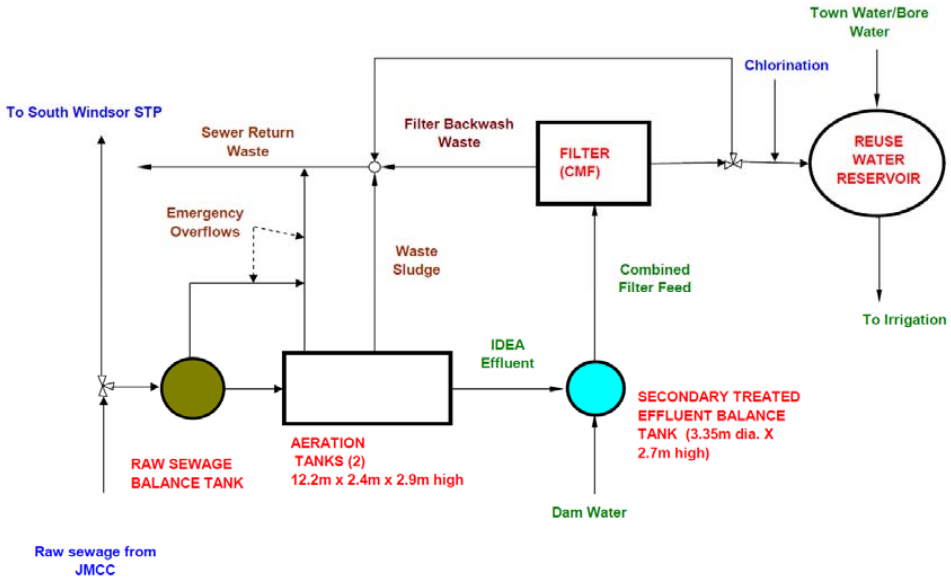


Figure 4-6: JMCC Process Flow Schematic

4.4.3 Proposed Unit

The package STP based on the IDEA process provides an alternative option if there are space constraints, flooding concerns, or if Council prefers a higher quality effluent so it can be released to one of the nearby creeks (Dudauman Creek or Bland Creek) or reused on municipal parks. Due to the small residence time in an IDEA reactor, the peak daily flow needs to be taken into account. Therefore, the plant will be sized for 3xADWF which is: 112 kL/d. The layout is shown in Figure 4-7.

The proposed plant is as follows:

- A raw sewage balance tank
- Two IDEA modules (aeration tanks)
- An effluent balance tank
- A UV disinfection unit
- Two containerised sludge digesters with submerged air blowers
- Interconnecting pipework and pumps
- Access stairs and walkways

Waste activated sludge (WAS) will be produced by the IDEA process. Maintenance of the design sludge age will require that 4% of the reactor volume be wasted as MLSS per day to achieve a 25 day sludge age. Wastage will be undertaken throughout the day during each aeration phase of the process operating cycle. The WAS produced will have to be stabilised and dewatered.

Bio-solids management will be based on the production of Stabilisation Grade B sludge. Once the sludge has been stabilised, it can be dewatered and removed by contractor dewatering, which is ideal for smaller plants.

The effluent can be released to a nearby creek downstream of the town.

The required area of the containerised STP is less than 200 m^2. Therefore, it can be located on existing Council grounds.

A PV system can supply the power required for the aeration in the biological treatment and sludge digesters. This will minimise the power cost.

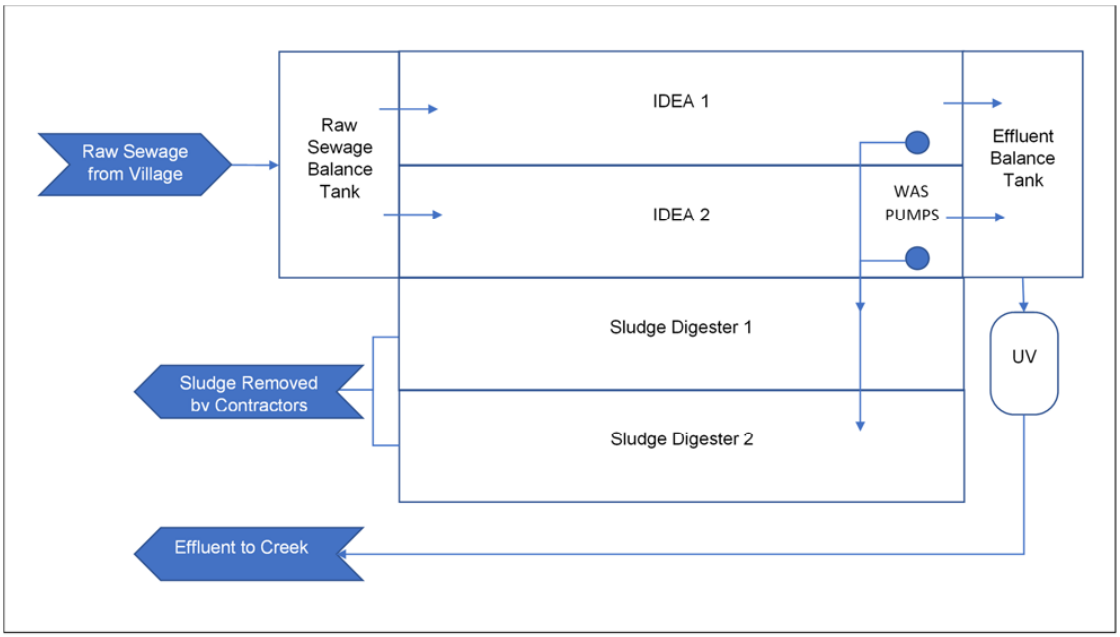


Figure 4-7: Containerised IDEA Plant

4.4.4 Effluent Management

Irrigation of Municipal Sites

The effluent would be suitable for reuse if desired. Potential reuse sites would be the Recreation Oval, Primary School playing fields etc. The following additional infrastructure will be required:

- Chlorination facilities to ensure that a chlorine residual is maintained in the treated effluent
- Irrigation facilities, which will include a storage tank and pump.

In addition, onsite measures will need to be followed to ensure public safety and to follow the AGWR. Onsite measures will include:

- Restrict public access during irrigation and one of the following:
  - no access after irrigation, until dry (1–4 hours)
  - minimum 25–30 m buffer to nearest point of public access
  - spray drift control; for example, through low-throw sprinklers (180° inward throw), vegetation screening, or anemometer switching

If irrigation is proposed for municipal sites excess effluent will likely need to be discharged.

Discharge to Waterways

Effluent from the package STP may be released to a local waterway. This would need to be assessed in conjunction with the regulators with environmental impacts assessed.

5. Costing and Summary

The cost in the following sections are high level estimates. The cost of the preferred options will be further refined during the concept design phase. The full estimates are included in Appendix A.

5.1 Reticulation Options

Strategy level cost estimates have been undertaken and are summarised in Table 5-1 for the pressure sewer system and conventional gravity system respectively. A 20% allowance for contingency has been used for the pressure system and 25% for the gravity system considering the unknowns present. The SID allowance for the pressure system is 10% and 15% for the gravity system reflecting the complexity of the gravity system as compared to the pressure system.

Connection costs are included in the pressure option. But, there are variable costs for the residents which have not been included in this cost estimate, as the costs can vary greatly:

- **Pressure System:** The upgrade cost for the residents' switchboards if their existing switchboard is unsafe for connection
- **Gravity System:** The connection costs for the gravity system ($1,000-$3,000 per household)

The pressure sewer system is the lower cost option of the two systems examined.

Table 5-1: Cost Estimates – Pressure Sewer and Conventional Gravity Sewer Options

Item	Pressure Sewer System	Conventional Gravity Sewer System
Construction Cost		
Pressure Units	$899,500	$35,000
Reticulation	$1,050,000	$1,369,250
Rising Main to STP	$485,000	$650,000
Sewage pump stations		$637,304
Construction Cost	**$2,434,500**	**$2,691,554**
Contingency 20-25%	$486,900	$672,888
Survey investigation and design and project management 10-15%	$243,450	$403,733
Total Capital Cost	**$3,164,850**	**$3,768,175**
Per tenement construction cost	$26,156	$31,142
Residents		
Power	$3,000	
Council		
Pump replacement (5% per annum)	$45,000	
Power		$1,300
Operation and maintenance		$12,000
Chemical Dosing	$5,000	$5,000
Total Annual Cost	**$53,000**	**$18,300**
NPV (7%, 20 years)	**$3,519,286**	**$3,715,530**

5.2 STP Options

Table 5-2 gives a cost breakdown of the STP options.

The annual operational costs have been estimated based on:

- Expected hours of usage and motor power ratings of mechanical equipment such as aerators and pumps.
- Standard testing requirements for EPA and internal operation of the plant.
- Volume of screening and grit expected and likely disposal rates.
- Standard allowances for mechanical maintenance and cleaning.
- General site maintenance.
- Staff costs
  - IDEA one part time plant operator with total wages $65,000 (base wage plus other costs) based on 2 days per week attendance midweek and 1 hours on weekends for inspection.
- Vehicle/plant usage allowance.
- Disposal/reuse of biosolids (other than screenings and grit).

Based on the capital and annual costing the oxidation pond STP with an irrigation system is the lowest cost system, as long as an appropriate site outside of the flood zones and away from nearby residents can be purchased by Council at a reasonable cost. The package STP option has a higher cost but also has the following potential benefits:

- Reduced potential for odour. Weather conditions such as temperature inversions and wind directions can cause odours to travel beyond the 400 m buffer of an oxidation pond STP.
- Potential use of effluent for irrigation of public areas (parks, recreation area etc.).
- Community satisfaction in having a “modern” treatment system in line with surrounding communities.
- Eliminating the need for the irrigated area with its attendant supervision, operation and maintenance issues (if the predominant effluent management strategy is release).

Table 5-2: Cost Estimates – Oxidation Pond and IDEA based STP Options

Item	Oxidation Pond with Evaporation	Oxidation Pond with Irrigation	Package Type STP and Release	Package Type STP and Municipal Irrigation
IDEA Based STP			$1,138,000	$1,138,000
Chlorination System				$25,000
Oxidation Ponds	$253,395	$253,395		
Evaporation Pond	$1,425,520			
Maturation/storage ponds		$536,605		
Irrigation system (pump and irrigation system)		$250,000		$80,000*
Pipework	$100,000	$100,000	$100,000	$100,000
Roadworks	$452,000	$550,400	$60,000	$60,000
Fencing	$45,200	$55,040	$6,000	$6,000
Power	$100,000	$100,000	$274,000	$274,000
Inlet structure	$150,000	$150,000	$150,000	$150,000
Land $10,000/ha	$100,000	$100,000	$50,000	$50,000
Construction Cost	**$2,626,115**	**$2,095,440**	**$1,778,000**	**$1,883,000**
Contingency 25%	$656,529	$523,860	$444,500	$470,750
Survey investigation and design and project management 10%	$262,612	$209,544	$177,800	$188,300
Total Capital Cost	**$3,545,256**	**$2,828,844**	**$2,400,300**	**$2,542,050**
Power		$8,000 (irrigation system)	$25,000 (STP)	$30,000 (STP + irrigation)
Maintenance	$5,000 (mowing)	$5,000 (mowing)	$50,000	$50,000
Operation (labour)	$25,000 (0.25 x operator)	$25,000 (0.25 x operator)	$65,000 (1 x operator or 2 x part time)	$65,000 (1 x operator or 2 x part time)
Annual Cost	**$30,000**	**$38,000**	**$140,000**	**$140,000**
NPV (7%, 20 years)	**$3,631,143**	**$3,046,352**	**$3,726,433**	**$3,858,910**

* One nearby irrigation system and a small holding tank

6. References

1. Stockinbingal Village Strategy, CGRC, 2017
2. Pressure Sewer Code WSAA - 2007 1.1
3. Sewerage for Small Communities, NSW Department of Land and Water Conservation, 1996
4. Affordable Water Supply and Sewerage for Small Communities, WSAA, 1999
5. NSW Public Works, Sewer Design Manual
6. Natural Resource Management Ministerial Council, Environment Protection and Heritage Council, Australian Guidelines for Water Recycling, 2006
7. NSW EPA, Environmental Guidelines – Use & Disposal of Bio-solids Products, 1997.

Appendix A Detailed Cost Assessment

STOCKINBINGAL SGE
COLLECTION AND TRANSPORT SYSTEM
CAPITAL COST ESTIMATE

PRESSURE SYSTEM

ITEM NO.		UNIT	RATE $/unit	QUANTITY	AMOUNT $
1.0	Pressure Units				
	i) Standard	each	3,500	116	406,000
	ii) Quad units	each	14,000	5	70,000
	Installation	each	3,500	121	423,500
2	Reticulation	m	150	7,000	1,050,000
					$1,949,500

PRESSURE SEWER TRANSPORT SYSTEM

ITEM NO.		UNIT	RATE $/unit	QUANTITY	AMOUNT $
1.0	**RISING MAINS AND PUMPING STATIONS**				
1.1	All work not included elsewhere	Allowance			
1.2	Clear the line, excavate and backfill, supply pipe and initially test for all rising mains including disposal of excess excavated material, trench support, dewatering and restoration of surfaces				
	i) Rising main 110mm PE	m	140	2,500	350,000
1.3	Extra over for items 1.2, for excavating in rock	m^3	500	250	125,000
2.0	**WORK AS EXECUTED PRODUCT PACKAGE**				
2.1	Rising Mains	m	4.00	2,500	10,000
					$485,000
	Construction Cost				**$2,434,500**
	Contingency (20%)				**$486,900**
	Survey investigation and design and project management 10%				**$243,450**
	Capital Cost				**$3,164,850**

STOCKINBINGAL SGE
COLLECTION AND TRANSPORT SYSTEM
CAPITAL COST ESTIMATE

GRAVITY COLLECTION AND TRANSPORT SYSTEM

ITEM NO.		UNIT	RATE $/unit	QUANTITY	AMOUNT $
1.0	All work not included elsewhere	Allowance			30,000
2.0	Clear the line in other than rock and excavate for all gravity sewers and manholes, including disposal of excess excavated material, trench support and dewatering				
	a. Average trench depth 0 - 1.5m				
	ii) Nominal dia. 150mm	m	40	4,500	180,000
	v) Sidelines and Risers	m	40	450	18,000
	b. Average trench depth 1.5 - 3.0m				
	ii) Nominal dia. 150mm	m	70	1,200	84,000
	v) Sidelines and Risers	m	70	120	8,400
	c. Average trench depth 3.0 - 6 m				
	ii) Nominal dia. 150mm	m	90	300	27,000
	v) Sidelines and Risers	m	90	30	2,700
3.0	Supply, lay, joint and initially test pipes and fittings for gravity sewers including provision for compaction bedding and select backfill around and up to 300 mm above the top of the pipe				
	a. Sidelines and Risers	m	30	600	18,000
	e. Nominal dia. 150mm	m	70	6,000	420,000
4.0	Supply materials for and construct manholes complete or supply and install plastic maintenance shafts, light duty concrete covers and surrounds			31	
	a. Depth of manhole				
	i) 0.0 - 1.5m	each	1,600	9	14,400
	ii) 1.5 - 2.0m	each	1,650	3	4,950
	iii) 2.0 - 2.5m	each	1,700	6	10,200
	iv) 2.5 - 3.0m	each	1,800	6	10,800
	v) 3.0 - 3.5m	each	2,000	5	10,000
	vi) 3.5 - 4.0m	each	2,200	6	13,200
	vii) 4.0 - 4.5m	each	2,400	2	4,800
	viii) 4.5 - 5.0m	each	2,700	5	13,500
	ix) 5.0 - 5.5m	each	3,000	3	9,000
	x) 5.5-6.0m	each	3,400	3	10,200
	b. Extra over for heavy type concrete covers		Allowance		2,500
	c. Extra over for gatic type covers		Allowance		2,500
5.0	Construct manhole vent stacks or deodorisation beds	each	3,000	1	3,000
6.0	Extra over for items 2.0, for excavating in rock		Allowance		50,000
7.0	Supply and place imported selected backfill				
	a. Non-cohesive	m³	25	540	13,500
	b. Other	m³	20	21	420
8.0	Additional compaction by mechanical means	m³	10	1,038	10,380
9.0	Road crossings		2	35,000	70,000
10.0	Dewatering	m²	1,000	100	100,000
11.0	Restoration of surfaces				
	a. Lawns	m²	10	1,500	15,000
	b. Bitumen pavement	m²	120	240	28,800
	c. Gravel pavement	m²	40	600	24,000
	d. Concrete kerb and gutter	m	0	240	0
12.0	Acceptance testing and commisioning	Item			25,000
13.0	Work as Executed Product Package	Item			20,000
					$1,254,250

ITEM NO.		UNIT	RATE $/unit	QUANTITY	AMOUNT $
1.0	**RISING MAINS AND PUMPING STATIONS**				
1.1	All work not included elsewhere	Allowance			
1.2	Clear the line, excavate and backfill, supply pipe and initially test for all rising mains including disposal of excess excavated material, trench support, dewatering and restoration of surfaces				
	i) Rising main 180mm PE	m	210	2,500	525,000
1.3	Extra over for items 1.2, for excavating in rock	m³	500	250	125,000
2	Transfer Pumping Station				
2.1	Civil works				
	i) Excavation		$500	82	$41,048
	ii) Walls		$2,500	37	$91,892
	iii) Floor		$2,500	5	$12,936
	iv) Roof		$3,000	7	$20,697
	v) Plug		$600	6	$3,478
	vi) Blinding		$500	1	$254
	vii) Valve pit			Allowance	$16,000
	viii) Pipework including valves			Allowance	$80,000
	ix) Covers			Allowance	$20,000
	xii) Epoxy painting				$5,000
2.2	Pumps				
	i) - Supply of submersible pumpsets		$8,000	4	$32,000
	ii) - Delivery & installation of pumping machinery		$5,000	4	$20,000
	iii) - Witness testing		$2,000	4	$8,000
	iv) - Testing and commissioning			Allowance	$15,000
	v) -Valves and fittings			Allowance	$25,000
2.3	Electrical				
	i) Supply and installation of SCA		30,000	2	$60,000
	ii) Power supply		15,000	2	30,000
	iii) Generator Connection Box				$4,000
	vi) Consumers Mains				$20,000
3.0	**ADDITIONAL PRESSURE SYSTEMS**				
3.1	Pressure units	10	3,500	Item	35,000
3.2	Additonal mains	1,000	150	m	150,000
4.0	**MISCELLANEOUS**				
4.1	Supply & install manproof fencing & gates for pumping stations	Lump Sum			2,000
4.2	Provide sealed pavements & drainage works for pumping stations	Lump Sum			15,000
4.3	Landscaping of pumping stations	Lump Sum			1,000
4.4	Supply & install water supply for pumping stations	Lump Sum			5,000
4.5	Telemetry	Allowance			15,000
					50,000
5.0	**WORK AS EXECUTED PRODUCT PACKAGE**				
5.1	Rising Mains	m	4,000		4,000
5.2	Pumping Station	Item	5,000		5,000
					$1,437,304

Construction Cost	**$2,691,554**
Contingency (25%)	**$672,888**
Survey investigation and design and project management 15%	**$403,733**
Capital Cost	**$3,768,175**

STOCKINBINGAL SGE
COLLECTION AND TRANSPORT SYSTEM
CAPITAL COST ESTIMATE

	PRESSURE SYSTEM	Evaporation				Irrigation			
ITEM NO.		QUANTITY	UNIT $/unit	RATE	AMOUNT $	QUANTITY	UNIT $/unit	RATE	AMOUNT $
1.0	Inlet works	Allowance			**150,000**	Allowance			**150,000**
2.0	OXIDATION PONDS 1 & 2				**253,395**				**253,395**
2.1	Earthworks								
	i) Top soil removal & stockpiling	1,549	m3	4	6,195	1,549	m3	4	6,195
	ii) Excavate to finish levels, stockpile and reclaim material	2,600	m3	10	26,000	2,600	m3	10	26,000
	iii) Fill	1,300	m3	10	13,000	1,300	m3	10	13,000
	iv) Rip rap protection	1,162	m2	25	29,040	1,162	m2	25	29,040
	vi) GCL Liner	5,808	m2	20	116,160	5,808	m2	20	116,160
	vi) Top soil distribution (outer embankment)	Allowance			30,000	Allowance			30,000
2.2	Transfer structure (Oxidation Pond 1 to Oxidation Pond 2)	Allowance			15,000	Allowance			15,000
2.3	Transfer structure (Oxidation Pond 2 to maturation pond)	Allowance			15,000	Allowance			15,000
2.4	Inlet splash pads	3	m3	1,000	3,000	3	m3	1,000	3,000
3.0	EFFLUENT/EVAPORATION PONDS				**1,425,520**				
3.1	Earthworks								
	i) Top soil removal & stockpiling	20,480.00	m3	4	81,920				
	ii) Excavate to finish levels, stockpile and reclaim material	12,800.00	m3	10	128,000				
	iii) Fill	6,400.00	m3	10	64,000				
	iii) Fill and lime stabilisation	2,720.00	m4	30	81,600				
	vi) GCL Liner	51,200.00	m2	20	1,024,000				
	vi) Top soil distribution (outer embankment)	Allowance			30,000				
3.2	Transfer structure (Pond 1 to Pond 2)	Allowance			15,000				
3.3	Inlet splash pads	1.00	m3	1,000	1,000				
4.0	Maturation ponds								**169,847**
4.1	Earthworks								
	i) Top soil removal & stockpiling					739	m3	4	2,957
	ii) Excavate to finish levels, stockpile and reclaim material					1,800	m3	10	18,000
	iii) Fill					900	m3	10	9,000
	iv) Rip rap protection					858	m2	25	21,450
	vi) GCL Liner					2,772	m2	20	55,440
	vi) Top soil distribution (outer embankment)					Allowance			30,000
4.2	Transfer structure (Oxidation Pond 1 to Oxidation Pond 2)					Allowance			15,000
4.3	Transfer structure (Oxidation Pond 2 to maturation pond)					Allowance			15,000
4.4	Inlet splash pads					3	m3	1,000	3,000
5.0	Storage Pond								**366,758**
5.1	Earthworks								
	i) Top soil removal & stockpiling					1,141	m3	4	4,563
	ii) Excavate to finish levels, stockpile and reclaim material					5,000	m3	10	50,000
	iii) Fill					2,500	m3	10	25,000
	iv) Rip rap protection					812	m2	25	20,295
	vi) GCL Liner					8,556	m2	25	213,900
	vi) Top soil distribution (outer embankment)					Allowance			50,000
5.2	Inlet splash pads					3	m3	1,000	3,000
6.0	PIPEWORK, VALVES & FITTINGS	Allowance			**100,000**	Allowance			**100,000**
7.0	IRRIGATION SYSTEM					Allowance			**250,000**
	Construction Cost				**$1,928,915**				**$1,290,000**
	Contingency (25%)				$482,229				$322,500
	Survey investigation and design and project management 10-15%				$192,892				$129,000
	Capital Cost				**$2,604,036**				**$1,741,500**

Item	Item Description	Qty	Unit	Rate	Amount
1.0	**Containers**				**$280,000**
1.1	Containers (for IDEA and Sludge)	4	each	$10,000	$40,000
1.2	Balance tanks (inlet and effluent)	2	each	$10,000	$20,000
1.3	Conrete base	95	m^2	$1,800	$170,100
1.4	Access stairs and walkways			allowance	$50,000
2.0	**IDEA REACTOR - MECHANICAL**				**$542,000**
2.1	Mechanical Works				
	i) Jet aerators	4	each	$50,000	$200,000
	ii) Decanting system	2	each	$50,000	$100,000
	iii) WAS pumps, pipework and fittings		Item	LS	$120,000
2.2	Pipework, valve and fittings				$50,000
2.3	i) Decant pipework		Item	LS	$60,000
	ii) DO sensor	4	each	$2,000	$8,000
	iii) pH sensor	2	each	$1,000	$2,000
2.4	iv) level sensor	2	each	$1,000	$2,000
3.0	**UV unit**				**$50,000**
3.1	UV unit			LS	$50,000
4.0	**AEROBIC DIGESTER**				**$266,000**
4.1	Jet aerators	4	each	$50,000	$200,000
4.2	Pipework, Valve and Fittings				$30,000
4.3	i) DO sensor	4	each	$2,000	$8,000
	ii) pH sensor	2	each	$1,000	$2,000
	iii) level sensor	2	each	$1,000	$2,000
	iv) Sludge discharge flow meter	2	each	$12,000	$24,000
5.0	**Electrical**				**$274,000**
	i) Supply and installation of SCA				$150,000
	ii) Power supply				$100,000
	iii) Generator Connection Box				$4,000
	vi) Consumers Mains				$20,000
	Construction Cost				**$1,412,000**
	Contingency (25%)				$353,000
	Survey investigation and design and project management 10-15%				$141,200
	Capital Cost				**$1,906,200**

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Appendix B Concept Design

NSW GOVERNMENT Public Works Advisory

Stockinbingal Sewerage Scheme

Concept Design Report

Report Number: ISR19178

February 2020

Prepared for:

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

Trim Project No. DIR19/1649

Report Number: ISR19178

Document control

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			Name	Date
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Final	Heleen Lindeque	Brett Douglas	Brett Douglas	05/02/2020

Executive Summary

General

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales. Stockinbingal is 388 km south west of Sydney and 102 km north east of Wagga Wagga. The town has a population of approximately 250 at present. A reticulated sewerage system is proposed to replace the existing individual property based on-site wastewater systems.

An options assessment to determine the type of wastewater system (including reticulation and treatment) was completed in March 2019. Following the assessment, Cootamundra-Gundagai Regional Council (CGRC), has endorsed a pressure sewerage collection system with a package type treatment plant as the preferred servicing strategy for Stockinbingal.

Public Works Advisory has been engaged by CGRC to prepare a concept design for the proposed Stockinbingal Sewerage Scheme based on the endorsed servicing strategy.

Serviced Population

A total of 111 properties have been identified for servicing with an additional 16 properties to be considered for servicing.

The properties identified for servicing include:

- 92 residential properties within the village zone boundary (land zoned RU5)
- 6 non-residential properties (2 churches, 1 school, 2 public toilets and a bowling club) within the village zone
- 8 commercial properties (7 shops and one hotel) within the village zone
- 5 properties adjoining the village zone boundary

The additional 16 residential dwellings identified by Council for possible servicing are located to the east of the village. These additional dwellings will be included in the concept level scheme development. The final decision to included or exclude any of these properties will be determined by Cootamundra-Gundagai Regional Council at a later stage.

It is noted that there are a significant number of vacant blocks within the village zone. Our understanding is that there is no driver at this time for infill development to occur. In order to accommodate some infill growth, a high flow scenario will be tested, to determine the ability of the system to accommodate future infill growth.

The average daily wastewater flow for the developed properties within and adjoining the village area is estimated to be 67 kL/day. This includes the non-residential properties such as churches, schools etc. The estimated total daily wastewater flow for the additional 16 properties (with a dwelling) outside the village area is 6 kL/day.

Pressure Sewer System

The proposed Pressure Sewerage System consists of small grinder pumps located on each property which macerates the sewage into a fine slurry and pumps it through a pressurised sewerage network directly or indirectly to a wastewater treatment facility. This system was selected in the Options Study as being the most suitable for Stockinbingal.

STP Options

Several secondary treatment options have been investigated:

- Option 1: Conventional Activated Sludge (CAS) Treatment
- Option 2: Membrane Aerated Biofilm Reactor (MABR)
- Option 3: Membrane Bioreactor (MBR)
- Option 4: Moving Bed Bio Reactor (MBBR)
- Option 5: Intermittently Decanted Extended Aeration (IDEA) reactor

Options 1-4 are for package type systems, whereas Option 5 is for a concrete aeration tank. These options were assessed with Option 5 being the preferred option. Option 5, a concrete IDEA based plant, is recommended for Stockinbingal as it will provide a more permanent solution. This type of STP will also meet the quality requirements, is cost effective to provide and operate, has no propriety equipment and requires a low level of operator skill. The adopted effluent management strategy is to discharge to Dudauman Creek.

STP Design

The pressure sewer modelling results were used as the input to the design flow rate and balancing requirement for the STP. Flow balancing will be used to minimise the size of the treatment plant. The inlet works will be sized for 7.2 L/s, based on the daily peak inflow and the rest of the STP will be designed for a maximum of 1.2 L/s based on the high daily inflow.

As there is not currently a STP, the values in Table S-1 have been assumed, based on typical domestic strength sewage, while the effluent values are based upon typical requirement values from the EPA for modern technology STPs and discharge to inland waterways.

For reuse requirements in the future, additional chlorination and a recycled water management plan will be required to conform with the Australian Recycled Water Guidelines.

Table S-1: Inflow and Effluent Values

Parameter	Inflow values	Effluent Values
Biochemical Oxygen Demand (BOD_5)	325-360 mg/L	10-15 mg/L
Faecal Coliforms		200 CFU/100 mL
pH		
Suspended Solids (SS)	275-300 mg/L	15 -20 mg/L
Ammonia		2-5 mg/L
Total Nitrogen (TN)	60-70 mg/L	10-15 mg/L
Total Phosphorus (TP)	13-15 mg/L	0.5 – 1 mg/L

Proposed New Infrastructure

The new infrastructure to be delivered as part of this proposed scheme includes:

A Pressure Sewerage network consisting of:

- 121 simplex pump units, control/alarm panels and associated electrical/control wiring
- 5 duplex pump units, control panels and associated electrical wiring (Elwood Hall, Bowling Club, School and public toilets)
- 1 quadraplex pump unit, control panel and associated electrical wiring (Commercial Hotel)
- 3,800m of DN40 property discharge pipework from the collection tank to the street network
- Street reticulation network 6,300 m long consisting of DN50-DN125 polyethylene pipes
- Network storage of about 16,500 L
- 4 air valves and vent pipes
- 14 flushing and 11 isolation valves.

A new STP which will include:

- An inlet screen
- A 50kL emergency storage tank
- A concrete IDEA reactor and balance tank
- Alum and caustic dosing facilities
- A UV disinfection unit and an effluent pump to Dudauman Creek (provisional)
- A sludge tank and geobag sludge drying system
- Interconnecting pipework and pumping
- Electrical Switchboard with HMI (Touch Screen)
- Provision for remote monitoring via a telemetry system
- A new power supply
- A containerised amenities building which will include a control room and a laboratory.

Cost Estimate for the Pressure Sewer System

A summary of the Pressure Sewer Network Costs based on the concept design is shown in Table S-2. A detailed costing is provided Appendix F.

For pipe lengths an additional 10% allowance has been made for changes during the detail design and to reflect the level of design (concept design level at this stage). In addition, five air valves and vent shafts have been allowed for, however based on the concept design, no vent shafts are required. These values have been added to the contingency.

Another thing to note, is that the 16 properties outside the village boundary contribute to a significant part of the capital, due to the long reticulation lines. The total cost of expanding the network beyond the village network is around $800,000.

Table S-2: Pressure Sewerage Network – Estimated Cost Summary

	Cost Item	Cost (includes GST)
1.	Site Establishment	
2.	Pressure Units	$1,373,200
3.	Reticulation	$1,365,000
4.	Miscellaneous	$44,000
	Sub Total – Direct Construction Costs	**$2,892,200**
	Contractor Indirect Costs	$144,610
	Total Construction Costs	**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)	$682,800
	Survey, Investigation, Design and Project Management	$289,220
	Total Estimated Project Cost[1]	**$4,008,830**

Note: 1 – Total Estimated Project Costs do not include client costs such as community consultation and client liaison by the project manager.

Cost Estimate for the STP

The following table shows the cost estimate for a concrete IDEA reactor plant.

Table S-3: STP - Cost Summary

Item No	Description	Cost (includes GST)
1.	Site Establishment	$108,000
2.	Roadworks and Site Drainage	$90,000
3.	Emergency Balance Tank	$25,200
4.	Inlet Works	$90,000
5.	Concrete IDEA reactor and balance tank	$728,471
6.	Sludge Tank	$18,200
7.	Sludge Dewatering	$83,700
8.	Chemical Dosing	$20,000
9.	Disinfection	$30,000
10.	Treated effluent outfall pump	$9,000
11.	Amenities Building	$200,000
12.	Pipework, Valves and Fittings	$72,500
13.	Installation/Testing/Commissioning	$145,000
14.	Electrical Works	$364,100
15.	Potable water connection to STP	$10,000
16.	Miscellaneous	$90,000
	Subtotal	**$2,084,171**
	Project Contingency (20%)	$416,834
	Survey, investigation, design and project management (10%)	$208,417
	Total Estimated Capital Cost	**$2,709,422**

Contents

Tables

Figures

Abbreviations

ARTC	Australian Rail Track Corporation
BWL	bottom water level
CGRG	Cootamundra-Gundagai Regional Council
DPIE Water	Department of Planning, Industry and Environment - Water
EP	equivalent population
ET	equivalent tenement
HMI	Human machine interface
IDEA	Intermittently Decanted Extended Aeration
L/s	litres per second
MABR	membrane aerated biofilm reactor
MBBR	moving bed bioreactor
MBR	membrane bioreactor
OEH	Office of Environment and Heritage, NSW
PLC	programmable logic controller
PSS	Pressure Sewerage System
PWA	Public Works Advisory
REF	Review of Environmental Factors
RL	reduced level
RPZ	reduced pressure zone
SCA	Switchgear and control assembly
STP	sewage treatment plant
T.O.	top of
TWL	top water level
UPS	uninterruptible power supply
WHS	Workplace, Health and Safety

1. Introduction

1.1 General

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales. Stockinbingal is 388 km south west of Sydney and 102 km north east of Wagga Wagga. The town has a population of approximately 250 at present. The town does not have a reticulated sewerage system and relies on individual property based on-site wastewater management.

A reticulated scheme is proposed. An options assessment to determine the type of wastewater system (including reticulation and treatment) was completed in March 2019. Following the assessment, Cootamundra-Gundagai Regional Council (CGRC), has endorsed a pressure sewerage collection system with a package type treatment plant as the preferred servicing strategy for the Stockinbingal village.

Public Works Advisory has been engaged by CGRC to prepare a concept design for the proposed Stockinbingal Sewerage Scheme based on the endorsed servicing strategy.

This report details the concept design for a Pressure Sewerage System and sewerage treatment plant serving the village of Stockinbingal.

1.2 Purpose of the Report

The purpose of this report is to provide a concept design for the Stockinbingal Pressure Sewerage Scheme that details the proposed scheme including the service area, the properties to be served and the assumptions made in developing the concept.

This report along with the environmental assessment and funding approvals will provide sufficient information for Council to move forward to the design and procurement stage.

1.3 Project Objective and Approach

The objective of the concept design is to provide a reticulated wastewater service to all existing developed properties within the village area as well as about sixteen properties that adjoin the village area (generally to the east of the village area) which will also be considered for servicing. The properties to be serviced are shown in Figure 2-1.

