Civil, Flood and Integrated Water Management Plan

Maitland Mental Health Rehabilitation Project

Prepared for HI / 30 August 2024

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Contents

1.0 Executive Summary

Taylor Thomson Whitting (NSW) has been engaged by Health Infrastructure to provide civil engineering and stormwater drainage management systems designs for the Maitland Mental Health Rehabilitation Project. The Maitland Mental Health Rehabilitation Project consists of:

- Access roads from existing hospital roads, including drop off at front of the facility, loading dock, staff car park, and visitor parking at the front of house. A fire access road around the facility has also been provided
- Bulk Earthworks
- Stormwater works, including the demolition of existing OSD and Water Quality basin for the New Maitland Hospital and construction of a new OSD and water quality basin on the northern portion of the site to cater for both the existing hospital, future, the new mental health building and future developments.
- Stormwater for the building and car park works
- Retaining walls and other associated civil works

This report covers the civil infrastructure and stormwater aspects relevant to the site based on information known at the time of report production.

Civil and stormwater design has been undertaken based on the site layout plans as developed by the site architect (BSA) and the design team, and incorporates the following design principles:

- Civil works and roadworks, including vehicular accesses and carparks, emergency vehicle access, and pedestrian pathways have been designed to provide clearly defined, efficient, and functional traffic and pedestrian movements on the site, for all anticipated users.
- Earthworks designs have been undertaken in coordination with the architect, and structural engineer, and take into account the landform and existing site materials, and to minimise earthworks cut and fill on the site.
- Stormwater has been designed to ensure that the requirements of the local Council (Maitland City Council) are met, that stormwater discharges from the site are not changed or detrimental to the surrounding areas, and that the site is accessible in minor and major rainfall events and is operational in extreme rainfall events.

2.0 Introduction

This Civil, Flood and Integrated Water Management Plan has been prepared by TTW on behalf of Health Infrastructure (**HI**) to assess the potential environmental impacts that could arise from infrastructure works at 51 Metford Rd, Metford NSW 2323 (the **site**). The project is seeking approval for a Development Without Consent (REF) application under Part 5 of the EP&A Act.

This report has been prepared to detail the stormwater management at the Maitland Mental Health development. This report accompanies a Review of Environmental Factors (**REF**) for the construction and operation of a new mental health services building within the Maitland Hospital campus, including:

- Site establishment
- Site preparation including earthworks;
- Construction of internal roads and addition of at-grade car parks;
- Construction of 2 storey mental health facility;
- 20 Medium Secure Forensic beds; 24 Low Secure Forensic beds 20 General Rehabilitation beds (Rehabilitation and Recovery unit) (64 beds total);
- Inground building services works and utility adjustments, including service diversions;
- Building foundation works;
- Tree removal;
- Associated landscaping;.
- Bioretention basin.

Refer to the Review of Environmental Factors prepared by Ethos Urban for a full description of works.

2.1 Site Description

The site is located at the Maitland Hospital Campus on Metford Road, Maitland, approximately 6.4km from the CBD of Maitland. The project site is located within the development parcel, legally described as Lot 73 DP 1256781, as identified in Figure 1 below. The site is located to the east of the recently constructed Maitland Hospital.

