STRUCTURAL
CIVIL
ELECTRICAL
MECHANICAL
HYDRAULIC
FIRE
VERTICAL TRANSPORT
SEISMIC

STP CONSULTANTS

Proposed 32 Unit Development

500-504 ROSS RIVER ROAD, CRANBROOK

CIVIL ENGINEERING SERVICES AND A SITE BASED STORMWATER MANAGEMENT PLAN REPORT

KAENETTO INVESTMENTS

STP25-0597

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1. Introduction

Urban Space Consulting, on behalf of Kaenetto Investments, has engaged STP Consultants to produce a Civil Engineering Services and a Site Based Stormwater Management Plan Report in support of a Material Change of Use Development Application over the subject site.

This Civil Engineering Services Report focuses on the impact of the development in the following areas:

- Earthworks
- Flood Hazard Assessment
- Stormwater Management
- Stormwater Quality
- Water supply
- Sewerage connection

1.1 Limitations

This report provides a desktop assessment of services and stormwater investigation from the information obtained from the following sources.

- Architectural Plans.
- Survey of site provided by Atkinson Surveys.
- Townsville City Council Infrastructure Mapping Information.
- Townsville City Council Flood Map Overlays.
- QUDM 4th Edition 2017
- MUSIC Modelling Guidelines November 2018 (Water by Design)
- Rainfall and Meteorological Data by the Australia Bureau of Meteorology.
- Queensland Globe

2. Site Description

The site is located at 500-504 Ross River Road, Cranbrook and described as Lot 2 on SP130958 with a land area of 6,115m2. The site is currently zoned Low Density Residential within the Townsville City Council local government area and currently has three existing buildings/sheds on site.

Figure 2.1 – Locality Plan, cadastral boundaries and easement (Queensland Globe)

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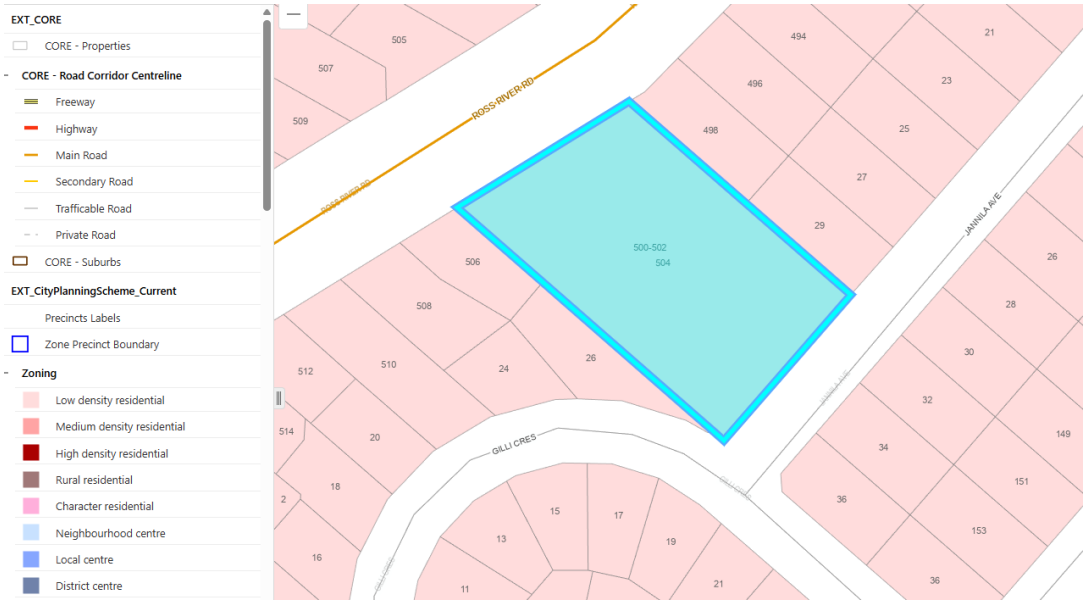

Figure 2.2 – Planning Zones (Townsville Maps – City Plan)

2.1 Easements

There are currently no easements that encumber the subject allotment.
There are currently no proposed road resumptions over the subject allotment.

2.2 Proposed Development

A copy of the Architectural drawings for the proposed development is provided in Appendix A.

The proposed 32 Unit Development consists of the following civil works: -

- minor earthworks for the new building pads, landscape areas, driveway and car parks including retaining walls
- the construction of the new 32 Units
- the construction of the new concrete pavement for the driveway and car parking accessing from Jannila Avenue
- the construction of the site's stormwater drainage system including stormwater quality improvement devices; and
- the construction of the landscaped areas.

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3. Earthworks

3.1 Existing Earthworks

A detailed survey has been undertaken by Atkinson Surveys for the extent of the proposed development area and a copy is provided in Appendix B.

The subject allotment's lowest level is approximately 13.35m AHD on the southern boundary of the property adjacent to Jannila Avenue and the highest level of approximately 14.20m AHD is approximately 35m in from the northern boundary adjacent to Ross River Road.

Approximately a third of the subject site slopes gently to the north from the ridgeline to Ross River Road. The balance two thirds of the allotment slopes gently south from the ridgeline to Jannila Avenue.

The adjacent allotments on the eastern and western side boundaries of the subject allotment, grade directly to Ross River Road or Jannila Avenue and therefore no provisions for accepting external runoff onto the subject allotment are required.

3.2 Proposed Site Earthworks

A copy of the Preliminary Engineering Services drawing for the proposed development is provided in Appendix C.

A Geotechnical Report was not available at the time of preparing this document.

Preliminary earthworks are based on the existing levels surveyed and the preliminary finished surface levels shown on the Preliminary Engineering Services drawing. The proposed levels shown on the drawing, when compared to the surveyed levels, indicate that generally there will be no more than 300mm cut or fill on site for the proposed housing development, driveway, car parks and landscaping, thereby negating the need for significant site earthworks.

The subject allotment is proposed to be developed with a concrete pavement (car parks and aisles) that will generally be provided with 2% crossfalls and longitudinal grading at 0.5% to stormwater drainage pits.

The landscaping buffer zones adjacent to the car parking will need to grade at a minimum of 1% back onto the driveway or kerbing to be collected by the proposed drainage system.

Geotechnical testing for CBR values for pavement design can be undertaken prior to construction commencing to confirm the pavement design.

3.3 Minimum Floor Levels

As indicated on the Townsville City Council flooding maps, the site is not subject to inundation from flooding in the defined flood event of 1% AEP. The Defined Flood Event Levels adjacent to the subject site are as follows: -

Ross River Road -

- Western side boundary - AEP 1% Flood – RL13.93m AHD
- Eastern side boundary - AEP 1% Flood – RL13.81m AHD

Janilla Avenue-

- Western side boundary - AEP 1% Flood – RL13.31m AHD
- Eastern side boundary – AEP 1% Flood – RL 13.30m AHD

Habitable floor levels for the units should be set a minimum of 300mm above the relevant Defined Flood Event (DFE).

4. Roadworks and Traffic Impacts

A Traffic Impact Assessment report will be provided under separate cover for this MCU Development Application.

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5. Stormwater Management Plan

5.1 Flood Hazard Overlay

In accordance with the Townsville City Plan – Flood Hazard Overlay (OM-06.1) the subject site is just on the edge of a low hazard category due to the coarseness of the grid used to undertake the modelling. The subject site is not subject to flooding in the 1% AEP event as the surveyed levels of the land confirm.

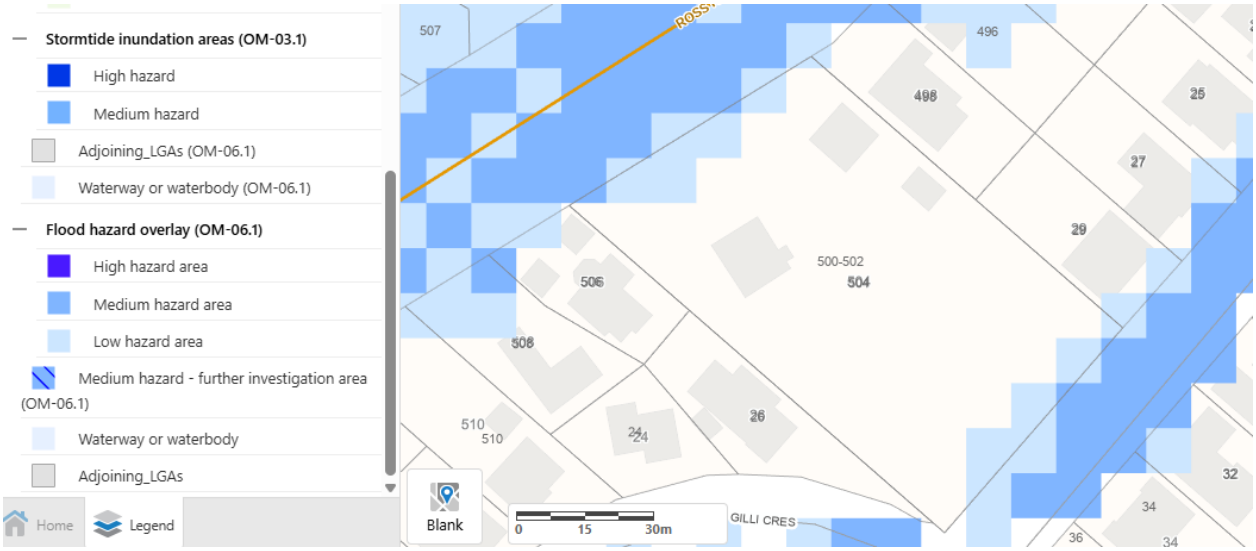

Figure 5.1 – AEP 1% Flood Hazard Overlay (OM-06.1) (TownsvilleMAPS – Townsville City Plan)

5.2 Coastal Hazard Overlay

In accordance with the Coastal Environment Overlay Code of the Townsville City Council Planning Scheme, the Defined Storm Tide Event (DSTE) level is RL4.5m AHD, within 100m of the coastline or RL3.9m AHD in other areas. Therefore, the subject allotment is not affected by DSTE as the minimum ground level on the site is RL13.3m AHD.

