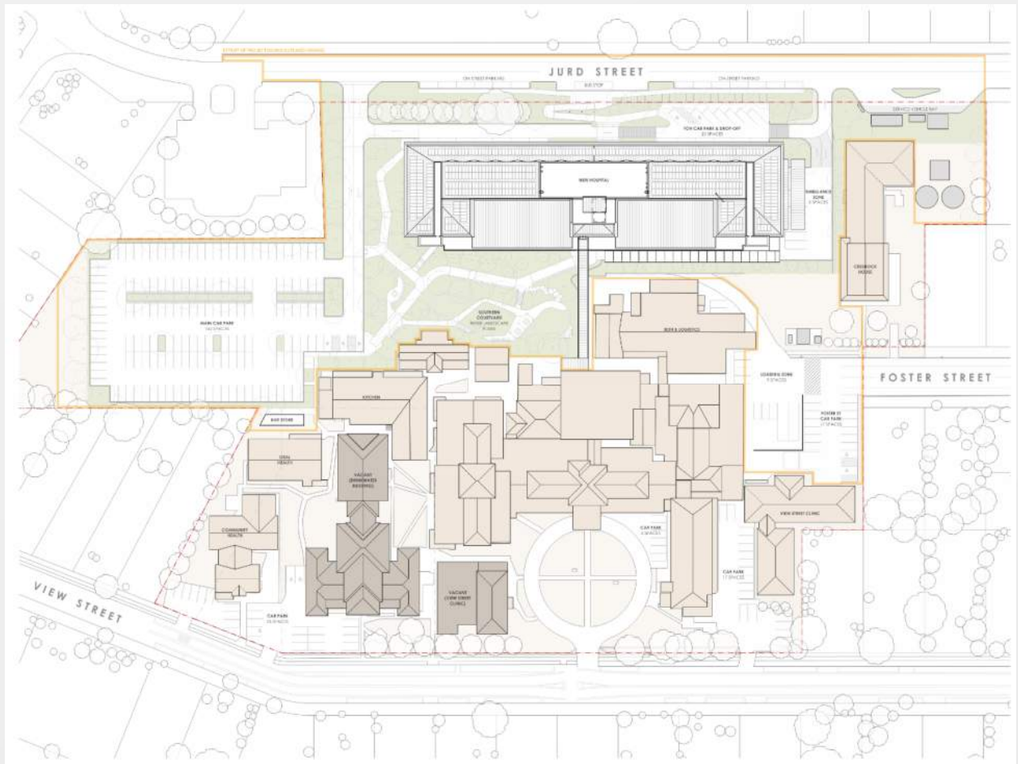
Cessnock Hospital Redevelopment

REVIEW OF ENVIRONMENTAL FACTORS - CIVIL



For: Health Infrastructure NSW
By: **en**struct group pty ltd
Revision B
October 2024

ISSUE AUTHORISATION

PROJECT: Cessnock Hospital Redevelopment
Project No: 6850

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorise by
A	03/09/24	Issue for REF Review	MZV	PAL	PAL
B	31/10/24	Issue for REF Review	MZV	PAL	PAL

Executive Summary

This report describes the civil engineering constraints to meet the requirements of the proposed Cessnock Hospital Redevelopment, covering the following:

- Existing site conditions.
- Civil engineering requirements for the site.
- Key civil engineering issues and risks.

This Civil Design Report accompanying a Review of Environmental Factors (REF) has been prepared to outline the principles the civil design is in accordance with. The civil principles developed specifically address issues including:

- Response to flooding, stormwater treatment quality and quantity for the project.
- Design in accordance with HI requirements.
- Stormwater detention systems design development to consider the Council and Greenstar requirements and required site works.

Typically, stormwater design will address Council requirements along with Sustainability/ESD measures.

Table 1: Summary of Mitigation Measures

Project Stage	Mitigation Measures	Relevant Section of Report
Design	The site is not flood affected and the proposed design ensure there is no negative flood affectation to surrounding properties because of the development.	Section 2.4 and Appendix A for Flood Statement
Construction	Erosion and sediment control measures have been designed and will be installed during construction to ensure impacts to downstream waterways and properties due to construction are limited.	Section 4.4
Operation	On-site stormwater detention has been designed to ensure no impacts to the downstream system, properties, or waterways because of the development.	Section 3.1
Operation	Water Sensitive Urban Design measures have been utilised at the site to ensure the development proposes minimal impacts to downstream waterways and ecological systems.	Section 3.2, 3.3, and 3.4

Contents

1 Introduction

This REF has been prepared by enstruct's Civil engineering team on behalf of Health Infrastructure (HI) to assess the potential environmental impacts that could arise from the redevelopment of the Cessnock Hospital health service at 24 View Street, Cessnock.

This report has been prepared to discuss the concept design stage civil engineering works associated with the hospital redevelopment.

