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YARRABILBA MIBA SOUTH ROL₁ STORMWATER MANAGEMENT PLAN

VERSION ₁

DesignFlow
Prepared for Stockland
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1 INTRODUCTION

The Yarrabilba Priority Development (PDA) is located within the Logan City Council area and occupies a former pine plantation situated south of Logan Village. The Yarrabilba PDA was declared by regulation under the Economic Development Act (2012). Yarrabilba is part of a regional growth area identified in the South East Queensland Regional Plan, which identifies a need for a further 70,000 dwellings across a number of localities in the Logan City Council area by 2031. The Yarrabilba development aims to provide approximately 17,000 dwellings for a population of 45,000.

Precinct 5 Mixed Industry and Business Area (MIBA) South ROL1 (subject site) covers an area of approximately 21.5 ha which includes around 14.6 ha of development lots (51 lots), 5.2 ha of roads 1.6 ha of open space (including 1.5 ha for stormwater management).

This document presents the stormwater management strategy for the subject site to meet the requirements set out in the *Context Planning Area Strategy – MIBA South & Part of Sub-Area A, Yarrabilba* (RPS, 2024). These are generally consistent with the *State Planning Policy, Yarrabilba Total Water Cycle Management Strategy* (DesignFlow, 2024) and *Yarrabilba Stormwater Infrastructure Master Plan* (DesignFlow, 2024). This report provides details of the proposed stormwater quality and quantity management including location, conceptual sizing and functional earthworks.

This report focuses on the construction phase erosion/sediment control and operational phase stormwater quality and quantity management elements specific to Precinct 5 MIBA South ROL1. Flood management has been addressed separately in the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) as the flood management strategy spans numerous current and future precincts requiring site wide planning. Verification of the local catchment flood detention and diversion drainage are provided to support the subject site application.

2 SITE CHARACTERISTICS

2.1 LOCATION

Precinct 5 MIBA South ROL1 (MIBA South ROL1) lies in the western portion of the Stockland Yarrabilba site just south of the existing MIBA north development zone and interfacing with Waterford Tamborine Road shown in Figure 1. The subject development area covers a total area of approximately 21.5 hectares and forms part of the broader MIBA South & Part of Sub-Area A Context Planning Area Strategy (CPAS) endorsed by EDQ (DEV2011/187/29, 4 October 2024)

2.2 TOPOGRAPHY, CATCHMENTS AND DRAINAGE

The existing topography across MIBA South ROL1 area falls generally east from Waterford Tamborine Road and exhibits variable grades in the order of 5% in the southwestern areas reducing to around 1% on the eastern fringe. Quinzeh Creek borders the northern development edge with an ecological protection zone to the east. Broad gullies lie south of the subject development area with low ridgeline between future MIBA development south of the subject site. Elevation within the ROL1 area varies from around 43mAHD in the east to 56mAHD adjacent to Waterford Tamborine Road. The site topography is shown in Figure 2.

Although minor cross road culverts exist on Waterford Tamborine Road west of the subject site, these have very minimal capacity and significant road overtopping occurs in minor flood events resulting in large areas of broad shallow overland flow through MIBA South ROL1. This is an important aspect of the grading and drainage design for the development. Major road culverts (5 x 1800mm diameter pipes) exist on Waterford Tamborine Road at Quinzeh Creek (north west of MIBA South ROL1) and these convey the main drainage line discharge from the upstream external catchment.

Precinct 5 MIBA South ROL1 sits generally within flood Catchment QC-4 of the broader Yarrabilba development site as defined in Figure 2 of the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024).

2.2.1 Lawful Point of Discharge

The lawful point of discharge for stormwater from Precinct 5 MIBA South ROL1 is to the existing Quinzeh Creek waterway (via overland flow paths and unnamed waterway to the south) as illustrated in Figure 2. This creek (south of the Powerlink easement) is mapped as a watercourse under the Water Act (2000). Quinzeh Creek flows through generally east from MIBA South before discharging north from the site (through Precinct C) near Steele Road approximately 2.9 km downstream of Precinct 5 MIBA South ROL1.

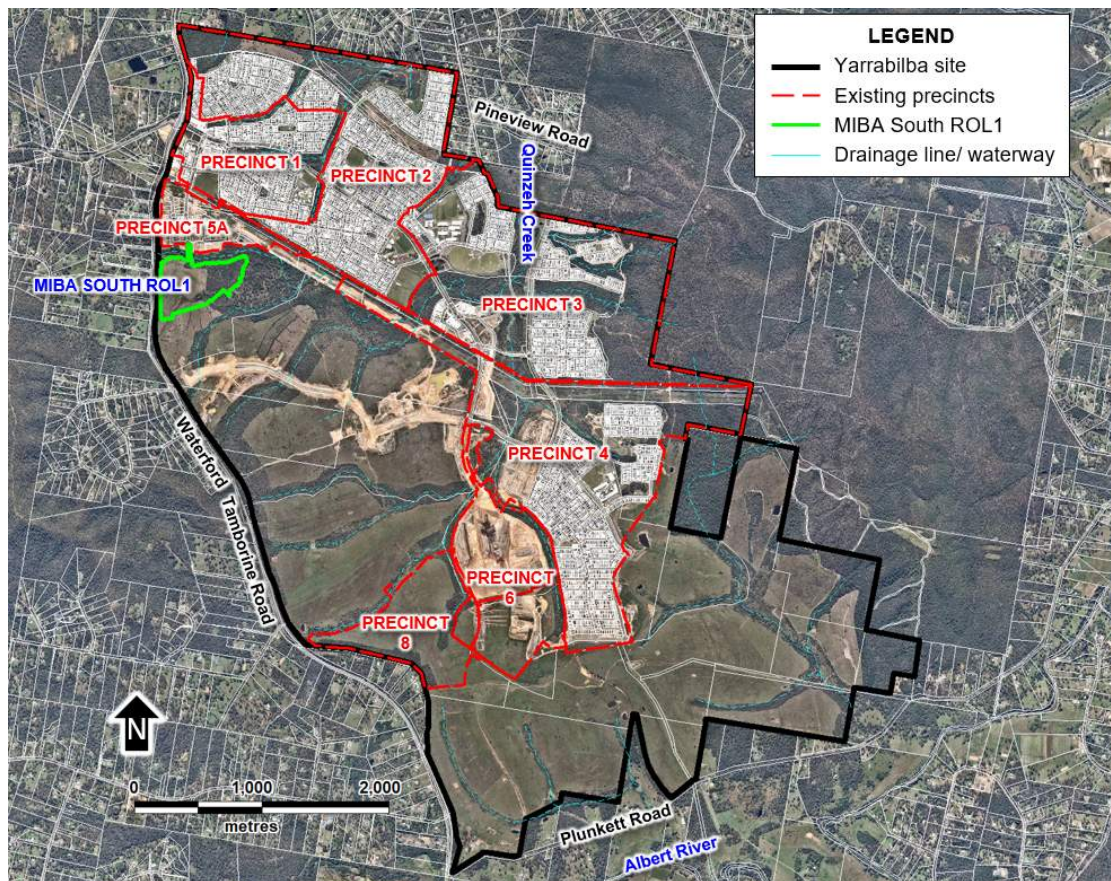


Figure 1: Yarrabilba Precinct 5 MIBA South ROL1 locality

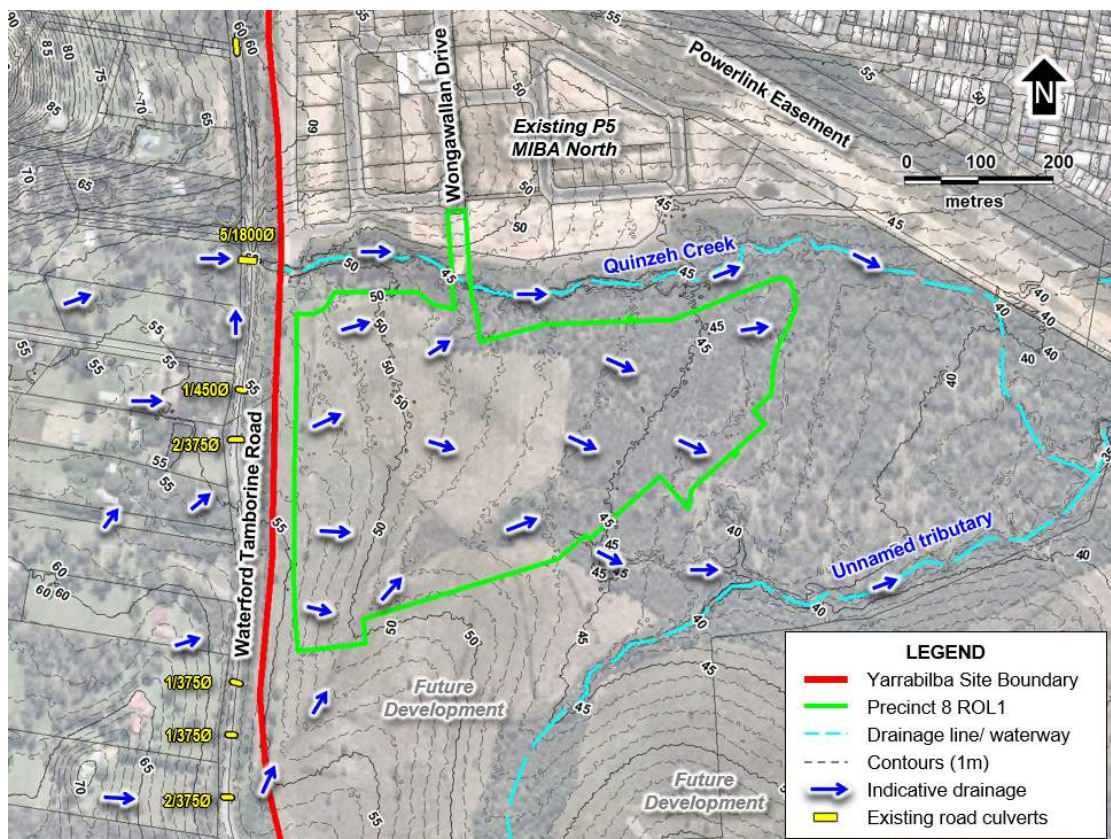


Figure 2: Existing topography, catchments and drainage

2.3 GEOLOGY AND SOILS

Geological mapping indicates Precinct 5 MIBA South ROL1 is located across two geological units:

- Woogaroo sub-group (RJbw)
- Alluvium (Qa)

Broad scale geotechnical investigations completed across the site (Bowler, 2004) indicate subsurface soils are typically sands overlying silty clays and weathered sandstones. The soil conditions for much of Precinct 5 MIBA South ROL1 are not expected to vary significantly from those encountered in the balance of Precinct 1 to 6 previously (i.e. those within the lower slope development zones). The alluvium zones (northern portion of MIBA South ROL1) have often displayed deep sand zones in localised areas where historic channel/creek incisions have been filled with sediment eroded from upslope catchments. Further site specific geotechnical investigations will occur within Precinct 5 MIBA South ROL1 to confirm soil conditions for civil engineering design.

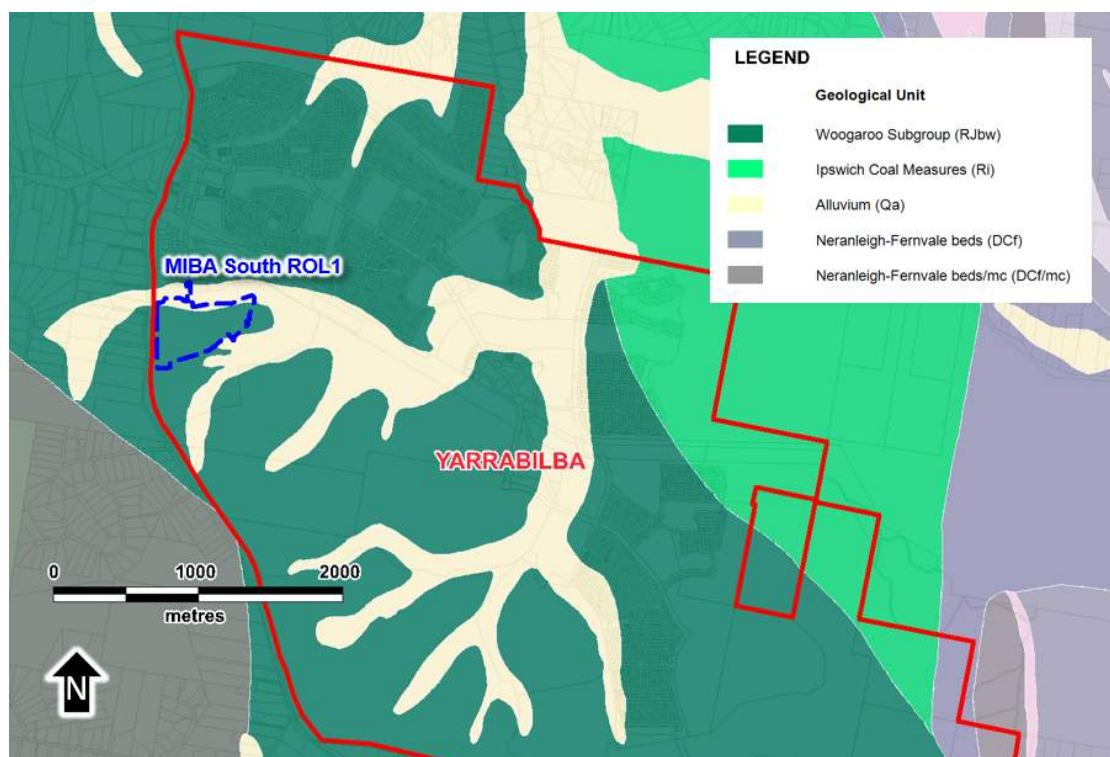


Figure 3: Geology and soils

2.4 VEGETATION

The majority of the Yarrabilba site was previously pine plantation, with most vegetation associated with grassland or pine and eucalypt/acacia regrowth of limited ecological value. Historical aerial imagery illustrates grassland and pine areas represent around 80% of the previous land use across the Yarrabilba site, which have subsequently been cleared and are currently grazed or covered with regrowth

vegetation (refer Figure 2) where development has not already occurred. Moderate to dense vegetation generally occurs along drainage lines in the Yarrabilba site.