The network layouts have been developed whilst taking the following into consideration:

- Minimising the impacts on the community and the environment.
- Minimising construction, operational and maintenance costs.
- Eliminating and minimising potential wet weather flows.
- Pipe routes will serve the identified properties within and adjoining the properties minimising the total length of pipework wherever possible. Additional network routes will then be developed to serve the potential 16 properties identified.
- Minor deviation of pipe routes may be adopted where it serves additional existing dwellings.
- The number of rail and road crossings will be minimised and located to minimise construction difficulties.
- Crossing of major telecommunications cables will be minimised where possible.

The sizing of the pipework has been determined using the hydraulic criteria detailed in Section 2.2.3. There is often more than one pipe size which meets the criteria, however in order to help cater for future infill growth the largest possible pipe which meets the criteria has been adopted (note this is not expected to have a significant difference to the pipe sizes used).

The potential infill growth is significant compared to the number of current properties. However, significant infill development is unlikely to occur within the next 20 years. As a result, development of a concept which serves both the current properties and potential growth areas is problematic from a technical perspective. The approach undertaken was to identify the scale of the growth areas and allow for the future connection through the sizing of the reticulation network.

The sewage treatment plant (STP) should be robust and allow for sufficient treatment of sewage to enable effluent discharge to the nearby creek.

1.4 Project Scope

The project scope includes the following tasks:

- Developing and documenting a Basis of Design for the sewer network and the STP
- Producing preliminary layouts and determining a preferred system layout
- Network modelling of the preferred layout
- Using the outputs from the network modelling to size the STP
- Refining of the concept sewerage network layout and treatment plant site
- Discussion of key challenges and opportunities
- Compiling a cost estimate for the project.

2. Basis of Design

The Basis of Design (BOD) details the assumptions and parameters adopted during the concept development (e.g. layout development and hydraulic modelling) of the sewerage scheme.

Specifically:

- The properties to be served by the scheme.
- The current population and any planned future growth.
- Current and future wastewater flows.
- Hydraulic parameters and assumptions to be adopted.
- Approach and decisions made during the concept development.

2.1 General

2.1.1 Scheme Service Area

The service area includes the village area of Stockinbingal and 16 adjoining properties that may be included.

The village has a small commercial area on Hibernia and Martin Streets but is otherwise residential. Many properties comprise multiple lots and so there is a potential for infill growth however the likelihood for this to be substantial is low.

A rail corridor bisects the village area with the largest section of the service area (including the commercial area) to the north of the rail line. The major road through the village (Hibernia Street) runs parallel to the railway track through the village area.

Several creeks (Bland, Powder Horn and Dudauman Creeks) run through the village area. The village is flood prone as detailed in Councils Village Strategy Report. Infrastructure will be designed to minimise flood impacts.

2.1.2 Properties Serviced by the Proposed Scheme

A total of 111 properties have been identified for servicing with an additional 16 properties to be considered for servicing.

The properties identified for servicing include:

- 92 residential properties within the village zone boundary (land zoned RU5)
- 6 non-residential properties (2 churches, 1 school, 2 public toilets and a bowling club) within the village zone
- 8 commercial properties (7 shops and one hotel) within the village zone
- 5 properties adjoining the village zone boundary

The additional 16 residential dwellings identified by Council for possible servicing are located to the east of the village. These additional dwellings will be included in the concept level scheme development. The final decision to included or exclude any of these properties will be determined by Cootamundra-Gundagai Regional Council at a later stage.

Note: the GrainCorp facility on Troy St has not been included for servicing at this time.

All residential properties, including the additional properties being considered, are shown in Figure 2-1. It is noted that there are a significant number of vacant blocks within the village zone. Our understanding is that there is no driver at this time for infill development to occur. In order to accommodate some infill growth, a high flow scenario will be tested, to determine the ability of the system to accommodate future infill growth.

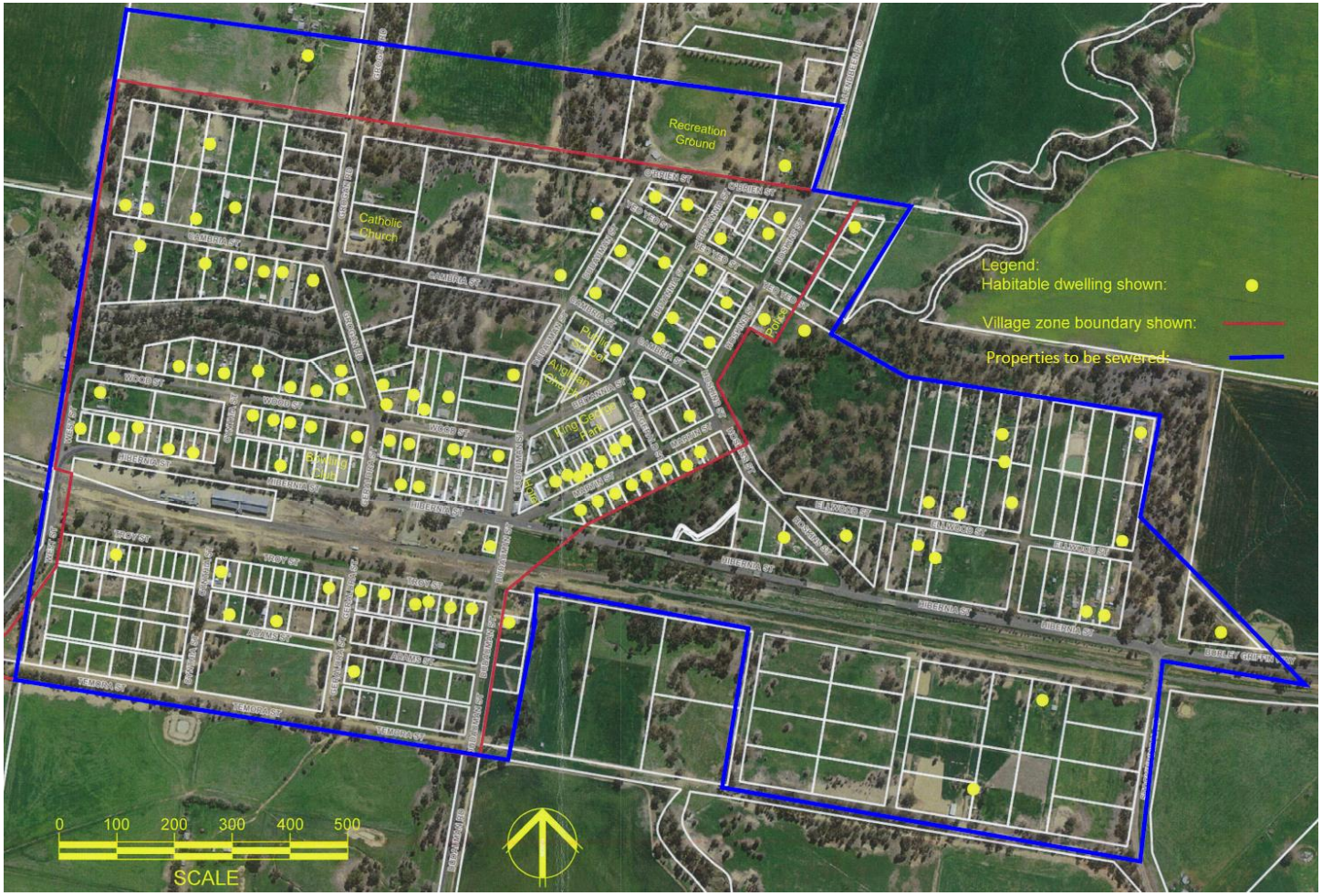


Figure 2-1: Properties to be Served by the Proposed Scheme

2.1.3 Property Zonings

The property zonings for the Stockinbingal village and surrounding area are shown in Figure 2-2. The village area is almost entirely zoned “Village - RU-5”, with a park area to the north of the village zoned “Public Recreation - RE1” and the rail corridor through the village zoned “Infrastructure - SP2”. The surrounding land is zoned “Primary Production - RU1”.

The properties to be serviced are generally residential. Non-residential usage within the village include a small commercial centre, churches, a school and a bowling club.

The detail and location of the properties with a non-residential usage are listed below:

Table 2-1: Non-Residential Properties

Description	Location
Commercial Shops (approximately 6)	24-38 Hibernia Street
Commercial Hotel	32 Martin St (Lot 131 DP750619)
Post Office (Cootamundra Hall)	32 Martin St
St Joseph’s Catholic Church	Grogan Rd (Lot 2, DP504837)
St James Anglican Church	Lot 1, Sec 7 DP758928
Stockinbingal Bowling Club	48 Hibernia St
Police Station	6 Hoskins St
GrainCorp Silo	Troy St
Stockinbingal Public School	Britannia St

2.1.4 Future Development Outside the Current Village Boundary

The Council’s Village Strategy has identified four potential growth areas. This includes three residential areas and one industrial area. Council has indicated the development timeframe for these areas is beyond 20 years.

The potential residential areas have a combined area of about 55 hectares and based on 8 lots/gross hectares, the total number of potential lots is about 440 lots.

The potential industrial area is about 380 hectares in size. No information regarding the type of industrial business that may operate in the area are known at this time.

These potential development areas have not been included in the scheme concept. These development areas could be included in the future as new sewer catchments. The STP would likely need to be expanded should this development occur.

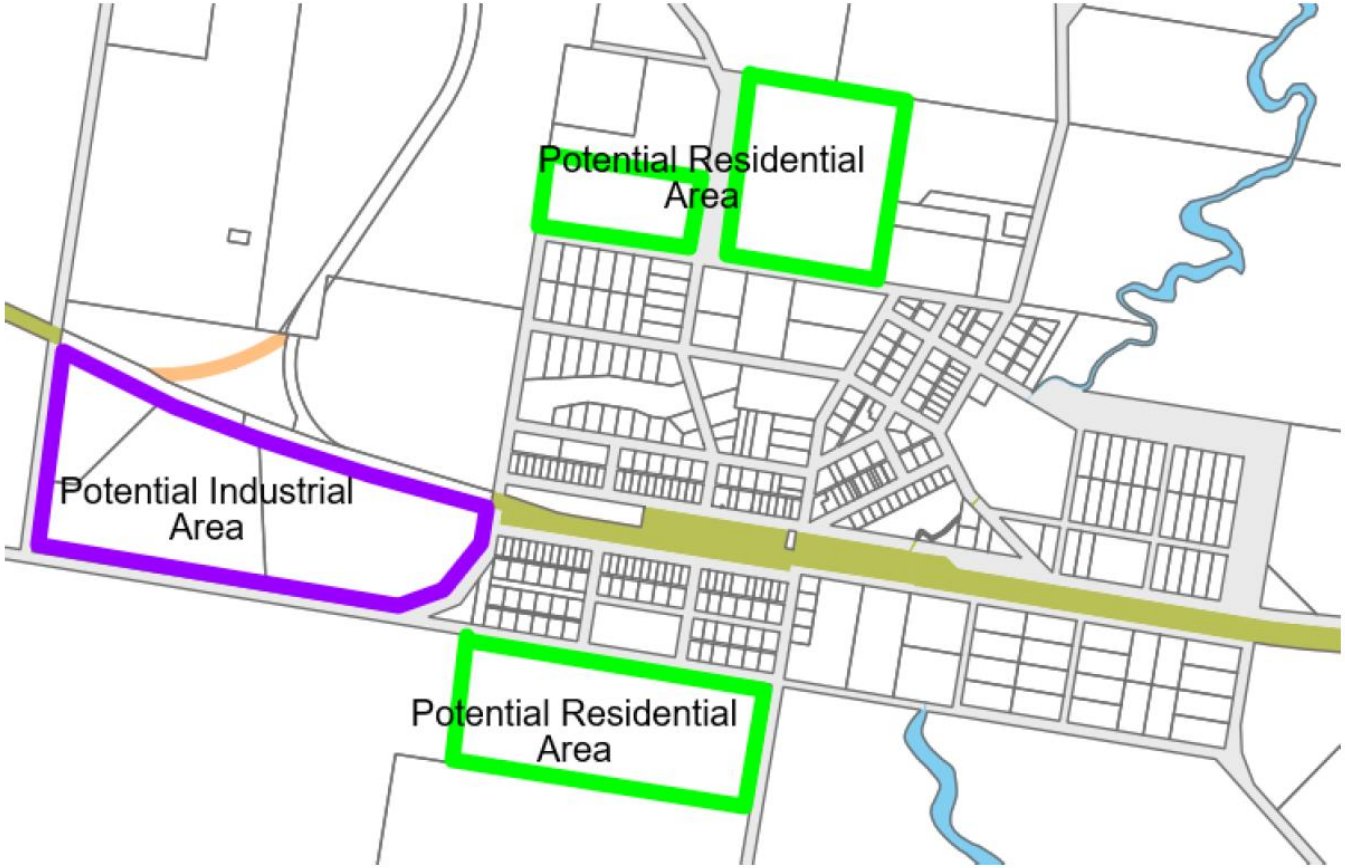


Figure 2-2: Zoning Plan - Stockinbingal

2.1.5 Climate

Mean minimum and maximum ambient temperatures for Cootamundra Airport (20 km from Stockinbingal) based on historical Bureau of Meteorology (BOM) data ranges 1.1 °C (July) and 32.2 °C (January), respectively. The maximum recorded low and high temperatures are -7.8 °C and 43.6 °C respectively.

2.1.6 Flooding

The Stockinbingal Floodplain Risk Management Plan – July 2002 found areas of the proposed wastewater scheme impacted by flooding. The STP site is above the 1 in 100 year flood level, however the 1 in 100 year flood level inundates a considerable area of the Stockinbingal village. A plan showing the 1 in 100 year flood level from the flood study is provided in Appendix E.

Measures to address the impact of flooding on the collection system is discussed in detail later in the report.

2.1.7 Topographical Survey

An engineering survey of the proposed site as part of this investigation was carried out by PWA. The survey identifies the location of existing structures/ facilities, surface levels/ contours and other surface features upon which the concept is developed within this report, and later detailed designs, are to be based. The survey drawings have been added in Appendix A.

2.1.8 Geotechnical Investigation

Based on the published data (Cootamundra 1:250,000, Geological Series Sheet SI/55-11, 2nd Edition, 1996), the Stockinbingal township and proposed STP site are completely located within Quaternary alluvial deposits, comprising gravel, sand, silt and clay.

At the topographic high point at the north-western outer region of the township, the area is underlain by Early Devonian, Lochkovian age igneous rocks of the Stockinbingal and Bethungra Formations comprising rhyolite, rhyodacite and dacite. At the topographic high point at the south-eastern outer region of the township, the area is underlain by Late Ordovician, Bolindian age sedimentary rocks of the Bribbaree Formation comprising siltstone, sandstone, chert and mudstone. Portions of the Bribbaree Formation are largely obscured by Quaternary colluvium and eluvium.

A geotechnical investigation for the reticulation scheme and STP was conducted by PWA as part of this engagement. The main findings are:

- Construction difficulties associated with groundwater are not expected.
- In agreeance with the regional geology map, bedrock was not encountered within any of the boreholes.
- Shallow excavations in soil deposits should be readily achievable using a hydraulic excavator.

2.1.9 Review of Environmental Factors (REF)

A Review of Environmental Factors (REF) is required for the new STP. The REF is currently being undertaken and will review the effect on existing flora and fauna at the STP as well as the reticulation scheme and the effect of noise and odours that will be generated by the treatment process on the environment.

2.1.10 Noise and Odour

The main sources of noise are the mechanical equipment particularly the aeration system and to a lesser extent, other mechanical equipment such as pumps and the mechanical screen. Mechanical equipment will be designed to ensure that noise at the plant's boundaries does not exceed ambient noise levels by 5 dB. The buffer will be approximately 200 m to the nearest residence.

The main source of odour will be the inlet works which will be covered. The buffer will likely prevent odour complaints from neighbours. A noise and odour study is being undertaken for the scheme.

2.1.11 Workplace, Health and Safety

Workplace, Health and Safety (WHS) aspects relating to the proposed works will be in accordance with WHS Act 2011 and WHS Regulation 2017.

Sewage Treatment Plant

WHS requirements for STPs and related infrastructure are predominantly concerned with providing safe access for operators, prevention of injury from slips, trips and falls, procedures and equipment for confined spaces and requirement for handling of hazardous materials.

Handrails, platforms, stairs and/or safety chains are required to provide safe access and working conditions in circumstances where work is at height or there is a potential for falling off or into structures. Appropriate fencing is required around the STP site to prevent unintentional or unauthorised entry.

Design of the proposed plant will incorporate the relevant safety provisions to meet current WHS requirements, including the completion of Safety in Design checklists that outline potential safety issues and how they have been addressed in the plant design.

In addition, an operation and maintenance (O & M) manual will be prepared for Council following construction of the plant. All as built drawings will be included in paper and electronic format; which will form part of the O & M manual. This critical document will provide a detailed guide to plant operation and maintenance requirements. This will also include training provided to the operators and maintenance staff in the operation and maintenance of the new STP.

Pressure Sewer Network

Operation and the maintenance of the pressure reticulation network can be separated into two categories, the on-property assets and the street network.

In regard to the on-property assets, access to private properties is required and private properties are not controlled sites. The risks associated with entry onto private property need to be assessed before access occurs. These risks include slip trips and falls, manual handling of the pump units, physical contact with wastewater as well as potential for electrocution associated with the electrical component of the on-property assets. As these sites also include interaction with property owners there is the potential risk associated with this interaction which may put maintenance staff at risk.

Operation and maintenance of the street network is similar to the requirements of maintaining a water supply network. Risks associated with the street network include, slip, trips and falls, manual handling, potential contact with wastewater and working on roadways.

In order to ensure OH&S risks are addressed appropriately a Risk in Design Workshop should be undertaken during the design stage and a report prepared detailing the steps required to meet legislative requirements.

2.2 Pressure Sewerage System

2.2.1 Relevant Codes and Standards

A number of reference documents have been used in developing this concept design. These documents include:

- Pressure Sewerage Code of Australia WSA 07 – 2007
- AS/NZ4799 Installation of Underground Utility Services and Pipelines within Railway Boundaries
- ARTC - Installation of Utility Services and Pipelines within Railway Boundaries ETG-17-01
- AS3000 National Electrical Installation Standard

2.2.2 Estimated Wastewater Flows

The average daily wastewater flow for the developed properties within and adjoining the village area is estimated to be 67,806 L/day. This includes the non-residential properties such as churches, schools etc. The estimated total daily wastewater flow for the additional 16 properties (with a dwelling) outside the village area is 6,336 L/day.

Estimated wastewater flows are detailed in Table 2-2, Table 2-3 and Table 2-4.

In general, the flows have been based on the existing residential population data for the village, relevant Australian Codes and where appropriate and estimates from water consumption data. An allowance of 180 L/EP/d has been adopted.

A high flow scenario is also shown in Table 2-2 based on 200 L/EP for each existing residential property and an allowance of 20% for infill properties. For non-residential flows, an increase of 20% has been adopted for the sensitivity assessment. For downstream infrastructure, an allowance of 20% on top of the high flow scenario is recommended. This has been used to test the robustness of the concept design and for determining the appropriate flow to the downstream treatment plant.

Table 2-2: Flow Summary

Description	Equivalent Population (EP)	Average Daily Flow (L/day)	Daily Flow - High Flow Scenario (L/day)
Properties within and adjoining the Village Area	213	38,142	51,216
Other Residential Properties Outside the Village Area (up to 16 properties)	35	6,336	8,448
Non-Residential Wastewater Flows (refer to Table 2-4)	N/A	23,328	27,994
Sub total		*67,806*	*87,658*
Allowance for receiving infrastructure – 20%			17,531
Total		**67,806**	**105,189**

Table 2-3: Existing Properties - Residential Wastewater Flows

Description	No of Lots	Density EP/Property	Equivalent Population	Average Daily Flows - based on 180 L/EP/day (L/Day)
Residential Properties within the Village Boundary	92	2.2	202.4	36,432
Residential Properties adjoining the Village Boundary	5	2.2	10.4	1,872
Sub Total				*38,412*
Other Residential Properties Outside the Village Area	16	2.2	35.2	6,336
Total				**44,748**

Note: Population densities are based on the Stockinbingal Village Strategy (202 residents in the 91 residential properties in the urban area).

Table 2-4: Non-Residential Wastewater Flows

Description	Criteria	Students/Occupants	Equivalent Tenement (ET)	Average Daily Flows (L/Day)
Commercial Premises				
6 Small Commercial Properties (24-38 Hibernia Street)	Considered as a Residential Dwelling	N/A	3.5 EP per property	3,780
Commercial Hotel [1]	See Notes		N/A	5,900
Sub Total			*N/A*	*9,680*
Non-Residential Properties (General)				
Stockinbingal Bowling Club [2]	0.25 EP/Occupant	95	23.6	4,248
St Josephs Catholic Church [3]	See Notes		6	1,080
St James Anglican Church [3]	See Notes		6	1,080
Stockinbingal Public School	0.2 EP/Student	27	6	1,080
Stockinbingal Police Station [4]	See Notes	N/A	7	1,260
Post Office (Ellwood Hall) [5]	0.25 EP/Occupant	100	0.25	4,500
2 x Public Toilets	20 people/d x 10 L/use per site			400
Sub Total				*13,648*
Total				**23,328**

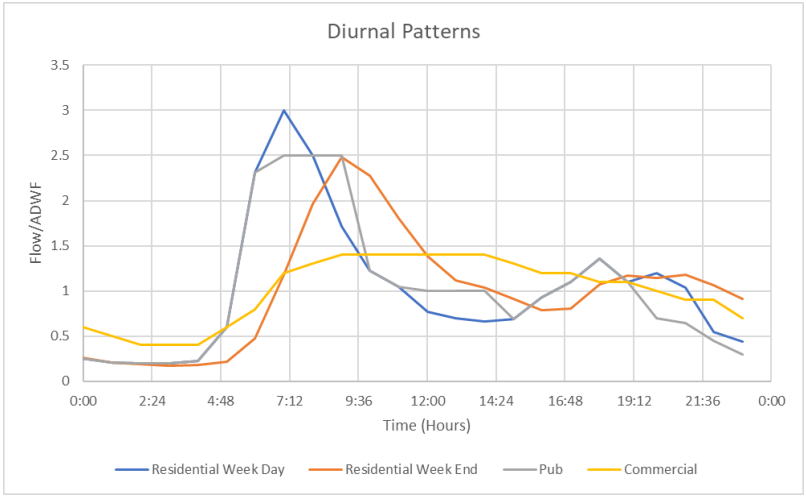
Notes:

1. Wastewater discharges have been based on the general water consumption information with an increase (approx. 25%) to allow for daily variations.
2. Based on water consumption data and assumes water used for non-sanitary use will be offset by liquids consumed and allowing an increase of 50% due to daily variations.
3. The churches do not appear to have any water demand. In order to allow for future toilet facilities a daily flow equivalent to 6 EP @ 180 L/EP/day has been adopted.
4. Based on water consumption data the water usage is approximately double that used by a typical single dwelling (e.g. 3.5 EP@ 180 L/EP/Day) and without further explanation it is considered that an EP of 7 is appropriate.
5. Flows for this property have been based on the use as a hall with potentially 100 occupants.

2.2.3 Pressure Sewerage System Parameters

The following table details the parameters assumed in the development of the concept design and hydraulic model.

Table 2-5: Pressure Sewerage Systems Hydraulic Parameters

Item	Parameter	Commentary
1	EP/Lot	For existing developed properties: 2.2 EP/Property For commercial premises: See below Wastewater flows for non-residential properties are based on EPs as detailed in Table A1 of the Sewerage Code of Australia WSAA 02-2002 or water demand data as appropriate.
2	Wastewater Flows	Wastewater flows per residential property are be based on 180 L/EP/day or available water demands for non-residential properties. The diurnal flow patterns for residential, commercial properties are shown below.  Wastewater network flows for development of concept options and initial pipe sizing are based on the probability method as per WSAA 07 - 2007. For hydraulic modelling appropriate diurnal curves for each property type (residential, commercial) have been adopted. No wet weather allowance is allowed for the peak wastewater flow analysis. It is recommended that an allowance of 20% on a high flow scenario be allowed at downstream infrastructure (refer item 9). Note that mitigation measures to address potential wet weather inflow and infiltration are included later in this report.
3	Flow Velocity	Maximum allowable velocity - 3.5 m/s as per WSAA 07 – 2007 Preferred maximum velocity - 2.5 m/s (Note maximum preferred velocity will be adopted to minimise unnecessary system head loss and power consumption) Minimum velocity - 0.6 m/s as per WSAA 07 – 2007. Note: At the extremities of the system where only one pump is connected the minimum velocity cannot be achieved. In this case a velocity of 0.4 m/s is considered acceptable.

Item	Parameter	Commentary
4	Friction factor	A pipe friction factor of 0.75 has be adopted as per WSAA 07 -2007 A sensitivity assessment using a lower friction factor of 0.6 has been used to examine any potential impacts. As the WSAA - 07 friction factors are considered a conservative (high) friction factor so no high friction factor sensitivity has been undertaken.
5	Pressure Pump Unit	Wastewater modelling is based on E-One Pump units. For residential and typical commercial properties EOne Simplex units (One Extreme Pump) with 2010P collection tanks has been adopted. For schools or other properties where additional storage, pump capacity or reliability is required an EOne Duplex unit (2 Extreme Pumps) with 2010P collection tanks has been adopted. For large wastewater discharge properties such as the bowling club and hotel the need for larger units will be considered at the detailed design stage. Pressure Sewer Pump Units meet the following criteria: ▪ Operational head of 55 m minimum ▪ Operating flow between 0.6-0.9 L/s ▪ High level and pump failure visible and audible alarm ▪ Motor thermal overpressure protection ▪ Power spike and brownout protection ▪ Automatic restart protocol for managing power outage conditions ▪ Remote operational analysis capacity to assess operating hours on a daily basis Note: EOne Extreme pumps require 240 volts at 50 Hz.
6	Pipe Type and Sizes	Polyethylene (PE 100) PN16 (SDR11) cream strip Note: WSAA 07 – 2007 requires a minimum pipe class of PN16. All pipes will be designed in accordance with AS/NZ 2655 Design and Installation of Buried Flexible Pipelines. A check of the maximum system pressure will be undertaken to ensure a PN16 pipe is satisfactory. Given the relatively flat terrain it is expected that a PN16 PE100 pipe should generally be satisfactory. The design of the pipeline under the rail corridor will need to meet the requirements of AS/NZ 4799 Installation of underground utility services and pipelines within railway boundaries and the requirements of the Australian Rail Track Corporation. Pipe sizes chosen in this concept report are available pipe sizes as detailed in Table 10.2 of the Pressure Sewerage Code of Australia WSAA 07 – 2007.
7	Power Outage Recovery	During power outage, the individual property pumps will be unable to function. When power returns the pumps will operate where required and this usually results in a higher than normal operating flow. In order to manage this, a number of alternatives are available including providing a small buffer volume at the receiving sewer/treatment facility or restricting the flow rate to the plant until the system recovers (either through a control valve or staging the pump restart). In order to understand the appropriate method of mitigating this issue a power outage recovery scenario has been modelled. The duration of power outage is based on information from the power supplier.

Item	Parameter	Commentary
8	Air Containment	While pressure sewerage systems are sealed, small amounts of air can find their way into the system. In order to alleviate potential hydraulic issues air needs to be moved through the system or allowed to vent from the system. Calculations in accordance with the Pressure Sewerage Code of Australia WSAA07 have been undertaken to ensure that any air in the system is able to be moved along and out of the system. Where this is not possible suitable vent locations have been included.
9	Sensitivity analysis	Sensitivity analysis has been undertaken to test the system concept. Specifically, a higher flow per EP (200 L/EP) for each existing residential property and an allowance of 20% for infill properties. For non-residential flows, an increase of 20% has been adopted for the sensitivity assessment. For downstream infrastructure, an allowance of 20% on top of the high flow scenario is recommended.

Table 2-6: Concept Design Considerations

Item	Description	Consideration
1	Location of Vent Shafts if required	Where possible vent shafts have been located away from sensitive receivers. Where this is not possible treatment of the air through carbon canisters is recommended.
2	Location of Stop Valves and Flushing Points	Stop Valves and Flushing Points are generally located as prescribed in the Pressure Sewerage Code of Australia WSAA 07. If the number of Stop Valves or Flushing Points appear excessive then the number have been reduced where it does not compromise the operability. This will be done in consultation with Council.
3	Rail Crossings	Discussions with the rail authority have been undertaken to understand their requirements. The concept design considers those requirements and detail an approach to meet them.
	Future adjustment to the rail corridor	It is noted that a future adjustment to the railway alignment through/near the village area may occur as part of the proposed Inland Rail Project. Contact with the relevant rail authority (Australian Rail Track Corporation) has occurred during the concept development to understand possible impacts and any mitigation measures or requirements to be adopted.
4	Potential Flood Impacts	The concept design has considered the flood impacts. Specifically, the 1% AEP flood event. The 1% AEP flood level will be taken from the "Stockinbingal Floodplain Risk Management Plan – July 2002. It should be noted that the flood level varies across the village and is not a single value." To address flooding the following would be undertaken: Pump unit, with a sealed lid with venting and power taken out the side of the tank with the cables to the building. The alarm panel will be mounted at a suitable height above the flood level. All tanks with the pumps will be installed with ballasting at the base to eliminate any chance of floatation.
5	Potential Impacts of Power Outages	The impact of power outages on commercial premises or lengthy power outages are considered later in this report.

2.3 Sewage Treatment Plant

2.3.1 Site Location

The STP will be constructed within Lot 7003 DP94543. The approximate location is outlined in red below.

Figure 2-3: Aerial View of Proposed new Stockinbingal STP Location

2.3.2 Design flows

The plant will be designed for an equivalent population of 450 EP. This is based on:

- Residential EP of 248 as per Table 2-2.
- Estimated industrial EP of 130 based on Table 2-2.
- An allowance for 20% growth in the future.

Therefore, the average dry weather flow (ADWF) will be 0.94 L/s. The pressure sewer modelling results were used to determine the peak inflow values. The methodology of the modelling is further discussed in Section 4.2. Figure 2-4 shows the modelled results based on normal operation. The peak instantaneous flow rate is 6 L/s, however, the peak 30 minute running averaged flow rate is 3 L/s.

The following design values have been adopted:

- Average dry weather flow (ADWF): 0.94 L/s.
- Design dry weather flow (DDWF) for secondary treatment: 3.6 L/s (3 L/s, based on averaged peak inflow plus 20% for future growth).
- The maximum plant inflow and flow requirement for the inlet works: 7.2 L/s (6 L/s based on instantaneous peak inflow plus 20% for future growth).

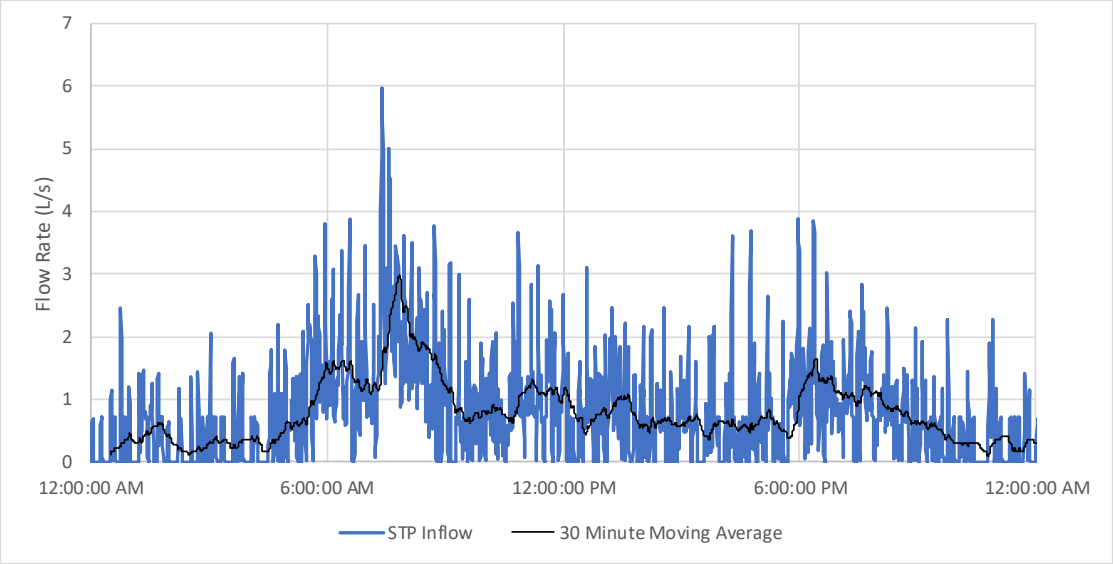


Figure 2-4: 24 hour modelled inflows

2.3.1 Inlet and Outlet Quality

As there is currently no STP the values in Table 2-7 have been assumed based on typical domestic strength sewage, while the effluent values are based upon typical requirement values from the EPA for modern technology STPs.

Table 2-7: Inflow and Effluent Values

Parameter	Inflow values	Effluent Values
Biochemical Oxygen Demand (BOD_5)	325-360 mg/L	10-15 mg/L
Faecal Coliforms		200 CFU/100 mL
pH		
Suspended Solids (SS)	275-300 mg/L	15 -20 mg/L
Ammonia		2-5 mg/L
Total Nitrogen (TN)	60-70 mg/L	10-15 mg/L
Total Phosphorus (TP)	13-15 mg/L	0.5 – 1 mg/L

2.3.2 Electrical Aspects

The main electrical aspect to be considered is a new power supply to the proposed STP site.

Instrumentation, uninterruptible power supply (UPS), programmable logic controllers (PLCs), telemetry and an HMI system will also be incorporated as part of the proposed electrical works. Other local switchgear control assemblies (SCAs) and field switch stands will be provided near minor mechanical plant, including chemical dosing pumps. The STP will have a high level of automation.

Building services such as power, lighting, air conditioning, security systems and smoke detectors will be included as required.

2.3.3 Water Supply to Site

Potable water will need to be supplied to the new STP. Service lines will be extended, from O'Brien Street (Council to confirm), to the new STP for washdown purposes, for the operator amenities and chemical safety shower/eyewash facilities. A new reduced pressure zone (RPZ) device will provide protection of the town supply from backflow contamination from the plant.

2.3.4 Structural Aspects

The structural design of a new treatment facility will be carried out in accordance with relevant Australian standards for steel and concrete structures and take the following into consideration:

- Allow construction to be facilitated to minimise costs.
- Requirements for corrosion protection and subsequent incorporation into the design.
- Buoyancy of structures with respect to groundwater and flood levels identified from investigations (no groundwater expected, based on Geotechnical investigation).

2.3.5 Construction Planning

Section 60 approval will be required from DPIE Water before construction can commence. The concept design report and a draft set of design drawings will have to be submitted to DPIE Water for review and comments as part of the approval process.

The target effluent quality limits will be assessed as part of the REF with DPIE Water for reuse and NSW EPA for discharge.