This report accompanies a Review of Environment Factors that seeks approval for the construction and operation of a new two-storey clinical services building including:

- Demolition of select existing structures.
- Construction of a new hospital building on the site's northern portion.
- Realignment of internal roads and a new primary vehicular and pedestrian entrance to the hospital campus from Jurd Street.
- Refurbishment of the existing at-grade car park.
- Installation and realignment of selected services.
- Installation of ancillary development including, but not limited to, lighting and signage.
- Landscaping.

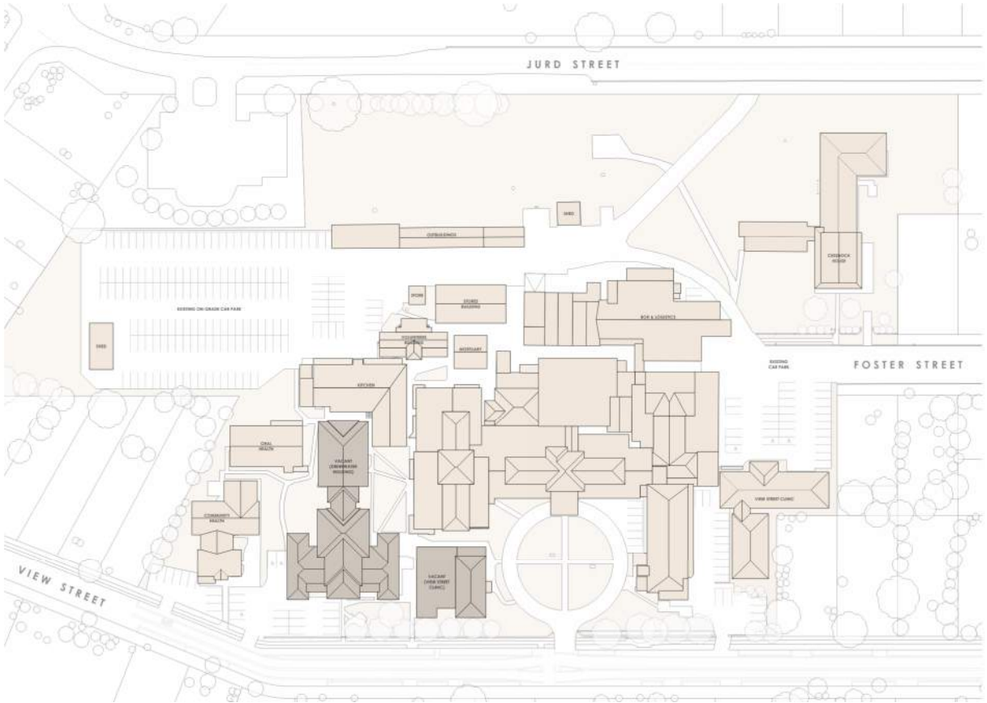


Figure 1: Cessnock Hospital Existing Plan

1.1 Project Description

The Cessnock Hospital is a district level hospital within the Hunter New England Local Health District. It provides low acuity medical and sub-acute services to the local community and is networked with Maitland Hospital for higher acuity services, and John Hunter Hospital for Tertiary level services.

The clinical services provided by the project will be generally consistent with what is currently being provided at the Hospital, except changes in services where network efficiencies are identified.

The project scope includes the following clinical services:

Emergency Department (ED)

- Medical Imaging
- Perioperative Suite
- Sterilizing Services Unit (SSU)
- 2 x 28 Bed Inpatient Units (IPUs)
- Pharmacy
- Mortuary
- Front of House (FOH) services

The overall project scope also includes the following:

- Demolition of select existing structures.
- In-ground infrastructure and enabling works
- A new acute services building containing the above clinical services
- A new primary vehicular and pedestrian entrance to the hospital campus from Jurd Street
- New vehicular drop-off
- Refurbishment of the existing on-grade car park
- A new connection between the new hospital building and the existing
- Landscaping.

1.2 Statement of Significance

Based on the identification of potential issues and as 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.

2 Site Existing Conditions

2.1 Site Description

The site is located at 24 View Street, Cessnock, in the Cessnock Local Government Area. It is occupied by Cessnock Hospital Health Service, a district-level hospital in the Hunter New England Local Health District. The site comprises the following lots.

- Lot 2 DP1173784
- Lot 7 DP13203
- Lot 8 DP13203
- Lot 1 DP103663
- Lot 10 DP5442
- Lot B DP103664
- Lot 2 Section 20 DP5442
- Lot 1 DP254743
- Lot 11 DP882585

An aerial image of the site is shown in **Figure 2**.

Figure 2: Site Aerial (Source: Nearmap)

The Cessnock Hospital campus is located between View and Jurd Street, on the south and north sides respectively, with main vehicle access entering from the east along Foster Street. The hospital site is bounded by residential properties and the Ambulance Station on the western side of the campus. The location of watercourses and existing hospital infrastructure is shown in **Figure 3** and **Figure 4** below.