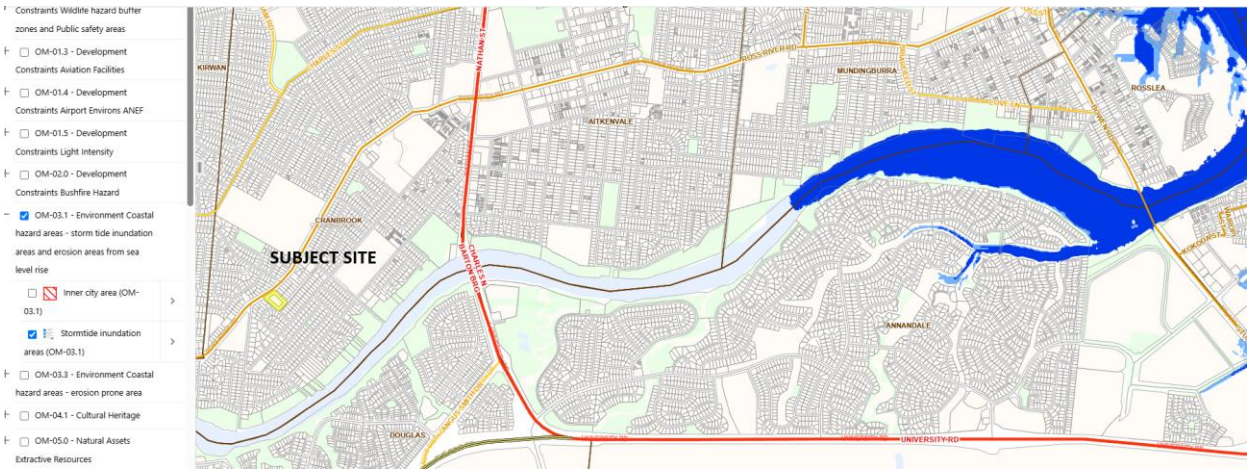

Figure 5.2 – Environment Coastal hazard areas – Storm Tide inundation (OM-03.1) (TownsvilleMAPS – Townsville City Plan)

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5.3 Existing Stormwater Infrastructure

The Lawful Points of Discharge for the subject site will be the Ross River Road and Jannila Avenue road reserves.

There is an existing 375mm dia. reinforced concrete stormwater pipe in Ross River Road with a USIL of 11.92m and a DSIL 11.7m. This stormwater pipe is in the shared parking and bike lane of Ross River Road. The stormwater pipe is connected to a side inlet drainage pit which is adjacent to the western boundary of the subject site. There is an existing stormwater manhole adjacent to the eastern side boundary of the subject site.

There is no existing stormwater infrastructure in Jannila Avenue as the subject allotment is at the top of the stormwater catchment. The first stormwater pit in Jannila Avenue is 140m to the east of the site.

There is an existing stormwater inlet pit in Gilli Crescent with an invert level of 12.12m that discharges into a 375mm stormwater pipe. However, this stormwater pipe services a different stormwater catchment than the subject allotment.

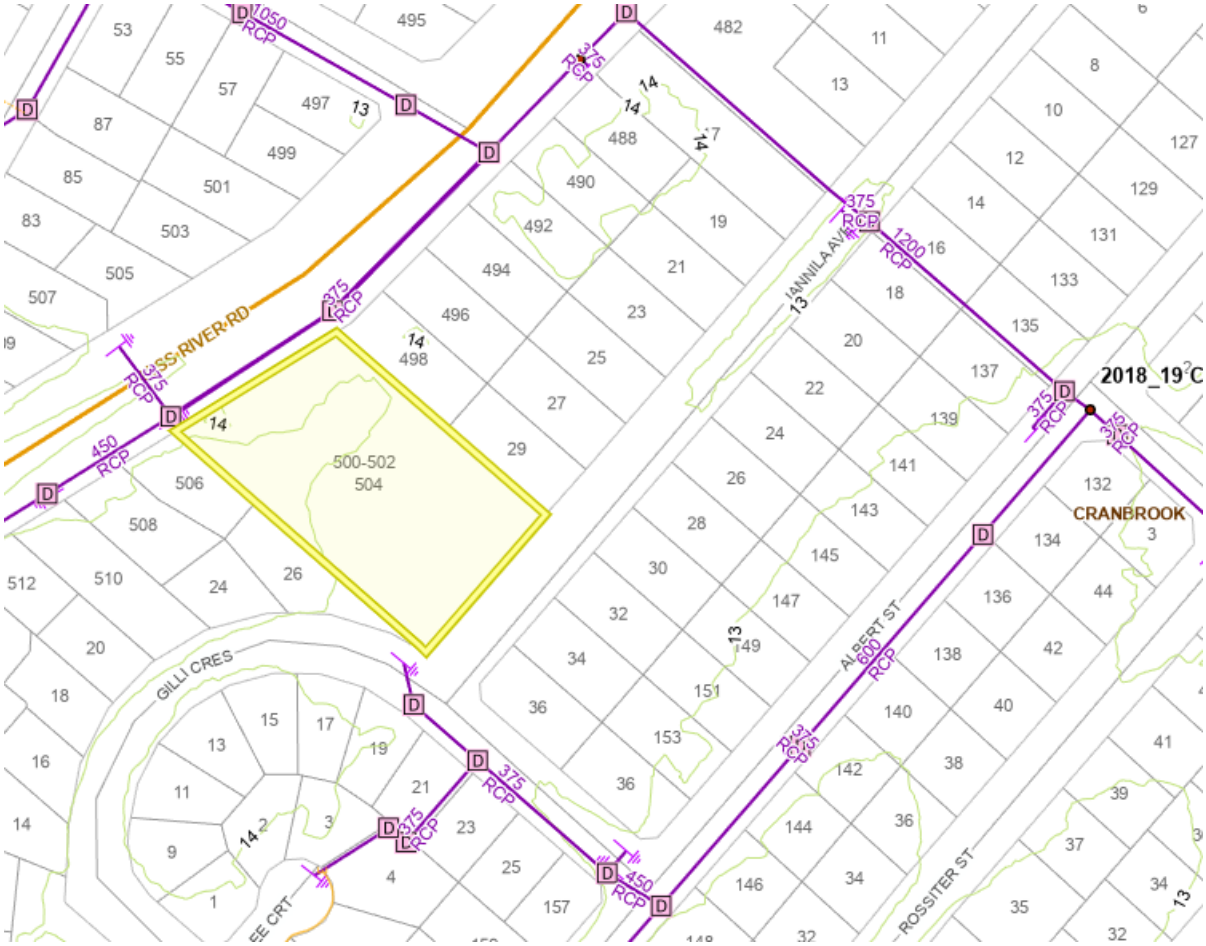

Figure 5.3 – Existing Stormwater Infrastructure (TownsvilleMAPS - Community)

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There is an existing northern stormwater catchment of 2,285m2 that discharges onto Ross River Road via overland flow and there is an existing southern stormwater catchment of 3,830m2 that discharges onto Jannila Avenue via overland flow.

Figure 5.4 – Existing Northern and Southern Stormwater Catchments

5.4 Site Stormwater Drainage

The preliminary stormwater drainage layout is illustrated on the Preliminary Engineering Services drawing provided in Appendix C.

The roofs, car parks, driveway and landscaped areas in the northern portion of the development are to be collected in a grated stormwater inlet pits containing Atlan Stormsacks and conveyed via stormwater pipes to an Atlan FlowFilter (1200/3 series) prior to discharging into the back of the existing side inlet pit in Ross River Road.

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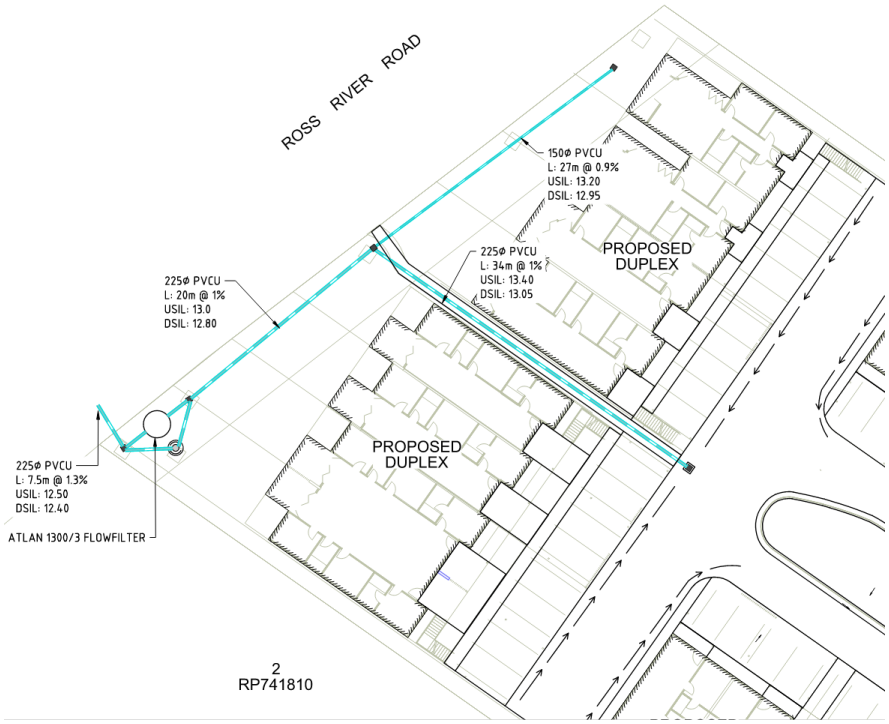

Figure 5.5 – Northern Stormwater Drainage

The roofs, car parks, driveway and community areas centrally located within the southern stormwater catchment are to be collected via overland flow into a trench grate containing Atlan FlowGuards and then discharged to the kerb and channel Jannila Avenue via galvanised RHS.

The roofs of the units and the landscaped areas at the rear of the units (eastern and western boundaries) located within the southern stormwater catchment are to be collected via overland flow into a kerb and channel containing Atlan FlowGuards and then discharged to the kerb and channel in Jannila Avenue via galvanised RHS.