2.4 Key Challenges and Opportunities

A number of key challenges and opportunities have been identified during the development of the concept design.

Table 2-8 details the key challenges and opportunities identified during development of the concept design and the mitigation measure suggested to address these risks. Where mitigation measures are to be assessed in future stages this has also been identified.

Some of these risks and the mitigation measures are discussed in more detail later in this report. Table 2-8 provides a reference to direct the reader to the location in the report where an item is discussed in more detail.

Table 2-8: Summary of Key Challenges and Opportunities

Item	Challenge and Opportunity	Type of Risk	Action Required	Report Reference
On-property Pressure Sewer System Component				
1	*Flood Risk* During flooding the system can be inundated and there is potential for damage to the control/alarm panel.	Operational	Collection tanks will be sealed with a small one-way valve (duckbill valve) installed or vent pipes connecting to the properties plumbing vent to allow the top part of the tank to vent in properties with ground levels below the 1 in 100 flood level. Control Panels to be located a minimum of 0.5m above the 1in100 year flood level.	See 4.5.1
2	*Local flooding/overland flows* During rain events local overland floodwater flows may enter the collection tanks.	Operational	Collection tanks are not to be located in low points in the property where overland flows may occur. Location of tanks to be determined during the detailed design stage.	See 4.5.1
3	Non-Compliance of Electrical distribution boards	Legal compliance	Audit during the design stage to identify non-compliant electrical distribution boards to be upgraded during the project delivery.	See 4.5.5
4	Power Outage and pump failure causing overflow of the collection tank	Customer impact	The size of the tank is sufficient to store approximately one day's sewage discharge from an average house. Flows to the STP will be larger than normal following a power outage and emergency storage volume at the STP is recommended to allow all of the system to recover as quickly as possible and not compromise the treatment plant operation. Protocols to respond to extremely long power outages (longer than outages recorded) or pump/control failure will need to be put in place to ensure relatively prompt response. It is recommended that large commercial customers be required to provide backup power so that the impact of a power outage on their commercial operation is minimised and the potential for overflows from the tank are minimised.	See 4.4
5	Community education will be required to ensure property owners understand Council and property owners' responsibilities	Customer impact	Information about Pressure Sewerage Systems to be provided to property owners when Council determine to proceed with the scheme.	See 4.5.3 and 4.5.4

Item	Challenge and Opportunity	Type of Risk	Action Required	Report Reference
Reticulation Network Component				
1	Network Main Crossing of Railway	Design	The network will cross the rail corridor at Burley Griffin Way on the Western end of the village. Preliminary discussions with ARTC indicate that the location is suitable however there are some risks which will need to be resolved during the detailed design stage.	See 4.5.2
2	Allowing for Potential Growth	Operational	Infill growth will be catered for within the design and potential small volumes of growth outside the village area. Given the long lead time for growth outside the village area and the scale of growth outside the village area amplification of the system should be deferred until the scale and location of growth is known.	See 4.3
3	Odour and Air Management	Operational	Odour and air management will be addressed by ensuring air flow out of the reticulation network is minimised and odorous issues at the STP are addressed by chemical dosing or filtering of the air.	See 4.2.4
4	Training of Maintenance Staff	Operational	Training of maintenance staff to understand Pressure Sewerage Systems and how to respond to issues will be required. This should occur prior to project commissioning.	See 4.6
Sewerage Treatment Plant				
1	Proposed site location for STP is Crown Lands and part of an Aboriginal Land Claim	Customer impact	Council is working on resolving the land claim.	
2	Power outage recovery will result in larger than normal flows to the STP.	Operational	An emergency storage sufficient to accommodate additional flows shall be provided to allow recovery of the system as soon as possible after a power outage.	See 4.4 and 6.1

3. Pressure Sewerage System Description

Pressure Sewerage Systems consist of small grinder pumps located on each property which macerate the sewage into a fine slurry and pump it through a pressured sewerage network directly or indirectly to a wastewater treatment facility.

3.1 On-Property Infrastructure

The on-property system comprises a control/alarm panel, a collection tank containing the grinder pump, a property discharge line and property boundary assembly. Figure 3-1 provides a cross section of the on-property arrangement.

The house plumbing (customer sanitary drain) discharges to a collection tank. The grinder pump located inside the collection tank then macerates the sewerage and pumps it though a small polyethylene pipeline (property discharge line) to the pressurised street network.

A control/alarm panel is generally located on the dwelling (above the flood level) near the collection tank and is connected to the house's electrical distribution board providing power and control signals to the grinder pump. A property boundary assembly (small plastic valve pit) is located within the property boundary and includes a stop valve and reflux valve are located along the property discharge line and within the property boundary. These valves allow the system within the property to be isolated from the street network if necessary.

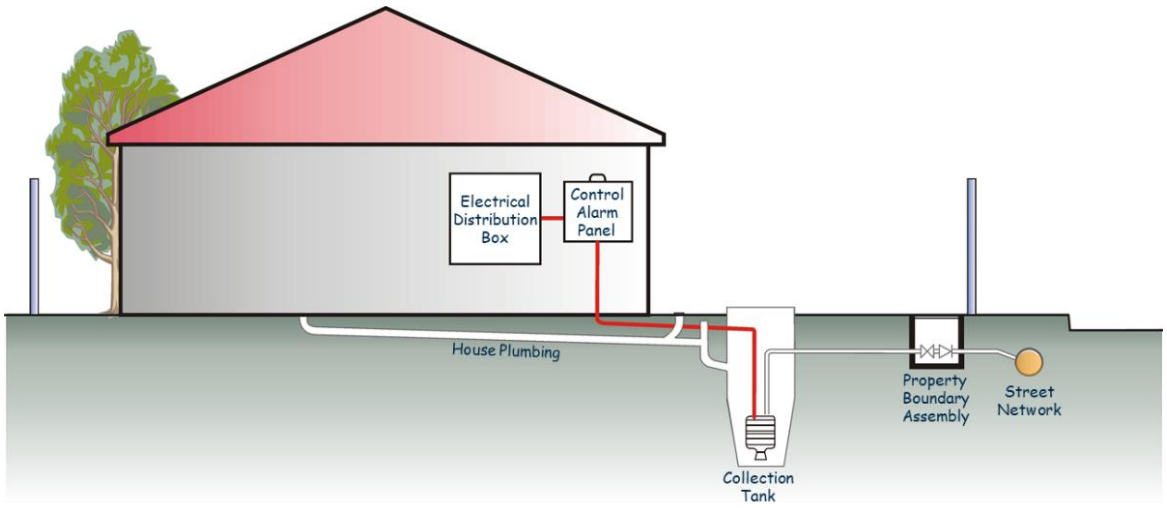


Figure 3-1: On-Property PSS Infrastructure

3.2 Street Network

The street network receives flows from each of the grinder pump units located on the properties served by the wastewater system. These networks are normally pressurised and are designed to transfer flows to a wastewater treatment facility. This may occur directly or via another wastewater system or wastewater pumping station.

Polyethylene pipes are generally used for the street network and are fully welded systems ensuring no ingress of water occurs. These pipes are relatively small compared to a gravity wastewater system and unlike gravity systems are generally laid at a shallower depth.

The infrastructure associated with PSS networks include:

- Isolation and flushing valves
- Vents
- Barometric loops where required
- Chemical dosing facilities where required

Isolation and flushing valves are located throughout the network to allow isolation and/or pipe flushing for maintenance purposes. The surface fittings for these valves are similar to that used in water systems.

While only relatively small amounts of air are able to enter a PSS system the accumulation of air at local high points in the network can be detrimental to the hydraulic performance of the system. In order to mitigate this issue systems are designed wherever possible to move air along and out of the system at the downstream discharge point. However, where this is not possible it may be necessary to provide a vent shaft to allow air to leave the network. The air is released through an air release valve to the vent before it is discharged to the atmosphere. The standard air valve arrangement (see Figure 3-2) shown in the Pressure Sewerage Code of Australia has the air valve located in a pit. Many authorities have adopted an alternative arrangement where the air valve is located in an above ground cubicle. This makes maintenance easier and avoids water building up in the pit. Where possible these vents should be located away from sensitive receivers (e.g. schools, nearby dwellings). Where there are sensitive receivers close to vent locations, local carbon filters can be used to minimise any potential odour issues.

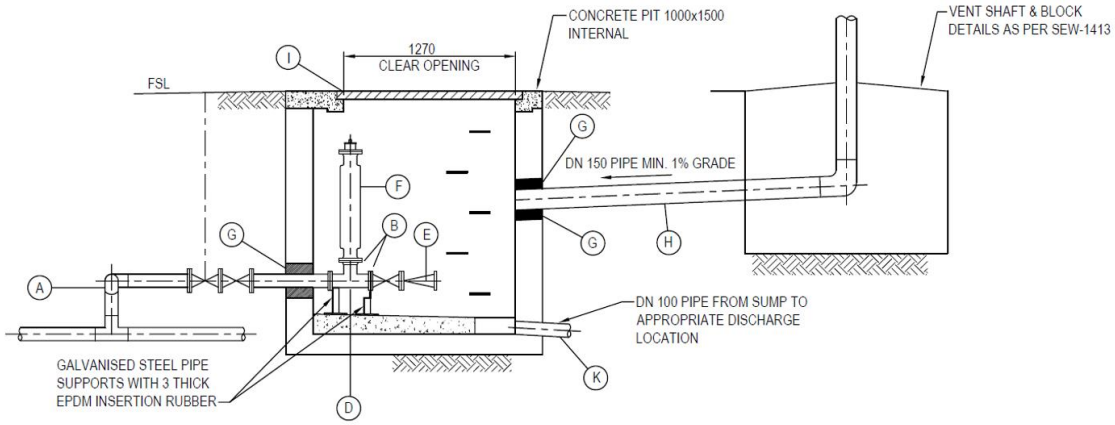


Figure 3-2: Standard Air Valve Arrangement

Barometric loops are required where part of the network is at a higher elevation than any part of the downstream system. The Barometric loop provides a high point in the system ensuring the entire network remains flooded, eliminating the movement of air in and out of the system. Barometric loops are not always required in a pressure sewerage system and the need for these will need to be assessed on a system by system basis.

Chemical dosing facilities are sometimes required where air movement out of the system may cause odour issues. In general PSS systems discharge only small amounts of air from vents within the system and chemical dosing within the network is not required for odour control in the network. However, chemical dosing may be required to address potential odour issues at the receiving infrastructure (pumping stations, gravity networks or sewerage treatment facilities). The need for and type of chemical dosing will need to be examined as part of an overall approach to odour control at the receiving infrastructure.

3.3 Wet Weather Flows

Pressure Sewerage systems remove the potential for infiltration and inflow via the street reticulation system with the only source on inflow being from the house plumbing or the small air vents in the collection tank. It is recommended that no wet weather allowance be included when determining the peak flow in the system.

Pressure Sewerage systems are not generally designed to cater for inflow and infiltration flows from the property plumbing. It is recommended that an audit of the property plumbing be undertaken and that the control panel used in the system has the capacity to identify properties with higher pump operation during rain events. This aids the water authority to identify sources of high inflow which may negatively impact the sewerage system. Identifying and rectifying this issue will reduce the power consumption of the pumps and the cost to the homeowner.

In order to accommodate some infiltration and inflow allowance it is recommended that receiving infrastructure be sized based on the high sensitivity analysis flow plus 20%.

3.4 Power Outages

In Pressure Sewerage Systems the peak flow to the downstream system occurs after a significant power outage. In order to assess the impact of a power outage records from the electricity supplier to the Stockinbingal area were examined and a hydraulic simulation of a power outage situation modelled. This is further discussed in Section 4.4.

4. Reticulation Network

In developing the reticulation network, a number of factors have influenced the network layouts. These factors include:

- The area to be served is bisected by the rail corridor. Potential crossing points have been limited to one location where the roads crosses the rail corridor, and this is preferred by the Australian Rail Track Corporation (ARTC). The single rail crossing minimises risks (approval timeframes, cost increases and potential construction impacts).
  It should be noted that ARTC have advised that there are no current plans to widen the rail corridor for the Inland Rail Project between the two locations where the Burley Griffin Way crosses the Rail corridor at Stockinbingal.
- To avoid potential environmental issues and for ease of construction all pipe routes were kept to existing roadways unless this was not possible.
- The location of the proposed wastewater treatment plant is lower than some of the village area and so a barometric loop will be required at the Sewerage Treatment Plant Site to keep the network flooded and minimising air movement in and out of the system.

4.1 Potential Network Layouts

Details of the preferred network layout has been attached in Appendix A. The layout was influenced by the factors detailed above.

The main difference in the options developed are, the location where the wastewater network crosses the railway corridor and the route adopted for the main serving the south-western part of the system from the corner of Hibernia and Dudauman Streets.

Two alternative crossing points of the railway corridor have been considered, one at Burley Griffin Way and the other at Dudauman Street. A third option further to the east was also discussed but was not considered further as it was not within a road corridor.

For the network serving the southern side of the railway and the western end of Hibernia Street two routes were considered for connecting the network to the sewerage treatment plant. One route from the corner of Dudauman Street and Hibernia Street going north along Hibernia Street and then O'Brien Street before crossing the recreation ground to the STP site. The other from the corner of Dudauman Street and Hibernia Street along Martin, Hoskins and O'Brien Streets then through the Park to the STP site.

Description of options developed:

- Layout 1A - This layout crossed the rail corridor at Burley Griffin Way (western end of the village) and transferred the southern part of the system to the STP via Dudauman Street, O'Brien Street and through the park to the STP site.
- Layout 1B – This layout crossed the rail corridor at Dudauman Street and transferred flows to the STP via the northern part of Dudauman Street, then O'Brien St before crossing the park to the STP site.
- Layout 1C – This layout crossed the rail corridor at Dudauman Street and transferred flows from the southern part of the system to the STP via Martin Street, Hoskins Street and O'Brien Street before crossing the park to the STP site.

Layout 1A was considered the best layout because:

- It would have larger pipework near the crossing at Burley Griffin Way providing greater potential for servicing growth either to a potential industrial growth area to the west of the village or infill growth between Dudauman and Burley Griffin Way (south of the rail corridor). Note the ability to service any growth would be limited. During modelling of the system, the pipe size required at the rail crossing was found to be a DN 63 which is still only a relatively small pipe diameter.
- There was a slight advantage in transfer of flows from the southern part of the system via Dudauman Street rather than via Martin and Hoskins Streets, however this is marginal. The route along Dudauman street is slightly shorter and while a pipe line would still be required along Martin and Hoskins Streets it would be smaller. The choice between these two alternatives may be reconsidered during the detailed design if other factors are identified during that stage.

Following discussions with Council it was agreed that Layout 1A would be the preferred layout and hydraulic modelling was undertaken using that layout.

4.2 Hydraulic Modelling

Hydraulic modelling was undertaken based on the Basis of Design (BOD) detailed earlier and using InfoWorks IWM. The modelling optimised the pipe sizing and performed a sensitivity analysis to review the robustness of the system.

The hydraulic modelling analysed the flowing:

- Peak flow rates and velocities in each section of the reticulation system
- Peak operating pressures within in the system (at pump connection points)
- The average sewage retention times

This analysis was undertaken for normal operating conditions and then with a sensitivity analysis to test the robustness of the system. The sensitivity analysis was undertaken assuming a higher flow per EP of 200 L/EP and an allowance of 20% for infill properties. For non-residential properties an increase of 20% of flow was also adopted.

4.2.1 Preferred Network

Option 1A (the preferred network layout) was refined with revised pipe sizes based on the model results. The preferred network is shown in Figure 4-1 with further detail shown in Appendix B.

In summary the network consists of the following:

- On Property Assets
  - 121 Simplex units, 5 duplex units and 1 Quadraplex units
    - Duplex units for the school, bowling club, public toilets and Elwood Hall
    - Quadraplex unit for hotel
  - 127 control alarm panels and associated electrical wiring
  - 127 boundary valves and associated pits
  - 127 property boundary assemblies
  - 3,800 m of DN40 property discharge line and pressure sewer lateral

- Street network
  - About 9,600m of network mains consisting of: DN50-4012m, DN63-2298m, DN75-1808, DN90-522, DN110-653, DN125-254
- A barometric loop at the STP approximately 7 m high
- 4 Air valves and vents
- Approximately 11 Isolation and 14 flushing valves

For estimating purposes 5% additional length has been added to reflect the potential for changes during the detailed design. It should be noted that during the detailed design changes may be required to address constraints identified during that phase.

4.2.2 Model Outputs

Appendix D details the key hydraulic outputs for the normal operating scenario as well as the full hydraulic outputs for both the base flow case and the sensitivity analysis.

For the location of Upstream (U/S) and Downstream (D/S) Nodes refer to Appendix C.

Figure 4-1: Network Layout

4.2.3 Peak Flow Rates, Velocities and Pump Pressures

Normal Operation

Peak flow rates and peak instantaneous velocities for each pipe section are provided in Appendix D. As flows in Pressure Sewer Systems have sharp instantaneous flows, the pipe sizing has been generally based on 95% of the peak instantaneous flow for each pipe section.

The peak velocities generally meeting the generally required minimum velocity to achieve self-cleansing (0.4 m/s for DN50 and 0.6 m/s for larger pipes).

The inflow hydrograph to the STP for the normal operating condition is shown in Figure 4-2. For design of the plant it is recommended that the total and instantaneous peak flow to the plant plus a 20% allowance, in accordance with the BOD, be allowed. The peak flow of approximately 7.2 L/s should be adopted as the peak flow to the plant.

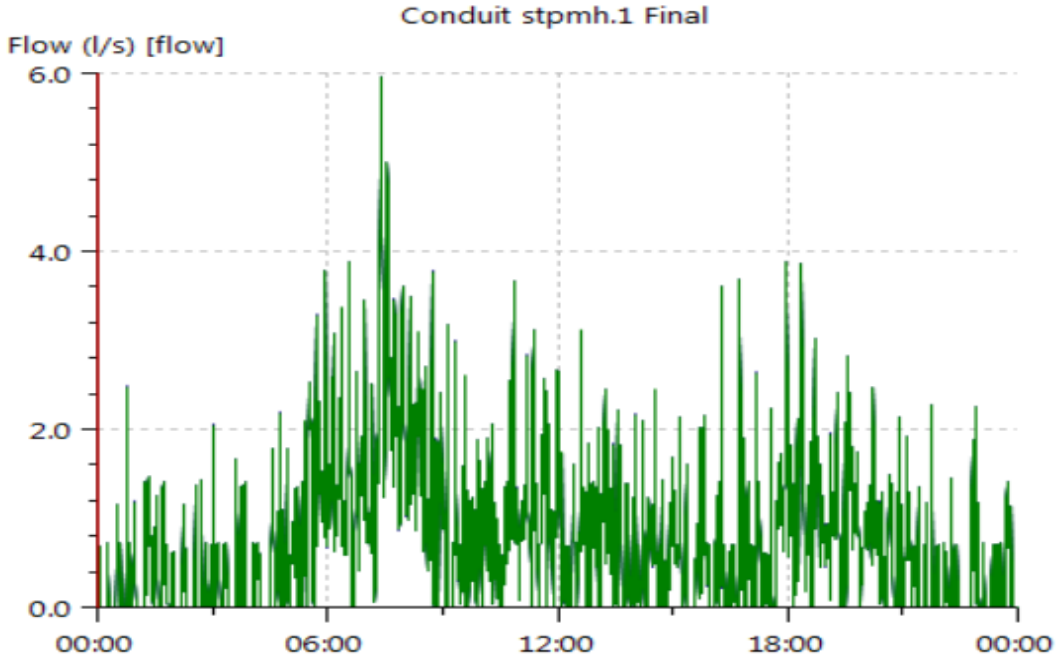


Figure 4-2: STP inflow hydrograph

Pump pressures do not exceed the 55 metres head recommended by the EOne Pump Manufacturer for any of the pumps under the normal operating scenario. 50% of the pumps see pressures less than 20 metres head and 96% see less than 30 metres head. In the sensitivity analysis the maximum recommended pressure was not seen for any of the pumps and the pressures were similar to that for the normal operating case.

4.2.4 Air, Odour Management and Corrosion Control

Air trapped within the network at local high points can lead to higher pressures in the network and is not desirable. Where possible, air should be moved along, and out of the system. Where this is not possible, air should be allowed to leave the system via air valves and vents.

The Network Layout has been developed so that the majority of the reticulation network is graded upwards in the direction of the flow. This allows air to move towards the STP and out of the system. However, there are some areas where this is not possible and so air needs to be driven along the system by the sewage flow or removed via a local vent.

The ability of an air bubble to move along a full pipe can be determined using the following formula as detailed in the Pressure Sewerage Code of Australia:

$$P = \frac{0.88\ V^2}{g \times D \times S^{0.32}}$$

Where:

- **V** is the velocity of the flow, m/s
- **g** is the gravitational constant, m/s^2
- **D** is the internal diameter of the pipe, m
- **S** is the grade of the pipe, m/m

Where P is greater than 1, the air pocket can theoretically be moved along the reticulation network by the sewage flow. Where P is less than 1 the air pocket is unable to be swept downstream with the flow. For the purpose of this project the maximum velocity has been assumed to be 90% of the maximum instantaneous velocity, as sufficient time to move the air along the system need to occur.

Results for normal operation

There are six local highpoints in the system. Based on the assessment and the calculated P factor, vent shafts are not required in the system. However, given the depth of cover under the rail line is yet to be determined, deeper pipework than indicated in the model may be required and so air movement through the pipe section under the rail line will not be possible. As a result, it is highly likely a vent will need to be provided on the upstream end (south of the railway rail crossing. Given the potential for vents to be required, potential vent locations have been included in the scheme layout.

It is recommended that the need for vents at high points be reassessed during the detailed design stage as alignments and levels may change to existing services and other yet unknown factors.

Odour issues are not generally an issue in Pressure Sewerage System networks (typically an issue at the point of discharge), the need for odour treatment using carbon activated treatment units should be considered at the detailed design stage. Based on the identified location of potential vents there does not appear to be any sensitive receivers (e.g. schools, nearby houses within 30 metres) and the potential to move them further away from the closest dwellings appears to be available.

The average age of the sewage when it arrives at the STP will be approximately 8.5 hours. This is considered a high risk for odour issues and will need to be addressed. Typically, odour issues can be managed by the use of chemicals in the network prior to reaching the treatment facility or at the STP inlet works. This normally involves covering the inlet works and extracting the odorous air through activated carbon or biological filters or through odour beds.

Chemicals normally used include magnesium hydroxide or ferric chloride. Given the relatively small flows, dosing of these chemicals is problematic, as the dosing equipment needs to pump more chemical into the system than is required to avoid blockages of dosing equipment. Ferric chloride creates a precipitate which often results in scale forming on pipe surfaces resulting in blockages which are difficult to remove. Due to these issues it is recommended that management of odours at the STP inlet be adopted.

As the reticulation network consists of polyethylene pipe, corrosion issues from the septic sewage within the street network should not be an issue. However, downstream infrastructure such as receiving maintenance holes or the inlet works at the STP should be coated with an appropriate coating to protect against corrosion.

4.3 Allowing for Growth

The village has the potential to have infill growth with many land holdings containing multiple lots. This is particularly evident for residential zoned properties on the southern side of the rail corridor.

Council's village strategy has identified four potential growth areas. This includes three residential areas and one industrial area. Council has indicated the development timeframe for these areas is beyond 20 years.

The potential residential growth areas have a combined area of about 55 hectares and based on 8 lots/gross hectares, the total number of potential lots is about 440.

The potential industrial growth area is about 380 hectares in size. No information regarding the type of businesses are available at this time.

The sensitivity analysis undertaken indicates that the system is capable of a 20% increase in flow distributed evenly across the system. Any substantial growth at the extremities of the system will require local amplifications as the pipe sizes are relatively small. Increasing these pipes as part of servicing the current village would create operation issues in the system as velocities would not be practical as self-cleaning requirements would not be met.

Given that the identified growth is much larger than the existing village, a pragmatic approach has been adopted where pipe sizing has favoured larger pipe sizes where possible. This will assist in providing some capacity to service growth in the future but will not be able to serve the scale of growth Council has identified in its growth strategy. However, given the relatively small size of the village area and the scale of the proposed growth, amplification of the proposed system would be required to service the identified growth areas outside the existing urban village.

If the growth identified by Council does occur, it is possible that very early stages may be able to be served by the proposed system. For the industrial growth area, it may be possible to limit the impact on the proposed system by limiting the flow rate from the properties and/or limiting them to off-peak pumping. This would allow some of the early growth in the industrial area to be serviced without amplification of the proposed system. It is also possible to provide a larger encasing pipe at the rail crossing which provides the opportunity to enlarge or provide an additional carrier pipe when required.

Given much of the growth outside the village area is expected to occur beyond a 20 year timeframe it is considered appropriate to plan and deliver the required amplifications to the sewerage system at that time. This allows the amplifications to be sized and located once the nature of the growth is better understood.

4.4 Power Outage Recovery

In Pressure Sewerage Systems the peak flow to the downstream system occurs after a significant power outage. In order to assess the impact of a power outage records from the electricity supplier to the Stockinbingal area were examined and a hydraulic simulation of a power outage situation modelled.

Power outage records from October 2014 till early July 2019 are shown in Figure 4-3. With the exception of one power outage in January 2018, which lasted almost 19 hours, there are two outages lasting just over six hours and the remainder were less than 6 hours in duration. Excluding the largest event, the average power outage is just under 3 hours.

Based on these records, the storage provided in the collection tanks at each property (nominally 24 hours of normal operating storage) is adequate for all of the likely power outages. For commercial properties (particularly those with large flows) it is recommended that the landlords/tenants be required to provide backup power to the pressure sewer unit or additional storage to lower the risk of overflows.

To assess the impact of power outage recovery, two scenarios were examined, a 6 hour and an 18 hour power outage. The storage requirements for the power outage recovery is discussed in Section 6.2.

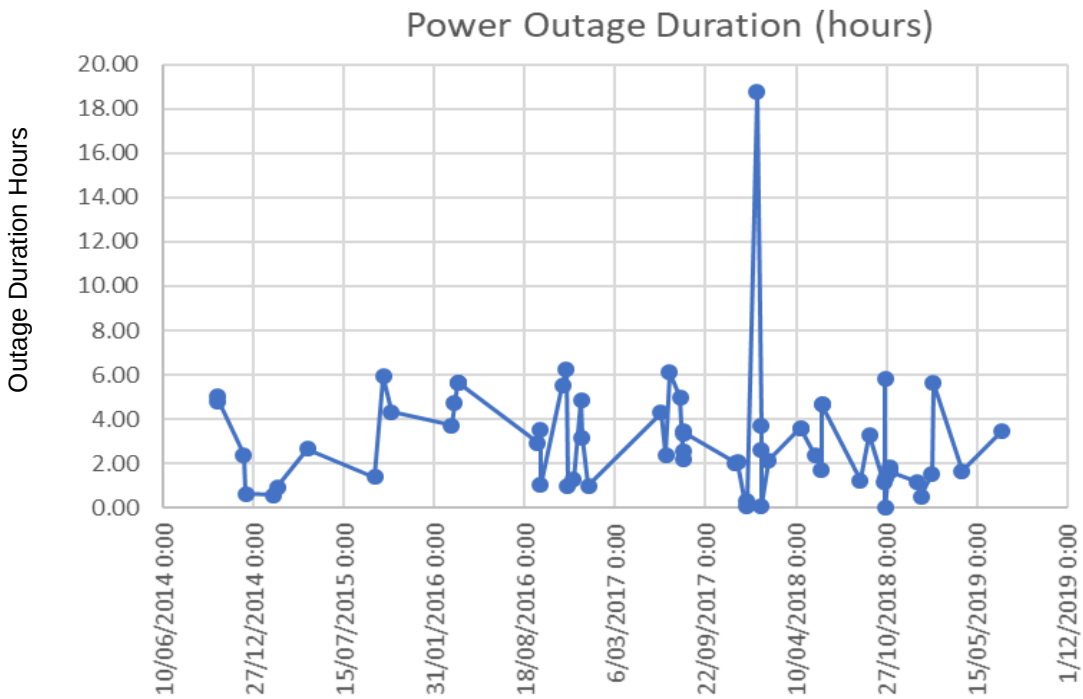


Figure 4-3 Power Outage Records

4.4.1 6 Hour Power Outage

When the system experienced a 6 hour power outage the system took approximately 1 hour to recover. A hydrograph of the discharge to the plant is shown in Figure 4-4. The period of power outage commences at 5 am and finishes at 11 am. The peak flow rate is 18 L/s but reduces to 3 L/s by 11.50 am.

During the power outage, only the hotel had overflow issues at the collection tank. This issue would be mitigated by requiring the property owners to provide backup power to the pumps in the case of a power outage. Alternatively, the collection tank volume can be increased to accommodate the additional flow. This issue should be investigated at the detailed design stage to determine the best method of addressing this issue.

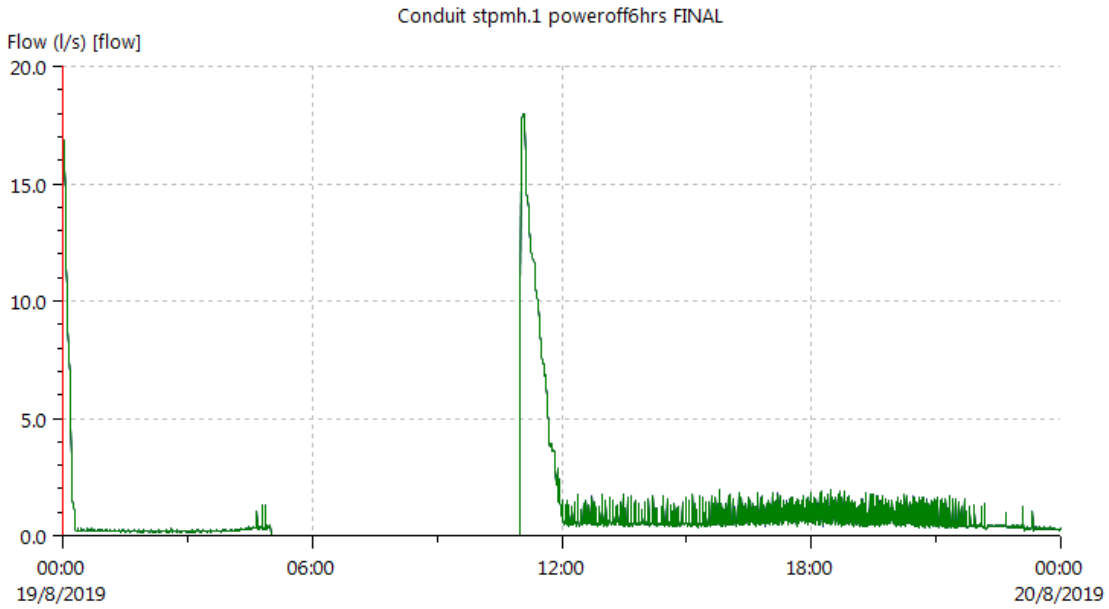


Figure 4-4: Sewerage network discharge hydrograph after 6 hour power outage

4.4.2 18 Hour Power Outage

This outage is considered an extreme event and has only occurred once in the records provided. When the system experienced an 18 hour power outage the system took approximately 2 hours to recover (flow rate of 5 L/s). A hydrograph of the discharge to the plant is shown in Figure 4-5. The period of power outage commences at 5 am and finishes at 10 pm. The peak flow rate is 18 L/s but reduces to 3 L/s at about 11.30 pm.

During the power outage the hotel, the bowling club, the hotel and Elwood Hall have overflows based on the collection tank storage provided in the model. This issue would be mitigated by requiring the property owners to provide backup power to the pumps, providing a larger collection tank volume to accommodate the additional flow or by restricting usage (closing the facility). This issue should be investigated at the detailed design stage to determine the best method of addressing this issue.

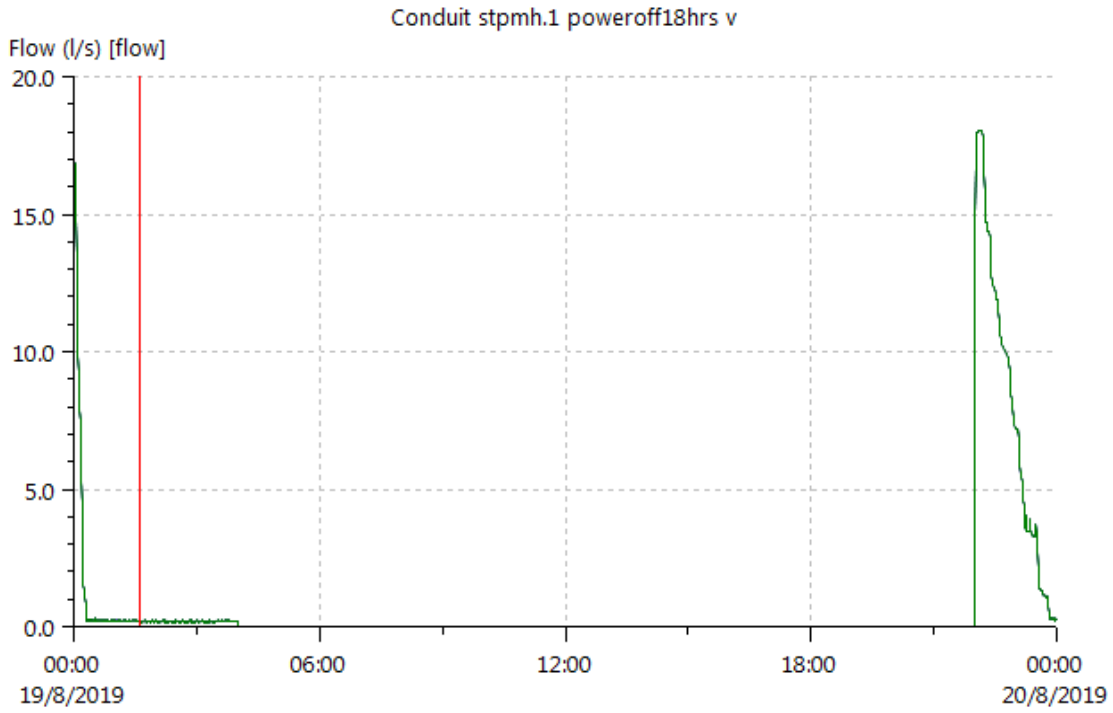


Figure 4-5: Sewerage network discharge hydrograph after 18 hour power outage

4.5 Required Controls and Mitigation Measures

4.5.1 Mitigating Flood Risk

The Stockinbingal village is prone to flooding and as a result measures will need to be taken to address this risk. Previous flood studies (Stockinbingal Floodplain Risk Management Plan – July 2002) provided by Council indicate that the depth of flooding for a 1 in 100 year event does not exceed 1 metre at any of the properties being served.

These measures include:

- Locating the control/alarm panel a minimum of 500 mm above the 1 in 100 flood level
- Installing flood proof gully trap covers on all properties where flood waters are likely to enter the house plumbing via the overflow relief gully.
- Installing either a duckbill valve on the collection tank to allow air to vent from the tank but keeping flood water from entering the tank or providing a vent pipe connected to the collection tank to the house vent.