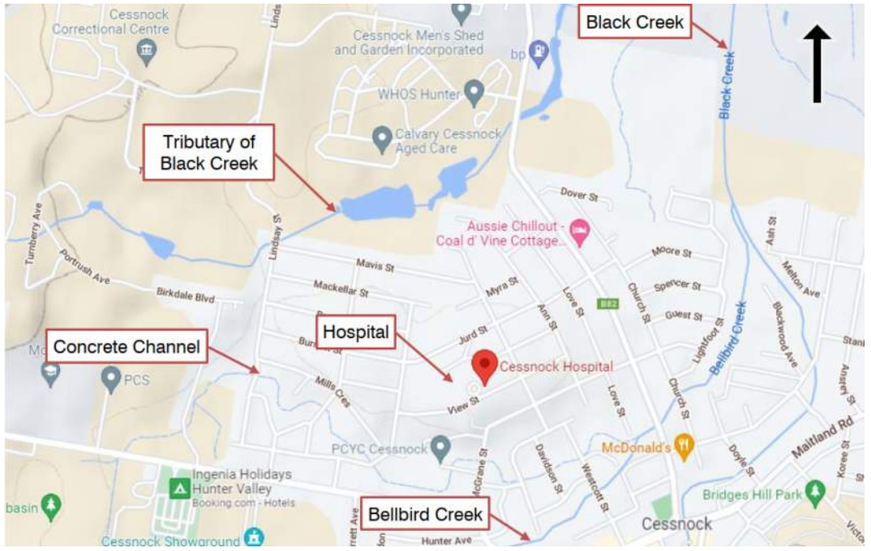


Figure 3: Local Context Map (Source: Google Maps 2021)

Figure 4: Site Context Map (Source: Google Earth)

The existing site has an undeveloped grassed area with helipad on the northern side. There is a homestead (Cessnock House) on Foster Street which is used for allied hospital services. The west side of the site is the staff carpark which is constructed from asphalt. This carpark combines access for service vehicles including trucks with loading and unloading facilities. There is a small carpark (about 20 spaces) in located in front of the Drinkwater/Drug and Alcohol buildings, with a carpark for about 35 vehicles off Foster Street.

There are approximately six accessible parking spaces allocated on the hospital campus, with a further two within the road reserve on Foster Street.

There are existing services running throughout the site. It is expected any active existing services that exist within the proposed building footprint will need to be rerouted around the proposed building footprint. Refer to **Figure 5** for the existing services overlayed onto the proposed building footprint.

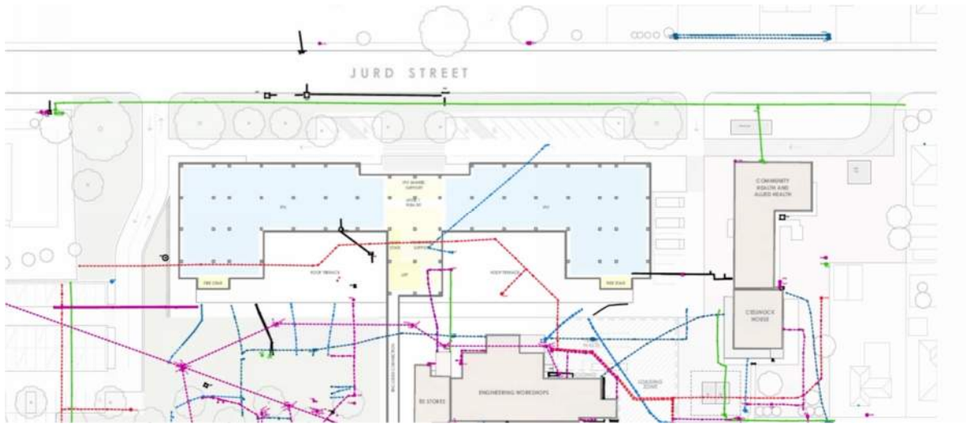


Figure 5: Existing Services on Proposed Development Building Plan

2.2 Site Topography

The hospital sits close to the crest of the surrounding hillock. The emergency entry and carpark are located on the higher aspect of the campus. The maximum hospital ground level is around RL85.80m and falls towards Jurd and View Streets which are lower by about 5m and 3m respectively. The main carpark in the west sits about 2m lower than the emergency department.

The carparks are paved of either asphalt or concrete and are in varying conditions. The main staff carpark was built around 1976, has exceeded its life expectancy with large ruts and potholes present.

The decommissioned helipad sits on a concrete pad and is surrounded by grass. The only other area of landscaping includes the space in front of, and behind, the Drinkwater building that is located between the main hospital building and the dental building. Further, more landscaping is located off View Street, around the access road that connects to the main building's Porte Cochere. Landscaping across the campus is generally grass, some shrubs, and mature trees along the View and Jurd Streets boundary. The trees along Jurd Street are located towards the ambulance building and away from the decommissioned helipad.