Vegetation management will generally be undertaken in accordance with *Yarrabilba Development: Natural Environment Site Strategy* (Natura Consulting, 2024 or later) which highlights vegetation management procedures with regards to clearing approvals, revegetation, monitoring/compliance and design requirements. Strategy 14 in the CPAS provides the individual mapping for waterway, flora and fauna constraints as well as bushfire setbacks for the Precinct 5 MIBA South ROL1 development.

2.5 WATERWAYS

There are no mapped waterways within the MIBA South ROL1 precinct boundary. Quinzeh Creek lies immediately north of the precinct and drains the external rural residential area west of Waterford Tamborine Road and receives discharge from the existing MBA North and proposed MIBS South development areas. Based on the broadscale Waterway Condition Assessment (DesignFlow, 2023) carried out to support the total water cycle management strategy (DesignFlow, 2024), the section of Quinzeh Creek east of Waterford Tamborine Road (bordering MIBA South) is in poor overall condition. While relatively good riparian habitat exists, the creek has poor stability rating (from historic head cut and erosion) and poor/disturbed ephemeral habitat. This waterway is subject to a separate rehabilitation assessment for management of existing and future waterway health.

An unnamed waterway also lies south of the subject site which conflues with Quinzeh Creek approximate 400 metres east of MIBA South ROL1 zone. This waterway also scored an overall poor condition rating mainly due to waterway stability issues (while having some areas of good ephemeral and riparian habitat).

Minimum waterway buffers of 15m to Quinzeh Creek (banks) and 15m to minor waterways/drainage centrelines set out in the *Stormwater Infrastructure Master Plan* (DesignFlow, 2024) have been applied to these waterways with any additional setbacks as required by the ecological and bushfire assessments also applied. All stormwater outlets from the proposed development will also be provided with scour protection to ensure stabilised concentrated flow paths.

2.6 PROPOSED DEVELOPMENT

Precinct 5 MIBA South ROL1 (subject site) covers an area of approximately 21.5 ha which includes around 14.6 ha of development lots (51 lots), 5.2 ha of roads 1.6 ha of open space (including 1.5 ha for stormwater management). The precinct layout is shown in Figure 4.

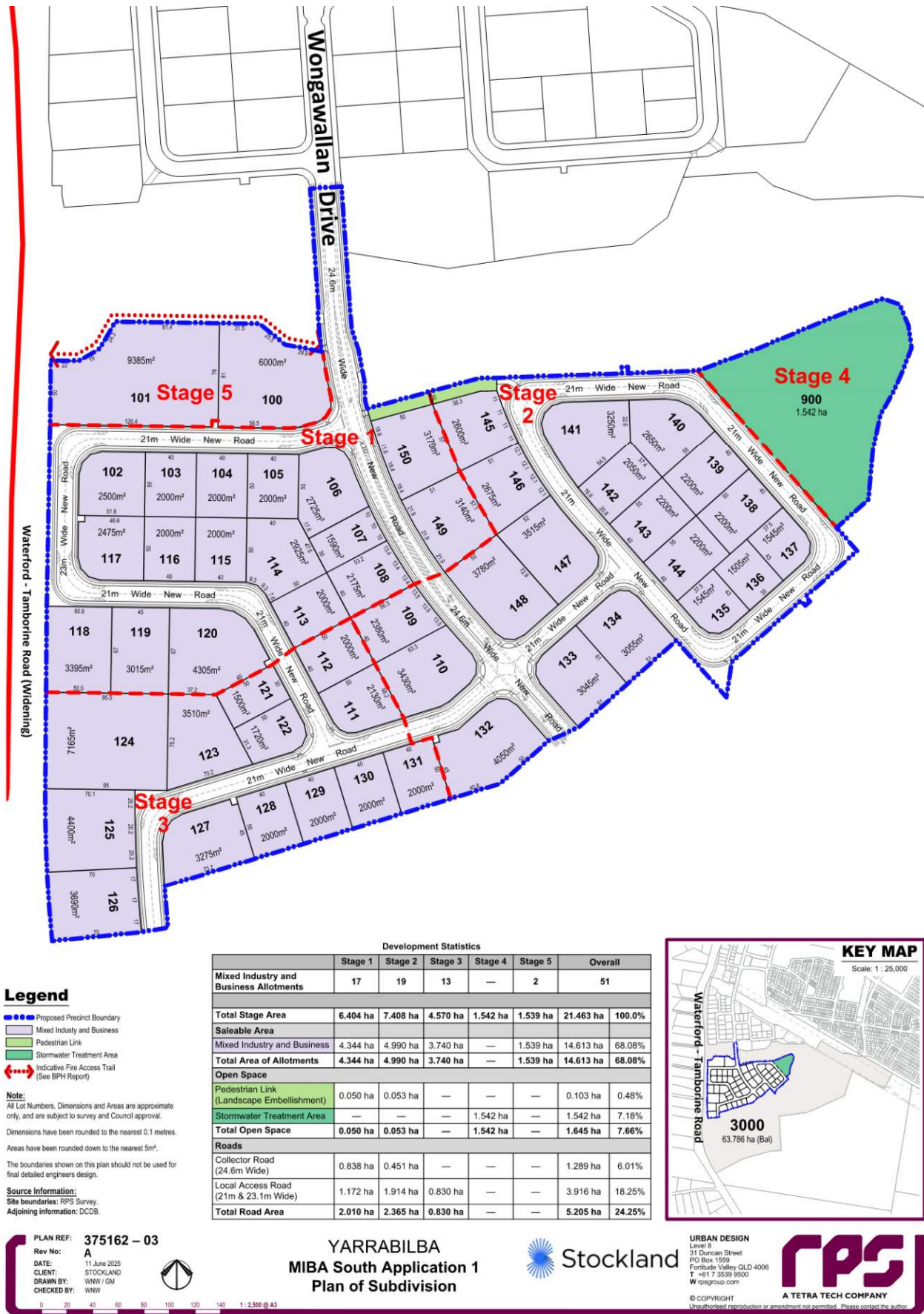


Figure 4: Precinct 5 MIBA South ROL1 proposed layout

3 STORMWATER QUALITY

3.1 DESIGN OBJECTIVES

The stormwater quality management objectives that apply to the operational phase of Yarrabilba Precinct 5 MIBA South ROL1 are listed in Table 1 as defined by *the Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024), which are consistent with the State Planning Policy (DSDIP, 2017).

These objectives require the reduction of pollutant loads discharged from the development site once all construction works are complete. These load reductions are aimed at protecting the environmental values of downstream receiving waterways from the impacts of urban stormwater runoff.

Table 1: Stormwater quality objectives

Pollutant	Discharge criteria (% reduction in mean annual load)
Total suspended solids (TSS)	80%
Total phosphorous (TP)	60%
Total nitrogen (TN)	45%
Gross pollutants (GP)	90%

3.2 STORMWATER QUALITY MANAGEMENT STRATEGY

A stormwater quality management strategy has been developed for Precinct 5 MIBA South ROL1 based on a review of the site characteristics, constraints and masterplan for the proposed development zones. The proposed strategy has been developed in collaboration with the design team to ensure it is well integrated with both engineering and landscape aspects of the design.

When developing the treatment strategy, several key principles were considered:

- Adopt multiple use open space principles where possible
- Adopt similar treatment philosophy to Precincts 1 to 8 development areas to maintain successful integration of treatment with development and outcomes
- Minimise the impact on existing vegetation and ecosystems
- Ensure future development/catchments are allowed for in precinct scale treatment systems.

Figure 5 shows the overall proposed treatment strategy for Precinct 5 MIBA South ROL1 with details of treatment systems provided in Table 2. Due to the significant variability in potential industrial uses within the development, the requirement for gross pollutant traps for individual lots is included to ensure that litter and coarse sediment are managed prior to discharge to the centralised treatment basins shown. The GPTs

do not need to target any treatment of stormwater nutrients (phosphorus and nitrogen).

Design levels and the relevant flood immunity details are provided in Section 4.5, Figure 13. Further details of performance assessments of the proposed treatment strategy are presented in Section 3.3.

Table 2: Stormwater treatment elements

Treatment Type and ID	Size	Catchments	Comment
Sediment Pond 5B1	400 m ²	5B	Sediment pond pre-treatment to dual bios
Bioretention 5B2/5B3	2 x 900 m ²		
Gross Pollutant Traps	varies	Each lot	Required on all MIBA lots (by others)

Note:

1. GPTs on lots are only required for litter and coarse sediment. End of line basins target fine sediment and nutrients.

The concept layout and earthworks for the proposed basin has been documented in the functional design plans by KN Group (Appendix A). Key design parameters are summarised in Table 3. These are subject to detailed design as part of operational works and some flexibility in configuration exists in these basins to enable design response to ultimate catchment and landscape outcomes in these zones (e.g. sediment ponds may be replaced with sediment forebays where future drainage design dictates).

Table 3: Basin 5B concept design summary

Parameter	Sed 5B1	Bio 5B2/853
Area	400 m ²	2 x 900 m ²
Surface level	RL44.6	RL44.5
Bunds	RL46.5 (min.) ¹	
1% AEP flood (in adjacent waterway)	RL45.0 (max.)	

Notes:

1. External bunds relate to detention basin function over treatment areas. Internal bunds between treatment basins will be lower than the design external bund level noted above

A small area of road (0.6 ha) on the northern portion of the development covers the road crossing of Quinzeh Creek from MIBA north. This drains directly to the waterway untreated (from road sag) and is included in the water quality assessment to ensure sufficient offset treatment occurs in the balance of the catchment. Approximately half of this area was accounted for in the Precinct 5A MIBA north stormwater treatment so the balance (0.3 ha) is included in the MIBA South ROL1 strategy. A very minor area of Wongawallan Drive (<0.2 ha) from the ROL1 areas drains south into the future development area. This will be managed as part of the stormwater management strategy to the south.

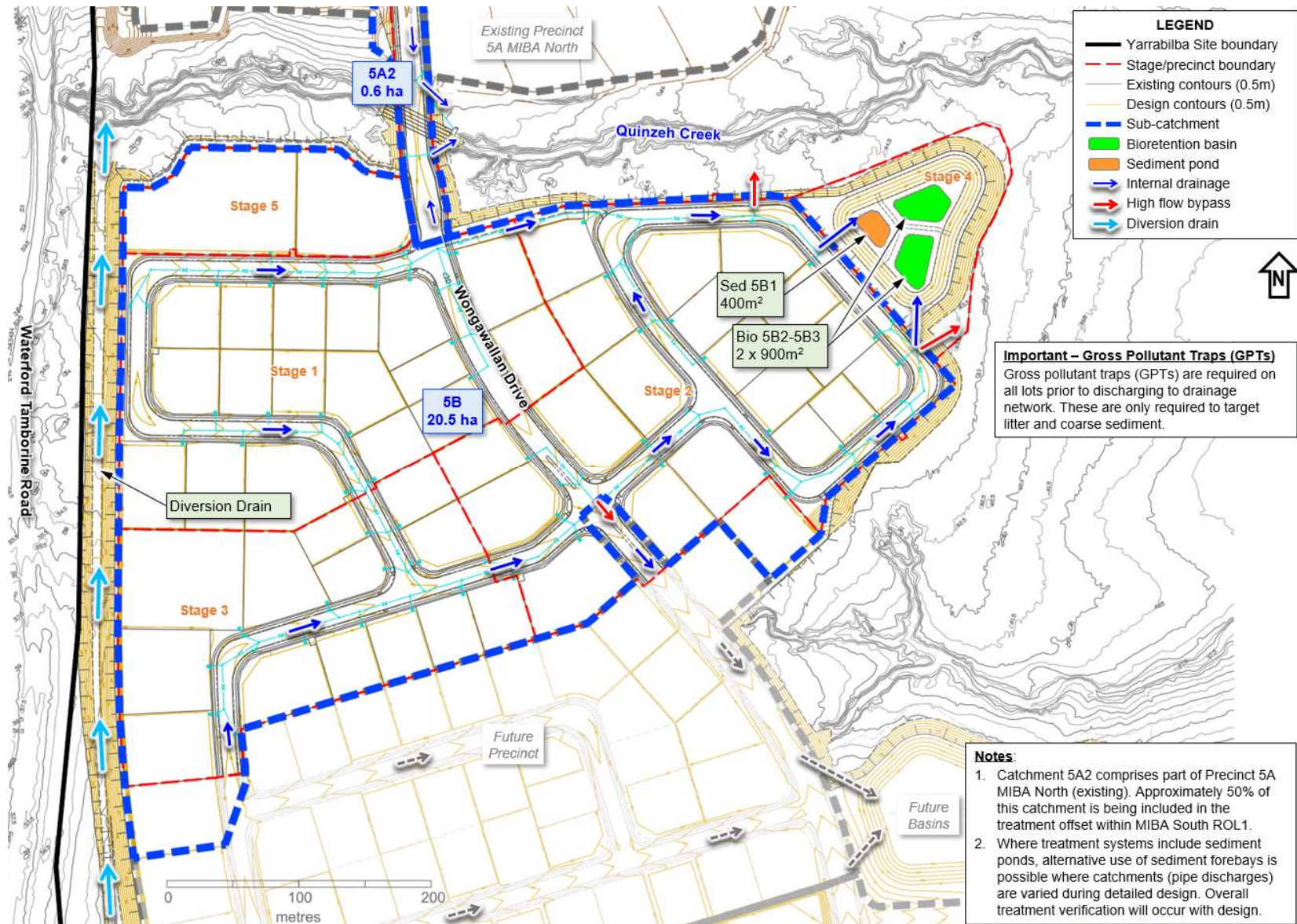


Figure 5: Precinct 5 MIBA South ROL1 stormwater quality management strategy

3.3 STORMWATER QUALITY ASSESSMENT

MUSIC modelling was undertaken to assess the stormwater treatment performance of the proposed treatment strategy. MUSIC Version 6.4 was used for the assessment.