4.5.2 Rail Crossing

The rail crossing at Burley Griffin Way on the western end of the village will need to comply with AS4799 – Installation of Underground Utilities Services and Pipelines within Railway Boundaries and ARTC requirements.

The key elements of these requirements are:

1. Services and pipelines shall be laid at least 3 m clear of rail structures, cable pits and stops, drains, signalling equipment, overhead masts, poles, underground cables, buildings, points and crossings, bridges and culverts.
2. The alignment of the services to be 90 degrees to the rail alignment.
3. The service will not be located within 6 m of the toe of banks or top of cuttings.
4. Pits and access chambers are not to be located within 6 m of the toe of embankments or top of cuttings, nor within 10 m of the nearest rail.
5. If boring the bore shall extend 3 m beyond the track or toe of the embankment whichever is the greatest.
6. Pressure pipelines under the track shall be either encased in a pipe designed in accordance with AS4799-2000 Clause 3.3.
7. The size of the encasing pipe shall be such that the internal diameter of the encasing pipe shall be at least 50 mm larger than the internal diameter of the carrier pipe (for pipes 150 mm or less).
8. The depth of installation from the top of the rails to the top of the encasing pipe shall be a minimum of 2000 mm and extend for 3000 mm beyond the rail tracks.

Note: this list is a summary of key requirements and is not a complete list.

In terms of the requirements 2-8 above, the proposed crossing will be able to either comply with the requirements or the requirements are not applicable (e.g. there are no embankments at the rail crossing).

In regard to requirement 1 above and based on photographic records it appears likely that the pipeline route can meet this condition but this would need to be confirmed by a survey of the railway assets and if necessary, discussions with ARTC.

If clearances to rail structures etc. cannot be met then the alignment could be adjusted to the west or east of the proposed crossing location. While this would move the alignment outside the rail corridor it may be necessary to meet the requirement above. It should be noted that there are existing service that cross the corridor at this location so it is unlikely that a crossing at this location cannot be achieved.

It is recommended that the full length of the carrier pipe be encased in the rail corridor as it is possible that additional rail tracks may be laid within the rail corridor in the future. As the ARTC are likely going to require that the carrier pipe be grouted in the encasing pipe, later amplification of the carrier pipe could be difficult. Therefore it is recommended to install an additional, larger, carrier pipe (sized for future use), within the same encasing pipe which could be connected when required. It is also recommended that isolation and flushing valves be located on either side and outside of the rail corridor allowing isolation of the pipework within the rail corridor without the need for Council personnel to work in the rail corridor.

Based on drawing PSS-1004 of the Pressure Sewerage Code of Australia WSA-07 it is expected that a steel encasing pipe of DN300 will be required. This sizing shall be confirmed during the detailed design stage and be subject to geotechnical assessment.

In order to avoid approval delays with the ARTC it is recommended that the ARTC be engaged during the design stage and “In Principle” approval sought.

4.5.3 Community Education

Unlike gravity systems the property owners play a greater role in reporting issues to the Council when the system fails. When pump alarms occur, property owners will be required to contact Council to let them know the pump failure has occurred. It is also necessary for property owners to understand that they can contribute to the failure of the pump because inappropriate items get flushed down the toilet.

In order to educate the property owners, it is suggested that information packages be provided to property owners once the decision to progress with the scheme occurs. Many examples of these information packages are available from various water authorities.

4.5.4 Suitable Access to Properties

Where possible collection tanks should be located in the front of the property to make access easier. However, in existing villages the tank is normally located near the existing septic tank which may be located at the rear of the property. In any case, safe access to the on-property pressure sewer infrastructure is required. As part of the detailed design it is recommended that properties be examined to identify any potential access issues and Council consulted to ensure access is appropriate.

The need to maintain a clear and safe access to the Pressure Sewerage infrastructure needs to be conveyed to property owners so they understand what is required.

4.5.5 Compliance of the Electrical Distribution Board

Electrical distribution boards need to comply with AS3000 the National Electrical Installation Standard. In practice this means that when the electrical supply to the pressure sewer systems control alarm panel is made the electrician has a responsibility to ensure that the electrical distribution board is compliant. While the power demand from the pressure sewer pump is not significant the original electrical distribution board may not be compliant and may need to be replaced.

In order to understand the number of electrical distribution boards which are not compliant it is recommended that an audit occur during the detailed design stage. It is also recommended that Council determine prior to this audit who will be responsible for the cost of upgrading any electrical distribution boards that are not compliant.

4.6 Operating Requirements

4.6.1 Training of Maintenance Personnel

Training of maintenance personnel is an important aspect for a new Pressure Sewerage Scheme. The people who will deal with the day to day maintenance of the system will need to understand how the system works and what to do when there is an issue.

In order to understand how to respond some training in the following areas should be undertaken:

- Problem identification of pump and control unit failure.
- Maintenance procedures for replacement of pump units and control panels.
- Repair of polyethylene pipes in the field.

It should be noted that Pressure Sewerage Systems are constructed as fully welded pipe systems and replacement of damaged pipes should ensure the integrity of the pipe including the ability to transfer loads along the pipe. As a result, the use of simple mechanical couplings to replace a section of damaged pipe may not be suitable.

4.6.2 System flushing

The WSA code specifies flush points in the reticulation network, however there is no guideline on the flushing requirements. Flushing is about reducing build up over time which will impact head losses and system performance. If no flushing occurs, the pipes should not block up as the velocities will increase where the pipe sizes are reduced. At Stockinbingal this is less of an issue due to the flat terrain.

As the system has been designed on the upper scale of pipe sizes to allow for future growth, occasional flushing might be required. It is recommended to do annual system flushing in the early years as a preventative measure.

Flushing operations should be undertaken by flushing the system extremities and then progressively flushing downstream until the complete system has been flushed. To achieve this, it is recommended that the extremities of the system are flushed by isolating the section to be flushed and collection tanks be allowed to fill so that the pumps will operate when the isolation valve is opened. For larger pipe sections (nominally DN75 and above) a pumped flow via the flushing valve is injected into the system. The volume and rate of flow should be sufficient to move any sediment along the pipe past the section of pipework being flushed.

4.6.3 Spare parts

Like any sewerage system spare parts are required to maintain the system. Given that parts may be required on the spot it is important to maintain an appropriate level of spare parts.

As a guide the following spare parts inventory is recommended:

Table 4-1: Recommended Spare Parts Inventory

Item	Suggested number of spare components
Control Panels	Number of spare control panels should be approximately 5% of the total number of control panels in the system. Where small numbers of duplex and quadraplex units are located in the system a minimum of one spare unit of each type should be held as a minimum.
Collection tanks	It is suggested that two spare tanks be held in inventory.
Pumps	In any year 5% of pumps will need replacement. As such at least 6 spare pumps should be kept to allow immediate replacement.
Polyethylene Pipe	Spare pipe sections should be held in stock, particularly as cream stripe pipe is not a common PE pipe designation. It is suggested that the length of pipe sections required should be determined in consultation with Councils Wastewater operating personnel.
Property Boundary Assembly	Approximately 4% of the number of properties.
Isolation and flushing valves	The number of spare isolation and flushing valves should be determined in consultation with the Councils maintenance area.

4.6.4 Protection of the Treatment Plant

Following Power Outages and flood events the treatment plant will see higher flows than under normal operating conditions. The plant will be capable of operating with higher flows to some degree but where the flows exceed this appropriate mitigation measures need to be in place.

It is suggested that a control valve be located in the pressure reticulation network just before the sewage treatment plant to reduce flows if and when required to protect the plant. This will ensure the integrity of the plant and utilise the available storage in the individual property collection tanks.

As detailed earlier it is recommended that emergency balancing storage is provided at the plant to allow system recovery during power outage.

5. Sewage Treatment Description

5.1 General Description

Generally, sewage treatment can be succinctly represented through Figure 5-1.

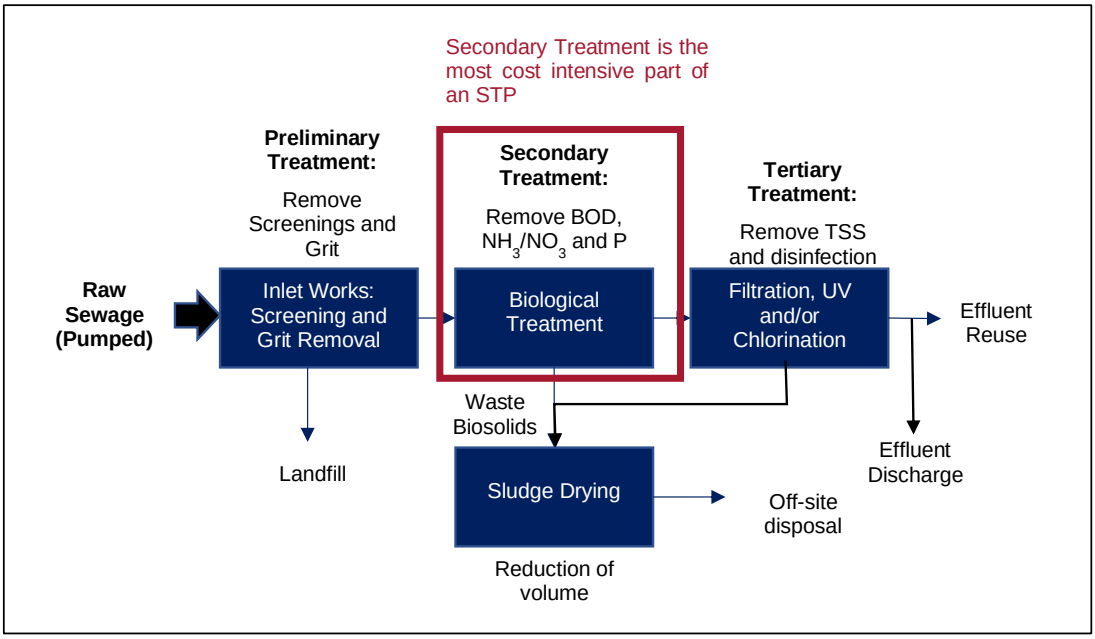


Figure 5-1: Flow Diagram of a STP

5.1.1 Preliminary Treatment

Preliminary treatment facilities will allow for:

- Reception of sewage inflow and internal recycle/ return streams (i.e. site drainage and sludge management system supernatant).
- Measurement of all inflows to the plant as well as the bypassed flows.
- Mechanical screening and washing of screenings to remove gross solid material. This material will go to landfill.
- Grit removal and washing to minimise grit accumulation in downstream main process units and to protect mechanical equipment from excessive wear.

5.1.2 Secondary Treatment

Secondary treatment facilities will allow for:

- Biological oxidation of organic material
- Nitrification and denitrification
- Stabilisation of waste MLSS
- Dewatering of stabilised sludge (via gravity or mechanical dewatering).

5.1.3 Tertiary Treatment

Tertiary treatment facilities will allow for:

- Filtration of suspended matter
- Disinfection of the effluent (degree of disinfection will depend on whether effluent is discharged or reused)
- Measuring of effluent volumes.

5.1.4 Chemical Dosing

If phosphorus removal is required, liquid alum may be used to facilitate phosphorus removal.

If pH correction is required, a caustic dosing system will likely be used.

5.1.5 Secondary Treatment Options Investigated

Several secondary treatment options have been investigated:

- Option 1: Conventional Activated Sludge (CAS) Treatment
- Option 2: Membrane Aerated Biofilm Reactor (MABR)
- Option 3: Membrane Bioreactor (MBR)
- Option 4: Moving Bed Bio Reactor (MBBR)
- Option 5: Intermittently Decanted Extended Aeration (IDEA) reactor

Options 1-4 are for Package type systems, whereas Option 5 is for a concrete aeration tank. These options are further discussed in the following section.

5.2 Option 1 – Conventional Activated Sludge (CAS) Treatment

5.2.1 Scope of Supply

The simplest secondary treatment method is a conventional activated sludge unit. Hydroflux has a robust package treatment plant (Roadtrain) which operates as a CAS system. This is of a robust welded 6mm mild steel epoxy coated construction. There are other suppliers available for this technology.

The treatment system includes an aeration tank with course bubble diffusers and a clarifier tank as shown in Figure 5-2. The unit also includes a chlorine tank with a chlorination box which has chlorine tablets. For discharge to a creek, this will be replaced with UV disinfection.

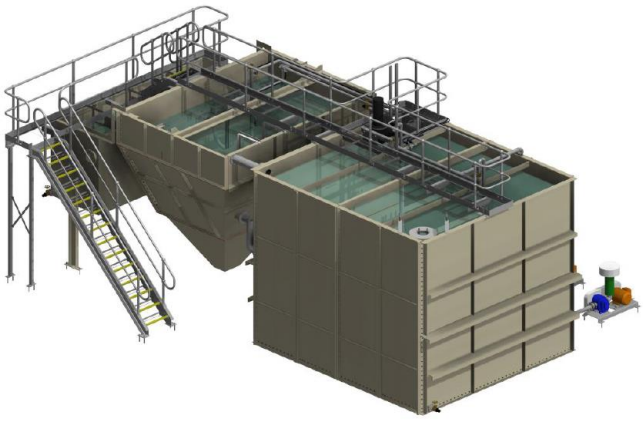


Figure 5-2: General Arrangement for Roadtrain Unit

The principal role of the aeration tank is to provide a favourable environment in which the bacteria can feed and reproduce. The bacteria in this tank consume the pollutants and oxygen (supplied via the blowers) and reproduce. This allows oxidation of both carbonaceous organics and ammonia, producing CO_2, more bacteria and nitrates.

The initial bacteria population is also elevated by the RAS (returned activated sludge) which is drawn from the bottom of the clarifier tank and returned to the aeration tank. This is the main biological stage in the treatment process. Oxygen input is achieved via a pair of duty-standby positive displacement air blowers and coarse-bubble cast iron diffusers.

Course bubble diffusers are less efficient with oxygen transfer than fine bubble diffusers but are more robust and provide mixing as well.

The blowers operate intermittently to allow for anoxic periods where denitrification takes place. Since aeration performs such a critical role in sewage treatment, the blower status is monitored by a pressure switch connected into the delivery pipework. Failure to develop pressure in the pipeline after a blower has started will initiate a changeover to the standby blower and signal an alarm.

5.2.2 Reference Installations

Roadtrain packaged sewage treatment plants are operating in over 140 sites around the world. Some installations in Australia are shown in the following table.

Table 5-1: Roadtrain Package Plants Reference Installations in Australia

#	Site	State	Capacity (EP)	Details
1	Port Hinchinbrook Resort	QLD	500	▪ Sewage from a resort with discharge to the great barrier reef ▪ High water quality required ▪ Prefabricated systems to reduce site installation time and costs
2	Wujal Wujal Community	QLD	350	▪ Sewage from a remote community ▪ Environmental discharge with high quality effluent required ▪ Prefabrication to simplify the site installation process
3	Masig Island	QLD	650	▪ Sewage from the island of Masig, located in the Torres Straits ▪ High discharge requirements, the site is in an environmentally sensitive area ▪ Robust solution to manage the variations experienced

5.2.3 Advantages and Disadvantages

This is a robust solution. There are no unique major replacement parts for this system.

This is the solution with the biggest footprint, however, the treatment plant would be less than 250 m^2, which would fit within the site.

The biggest concerns are the noise and odour from the aeration basin. The unit might have to be covered to mitigate odour emissions.

5.3 Option 2 - Membrane Aerated Biofilm Reactor (MABR)

5.3.1 MABR Technology

In an MABR, a spirally wound membrane is submerged in a tank. This tank is continuously fed with pre-treated sewage (includes pre-screening down to 1 mm dia.) and effluent discharged through an overflow. Low pressure air is blown through one side of the membrane and the biological activity takes place on the other side as shown in Figure 5-3.

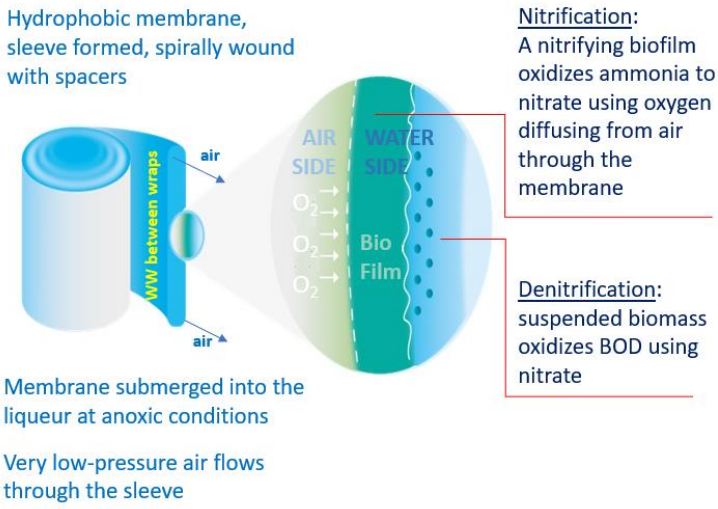


Figure 5-3: Operating Principles of a MABR Membrane

Oxygen is constantly available to a fixed biofilm that develops on the sewage side of the membrane sleeve. Simultaneous aerobic and anoxic conditions develop in this zone, leading to simultaneous nitrification and denitrification with little energy and space requirements. The low-pressure passive aeration results in significant cost savings over conventional high pressure diffused aeration, even at low temperatures.

Because the aeration is passive (not compressed), power requirements are minimised.

5.3.2 Scope of Supply

The recommended flow diagram for the whole process is shown in Figure 5-6.

The feed pumps provide effluent to the MABR package system through a fine (1mm) screen. The screened effluent then flows via gravity into the selector tank where screened effluent is mixed with the pumped RAS. The mixed effluent is then gravity fed into the L3 Aspiral treatment module tank (Figure 5-4). The mixed effluent is passed through the L3 Aspiral stage once only.

The 40 ft L3 Aspiral treatment module includes three MABR spiral units and one Conventional Activated Sludge (CAS) final stage. The effluent forms an anoxic zone in the MABR spiral compartment resulting in simultaneous nitrification/denitrification and advanced phosphorous removal, followed by BOD polishing through the aerobic CAS stage.

Following biological treatment, effluent is then pumped to the 20 ft clarifier module (Figure 5-5) where the supernatant is pumped back to the existing STP for discharge/ reuse. Settled solids in the clarifier are returned to the selector tank (RAS) or wasted (1-2%) via the RAS/ WAS pumps.

The secondary effluent is then tertiary treated (media filtration), disinfected by sodium hypochlorite and discharged or used as recycled water. For discharge to a creek, this will be replaced with UV disinfection.

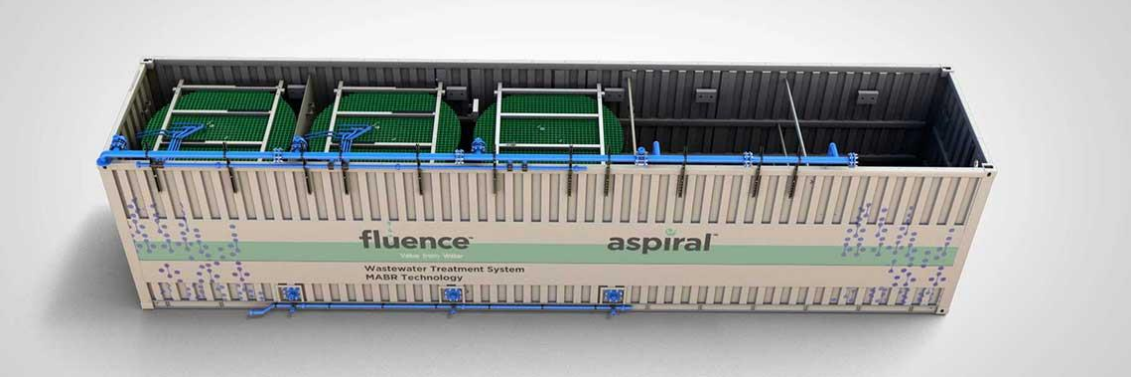


Figure 5-4: Fluence MABR unit (Aspiral L3)

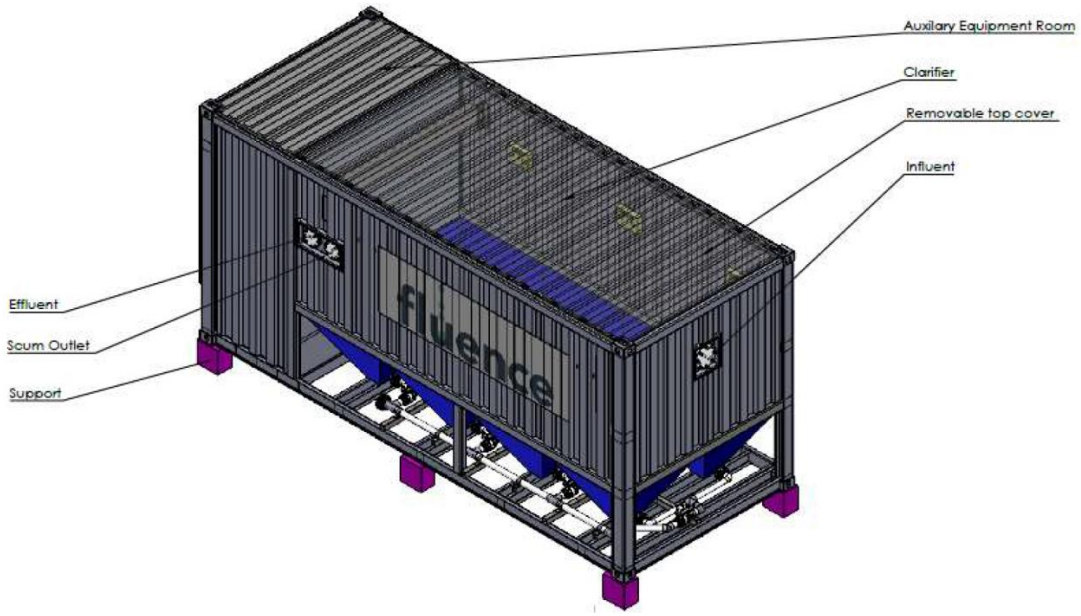


Figure 5-5: Clarifier Unit

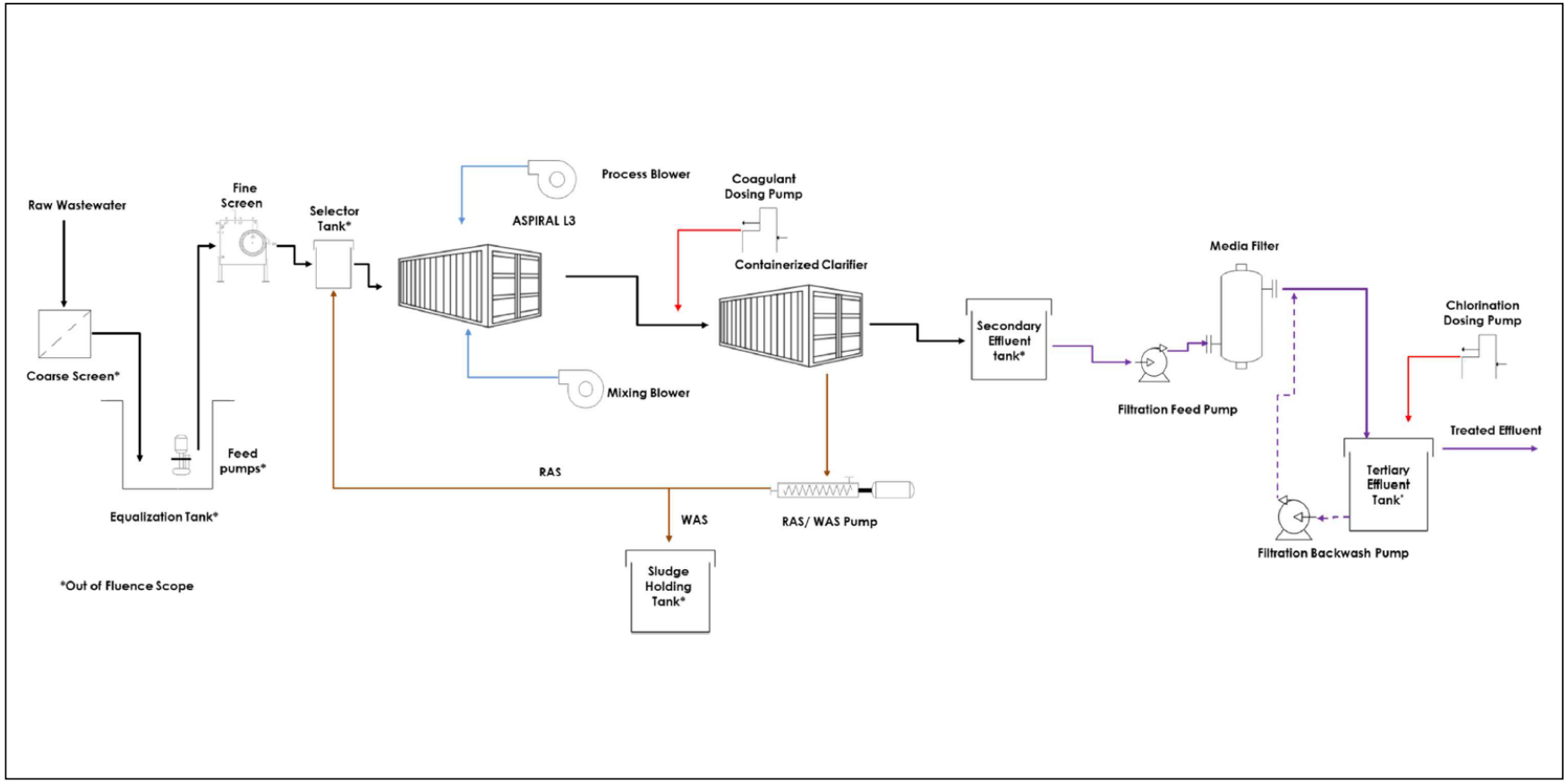


Figure 5-6: A Potential Flow Diagram of a MABR for Stockinbingal (Provided by Vendor)

5.3.3 Reference Installations

A reference MABR installation list is shown in Table 5-2. This company to date does not have an Australia reference plant.

Table 5-2: MABR Reference List

#	Site	Country	Capacity [GPD]	Partner/client	Status
1	Hayogev	Israel	18,000	Yuvaley Haemek	Operational (2016)
2	Bordeaux	USVI	26,500	VIMWA	Operational (2016)
3	Quzhou	China	10,500	Tiandi	Operational
4	Voss	China	5,300	Shanghai Winner	Installation on hold (by customer)
5	Wuxi	China	5,300	Wuxi DI	Demonstration (2017)
6	Tech. College Changzhou	China	5,300	Jinzi	Demonstration (2017)
7	Miyun, Beijing	China	5,300	Sinorichen	Demonstration (2017)
8	Jingmen, Hubei	China	5,300	CGGC	Demonstration (2017)
9	Codiga center, Stanford	US	3,200	Stanford	Demonstration (2018)
10	Mekelle University	Ethiopia	84,500	TTV	Under construction
11	REPI housing development	Ethiopia	49,000	TTV	Under construction
12	Luoyang	China	79,250	QSY	Under construction
13	ZHenfeng Educational Center	China	264,200	Jinzi	Under construction
14	Ma'ayan Zvi	Israel	1,585,000	Ma'ayanot Hamakim	Under construction
15	Hubei Xiaogan Highway	China	52,834	Hubei ITEST	Under construction (2018)
16	Xie Lin Gang, Yiyang, Hunan	China	52,834	Xie Lin Gang Township Gov.	Under construction
17	Westgrove	Philippine s	105,668	Uni-Field enterprises Inc.	Manufacturing
18	LNG worksite	Texas, USA	33,146	WaterFleet, LLC	Manufacturing

5.3.4 Advantages and Disadvantages

The advantages are that the power savings for this option is significant compared to the other options. However, the membrane is a proprietary product which will need to be replaced after around 7 years.

There are no reference installations of the MABR in Australia, therefore it has not been proven in local conditions.

5.4 Option 3 - Membrane Bioreactor (MBR)

5.4.1 MBR Technology

An MBR is basically a high density activated (suspended biomass) system that uses a membrane to separate the biomass from the liquid. Because of the higher suspended solids density, a smaller footprint is required than for a conventional activated sludge unit.

The Membrane Bioreactor (MBR) type packaged sewage treatment plants are designed to treat domestic strength sewage, to achieve high quality treated effluent, suitable for reuse in “risk category high” applications or for discharge to sensitive environments.

5.4.2 Scope of Supply

There are many package type membrane bioreactor suppliers for wastewater treatment. The MAK Water unit was used as a reference (shown in Figure 5-7).

The main secondary treatment aspects include a corrosion resistant fibre reinforced plastic (FRP) aeration tank with a membrane cassette and a sludge treatment system.

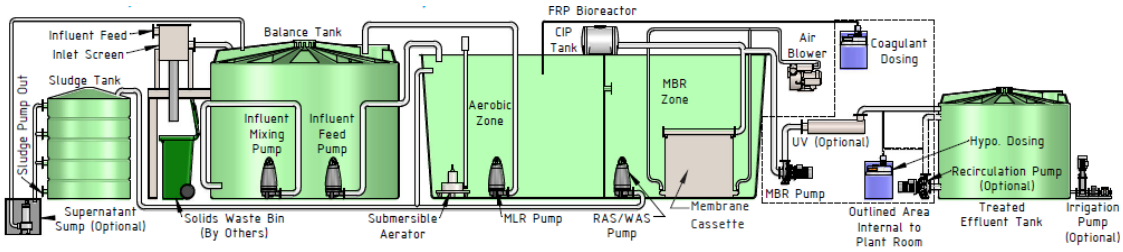


Figure 5-7: MAK Water’s Modular MBR system

5.4.3 Reference Installations

There are many reference installations for MBR package plants in Australia and MAK Water has several different reference installations for wastewater treatment across Australia as shown in the following table.

Table 5-3: MAK Water MBR Reference Installation

Year	Application	Plant Type	Flow Rate
2017	Sewage Treatment for Coal Mine Infrastructure Area	MBR	30 m^3/day
2017	Sewage Treatment for Gas Plant Infrastructure Area	MBR	2 x 50 m^3/day
2015	Sewage Treatment for Quarry	MBR	5 m^3/day
2014	Sewage Treatment for LNG Project Permanent	MBR	2 x 250 m^3/day
2013	Sewage Treatment for LNG Barge	MBR	50 m^3/day
2013	Sewage Treatment for Airport Infrastructure	MBR	200 m^3/day

5.4.4 Advantages and Disadvantages

Although it is still a relatively new technology, it has been well established as an alternative to CAS treatment where space is limited or a high quality effluent is required. This option does not require additional filtration for suspended solids or further phosphorus removal. If additional odour measures are required, the aeration tank can easily be covered.

The main disadvantage is that the membranes need to be routinely cleaned. This can be done by a trained service technician (many suppliers include an option for service contracts however this may be expensive given the location of Stockinbingal).

The membranes typically last between 5-7 years, and the replacement cost for this size plant would be around $60,000.

5.5 Option 4 - Moving Bed Bio Reactor (MBBR)

5.5.1 MBBR Technology

A Moving Bed Bio Reactor (MBBR) system consists of an aeration tank (similar to an activated sludge tank) filled with special plastic carriers (Figure 5-8) that provide a surface where a biofilm can grow. The carriers will be mixed in the tank by the aeration system and thus will have good contact between the substrate in the influent wastewater and the biomass on the carriers.

In principle, the attached growth process works the same as a trickling filter or rotating bioreactor, but as it is more concentrated a smaller footprint is required.

Figure 5-8: Example of MBBR Packing

5.5.2 Scope of Supply

There are many package type MBBR suppliers for wastewater treatment. The MAK Water unit was used as a reference (shown in Figure 5-9).

The main secondary treatment aspects include a corrosion resistant fibre reinforced plastic (FRP) aeration tank with several zones. The zones include the aerobic zone filled with floating media, an anoxic and second aerobic zone and a clarifier. The setup is designed to optimise the required conditions for nitrogen removal.

The unit also includes a tablet chlorinator. For discharge to a creek, this will be replaced with UV disinfection.

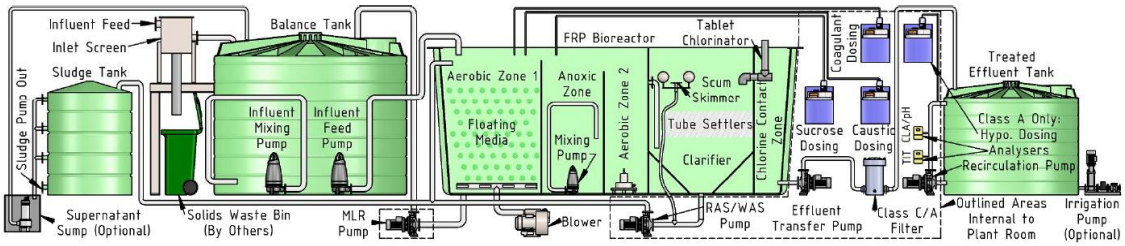


Figure 5-9: MAK Water's Modular MBBR system

5.5.3 Reference Installations

There are many reference installations for MBBR package plants in Australia and MAK Water has several different reference installations for wastewater treatment across Australia. The following table shows the MAK Water reference list for MBBR installations.

PWA also operates a 240 m^3/day package type MBBR plant at the John Morony Correctional Centre which was built in 2016.

Table 5-4: MAK Water Australian MBBR Project Reference List

Year	Application	Plant Type	Flow Rate
2016	Sewage Treatment for Gold Mine Camp	MBBR	200 m^3/day
2016	Sewage Treatment for Holiday Park	MBBR+	45 m^3/day
2014	Sewage Treatment for Iron Ore Mine Infrastructure	MBBR	35 m^3/day

5.5.4 Advantages and Disadvantages

An MBBR is very resilient to load fluctuations and toxic shock, which is advantageous for a small sewerage scheme like Stockinbingal. Sludge production is also much less than for the other options. The STP operation is fairly simple, comparable to the CAS option, as it does not rely on the use of membranes.

5.6 Option 5 – Intermittently Decanted Extended Aeration (IDEA) reactor

A smaller version of the PWA IDEA can be provided. PWA also operates a container-based version of this plant at the John Morony Correctional Centre. This was a one-off design that was built at the time when there were few alternatives. Currently no one is offering an IDEA based package treatment plant. Therefore, a concrete tank IDEA option, which has advantages in terms of longevity, has been investigated.

5.6.1 IDEA Process

An IDEA based process provides the functions of a traditional activated sludge treatment process with aeration and secondary settling within a single process unit. These functions are separated by means of timed process cycles controlled by a PLC (programmable logic controller). This process configuration is cost effective, as aeration and settling can be achieved within a single structure, in comparison to a conventional activated sludge treatment system where two or more units (i.e. at least a biological reactor and separate clarifier) are required.