2.3 Existing Drainage

The existing stormwater system on the campus consist of downpipes, grated drains, and some stormwater pits. There is limited information on the existing stormwater system. However, it is expected that the downpipes and grated drains connect to the pit and pipe system which connects to Council's system on Jurd and View Street. There is the possibility, due to the age of the existing campus, that the building downpipes and grated drains connect to the campus sewer system. Advice from the campus maintenance assistant is that the trap low lying stair located under the canteen and near the staff carpark, has stormwater pumped to the sewer system.

Figure 6 shows a downpipe and grated drain servicing the area around the hospital generator. The circular manhole in the foreground is a sewer manhole access point. **Figure 7** shows a typical downpipe connection discharging into a grated drain.

Figure 6: Campus Generator Stormwater Connections

Figure 7: Downpipe Discharging into Grated Drain

Figure 8 and **Figure 9** shows the existing drainage points on Jurd and View Streets owned by Cessnock City Council. The Jurd Street stormwater pit drains across the road and discharges into an open channel which eventually connects to the tributary of Black Creek. The View Street stormwater system consists of pits located within sag points which connect under the road and travels south. It is believed Council's pipes travel south and continues through private properties eventually connecting in the concrete channel.

Figure 8: Existing Council Letterbox Pit on Jurd Street

Figure 9: Existing Council Sag Pit on View Street

2.4 Flooding

The campus is located on a crest and therefore, riverine flooding is not a risk. The nearest watercourses, as noted in **Figure 3,** are the concrete channel that connects to Bellbird Creek and the tributary of Black Creek, both of which are some distance from and at a lower elevation to the hospital site. These watercourses are around 10m or lower than the site (somewhere around RL70).

With regards to flooding caused by overland flow, being at the crest of the hill limits the amount of catchment and water concentration that leads to overland flow flooding within the site. However, as noted in Council's flood map, shown below in **Figure 10,** the northern side of Jurd Street is affected by flooding which had the potential to affect any development on the decommissioned helipad. However, the proposed development has been designed above the flood height with the appropriate freeboard. The design is above the Probable Maximum Flood (PMF), as is suitable for hospital developments.

Council does not specifically provide advice for health facilities, whereas commercial developments, as noted in Council's *Engineering Requirements for Development - Chapter-6 Stormwater Drainage-Design* are required to have floor levels at least 500mm above the 1 in 100 Year Average Recurrence Interval flood level.

The PMF level in the property across the street is expected to be below ~RL80.35m. The proposed minimum building floor level is at RL82.00m. This provides significant (1.65m) freeboard to the PMF level and hence the development meets Council's guidelines. Refer to **Appendix A** for the Flood Impact Statement confirming the development is not impacted by flooding.

Figure 10: PMF Flood Extent (Source: Cessnock Council Maps)

3 Civil Design

3.1 Onsite Stormwater Detention (OSD)

Due to the change in impervious area on the site, OSD is required to manage the stormwater discharge rate from the site. enstruct has reviewed the OSD requirements as outlined in Cessnock City Council Council's *Engineering Requirements for Development - Chapter-6 Stormwater Drainage-Design.* This publication does not specify requirements for health facilities however, commercial developments require the following:

6.1.3 On-Site Stormwater Detention

(a) For storage up to 100m^3 it is acceptable to use "Evaluation of Simplified Methods for Design of Retarding Basins" by M.J. Boyd (Lecturer, Department of Civil Engineering, University of Wollongong).

For storages above 100m^3 the detention structure will be required to be modelled by a reservoir routing model.

(b) Provision is to be made for 100-year average recurrence interval flows through the detention structure via an overflow spillway and/or overland flow path.

Advice from Council has indicated only new impervious area across the site will need to be serviced by OSD. The upgrade of the car park does not introduce new impervious area, hence, the OSD has only been sized to limit post-development stormwater flow collected from the new building. The OSD will be required to attenuate post-development stormwater flows for all storms up to 1% AEP to below predevelopment rate. Refer to **Appendix B** for communication with Council.

3.1.1 DRAINS Modelling

A DRAINS model has been created to compare the pre-developed site discharge rate with the post-development site discharge rate with the addition of an approximately 260m^3 OSD tank. The OSD tank is to have a double outlet formation with a 203mm diameter orifice to service all flows up to the 50% AEP storm event, and a 450mm diameter pipe outlet to service all other storms up to the 1% AEP storm event.

The impervious areas inputted into DRAINS for the site catchment pre- and post-development have been calculated from the design plans. That is, the pre-development site has been inputted with 10% impervious area and the post-development site has been inputted with 83% impervious area.

A comparison of the pre- and post- development flow rates through DRAINS is available in **Table 2**.