3.3.1 Model Structure

The structure of the MUSIC model is shown in Figure 6 with the general data provided in Table 4. MUSIC model parameters were adopted generally in accordance with the *MUSIC Modelling Guidelines* (Water by Design, 2010/2018) using 10 years (1990-2000) of modified Shailer Park meteorological data. Six minute rainfall data and monthly average evapotranspiration data was used. The Shailer Park station was selected for adoption as it is the closest rainfall station to the site with 6 minute data. The rainfall data set was modified to generate a data set closer representing Logan Village rainfall. The Shailer Park 6 minute rainfall was scaled by a factor of 0.849 to produce a rainfall data set with a similar annual total to Logan Village (950mm) for the period considered. Discussion of this was provided in Section 5.1 of the *Precinct 1 Stormwater Management Plan* (DesignFlow, 2011) and has been consistently used in all subsequent applications since that time.

Gross pollutant traps required on all lots have been excluded from the assessment as these are only targeting litter and coarse sediment from individual lot activities (as pre-treatment to Councils ultimate stormwater quality asset).

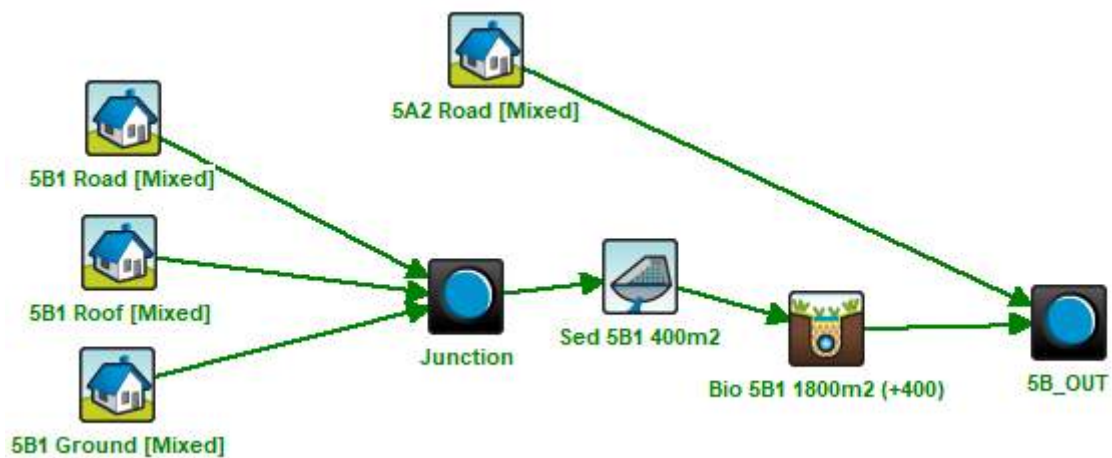


Figure 6: MUSIC model layout

Table 4: MUSIC modelling parameters

Parameter	Value
Source Data	
Rainfall data set	1990-99– Modified Shailer Park Station 040715
Modelled time step	6 minute
Mean annual rainfall 1990-2000	950 mm
Potential evapotranspiration	1,446 mm
Soil properties (runoff generation parameters)	Table 3.7 Music Modelling Guidelines (as appropriate depending on land use)
Pollutant concentrations (base flow and storm flow concentration)	Table 3.8 Music Modelling Guidelines (as appropriate depending on land use)
Percent impervious	Table 3.5 and 3.6 Music Modelling Guidelines (as appropriate depending on land use)
Treatment Devices	
Bioretention	Filter media depth = 0.6 m Extended detention depth = 0.3 m Extended detention area = Bio area (when stand-alone) or Bio + wetland + sed pond (when in combined system) Seepage = 0 mm/hr TN content 400 mg/kg Orthophosphate content 30 mg/kg Overflow weir width = bio area/10
Sediment Basin	Extended detention depth (EDD) = 0.01 m (extended detention depth over 0.01m is included in bio basin where linked) Evaporative loss 75% of PET Notional detention time = <0.1hr (upstream of wetland or bioretention basin) Overflow weir width = sediment pond area/10

3.3.2 Assumptions

1. A split catchment approach was adopted for modelling. Split land use percent imperviousness is generally in accordance with Table 3.5 in MUSIC Modelling Guidelines (Water by Design, 2010/2018). Minor increases in impervious fraction to road and ground level have been applied to achieve overall imperviousness of 90%.
2. Sediment ponds connect via culverts or weirs to bioretention basins with minimal flow restriction (i.e. minimum allowable 0.01m extended detention adopted in MUSIC with large pipe connection to freely convey inflows)

3. Bioretention basins cells are modelled as combined total surface area (where actual design will split these into multiple cells to ensure flow distribution across filter).
4. Bioretention basins have 0.3m extended detention depth before overflowing to discharge pits. Extended detention area is taken as the sum of 'shared' area over bioretention and sediment pond (refer also to item 2 above) as bioretention controls rapid water level drawdown for all these systems.
5. All overflow weirs from treatment systems adopt the treatment area/10 for the weir width as per the *MUSIC Modelling Guideline* which ensures conservatively large weirs and avoids any additional treatment resulting from extended detention above weirs. No allowances have been made for the minor flood attenuation function of the basin in the water quality modelling.

The above assumptions ensure the functional design of all treatment systems is conservative and allows for sufficient earthworks, treatment and maintenance access space allowances within the current layout. All systems will be subject to detailed hydraulic and MUSIC model verification at detailed design stage to optimise the sizing for the contributing catchments and surrounding open space integration.

3.3.3 Catchment Data

The catchment areas draining to each treatment system have been derived from the urban design and drainage layouts for sub-stages where available. Table 2 previously identified catchments contributing to each treatment element. Table 5 below lists the catchment area and percent impervious for each sub-catchment modelled with a detailed breakdown of surface types. All land use is based on industrial land use.

Table 5: MUSIC model catchment split data

Catchment ID (refer to Figure 5)	Total Area (ha)	% Impervious	Surface Type	Sub-Area (ha)	Impervious %
5A2	0.3 ²	80%	Road	0.60	80% ¹
5B	20.5	90%	Road	6.15	80% ¹
			Roof	10.25	100%
			Ground	4.10	80% ¹
Total	20.5	90%			90%

Notes:

1. Road and ground level impervious fractions have been scaled up from minimum guideline values to achieve overall 90% impervious to ensure sufficient treatment for conceptual design.
2. Half of catchment 5A2 included in MIBA South ROL1 as MIBA North included the northern half in the previous strategy (already constructed).

3.3.4 Results

The results of the MUSIC modelling are presented in Table 6. All water quality objectives can be readily achieved with the proposed treatment strategy. This includes the minor area of untreated road crossing over Quinzeh creek from existing MIBA North.

Table 6: MUSIC results

Catchments	Treatment ID	Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction (%)	
5A2, 5B (accounting for 5A2 untreated)	Sed 5B1, Bio 5B2/5B3	TSS	29500	5830	80.2%	✓
		TP	62.4	17.8	71.5%	✓
		TN	395	201	49.0%	✓
		GP	4220	57.5	98.6%	✓

These results indicate conservative outcomes which enables the detailed design of the basins or stormwater drainage network (or earthworks updates) to divert flows to different parts of the catchment without adversely impacting overall treatment performance. It also provides flexibility in design for integration (and downsizing) of treatment systems in open space areas. This will be resolved in conjunction with civil and landscape design with verification MUSIC modelling provided with each basin.

3.4 COMPLIANCE AND CERTIFICATION

Design and construction certification of operational stormwater quality measures is to occur in accordance with the following guidelines:

- Water by Design (2014). *Bioretention Technical Design Guidelines (Version 1.1)* Healthy Waterways Ltd, Brisbane
- Water by Design (2009), *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*, SEQ Healthy Waterways Partnership. Brisbane, Queensland.
- Water by Design (2012), *Transferring Ownership of Vegetated Stormwater Assets Version 1*. Healthy Waterways Partnership. Brisbane, Queensland.

4 STORMWATER QUANTITY AND FLOODING

4.1 DESIGN OBJECTIVES

The stormwater quantity and flood management objectives that apply to the subject development as defined by the *Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and summarised in the MIBA South CPAS are provided below.

- Preserve peak site discharges at the boundary of the (Yarrabilba) site at or below pre-development conditions for all events from 50% to 1% AEP
- No worsening of flooding to properties downstream of the site
- Maintain flood conveyance capacity through site
- Provide for 1% AEP flood immune development within the site with consideration of climate change

Key aspects of stormwater quantity management for MIBA South ROL1 relate to external site overland flow from west of Waterford Tamborine Road as well as management of local site peak discharge increases as part of the site wide *Yarrabilba Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) and ensuring the proposed development designs for flood immunity.

An updated version of the Quinzeh Creek portion of the hydrological and hydraulic models derived from the Yarrabilba Flood Risk Management Strategy described above has been used to define the MIBA South specific requirements for development including the inclusion of the preliminary earthworks design TIN for the subject site. A description of the key design areas and proposed design responses are provided below.

4.2 FLOOD DETENTION

As described in Section 5.1.1 of the *Yarrabilba Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) (referred to herein as FRMS) the ultimate site flood mitigation strategy for the Quinzeh Creek catchment of Yarrabilba is reliant on a large regional scale flood detention basin (formerly Flood Basin 15, now referred to by Council as Expedition Road Detention Basin adjacent to Precinct 3). This major basin enables the flood hydrograph separation of the western and southern sub-catchments (under ultimate development conditions) within the broader Catchment QC-4 (refer to Figure 7 below), in order to avoid coincident flood peaks discharging from site to the north.

The western part of catchment QC-4 containing MIBA South ROL1 development zone included a preliminary detention basin upstream of Garragull Drive as part of a future road extension, which only required attenuation of frequent minor flooding (up to 50% AEP) rather than major flooding events which were offset by the Expedition Road Detention Basin. As noted in the MIBA South CPAS (RPS, 2024), an alternative approach utilising distributed local detention basins to achieve equivalent outcomes was also possible in the western catchment areas. Given the implications for fish passage on the conceptual Garragull Drive detention option, local offline detention approach has been pursued as part of this application.

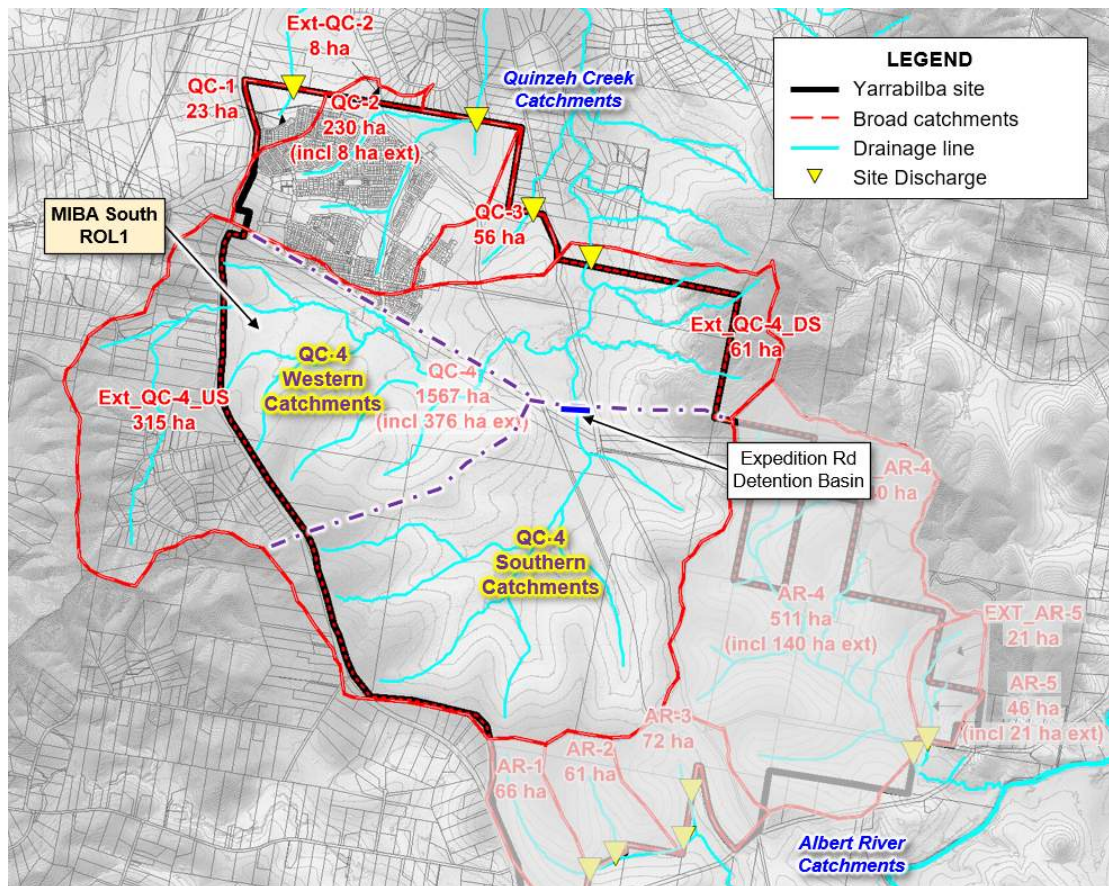


Figure 7: Broad catchment delineation (extract from Figure 2, Yarrabilba FRMS (Designflow, 2024))

Updated FRMS modelling review was undertaken to determine the equivalent sizing of offline detention required to achieve the same (or better) no worsening outcomes as the original FRMS concept (with online Garragull Drive future detention). This involved the following modifications to the FRMS model:

- Remove Garragull Drive detention function (refer Figure 11, FRMS, 2024) by enlarging culverts to minimise headwater/tailwater difference.
- Application of local detention on western QC-4 sub-catchments within hydrological model (applied as basin area and outlets scaled to catchment area).
- Iterative runs of detention area and outlets on local basins until no flood level impacts result downstream of Yarrabilba site in hydraulic model (full Quinzech catchment).
- Derivation of a permissible unit discharge ($\text{m}^3/\text{s}/\text{ha}$) allowance from all conceptual offline detention basins (in western catchments) that can be applied progressively to local catchments in design (as they vary in size from masterplan assumptions).