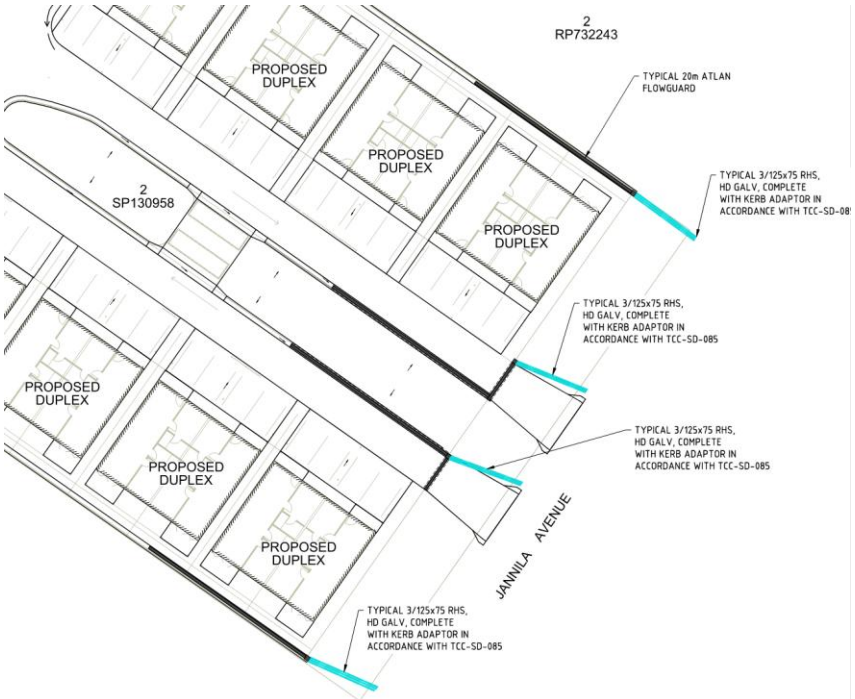

Figure 5.6 – Southern Stormwater Drainage

Full hydraulic design in accordance with QUDM will be undertaken during the detailed design phase for all the proposed stormwater infrastructure.

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5.5 Stormwater Runoff and Detention

The Townsville City Plan, *Schedule 6.4 Development Manual Planning Scheme Policy, SC6.4.9.3 Major and Minor system design,* prescribes the design parameters of an Urban Residential development to be 2-year ARI event for a Minor system and to be 100-year ARI for the Major system.

The 1-hour rainfall intensity for the 10-year ARI at the subject location in Townsville is 74mm/h.

In accordance with QUDM clause 4.6.4 the Standard Inlet for the developed catchment is unchanged for the pre-development (low density residential) and the post development (medium density residential) proposed Housing Development – 10 minutes.

The Townsville City Plan, *Schedule 6.4 Development Manual Planning Scheme Policy, Table SC6.4.9.2 – Fraction impervious for Land Use Zones,* prescribes the fraction impervious for Low Density Residential zoning of 0.65 and for a fraction impervious of 0.70 for a Medium Density Residential zoning.

With reference to the Architectural drawings 'Area Schedule' the grassed areas and garden beds make up 30.5% of the land area, giving a fraction impervious for the subject site 69.5%.

The pre-development (low density residential) Coefficient of Discharge (C_{10}) for the subject site, in accordance with QUDM Table *4.5.3 – Table of C_{10} Values,* based on a fraction impervious of 0.65 is 0.83.

The pre-development (medium density residential) Coefficient of Discharge (C_{10}) for the subject site, in accordance with QUDM Table *4.5.3 – Table of C_{10} Values,* based on a fraction impervious of 70% is 0.84.

The post development northern stormwater catchment of 2,247m2 will discharge via pits and pipes, directly into the existing stormwater system in Ross River Road during minor events. During major events the excess runoff will discharge onto Ross River Road via overland flow.

The post development southern stormwater catchment of 3,868m2 will discharge via overland flow on kerbs and concrete pavement, be collected in pits and discharged directly into the existing kerb and channel in Jannila Avenue during minor events. The southern catchment will be split into four smaller catchments to ensure at no time during the minor event is more than 30l/s discharged into the kerb and channel at one location. During major events the excess runoff will discharge onto Jannila Avenue via overland flow.

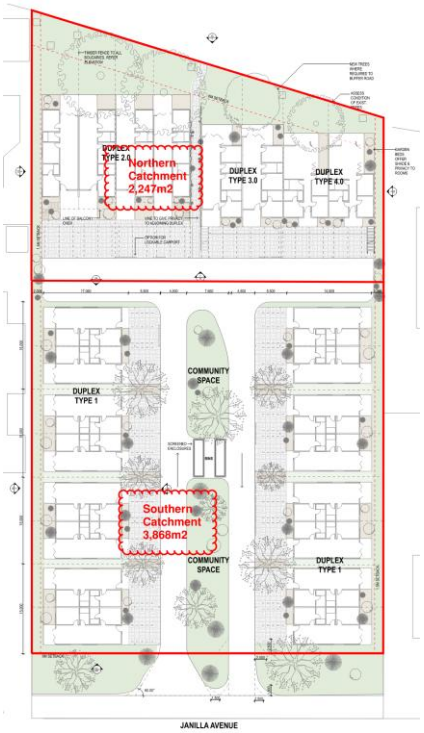

Figure 5.5 – Post Development - Northern and Southern Stormwater Catchments

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Based on the above information the pre-development and post-development discharge volumes from the subject site are provided below: -

Northern Catchment Pre-Development and Post-Development

Northern Catchment - Predevelopment							
Area (m^2)	(ha)	Impervious Area (%)		C_{10}	Time of Concentration (min)		
2285	0.229	0.65		0.83	10		
	C_1	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
	0.664	0.7055	0.7885	0.83	0.8715	0.9545	0.996
	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
	89.5	102	140	164	187	215	236 mm/hr
	Q_1	Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}
	0.038	0.046	0.070	0.086	0.103	0.130	0.149 m^3/s

Northern Catchment - Post-development							
Area (m^2)	(ha)	Impervious Area (%)		C_{10}	Time of Concentration (min)		
2247	0.225	0.7		0.84	10		
	C_1	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
	0.672	0.714	0.798	0.84	0.882	0.966	1
	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
	89.5	102	140	164	187	215	236 mm/hr
	Q_1	Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}
	0.038	0.045	0.070	0.086	0.103	0.130	0.147 m^3/s

With reference to the above stormwater runoff calculations for the northern catchment, it is noted that there is a decrease in post development runoff from the site of 1.0l/s in the minor event (2-year ARI) or a 2% decrease.

In the major event (100-year ARI) it is noted that there is a decrease in the post development runoff of 2.0l/s from the site or a 1.5% decrease.

As there is no increase in runoff from the proposed development in the northern catchment, stormwater detention measures are not required, as the peak discharges from the site are slightly less than that of pre-development.

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Southern catchment Pre-Development and Post-Development

Southern Catchment - Pre-development							
Area (m^2)	(ha)	Impervious Area (%)		C_{10}	Time of Concentration (min)		
3830	0.383	0.65		0.83	10		
	C_1	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
	0.664	0.7055	0.7885	0.83	0.8715	0.9545	0.996
	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
	89.5	102	140	164	187	215	236 mm/hr
	Q_1	Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}
	0.063	0.077	0.117	0.145	0.173	0.218	0.250 m^3/s

Southern Catchment - Post-development							
Area (m^2)	(ha)	Impervious Area (%)		C_{10}	Time of Concentration (min)		
3868	0.387	0.7		0.84	10		
	C_1	C_2	C_5	C_{10}	C_{20}	C_{50}	C_{100}
	0.672	0.714	0.798	0.84	0.882	0.966	1
	I_1	I_2	I_5	I_{10}	I_{20}	I_{50}	I_{100}
	89.5	102	140	164	187	215	236 mm/hr
	Q_1	Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}
	0.065	0.078	0.120	0.148	0.177	0.223	0.254 m^3/s

With reference to the above stormwater runoff calculations for the southern catchment, it is noted that there is an increase in post development runoff from the site of just 1.0l/s in the minor event (2-year ARI) or a 1.3% increase.

In the major event (100-year ARI) it is noted that there is an increase in the post development runoff from the site of just 4.0l/s or a 1.6% increase.

Given the increase in stormwater runoff from the southern catchment is minimal and the stormwater runoff must discharge into the kerb and channel in Jannila Avenue, as there is no existing stormwater infrastructure, stormwater detention measures are not considered necessary for this development.

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6. Stormwater Quality Management

In accordance with the requirements of the State Planning Policy – July 2017, the Assessment Benchmarks for Water Quality, the proposed development site is greater than 2,500m2 in size and will result in 6 or more dwellings. Therefore, the proposed development site exceeds the criteria for requiring permanent methods of stormwater quality control.

Assessment benchmarks – water quality

These performance outcomes apply to the following development applications, to the extent the SPP has not been identified in a local planning instrument as being appropriately integrated.

For receiving waters, a development application for:

(1) a material change of use for an urban purpose that involves premises 2500 metres² or greater in size and;

(a) will result in six or more dwellings; or

(b) will result in an impervious area greater than 25 per cent of the net developable area; or

(2) reconfiguring a lot for an urban purpose that involves premises 2500 metres² or greater in size and will result in six or more lots; or

(3) operational works for an urban purpose that involves disturbing a land area 2500 metres² or greater in size.

For water supply buffer areas, a development application:

(4) located wholly outside an urban area and relating to premises that is within, or partly within, a water supply buffer area, that involves:

(a) a material change of use for the intensive animal industry, medium and high-impact industry, noxious and hazardous industry, extractive industry, utility installation that involves sewerage services, drainage or stormwater services, waste management facilities, or motor sport facility; or

(b) reconfiguring a lot to create five or more additional lots if any resultant lot is less than 16 hectares in size, and any of the lots created will rely on on-site wastewater treatment.

The following requirements are assessment benchmarks for the development:

(1) Development is located, designed, constructed and operated to avoid or minimise adverse impacts on environmental values arising from:

(a) altered stormwater quality and hydrology

(b) waste water

(c) the creation or expansion of non-tidal artificial waterways

(d) the release and mobilisation of nutrients and sediments.

(2) Development achieves the applicable stormwater management design objectives outlined in tables A and B (appendix 2)

(3) Development in a water supply buffer area avoids adverse impacts on drinking water supply environmental values.

Further information in relation to these requirements is detailed in the water quality guidance material.

Figure 6.1 – State Planning Policy – Assessment Benchmarks

An Erosion and Sediment Control Plan (ESCP) for the site will be required during construction to minimise the risk of soil leaving the site. The ESCP and associated devices will be required to be implemented/installed prior to commencement of the new building and associated infrastructure until the landscaping is completed.

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6.1 Pollutants of Concern

The Townsville City Council Development Manual, SC6.4.10 Stormwater Quality, provides guidance on the types of pollutants likely to be generated from different developments. The pollutants most likely to be of concern for Commercial/Industrial developments are identified in the table below.

Pollutant	Development Phase	
	Construction	Operation
Litter	✓	✓
Sediment	✓	unlikely
Hydrocarbons (including oil and grease)	✓	✓
Toxic materials (e.g. cement slurry, asphalt primer, solvents)	✓	unlikely
pH altering substances (e.g. cement slurry and wash waters)	✓	unlikely
Oxygen demanding substances (organic and chemical matter)	possibly	unlikely
Nutrients (nitrogen and phosphorus)	✓	✓
Pathogens / Faecal coliforms (bacteria and viruses)	unlikely	unlikely
Heavy metals (often associated with fine sediment	unlikely	unlikely
Surfactants (e.g. detergents from car washing)	unlikely	possibly
Thermal pollution (heat)	unlikely	unlikely

Table 6.1 Pollutants likely to be of most concern

6.2 Design Objectives for Water Management

The Water Quality Objectives for the proposed development in Townsville are listed in the table below.