Table 2: Pre- and Post Development Flow Rate Comparison

	Pre-Development Flow Rate (m^3/s)	Post-Development Flow Rate (m^3/s) with OSD
1EY	0.053	0.050
50% AEP	0.061	0.054
20% AEP	0.16	0.155
10% AEP	0.19	0.168
5% AEP	0.236	0.187
1% AEP	0.389	0.241

Base on the results shown in Table 2, the post-development flows do not exceed the pre-developments flows through the introduction of the OSD system. This will ensure the flows discharging form the site will not impact any downstream infrastructure or property.

3.2 Green Star

Civil influence on Green Star targets for a building of this nature is limited to the EMI 5 Stormwater criteria: To encourage and recognise the minimisation of peak stormwater flows and the protection of receiving waters from pollutants.

Credits can be gained through the provision of stormwater detention and stormwater quality treatment to meet Greenstar targets.

3.3 Water Sensitive Urban Design (WSUD)

Council is in the process of updating the DCP to include stormwater quality targets. The aim of the project is to target Greenstar credits for stormwater quality treatment.

If rainwater harvesting is proposed there is risk of water-borne disease/infection preventing the ability to re-use stormwater for non-potable uses across hospital buildings and departments.

Vegetated water sensitive urban design features such as vegetated swales, bioretention basins and buffer strips can be integrated into landscaped areas as the design progresses. Where spatial requirements on the site limit the ability to provide WSUD measures such as vegetated swales and bioretention, stormwater quality will be achieved using proprietary filters. The filters target nitrogen, phosphorus, and suspended solids.

3.4 MUSIC Model

A MUSIC model was developed to indicate the suitability of the proposed WSUD measures on the site. The MUSIC model was set up in accordance with AR&R Guidelines. The model uses rainfall data from Sydney.

The proposed water quality control devices for the site are:

- Six 690mm StormFilter cartridges within a $5m^2$ chamber within the OSD Tank,
- At least seven OceanProtect OceanGuard pit inserts, and
- A $15m^2$ OceanProtect Filterra bio-filtration pond.

The results of the MUSIC model confirmed the ability of the above devices to reduce the pollutants discharged from the site to below the requirements described by council. A comparison of the results against the recommended reduction targets described in *Australian Runoff Quality Guide to WSUD and Greenstar* is shown in **Table 3** below. Further detail is available in **Appendix B.**

Table 3: Pollutant Reduction MUSIC Results Comparison

Pollutant	Post-development average annual load reduction target	Greenstar Column B	Post-development average annual load reduction result
Gross pollutants	Retention of litter greater than 50mm for flows up to the 4 exceedances per year (EY) event (3-month ARI peak flow). Corse sediment: Retention of sediment coarser than 0.125mm for flows up to the 4EY peak flow.	90%	~99%
Total suspended solids	80%	80%	82%
Total phosphorus	45%	60%	70%
Total nitrogen	45%	45%	47%

Therefore, with the introduction of the StormFilters, pit inserts and bio-filtration pond to remove large debris, gross pollutants, the total suspended solids, Phosphorus and Nitrogen, the reduction targets are within the requirements of Greenstar's Column B.

4 Civil Engineering Design Principles

All new works will utilise the HI systemised design approach and be designed in accordance with the following civil principles and parameters.

The civil works will be designed to provide adequate performance for a minimum period of 50 years with a typical maintenance system.

4.1 Design Standards

The civil design shall be in accordance with the latest revision of all relevant structural Australian Standards, relevant structural sections of the BCA and other statutory requirements. The design will be in accordance with the following relevant Australian Standards:

- AS3500.3 (2021) – Plumbing and Drainage Part 3: Stormwater Drainage
- AS3600 (2018) – Concrete Structures
- AS3700 (2011) – Masonry Code
- AS4678 (2002) – Earth Retaining Structures
- AS1428.1 (2021) - Design for access and mobility General requirements for access - New building work
- AS2890.1 (2004) - Parking facilities Off-street car parking
- AS2890.2 (2018) - Parking facilities Off-street commercial vehicle facilities
- AS2890.6 (2022) - Parking facilities Off-street parking for people with disabilities
- Australian Rainfall and Runoff (ARR 2019)
- Managing Urban Stormwater: Soils and construction - Volume 1 4th edition (Landcom)

4.2 Stormwater design

All stormwater drainage will be designed to comply with best practise as designated in Australian Rainfall and Runoff and the Australian Standards AS3500.3

Element	Criteria
Pipe Class	Minimum Class 2
Design Loading	SM1600 – Traffic Loading T44, CAT16H – Construction Loading
Minimum Pipe Size	Hospital Property – 225mm Diameter min. Local Roads – 375mm Diameter min.
Maximum Spacing of Pits	Desirable – 70m Absolute – 120m
Pit Blockage Allowance	On-grade – 0.2 Sag – 0.5
Minimum Pipe Cover	Greater of 600 mm
Design Storm	Minor - 5% AEP Major – 1% AEP
Minor Storm Pit Freeboard	Desirable – 150 mm Absolute – 100 mm
Design Freeboard	0.5m above trunk open drainage channel. 0.5m above PMF for habitable floors.
Allowable Flow Velocities	Max. 6.0m/s for 10% AEP Min. 0.6m/s in 2EY

4.3 Bulk Earthworks

The bulk earthworks for the development will be designed to comply with AS3798-1996 Guidelines on earthworks for commercial and residential developments. Bulk earthworks will aim to balance cut and fill, however, it is expected with the site constraints there will be excess cut.