The revised FRMS modelling of the MIBA South, Town centre core and frame areas (all characterised by high fraction impervious and yet to be developed) indicated

attenuation of flows up to the 50% AEP is required to manage flood impacts downstream of the broader Yarrabilba site. Events larger than this can bypass detention without impacts external to the site. A permissible 50% AEP discharge from all new development within the western catchments of site was derived at 0.025 m³/s per hectare of development (primarily commercial, industrial and high density residential) which was broadly applied to the respective catchments within the western Quinzeh Creek catchment zone of Yarrabilba.

This contrasts with the majority of development in recent years (Precinct 4 and 6) lie upstream of the Expedition Road Detention Basin constructed as part of Precinct 3 and therefore do not require local detention basins within those precincts.

A localised XPSWMM model was set up for the MIBA South ROL1 area in order to refine the local detention basin required and outlet structures associated with this development. This is discussed below.

4.2.1 Hydrological and Hydraulic Assessment

XPSWMM (1d) was used to assess post development catchment discharge and derive an appropriately sized storage (co-located with local stormwater treatment basin) to achieve the permissible 50% AEP discharge of 0.025 m³/ha for the 20.5 ha catchment (0.51 m³/s total). The ensemble storms approach was used in line with ARR2019 using the latest rainfall data from the Bureau of meteorology (BOM). Temporal patterns, losses and pre-burst data was sourced from the ARR Data Hub (Appendix B). Durations from 10 minutes to 6 hours were assessed with the critical duration for the basin storage and discharge being 2 hour duration for the minor 50% AEP event.

4.2.2 Catchments

Catchment data used in XPSWMM (Figure 8) is provided in Table 7 below which is derived from the current layout and grading.

Table 7: Catchment data

Catchment	Area	Slope %	Impervious %	Pervious Roughness	Impervious Roughness
5B	20.5	0.85	90%	0.035	0.015

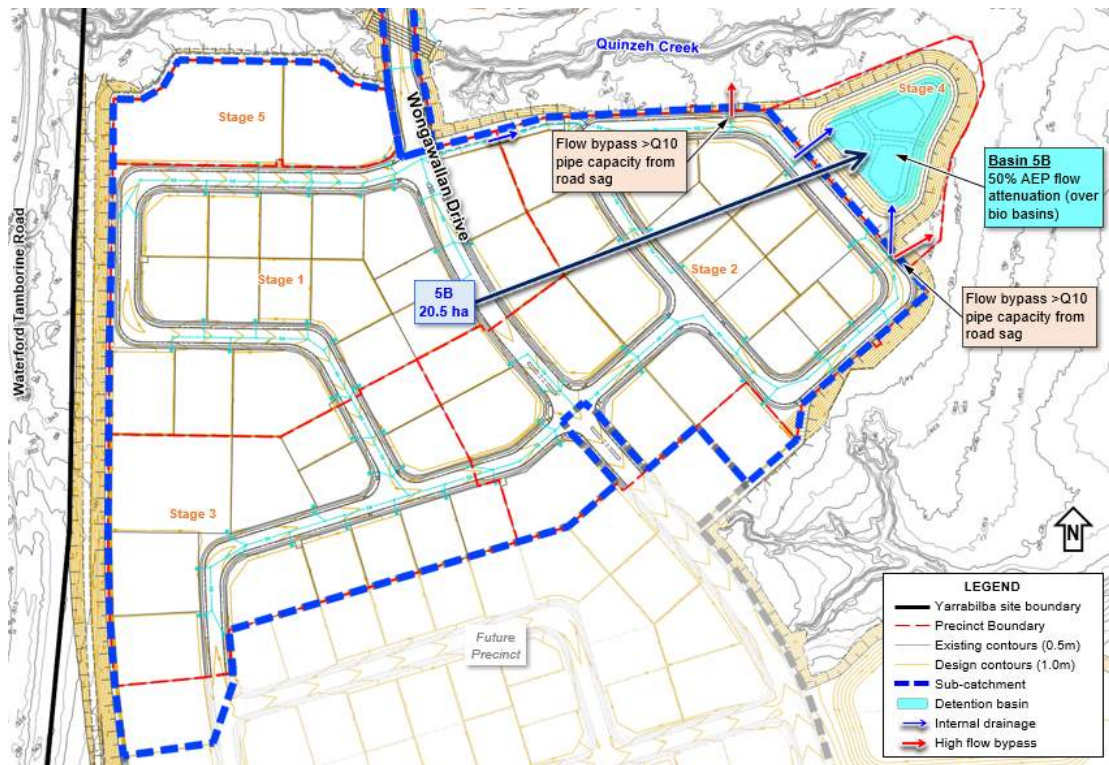


Figure 8: XPSWMM catchment layout

4.2.3 Rainfall and losses

Rainfall data has been obtained from the Bureau of Meteorology rainfall data system while losses (Table 8) and temporal patterns were extracted from the ARR Data Hub for the location co-ordinates below. Pre-burst rainfall has been included in the analysis to translate total storm loss (Table 8) into burst loss which varies with AEP and duration. The Data Hub extract is provided in Appendix B.

- Longitude 153.101°
- Latitude -27.813°
- ARR division: East Coast North

Table 8: Rainfall losses

	Pervious	Impervious
Initial Loss (mm)	26	1
Continuing Loss (mm/hr)	1.9	0

4.2.4 Minor and major drainage

Preliminary grading and drainage layout by KN Group has been used to derive indicative minor and major flows into Basin 5B and potential bypass flows directly to waterway corridors (where road sag locations are not adjacent to basin). These bypass locations are shown in Figure 8 and are represented in XPSWMM as surcharge from drainage in events larger than the nominal pipe capacity (nominally 10% AEP).

4.2.5 Detention storage volumes

The preliminary assumptions for the stage-storage relationship for the minor detention basins are represented by the volume over the sediment pond and/or bioretention basins, with the depth above this being dedicated to minor flood storage. Refined modelling of the detailed earthworks will occur as part of design with hydraulic model verification.

An initial water level has been applied to each basin to represent the first 0.3m of depth being full (stormwater quality volume) prior to the storm burst.

Table 9: Preliminary stage storage data

Depth (m)	Elevation (mAHD)	Stage Area (m ²) ^{1,2}	Volume (m ³)
Basin 5B			
0	44.5	4231	0
1	45.5	5994	5087
2	46.5	7978	12049

Notes:

1. XPSWMM utilises stage-area relationship to calculate the incremental volume internal to the model.
2. Stage area tabulated above are combined for area over sediment pond and/or bio basins. Model has assigned sub areas to each of sediment pond and bio basin(s).
3. A 0.3m initial depth has been applied to the basins for stormwater treatment volume being full prior to storm burst.

4.2.6 Basin concept design

Preliminary design details for each basin are provided in Table 10 with concept layouts shown in Figure 9.

Table 10: MIBA South basin preliminary design

Parameter	Basin 5B
Basin floor (bio filter surface)	RL44.5
Bund	RL46.5 (min. external bunds) RL45.3 (internal bunds)
Stormwater quality	400m ² sediment pond, 2 x 900m ² bioretention basin (with culvert or weir connection between). Batters/storage areas typically 1:6 or flatter.
Basin Outlet Structures <i>Low level outlet¹</i> <i>High flow weir</i>	2/ 1.5m x 1.5m pits at RL44.8, 375mm dia pipe from pit at RL43.45, 1% grade (with orifice plate in pit to reduce outlet area to equiv. 270mm dia pipe). 15m at RL 45.70

Notes:

1. Low level outlets set bioretention basin extended detention depth required for treatment

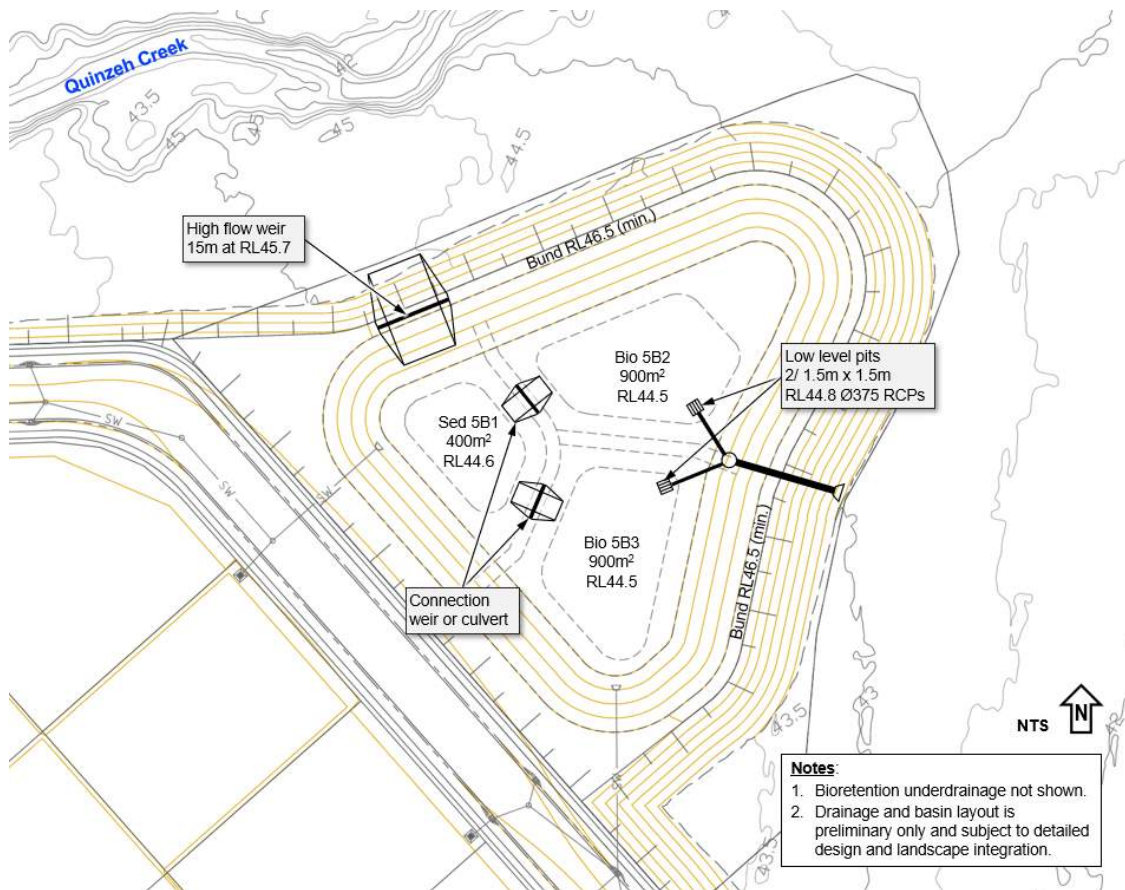


Figure 9: Basin 5B concept design

4.2.7 Results

Table 11 provides results for the minor detention basin 5B which provides adequate discharge control of the target 50% AEP event at or below $0.51\text{m}^3/\text{s}$. Results are reported as the median peak results for the full range of ensemble storms and durations. Results are provided up to 1% AEP for inflows from the pipe drainage network to ensure adequate freeboard and bypass flow management occurs within the basin. Flows greater than 10% AEP bypass the basin as overland flow directly from the road sag locations within the adjacent street and are directed to the open space/waterway corridors (noting a portion of flows greater than 10% AEP enter drainage from ponding).

Table 11: Basin 5B hydraulic results (median)

AEP	Peak Discharge (m^3/s)	Detention Level (mAHD) (& Depth) ²	Detention Volume (m^3)
Detention Function (zero outlet blockage)¹			
63.2%	0.46	45.42 (0.92m)	4636
50%	0.48	45.56 (1.06m)	5447
10%	2.97	45.91 (1.41m)	7706
1%	5.95	46.06 (1.56m)	8717
<i>Flows in excess of 10% AEP bypass basin as overland flow from road sags (x2)³</i>			

Table 11 Notes:

1. Discharge results based on zero blockage to outlets structures (i.e. no reliance of blockage to achieve discharge control).
2. Detention depth includes 0.3m initial water level in water quality basins.
3. Flows greater than 10% AEP pipe drainage capacity bypass directly to adjacent waterway/open space as overland flow. Allowance for partial 1% AEP flows entering pipe network from ponding in road sag locations.

Table 12 provides a check of flood levels and freeboard in the basin under blocked outlet conditions (100% pit blockage). Outflows occur via the bypass weir only.