5.6.2 Scope of Supply

The IDEA process will include a concrete aeration tank with diffused aeration and an end wall syphon decanting unit. This process has been proven to treat the effluent to achieve the required phosphorus concentration without an additional physical filtration unit.

5.6.3 Reference Installations

There are numerous IDEA reactors operating in NSW and it is a local proven process. The following table shows some examples of smaller IDEA reactors. The package type unit at John Morony currently runs in parallel with the newly installed MBBR package type reactor.

Table 5-5: Smaller IDEA Reactor Reference List

Year	Location	Flow Rate	Details
2018	Wyangala	1,400 m^3/day	Concrete structure
2010	Taralga	450 m^3/day	Concrete structure
1988	John Morony Correctional Centre	180 m^3/day	Package Type STP

5.6.4 Advantages and Disadvantages

The IDEA process is a robust process with little maintenance required. The advantage of a concrete structure is that the lifetime of the structure is 60 years, double the lifetime of the package plant structures.

Most of the construction, programming and testing will have to happen on site, whereas the construction and testing for the package plants happen off-site. The design and construction period will be longer.

5.7 Recommendation

A concrete IDEA construction is recommended for this design as it will provide a more permanent solution and is easy to operate. This type of STP will also meet the quality requirements, is cost effective to provide and operate, has no propriety equipment and requires a low level of operator skill.

Table 5-6: Comparison of Options

Criteria	1 - CAS	2 - MABR	3 - MBR	4 - MBBR	5 – IDEA
Effluent quality	Good w/ Proper Design	Very Good	Very Good	Good w/ Proper Design	Good w/ Proper Design
Additional filtration required for Phosphorus removal	Yes	Yes	No	Yes	No
Footprint	Large	Very Small	Small	Small	Intermediate
Sludge Production	High	Average	Average	Very Low	Average
Complexity in operation	Low	Complex	Complex	Higher than Average	Low
Proven performance	Proven for small, medium to large STPs	Proven in other than Australia	Proven for medium to large STPs	Proven for medium STPs	Proven for small, medium to large STPs
Operator skill required	Low	Higher than average	Higher than average	Higher than average	Average
Proprietary technology	No	Yes	No	No	No
Capital Cost (whole STP)	$2.4	$2.0mil	$1.9mil	$2.2	$2.4
25-year present value cost (7%)	$4.3	$2.6	$4.5	$3.6	$3.2

6. Sewerage Treatment Plant

6.1 Treatment Plant Overview

The scope of the new STP will include:

- An inlet screen
- A 50 kL emergency storage tank
- A concrete IDEA reactor and effluent balance tank
- Alum and caustic dosing facilities
- A UV disinfection unit and an effluent pump to Dudauman Creek (provisional)
- A sludge tank and geobag sludge drying system
- Interconnecting pipework and pumping
- Electrical Switchboard with HMI (Touch Screen)
- Provision for remote monitoring via telemetry system
- A new power supply
- An amenities building which will include a control room and a laboratory

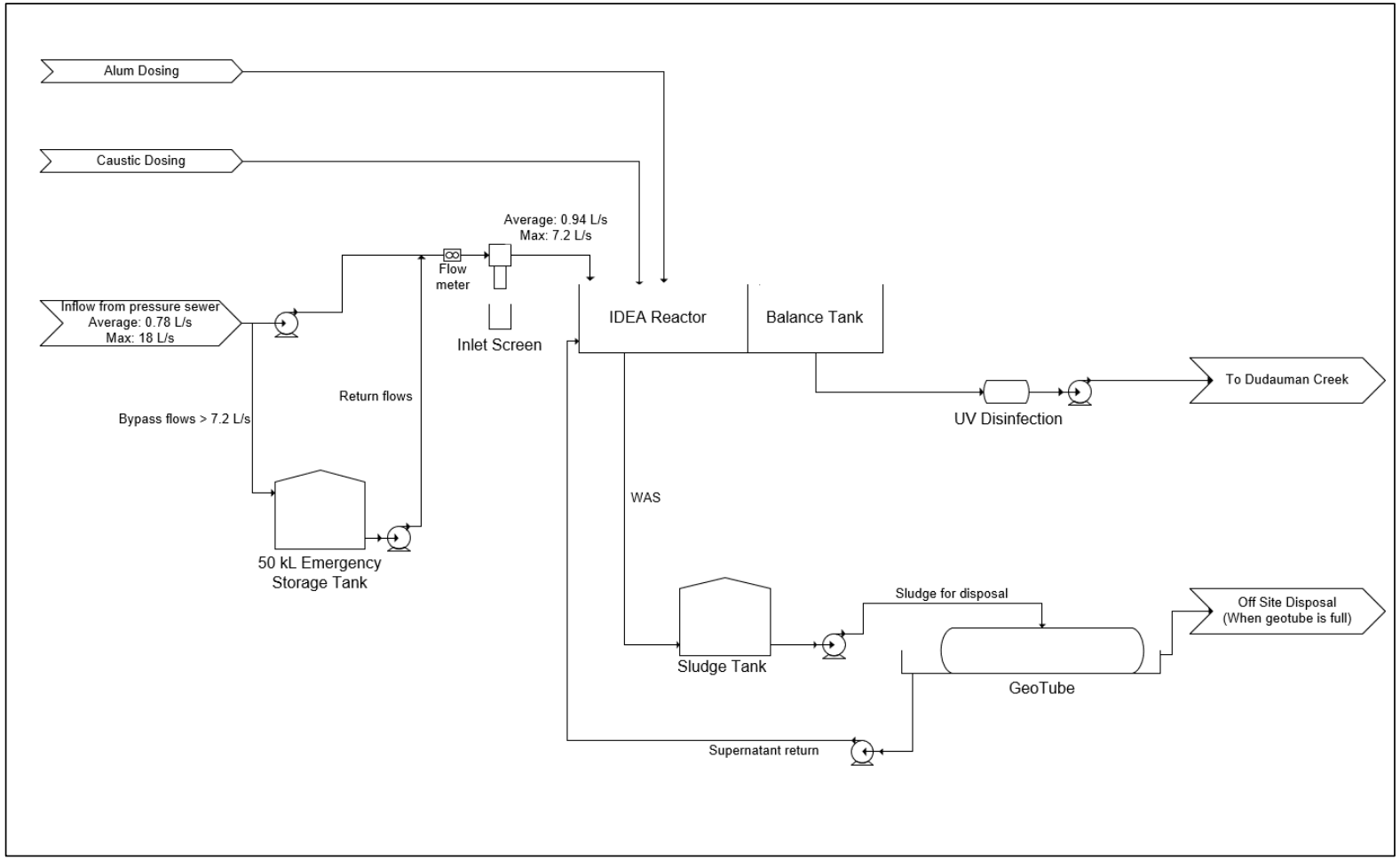


Figure 6-1: Flow Diagram For the STP

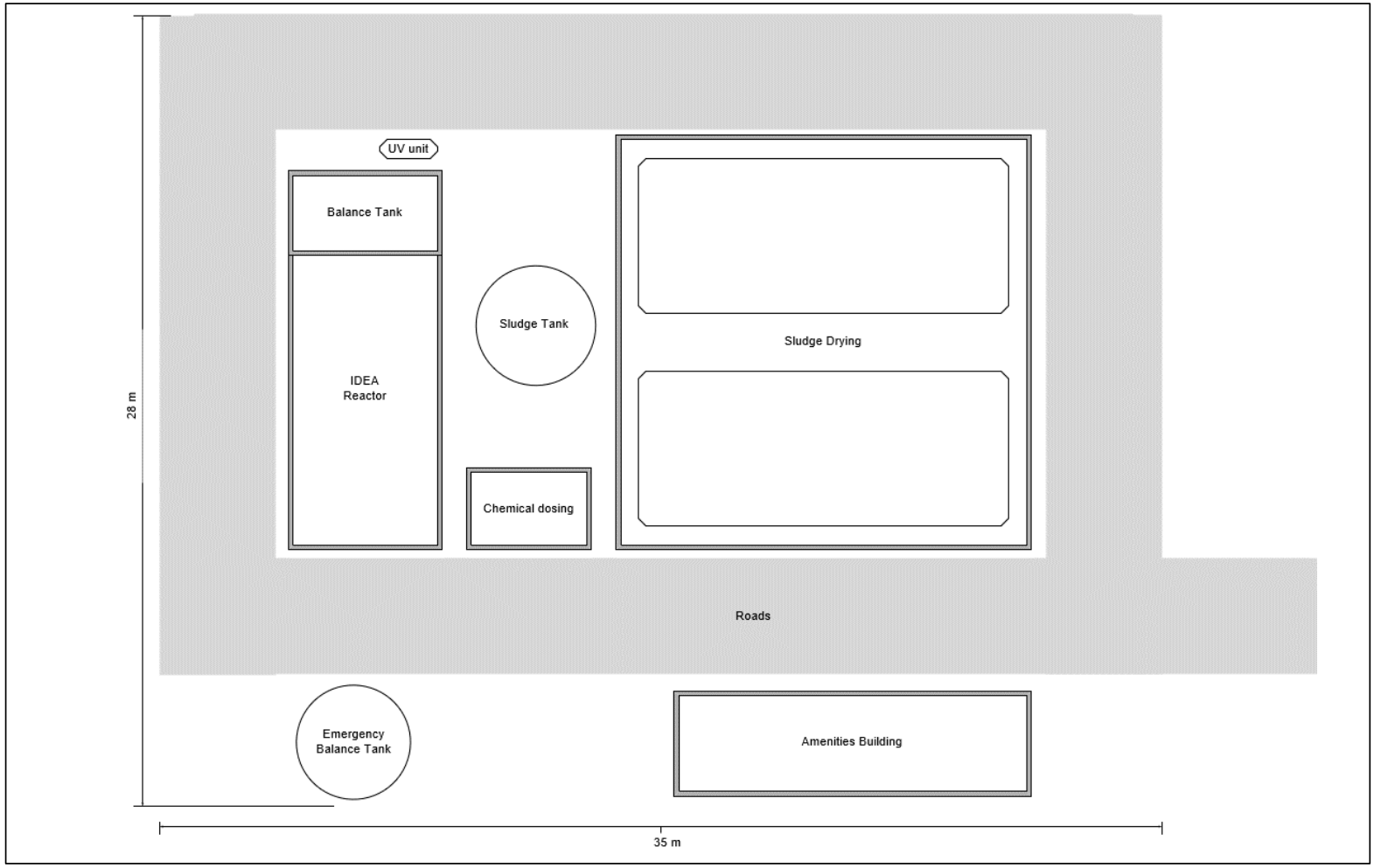


Figure 6-2: Proposed Site Layout

6.2 Inflow Balancing

The pressure sewer modelling results were used as the input to the design flow rate and emergency inflow balancing requirement for the STP.

6.2.1 Inlet Works

The inlet Works will be designed to treat the peak instantaneous inflow rate under normal conditions of 7.6 L/s.

6.2.2 IDEA Reactor

The IDEA reactor will be designed to accommodate 3.8xADWF (3.6 L/s). The reactor has sufficient capacity to absorb the instantaneous peak flows of 7.2 L/s, given that the 30 minute inflow average is below 3.6 L/s.

6.2.3 Emergency Balance After a Power Outage

The worst-case scenario for inflows to the STP is the period following an 18 hour power outage. As most of the pumps in the reticulation system will start up simultaneously, the maximum instantaneous inflow is 18 L/s. Therefore emergency storage is required. If any pressure pumps operate during the power outage (due to backup generators at pump sites), the inflow will be diverted to the emergency balance tank.

If the average inflow to the STP exceeds 3.6 L/s over a 30 minute period, all flows above 3.6 L/s will be diverted to the emergency balance tank. This will typically only happen after a long power outage.

Once the inflow has stabilised (after around 3 hours), flows from the storage tank will be pumped to the STP at a rate of 1 L/s. A 50 kL storage tank will be required. This tank will only be used occasionally (after a major power outage or if the STP is under maintenance), but as it will receive unscreened sewage, it will have to be cleaned after usage.

6.3 Inlet Works

The inflow to the STP will be macerated sewage from the town. The inlet works capacity has been based on the maximum daily instantaneous inflow of 7.2 L/s, based on normal operation.

A 0.5 mm rotary type inlet screen is proposed. The chute will be covered, and the screenings can go into a bagging unit in a collection hopper.

This is the part of the STP with the highest risk of generating odour. As such the inlet works will be epoxy coated, covered and have foul air extraction and an odour control system. The system would likely be a combined activated carbon and biological filter treatment unit.

An electromagnetic flow meter installed on the rising main will be used to monitor the inflow rate and cumulative inflow volumes.

6.4 Intermittently Decanted Extended Aeration (IDEA) Reactor

6.4.1 General

The IDEA process is the most commonly used secondary biological treatment process in NSW. IDEA is a modified form of the activated sludge treatment process. The process has been developed by PWA and is utilised at over 130 plants in NSW. This process configuration incorporates continuous influent feed to the reactor and intermittent aeration and subsequent settling and decant for clarification of effluent that allows the complex secondary treatment processes to take place in a single reactor, thus reducing capital costs and simplifying the process operation and control compared to alternative conventional processes that employ separate reactor and clarifier units (which require return activated sludge facilities).

6.4.2 Process Description

Activated sludge is composed of live and dead bacteria and algae which mediate removal of organic material and ammonia (NH_3) from the raw wastewater in the presence of oxygen, i.e. nitrification, and reduce nitrates (NO_3) and nitrites (NO_2) to gaseous nitrogen in the absence of oxygen, i.e. denitrification. These suspended micro-organisms are referred to as mixed liquor suspended solids (MLSS).

The inflow to the IDEA reactor is continuous. An operating cycle typically begins with the water level at the BWL when the decant mechanism is resting at this level and aeration is turned off. The decant mechanism is then raised and parked at the reactor TWL and aeration is turned on to start the aeration phase. The action of the aeration system, in addition to providing process oxygen, mixes the entire contents of the reactor. BOD_5 removal and biological nitrification take place during the aeration phase of the operating cycle.

During this aeration phase, the WAS pump will operate to withdraw MLSS or transfer to the sludge tanks. The quantity of activated sludge wasted from the reactor dictates the MLSS concentration within the reactor and sludge age for the process. For example, wasting 1/25th of the reactor BWL volume each day will maintain the sludge age at 25 days. Operation of the WAS pump will commence a short time period after aeration commences to ensure that reactor contents are fully mixed. The WAS will be controlled by operator adjustable timer or volume settings.

An electromagnetic flow meter installed on the WAS rising main will be used to monitor the activated sludge wastage rates and cumulative volumes. Historical trends of WAS flows recorded by the flow meter will also be capable of being displayed on the HMI screen.

After a set period of aeration has elapsed, aeration is switched off and the MLSS, which had previously been suspended throughout the reactor during aeration, begins to settle. Settlement leaves a clear supernatant layer at the top of the reactor. After a set settling period, the decanting mechanism is lowered at a controlled rate to decant the supernatant (treated effluent) that lies above the settled sludge blanket and draws the water level down to the reactor BWL.

It is during the settling and decanting phases of the operating cycle, in the absence of aeration, that biological denitrification takes place. Balancing of both the relative extent of nitrification and denitrification achieved for nitrogen removal and the oxidation of organic material in the process, requires careful design of the process cycle into the aeration, settling and decant phases.

6.4.1 New IDEA

The IDEA process will be designed to operate on the following basis:

- Full nitrification and denitrification for inflows up to 3.8xADWF
- No storm flow allowance is required for this unit.

Sizing of the reactor is based on maintaining a sludge age of 25 days assuming a process sludge yield 0.85 gTSS/gBOD_5.

The reactor will comprise:

- A single above ground concrete reactor of 450 EP capacity, based on a process sludge age of 25 days.
- High length to width ratio (minimum 2:1) to minimise the potential for short circuiting of flow from the reactor inlet to the end wall decanter.
- Inlet pipework from the feed pump, with a transverse diffuser manifold at one end of the reactor.
- A jet aerator with a submersible motor.
- A lowering trough type decanting mechanism. The trough will be located at the end of the reactor.

- A waste activated sludge (WAS) pump which is mounted on a plinth at ground level beside the reactor, with associated rising main and flow meter to transfer waste sludge to the sludge storage tanks.
- Outlet pipework between the decant mechanism and effluent balance tank.
- An access platform with handrails to support the decant mechanism and provide access to reactor equipment and instrumentation.
- Instrumentation for process monitoring and control, including level sensors, dissolved oxygen (DO) probes and a pH probe.

6.4.2 Inlet Zone

Flow from the balance tank will be pumped to the reactor via a transverse submerged diffuser inlet manifold. Port openings in the manifold will be positioned just above the reactor floor level to allow a relatively even distribution of sewage inflow across the full width of the reactor into the sludge blanket. This arrangement allows rapid dissipation of any temperature differential between the MLSS within the reactor and sewage inflows, minimising the potential for stratification of flow that may lead to short circuiting.

6.4.3 Aeration Equipment

Submersible jet aerators are ideal for small treatment systems. The system includes a static vertical pipe which protrudes above the water through which air is drawn by the action of the associated high-volume pump forcing mixed liquor past an eductor ring. This generates a negative pressure and draws in air which is sheared and mixed with the pumped discharge downstream of the eductor. This highly aerated diffused air-water mixture is then discharged into the reactor as a pressurized jet.

The main advantage of this type of aerator is that there is little noise other than the hiss of air entering the down-pipe and the “aeration” device is a standard, robust submersible pump.

It is less efficient in terms of energy use than diffused aeration, but the lift-in, lift-out aeration system offers a cost-effective alternative to fixed mechanical or diffused aeration systems. The aerator can be installed quickly without emptying the existing tank. Alternative aeration technologies can be investigated during the detail design phase.

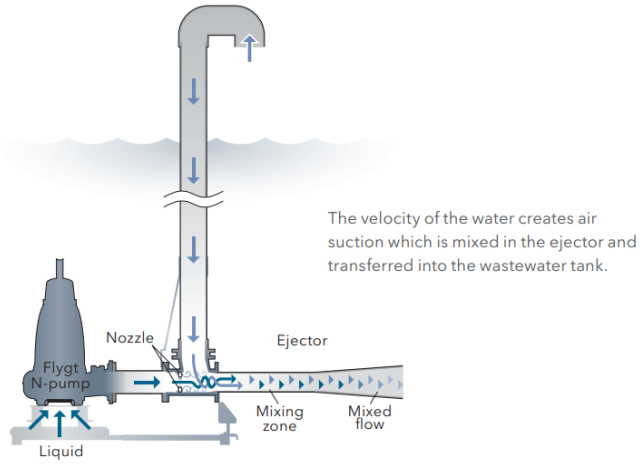


Figure 6-3: Jet Aerator Example

One 12 kW jet aerator (based on an efficiency of 0.85 kgO_2/kWh) will be required for a biological loading of 450 EP. The unit will be capable of delivering a total of 8.5 kgO_2/h as well as provide the required mixing in the tank.

6.4.4 Decant Mechanism

Decanting of effluent from the IDEA reactor will occur via an end located trough type mechanism. The trough will be positioned transverse to the longitudinal axis of the reactor and consist of a galvanised steel channel which is lowered from the TWL to BWL during the decant phase of each cycle. Lowering/raising of the decant trough is by a helical worm gear drive system and wire ropes attached to both ends of the trough. On reaching BWL at completion of the decant phase, the trough is raised to the reactor TWL to await filling of the tank under subsequent aeration and settling phases of the IDEA operating cycle.

Gradual lowering of the trough over the decant phase allows the flow of clarified effluent over the trough weir side in a controlled manner and down through the connecting outlet pipework. The outlet pipework conveys decanted effluent through the wall of the tank and into the existing effluent balance pond.

Table 6-1: Decanter Design Details

Parameter	Details
Number of troughs	1
Trough type	End wall
Weir length	5.8 m
Decant time	47 min
Maximum decant flow rate	13.6 L/s (2.3 L/m/s)

6.4.5 Waste Activated Sludge Pumping

Wastage of sludge (i.e. mixed liquor suspended solids) will be undertaken during the aeration phase of each process operating cycle.

The design sludge wasting rate is 0.8 L/s. This will be achieved by installation of a dry well type pump located under the IDEA walkway of the reactor, with suction pipework passing through the reactor wall. Pump operation will be controlled via the plant PLC and adjusted to suit the actual required wastage. WAS withdrawn by the pump during the aeration phase will be directed to the sludge storage tank via an 80 mm dia. main.

An uninstalled standby WAS pump will be kept in storage if the duty pump needs to the replaced or requires major pump overhaul/workshop servicing.

Operation of the WAS pump will normally be controlled by the operator adjusting the run time settings. However, when required to effect process changes that require operation at a different MLSS concentration for significant wastage to overcome operating problems, the operator may select to undertake wastage on an adjustable WAS volume setting. This will utilise an electromagnetic flow meter installed on the WAS rising main to monitor activated sludge wastage rates and cumulative volumes.

6.4.6 IDEA Reactor Sizing and Operation

PWA has developed a rotational method for sizing IDEA reactors. This considers the behaviour of the sludge blanket, process requirements and hydraulics within a reactor. The output of computer modelling for the proposed IDEA reactor configuration undertaken for the Stockinbingal STP is provided in summary form in Table 6-2. A 25-day sludge age has been adopted to provide a more robust design under foreseeable operational conditions with an appropriate margin of safety, and to maximise nitrification potential during the colder winter months.

Table 6-2: IDEA Reactor Design Criteria

Parameter	Value
Design EP	450 EP
Length	10 m
Width	6 m
TWL depth above reactor floor	3.7 m
BWL depth above reactor floor	3.2 m
Decanter length	5.8 m
Process Parameters	
Sludge Age	25 days
Design MLSS Concentration (at BWL)	3,700 mg/L
Sludge Settling Rate	5 m/h
DDWF Cycle	
Aeration Time	12 h/day
Aeration Time	90 mins/cycle
Mixing/Settling Time	36 mins/cycle
Decant Time	49 mins/cycle
Decanter Raising Time	5 mins/cycle
Total Cycle Time	180 mins/cycle
Aeration Requirements	
Total Oxygen Requirement	3.5 kgO_2/h
Average Standard Oxygen Transfer Rate (SOTR)	8.5 kgO_2/h

Operation of the aeration system will be DO controlled. The DO setpoint will normally be set between 1 to 2mg DO/L. The DO control will allow the aeration system to operate optimally and minimise electrical consumption and power costs. Two DO probes will be installed in the IDEA reactor to monitor the DO and to facilitate this method of process control.

Sludge age will be controlled by wasting MLSS from the reactor. The waste MLSS will be withdrawn from the reactor by a WAS pump. The WAS pump will operate for a set (adjustable) run time during the aeration phase to ensure that the sludge (i.e. MLSS) is fully mixed and to minimise the risk of 'rat-holing'. Based on a 25-day sludge age, the amount of sludge withdrawn daily will be equivalent to $1/25^{th}$ of the reactor BWL volume.

Should it be required to undertake process changes that require operation at a different MLSS concentration or if significant wastage is needed, the operator will be able to select to undertake wastage on an adjustable WAS volume setting.

Chemical dosing for P removal and/or for improving sludge settling characteristics will be directly into the IDEA reactor during the aeration phase. Dosing will be controlled by the plant PLC and sequenced to occur during the aeration phase.

6.5 Effluent Balance Tank

Balancing is required for effluent decanted from the IDEA reactor. The function is attenuating high intermittent decant flows and the higher flows after power outages. This attenuation reduces the size of UV disinfection system and effluent pump system.

A 66 kL volume is required. The balance tank will be a concrete tank at the decanting side of the IDEA reactor.

6.6 Chemical Dosing Facilities for Phosphorus Removal

Chemical dosing for phosphorus removal will be required for additional phosphorus removal before effluent discharge.

This section outlines the typical installation and sizing of units required.

6.6.1 Process description

The principle of chemical phosphorus removal is to precipitate phosphorus in the sewage using metal ions. Phosphorus must be in the ortho-phosphate form, i.e. soluble hydrolysed phosphate, to react with the metal ions added in the form of a metallic salt to the wastewater. The metal ions and the ortho-phosphate combine to form insoluble metal phosphates, this precipitate being flocculated in a settleable sludge, removed from the effluent stream.

The requirements for effective chemical phosphorus removal are:

- addition of correct quantities of chemical
- effective mixing of the chemical with the wastewater
- adjustment of pH, if required, to replenish alkalinity lost due to chemical phosphorus removal

Chemical dosing requirements are determined by the sewage P levels, and the degree of removal required. This is usually denoted as the mole ratio of the metal ion needed and the P removed. The theoretical mole ratio of metal ions added to P removed for 100% removal is 1:1. However, side reactions occur between the metal and hydroxide ions, forming metal hydroxide. This causes an increase in the metal ion dose ratio. The actual ratio would normally be between 1.5: 1 and 2.5: 1. Dose rates can be optimised by performing jar tests on the wastewater.

Three of the more commonly used chemicals for phosphorus removal are alum, ferrous chloride (spent pickle liquor) and ferric chloride.

Alum is recommended over iron based chemicals as:

- Iron based chemicals can discolour the effluent and can affect the performance of the downstream UV system
- The quality and supply of pickle liquor cannot be guaranteed. The $FeCl_2$ content of pickle liquor varies between 9 and 13% w/w, resulting in greater storage requirements (compared to liquid alum)
- Chemical sludge production for iron based chemicals is approximately double that of aluminium based chemicals, due to the higher atomic weight of iron (56 for Fe and 27 for Al).

The design criteria for the chemical phosphorus removal system are given in the following table.

Table 6-3: Design Criteria for Chemical Phosphorus Removal System

Parameter	Details
Dosing agent	Liquid aluminium sulphate (alum)
Metal ion: P removed	2.5 (Al): 1 (P removed)
Molar dose ratio	2.5 (Al): 1 (P removed)
Raw sewage TP	15 mg/L
Biological P removal	3.0 mg/L
TP of final effluent	0.5 mg/L (average)
Dosing control mechanism	Fixed dose rate into IDEA reactor during aeration phase

6.6.2 Chemical Usage

Phosphorus removal will be facilitated by a single stage dosing. Liquid alum will be dosed into the IDEA reactor during the aeration phase of its operating cycle. The dosing lines can be supported on a wire that can be placed across the reactor. Dosing will be programmed to occur during the aeration phase as this enables rapid mixing and flocculation within the reactor. The mixed liquor captures the resulting chemical sludge. Dosing into the reactor will also result in an overall improvement of the MLSS settlement rate during the settlement phase.

The estimated maximum liquid alum usage is 17 L/d at the design plant load.

6.6.3 Storage Area and Dosing Facility

Liquid alum would be delivered to the STP by chemical tanker trucks, 1 kL at a time, and will be stored in a 1.6 kL self-bunded liquid storage tank, which is sufficient for 3 months' storage. The bund will have a minimum volume of 110% of the total chemical storage tank located in the bund.

The dosing pumps are also located within the integrated bunding system. Safety shower and eyewash facilities will be provided adjacent to the storage tank for use in the event of operator (or other persons) direct contact with the chemical.

The storage tank will have two (2) sets of level indicators. One indicator will be a pressure sensor to relay a signal to the plant control system, with the second being a visual level indicator at the filling point.

6.6.4 Dosing Pumps

Dosing pump operation will be PLC controlled. Two (2) x 1 L/h dosing pumps (automatic duty and standby) will dose alum into the IDEA reactor during the aeration phase to enable rapid mixing and flocculation within the reactor.

The dosing pump operation will be PLC controlled for dosing to occur during the IDEA reactor aeration phase to ensure adequate mixing. Dosing will be at a fixed set rate (i.e. not flow paced). The reactor should sufficiently balance the inflow to offset any variations in influent wastewater P loads. Hence, changes of dose rates due to diurnal variations in inflow should not be required.

6.7 Chemical Dosing System for pH Correction

pH correction might be required due to the alum dosing, depending on the incoming alkalinity.

If pH correction is required it would be similar to the alum system, but the chemical would be caustic soda. A 1.6 kL self-bunded caustic soda tank and 1 L/h dosing pumps (automatic duty and standby) will be provided.

A set of pH sensors will be installed in the IDEA reactor. The caustic dosing pumps will only dose during the aeration phase to ensure adequate mixing of the caustic soda when the reactor pH falls below a minimum pH set point. Dosing rates will be fixed at a set rate (i.e. not flow paced) which will be operator adjustable.

6.8 Effluent Pumping

An effluent pump has been allowed for to transfer flows from the STP to Dudauman Creek. However, survey results might show that the effluent can gravitate from the catch tank through the UV system to the creek. This will be confirmed during the detail design phase.

6.9 Disinfection

Artificial UV will be required to provide disinfection of the effluent before discharge. The UV system will be sized for 0.78 L/s.

Table 6-4: Design Parameters for the UV System

Parameter	Value
Flow rate	0.78 L/s
UV wavelength	254 nm
Maximum ON/OFF switched per day	4
Design UVT	50%
Minimum lamp life	12,000 hours
Influent faecal coliform	1,000,000 CFU/100ml
Disinfection faecal coliform target	200 CFU/100ml (90th percentile)

6.10 Sludge Dewatering

After the inlet works, the sludge handling has the second highest risk of generating odours. A geobag system is proposed for sludge drying, as this process reduces the odours from the sludge as it is dried fairly quickly. In addition, sludge does not need to be stabilised before being pumped to the geobags. This process is also not very labour intensive except that when the bag is full it will need to be emptied via a loader and truck, this will be required once a year.

The dried sludge will be Stabilisation Grade C, which is suitable for landfill, but not agricultural reuse.

6.10.1 Operation

WAS from the IDEA reactor will be pumped to a sludge collection tank. From there, sludge is pumped to the geobag. The geobag traps the solids and effluent water drains through the pores. Over 99% of solids are captured, and clear filtrate can be collected and recirculated through the system. Filling the geobag with solids and draining the filtrate is a continuous process.

After the final cycle of filling and dewatering, the solids remain in the bag and continue to densify due to desiccation as residual water vapor escapes through the fabric. Volume reduction can be as high as 90%. When full, the geobag and contents can be deposited at a landfill.

6.10.2 Sizing

The process will produce approximately 420 m^3 sludge per year. If the sludge is dewatered to a final solids content of 15%, the total dry cake per year would be 83 m^3.

Two 83 m^3 bags are required in order to cycle between the units. The bags will be placed in a 14x14 m bund. Therefore, several truck loads will be required to transport the dried sludge to the Cootamundra Landfill site 25 km from the STP.

Table 6-5: Sludge Drying Design

Original in situ and final tube properties		
V_0	420	Sludge Volume rate (m^3/yr)
S_t	15%	Final in tube solids concentration of dewatered material (%)
S_0	3%	Original in situ solids concentration of sludge (%)
G	1.1	Specific gravity of solids in sludge
V_t	**83.1**	Final in tube volume of dewatered material (m^3/yr)

6.11 Amenities Building

This building will incorporate:

- an electrical switchroom
- a laboratory
- an office/lunch room
- a unisex/disabled toilet with shower
- a control room to accommodate the HMI control system
- a storage room.

The size of the building will be approximately 12 m x 6 m. A 1.5 m wide concrete veranda along the main entrance facade and a 1 m footpath around the rest of the building will be provided. Alternatively, a containerised amenities building can be provided to reduce the construction cost.

6.12 Electrical System

The following concept for electrical works should be considered only as a preliminary basis for design. Details may change during detailed design and development, and confirmation of power supply arrangement with the Electricity Distributor.

6.12.1 Power Supply

The electricity network solution for the new Sewage Treatment Plant has been based on a plant peak demand of 50 kW. This includes adequate spare capacity for future use.

The closest Essential Energy network infrastructure is a single-phase pole mounted substation that is on the shared boundary of Lot 7003 DP94543 with Lot 279 DP750619, with the pole positioned adjacent to Old Wallendbeen Road. This single-phase overhead power line is connected to a three-phase overhead power line on the eastern side of Old Wallendbeen Road within private property. It has been assumed that the three-phase power line has available capacity for the additional 50 kW

demand. This can only be verified when a connection application is lodged with Essential Energy as part of the design phase.

The scope of works will be:

1. Upgrade the single-phase HV power line to a three-phase HV power line.
2. Replace the existing substation power pole.
3. Upgrade the pole mounted transformer to a 200 kVA, three phase unit.
4. Reconnect the existing customer's service mains.
5. Install a customer LV pillar near to the new pole mounted substation, with service mains connected from the upgraded pole mounted substation to the customer LV pillar. This will allow the STP consumer's mains to be connected and not restricted by the distance limits for service mains.
6. Essential Energy statutory fees and Design Fees.
7. The customer LV pillar will be approximately 115 m from the new STP Main Switchboard.

6.12.2 Photovoltaic Power Supply

To offset the power cost of the operation of the STP, a small Photovoltaic (PV) system could be investigated during the detail design phase to provide alternative power to the STP.

6.12.3 STP Electrical Switchboard

A new electrical switchboard will be provided for the STP. This switchboard will be an indoor type, IP54, Form 3b/4 type to AS/NZS 3439.1 and will be located inside the new switchroom in the amenities building.

6.12.4 Meter Box

A new meter box will be provided for revenue metering and will be located on an external wall of the new electrical switchroom.

6.12.5 Provision for back-up power supply arrangement

Provisions for back-up power supply from a portable generator will be incorporated into the new Switchboard. A manually operated source change-over switch will be included.

6.12.6 PLC Panel

A PLC Panel will be provided as part of the Electrical Switchboard; and will be located in a segregated compartment.

6.12.7 HMI (Touch Screen)

The STP will include an HMI (Touch Screen) for operation and control. The HMI will be located on the front door of the PLC Panel/Compartment. This will help the Council Operator to view equipment status and alarms, make operational changes to operator adjustable settings, monitor/acknowledge/reset alarm conditions and undertake switching between manual and automatic equipment control.

The HMI system will interface with the new PLC panel and the telemetry system for remote access and monitoring. A telemetry system will be included for remote monitoring.

If required, a SCADA system could be provided instead of the HMI system. This has not been costed.

6.12.8 Cable and Cable Supports

New cabling will be provided to new equipment and systems. New underground conduits will be provided for installation of new cabling.

6.12.9 Emergency Stop Switches

Emergency stop switches will be provided for each motor and drive in compliance with AS/NZS 3000:2018, AS/NZS 4024.1, and current WHS regulations.

Each emergency stop switch will be mounted at a suitable location close to the respective drive/pump motor and will be readily and conveniently accessible.

6.12.10 Building Services

Building services will include LED lighting for daytime and night-time operation, EXIT lights and general power outlets (GPO). The building will include a smoke and fire alarm system and a new reverse-cycle air-conditioning system in the electrical switchroom, control room and laboratory.

7. Project Costs

7.1 Pressure Sewerage Network

A summary of the Pressure Sewer Network Costs based on the concept design is shown in Table 7-1. A detailed costing is provided in Appendix F.

These costs have been developed based on the quantity of items to be supplied and installed (number of PSS units and pipe lengths) and identified rates.