Parameter	Statistic	Load Based Reduction	Water Quality Objectives
Total Suspended Solids (TSS)	Mean Range	80%	Less than 5mg/L
Total Phosphorous (TP)	Mean Range	65%	Less than 0.01 to 0.05mg/L
Total Nitrogen (TN)	Mean Range	40%	Less than 0.2 to 0.5mg/L
Gross Pollutants	-	90%	Retention of litter greater than 50mm for flows up to the 3-month ARI peak flow
PH	Mean Range	-	Between 7 and 8

Table 6.2 Water Quality Objectives for Townsville City Council – Dry Tropics (TCC Development Manual SC6.4.10.2(3)

6.3 Proposed Stormwater Treatment Train analysis

The proposed 32 Unit development site has sufficient area available to dedicate to stormwater quality improvement devices.

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Northern Catchment

The roofs, car parks, driveway and landscaped areas in the northern portion of the development are to be collected in a grated stormwater inlet pits containing Atlan Stormsacks and conveyed via stormwater pipes to an Atlan FlowFilter (1200/3 series) prior to discharging into the back of the existing side inlet pit in Ross River Road.

Southern Catchment

The roofs, car parks, driveway and community areas centrally located within the southern stormwater catchment are to be collected via overland flow into a trench grate containing Atlan FlowGuards and then discharged to the kerb and channel Jannila Avenue via galvanised RHS.

The roofs of the units and the landscaped areas at the rear of the units (eastern and western boundaries) located within the southern stormwater catchment are to be collected via overland flow into a kerb and channel containing Atlan FlowGuards and then discharged to the kerb and channel in Jannila Avenue via galvanised RHS.

The proprietary stormwater treatment devices included above in the design solutions, have been independently verified by Stormwater Australia SQIDEP (Verification Certificate) and the certified performance metrics are reflected in the MUSIC modelling.

6.4 Music Model Parameters

6.4.1 Model Parameters

Input	Data Used
Rainfall Station	32040 TOWNSVILLE
Rainfall Period	01/01/1995 – 31/12/2005
Mean Annual Rainfall (mm)	976mm
Evapotranspiration	1201mm
Model Timestep	6 minutes

Table 6.3 - Basic MUSIC Model Parameters

6.4.2 Rainfall & Runoff Parameters

Parameter	Roof/ Road/Ground Level
Rainfall Threshold (mm/day)	1
Soil Storage Capacity (mm)	400
Soil Initial Storage (% of Capacity)	10
Field Capacity (mm)	200
Infiltration Capacity coefficient - a	211
Infiltration Capacity exponent - b	5.0
Initial Depth (mm)	50
Daily Recharge Rate (%)	28
Daily Baseflow Rate (%)	27
Daily Deep Seepage Rate (%)	0

Table 6.4 - Water by Design recommended MUSIC Rainfall – Runoff Parameters (Urban Residential SEQ - Table A1.2) – adopted for

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6.4.3 Pollution Generation

In MUSIC, stormwater quality is characterised by event mean concentrations (EMC) for storm flows and base flows. In this study, the EMC's were adopted from Water by Design MUSIC Modelling Guidelines. The pollutants of concern that were assessed include total suspended solids (TSS), total phosphorous (TP) and total nitrogen (TN). The quality of stormwater runoff is characterised by inputting event mean concentrations (EMC) for storm flow and base flow conditions as well as the standard deviation of each EMC.

Pollutant concentrations are based on Urban Residential land use parameters.

Flow Type	Surface Type	TSS (log_{10} values)		TP (log_{10} values)		TN (log_{10} values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Urban Residential	Baseflow	1.00	0.34	-0.97	0.31	0.20	0.20
	Stormflow	2.18	0.39	-0.47	0.32	0.26	0.23

Table 6.5 Water by Design MUSIC Modelling Pollutant Export Parameters for Lumped Catchment Land Uses – MUSIC Modelling Guidelines - Table 3.8

6.4.4 Results

Northern Catchment

The indicative layout of the MUSIC model, treatment train parameters and results for the northern catchment are shown below.

Figure 6.2 MUSIC Model (Northern Catchment)

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	Sources	Residual Load	% Reduction
Flow (ML/yr)	1.72	1.72	0
Total Suspended Solids (kg/yr)	383	57.5	85
Total Phosphorus (kg/yr)	0.758	0.273	64
Total Nitrogen (kg/yr)	3.52	1.33	62.1
Gross Pollutants (kg/yr)	31.7	0.0758	99.8

Figure 6.3 MUSIC Modelling – Treatment Train Effectiveness (northern catchment)

The proposed treatment train for the northern catchment consists of 3 Atlan Stormsacks (one in each proposed inlet pit) and an Atlan FlowFilter (1200/3) containing 3 cartridges capable of processing 4l/s each or 12l/s total with a high flow bypass.

Southern Catchment

The indicative layout of the MUSIC model, treatment train parameters and results for the southern catchment are shown below.

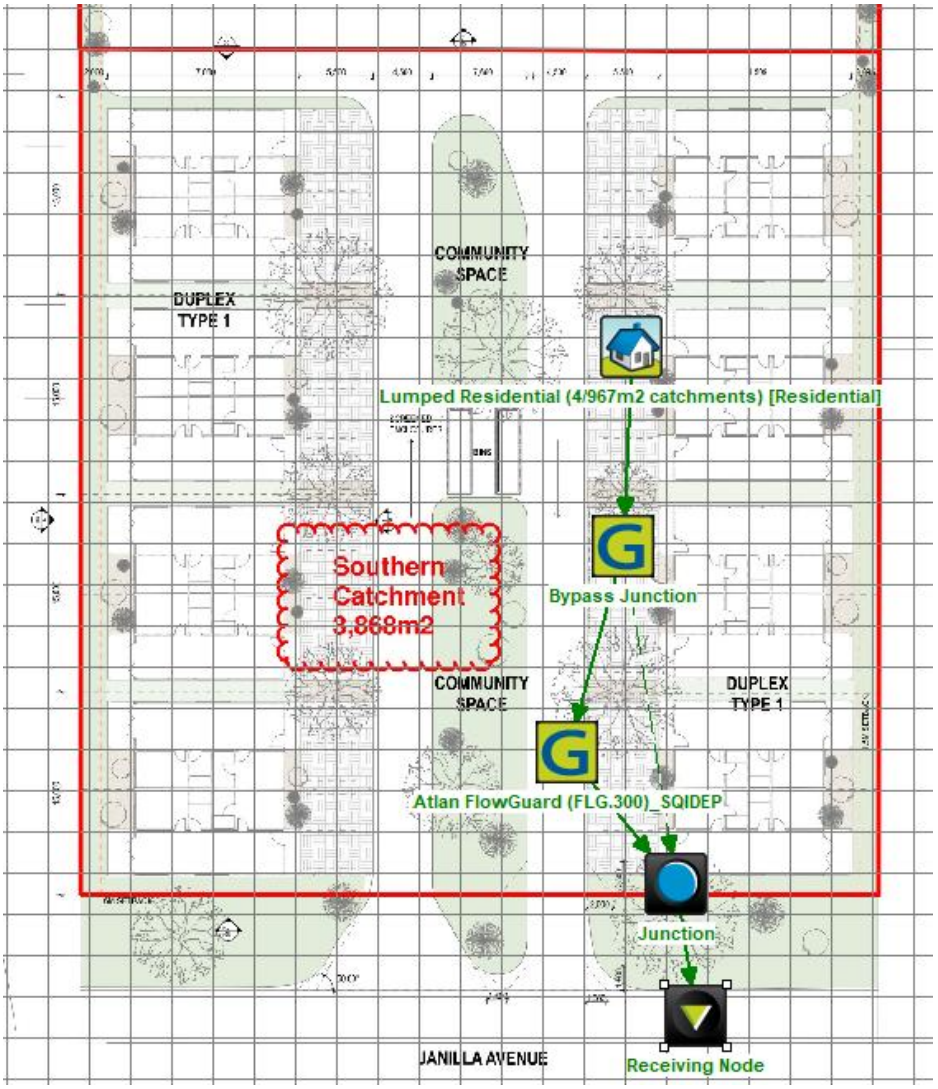

Figure 6.4 MUSIC Model (Southern Catchment)

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	Sources	Residual Load	% Reduction
Flow (ML/yr)	0.73	0.73	0
Total Suspended Solids (kg/yr)	161	32.2	80
Total Phosphorus (kg/yr)	0.313	0.116	62.9
Total Nitrogen (kg/yr)	1.53	0.598	61
Gross Pollutants (kg/yr)	13.5	0.211	98.4

Figure 6.5 MUSIC Modelling – Treatment Train Effectiveness (southern catchment)

The proposed treatment train for the southern catchment consists of 80m of Atlan FlowGuard (300mm) which will be separated into 4 separate catchments (20m of FlowGuard in each catchment).

While the modelled treatment trains indicate that the stormwater quality outcomes for Townsville City Council can be achieved for the proposed 32 Unit development, equivalent alternative proprietary products may be investigated and adopted during detailed design, provided the required outcomes are achieved.

The proposed treatment trains will reduce pollutant loadings to the extent specified by the Townsville City Council Stormwater Quality Guidelines.

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7. Water and Sewerage

7.1 Water Connection

In accordance with the information provided on TownsvilleMAPS – Community, the subject site is serviced by an existing DN20mm water service on the northern boundary which in turn is connected to the existing DN300mm water main in Ross River Road.

During the detailed design phase of the project, the Hydraulic Consultant will confirm the size of the larger water connection required for the proposed housing development based on the actual site water demands.

A fire hydrant exists on the 300mm water main in the verge of Ross River Road and is generally central to the subject allotment.

Another fire hydrant exists on the 100mm reticulation main on the opposite side of Jannila Avenue and is slightly west of central to the subject allotment.

The location of the existing water connection and fire hydrants is provided on the Preliminary Engineering Services drawing provided in Appendix C.