Table 12: Basin 5B flood levels with blockage (100% pit blocked, weir flow only)

AEP	Detention Level (mAHD)	Increase (from zero blockage) (m)	Freeboard (m)
63.2%	45.83	0.41	0.67
50%	45.84	0.28	0.66
10%	45.97	0.06	0.53
1%	46.11	0.05	0.39

4.2.8 Discussion

The preliminary design of the minor flood detention basin provides adequate attenuation of local development runoff to mitigate flows up to the 50% AEP down to the required target of 0.025m³/s/ha of development equating to 0.51m³/s for MIBA South ROL1 catchment. This contributes to the broader flood strategy for the western development zones within the Quinzeh Creek catchment of Yarrabilba site.

Analysis of adverse blockage conditions within the basin (all pits 100% blocked) indicates that all events up to the 1% AEP remain below the top of bund with controlled discharge to adjacent open space via the high flow bypass weir. With all basin pits designed with raised dome grates, this level of blockage is considered conservative and unlikely to occur in practice.

Detailed design of the basins will involve further review of the water quality basin design within the floor of the system, outlet structures and considerations of the ultimate pipe drainage network design (and catchment) to this location. This current assessment provides adequate support for the current functional design of this basin area for both water quality management and minor flow attenuation.

4.3 DRAINAGE DIVERSION

As described in Section 6.1.7 of the *Yarrabilba Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) and Section 2.2 above, there is a significant area of overland flow entering the development from the west as a result of the Waterford Tamborine Road geometry and inadequate cross road drainage. With proposed upgrades to this state road (realignment and duplication), drainage will be progressively upgraded to provide sufficient conveyance and flood immunity to the ultimate road design while managing the redirection of flooding resulting from the

ultimate increase in upgraded Waterford Tamborine Road levels (required for compliant road grading to reduce grade between crests and sags) along the proposed alignment.

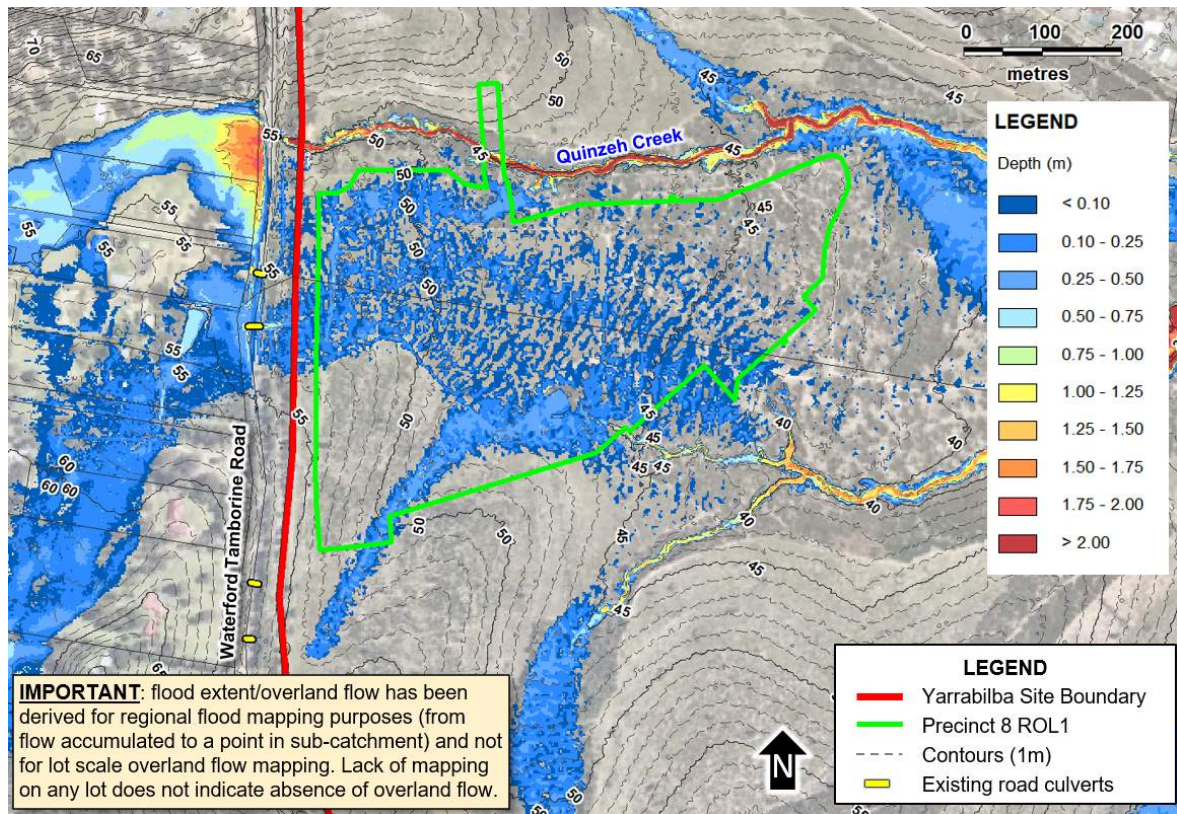


Figure 10: Pre development overland flow extent within MIBA South (1% AEP)

As part of the approved design of the Dollarbird Drive intersection with Waterford Tamborine Road (approximately 500m south of MIBA South ROL1), the ultimate intersection design (prepared by KN Group) transitions back to existing Waterford Tamborine Road alignment with provision for interim drainage to manage the changes in vertical and horizontal geometry. This includes a diversion drain along the western boundary of MIBA South ROL1 (within the Yarrabilba site) to convey the broad overland flow from the western rural residential catchments while capturing the local discharge from the Dollarbird Drive intersection upgrade to the south. This discharges north into Quinzeh Creek. This open drain be grassed with localised rock stabilised outlet zone interfacing the waterway corridor.

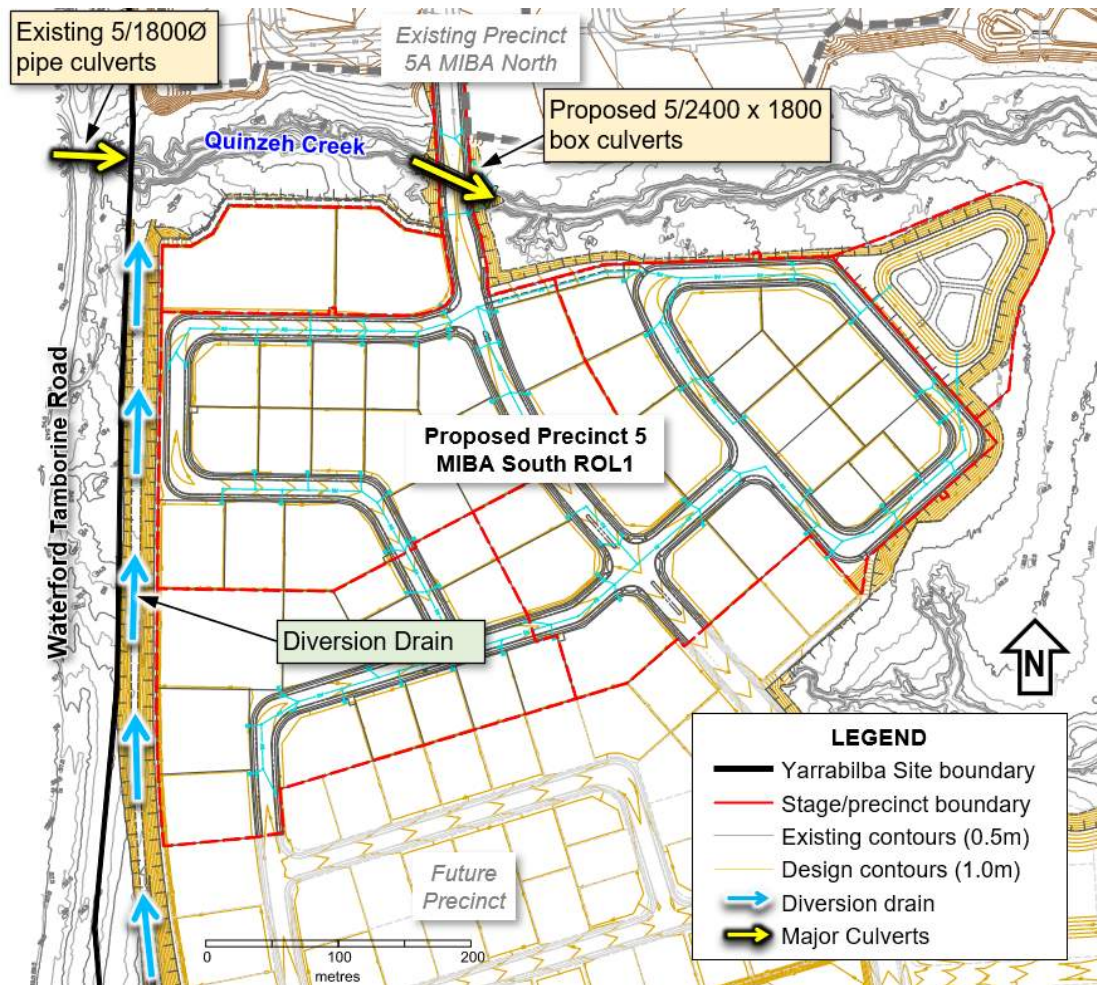


Figure 11: Drainage diversion alignment

The typical channel profile is provided in Figure 12 which represents the minimum channel depth. 1% AEP (climate change case) flood depths within the channel vary from around 0.9m towards the southern end up to 1.2m at the northern end. The flood levels within the diversion drain in relation to the adjacent development are provided in Section 4.5, Figure 13. As the embankment between the drain and MIBA South ROL1 development has been derived from the preliminary design of the future Waterford-Tamborine Road fill levels, it is well above (>1m) 1% AEP climate change flood levels.

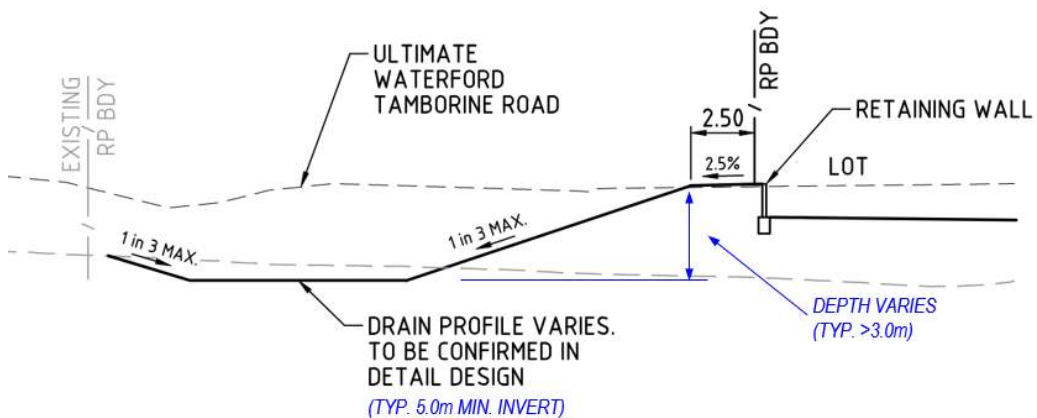


Figure 12: Diversion drain typical section

4.4 CULVERTS

The northern road crossing of Quinzech Creek (Wongawallan Drive) from existing MIBA North into MIBA South ROL1 (shown previously in Figure 11) includes the provision of culverts designed as part of a separate application (DEV2025/1596). These culverts comprise 5 box culvert cells of 2.4m wide x 1.8m high to convey Quinzech Creek flow from the external upstream catchment to site. These culverts remain flood free in the 1% AEP event as shown in Figure 13 below.

4.5 FLOOD LEVELS AND IMMUNITY

A review of the preliminary earthworks design of the proposed development area in relation to local flood levels is provided in Figure 13. This indicates that MIBA South ROL1 area is above the 1% AEP climate change flood level (year 2090 RCP4.5 in line with Logan City Council) being conveyed within both the western diversion drain and Quinzech Creek under ultimate development conditions. This is based on the latest available flood model data (with consideration of the western diversion drain).