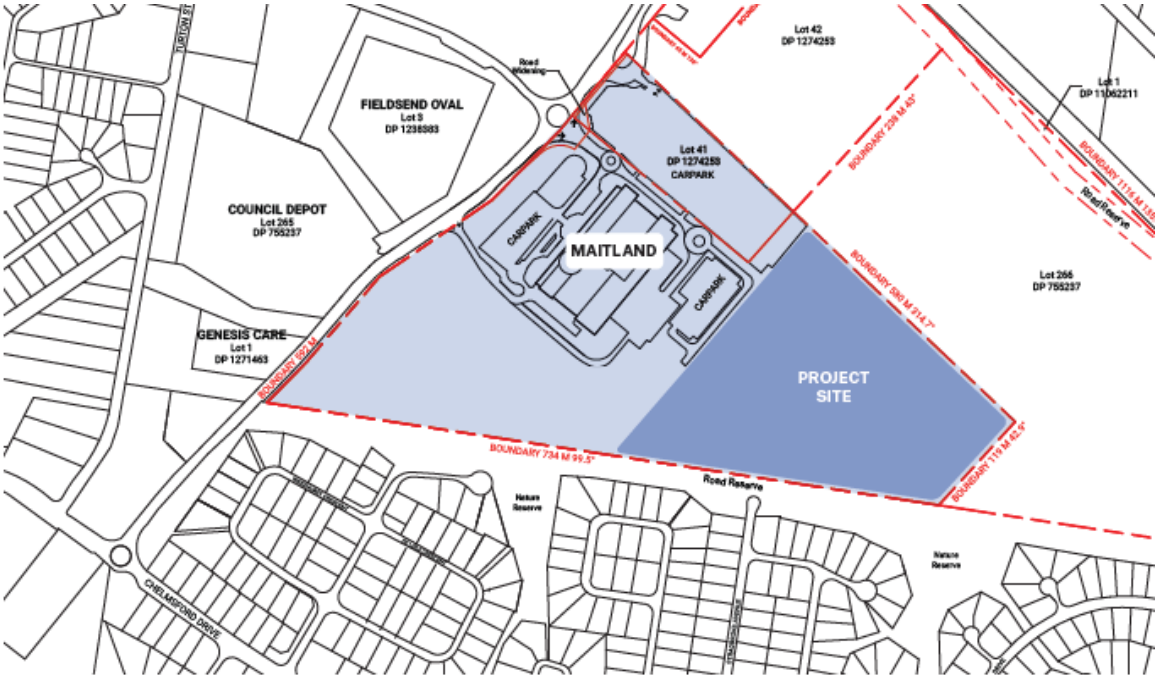

Figure 1: Project location diagram (Source: Bates Smart)

2.2 Statement of Significance

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed development, it is determined that:

- The extent and nature of potential impacts are low and will not have significant adverse effects on the locality, community and the environment.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community.

3.0 REF Deliverable Requirement Reporting

This Civil, Flood and Integrated Water Management Plan addresses the following relevant Review of Environmental Factors (REF) requirements from HINSW in relation to the proposed Mental Health Hospital set out in Table 1 below.

Table 1: Review of Environmental Factors Requirements

REF Requirement	Report Section / Response
Item 13 - Ground and Water Conditions	

• *Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity and acid sulfate soils.*
• *Provide a Surface and Groundwater Impact Assessment that assesses potential impacts on:*
  ○ *surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses.*
  ○ *groundwater resources in accordance with the Groundwater Guidelines.*
	Section 6.0 and Section 7.0 – Surface water resources (quality and quantity) only.
	
	This is to be read in conjunction with the Geotech and hydraulic consultant reports.

Item 14 – Water Management	

• *Provide an Integrated Water Management Plan for the development that:*
  ○ *is prepared in consultation with the local council and any other relevant drainage or water authority.*
  ○ *outlines the water-related servicing infrastructure required by the development (informed by the anticipated annual and ultimate increase in servicing demand) and evaluates opportunities to reduce water demand (such as recycled water provision).*
  ○ *details the proposed drainage design (stormwater and wastewater) for the site including any on-site treatment, reuse and detention facilities, water quality management measures, and nominated discharge points.*
  ○ *demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse downstream impacts.*
• *Where water and drainage infrastructure works are required that would be handed over to the local council, or other drainage or water authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority.*
	Section 6.1, and Section 6.2
	
	Section 7.3 – Proposed Treatment Devices
	
	Section 6.2, Section 7, and Section 9
	
	Section 9.0

Item 15 – Flood Risk	

• *Identify the flood planning level as set out in the relevant council LEP or SEPP and identify any:*
  ○ *flood risks on site having regard to adopted flood studies*
  ○ *the potential effects of climate change, and*
  ○ *any relevant provisions of the NSW Flood Risk Management Manual.*
• *Where the development is occurring on flood prone land a flood impact and risk assessment (FIRA) must be prepared having regard to the Flood Impact and Risk Assessment Guideline - LU01 (FIRA guide). When determining the scope and category of the FIRA the requirements outlined in the FIRA guide must be considered.*
• *Detail any flood risk management measures that are to be incorporated as part of the development having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).*
	Section 5.0

4.0 Existing Site

The Maitland Mental Health Rehabilitation Project is proposed on the existing New Maitland Hospital site on Metford Road, Metford. The existing bio-retention basin will be relocated north of the new Maitland Mental Health building and will accommodate flows for both the existing Maitland Hospital, new Maitland Mental Health Rehabilitation Project, and any future expansions. The new bio-retention basin will discharge north towards the Hunter River via the Four Mile Creek tributary. The location of the proposed site is shown in Figure 2.