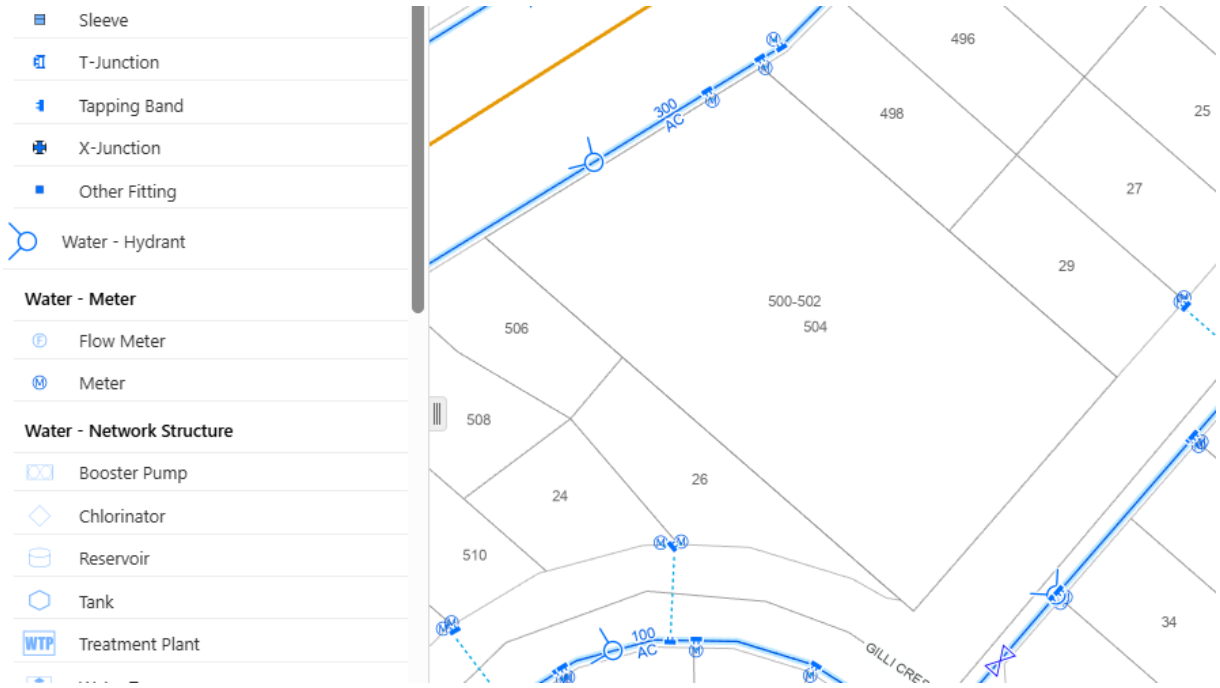

Figure 7.1 – TownsvilleMAPS existing water layout

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7.2 Sewer Connection

In accordance with the information provided on the TownsvilleMAPS - Community, the subject site is currently serviced from a 100mm house connection from the existing sewer manhole 3/L1A1C which is contained in the adjacent easterly allotment which fronts onto Jannila Avenue.

Sewer manhole 3/L1A1C is the top of the sewer catchment and connects to an existing 150mm AC/FRC sewer with an USIL of 11.884m.

A new 150mm dia. stub connection is required to service the proposed housing development and will replace the existing 100mm house connection.

Given the minimum Finished Floor Level of RL13.60 for the proposed houses adjacent to Jannila Avenue and the invert level of the new 150mm sewer connection will be IL 11.94m, there is sufficient depth to grade the internal sewers at 1 in 60 to the proposed new sewer connection.

The Hydraulic Consultant will determine the final layout of the internal sewers to service the proposed housing development during the detailed design phase of the proposed development.

The location of the existing sewer, the existing sewer manhole 3/L1A1C and the proposed new sewer connection are provided on the Preliminary Engineering Services drawing provided in Appendix C.

Figure 7.2 – TownsvilleMAPS existing sewerage layout

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8. Discussion / Conclusion

As demonstrated within the Report, the proposed Housing development can be undertaken, and a summary of the requirements are as follows: -

- The subject site is not affected by the Defined Flood Event.
- The subject allotment is not affected by the Defined Storm Tide Event (DSTE) – 3.9m
- The Housing development minimum finished floor levels (FFL) are: -
  - Houses fronting Ross River Road – 13.93m + 0.3m = 14.23m
  - Houses fronting Jannila Avenue – 13.31m + 0.3m = 13.61m
- The Minor Design Event is ARI 2 year
- The Major Design Event is ARI 100 year
- No detention is required
- The site does require Stormwater Quality Treatment as per the State Planning Policy
- The Legal Points of Discharge is Ross River Road and Jannila Avenue road reserves.

Based on our investigative works, we consider that Council has no impediment to the approval of this development within the context of engineering issues. We therefore recommend that Council approves the application subject to reasonable, relevant, equitable and justifiable conditions.

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9. APPENDIX A – Architects - Proposed Development Layout

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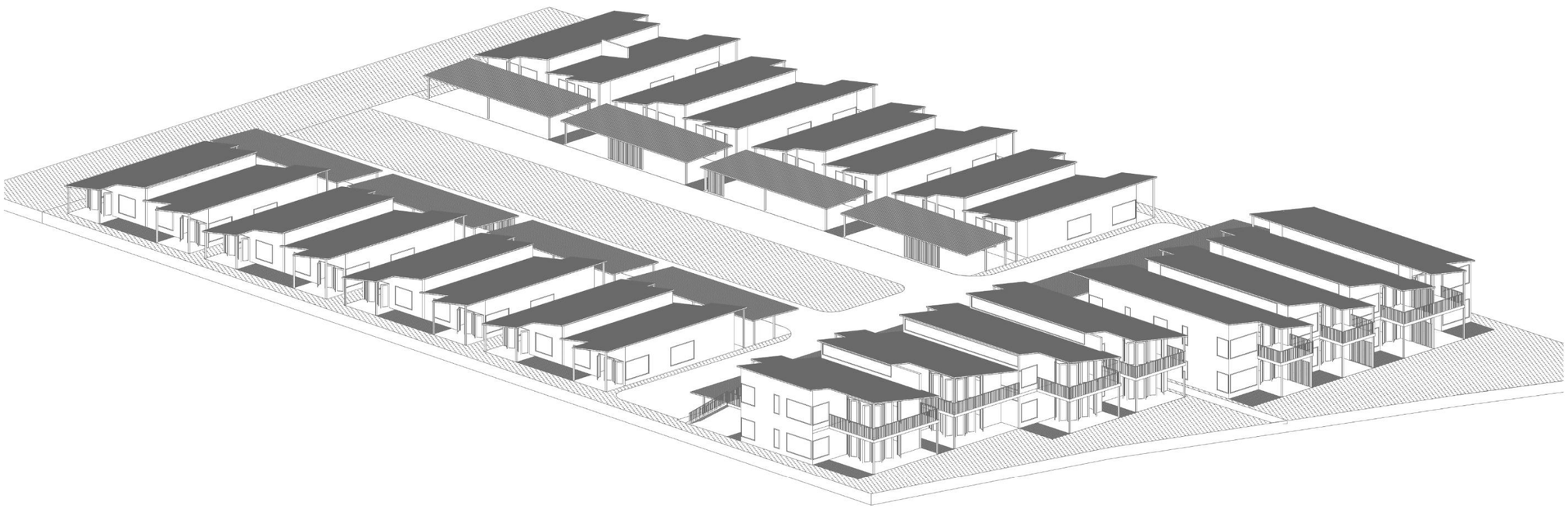
Version: 1, Version Date: 08/08/2025



1.AXONOMETRIC VIEW

2. PRELIMINARY RENDERS

500 - 504 Ross River Rd
Cranbrook
Kaenetto Investments

PRELIMINARY
CONCEPT

DRAWING NO.
01

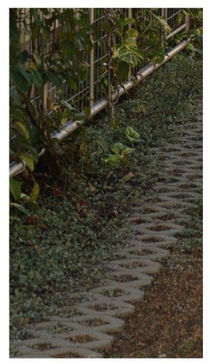
Document Set ID: 27418124
Version: 1, Version Date: 08/08/2025

KEY PRINCIPALS

LIGHT	Sawtooth roof allows central rooms (first floor) a high-level window & light Plans feature maximum north openings
COOLTH	Shade buildings with (low-maintenance) native planting Increase green space to reduce heat island effect Exposed concrete as thermal mass Plans allow cross-ventilation
ROBUST & COST EFFECTIVE	Limit additional materials to reduce trades required and increase building longevity Simple materiality (concrete, FC sheet, strategic use of timber) to reduce cost
WATER	Permeable surfaces to support drainage in tropical weather Opportunity for water collection for greenspace maintenance
COMMUNITY WELL-BEING	Light, ventilated buildings Front patios allow greater connection Neighbourhood pride - strategic use of timber to elevate duplex appearance

shade & privacy

permeable



robust

elevated appearance

500 - 504 Ross River Rd
Cranbrook
Kaenetto Investments

PRELIMINARY
CONCEPT

DRAWING NO.
02

Document Set ID: 27418124
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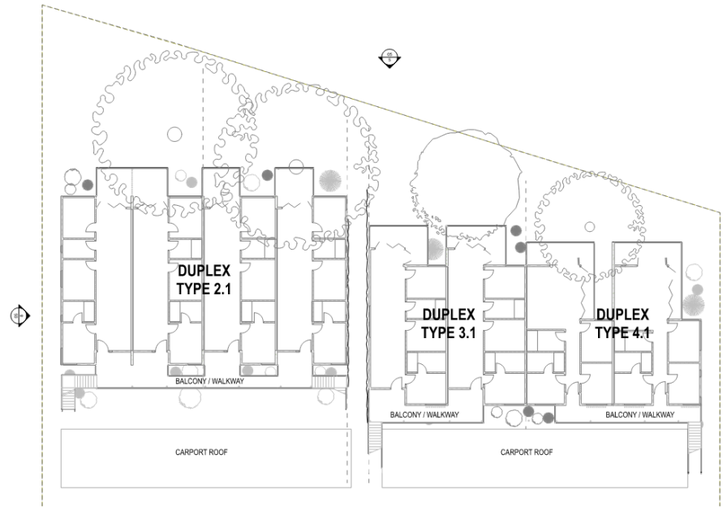
1. SITE PLAN 1:250 @ A1