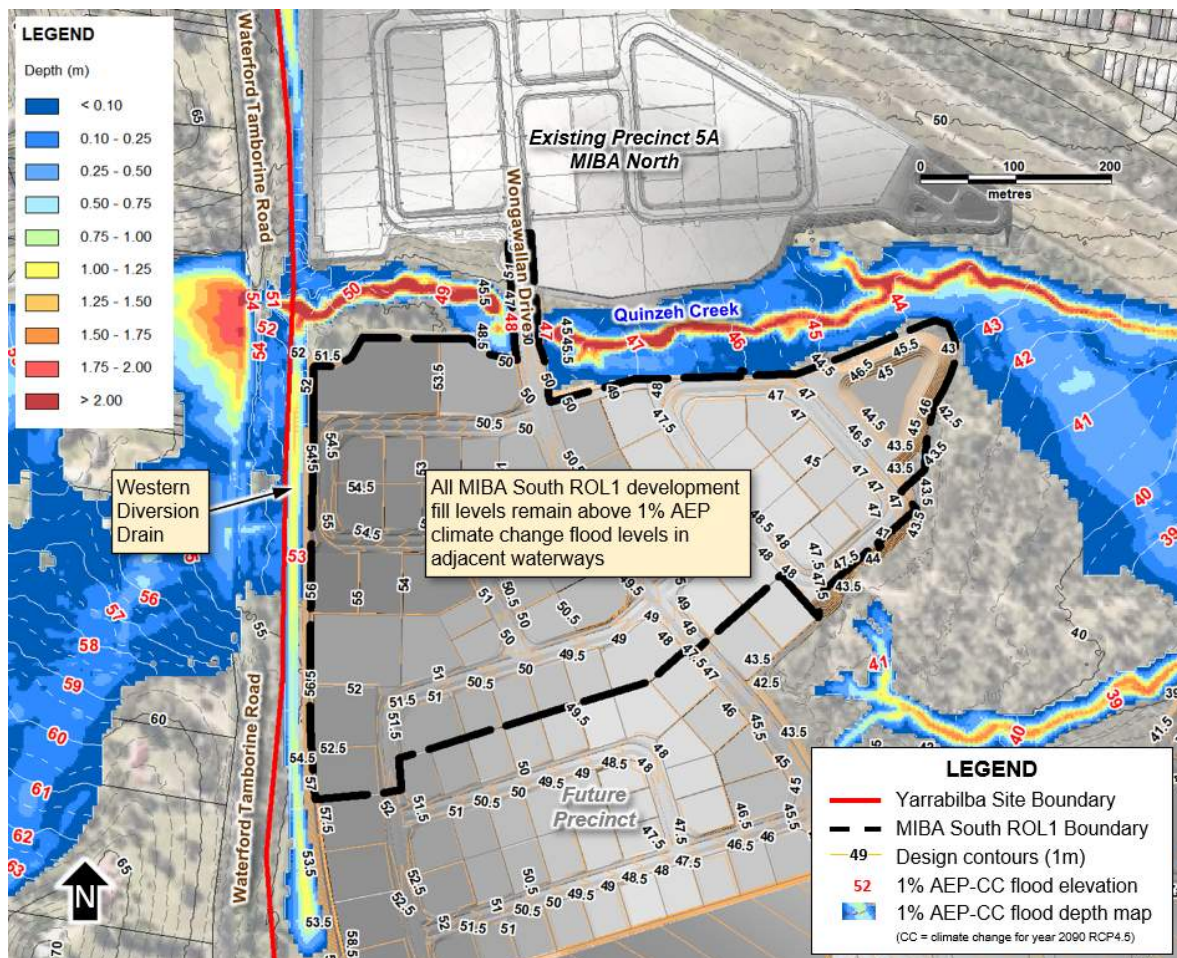


Figure 13: 1% AEP climate change flood levels and preliminary earthworks

5 EROSION AND SEDIMENT CONTROL

5.1 DESIGN OBJECTIVES

The management of stormwater runoff during the construction phase is a critical part of protecting the Yarrabilba waterways and drainage lines. Construction phase design objectives for Precinct 5 MIBA South ROL1 are provided in Table 13 which are generally in accordance with the *Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and the State Planning Policy (DSDIP, 2017).

Table 13: Construction phase stormwater quality

Issue	Desired outcomes
Drainage control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2). 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins (part 3).
Erosion control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised* using methods which will achieve effective short-term stabilisation.
Sediment control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 metres² must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).
Litter, hydrocarbons and other contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway stability and flood flow management	1. Where measures are required to meet post-construction waterway stability objectives (specified in table B), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

*Note: An effectively stabilised surface is defined as one that does not, or is not likely to result in visible evidence of soil loss caused by sheet, rill or gully erosion or lead to sedimentation water contamination.

5.2 MANAGEMENT STRATEGY

5.2.1 Local Erosion and Sediment Control

Erosion and sediment control (ESC) will occur on a development stage by stage basis in accordance with *Best Practice Erosion and Sediment Control* (IECA, 2008) to achieve the objectives listed in Table 1. This will involve a combination of:

- Erosion control - Ensuring that all exposed surfaces are stabilised as soon as possible and that erosion of un-stabilised areas of works are minimised
- Drainage control - Ensuring that provision is made to control all on site runoff to designated treatment areas and to enable appropriate bypass of external flows which do not require treatment
- Sediment capture - Ensuring that mobilised sediment is captured through a combination of source controls such as silt fences and appropriately designed sediment basins. Where possible sediment basins for construction will be located within the voids required for the future stormwater quality treatment systems (sediment basins, bioretention basins, wetlands etc.).

The details of the local erosion and sediment controls for bulk earthworks and for each stage of development are not provided in this report given the high level nature of the document. However, prior to any works commencing on a particular development stage in Precinct 5 MIBA South ROL1, a site specific Erosion and Sediment Control Plan (E&SCP) will be documented for the development stage in question prior to works starting. This will occur as part of the operational works application but can be adjusted by the contractor and site supervisor prior to commencement of construction provided the E&SCP complies with Best Practice Erosion and Sediment Control (IECA, 2008) and delivers the objectives listed previously in Table 13.

5.2.2 High Efficiency Sediment (HES) Basins

Given the importance of managing construction runoff into the waterways downstream of Yarrabilba and the potential impact on the ecology and residents, HES sediment basins are being strategically adopted (where practical) across Precinct 5 MIBA South ROL1. HES basins offer an improved technology for construction sediment management which essentially converts batch sediment basins into continuous flow treatment systems that respond in real time to storm events. The design sought to be achieved by HES basins that ensures at least 80% of the average annual runoff volume treated to 50mg/L TSS or less

The HES basin essentially comprises:

- Flocculent dosing system
- Inlet zone for mixing, flow distribution and efficient removal of coarse sediment
- Settling basin
- Outlet(s)

Implementation of HES basins have the potential to significantly reduce the fine and dispersive sediment load discharge from the site by a further 50% compared to traditional batch sediment basins.

5.3 MONITORING AND AUDITING

5.3.1 Principal Contractor

Site inspections and monitoring are to be undertaken by the principal contractor in accordance with Sections 6.17 and 7.4 of *the Best Practice Erosion and Sediment Control Document* (IECA, 2008) as detailed below. Best practice site management requires all ESC measures to be inspected at the following frequencies and include the following checks as a minimum:

Daily site inspections (during rainfall):

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- All site discharge points (including dewatering activities as appropriate)

Weekly site inspections (even if work is not occurring on-site)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
- Litter and waste receptors
- Oil, fuel and chemical storage facilities

Prior to anticipated runoff producing rainfall (within 24 hours of expected rainfall)

- All drainage, erosion and sediment control measures
- All temporary flow diversion and drainage works

Following runoff producing rainfall (within 18 hours of rainfall event)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements

5.3.2 CPESC Compliance Audits

The ESC measures implemented at the site are proposed to be inspected on a bi-monthly to quarterly basis by a CPESC (Certified Professional in Erosion and Sediment Control) who is independent of the principal contractor and an audit report kept on file. The purpose of the audits is to ensure the developer and the contractors are meeting

their obligations for ESC under the Environmental Protection Act (EP Act). The site will be assessed against these requirements in accordance with *Procedural Guideline: Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland EM1135* (DEHP, 2011).

The compliance audits will involve:

- Site inspection with the contractors to assess ESC actions on the site against the ESC plans and the requirements of EP Act and DEHP Procedural Guideline.
- Identifying non-compliances on the site, photographing and recording these for reporting.
- Where the rectification action is simple, these will be recorded and verbally communicated to the contractor for action.
- Review of any water quality and rainfall information for the site
- Compilation of a ESC Audit report which:
 - Identifies the ESC obligations;
 - ESC issue and non-compliances; and
 - Actions (simple) to be taken to rectify the issues and non-compliances.

The triggers for inspections and reporting by the CPESC are as follows:

- Prior to the commencement of clearing works in each catchment;
- Prior to the commencement of bulk earthworks;
- Prior to the commencement of civil works; and
- At regular monthly intervals during works.

6 CONCLUSION

A stormwater management strategy for Yarrabilba Precinct 5 MIBA South ROL1 development has been prepared to meet the requirements of the *Yarrabilba Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and Context Plan Area Strategy.

The strategy adopts stormwater treatment measures including sediment pond and bioretention basins that manage the stormwater runoff pollutant generation from Precinct 5 MIBA South ROL1 development area. These treatment systems integrate with the local urban and natural environment to ensure the stormwater quality objectives are achieved for the precinct while providing protection or enhancement to the local waterways and amenity. Sufficient space has been allowed for in the development layout for the stormwater treatment measures which have been verified via preliminary layout plans. Individual lots owners within the catchment will be required to install gross pollutant trap(s) (GPT) upstream of their connection to the drainage network as part of development of lots. These GPTs are only required to serve as littler and coarse sediment pre-treatment to the end of line basins (ultimate Council stormwater asset)

Site design has also ensured all development lots are above the local 1% AEP flood level and provided with adequate flow conveyance for external catchment discharge. Local flood detention Basin 5B (co-located with stormwater quality basins) provides attenuation of developed catchment flows up to the required 50% AEP as part of the broader western catchment flood management strategy within Quinzeh Creek portions of Yarrabilba.

Future management or rehabilitation of waterways adjoining the subject site will occur as part of future development expansion of the broader MIBA south zone.

Construction phase stormwater management objectives have been established for the site, in accordance with State Planning Policy (DSDIP, 2017). Preparation of detailed erosion and sediment control plan(s) are required prior to works commencing plus ongoing staging and updates to these plans to ensure the ESC strategy responds to the changing site conditions. Audits will be completed during construction to ensure compliance with State Planning Policy and Environment Protection Act.

7 REFERENCES

DesignFlow (2024) *Yarrabilba Stormwater Infrastructure Master Plan*

DesignFlow (2023) *Yarrabilba Waterway Condition Assessment*

DesignFlow (2024) *Yarrabilba Masterplan Flood Risk Management Strategy*

DSDIP (2017) *State Planning Policy*

IECA (2008) *Best Practice Erosion and Sediment Control*

Water by Design (2010). *MUSIC Modelling Guidelines. SEQ Healthy Waterways Partnership.*

Water by Design (2018) *MUSIC Modelling Guidelines.* Water by Design, Healthy Land and Water Limited, Brisbane, Queensland.

(<https://waterbydesign.com.au/download/music-guideline-2018>)

IPWEAQ (2016) *Queensland Urban Drainage Manual*

LEGEND

- STAGE BOUNDARY
- PROPOSED KERB FACE
- S PROPOSED SEWER
- TS PROPOSED TRUNK SEWER
- SW PROPOSED STORMWATER
- W PROPOSED WATER
- TW PROPOSED TRUNK WATER
- S EXISTING SEWER
- TS EXISTING TRUNK SEWER
- SW EXISTING STORMWATER
- W EXISTING WATER
- TW EXISTING TRUNK WATER
- BIO BASIN/SEDIMENT POND
- REFER DESIGNFLOW'S REPORT:
SMP - PRECINCT 5 MIBA SOUTH
- CONSTRAINT LINE

**

QUINZEH CREEK

QUINZEH CREEK

STAGE 5

STAGE 4

STAGE 1

STAGE 2

STORMWATER PLAN
SCALE 1:1000

SCALE
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1: 1000 (A1 UNREDUCED)

FOR
APPROVAL

REVISIONS					
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Project
YARRABILBA
PRECINCT 5 - MIBA STH - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

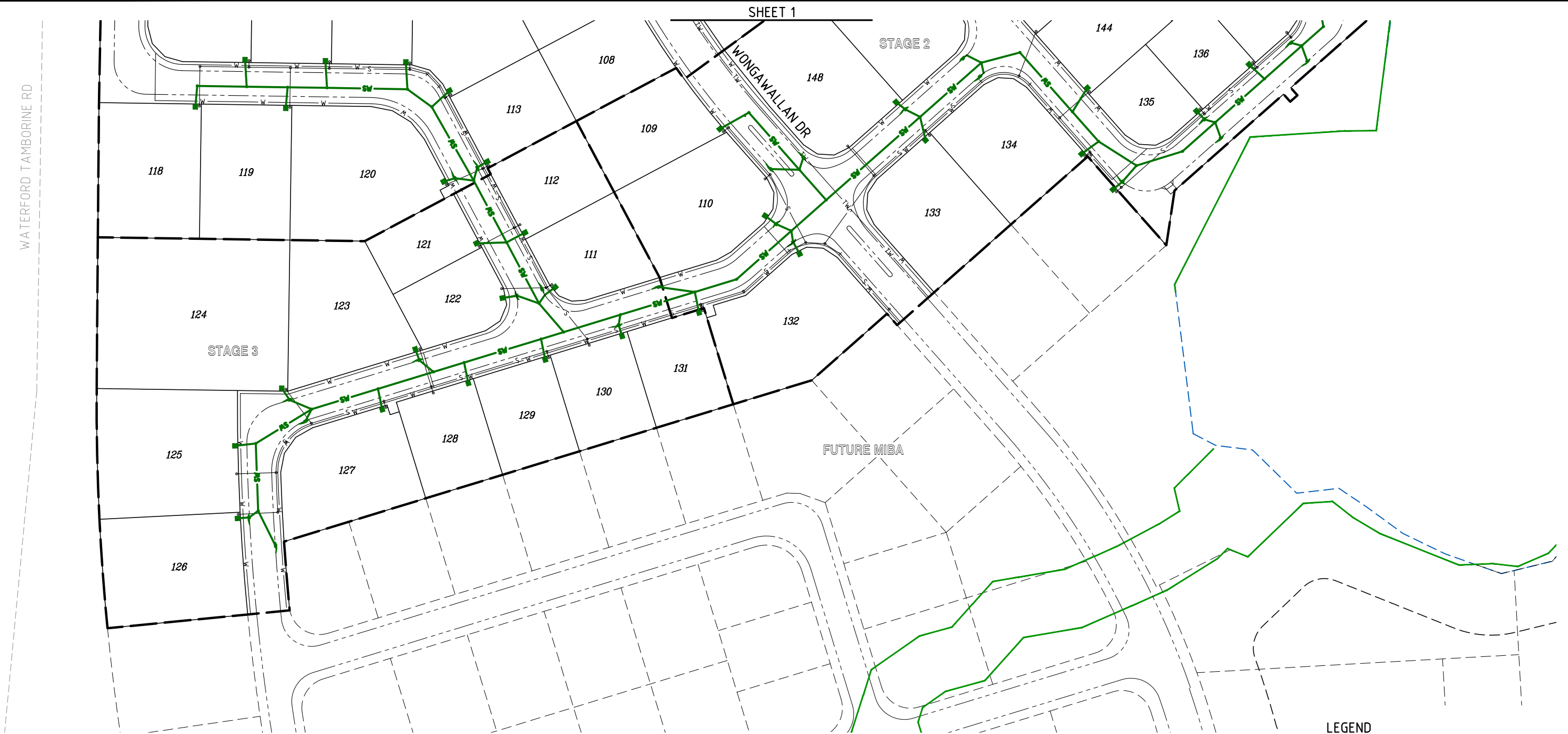
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Drawing Title
**FUNCTIONAL LAYOUT
STORMWATER PLAN
SHEET 1**
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Sheet
09 of 24
Revision
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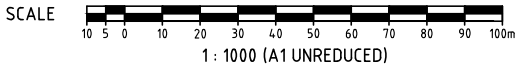
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STORMWATER PLAN
SCALE 1:1000