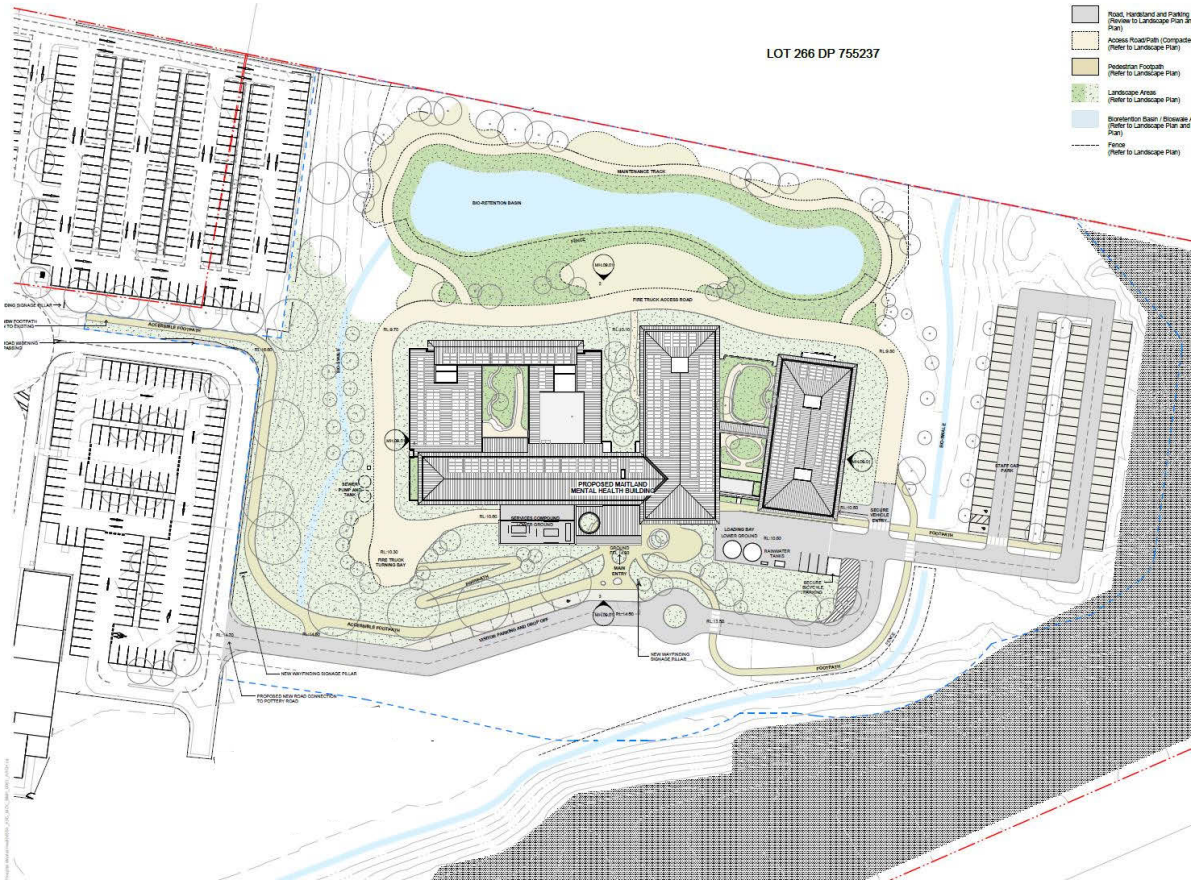

Figure 2: Proposed Site Location

5.0 Flood Impact Assessment

As part of the State Significant Infrastructure Application for the New Maitland Hospital, an assessment of flood impacts was undertaken by Wood & Grieve Engineers. TTW have reviewed this report and the following documents in assessing the potential impacts on flooding and local drainage.

The following reports are available and have been reviewed in this investigation:

- Hunter River (Branxton to Green Rocks) Flood Study, Maitland City Council, WMA Water, September 2010
- Hunter River Floodplain Risk Management Study and Plan, Final, Maitland City Council, WMA Water, November 2015

Based on these reports and the previous flood impact assessment, the highest regional flooding levels were ascertained at RL7.8m, being considerably lower than the minimum floor levels on the proposed development of RL15. It was noted in the Wood & Grieve Stormwater Management Plan that local catchment impacts did not exceed RL6.2 on the northern boundary of the site, and again this will not impact on floor levels or local catchment drainage.

Further, the development is proposed outside of the Hunter River Floodplain Storage or Flood Fringe areas, and as such will not impact on those flood levels.

No further analysis on regional flooding or local flooding is required.