1. FIRST FLOOR 1:250 @ A1

AREA SCHEDULE

TOTAL AREA	6,106 M2		
GFA			
DUPLEX TYPE 1 (X8)	1,387.7M2	(173.5M2 EA)	22%
DUPLEX TYPE 2 (X4)	882M2	(220.8M2 EA)	14%
DUPLEX TYPE 3 (X2)	442M2	(221M2 EA)	8%
DUPLEX TYPE 4 (X2)	424M2	(212M2 EA)	6%
TOTAL DUPLEX	3,127.7M2		51%
PRIVATE OPEN SPACE			
DUPLEX TYPE 1 (X8)	30M2 EA		
DUPLEX TYPE 2 (X4)	49M2 + EA		
DUPLEX TYPE 3 (X2)	50M2 + EA		
DUPLEX TYPE 4 (X2)	55M2+ EA		
ROAD	1057M2		17.5%
SHARED PATH	107M2		1%
PARKING	860M2		14%
GRASS AREA	1,423M2 (388M2 SHARED COMMUNITY)		25%
GRAVEL GARDEN BEDS	330M2		5.5%
TOTAL RESIDENTS	80		
TOTAL CARPARKS	49 (INCLUDING VISITOR)		

*SURPLUS EFFICIENCY DUE TO 2ND STORY DUPLEX - EXCEEDS 100% OF GROUND SPACE

500 - 504 Ross River Rd
Cranbrook
Kaenetto Investments

PRELIMINARY
SITE PLAN

DRAWING NO.
03

Document Set ID: 27418124
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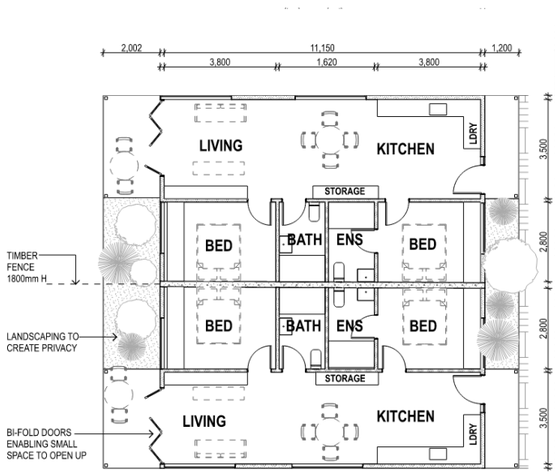
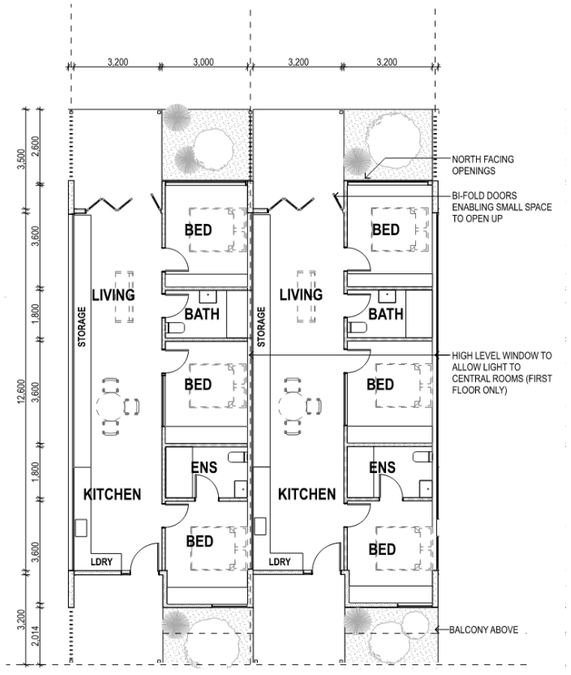
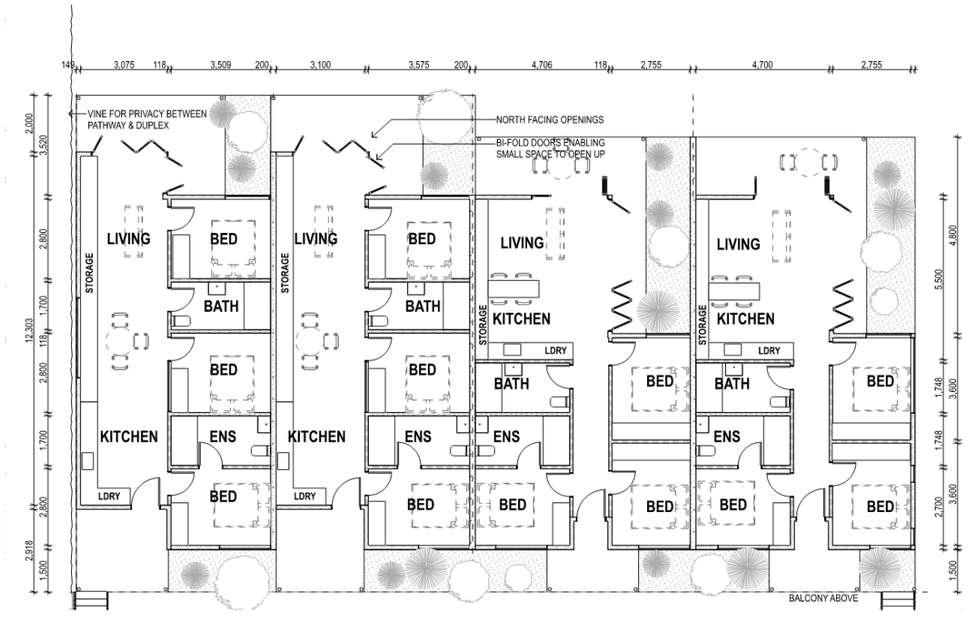


1. FLOOR PLAN - DUPLEX TYPE 1
1:100 @ A1



2. FLOOR PLAN - DUPLEX TYPE 2
1:100 @ A1



3. FLOOR PLAN - DUPLEX TYPE 3
1:100 @ A1

4. FLOOR PLAN - DUPLEX TYPE 4
1:100 @ A1

500 - 504 Ross River Rd
Cranbrook
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PRELIMINARY
FLOOR PLANS

DRAWING NO.
04

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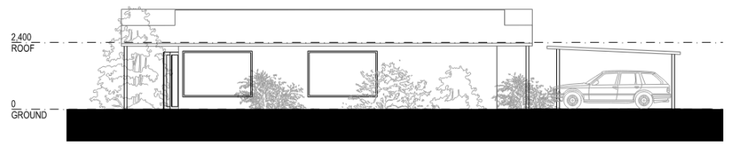
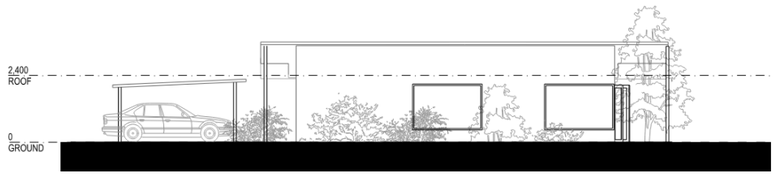
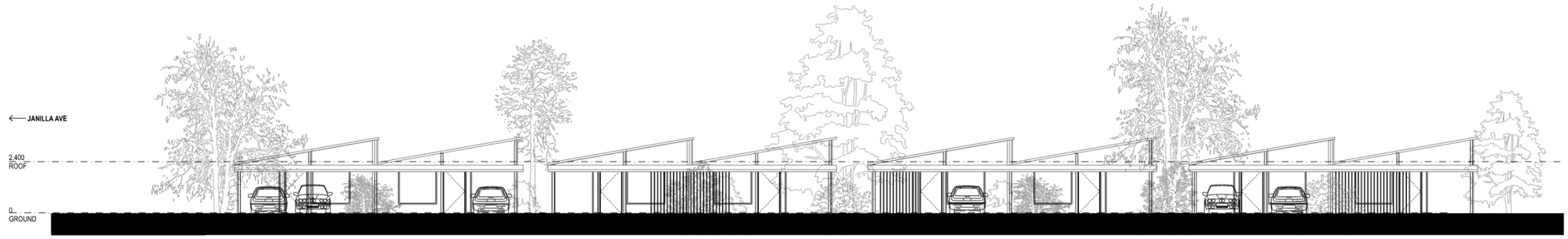


1. DUPLEX TYPE 1 - SOUTH ELEVATION
1:100 @ A1



2. DUPLEX TYPE 1 - NORTH ELEVATION
1:100 @ A1



3. DUPLEX TYPE 1 - EAST ELEVATION
1:100 @ A1

4. DUPLEX TYPE 1 - WEST ELEVATION
1:100 @ A1

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Cranbrook

Kaenetto Investments

PRELIMINARY
DUPLEX TYPE 1
ELEVATIONS
DRAWING NO.
06

Document Set ID: 27418124
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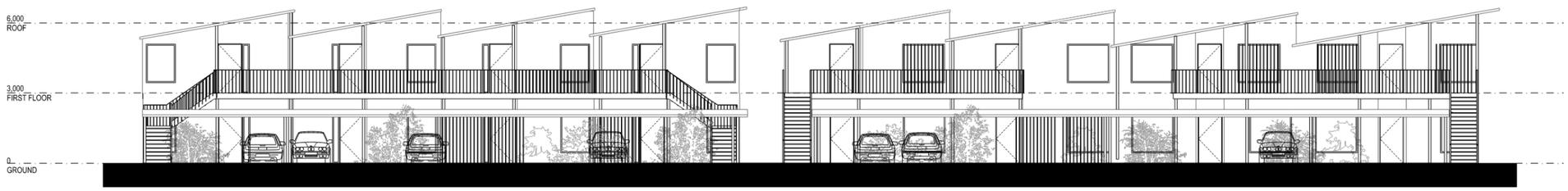
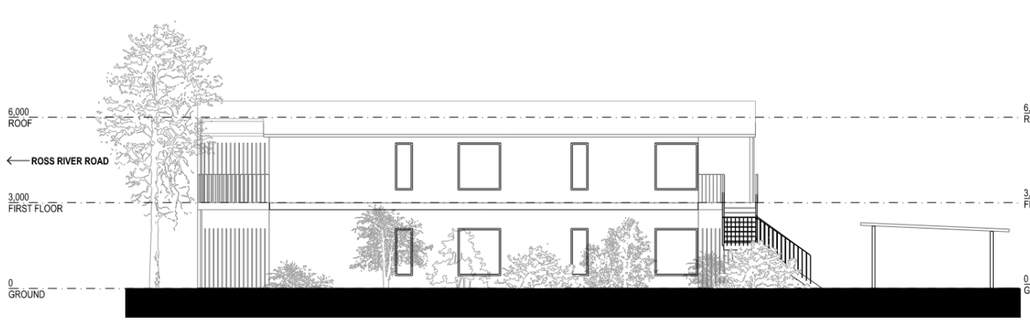
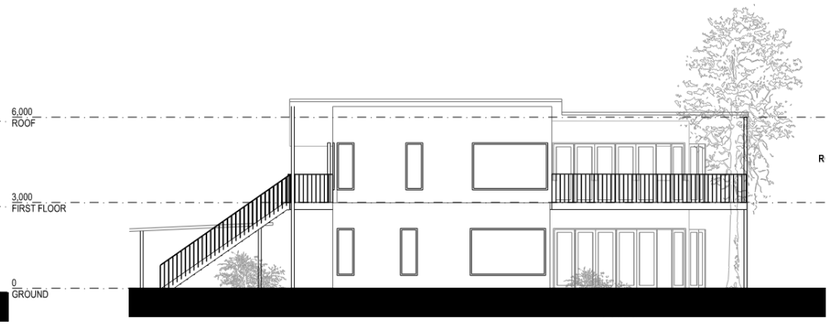
1. DUPLEX TYPE 2, 3, 4 NORTH ELEVATION
1:100 @ A1