The quantity of items to be installed was determined based on the Basis of Design document, the concept design layout or the hydraulic model (e.g. pipe lengths). Rates used for developing the project cost have been based on available rates and discussions with suppliers or contractors where possible.

An allowance has been made for the railway underbore of approximately 40 m in length.

For pipe lengths an additional 10% allowance has been made for changes during detail design and to reflect the level of design (concept design level). In addition, five air valves and vent shafts have been allowed for, however based on the concept design, no vent shafts are required. These values have been added to the contingency.

Another thing to note, is that the properties outside the village boundary contribute to a significant part of the capital, due to the long reticulation lines. The total cost of expanding the network beyond the village network is around $800,000.

The cost of the audit and possible replacement of non-complying electrical distribution boards has not been allowed for in the cost estimate.

Table 7-1: Pressure Sewerage Network – Cost Estimation Summary

	Cost Item	Cost (includes GST)
1.	Site Establishment	$110,000
2.	Pressure Units	$1,373,200
3.	Reticulation	$1,365,000
4.	Miscellaneous	$44,000
	Sub Total – Direct Construction Costs	**$2,892,200**
	Contractor Indirect Costs	$144,610
	Total Construction Costs	**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)	$682,800
	Survey, Investigation, Design and Project Management	$289,220
	Total Estimated Project Cost[1]	**$4,008,830**

Note: 1 – Total Estimated Project Costs do not include client costs such as community consultation and client liaison by the project manager.

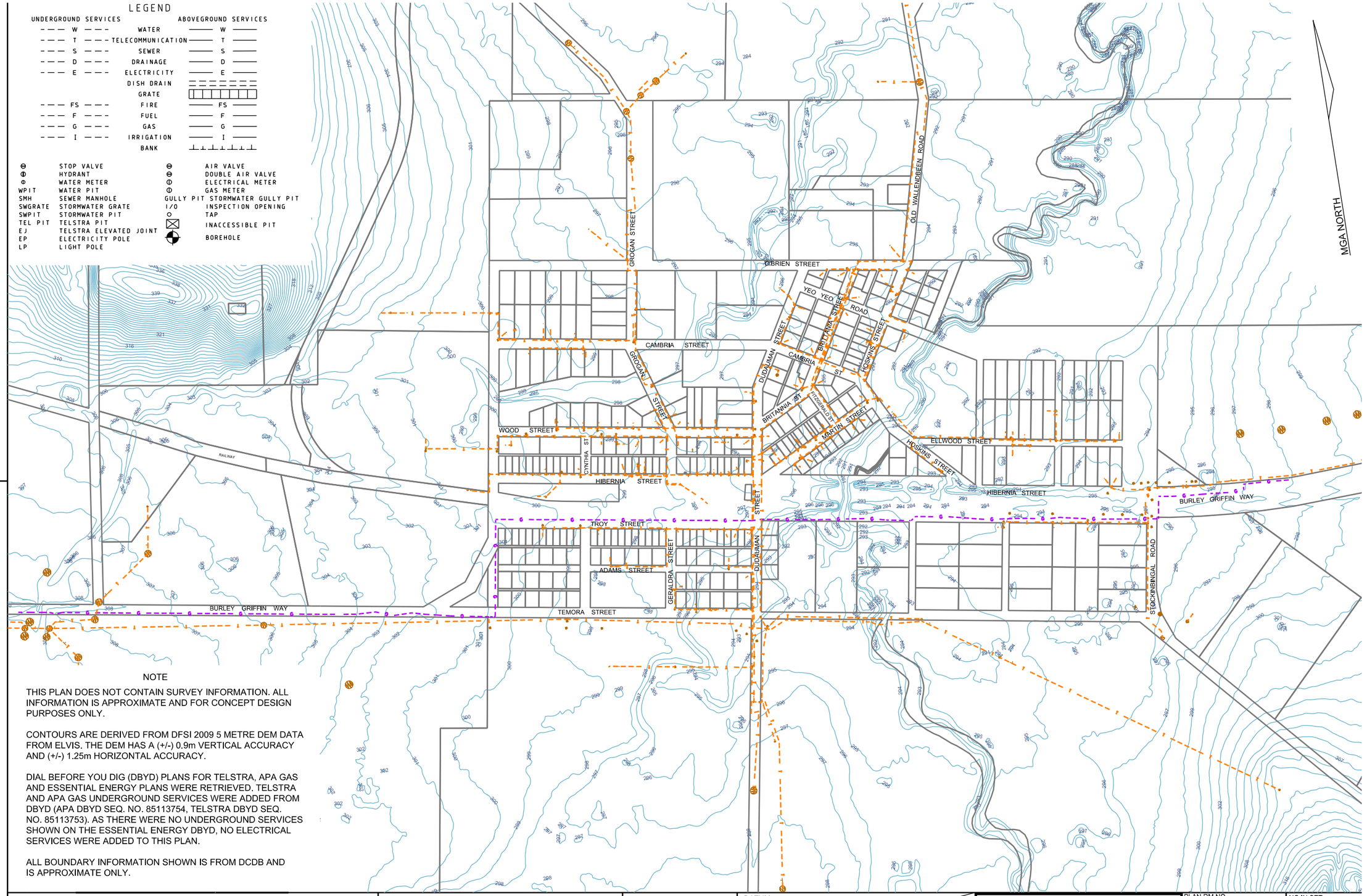
7.2 Sewage Treatment Plant Cost

The following table shows the cost estimate for a concrete IDEA reactor plant. A detailed estimated costing is provided Appendix F.

Table 7-2: STP - Cost Summary

Item No	Description	Cost (includes GST)
5.	Site Establishment	$108,000
6.	Roadworks and Site Drainage	$90,000
7.	Emergency Balance Tank	$25,200
8.	Inlet Works	$90,000
9.	Concrete IDEA reactor and balance tank	$728,471
10.	Sludge Tank	$18,200
11.	Sludge Dewatering	$83,700
12.	Chemical Dosing	$20,000
13.	Disinfection	$30,000
14.	Treated effluent outfall pump	$9,000
15.	Amenities Building	$200,000
16.	Pipework, Valves and Fittings	$72,500
17.	Installation/Testing/Commissioning	$145,000
18.	Electrical Works	$364,100
19.	Potable water connection to STP	$10,000
20.	Miscellaneous	$90,000
	Subtotal	**$2,084,171**
	Project Contingency (20%)	$416,834
	Survey, investigation, design and project management (10%)	$208,417
	Total Estimated Capital Cost	**$2,709,422**

Appendix A Survey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F FUEL
G GAS
I IRRIGATION
BANK
STOP VALVE
HYDRANT
WATER METER
WPIT WATER PIT
SMH SEWER MANHOLE
SWGRATE STORMWATER GRATE
SWPIT STORMWATER PIT
TEL PIT TELSTRA PIT
EJ TELSTRA ELEVATED JOINT
EP ELECTRICITY POLE
LP LIGHT POLE
AIR VALVE
DOUBLE AIR VALVE
ELECTRICAL METER
GAS METER
GULLY PIT STORMWATER GULLY PIT
I/O INSPECTION OPENING
TAP
INACCESSIBLE PIT
BOREHOLE
MGA NORTH
GROGAN STREET
O'BRIEN STREET
OLD WALLENDBEEN ROAD
YEO YEO STREET
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GERALDRA STREET
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NOTE
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CONTOURS ARE DERIVED FROM DFSI 2009 5 METRE DEM DATA FROM ELVIS. THE DEM HAS A (+/-) 0.9m VERTICAL ACCURACY AND (+/-) 1.25m HORIZONTAL ACCURACY.
DIAL BEFORE YOU DIG (DBYD) PLANS FOR TELSTRA, APA GAS AND ESSENTIAL ENERGY PLANS WERE RETRIEVED. TELSTRA AND APA GAS UNDERGROUND SERVICES WERE ADDED FROM DBYD (APA DBYD SEQ. NO. 85113754, TELSTRA DBYD SEQ. NO. 85113753). AS THERE WERE NO UNDERGROUND SERVICES SHOWN ON THE ESSENTIAL ENERGY DBYD, NO ELECTRICAL SERVICES WERE ADDED TO THIS PLAN.
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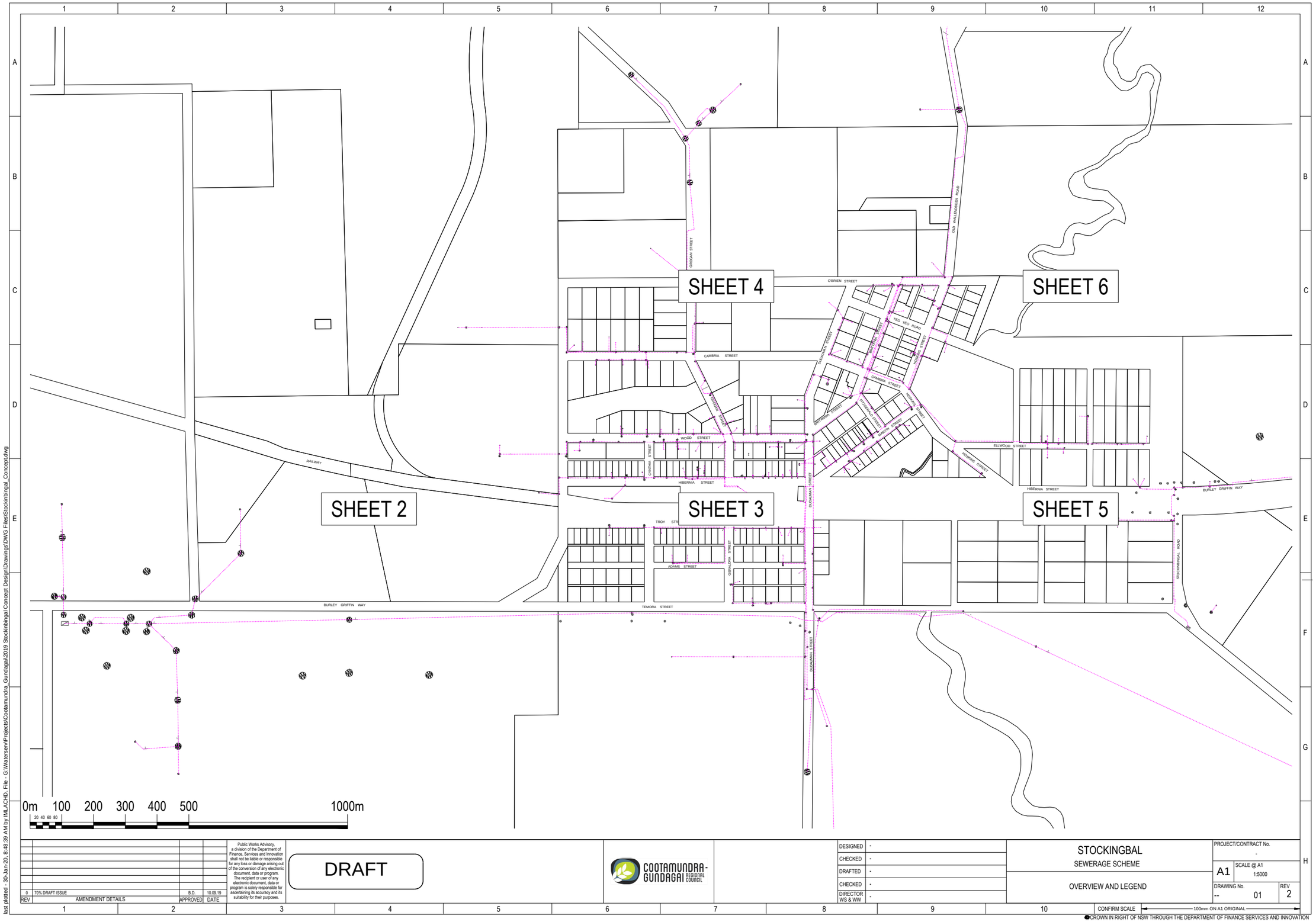
Appendix B Preferred Network Layout



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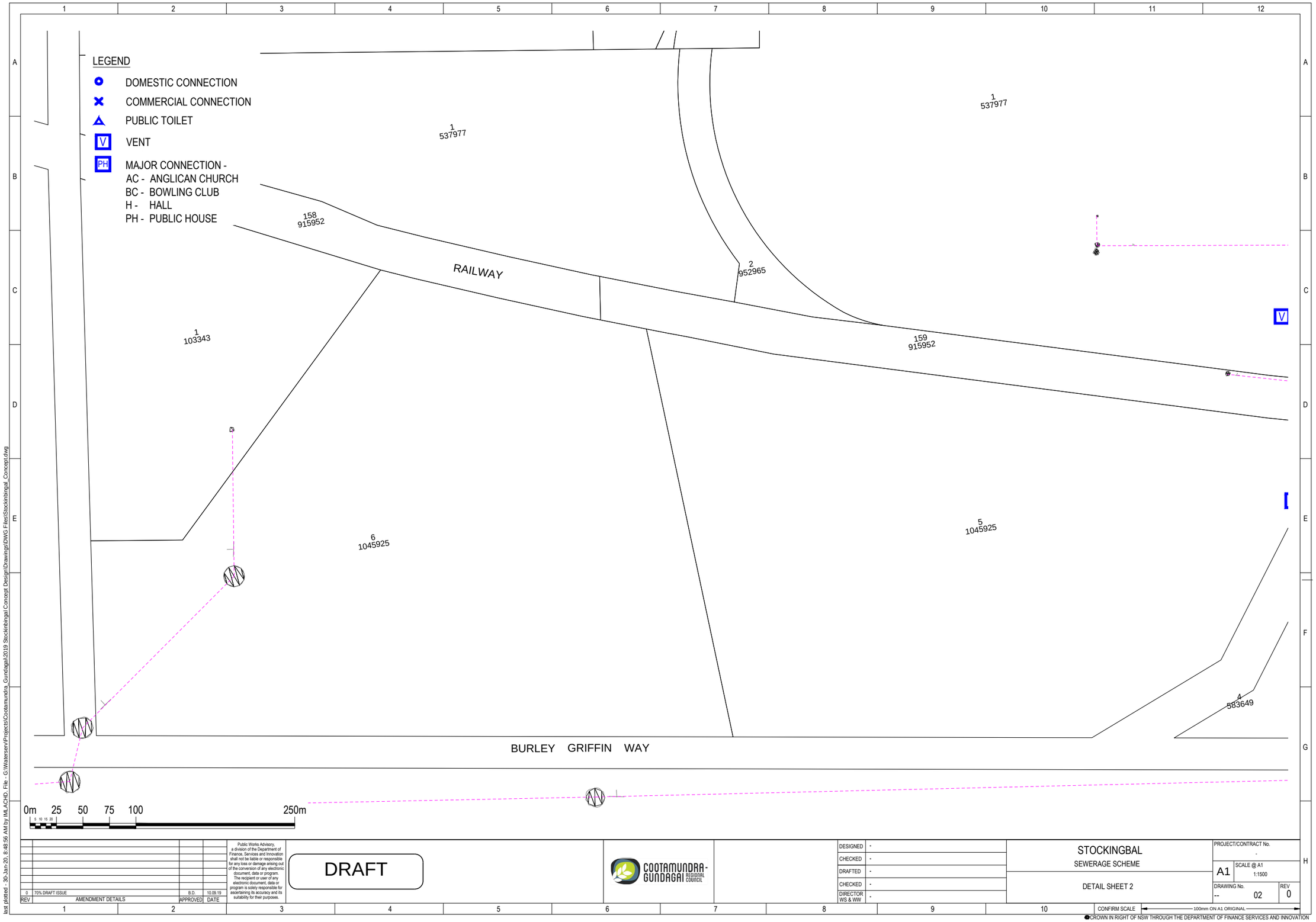
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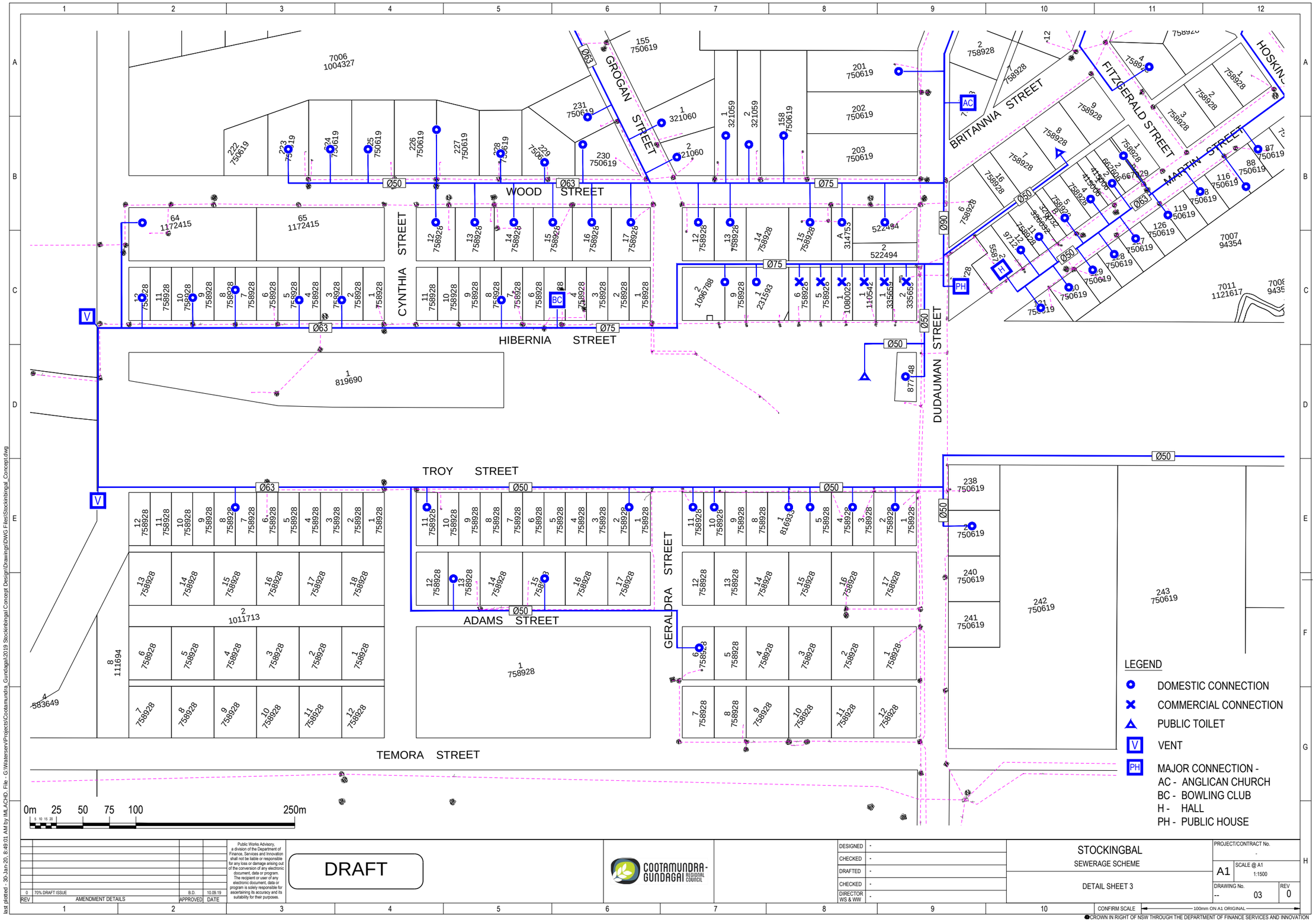
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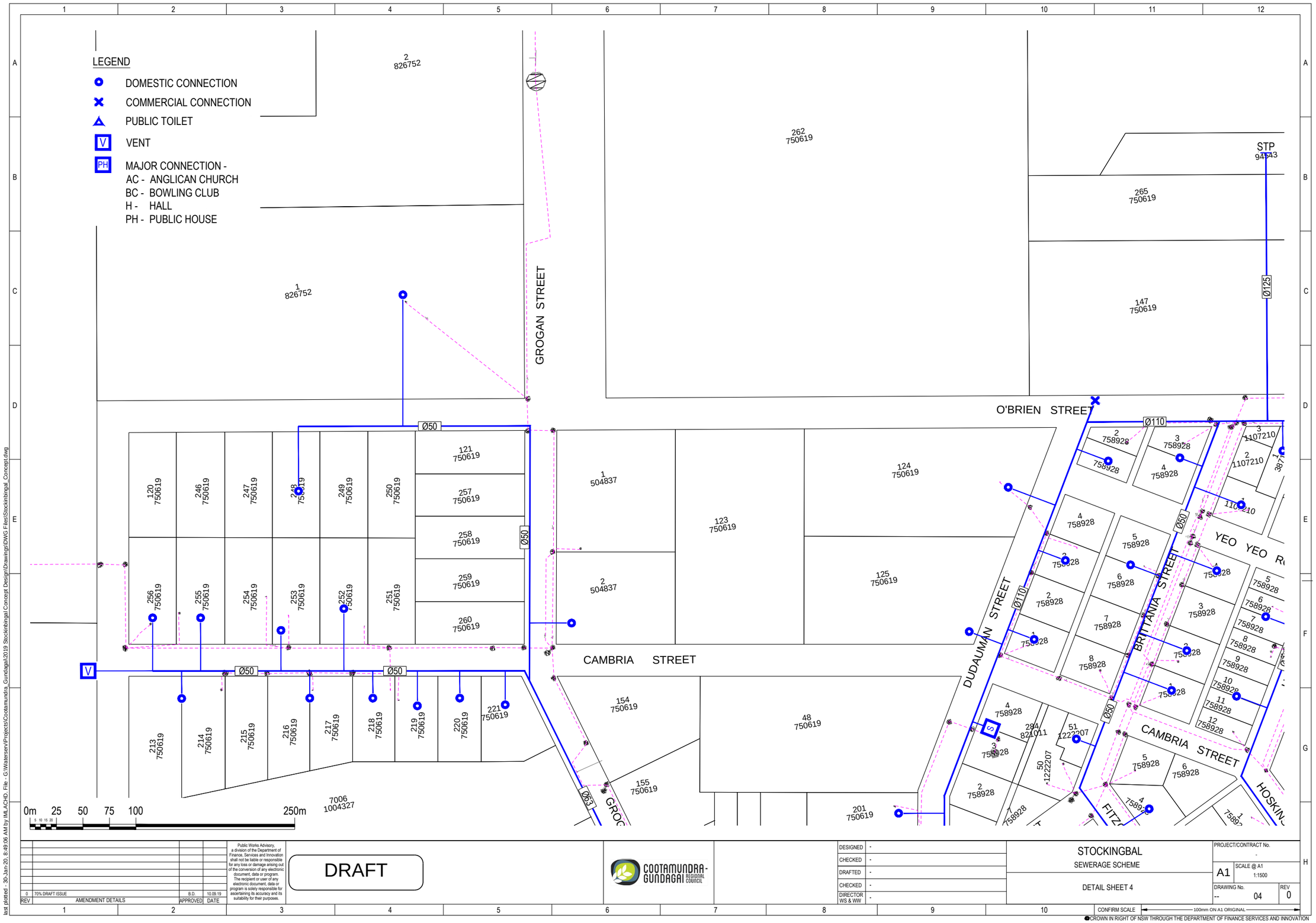
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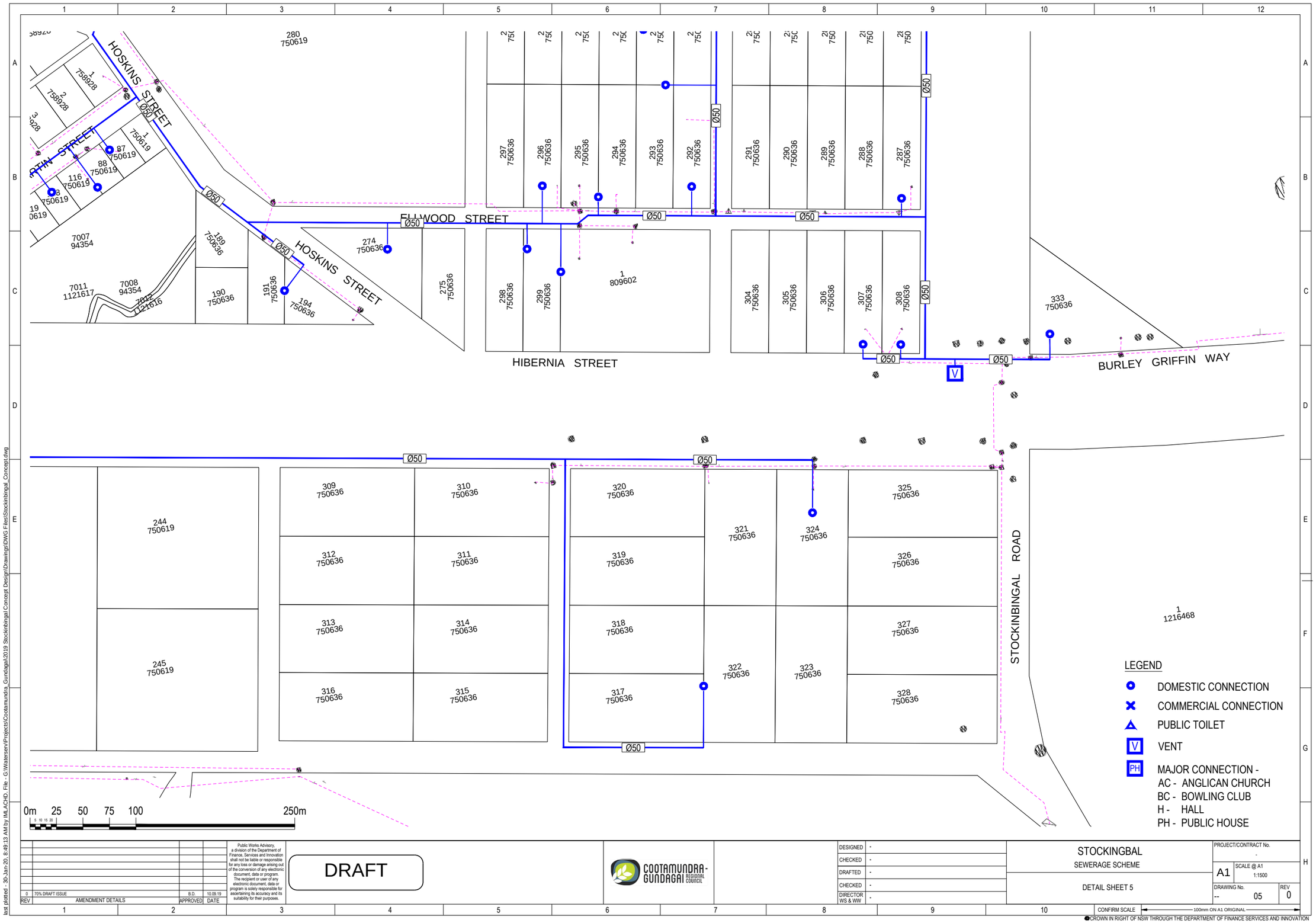
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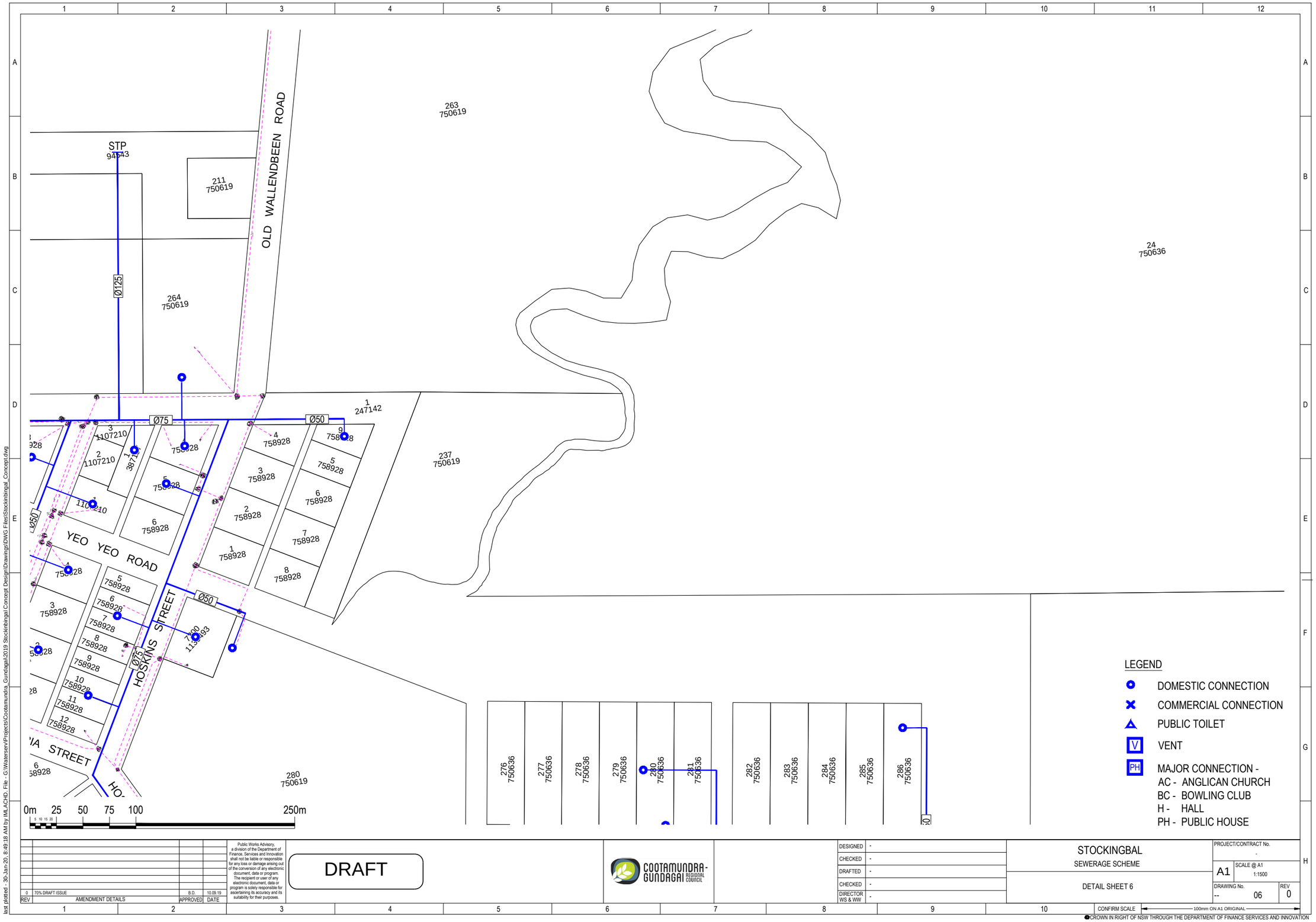
OLD WALLENDBEEN ROAD
YEO YEO ROAD
HOSKINS STREET
STP
94543
263
750619
211
750619
264
750619
1
247142
237
750619
24
750636
280
750619
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276 750636
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286 750636
0m 25 50 75 100 250m
LEGEND
DOMESTIC CONNECTION
COMMERCIAL CONNECTION
PUBLIC TOILET
V VENT
PH MAJOR CONNECTION -
AC - ANGLICAN CHURCH
BC - BOWLING CLUB
H - HALL
PH - PUBLIC HOUSE
DRAFT
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REV AMENDMENT DETAILS APPROVED DATE
COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL
DESIGNED -
CHECKED -
DRAFTED -
CHECKED -
DIRECTOR WS & WW -
STOCKINGBAL
SEWERAGE SCHEME
DETAIL SHEET 6
PROJECT/CONTRACT No. -
A1
SCALE @ A1 1:1500
DRAWING No. -- 06
REV 0
CONFIRM SCALE 100mm ON A1 ORIGINAL
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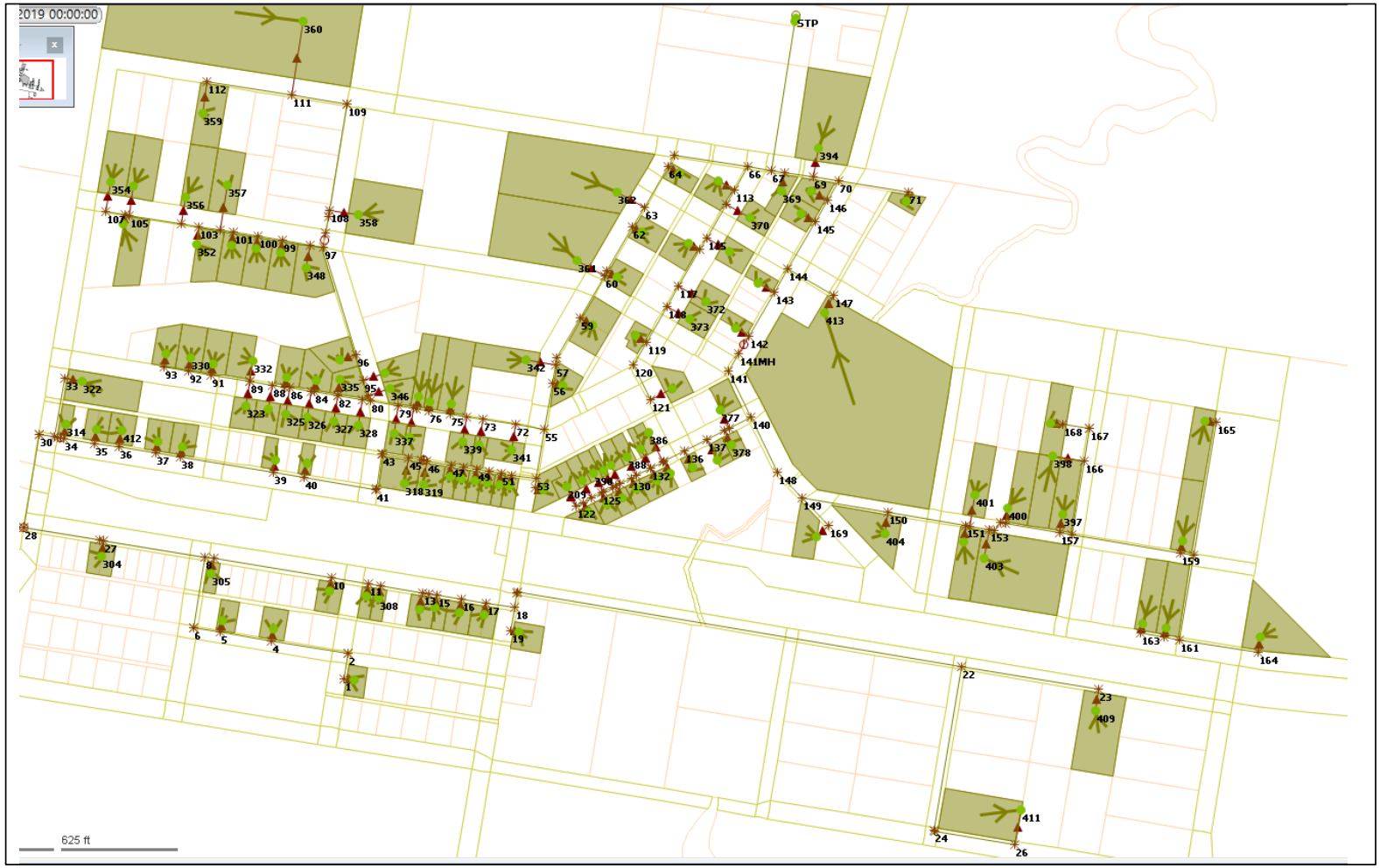
CROWN IN RIGHT OF NSW THROUGH THE DEPARTMENT OF FINANCE SERVICES AND INNOVATION