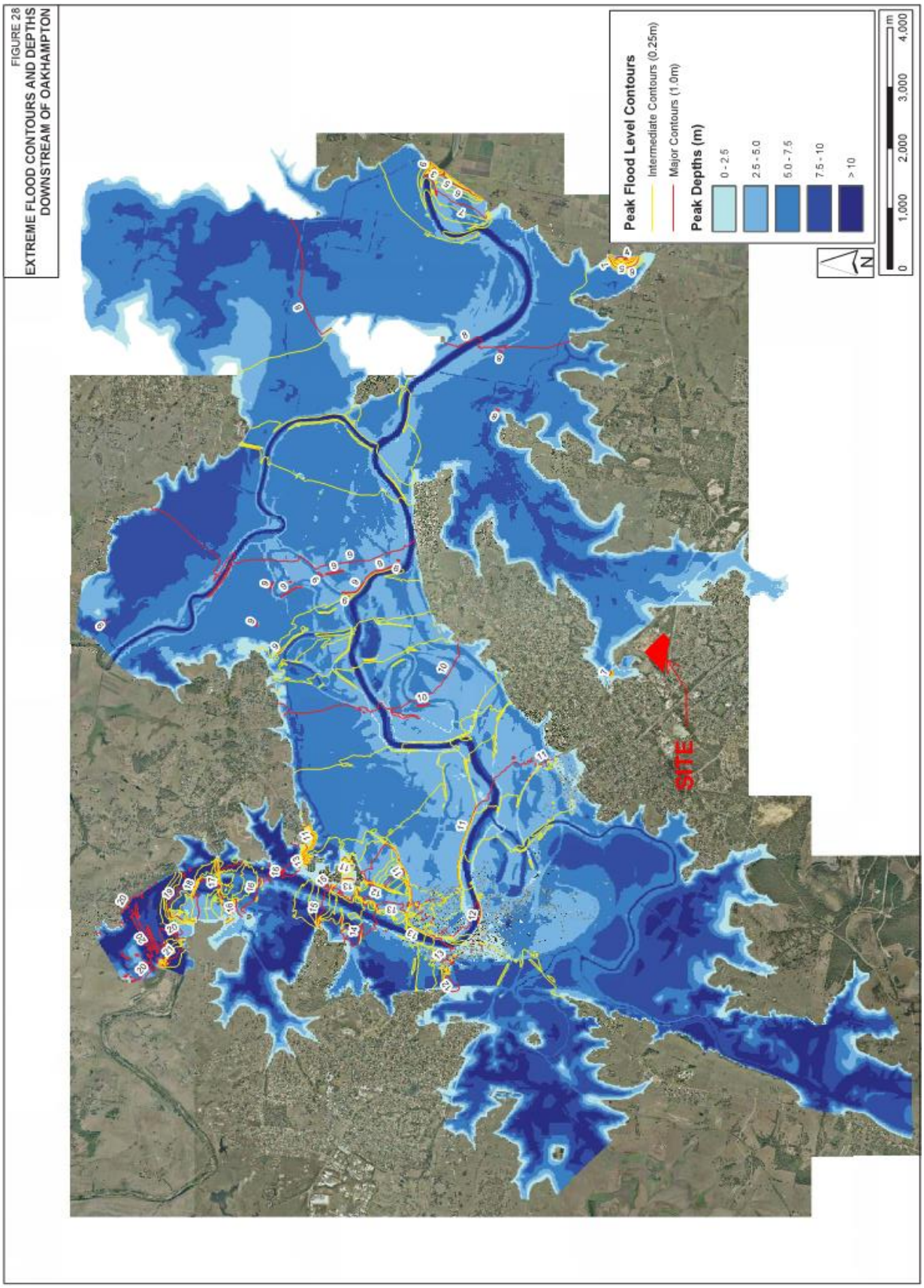

Figure 3: Extreme Flood Levels. (Hunter River (Branxton to Green Rocks) Flood Study)

6.0 Stormwater

Maitland City Councils Development Control Plan (DCP) and Manual of Engineering Standards - Stormwater define the requirements for the control, treatment and discharge of stormwater from development sites within the Council area. This DCP, along with relevant Australian Standards, and industry guides have been used as the basis for the design of the proposed stormwater system.

6.1 Authority Requirements

6.1.1 Conveyance

Maitland City Council require the following design principals, and that stormwater drainage systems shall be designed to achieve the following goals:

- An underground “minor system” of conduits that eliminates inconvenience to traffic and pedestrians.
- An overland “major system” that conveys stormwater flows within suitable velocity/depth limits, generally located within public land, or where approved or unavoidable, within private land covered by an easement.
- Detention of stormwater flows that mimics natural, pre-developed flows for all storm events up to and including the 100 year ARI event.
- Retention of stormwater flows to achieve target water quality standards.
- Control of stormwater flows to minimise the impacts of erosion and sediment in the environment.
- Consideration of upstream and downstream catchments in their ultimate developed state to achieve a total system which does not adversely affect existing systems or properties within the flow path and catchment.
- Minimisation of the maintenance burden of Council
- Enhancement of the urban landscape.
- Employment of principles of Water Sensitive Urban Design and Stormwater Reuse.