2. DUPLEX TYPE 2, 3, 4, SOUTH ELEVATION
1:100 @ A1



3. DUPLEX TYPE 4, WEST ELEVATION
1:100 @ A1



4. DUPLEX TYPE 4, EAST ELEVATION
1:100 @ A1

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PRELIMINARY
DUPLEX TYPE 2, 3, 4
ELEVATIONS
DRAWING NO.
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500 - 504 Ross River Rd
Cranbrook
Kaenetto Investments

PRELIMINARY
CONCEPT

DRAWING NO.
07

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10. APPENDIX B – Detailed Survey

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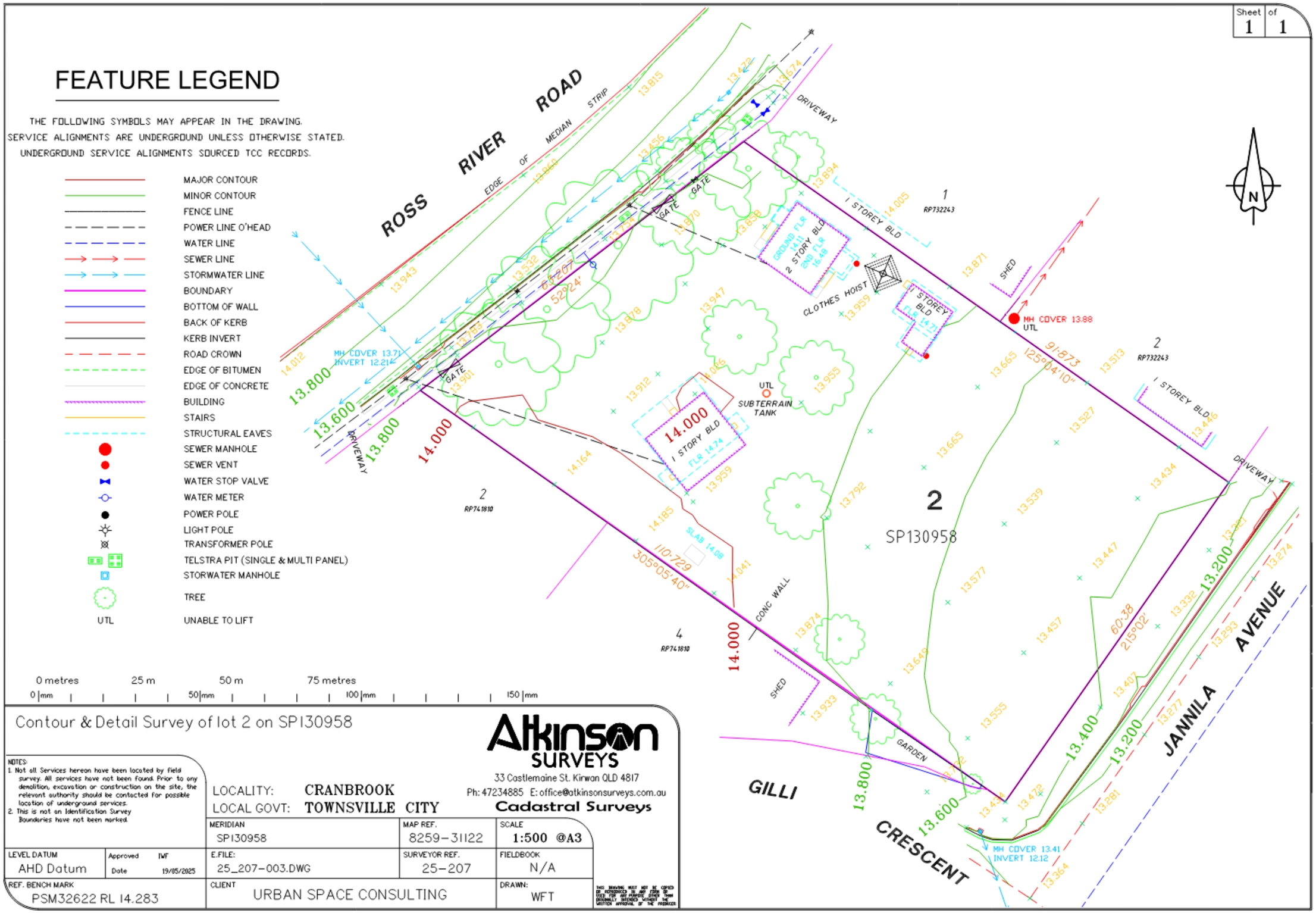

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11. APPENDIX C – Preliminary Engineering Services Drawing

Document Set ID: 27418124
Version: 1, Version Date: 08/08/2025

NOTES:

FOR OVERARCHING NOTES REFER PROJECT SPECIFICATIONS.

LEGEND:

- EXISTING UNDERGROUND ELECTRICITY
- EXISTING OVERHEAD ELECTRICITY
- EXISTING UNDERGROUND TELECOMMUNICATIONS
- EXISTING UNDERGROUND NBN
- EXISTING WATER MAIN
- EXISTING STORMWATER DRAINAGE
- EXISTING SEWER MAIN
- EXISTING LOT BOUNDARY
- EXISTING LOT EASEMENT
- EXISTING OVERLAND FLOW
- EXISTING TOE OF BATTER
- EXISTING TOP OF BATTER
- EXISTING ROAD CENTRELINE
- EXISTING EDGE OF BITUMEN
- EXISTING FENCE
- EXISTING BUILDING
- PROPOSED OVERLAND FLOW
- PROPOSED TOE OF BATTER
- PROPOSED TOP OF BATTER
- PROPOSED BUILDING
- PROPOSED STORMWATER DRAINAGE, REFER STORMWATER LAYOUT PLAN FOR DETAILS
- PROPOSED CONTOUR (0.1m CONTOUR INTERVAL)
- BCK — PROPOSED BARRIER KERB AND CHANNEL REFER TCC-SD-020 FOR DETAILS
- DD2 — PROPOSED DISH DRAIN (600mm) REFER TCC-SD-020 FOR DETAILS
- PLXX.XX — SPOT LEVEL AT PAVEMENT
- FSXX.XX — SPOT LEVEL AT FINISHED SURFACE
- TOGXX.XX — SPOT LEVEL AT TOP OF GRATE
- TOWXX.XX — SPOT LEVEL AT TOP OF WALL
- BOWXX.XX — SPOT LEVEL AT BOTTOM OF WALL
- ILXX.XX — SPOT LEVEL AT INVERT
- ExXX.XX — SPOT LEVEL AT EXISTING

FOR CONTINUATION REFER C402

HATCHING LEGEND:

- EXTENT OF CONCRETE PATHWAY, REFER PROJECT SPECIFICATIONS FOR DETAILS.
- EXTENT OF CONCRETE PAVEMENT – MEDIUM DUTY, REFER PROJECT SPECIFICATIONS FOR DETAILS.
- EXTENT OF LANDSCAPING AREA, REFER TO ARCHITECTS PLANS FOR DETAILS.
- EXTENT OF PROPOSED BUILDING, REFER ARCHITECTS PLANS FOR DETAILS.
- EXTENT OF COUNCIL PAVEMENT, REFER COUNCIL STANDARD DRAWINGS FOR DETAILS.

MINIMUM FINISHED FLOOR LEVELS:

ROSS RIVER ROAD SIDE:
300mm ABOVE THE 1% AEP FLOOD LEVEL.
13.930m + 0.300m = 14.230m AHD

JANILLA AVENUE SIDE:
300mm ABOVE THE 1% AEP FLOOD LEVEL.
13.310m + 0.300m = 13.610m AHD

ATTENTION: FOR BEST RESULTS AND ACCURATE UNDERSTANDING OF THESE DRAWINGS, PLEASE PRINT IN COLOUR.

LEVEL DATUM

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LEVEL DATUM RL14.283 AHD DERIVED
SITE COORDINATES E473479.212 N7864859.714

AMENDMENTS

Rev:	Date:	Description:	By:	Appd:
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IN ASSOCIATION WITH

KAENETTO INVESTMENTS

500 ROSS RIVER ROAD CRANBROOK
500 - 504 ROSS RIVER RD, CRANBROOK

FINISHED LEVELS PLAN - SHEET 1

STP CONSULTANTS
BRISBANE CAIRNS ROCKHAMPTON TOWNSVILLE MACKAY WHITSUNDAYS
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Drawn: DR
Approved: ENG.
RPEQ No: RPEQ.

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Version: 1, Version Date: 08/08/2025

FOR CONTINUATION REFER C403

FOR CONTINUATION REFER C401

NOTES:

FOR OVERARCHING NOTES REFER PROJECT SPECIFICATIONS.

LEGEND:

- EXISTING UNDERGROUND ELECTRICITY
- EXISTING OVERHEAD ELECTRICITY
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- DD2 — PROPOSED DISH DRAIN (600mm) REFER TCC-SD-020 FOR DETAILS
- PLXX.XX — SPOT LEVEL AT PAVEMENT
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- EXXX.XX — SPOT LEVEL AT EXISTING

HATCHING LEGEND:

- EXTENT OF CONCRETE PATHWAY, REFER PROJECT SPECIFICATIONS FOR DETAILS.
- EXTENT OF CONCRETE PAVEMENT - MEDIUM DUTY, REFER PROJECT SPECIFICATIONS FOR DETAILS.
- EXTENT OF LANDSCAPING AREA, REFER TO ARCHITECTS PLANS FOR DETAILS.
- EXTENT OF PROPOSED BUILDING, REFER ARCHITECTS PLANS FOR DETAILS.
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JANILLA AVENUE SIDE:
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13.310m + 0.300m = 13.610m AHD

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LEVEL DATUM RL14.283 AHD DERIVED
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IN ASSOCIATION WITH

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500 ROSS RIVER ROAD CRANBROOK
500 - 504 ROSS RIVER RD, CRANBROOK

FINISHED LEVELS PLAN - SHEET 2

STP CONSULTANTS
BRISBANE CAIRNS ROCKHAMPTON TOWNSVILLE MACKAY WHITSUNDAYS
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Drawn: DR
Approved: ENG.
RPEQ No: RPEQ.