The geotechnical report *36230BFrptrev1 Cessnock* has recommended temporary batter slopes to be 1(H):1(V) for a maximum height of 3m where batters exceed 3m, further geotechnical advice should be sought. Further, a maximum batter slope of 2(H):1(V) is recommended for permanent slopes, however, if the slopes are to be vegetated a maximum of 3(H):1(V) is recommended for maintenance.

According to the latest architectural plan, the ground floor of the building is set at FFL82.40m, with accompanying facilities such as footpaths and carparks. Based on initial assumptions, the estimated net bulk earthwork volume is approximately **6,415** m^3 of cut.

4.4 Erosion and Sediment Control

During construction and while the site is disturbed, erosion prevention and sediment control measures will be required. Erosion prevention generally involves managing stormwater by diverting overland flow around construction areas as well as collecting stormwater within the construction zone and directing to sediment control devices. Devices likely to be incorporated are silt removal fences, hay bales, catch drains, and water flow dissipation and discharge control devices such as sandbags, pollution mattresses, and basins.

Erosion prevention and sediment removal strategies need to be inspected regularly during construction works, cleaned, and maintained after storm events, and modified to suit construction work progress, decanting and demolition.

Erosion and sediment controls are to be designed, constructed, and installed in accordance with Managing Urban Stormwater: Soils and construction - Volume 1 and maintained until the site is fully stabilised to prevent pollution of the receiving environment. An erosion and sediment control plan will be provided in the civil drawing set.

5 Conclusion

The civil works associated with the design and construction of the works at Cessnock Hospital will be carried out in accordance with normal engineering practice and will meet the requirements of relevant standards.

After consideration of the Cessnock City Council Engineering Standards as well as communication with Council, the site will require Onsite Stormwater Detention (OSD) for all areas except the existing car park, as well as stormwater quality control measures. An OSD tank sized is to be 260m^3. The water quality measures include a stormfilter chamber within the OSD tank containing six Ocean Protect Stormfilters, a Filterra bio-retention for treatment of the car-park run-off and OceanProtect OceanGuard pit inserts within grated inlet pits across the site.

The site is not expected to be impacted by mainstream or overland flooding. Cessnock Council flood mapping has confirmed the site is not impacted by the 1% AEP flood event or the PMF flood event. Further, the proposed ground floor level of RL 82.40m is over 1m higher than the PMF flood level across Jurd Street.

The proposed ground floor level is RL 82.40m which is generally lower than the surrounding existing ground level. Hence, it is expected there will be excess cut for this development. The volume expected is 6,415 m^3 of cut.

Erosion and sediment control measures are to be in place during construction to prevent contamination of the downstream stormwater system and tracking of grit and sediment onto the roadway.

6 Risk Assessment

The key risks in relation to civil works for the redevelopment are identified in the table below:

Risk	Risk Strategy	Risk Rating with Risk Strategy Implemented	Risk Value
Existing Services	Identify and locate all underground services on site and coordinate existing services with new building works and/or services.	Low	High if unidentified services are damaged during construction
Contamination	Detailed contamination investigation of works area to be undertaken in initial phases of the project to ensure detailed understanding of the building and ground contamination conditions is in place.	Low	High if adverse contamination conditions are not identified prior to works on site commencing
Loading dock and ambulance areas not fit for purpose	Coordinate with traffic engineer and other stakeholders on required vehicles, for example MME machine delivery/removal, substation transformers, ambulance requirements. Design to consider cross falls, longitudinal grades, vehicle maneuvering, multiple simultaneous vehicle requirements (e.g., truck plus crane to load/unload)	Low	Moderate risk of restricted access
Flooding	Critical hospital facilities to be built above the flood level. Overland flows to be diverted around buildings. During a flood event, shelter-in-place strategy is recommended	Low	Low following assessment of existing flood levels.
Existing Infrastructure	Allowing time for approval, relocation, cut in of permanent and temporary substations, generator, Switch Boards, or gas supplies to ensure the hospital remains operational without any loss of service.	Low	High risk to operations and program if approved infrastructure is not in place when required.