The following table summarised the Council requirements for stormwater conveyance systems for the proposed development:

Table 2: Council Requirements

DRAINAGE COMPONENT	CONVEYANCE	DESIGN PARAMTER	DESIGN REQUIREMNT
Formalised Drainage	In Ground Piped	Minor Drainage System	10 year ARI
	Piped Access Road Crossings	Major Drainage System	100 year ARI
	Overland	Major Drainage System	100 year ARI
Open Channels	Overland	Freeboard	300mm from top of channel
	Overland	10	500mm to adjacent floor levels
Swales	Overland	Velocity x Depth	<0.4

It is noted that whilst Maitland City Council refer to the rainfall intensities of Australian Rainfall and Runoff 1987, the modelling of the stormwater on the project has been undertaken in the updated Australian Rainfall and Runoff 2016 version. As such, rainfall events that infrastructure is designed for is in relation to an Annual Exceedance Probability rather than a return period. As such, major stormwater has been designed for the 1% AEP rather than the equivalent 100 year ARI rainfall event. Minor drainage systems have been designed for the 10% AEP event.

6.2 On Site Detention

Maitland City Council guidelines state:

- Stormwater runoff shall be designed so that peak discharges from new development are not increased beyond that of the pre-development environment for nominally the critical 1, 10 and 100 year ARI storm events.
- Where a basin is located in a flood plain the design should achieve its maximum elevation (RL) to limit inundation by flood waters. The lowest desirable level of the spillway should aim to be higher than the 20 year ARI event in the flood plain.
- All basins should incorporate permanent Gross Pollutant Traps (GPT), to collect silt, trash and litter from the road drainage system.
- The minimum slope of a dry basin floor should be 2%.
- The overflow weir shall have the capacity to maintain the 100 year ARI event.
- Temporary water depth calculated for the 20 year ARI event shall be limited to a maximum depth of 1.2m.

The current bio-retention basin at Maitland Hospital will be relocated and revised to accommodate entire precinct encompassing not only the existing Maitland Hospital but also the Maitland Mental Health Rehabilitation Project, and any future expansion. Consequently, the new proposed bio-retention basin has been calculated using DRAINS to be 2,000m^2. This design ensures that the bio-retention basin is able to limit the flow of post-development to pre-development rates (or lower) for the 1, 10, and 100 year ARI storm events, thereby fulfilling the stormwater requirements outlined by the council, as shown in Table 3 below.

Table 3: Pre-development vs Post-development Flows

Storm Event ARI	Pre-Development Flow (L/s)	Post-Development Flow (L/s)
100yr	2640	2544
10yr	1360	1266
1yr	579	418

The peak flows for the 1, 10 and 100-year storm events were calculated using DRAINS. Additionally, the DRAINS model incorporated the 1, 10, and 100-year flows originating from the existing Maitland Hospital project, as well as from the existing swale designed to capture runoff from the southwest area which may serve future developments. These flows are directed to the newly proposed bio-retention basin. Moreover, the post-development flows also account for runoff from the western carpark, which discharges into the eastern swale, bypassing the bio-retention basin. The DRAINS Model is illustrated in Figure 4.