Appendix C Node Map



Appendix D Hydraulic Modelling Output

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
1	2	41	40	296.35	295.35	0.65	0.521	0.65	0.521	296.4	297	295.4	296
10	9	192.8	40	297.337	297.337	0.98	0.776	0.98	0.776	297.4	298	297.4	298
100	99	40.2	40	298.337	297.337	0.84	0.671	0.84	0.671	298.4	299	297.4	298
101	100	40.1	40	298.337	298.337	0.82	0.653	0.82	0.653	298.4	299	298.4	299
102	101	21.3	40	298.337	298.337	0.77	0.613	0.77	0.613	298.4	299	298.4	299
103	102	33.9	40	298.337	298.337	0.76	0.601	0.76	0.601	298.4	299	298.4	299
104	103	29.3	40	298.35	298.35	0.71	0.567	0.71	0.567	298.4	299	298.4	299
105	104	85.4	40	298.35	298.35	0.7	0.558	0.7	0.558	298.4	299	298.4	299
106	105	6.3	40	298.35	298.35	0.69	0.55	0.69	0.55	298.4	299	298.4	299
107	106	30.8	40	299.91	298.35	0.69	0.549	0.69	0.549	300	300	298.4	299
108	108MH	10.8	40	297.35	297.75	1.92	1.53	1.92	1.53	297.4	298	297.85	298
108MH	108F1	25.6	40	297.35	297.35	0.85	0.679	0.86	0.682	297.85	298	297.85	298
109	108	172.5	40	296.35	297.35	0.88	0.698	0.86	0.687	296.4	297	297.4	298
11	10	59.4	40	296.337	297.337	0.98	0.778	0.98	0.778	296.4	297	297.4	298
110	109	1.5	40	296.35	296.35	0.7	0.554	0.7	0.554	296.4	297	296.4	297
111	110	90.1	40	296.35	296.35	0.68	0.542	0.68	0.542	296.4	297	296.4	297
112	111	136.9	40	298.35	296.35	0.67	0.537	0.67	0.537	298.4	299	296.4	297
113	66	43.2	40	294.337	294.337	1.25	0.998	1.25	0.998	294.4	295	295	295
114	113	26.7	40	294.337	294.337	1.26	0.999	1.26	0.999	294.4	295	294.4	295
115	114	63.2	40	294.337	294.337	1.26	1	1.26	1	294.4	295	294.4	295
116	115	21.2	40	294.337	294.337	1	0.797	1	0.797	294.4	295	294.4	295
117	116	68.4	40	294.337	294.337	0.7	0.557	0.7	0.557	294.4	295	294.4	295
118	117	37.3	40	294.35	294.35	0.69	0.545	0.69	0.545	294.4	295	294.4	295
119	118	66.2	40	294.35	294.35	0.68	0.538	0.68	0.538	294.4	295	294.4	295
12	11	19.9	40	296.337	296.337	0.98	0.78	0.98	0.78	296.4	297	296.4	297
120	119	43	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
121	120	61.7	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
122	123	12.8	40	295.35	295.35	1.31	1.04	1.31	1.04	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
123	124	15.4	40	295.35	294.35	1.79	1.428	1.79	1.428	295.4	296	294.4	295
124	125	17.8	40	294.35	294.35	1.77	1.406	1.77	1.406	294.4	295	294.4	295
125	126	3.7	40	294.35	294.35	1.77	1.411	1.77	1.411	294.4	295	294.4	295
126	127	16	40	294.35	294.35	1.76	1.399	1.76	1.399	294.4	295	294.4	295
127	128	6.1	51	294.337	294.337	2.17	1.064	2.17	1.064	294.4	295	294.4	295
128	129	7.6	51	294.337	294.337	2.16	1.057	2.16	1.057	294.4	295	294.4	295
129	130	19.9	51	294.337	294.337	2.15	1.051	2.15	1.051	294.4	295	294.4	295
13	12	68.6	40	296.337	296.337	0.98	0.782	0.98	0.782	296.4	297	296.4	297
130	131	10.1	51	294.337	294.337	2.13	1.045	2.13	1.045	294.4	295	294.4	295
131	132	25.2	51	294.337	294.337	2.12	1.038	2.12	1.038	294.4	295	294.4	295
132	133	1.5	51	294.337	294.337	2.11	1.032	2.11	1.032	294.4	295	294.4	295
133	134	23	51	294.337	294.337	2.1	1.026	2.1	1.026	294.4	295	294.4	295
134	135	2	51	294.337	294.337	2.08	1.02	2.08	1.02	294.4	295	294.4	295
135	136	36.3	51	294.337	293.337	2.07	1.014	2.07	1.014	294.4	295	293.4	294
136	137	41.1	51	293.337	293.337	2.06	1.009	2.06	1.009	293.4	294	293.4	294
137	138	31.1	51	293.337	293.337	2.05	1.004	2.05	1.004	293.4	294	293.4	294
138	139	9.4	51	293.337	292.337	2.04	0.999	2.04	0.999	293.4	294	292.4	293
139	140	37.9	51	292.337	292.337	2.03	0.994	2.03	0.994	292.4	293	292.4	293
14	13	10.8	40	296.337	296.337	0.65	0.518	0.65	0.518	296.4	297	296.4	297
140	141	82.6	61	292.325	293.778	2.59	0.887	2.6	0.889	292.4	293	294	294
141	141MH	32.9	61	293.6	293.109	3.82	1.306	3.83	1.309	294	294	294	294
142	143	80.5	61	292.325	292.325	1.76	0.603	1.76	0.603	292.4	293	292.4	293
143	144	44.8	61	292.325	292.325	1.76	0.602	1.76	0.602	292.4	293	292.4	293
144	145	87.7	61	292.325	292.325	1.76	0.602	1.76	0.602	292.4	293	292.4	293
145	146	38.9	61	292.325	292.325	2.27	0.777	2.27	0.777	292.4	293	292.4	293
146	70	36.4	61	292.325	292.325	2.27	0.776	2.27	0.776	292.4	293	292.4	293
147	144	85.4	40	292.35	292.35	0.71	0.563	0.71	0.563	292.4	293	292.4	293
148	140	97.5	40	290.337	292.337	0.86	0.683	0.86	0.683	290.4	291	292.4	293

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
149	148	57.4	40	291.337	290.337	0.86	0.686	0.86	0.686	291.4	292	290.4	291
15	14	12.3	40	296.35	296.35	0.65	0.517	0.65	0.517	296.4	297	296.4	297
150	149	140.4	40	291.337	291.337	0.87	0.693	0.87	0.693	291.4	292	291.4	292
151	150	127.5	40	291.337	291.337	0.88	0.699	0.88	0.699	291.4	292	291.4	292
152	151	5.9	40	291.337	291.337	0.89	0.707	0.89	0.707	291.4	292	291.4	292
153	152	31.9	40	291.337	291.337	0.9	0.717	0.9	0.717	291.4	292	291.4	292
154	153	7.8	40	291.337	291.337	0.66	0.528	0.66	0.528	291.4	292	291.4	292
155	154	16.5	40	291.337	291.337	0.67	0.535	0.67	0.535	291.4	292	291.4	292
156	155	7.7	40	291.337	291.337	0.68	0.543	0.68	0.543	291.4	292	291.4	292
157	156	88.4	40	291.337	291.337	0.69	0.551	0.69	0.551	291.4	292	291.4	292
158	157	19.5	40	291.337	291.337	0.71	0.561	0.71	0.561	291.4	292	291.4	292
159	158	177	40	292.337	291.337	0.79	0.629	0.79	0.628	292.4	293	291.4	292
16	15	40.2	40	296.35	296.35	0.64	0.507	0.64	0.506	296.4	297	296.4	297
160	159	22.7	40	292.337	292.337	0.83	0.66	0.83	0.66	292.4	293	292.4	293
161	160	137.9	40	293.25	292.25	0.92	0.728	0.91	0.728	293.3	294	292.4	293
162	161	25.1	40	293.25	293.25	0.62	0.49	0.62	0.49	293.3	294	293.3	294
163	162	39.5	40	293.25	293.25	0.63	0.504	0.63	0.504	293.3	294	293.3	294
164	161	127.6	40	294.25	293.25	0.63	0.504	0.63	0.504	294.3	295	293.3	294
165	160	216.7	40	292.35	292.35	0.63	0.498	0.63	0.498	292.4	293	292.4	293
166	158	119	40	291.35	291.35	0.62	0.49	0.62	0.49	291.4	292	291.4	292
167	171	1	40	291.35	291.35	0.62	0.49	0.62	0.49	291.4	292	291.4	292
168	167	42.4	40	291.35	291.35	0.63	0.505	0.63	0.505	291.4	292	291.4	292
169	149	61.6	40	291.35	291.35	0.67	0.533	0.67	0.533	291.4	292	291.4	292
17	16	40.2	40	295.35	296.35	0.63	0.5	0.63	0.5	295.4	296	296.4	297
171	166	53.4	40	291.35	291.35	0.61	0.484	0.61	0.484	291.4	292	291.4	292
18	17	46.4	40	295.35	295.35	0.61	0.488	0.61	0.488	295.4	296	295.4	296
19	18	37.8	40	294.35	295.35	0.66	0.526	0.66	0.526	294.4	295	295.4	296
2	3	1.5	40	295.35	295.35	0.65	0.514	0.65	0.514	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
20	18	24.7	40	295.35	295.35	0.56	0.443	0.56	0.443	295.4	296	295.4	296
21	20	1.5	40	295.35	295.35	0.56	0.442	0.56	0.442	295.4	296	295.4	296
22	21	725.5	40	293.35	295.35	0.55	0.44	0.55	0.441	293.4	294	295.4	296
23	22	222.6	40	293.35	293.35	0.6	0.474	0.6	0.474	293.4	294	293.4	294
24	22	267.8	40	293.35	293.35	0.55	0.434	0.55	0.434	293.4	294	293.4	294
25	24	1.5	40	293.35	293.35	0.55	0.442	0.55	0.442	293.4	294	293.4	294
26	25	131.7	40	293.35	293.35	0.58	0.464	0.58	0.464	293.4	294	293.4	294
27	27MH	6	51	299.325	299.4	0.96	0.471	0.96	0.471	299.4	300	299.6	300
27MH	28	124	51	298.975	298.925	0.96	0.47	0.96	0.47	299.6	300	299	301
29	30	150.8	51	298.925	297.925	0.96	0.469	0.96	0.469	299	301	298	300
3	4	125.7	40	295.35	296.35	0.64	0.51	0.64	0.51	295.4	296	296.4	297
30	31	1	51	297.925	297.925	0.96	0.468	0.96	0.468	298	300	298	300
31	32	25.5	51	297.925	299.6	0.96	0.468	0.96	0.468	298	300	299.7	300
32	32F1	4.5	51	299.225	299.225	1.16	0.568	1.16	0.568	299.7	300	299.7	300
33	32	96.1	40	299.325	299.778	0.71	0.566	0.71	0.566	299.4	300	299.7	300
34	35	49.5	51	299.225	299.225	1.33	0.653	1.33	0.653	299.3	300	299.3	300
35	36	40.2	51	299.225	299.225	1.39	0.681	1.39	0.681	299.3	300	299.3	300
36	37	60.3	51	299.225	298.225	1.39	0.678	1.39	0.678	299.3	300	298.3	299
37	38	40.2	51	298.225	298.225	1.38	0.676	1.38	0.676	298.3	299	298.3	299
38	39	150.8	51	298.225	298.225	1.38	0.674	1.38	0.674	298.3	299	298.3	299
39	40	50.9	51	298.225	297.225	1.38	0.676	1.38	0.676	298.3	299	297.3	298
4	5	83.5	40	296.35	297.35	0.66	0.527	0.66	0.527	296.4	297	297.4	298
40	41	117.2	61	297.21	296.21	2.03	0.693	2.03	0.693	297.3	298	296.3	297
41	42	1	61	296.21	296.21	2.03	0.695	2.03	0.695	296.3	297	296.4	297
42	43	56.5	61	296.31	297.31	2.04	0.697	2.04	0.697	296.4	297	297.4	298
43	44	1	61	297.31	297.32	2.04	0.699	2.04	0.699	297.4	298	297.41	298
44	45	41.7	61	297.32	297.7	2.05	0.701	2.05	0.701	297.41	298	298	298
45	45MH	22	61	297.5	297.364	2.06	0.704	2.06	0.704	298	298	298	298

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
46	47	40.1	61	297.31	296.31	2.07	0.708	2.07	0.708	297.4	298	296.4	297
47	48	19	61	296.31	296.31	2.08	0.711	2.08	0.711	296.4	297	296.4	297
48	49	21.6	61	296.31	296.31	2.08	0.713	2.08	0.713	296.4	297	296.4	297
49	50	20.1	61	296.31	296.31	2.09	0.716	2.09	0.716	296.4	297	296.4	297
5	6	43	40	297.35	297.35	0.68	0.539	0.68	0.538	297.4	298	297.4	298
50	51	19.7	61	296.31	295.31	2.1	0.718	2.1	0.718	296.4	297	295.4	296
51	52	17.3	61	295.31	295.31	2.11	0.721	2.11	0.721	295.4	296	295.4	296
52	53	40.2	61	295.31	295.31	2.11	0.723	2.11	0.723	295.4	296	295.4	296
53	55	80.8	73	295.31	295.31	3.8	0.908	3.8	0.908	295.4	296	295.4	296
54	53	14.9	73	295.31	295.31	2.8	0.669	2.8	0.669	295.4	296	295.4	296
55	56	75.5	89	295.29	295.29	5.09	0.818	5.09	0.818	295.4	296	295.4	296
56	57	29.5	89	295.29	295.29	5.08	0.817	5.08	0.817	295.4	296	295.4	296
57	58	12.3	89	295.29	295.29	5.08	0.816	5.08	0.816	295.4	296	295.4	296
58	59	74.6	89	295.29	295.29	5.07	0.816	5.07	0.816	295.4	296	295.4	296
59	60	77.5	89	295.29	295.29	5.07	0.815	5.07	0.815	295.4	296	295.4	296
6	7	1	40	297.35	297.35	0.68	0.539	0.68	0.539	297.4	298	297.4	298
60	61	9.1	89	295.29	295.29	5.07	0.814	5.07	0.814	295.4	296	295.4	296
61	62	81.7	89	295.29	294.29	5.06	0.814	5.06	0.814	295.4	296	294.4	295
62	63	36.8	89	294.29	294.29	5.06	0.813	5.06	0.813	294.4	295	294.4	295
63	64	75.9	89	294.29	294.29	5.06	0.813	5.06	0.813	294.4	295	294.4	295
64	65	21.2	89	294.29	294.29	5.05	0.812	5.05	0.812	294.4	295	294.4	295
65	66	120.4	89	294.29	294.722	5.05	0.812	5.05	0.812	294.4	295	295	295
66	67	37.8	89	294.861	293.709	5.04	0.81	5.04	0.81	295	295	294	294
67	StandPipe	242.5	102	293.848	300.8	6.18	0.763	6.18	0.763	294	294	301	301
68	67	20.8	61	293.325	293.325	2.27	0.776	2.27	0.776	293.4	294	294	294
69	68	48	61	293.325	293.325	2.27	0.776	2.27	0.776	293.4	294	293.4	294
7	8	114.7	40	297.35	298.35	0.68	0.54	0.68	0.54	297.4	298	298.4	299
70	69	41.1	61	292.325	293.325	2.27	0.776	2.27	0.776	292.4	293	293.4	294

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
71	70	112.5	40	291.35	292.35	0.68	0.541	0.68	0.541	291.4	292	292.4	293
72	55	47.5	61	295.325	295.325	3.16	1.082	3.16	1.082	295.4	296	295.4	296
73	72	53.6	61	295.325	295.325	3.16	1.081	3.16	1.081	295.4	296	295.4	296
74	73	25.9	61	295.325	295.325	3.16	1.08	3.16	1.08	295.4	296	295.4	296
75	74	27.6	61	296.325	295.325	2.61	0.895	2.61	0.895	296.4	297	295.4	296
76	75	34.9	61	296.325	296.325	2.59	0.886	2.59	0.886	296.4	297	296.4	297
77	76	19.8	61	296.325	296.325	2.56	0.877	2.56	0.877	296.4	297	296.4	297
78	77	4	61	296.325	296.325	2	0.683	2	0.683	296.4	297	296.4	297
79	78	25.1	61	296.325	296.325	1.99	0.682	1.99	0.682	296.4	297	296.4	297
8	27	164.6	51	298.325	299.325	0.96	0.471	0.96	0.471	298.4	299	299.4	300
80	79	46.3	61	296.325	296.325	1.99	0.682	1.99	0.682	296.4	297	296.4	297
81	80	12.2	51	296.337	296.337	1.98	0.968	1.98	0.968	296.4	297	296.4	297
82	81	40	51	297.337	296.337	1.98	0.967	1.98	0.967	297.4	298	296.4	297
83	82	1.1	51	297.337	297.337	1.98	0.967	1.98	0.967	297.4	298	297.4	298
84	83	37.9	51	297.337	297.337	1.42	0.694	1.42	0.694	297.4	298	297.4	298
85	84	5.5	51	297.337	297.337	1.41	0.69	1.41	0.69	297.4	298	297.4	298
86	85	33.7	51	297.337	297.337	1.31	0.639	1.31	0.639	297.4	298	297.4	298
87	86	8.7	51	297.337	297.337	1.31	0.639	1.31	0.639	297.4	298	297.4	298
88	87	21	51	297.337	297.337	1.32	0.644	1.32	0.644	297.4	298	297.4	298
89	88	35.8	51	297.337	297.337	1.33	0.65	1.33	0.65	297.4	298	297.4	298
9	8	14.7	40	297.337	298.337	0.97	0.775	0.97	0.775	297.4	298	298.4	299
90	89	1.2	40	297.35	297.35	0.79	0.626	0.79	0.626	297.4	298	297.4	298
91	90	62.9	40	298.35	297.35	0.75	0.595	0.75	0.595	298.4	299	297.4	298
92	91	36.6	40	298.35	298.35	0.73	0.583	0.73	0.583	298.4	299	298.4	299
93	92	39.7	40	298.91	298.35	0.71	0.564	0.71	0.564	299	299	298.4	299
94	80	9.4	51	296.337	296.337	1.31	0.644	1.31	0.644	296.4	297	296.4	297
95	94	26.1	51	296.337	296.337	1.31	0.643	1.31	0.643	296.4	297	296.4	297
96	95	42	51	297.337	296.337	1.31	0.643	1.31	0.643	297.4	298	296.4	297

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
97	96	181.6	51	297.337	297.337	1.31	0.643	1.31	0.643	297.4	298	297.4	298
98	97	21.4	40	297.337	297.337	0.89	0.707	0.89	0.707	297.4	298	297.4	298
99	98	45.1	40	297.337	297.337	0.87	0.688	0.87	0.688	297.4	298	297.4	298
StandPipe	stpmh	6.4	102	300.8	291.8	6.01	0.692	6.01	0.227	301	301	292	292
stpmh	STP	4.4	102	300.8	291.306	6.01	4.126	6.01	4.126	292	292	292	292

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

US node ID	DS node ID	Length (m)	Internal Pipe Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
1	2	41	40	296.35	295.35	0.65	0.521	0.65	0.521	296.4	297	295.4	296
10	9	192.8	40	297.337	297.337	0.98	0.78	0.98	0.779	297.4	298	297.4	298
100	99	40.2	40	298.337	297.337	0.83	0.659	0.83	0.659	298.4	299	297.4	298
101	100	40.1	40	298.337	298.337	0.81	0.644	0.81	0.644	298.4	299	298.4	299
102	101	21.3	40	298.337	298.337	0.77	0.609	0.77	0.609	298.4	299	298.4	299
103	102	33.9	40	298.337	298.337	0.75	0.597	0.75	0.597	298.4	299	298.4	299
104	103	29.3	40	298.35	298.35	0.72	0.574	0.72	0.574	298.4	299	298.4	299
105	104	85.4	40	298.35	298.35	0.71	0.565	0.71	0.565	298.4	299	298.4	299
106	105	6.3	40	298.35	298.35	0.69	0.552	0.69	0.552	298.4	299	298.4	299
107	106	30.8	40	299.91	298.35	0.69	0.549	0.69	0.549	300	300	298.4	299
108	108MH	10.8	40	297.35	297.75	1.92	1.53	1.92	1.53	297.4	298	297.85	298
108MH	108F1	25.6	40	297.35	297.35	0.85	0.679	0.86	0.682	297.85		297.85	298
109	108	172.5	40	296.35	297.35	0.88	0.698	0.86	0.687	296.4	297	297.4	298
11	10	59.4	40	296.337	297.337	0.98	0.781	0.98	0.781	296.4	297	297.4	298
110	109	1.5	40	296.35	296.35	0.7	0.559	0.7	0.559	296.4	297	296.4	297
111	110	90.1	40	296.35	296.35	0.69	0.547	0.69	0.547	296.4	297	296.4	297
112	111	136.9	40	298.35	296.35	0.67	0.537	0.67	0.537	298.4	299	296.4	297
113	66	43.2	40	294.337	294.337	1.29	1.03	1.29	1.03	294.4	295	295	295
114	113	26.7	40	294.337	294.337	1.29	1.03	1.29	1.03	294.4	295	294.4	295
115	114	63.2	40	294.337	294.337	1.29	1.031	1.29	1.03	294.4	295	294.4	295
116	115	21.2	40	294.337	294.337	1.03	0.82	1.03	0.82	294.4	295	294.4	295
117	116	68.4	40	294.337	294.337	0.7	0.559	0.7	0.559	294.4	295	294.4	295
118	117	37.3	40	294.35	294.35	0.68	0.541	0.68	0.541	294.4	295	294.4	295
119	118	66.2	40	294.35	294.35	0.68	0.538	0.68	0.538	294.4	295	294.4	295
12	11	19.9	40	296.337	296.337	0.98	0.783	0.98	0.783	296.4	297	296.4	297
120	119	43	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
121	120	61.7	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
122	123	12.8	40	295.35	295.35	1.31	1.04	1.31	1.04	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

123	124	15.4	40	295.35	294.35	1.38	1.099	1.38	1.099	295.4	296	294.4	295
124	125	17.8	40	294.35	294.35	1.78	1.417	1.78	1.417	294.4	295	294.4	295
125	126	3.7	40	294.35	294.35	1.76	1.405	1.76	1.405	294.4	295	294.4	295
126	127	16	40	294.35	294.35	1.79	1.424	1.79	1.424	294.4	295	294.4	295
127	128	6.1	51	294.337	294.337	1.79	0.878	1.79	0.878	294.4	295	294.4	295
128	129	7.6	51	294.337	294.337	1.79	0.876	1.79	0.876	294.4	295	294.4	295
129	130	19.9	51	294.337	294.337	1.79	0.875	1.79	0.875	294.4	295	294.4	295
13	12	68.6	40	296.337	296.337	0.99	0.785	0.99	0.785	296.4	297	296.4	297
130	131	10.1	51	294.337	294.337	1.78	0.874	1.78	0.874	294.4	295	294.4	295
131	132	25.2	51	294.337	294.337	1.78	0.873	1.78	0.873	294.4	295	294.4	295
132	133	1.5	51	294.337	294.337	1.78	0.873	1.78	0.873	294.4	295	294.4	295
133	134	23	51	294.337	294.337	1.78	0.87	1.78	0.87	294.4	295	294.4	295
134	135	2	51	294.337	294.337	1.78	0.869	1.78	0.869	294.4	295	294.4	295
135	136	36.3	51	294.337	293.337	1.81	0.885	1.81	0.885	294.4	295	293.4	294
136	137	41.1	51	293.337	293.337	1.81	0.885	1.81	0.885	293.4	294	293.4	294
137	138	31.1	51	293.337	293.337	1.81	0.884	1.81	0.884	293.4	294	293.4	294
138	139	9.4	51	293.337	292.337	1.83	0.895	1.83	0.895	293.4	294	292.4	293
139	140	37.9	51	292.337	292.337	1.83	0.896	1.83	0.896	292.4	293	292.4	293
14	13	10.8	40	296.337	296.337	0.77	0.613	0.77	0.613	296.4	297	296.4	297
140	141	82.6	61	292.325	293.778	2.59	0.887	2.6	0.889	292.4	293	294	294
141	141MH	32.9	61	293.6	293.109	3.82	1.306	3.83	1.309	294	294	294	294
142	143	80.5	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
143	144	44.8	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
144	145	87.7	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
145	146	38.9	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
146	70	36.4	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
147	144	85.4	40	292.35	292.35	0.7	0.559	0.7	0.559	292.4	293	292.4	293
148	140	97.5	40	290.337	292.337	0.98	0.777	0.98	0.777	290.4	291	292.4	293
149	148	57.4	40	291.337	290.337	0.98	0.78	0.98	0.78	291.4	292	290.4	291
15	14	12.3	40	296.35	296.35	0.73	0.584	0.73	0.584	296.4	297	296.4	297
150	149	140.4	40	291.337	291.337	0.99	0.787	0.99	0.787	291.4	292	291.4	292
151	150	127.5	40	291.337	291.337	0.93	0.741	0.93	0.741	291.4	292	291.4	292
152	151	5.9	40	291.337	291.337	0.94	0.747	0.94	0.747	291.4	292	291.4	292

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

153	152	31.9	40	291.337	291.337	0.95	0.754	0.95	0.754	291.4	292	291.4	292
154	153	7.8	40	291.337	291.337	0.89	0.707	0.89	0.707	291.4	292	291.4	292
155	154	16.5	40	291.337	291.337	0.9	0.714	0.9	0.714	291.4	292	291.4	292
156	155	7.7	40	291.337	291.337	0.91	0.721	0.91	0.721	291.4	292	291.4	292
157	156	88.4	40	291.337	291.337	0.92	0.729	0.92	0.729	291.4	292	291.4	292
158	157	19.5	40	291.337	291.337	0.88	0.696	0.88	0.696	291.4	292	291.4	292
159	158	177	40	292.337	291.337	0.92	0.734	0.92	0.734	292.4	293	291.4	292
16	15	40.2	40	296.35	296.35	0.69	0.55	0.69	0.55	296.4	297	296.4	297
160	159	22.7	40	292.337	292.337	0.94	0.746	0.94	0.746	292.4	293	292.4	293
161	160	137.9	40	293.25	292.25	0.97	0.774	0.97	0.774	293.3	294	292.4	293
162	161	25.1	40	293.25	293.25	0.62	0.49	0.62	0.49	293.3	294	293.3	294
163	162	39.5	40	293.25	293.25	0.63	0.504	0.63	0.504	293.3	294	293.3	294
164	161	127.6	40	294.25	293.25	0.63	0.504	0.63	0.504	294.3	295	293.3	294
165	160	216.7	40	292.35	292.35	0.63	0.498	0.63	0.498	292.4	293	292.4	293
166	158	119	40	291.35	291.35	0.61	0.489	0.61	0.489	291.4	292	291.4	292
167	171	1	40	291.35	291.35	0.62	0.49	0.62	0.49	291.4	292	291.4	292
168	167	42.4	40	291.35	291.35	0.63	0.505	0.63	0.505	291.4	292	291.4	292
169	149	61.6	40	291.35	291.35	0.67	0.533	0.67	0.533	291.4	292	291.4	292
17	16	40.2	40	295.35	296.35	0.66	0.525	0.66	0.525	295.4	296	296.4	297
171	166	53.4	40	291.35	291.35	0.61	0.484	0.61	0.484	291.4	292	291.4	292
18	17	46.4	40	295.35	295.35	0.63	0.503	0.63	0.503	295.4	296	295.4	296
19	18	37.8	40	294.35	295.35	0.66	0.526	0.66	0.526	294.4	295	295.4	296
2	3	1.5	40	295.35	295.35	0.65	0.514	0.65	0.514	295.4	296	295.4	296
20	18	24.7	40	295.35	295.35	0.59	0.466	0.59	0.466	295.4	296	295.4	296
21	20	1.5	40	295.35	295.35	0.57	0.451	0.57	0.451	295.4	296	295.4	296
22	21	725.5	40	293.35	295.35	0.55	0.44	0.55	0.44	293.4	294	295.4	296
23	22	222.6	40	293.35	293.35	0.6	0.474	0.6	0.474	293.4	294	293.4	294
24	22	267.8	40	293.35	293.35	0.55	0.434	0.55	0.434	293.4	294	293.4	294
25	24	1.5	40	293.35	293.35	0.56	0.442	0.56	0.442	293.4	294	293.4	294
26	25	131.7	40	293.35	293.35	0.58	0.464	0.58	0.464	293.4	294	293.4	294
27	27MH	6	51	299.325	299.4	0.98	0.482	0.98	0.482	299.4	300	299.6	300
27MH	28	124	51	298.975	298.925	0.98	0.479	0.98	0.479	299.6		299	301
29	30	150.8	51	298.925	297.925	0.97	0.474	0.97	0.474	299	301	298	300

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

3	4	125.7	40	295.35	296.35	0.64	0.51	0.64	0.51	295.4	296	296.4	297
30	31	1	51	297.925	297.925	0.96	0.472	0.96	0.472	298	300	298	300
31	32	25.5	51	297.925	299.6	0.96	0.469	0.96	0.469	298	300	299.7	300
32	32F1	4.5	51	299.225	299.225	1.37	0.671	1.37	0.671	299.7	300	299.7	300
33	32	96.1	40	299.325	299.778	0.71	0.565	0.71	0.565	299.4	300	299.7	300
34	35	49.5	51	299.225	299.225	1.48	0.726	1.48	0.726	299.3	300	299.3	300
35	36	40.2	51	299.225	299.225	1.58	0.775	1.58	0.775	299.3	300	299.3	300
36	37	60.3	51	299.225	298.225	1.58	0.774	1.58	0.774	299.3	300	298.3	299
37	38	40.2	51	298.225	298.225	1.58	0.773	1.58	0.773	298.3	299	298.3	299
38	39	150.8	51	298.225	298.225	1.58	0.772	1.58	0.772	298.3	299	298.3	299
39	40	50.9	51	298.225	297.225	1.58	0.772	1.58	0.772	298.3	299	297.3	298
4	5	83.5	40	296.35	297.35	0.66	0.527	0.66	0.527	296.4	297	297.4	298
40	41	117.2	61	297.21	296.21	1.92	0.656	1.92	0.656	297.3	298	296.3	297
41	42	1	61	296.21	296.21	1.92	0.655	1.92	0.655	296.3	297	296.4	297
42	43	56.5	61	296.31	297.31	1.91	0.655	1.91	0.655	296.4	297	297.4	298
43	44	1	61	297.31	297.32	1.91	0.654	1.91	0.654	297.4	298	297.41	298
44	45	41.7	61	297.32	297.7	1.91	0.653	1.91	0.653	297.41	298	298	298
45	45MH	22	61	297.5	297.364	2	0.683	2	0.683	298	298	298	298
46	47	40.1	61	297.31	296.31	1.9	0.651	1.9	0.651	297.4	298	296.4	297
47	48	19	61	296.31	296.31	1.9	0.651	1.9	0.651	296.4	297	296.4	297
48	49	21.6	61	296.31	296.31	1.9	0.65	1.9	0.65	296.4	297	296.4	297
49	50	20.1	61	296.31	296.31	1.9	0.65	1.9	0.65	296.4	297	296.4	297
5	6	43	40	297.35	297.35	0.68	0.539	0.68	0.539	297.4	298	297.4	298
50	51	19.7	61	296.31	295.31	1.9	0.65	1.9	0.65	296.4	297	295.4	296
51	52	17.3	61	295.31	295.31	1.9	0.649	1.9	0.649	295.4	296	295.4	296
52	53	40.2	61	295.31	295.31	2.05	0.703	2.05	0.703	295.4	296	295.4	296
53	55	80.8	73	295.31	295.31	3.66	0.875	3.66	0.875	295.4	296	295.4	296
54	53	14.9	73	295.31	295.31	2.8	0.668	2.8	0.668	295.4	296	295.4	296
55	56	75.5	89	295.29	295.29	5.38	0.865	5.38	0.865	295.4	296	295.4	296
56	57	29.5	89	295.29	295.29	5.36	0.862	5.36	0.862	295.4	296	295.4	296
57	58	12.3	89	295.29	295.29	5.35	0.86	5.35	0.86	295.4	296	295.4	296
58	59	74.6	89	295.29	295.29	5.34	0.858	5.34	0.858	295.4	296	295.4	296
59	60	77.5	89	295.29	295.29	5.33	0.856	5.33	0.856	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

6	7	1	40	297.35	297.35	0.68	0.54	0.68	0.54	297.4	298	297.4	298
60	61	9.1	89	295.29	295.29	5.32	0.854	5.32	0.854	295.4	296	295.4	296
61	62	81.7	89	295.29	294.29	5.31	0.853	5.31	0.853	295.4	296	294.4	295
62	63	36.8	89	294.29	294.29	5.3	0.851	5.3	0.851	294.4	295	294.4	295
63	64	75.9	89	294.29	294.29	5.29	0.85	5.29	0.85	294.4	295	294.4	295
64	65	21.2	89	294.29	294.29	5.28	0.849	5.28	0.849	294.4	295	294.4	295
65	66	120.4	89	294.29	294.722	5.28	0.848	5.28	0.848	294.4	295	295	295
66	67	37.8	89	294.861	293.709	5.24	0.842	5.24	0.842	295	295	294	294
67	StandPipe	242.5	102	293.848	300.8	6.04	0.747	6.04	0.747	294	294	301	301
68	67	20.8	61	293.325	293.325	2.25	0.771	2.25	0.771	293.4	294	294	294
69	68	48	61	293.325	293.325	2.25	0.771	2.25	0.771	293.4	294	293.4	294
7	8	114.7	40	297.35	298.35	0.68	0.542	0.68	0.542	297.4	298	298.4	299
70	69	41.1	61	292.325	293.325	2.25	0.771	2.25	0.771	292.4	293	293.4	294
71	70	112.5	40	291.35	292.35	0.68	0.541	0.68	0.541	291.4	292	292.4	293
72	55	47.5	61	295.325	295.325	3.93	1.346	3.93	1.346	295.4	296	295.4	296
73	72	53.6	61	295.325	295.325	3.94	1.347	3.94	1.347	295.4	296	295.4	296
74	73	25.9	61	295.325	295.325	3.94	1.348	3.94	1.348	295.4	296	295.4	296
75	74	27.6	61	296.325	295.325	3.33	1.139	3.33	1.139	296.4	297	295.4	296
76	75	34.9	61	296.325	296.325	3.33	1.139	3.33	1.139	296.4	297	296.4	297
77	76	19.8	61	296.325	296.325	2.74	0.937	2.74	0.937	296.4	297	296.4	297
78	77	4	61	296.325	296.325	2.69	0.921	2.69	0.921	296.4	297	296.4	297
79	78	25.1	61	296.325	296.325	2.7	0.925	2.7	0.925	296.4	297	296.4	297
8	27	164.6	51	298.325	299.325	0.99	0.485	0.99	0.485	298.4	299	299.4	300
80	79	46.3	61	296.325	296.325	2.71	0.929	2.71	0.929	296.4	297	296.4	297
81	80	12.2	51	296.337	296.337	2.27	1.113	2.27	1.113	296.4	297	296.4	297
82	81	40	51	297.337	296.337	2.29	1.121	2.29	1.121	297.4	298	296.4	297
83	82	1.1	51	297.337	297.337	2.32	1.133	2.32	1.133	297.4	298	297.4	298
84	83	37.9	51	297.337	297.337	1.88	0.918	1.88	0.918	297.4	298	297.4	298
85	84	5.5	51	297.337	297.337	1.88	0.92	1.88	0.92	297.4	298	297.4	298
86	85	33.7	51	297.337	297.337	1.72	0.841	1.72	0.841	297.4	298	297.4	298
87	86	8.7	51	297.337	297.337	1.75	0.855	1.75	0.855	297.4	298	297.4	298
88	87	21	51	297.337	297.337	1.78	0.87	1.78	0.87	297.4	298	297.4	298
89	88	35.8	51	297.337	297.337	1.4	0.688	1.4	0.688	297.4	298	297.4	298