APPENDIX A: FLOOD IMPACT STATEMENT

enstruct

31 October 2024

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Turner & Towsend
Level 19
On Wharf Lane
171 Sussex Street
Sydney NSW 2000

Job Number: 6850

Attention: Georgia Leonard

Dear Georgia,

Cessnock Hospital Redevelopment
Flooding Impact Assessment Statement

Upon revision of Cessnock Council's Flood Plain Risk Management Study and Plan Report and the local topography it was noted that the campus is located on a crest and therefore, riverine flooding is not a risk. The nearest watercourses, as noted in Figure 1, are the concrete channel that connects to Bellbird Creek and the tributary of Black Creek, both of which are some distance from and at a lower elevation to the hospital site. These watercourses are around 10m or lower than the site (somewhere around RL70).

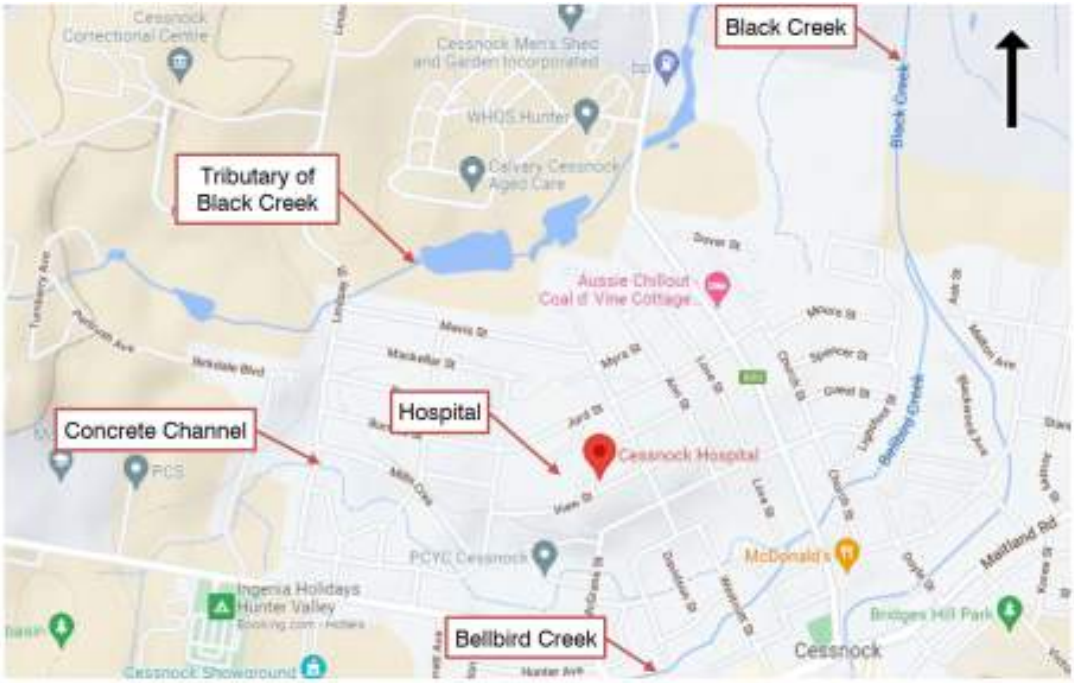

Figure 1: Local Context Map (Source: Google Maps 2021)

With regards to flooding caused by overland flow, being at the crest of the hill limits the amount of catchment and water concentration that leads to overland flow flooding within the site. However, as noted in Council's flood map, shown below in Figure 2, the northern side of Jurd Street is affected by flooding which had the potential to affect any development on the decommissioned helipad. However, the proposed development has been designed above the flood height with the appropriate freeboard. The design is above the Probable Maximum Flood (PMF), as is suitable for hospital developments.

Figure 2: PMF Flood Extent (Source: Cessnock Council Maps)

Council does not specifically provide advice for health facilities, whereas commercial developments, as noted in Council's Engineering Requirements for Development - Chapter-6 Stormwater Drainage-Design are required to have floor levels at least 500mm above the 1 in 100 Year Average Recurrence Interval flood level.

The PMF level in the property across the street is expected to be below ~RL80.35m. The proposed minimum building floor level is at RL82.40m. This provides significant (1.95m) freeboard to the PMF level and hence the development meets Council's guidelines.

I am an appropriately qualified and competent person in this area and as such can certify that the design and performance of the design systems comply with the above.

I possess Indemnity Insurance to the satisfaction of the building owner or my principal.

Full Name of Designer:	Phillip Lambley
Qualifications:	BE (Civil), CPEng, MIEAust, NER, VBA

Address of Designer:	680 George Street Sydney, NSW 2000
Business Telephone No:	02 9934 7587
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Name of Employer:	enstruct group pty ltd

for
enstruct group pty ltd

Phillip Lambley BE (Civil), CPEng, MIEAust, NER, VBA
Director

APPENDIX B: OSD CORRESPONDENCE WITH COUNCIL

From: Jules Bosco
Sent: Thursday, 3 August 2023 9:26 AM
To: 'mia.veipch@enstruct.com.au' <mia.veipch@enstruct.com.au>
Subject: Cessnock hospital carpark

Hi Mia
As discussed, replacement of an impervious carpark does not require additional OSD however should consider appropriate controlled drainage measure such as pits and pipes discharging to a legal point of discharge.
Any additional hardstands or buildings which increase the impervious areas will require some method of OSD to ensure post development flows are attenuated to pre development flowrates for storm events up to a 1% AEP.