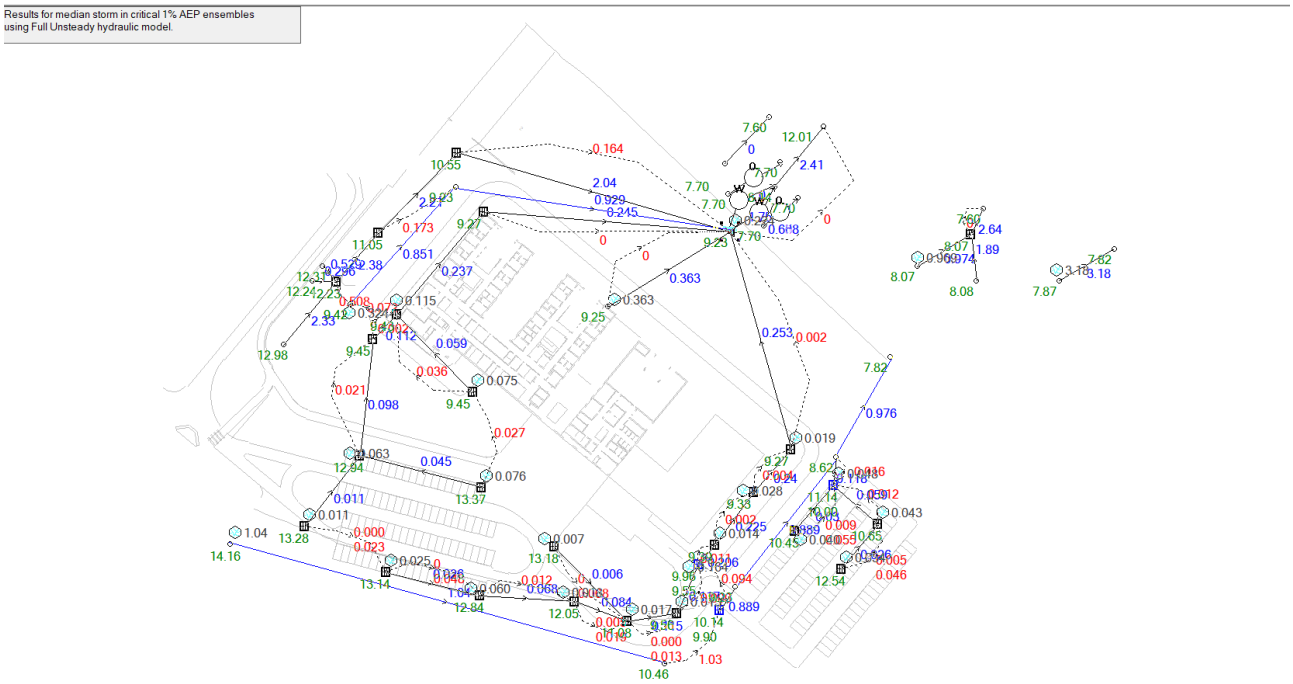

Figure 4: DRAINs Model of 100 year ARI Storm

6.3 Stormwater Conveyance Design

The schematic design of the stormwater system for the development includes both minor and major stormwater conveyance systems, consisting of conventional pit and pipe drainage networks within roads and car parks, swale on western side to convey surface run off to bio-retention basin, and a swale that diverts the upstream catchment as bypass around the site. Stormwater is captured, detained, treated and discharged to the same locations as the current predeveloped site, ensuring that there are no adverse impacts on downstream receiving environment as a result of the development. The stormwater design is shown in Appendix A to this report.

A traditional pit and pipe network of surface inlet pits, concrete box culverts and concrete stormwater pipes is proposed with the additional use of swales on the western side of site and a swale that bypasses the upstream catchment around the eastern side of the site. As shown in section 5.2 a stormwater network discharges via an On-Site Detention basin and flows are restricted to reduce site discharges to no greater than the current site.

6.3.1 Western Swale Design

The western swale has been designed with a 1:4 batter on either side. It is 4m wide and 0.6m deep. This swale diverts surface runoff and overflow from the pipes carrying the Maitland Hospital stormwater during the 100-year storm event.

During the 100-year storm, the water depth in the swale is greatest closer to the basin, reaching a depth of 0.63m, with a maximum velocity of 0.57 m/s. This results in a VxD ratio of 0.36, which is below council's requirement of maximum VxD ratio of 0.4. Similarly, at the beginning of the swale, the velocity is the highest at 0.70 m/s, while the maximum water depth is 0.33m. This yields a VxD ratio of 0.231, also below council requirements.

Hence, the western swale is deemed safe for children and elderly during the 100-year storm event, as per the NSW Government Department of Planning and Environment Flood risk Management Guide FB03.

6.3.2 Southern Swale Design

The southern swale is constrained in its batter design by the steep rock slope to the south. Consequently, the swale features a 1:2.5 batter, while maintaining an existing 1:1 batter along the steep rock slope. It is 1m wide and 0.8m deep. This swale functions to divert water collected from the upstream catchment along the southern boundary and then channels through pipes beneath the road that leads to the eastern car park.

During the 100-year storm, the peak water depth in the swale reaches 0.35m, accompanied by a peak velocity of 1.80 m/s. As a result, this produces a VxD ratio of 0.63 which unsafe for people and fails to meet the council's requirement of a maximum VxD of 0.4. However, given its location on the southern boundary, fencing around the swale can be installed to prevent unauthorized access.

6.3.3 Eastern Swale

The eastern swale is situated beyond the headwall of the pipes that run beneath the road. It is features a 1:3 batter on either side and measures 2.5m wide and 0.5m deep. The eastern swale is designed divert the flows from the upstream catchment and from the western carpark, it directs them past the bio-retention basin and discharges north towards the Hunter River via the Four Mile Creek tributary.

During the 100-year storm, the peak water depth in the swale reaches 0.20m, with a peak velocity of 1.18 m/s. As a result, this produces a VxD ratio of 0.24, which is below council's requirement of maximum VxD ratio of 0.4. Hence, the eastern swale is deemed safe for children and elderly during the 100-year storm event, as per the NSW Government Department of Planning and Environment Flood Risk Management Guide FB03.

7.0 Water Quality Treatment

The water sensitive urban design (WSUD) on site must be treated to comply with the requirements of the Water Quality section in Maitland City Council's Manual of Engineering Standards - Stormwater. Stormwater quality analysis was undertaken, and the catchment area has been modelled using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to demonstrate that the proposed stormwater treatment devices achieve the required stormwater treatment targets. Refer to the below table which shows the pollutant load reduction targets devised from Maitland City Council DCP.