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

9	8	14.7	40	297.337	298.337	0.98	0.778	0.98	0.778	297.4	298	298.4	299
90	89	1.2	40	297.35	297.35	0.91	0.727	0.91	0.727	297.4	298	297.4	298
91	90	62.9	40	298.35	297.35	0.83	0.659	0.83	0.659	298.4	299	297.4	298
92	91	36.6	40	298.35	298.35	0.78	0.62	0.78	0.62	298.4	299	298.4	299
93	92	39.7	40	298.91	298.35	0.71	0.564	0.71	0.564	299	299	298.4	299
94	80	9.4	51	296.337	296.337	1.39	0.681	1.39	0.681	296.4	297	296.4	297
95	94	26.1	51	296.337	296.337	1.38	0.678	1.38	0.678	296.4	297	296.4	297
96	95	42	51	297.337	296.337	1.38	0.674	1.38	0.674	297.4	298	296.4	297
97	96	181.6	51	297.337	297.337	1.37	0.671	1.37	0.671	297.4	298	297.4	298
98	97	21.4	40	297.337	297.337	0.87	0.69	0.87	0.69	297.4	298	297.4	298
99	98	45.1	40	297.337	297.337	0.85	0.674	0.85	0.674	297.4	298	297.4	298
StandPipe	stpmh	6.4	102	300.8	291.8	5.39	0.623	5.39	0.203	301		292	292
stpmh	STP	4.4	102	300.8	291.306	5.39	3.785	5.39	3.785	292		292	292

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - Normal Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	Max Pressure at Pump Node (m)
201	1	40	315.825	18.525
202	1	52	313.587	18.187
203	1	51	313.65	18.25
204	1	50	313.772	17.372
205	1	49	313.899	17.499
206	1	48	313.933	17.533
207	1	47	313.965	17.565
208	1	54	313.674	18.274
208	2	54	313.674	18.274
208	3	54	313.674	18.274
208	4	54	313.674	18.274
209	1	122	325.222	29.822
209	2	122	325.222	29.822
210	1	56	311.219	15.819
211	1	59	309.586	14.186
211	2	59	309.586	14.186
212	1	127	321.13	26.73
301	1	1	327.521	31.121
302	1	4	325.721	29.321
303	1	5	324.871	27.471
304	1	27	323.319	23.919
305	1	9	323.423	26.023
306	1	10	323.263	25.863
307	1	11	323.24	26.84
308	1	12	323.235	26.835
309	1	15	325.34	28.94
310	1	13	325.173	28.773
311	1	17	325.927	30.527
312	1	16	325.632	29.232
313	1	19	326.277	31.877
314	1	34	323.107	23.807
315	1	35	322.776	23.476
316	1	38	319.904	21.604
317	1	37	320.721	22.421
318	1	45	312.248	14.248
319	1	46	313.964	16.564
320	1	39	316.849	18.549
321	1	123	324.618	29.218
322	1	33	324.479	25.079
323	1	89	318.973	21.573
324	1	88	318.445	21.045
325	1	86	318.019	20.619
326	1	85	317.551	20.151
327	1	82	316.958	19.558
328	1	81	316.446	20.046

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - Normal Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	Max Pressure at Pump Node (m)
329	1	93	320.326	21.326
330	1	92	320.327	21.927
331	1	91	319.822	21.422
332	1	90	318.988	21.588
333	1	87	318.141	20.741
334	1	84	317.476	20.076
335	1	83	316.972	19.572
336	1	96	316.437	19.037
337	1	79	315.908	19.508
338	1	78	315.702	19.302
339	1	74	314.318	18.918
340	1	73	313.899	18.499
341	1	72	313.039	17.639
342	1	57	310.805	15.405
343	1	75	314.767	18.367
344	1	76	315.341	18.941
345	1	77	315.67	19.27
346	1	94	316.307	19.907
347	1	95	316.351	19.951
348	1	98	316.871	19.471
349	1	99	316.868	19.468
350	1	100	316.866	18.466
351	1	101	316.863	18.463
352	1	103	316.861	18.461
353	1	106	316.86	18.46
354	1	107	316.86	16.86
355	1	105	316.86	18.46
356	1	104	316.86	18.46
357	1	102	316.862	18.462
358	1	108	317.409	20.009
359	1	112	318.554	20.154
360	1	111	317.406	21.006
361	1	60	308.502	13.102
362	1	63	306.723	12.323
363	1	64	305.666	11.266
364	1	113	306.002	11.602
365	1	116	311.873	17.473
366	1	62	307.236	12.836
367	1	61	308.376	12.976
368	1	119	311.869	17.469
369	1	68	303.814	10.414
370	1	114	307.645	13.245
371	1	115	311.542	17.142
372	1	117	311.871	17.471
373	1	118	311.87	17.47

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - Normal Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	Max Pressure at Pump Node (m)
374	1	142	308.552	16.152
375	1	143	307.538	15.138
376	1	121	311.869	17.469
377	1	139	311.4	19
378	1	138	311.8	18.4
379	1	137	313.144	19.744
380	1	136	314.956	21.556
381	1	135	316.586	22.186
382	1	132	317.791	23.391
383	1	130	319.48	25.08
384	1	128	320.827	26.427
385	1	125	323.116	28.716
386	1	134	316.678	22.278
387	1	133	317.72	23.32
388	1	131	318.994	24.594
389	1	129	320.453	26.053
390	1	126	322.738	28.338
391	1	124	323.912	29.512
392	1	146	305.384	12.984
393	1	145	305.872	13.472
394	1	69	304.412	11.012
395	1	165	319.875	27.475
396	1	159	319.675	27.275
397	1	157	318.194	26.794
398	1	166	318.291	26.891
399	1	168	318.29	26.89
400	1	156	317.79	26.39
401	1	152	316.687	25.287
402	1	151	316.509	25.109
403	1	153	317.666	26.266
404	1	150	312.683	21.283
405	1	169	310.011	18.611
406	1	162	321.577	28.277
407	1	163	322.054	28.754
408	1	164	322.248	27.948
409	1	23	332.319	38.919
410	1	71	305.032	13.632
411	1	26	335.694	42.294
412	1	36	321.952	22.652
413	1	147	306.975	14.575

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - High Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	DS Node Max Level (m AD)	Max Pressure at Pump Node (m)
201	1	40	313.114	313.114	15.814
202	1	52	314.044	314.044	18.644
203	1	51	314.043	314.043	18.643
204	1	50	314.042	314.042	17.642
205	1	49	314.041	314.041	17.641
206	1	48	314.041	314.041	17.641
207	1	47	314.041	314.041	17.641
208	1	54	314.195	314.195	18.795
208	2	54	314.195	314.195	18.795
208	3	54	314.195	314.195	18.795
208	4	54	314.195	314.195	18.795
209	1	122	320.635	320.635	25.235
209	2	122	320.635	320.635	25.235
210	1	56	312.134	312.134	16.734
211	1	59	310.326	310.326	14.926
211	2	59	310.326	310.326	14.926
212	1	127	317.079	317.079	22.679
301	1	1	326.554	326.554	30.154
302	1	4	324.569	324.569	28.169
303	1	5	323.603	323.603	26.203
304	1	27	321.56	321.56	22.16
305	1	9	321.863	321.863	24.463
306	1	10	325.503	325.503	28.103
307	1	11	327.33	327.33	30.93
308	1	12	327.946	327.946	31.546
309	1	15	330.22	330.22	33.82
310	1	13	330.089	330.089	33.689
311	1	17	330.689	330.689	35.289
312	1	16	330.451	330.451	34.051
313	1	19	330.973	330.973	36.573
314	1	34	320.969	320.969	21.669
315	1	35	320.462	320.462	21.162
316	1	38	316.702	316.702	18.402
317	1	37	317.773	317.773	19.473
318	1	45	313.007	313.007	15.007
319	1	46	314.041	314.041	16.641
320	1	39	313.277	313.277	14.977
321	1	123	319.939	319.939	24.539
322	1	33	322.41	322.41	23.01
323	1	89	327.129	327.129	29.729
324	1	88	326.659	326.659	29.259
325	1	86	326.272	326.272	28.872
326	1	85	325.836	325.836	28.436
327	1	82	324.629	324.629	27.229

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - High Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	DS Node Max Level (m AD)	Max Pressure at Pump Node (m)
328	1	81	323.468	323.468	27.068
329	1	93	328.336	328.336	29.336
330	1	92	328.336	328.336	29.936
331	1	91	327.894	327.894	29.494
332	1	90	327.143	327.143	29.743
333	1	87	326.385	326.385	28.985
334	1	84	325.765	325.765	28.365
335	1	83	324.66	324.66	27.26
336	1	96	323.347	323.347	25.947
337	1	79	322.232	322.232	25.832
338	1	78	321.754	321.754	25.354
339	1	74	318.27	318.27	22.87
340	1	73	317.071	317.071	21.671
341	1	72	315.071	315.071	19.671
342	1	57	311.673	311.673	16.273
343	1	75	319.505	319.505	23.105
344	1	76	321.073	321.073	24.673
345	1	77	321.679	321.679	25.279
346	1	94	323.143	323.143	26.743
347	1	95	323.221	323.221	26.821
348	1	98	323.926	323.926	26.526
349	1	99	323.925	323.925	26.525
350	1	100	323.925	323.925	25.525
351	1	101	323.924	323.924	25.524
352	1	103	323.924	323.924	25.524
353	1	106	323.923	323.923	25.523
354	1	107	323.923	323.923	23.923
355	1	105	323.923	323.923	25.523
356	1	104	323.924	323.924	25.524
357	1	102	323.924	323.924	25.524
358	1	108	324.401	324.401	27.001
359	1	112	324.4	324.4	26
360	1	111	324.401	324.401	28.001
361	1	60	309.132	309.132	13.732
362	1	63	307.18	307.18	12.78
363	1	64	306.026	306.026	11.626
364	1	113	305.927	305.927	11.527
365	1	116	311.928	311.928	17.528
366	1	62	307.742	307.742	13.342
367	1	61	308.992	308.992	13.592
368	1	119	311.928	311.928	17.528
369	1	68	303.541	303.541	10.141
370	1	114	307.593	307.593	13.193
371	1	115	311.581	311.581	17.181

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - High Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	DS Node Max Level (m AD)	Max Pressure at Pump Node (m)
372	1	117	311.928	311.928	17.528
373	1	118	311.928	311.928	17.528
374	1	142	310.122	310.122	17.722
375	1	143	308.453	308.453	16.053
376	1	121	311.928	311.928	17.528
377	1	139	313.783	313.783	21.383
378	1	138	314.096	314.096	20.696
379	1	137	314.543	314.543	21.143
380	1	136	315.14	315.14	21.74
381	1	135	315.67	315.67	21.27
382	1	132	316.06	316.06	21.66
383	1	130	316.582	316.582	22.182
384	1	128	316.989	316.989	22.589
385	1	125	318.145	318.145	23.745
386	1	134	315.7	315.7	21.3
387	1	133	316.038	316.038	21.638
388	1	131	316.432	316.432	22.032
389	1	129	316.877	316.877	22.477
390	1	126	317.945	317.945	23.545
391	1	124	319.106	319.106	24.706
392	1	146	305.221	305.221	12.821
393	1	145	305.925	305.925	13.525
394	1	69	303.832	303.832	10.432
395	1	165	326.493	326.493	34.093
396	1	159	325.723	325.723	33.323
397	1	157	323.669	323.669	32.269
398	1	166	324.907	324.907	33.507
399	1	168	324.903	324.903	33.503
400	1	156	320.774	320.774	29.374
401	1	152	318.844	318.844	27.444
402	1	151	318.787	318.787	27.387
403	1	153	319.793	319.793	28.393
404	1	150	317.886	317.886	26.486
405	1	169	314.049	314.049	22.649
406	1	162	331.603	331.603	38.303
407	1	163	331.602	331.602	38.302
408	1	164	332.578	332.578	38.278
409	1	23	336.284	336.284	42.884
410	1	71	304.89	304.89	13.49
411	1	26	339.342	339.342	45.942
412	1	36	319.384	319.384	20.084
413	1	147	308.327	308.327	15.927

Appendix E Flood Map (1 in 100 Year Event)

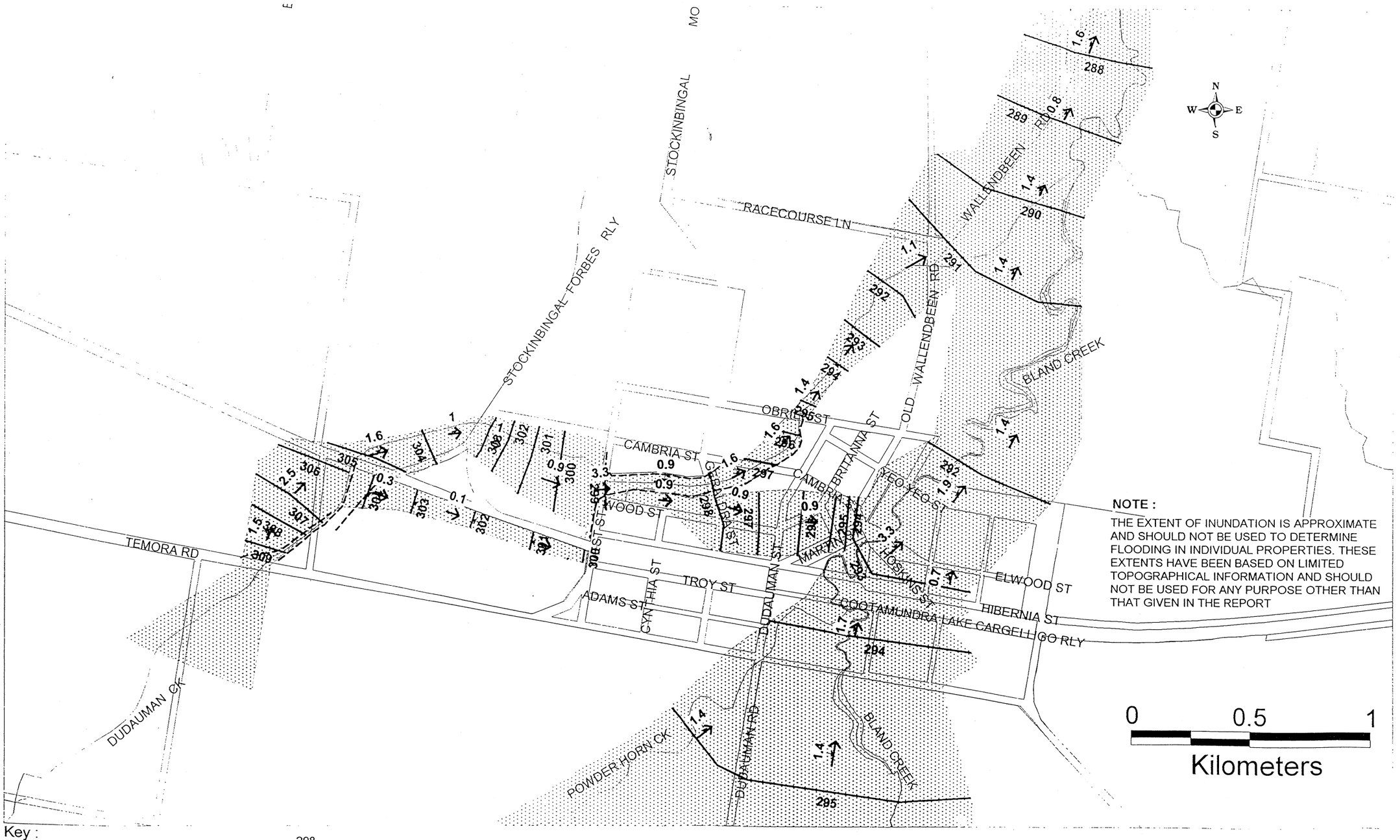
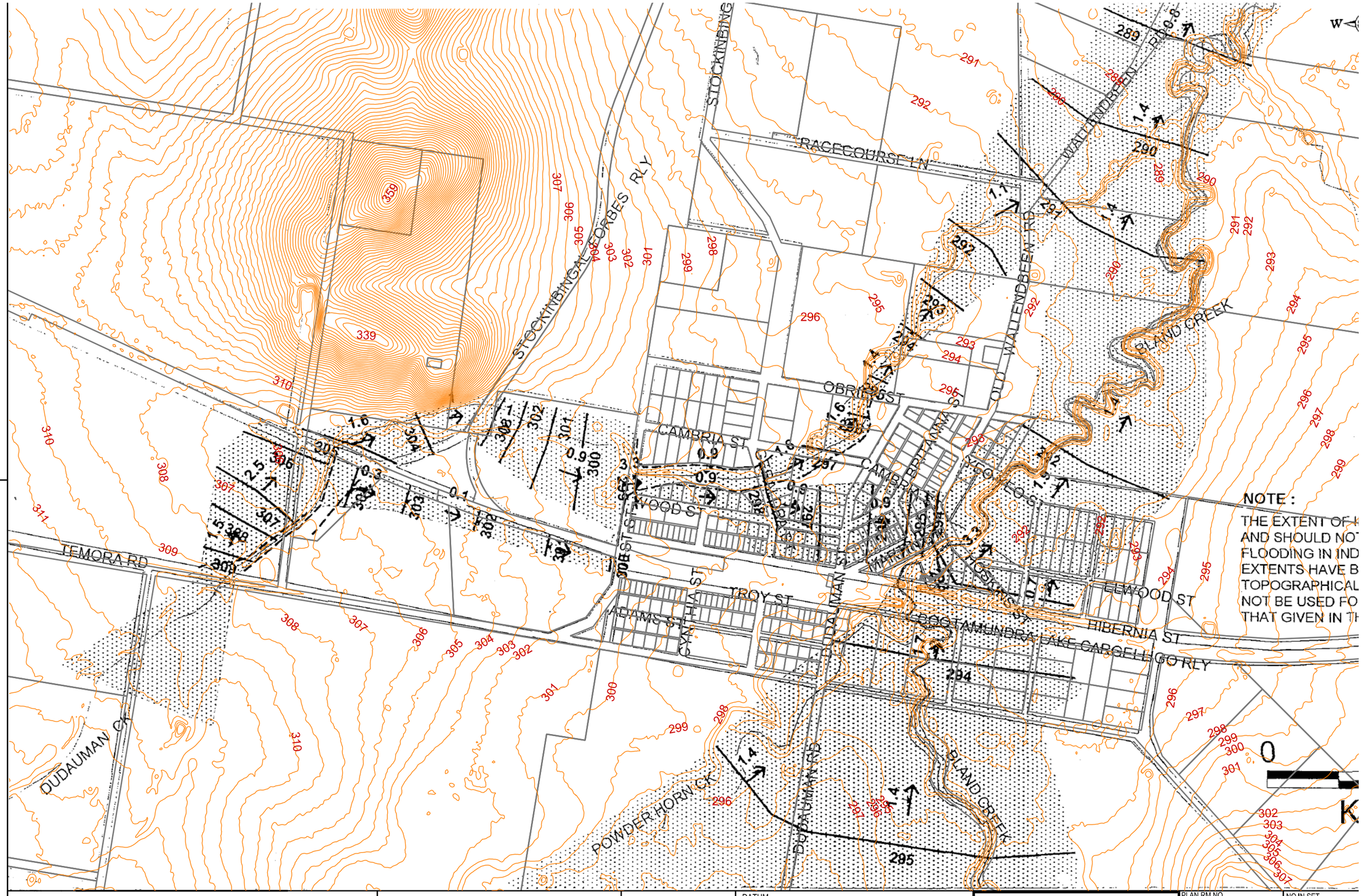


Figure 12: 1% AEP peak water levels and velocitie


STOCKINBINGAL-FORBES RLY
RACECOURSE LN
WALLENDBEEN RD
OLD WALLENDBEEN RD
OBRIEN ST
CAMBRIA ST
BRITANNIA ST
WOOD ST
TROY ST
ADAMS ST
CYPRUS ST
ELWOOD ST
HIBERNIA ST
COOTAMUNDRA-LAKE CARGELLIGO RLY
TEMORA RD
DUDAUMAN CK
DUDAUMAN RD
POWDER HORN CK
BLAND CREEK
NOTE :
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L. G. A.
SURVEYOR
SURVEY DATE
PLAN RM NO
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FOLDER
SHEET NO
SCALES 1:12000@A3
VERSION

Appendix F Capital Cost Estimate

STOCKINBINGAL SGE
COLLECTION AND TRANSPORT SYSTEM
CAPITAL COST ESTIMATE

PRESSURE SYSTEM

ITEM NO.		QUANTITY	UNIT	RATE $/unit	AMOUNT $
1	**Site Establishment**				**$ 110,000**
1.1	Mobilisation / Demobilisation including site amenities.			Allowance	$ 50,000
1.2	Traffic management including personnel, barriers, control signals (where required) etc			Allowance	$ 60,000
2	**Pressure Units**				**$ 1,373,200**
2.1	i) Standard	121	each	$ 4,500	$ 544,500
	ii) Duplex	5	each	$ 9,000	$ 45,000
	iii) Quad units	1	each	$ 27,000	$ 27,000
2.2	Installation				
	i) Property Owner consultation, electrical checks, photographic records, property	127	each	$ 300	$ 38,100
	ii) Installation Simplex	121	each	$ 4,200	$ 508,200
	iii) Installation Duplex	5	each	$ 7,900	$ 39,500
	iiii) Installation Quadraplex	1	each	$ 18,500	$ 18,500
2.3	Supply and Installation of Boundary Kits and Laterals	127	each	$ 1,200	$ 152,400
3	**Reticulation**				**$ 1,365,000**
3.1	PE100, PN16 Polyethylene Pipe and Fittings				
	i) 40 mm	3,810	m	$ 80	$ 304,800
	ii) 50 mm	4,020	m	$ 80	$ 321,600
	iii) 63 mm	2,300	m	$ 80	$ 184,000
	iv) 75 mm	1,810	m	$ 80	$ 144,800
	v) 90 mm	530	m	$ 100	$ 53,000
	vi) 110 mm	660	m	$ 100	$ 66,000
	vii) 125 mm	260	m	$ 120	$ 31,200
3.2	Extra Over for Under Road Bore with Conduit				
	i) 63 mm	60	each	$ 1,200	$ 72,000
	ii) 75 mm		each	$ 1,300	$ -
	iii) 90 mm		each	$ 1,400	$ -
	iv) 110 mm		each	$ 1,500	$ -
3.3	Installation of Isolation Valves				
	i) 50 - 63 mm	5	each	$ 1,200	$ 6,000
	ii) 75 -125 mm	6	each	$ 1,500	$ 9,000
3.4	Flushing points (Type 1)				
	i) 50 - 110 mm	14	each	$ 2,500	$ 35,000
3.5	Barometric Loop	1	each	$ 86,000	$ 86,000
3.6	Railway Crossings	1	each	Allowance	$ 51,600
4	**Miscellaneous**				**$ 44,000**
	Testing and commissioning of the pressure sewerage system			Allowance	$ 20,000
	Prepare and submit operations and maintenance manuals.			Allowance	$ 8,000
	Work as excecuted documentation			Allowance	$ 8,000
	Operational environmental managament plan			Allowance	$ 8,000
	Sub-total Construction Cost				**$2,892,200**
	Contractor Indirect Costs	**5%**			**$144,610**
	Construction Cost				**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)				**$682,800**
	Survey investigation and design and project management 10%				**$289,220**
	Capital Cost				**$4,008,830**

STOCKINBINGAL STP
COST ESTIMATE

IDEA reactor

Item	Item Description	Qty	Unit	Rate	Amount
1.0	**Site Establishment**				**$108,000**
1.1	Site Establishment & disestablishment			Allowance	$40,000
1.2	Strip top soil			Allowance	$1,000
1.3	Provide and maintain erosion/ siltation control measures			Allowance	$2,000
1.4	Landscaping			Allowance	$10,000
1.5	Fencing	150	m	$100	$15,000
1.6	Operational Environmental Management Plan etc.			Allowance	$40,000
2.0	**Roadworks and Site Drainage**				**$90,000**
2.1	Roads				
	i) Sealed roadway (bitumen sealed)	500	m^2	$100	$50,000
2.2	Drainage Works			Allowance	$40,000
3.0	**Emergency Balance Tank**				**$25,200**
3.1	40 kL tank				$12,000
3.2	Concrete Base	4	m^3	$1,800	$7,200
3.3	Level sensor	1	each	$1,000	$1,000
3.4	Return pump	1	Item	$5,000	$5,000
4.0	**Inlet Works**				**$90,000**
4.1	Feed pump	1	Item	$5,000	$5,000
4.2	Flow meter	1	m^2	$5,000	$5,000
4.3	Mechanical Screen (5-8 mm bar screen) and auxiliary equipment		Item	LS	$20,000
4.4	Odour Control	1	each	$60,000	$60,000
5.0	**Concrete IDEA reactor and balance tank**				**$728,471**
5.1	Foundation and earthworks		No excavation		
	i) Foundation preparation		Item	LS	$150,000
5.2	Concrete				
	i) Walls	82	m^3	$2,500	$206,061
	ii) Base	47	m^3	$1,800	$84,109
	iii) Pits	15	m^3	$2,000	$30,000
5.3	Metalwork				
	i) Emergency ladders	1	each	$2,100	$2,100
	ii) Handrails	32	m	$150	$4,800
	iii) Grating	18	m^2	$300	$5,400
5.4	Mechanical Works				
	i) Jet aeration system		Item	LS	$70,000
	ii) Decanting system		Item	LS	$100,000
	iii) WAS pumps, pipework and fittings		Item	LS	$20,000
5.5	Pipework, valve and fittings				
	i) Decant pipework		Item	LS	$50,000
	ii) DO sensor	2	each	$2,000	$4,000
	iii) pH sensor	1	each	$1,000	$1,000
	iv) level sensor	1	each	$1,000	$1,000
6.0	**Sludge Tank**				**$18,200**
6.1	22.5 kL tank				$10,000
6.2	Concrete Base	4	m^3	$1,800	$7,200
6.2	Level sensor	1	each	$1,000	$1,000
7.0	**Sludge Dewatering**				**$83,700**
7.1	Foundation and Earthworks			Allowance	$10,000
7.2	Supply and place concrete, including reinforcement				
	i) Walls	7	m^3	$2,000	$14,000
	ii) Floor	29	m^3	$1,500	$43,500
	iii) Pit		Item	LS	$10,000
7.3	Dewatering bags	2	Item	$1,600	$3,200
7.4	Filtrate return pump			Allowance	$3,000
8.0	**Chemical Dosing**				**$20,000**
8.1	Colorbond roof			Allowance	$10,000
8.2	Self bunded tanks and pumps			LS	$10,000
9.0	**Disinfection**				**$30,000**
9.1	UV disinfection		Item	LS	$30,000
10.0	**Treated effluent outfall pump**				**$9,000**
10.1	Treated effluent pump skid		Item	LS	$9,000
11.0	**Amenities Building**				**$200,000**
11.1	Building	72	m^2	$2,000	$144,000
11.2	Laboratory equipment			Allowance	$18,000
11.3	Air conditioning			Allowace	$20,000
11.4	Drainage pipework			Allowace	$18,000
12.0	**Pipework, Valves and Fittings**				**$72,500**
12.1	Pipeworks				
	i) General pipework between equipment			Allowance	$30,000
	ii) Effluent discharge line to creek	85	m	$500	$42,500
13.0	**Installation/Testing/Commissioning**				**$145,000**
13.1	Installation of Equipment			LS	$40,000
13.2	Comissioning of Reactors			LS	$25,000
13.3	Further Process Comissioning			Allowance	$10,000
13.4	Mechanical			Allowance	$10,000
13.5	Electrical testing demonstration and comissioning			Allowance	$20,000
13.6	Demonstration to the Principal's technical personnel operation of installed equipment,			Allowance	$40,000

IDEA STP estimate V2 Cost Estimate 15/01/2020 3:11 PM

STOCKINBINGAL STP
COST ESTIMATE

				IDEA reactor	
Item	**Item Description**	**Qty**	**Unit**	**Rate**	**Amount**
14.0	**Electrical Works**				**$364,100**
14.1	Electrical Switchboard and PLC Panel		Item	LS	$41,000
14.2	Consumers' main cabling and Meter Box			LS	$20,000
14.3	Earthing			LS	$4,000
14.4	Electrical Conduits - trenching & bedding			LS	$6,500
14.5	Electrical Conduits, 100mm dia.			LS	$5,000
14.6	Electrical Pits 1.2mx1.2mx0.9m heavy-duty			LS	$6,600
14.7	Electrical cables - power and control			LS	$18,000
14.8	Building services - lights, power, alarm			LS	$9,000
14.9	Instruments - level transmitters & Switches			LS	$10,000
14.10	PLC and HMI programming			LS	$33,000
14.11	Telemetry			LS	$20,000
14.12	FD and CHAZOP Workshop			LS	$11,000
14.13	Electrical accessories & misc. cost			LS	$8,000
14.14	Electrical testing and commissioning			LS	$6,000
14.15	Upgrade power supply			Allowance	$100,000
14.16	Consumer mains supply and installation			Allowance	$37,000
14.17	Supply and installation of main switchboard			Allowance	$29,000
15.0	**Potable water connection to STP**				**$10,000**
	Potable Water			Allowance	$10,000
16.0	**Miscellaneous**				**$90,000**
16.1	Work As Executed Drawings			Allowance	$30,000
16.2	Training of personnel			Allowance	$30,000
16.3	O & M guidelines and instructions			Allowance	$25,000
16.4	QA plans			Allowance	$5,000
	TOTAL DIRECT CONSTRUCTION COST (inlcuding contractor margin)				**$2,084,171**
	Project Contingency			20%	**$416,834**
	Survey investigation anddesign and projectmanagement 10%			10%	**$208,417**
	TOTAL CAPITAL COST				**$2,709,422**

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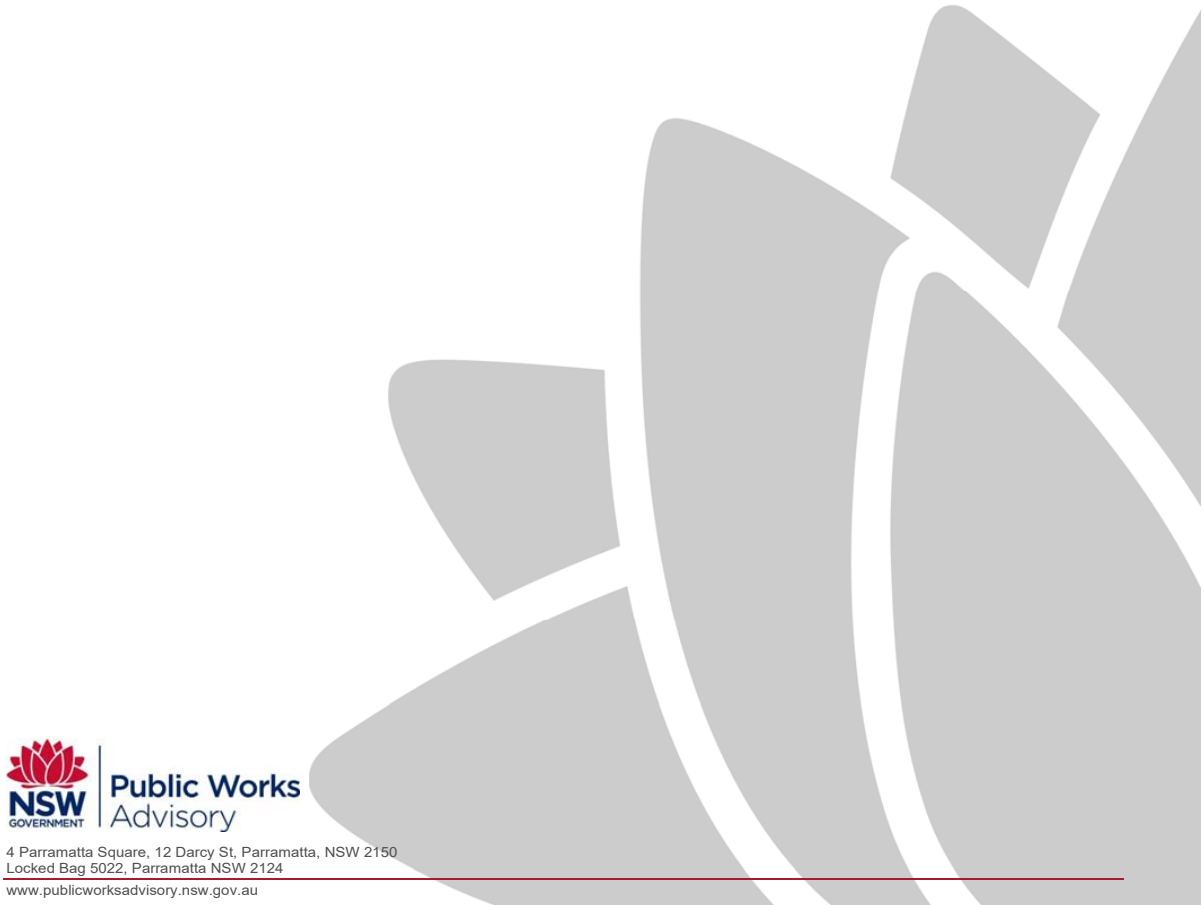

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