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NOTES:

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IN ASSOCIATION WITH

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500 - 504 ROSS RIVER RD, CRANBROOK

FINISHED LEVELS PLAN - SHEET 3

STP CONSULTANTS
BRISBANE CAIRNS ROCKHAMPTON
TOWNSVILLE MACKAY WHITSUNDAYS
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Approved: ENG.
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Job No:	Drawing No:	Rev:
STP25-0597	C403	A

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Document Set ID: 27418124
Version: 1, Version Date: 08/08/2025

FOR CONTINUATION REFER C403

NOTES:

FOR OVERARCHING NOTES REFER PROJECT SPECIFICATIONS.

LEGEND:

- EXISTING UNDERGROUND ELECTRICITY
- EXISTING OVERHEAD ELECTRICITY
- EXISTING UNDERGROUND TELECOMMUNICATIONS
- EXISTING UNDERGROUND NBN
- EXISTING WATER MAIN
- EXISTING STORMWATER DRAINAGE
- EXISTING SEWER MAIN
- EXISTING LOT BOUNDARY
- EXISTING LOT EASEMENT
- EXISTING OVERLAND FLOW
- EXISTING TOE OF BATTER
- EXISTING TOP OF BATTER
- EXISTING ROAD CENTRELINE
- EXISTING EDGE OF BITUMEN
- EXISTING FENCE
- EXISTING BUILDING
- PROPOSED OVERLAND FLOW
- PROPOSED TOE OF BATTER
- PROPOSED TOP OF BATTER
- PROPOSED BUILDING
- PROPOSED STORMWATER DRAINAGE, REFER STORMWATER LAYOUT PLAN FOR DETAILS
- PROPOSED CONTOUR (0.1m CONTOUR INTERVAL)
- BCK — PROPOSED BARRIER KERB AND CHANNEL REFER TCC-SD-020 FOR DETAILS
- DD2 — PROPOSED DISH DRAIN (600mm) REFER TCC-SD-020 FOR DETAILS
- PLXX.XX — SPOT LEVEL AT PAVEMENT
- FSXX.XX — SPOT LEVEL AT FINISHED SURFACE
- TOGXX.XX — SPOT LEVEL AT TOP OF GRATE
- TOWXX.XX — SPOT LEVEL AT TOP OF WALL
- BOWXX.XX — SPOT LEVEL AT BOTTOM OF WALL
- ILXX.XX — SPOT LEVEL AT INVERT
- ExXX.XX — SPOT LEVEL AT EXISTING

HATCHING LEGEND:

- EXTENT OF CONCRETE PATHWAY, REFER PROJECT SPECIFICATIONS FOR DETAILS.
- EXTENT OF CONCRETE PAVEMENT - MEDIUM DUTY, REFER PROJECT SPECIFICATIONS FOR DETAILS.
- EXTENT OF LANDSCAPING AREA, REFER TO ARCHITECTS PLANS FOR DETAILS.
- EXTENT OF PROPOSED BUILDING, REFER ARCHITECTS PLANS FOR DETAILS.
- EXTENT OF COUNCIL PAVEMENT, REFER COUNCIL STANDARD DRAWINGS FOR DETAILS.

MINIMUM FINISHED FLOOR LEVELS:

ROSS RIVER ROAD SIDE:
300mm ABOVE THE 1% AEP FLOOD LEVEL.
13.930m + 0.300m = 14.230m AHD

JANILLA AVENUE SIDE:
300mm ABOVE THE 1% AEP FLOOD LEVEL.
13.310m + 0.300m = 13.610m AHD

ATTENTION: FOR BEST RESULTS AND ACCURATE UNDERSTANDING OF THESE DRAWINGS, PLEASE PRINT IN COLOUR.

LEVEL DATUM

PSM32622
LEVEL DATUM RL14.283 AHD DERIVED
SITE COORDINATES E473479.212 N7864859.714

AMENDMENTS

Rev:	Date:	Description:	By:	Appd:
A	26.06.25	SD ISSUE	LJM	PP

IN ASSOCIATION WITH

KAENETTO INVESTMENTS

500 ROSS RIVER ROAD CRANBROOK
500 - 504 ROSS RIVER RD, CRANBROOK

FINISHED LEVELS PLAN - SHEET 4

STP CONSULTANTS
BRISBANE CAIRNS ROCKHAMPTON TOWNSVILLE MACKAY WHITSUNDAYS
www.stpconsultants.com.au 07 3539 8300

Design: DES
Drawn: DR
Approved: ENG.
RPEQ No: RPEQ.

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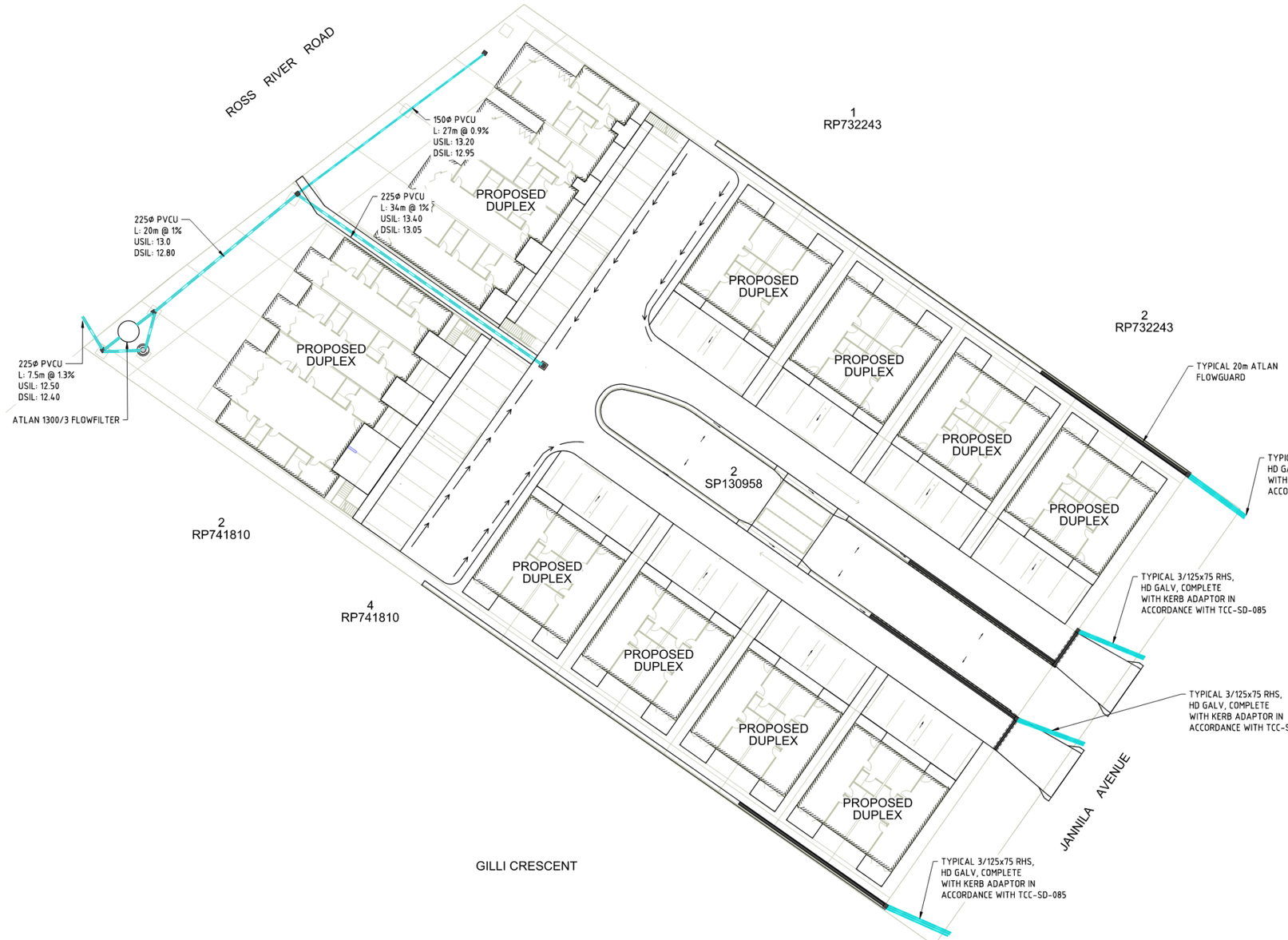

NOTES:

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- PROPOSED TOE OF BATTER
- PROPOSED TOP OF BATTER
- PROPOSED BUILDING
- PROPOSED STORMWATER DRAINAGE, REFER STORMWATER LAYOUT PLAN FOR DETAILS
- PROPOSED WATER MAIN
  REFER HYDRAULIC DRAWINGS FOR DETAILS
- PROPOSED SEWER MAIN, REFER SEWER RETICULATION DRAWINGS FOR DETAILS.
- DENOTES CONCRETE GRATED INLET PIT
  REFER MISCELLANEOUS DRAWINGS FOR DETAILS
- DENOTES POLYPROPYLENE (PE) GRATED INLET PIT
  REFER MISCELLANEOUS DRAWINGS FOR DETAILS
- DENOTES CATCHMENT BOUNDARY
- X/X 0.000ha — DENOTES CATCHMENT LABEL
- X/X — DENOTES PIT NUMBER

ATTENTION: FOR BEST RESULTS AND ACCURATE UNDERSTANDING OF THESE DRAWINGS, PLEASE PRINT IN COLOUR.

LEVEL DATUM

PSM32622
LEVEL DATUM RL14.283 AHD DERIVED
SITE COORDINATES E473479.212 N7864859.714

AMENDMENTS

Rev:	Date:	Description:	By:	Appd:
A	26.06.25	SD ISSUE	LJM	PP

IN ASSOCIATION WITH

KAENETTO INVESTMENTS

500 ROSS RIVER ROAD CRANBROOK
500 - 504 ROSS RIVER RD, CRANBROOK

STORMWATER DRAINAGE PLAN

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Design: DES
Drawn: DR
Approved: ENG.
RPEQ No: RPEQ.

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STP25-0597	C501	A

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