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- PROPOSED SEWER
- PROPOSED TRUNK SEWER
- PROPOSED STORMWATER
- PROPOSED WATER
- PROPOSED TRUNK WATER
- EXISTING SEWER
- EXISTING TRUNK SEWER
- EXISTING STORMWATER
- EXISTING WATER
- EXISTING TRUNK WATER
- BIO BASIN/SEDIMENT POND
- REFER DESIGNFLOW'S REPORT:
- SMP - PRECINCT 5 MBA SOUTH
- CONSTRAINT LINE



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PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

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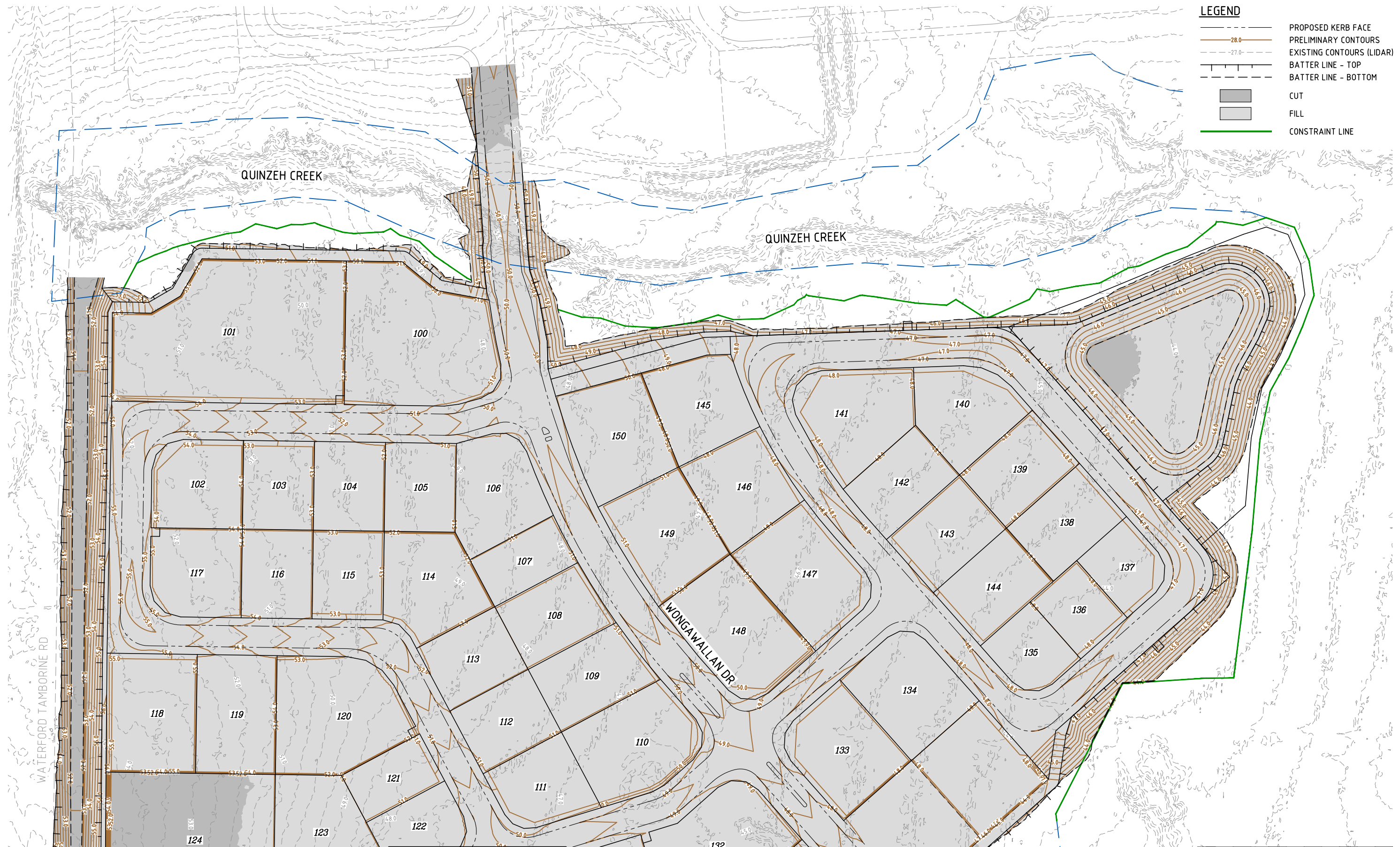
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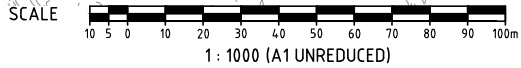
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LEGEND

- PROPOSED KERB FACE
- PRELIMINARY CONTOURS
- EXISTING CONTOURS (LIDAR)
- BATTER LINE - TOP
- BATTER LINE - BOTTOM
- CUT
- FILL
- CONSTRAINT LINE



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YARRABILBA

PRECINCT 5 - MBA STH - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

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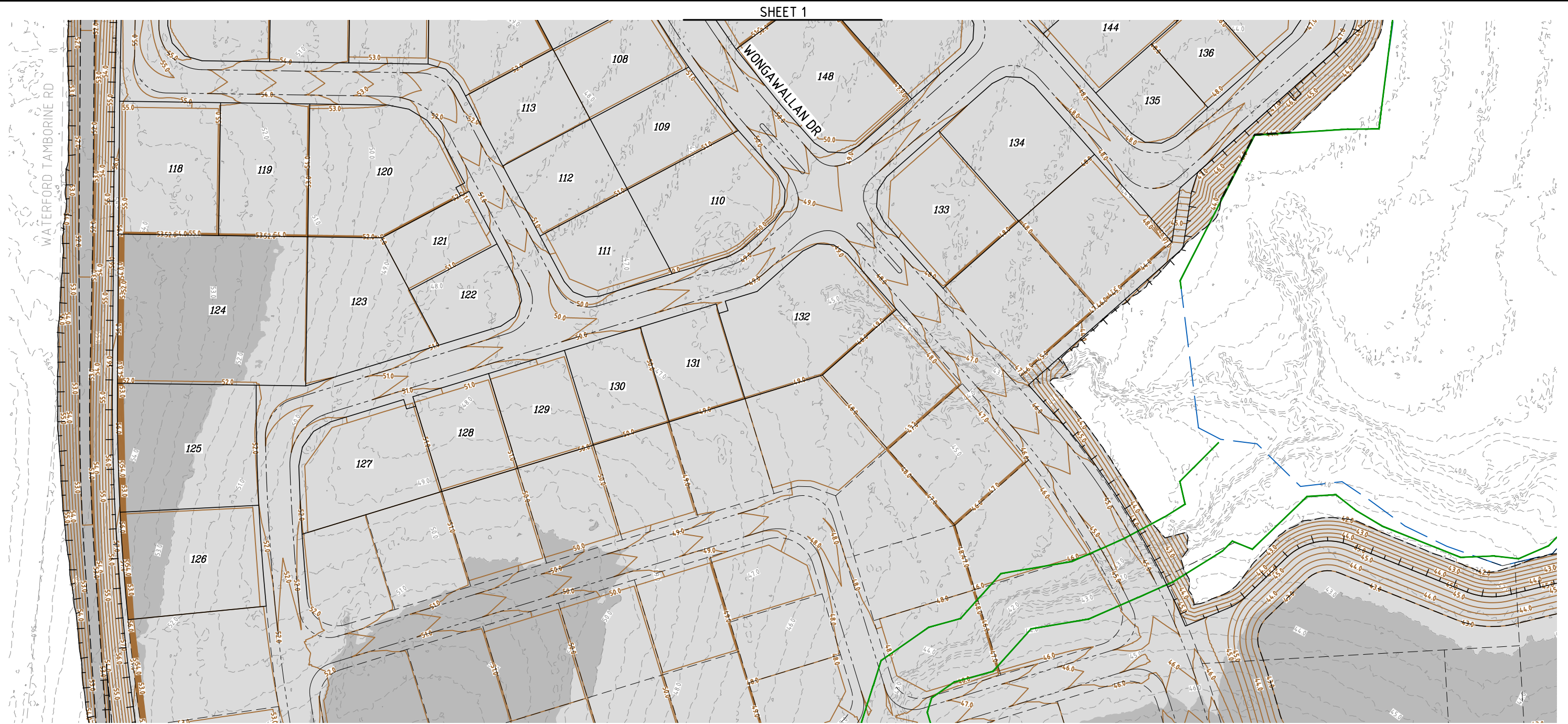
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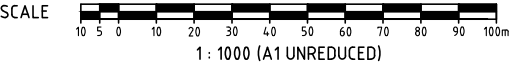
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EARTHWORKS CONTOUR PLAN
SCALE 1:1000

LEGEND

- PROPOSED KERB FACE
- PRELIMINARY CONTOURS
- EXISTING CONTOURS (LIDAR)
- BATTER LINE - TOP
- BATTER LINE - BOTTOM
- CUT
- FILL
- CONSTRAINT LINE



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Project

YARRABILBA

PRECINCT 5 - MBA STH - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

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IF IN DOUBT - ASK!

NORTH

Application No.

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Drawing Title

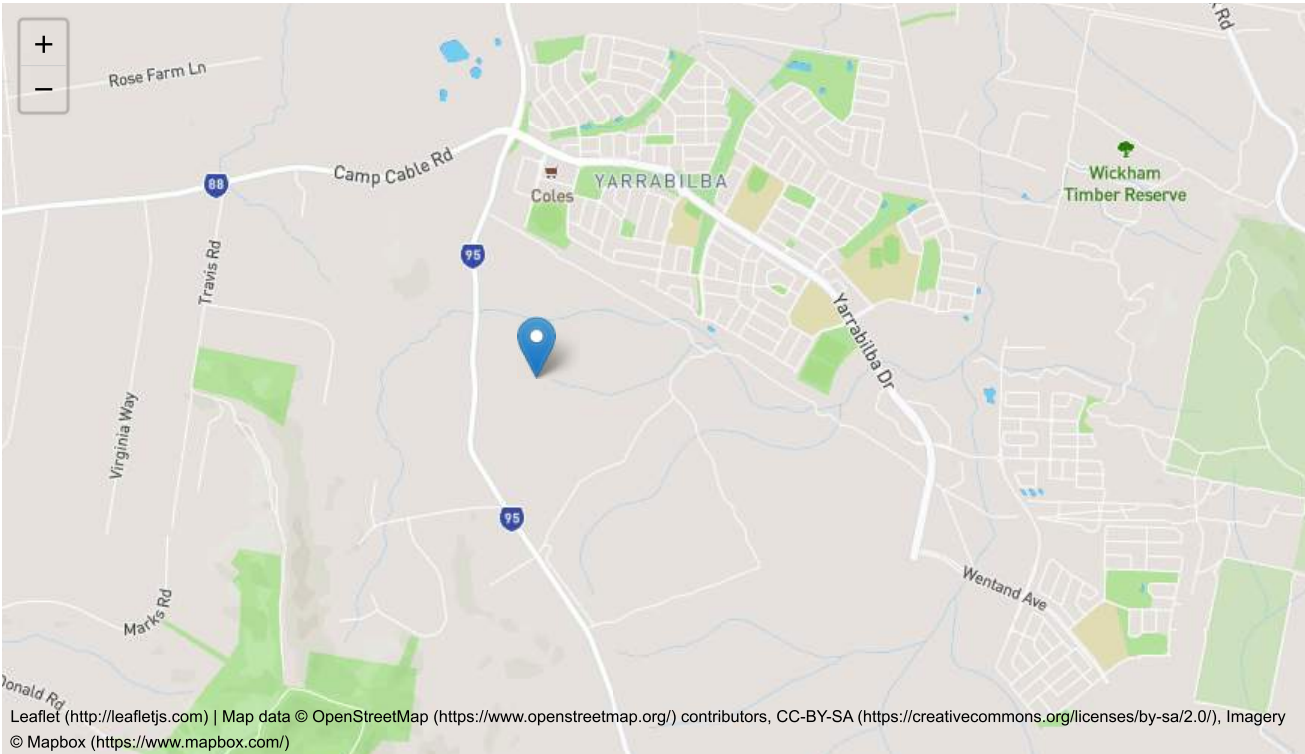
FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 2

Scale	AS SHOWN	Sheet	16 of 24
A1	Drawing No 24-157-SK016	Revision	A

Australian Rainfall & Runoff Data Hub - Results

Input Data

Longitude	153.101
Latitude	-27.813
Selected Regions (clear)	
River Region	show
ARF Parameters	show
Storm Losses	show
Temporal Patterns	show
Areal Temporal Patterns	show
BOM IFDs	show
Median Preburst Depths and Ratios	show
10% Preburst Depths	show
25% Preburst Depths	show
75% Preburst Depths	show
90% Preburst Depths	show
Climate Change Factors	show