Regards

Jules Bosco **Principal Development Engineer**
BEng. Grad.Dip EngSc. MEngSc. MIAust CPEng NER
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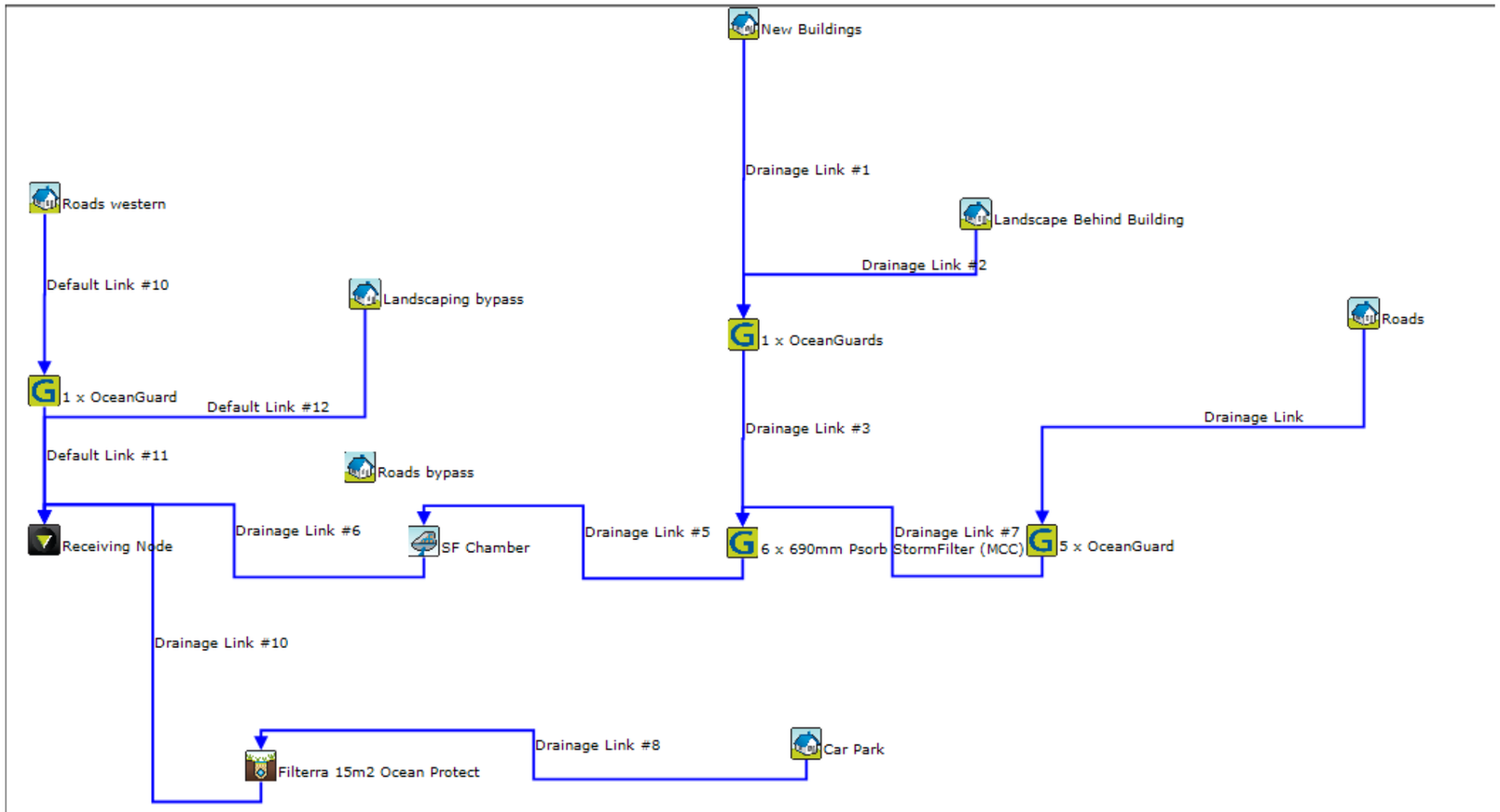
APPENDIX C: MUSIC Model



	Sources	Residual Load	% Reduction
Flow (ML/yr)	15.53	15.5	0.1444
Total Suspended Solids (kg/yr)	3088	541.9	82.45
Total Phosphorus (kg/yr)	5.994	1.812	69.77
Total Nitrogen (kg/yr)	35.11	18.64	46.9
Gross Pollutants (kg/yr)	334.6	0	100