Table 4: Pollutant Reduction Targets (Maitland City Council's Manual of Engineering Standards - Stormwater, Section 8.2)

Stormwater Pollutant	Reduction Target (%)
Total Suspended Solids (TSS)	80
Total Phosphorus (TP)	45
Total Nitrogen (TN)	45
Gross Pollutants (GP)	70

7.1 MUSIC Modelling

MUSIC simulates the performance of a group of stormwater management measures, configured in series or in parallel to form a "treatment train" against historic rainfall event data sets. It is the industry standard water quality modelling software developed by the MUSIC development team of the Cooperative Research Centre for Catchment Hydrology (CRCCH). The effectiveness of the combination of treatment train measures has been assessed using the numerical modelling within MUSIC.

The MUSIC user manual suggests that the time-step should not exceed the time of concentration of the smallest sub-catchment however, due consideration must also be made regarding the shortest detention time of nodes within the treatment train.

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted withing MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ).

7.2 Proposed Treatment Train

A MUSIC model was used to conceptualise stormwater treatment measures. This model encompasses the Maitland Hospital catchment, which was previously serviced by the bio-retention basin now undergoing relocation, as well as catchments for future developments, the upstream catchment and the runoff from the Maitland Mental Health Hospital. The proposed treatment train involves the utilisation of a 600m^2 Bio-Retention basin.

The MUSIC model layout for the whole site is shown in the figure below, while section 6.4 shows the MUSIC results.

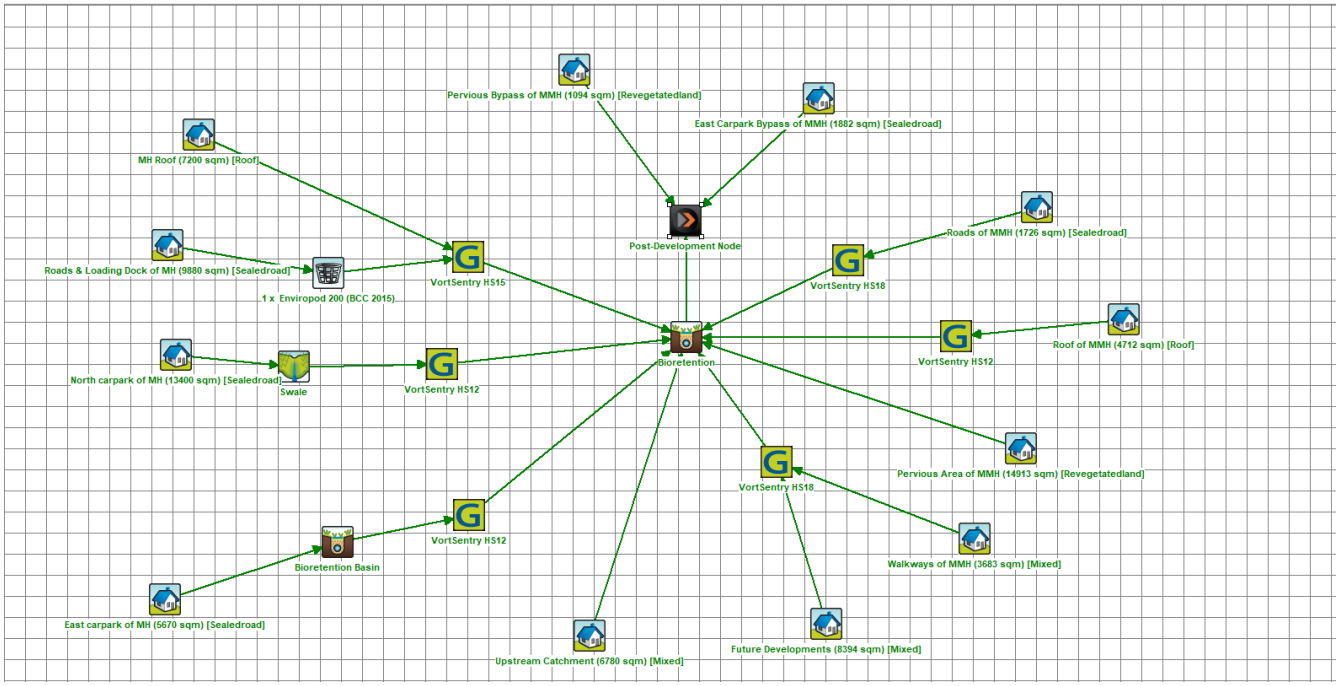

Figure 5: MUSIC Model

7.3 Stormwater Treatment Devices

To achieve the stormwater treatment reduction targets set by the Maitland City Council DCP, a treatment train based on the following is proposed:

- Vortsentry's that treat water from existing Maitland Hospital, proposed Maitland Mental Health Hospital and future development catchment areas.
- 600 m^2 Bio-retention basin to treat all catchments.

7.4 MUSIC Stormwater Quality Results

The results of the MUSIC modelling effectiveness are shown in the table below. The table indicates that the proposed stormwater treatment devices are sufficient in order to meet the council pollutant reduction targets.