Data

River Region

Division	North East Coast
River Number	45
River Name	Logan-Albert Rivers

Layer Info

Time Accessed	11 June 2025 04:53PM
Version	2016_v1

ARF Parameters

$$ARF = Min \left\{ 1, \left[1 - a \left(Area^b - c \log_{10} Duration \right) Duration^{-d} \right. \right. \\ \left. \left. + e Area^f Duration^g \left(0.3 + \log_{10} AEP \right) \right. \right. \\ \left. \left. + h 10^{i Area \frac{Duration}{1440}} \left(0.3 + \log_{10} AEP \right) \right] \right\}$$

Zone	a	b	c	d	e	f	g	h	i
East Coast North	0.327	0.241	0.448	0.36	0.00096	0.48	-0.21	0.012	-0.0013

Short Duration ARF

$$ARF = Min \left[1, 1 - 0.287 \left(Area^{0.265} - 0.439 \log_{10} (Duration) \right) . Duration^{-0.36} \right. \\ \left. + 2.26 \times 10^{-3} \times Area^{0.226} . Duration^{0.125} \left(0.3 + \log_{10} (AEP) \right) \right. \\ \left. + 0.0141 \times Area^{0.213} \times 10^{-0.021 \frac{(Duration-180)^2}{1440}} \left(0.3 + \log_{10} (AEP) \right) \right]$$

Layer Info

Time Accessed	11 June 2025 04:53PM
Version	2016_v1

Storm Losses

Note: Burst Loss = Storm Loss - Preburst

Note: These losses are only for rural use and are **NOT FOR DIRECT USE** in urban areas

ID	5092.0
Storm Initial Losses (mm)	26.0
Storm Continuing Losses (mm/h)	1.9

Layer Info

Time Accessed	11 June 2025 04:53PM
Version	2016_v1

Temporal Patterns | Download (.zip) (static/temporal_patterns/TP/ECnorth.zip)

code	ECnorth
Label	East Coast North

Layer Info

Time Accessed	11 June 2025 04:53PM
Version	2016_v2

code	ECnorth
arealabel	East Coast North

Layer Info

Time Accessed	11 June 2025 04:53PM
Version	2016_v2

BOM IFDs

Click here (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-27.813&longitude=153.101&sdmin=true&sdhr=true&sdday=true&user_label=) to obtain the IFD depths for catchment centroid from the BoM website

Layer Info

Time Accessed	11 June 2025 04:53PM
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Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.9 (0.027)	3.0 (0.062)	4.4 (0.076)	5.7 (0.085)	8.4 (0.105)	10.4 (0.116)
90 (1.5)	0.5 (0.014)	2.7 (0.049)	4.2 (0.063)	5.5 (0.072)	11.9 (0.129)	16.7 (0.159)
120 (2.0)	0.4 (0.009)	7.0 (0.116)	11.4 (0.156)	15.6 (0.182)	17.6 (0.171)	19.2 (0.164)
180 (3.0)	0.8 (0.017)	8.4 (0.123)	13.5 (0.162)	18.3 (0.187)	23.3 (0.196)	27.0 (0.198)
360 (6.0)	2.1 (0.034)	12.6 (0.143)	19.5 (0.182)	26.2 (0.206)	44.5 (0.286)	58.2 (0.325)
720 (12.0)	2.7 (0.034)	11.0 (0.094)	16.4 (0.115)	21.7 (0.127)	41.3 (0.198)	56.0 (0.234)
1080 (18.0)	2.3 (0.024)	11.9 (0.086)	18.3 (0.107)	24.4 (0.120)	36.4 (0.146)	45.4 (0.159)
1440 (24.0)	3.6 (0.033)	7.7 (0.049)	10.3 (0.053)	12.9 (0.056)	29.2 (0.103)	41.4 (0.128)
2160 (36.0)	0.0 (0.000)	4.6 (0.025)	7.6 (0.033)	10.5 (0.038)	22.7 (0.068)	31.8 (0.083)
2880 (48.0)	0.0 (0.000)	1.2 (0.006)	2.0 (0.008)	2.8 (0.009)	13.1 (0.035)	20.8 (0.048)
4320 (72.0)	0.0 (0.000)	0.1 (0.000)	0.2 (0.001)	0.3 (0.001)	4.7 (0.011)	8.1 (0.016)

Layer Info

Time Accessed	11 June 2025 04:53PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

10% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

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Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

25% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.2 (0.004)	0.4 (0.006)	0.5 (0.007)	0.5 (0.006)	0.5 (0.006)
90 (1.5)	0.0 (0.000)	0.2 (0.003)	0.3 (0.004)	0.4 (0.005)	1.0 (0.011)	1.5 (0.014)
120 (2.0)	0.0 (0.000)	0.8 (0.013)	1.3 (0.017)	1.7 (0.020)	1.3 (0.013)	1.0 (0.009)
180 (3.0)	0.0 (0.000)	0.2 (0.003)	0.4 (0.005)	0.5 (0.005)	0.8 (0.007)	1.0 (0.007)
360 (6.0)	0.0 (0.000)	0.6 (0.007)	1.0 (0.009)	1.4 (0.011)	4.0 (0.026)	6.0 (0.034)
720 (12.0)	0.0 (0.000)	2.1 (0.018)	3.6 (0.025)	4.9 (0.029)	8.6 (0.041)	11.4 (0.048)
1080 (18.0)	0.0 (0.000)	1.9 (0.014)	3.1 (0.018)	4.3 (0.021)	6.2 (0.025)	7.6 (0.027)
1440 (24.0)	0.0 (0.000)	0.1 (0.000)	0.1 (0.001)	0.2 (0.001)	4.2 (0.015)	7.2 (0.022)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.4 (0.001)	0.7 (0.002)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

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Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

75% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	16.8 (0.477)	28.4 (0.584)	36.2 (0.622)	43.6 (0.646)	39.8 (0.497)	37.0 (0.411)
90 (1.5)	14.6 (0.367)	23.0 (0.416)	28.6 (0.431)	33.9 (0.438)	65.5 (0.706)	89.2 (0.848)
120 (2.0)	10.6 (0.245)	29.6 (0.491)	42.3 (0.581)	54.4 (0.637)	93.7 (0.910)	123.1 (1.050)
180 (3.0)	30.2 (0.619)	49.4 (0.719)	62.1 (0.746)	74.2 (0.756)	112.9 (0.947)	141.9 (1.040)
360 (6.0)	32.4 (0.526)	51.6 (0.588)	64.3 (0.600)	76.4 (0.601)	117.9 (0.757)	149.0 (0.833)
720 (12.0)	37.7 (0.466)	59.1 (0.508)	73.2 (0.513)	86.8 (0.511)	112.1 (0.538)	131.1 (0.548)
1080 (18.0)	21.8 (0.227)	51.6 (0.372)	71.4 (0.419)	90.3 (0.444)	109.2 (0.439)	123.3 (0.432)
1440 (24.0)	28.9 (0.268)	47.5 (0.302)	59.7 (0.309)	71.5 (0.310)	84.8 (0.300)	94.7 (0.292)
2160 (36.0)	12.6 (0.099)	24.8 (0.133)	32.8 (0.143)	40.5 (0.148)	60.3 (0.180)	75.0 (0.195)
2880 (48.0)	12.9 (0.091)	27.2 (0.131)	36.7 (0.143)	45.8 (0.149)	62.4 (0.167)	74.9 (0.174)
4320 (72.0)	0.2 (0.001)	10.6 (0.045)	17.5 (0.060)	24.1 (0.069)	45.7 (0.107)	62.0 (0.126)

Layer Info

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Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

90% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	62.6 (1.777)	98.4 (2.019)	122.1 (2.102)	144.8 (2.148)	135.1 (1.686)	127.7 (1.418)
90 (1.5)	51.1 (1.287)	76.1 (1.376)	92.7 (1.398)	108.5 (1.401)	190.8 (2.054)	252.5 (2.399)
120 (2.0)	37.0 (0.856)	76.9 (1.273)	103.4 (1.421)	128.7 (1.508)	190.3 (1.848)	236.4 (2.016)
180 (3.0)	70.6 (1.447)	108.2 (1.574)	133.0 (1.599)	156.9 (1.598)	241.6 (2.026)	305.2 (2.236)
360 (6.0)	59.6 (0.967)	106.5 (1.213)	137.6 (1.284)	167.3 (1.315)	245.1 (1.575)	303.4 (1.696)
720 (12.0)	88.8 (1.098)	125.2 (1.076)	149.3 (1.046)	172.4 (1.014)	220.3 (1.058)	256.2 (1.071)
1080 (18.0)	57.8 (0.603)	95.5 (0.688)	120.4 (0.706)	144.4 (0.710)	179.0 (0.719)	205.0 (0.718)
1440 (24.0)	77.7 (0.718)	103.3 (0.657)	120.3 (0.622)	136.6 (0.591)	166.3 (0.589)	188.6 (0.582)
2160 (36.0)	37.6 (0.295)	76.9 (0.412)	102.9 (0.448)	127.8 (0.466)	149.7 (0.447)	166.0 (0.432)
2880 (48.0)	44.2 (0.312)	75.2 (0.362)	95.7 (0.374)	115.4 (0.376)	147.8 (0.395)	172.1 (0.400)
4320 (72.0)	14.4 (0.090)	40.5 (0.171)	57.7 (0.198)	74.3 (0.213)	94.1 (0.220)	109.0 (0.222)

Layer Info

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Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

Climate Change Factors

Rainfall Factors

SSP1-2.6

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.21	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.11
2050	1.22	1.2	1.18	1.17	1.15	1.15	1.14	1.13	1.12	1.11
2060	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2070	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2080	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2090	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2100	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12

SSP2-4.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12
2050	1.27	1.24	1.23	1.21	1.19	1.18	1.17	1.16	1.15	1.14
2060	1.3	1.27	1.25	1.23	1.21	1.2	1.19	1.18	1.16	1.16
2070	1.33	1.3	1.28	1.26	1.24	1.22	1.21	1.19	1.18	1.17
2080	1.37	1.33	1.31	1.28	1.26	1.24	1.22	1.21	1.2	1.19
2090	1.4	1.36	1.34	1.31	1.28	1.26	1.24	1.23	1.21	1.2
2100	1.41	1.37	1.35	1.32	1.29	1.27	1.25	1.24	1.22	1.21

SSP3-7.0

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2050	1.29	1.26	1.24	1.22	1.2	1.19	1.18	1.17	1.16	1.15
2060	1.35	1.32	1.3	1.27	1.25	1.23	1.22	1.2	1.19	1.18
2070	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2080	1.5	1.45	1.42	1.38	1.35	1.33	1.3	1.28	1.26	1.25
2090	1.59	1.53	1.49	1.44	1.4	1.38	1.35	1.33	1.3	1.29
2100	1.66	1.59	1.55	1.5	1.45	1.42	1.39	1.37	1.34	1.32

SSP5-8.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.2	1.18	1.17	1.16	1.14	1.13	1.13	1.12	1.11	1.11
2040	1.26	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.14
2050	1.34	1.31	1.29	1.26	1.24	1.23	1.21	1.2	1.18	1.18

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2060	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2070	1.52	1.47	1.43	1.4	1.36	1.34	1.31	1.29	1.27	1.26
2080	1.63	1.57	1.52	1.48	1.43	1.4	1.37	1.35	1.33	1.31
2090	1.77	1.69	1.64	1.58	1.52	1.49	1.45	1.42	1.39	1.37
2100	1.86	1.77	1.71	1.64	1.58	1.54	1.5	1.47	1.43	1.41

Loss Factors

Initial Loss (Adjustment Factors)

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2030	1.02	1.02	1.02	1.03
2040	1.03	1.03	1.03	1.03
2050	1.03	1.03	1.04	1.04
2060	1.03	1.04	1.04	1.05
2070	1.03	1.04	1.05	1.06
2080	1.03	1.05	1.06	1.07
2090	1.03	1.05	1.07	1.08
2100	1.03	1.05	1.07	1.09

Continuing Loss (Adjustment Factors)

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2030	1.04	1.05	1.05	1.05
2040	1.05	1.05	1.06	1.06
2050	1.06	1.06	1.07	1.08
2060	1.06	1.07	1.08	1.1
2070	1.06	1.08	1.1	1.12
2080	1.06	1.09	1.11	1.14
2090	1.06	1.09	1.13	1.16
2100	1.06	1.1	1.14	1.18

Temperature Changes (Degrees, Relative to 1961-1990 Baseline)

Year	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
2030	1.2	1.2	1.2	1.3
2040	1.3	1.4	1.5	1.6
2050	1.4	1.7	1.8	2.1
2060	1.5	1.9	2.2	2.5
2070	1.5	2.1	2.5	3
2080	1.5	2.2	2.9	3.5
2090	1.5	2.4	3.3	4.1
2100	1.4	2.5	3.6	4.5

Layer Info

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Version	2024_v1
Note	Updated climate change factors for IFD Initial loss and continuing loss based on IPCC AR6 temperature increases from the updated Climate Change Considerations (Book 1: Chapter 6) in ARR (Version 4.2). ARR recommends the use of Current and near-term (2030 midpoint). Medium-term (2050 midpoint) and Long-term (2090 midpoint)

[Download TXT \(downloads/5952472c-02eb-4f3c-a463-998b6252e654.txt\)](#)

[Download JSON \(downloads/629722d2-a09d-4656-8568-bb290082040b.json\)](#)

[Generating PDF... \(downloads/6c121029-17bb-4b73-af33-eddd5c355898.pdf\)](#)