Table 5: MUSIC Model Results

Stormwater Pollutant	Min. Required Reduction (%)	Modelled Reduction (%)
Total Suspended Solids (TSS)	80	89.4
Total Phosphorus (TP)	45	75.5
Total Nitrogen (TN)	45	57.9
Gross Pollutants (GP)	70	96.6

8.0 Sediment, Erosion and Dust Controls

The disturbance of the site during construction must be controlled through erosion prevention and sediment control measures. Silt fence will be installed to prevent silt and waste being washed into the proximity of the site and neighbouring properties. A catch drain with hay bales will be utilised to carry and treat site runoff which will then be transferred to the lowest point of site excavation. The existing pits on site will require sandbags or geotextile pit insert until the surface has been demolished. At the point of entry to site, cattle grids will be provided to ensure that vehicles and machinery leave the site with clean wheels. Additionally, the builder will be required to implement dust and noise control measures in order to minimise disruption to the neighbouring properties. The contractor will be required to demonstrate the proposed works equipment to be within acceptable limits for noise and vibration as determined by a registered acoustic consultant.

An erosion and sediment control plan (ESCP) is to be implemented during the construction stage to mitigate soil erosion and control the discharge of stormwater laden with sediment, nutrients and other pollutants to adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls on site are detailed in ESCPs which will be in accordance with regulatory authority guidelines including Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book").

9.0 Stormwater Discharge to Council Stormwater and Local Watercourses

The proposed development is located within the local catchment area considered as part of the New Maitland Hospital project, with discharges directed north to the upper tributaries of the Hunter River.

The site's east and west boundaries feature natural low points in the topography, forming overland flow paths and swale drains that divert stormwater to a large wetland area before discharging it below the main northern railway.

The design seeks to minimise the impact on the receiving environment and via OSD provided on the site will not discharge any additional stormwater runoff, therefore not impacting on capacity of downstream open channels, pits and pipes, and natural watercourses.

10.0 Earthworks

Earthworks cut and fill plans showing cut and fill depths across the site are shown in Appendix A. All earthworks to be undertaken in accordance with AS3798 and the recommendations of the Geotechnical report to ensure long term performance of fill platforms and stability in both sort and long term of any cut and fill batters.

It is noted that earthworks and demolition will be required of the existing bio-retention basin, and a Hazardous Material Risk Assessment should be undertaken to review previous contamination remedial works in this area.

11.0 Roads and Pavements

A schematic design for the access roads, carparks, loading docks and pathways has been prepared to guide the site layouts and designs. Design of these roads has been undertaken to ensure compliant access to and from the building, to minimise cut/fill, and to fit in with the existing topography wherever possible.

Pavements have been designed based on a 20-year design life in accordance with AustRoads Guide to Road Design, Volume 4, and will include asphalt surfaced flexible pavements for roads and carparks. All pavement surfacing in Asphalt will be designed for a 7-year surfacing life.

12.0 Conclusion

The development will provide a new stormwater drainage network including minor and major drainage system, stormwater quality measures and on-site detention measures. The bio-retention basin at Maitland Hospital is being relocated and expanded to a 2,000m² area to serve the entire precinct, including future developments. It is designed to manage stormwater, ensuring post-development flow rates remain at or below pre-development levels for 1, 10, and 100-year storm events, meeting council requirements.

The design for the proposed development has addressed relevant Review of Environmental Factors (REF) requirements from HINSW. Stormwater is required to comply with the relevant standards and requirements of Maitland City Council as outlined in the DCP and Maitland City Council's Manual of Engineering Standards - Stormwater

WSUD will be met using a several vortsentry's and a 600m^2 bio-retention basin to treat runoff from all catchments from Maitland Hospital, future developments, upstream catchments and the Maitland Mental Health Rehabilitation Project.

13.0 Mitigation Measures

Impacts on the environment as identified within the scope of the works, have had appropriate mitigation measures applied to reduce those impacts within the design, construction and operational phases of the development.

Project Stage Design (D) Construction (C) Operation (O)	Mitigation Measures	Relevant Section of Report
(D) (O)	*Implementation of Water Sensitive Urban Design including provision of on-site detention to reduce peak flows and bio-filtration to pollutant loads on downstream waters*	*Section 6.0 and Section 7.0*
(C)	*Erosion Sediment Control will be implemented during the construction stage to reduce disturbed area, loss of soils/pollution of downstream waterways and dust disturbance.*	*Section 8.0*
(C)	*Earthworks and demolition will be required of the existing bio-retention basin, and a Hazardous Material Risk Assessment should be undertaken to review previous contamination remedial works in this area.*	*Section 10.0*

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Appendix A

Civil Drawings