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16 August 2021

NL191366.B13

Health Infrastructure NSW
Level 6, 1 Reserve Road
St Leonards NSW 2065

Att: Health Infrastructure NSW

Re: John Hunter Hospital Innovation Precinct – SSDA Civil Response to Submissions

As part of the John Hunter Hospital assessment various regulatory bodies have undertaken a review of the development proposal and provided comment and/or requests for additional information. Comments received from Department of Planning Industry and Environment (DPIE, Newcastle City Council (NCC) and the Biodiversity Conservation Division (BCD) in relation to the proposed civil and stormwater drainage works have been reviewed by Northrop, with responses to the submissions outlined below:

1. Biodiversity Conservation Division Comments

BCD Recommendation 7 – Flooding and Flood Risk

- The proponent should assess the potential for stream bank erosion in receiving streams in accordance with the Newcastle DCP Stormwater & Water Efficiency for Development Technical Manual (City of Newcastle 2017).
- The need for additional scour protection measures at the watercourse crossings should be assessed during detailed design.

Northrop Response

As per the recommendation above, the Stream Erosion Index (SEI) has been assessed in accordance with Council's "City of Newcastle Stormwater and Water Efficiency for Development Technical Manual (2019)".

Site stream forming flow has been calculated in accordance with Section 4.15.4 being:

- 0.5 x Q 2yr ARI pre-development.

Utilising the continuous rainfall runoff simulation software MUSIC, the stream forming flow has been calculated as Q = 0.555m^3/s.

SEI has then been calculated in accordance with Section 4.15.6 being:

$$= \frac{\text{Sum of all post development flows exceeding the stream forming flow}}{\text{Sum of all pre development flows exceeding the stream forming flow}}$$

$$= \frac{0.28}{0.40}$$

$$= 0.70$$

		Date
Prepared by	CS	16/08/2021
Checked by	RJ	16/08/2021
Admin	BM	16/08/2021

The above calculations show the sites SEI is in accordance with Council's DCP as it is not greater than 2, as predicted by MUSIC.

As per the second item of this recommendation, Northrop agree that scour protection will be an important factor in the final drainage design for the site and confirm that consideration and documentation of these measures will be completed during detailed design.

Recommendation 8 – Water Quality Impacts

- The proponent should assess the impacts of the proposal on coastal wetlands in accordance with the Newcastle DCP Stormwater & Water Efficiency for Development Technical Manual (City of Newcastle 2017).

Northrop Response

Northrop acknowledge that the original submission did not provide appropriate consideration of the developments impact on coastal wetlands and have revised the drainage assessment to address recommendation 8. A summary of the design modifications, including revised stormwater quality assessment is provided below. We note that Section 5.7 of the submitted SSDA drainage report has been revised (Figure and Table references are consistent with the SSDA report), the below information supersedes the corresponding information in Northrop's SSDA report. The predominant change to the water quality measures proposed for the site is the inclusion of a 50kL rainwater reuse tank in line with Council's deemed to comply requirements for coastal wetland catchments. Harvested roof runoff from the proposed ASB building is proposed to be reticulated to the water cooling towers.

2. Stormwater Quality Assessment

The development falls within a coastal wetlands catchment as defined within section 7.06 of City of Newcastle's DCP, as such the below provisions consider Council's requirements in relation to coastal wetlands as well as their overarching requirements for development.

Stormwater quality on-site is proposed to be managed through a treatment train approach to minimise any adverse impacts on the ecology of downstream watercourses and to meet Council's pollutant removal efficiency targets outlined below in Table 5.

Table 5 – Stormwater Quality Reduction Targets

Pollutant	Council Reduction Target (%)
Total Suspended Solids (TSS)	85
Total Phosphorus (TP)	65
Total Nitrogen (TN)	45
Gross Pollutants (GP)	90

The performance of the proposed stormwater management strategy was assessed against the selected targets using the conceptual software MUSIC (Version 6.3.0). The MUSIC model was developed in accordance with the "NSW MUSIC Modelling Guidelines" (BMT WBM, 2015) and the "City of Newcastle Stormwater and Water Efficiency for Development Technical Manual" (2019), using Council's MUSIC-link. The MUSIC-link was used to set up all default source node data, rainfall data and evapotranspiration data.

The MUSIC model catchment area was broken down into sub-catchments to effectively simulate the proposed treatment measures along the treatment train. The proposed future road area was also included within the model to ensure any future works have been accounted for in the water quality provisions provided as part of the JHHIP project works. Whilst the future road has been considered in drainage calculations, the biofiltration basin is not being delivered as part of the JHHIP project and will be constructed in future stages in conjunction with the north road extension. A screenshot of the MUSIC model can be seen below in Figure 12. The catchment areas included only the proposed works.

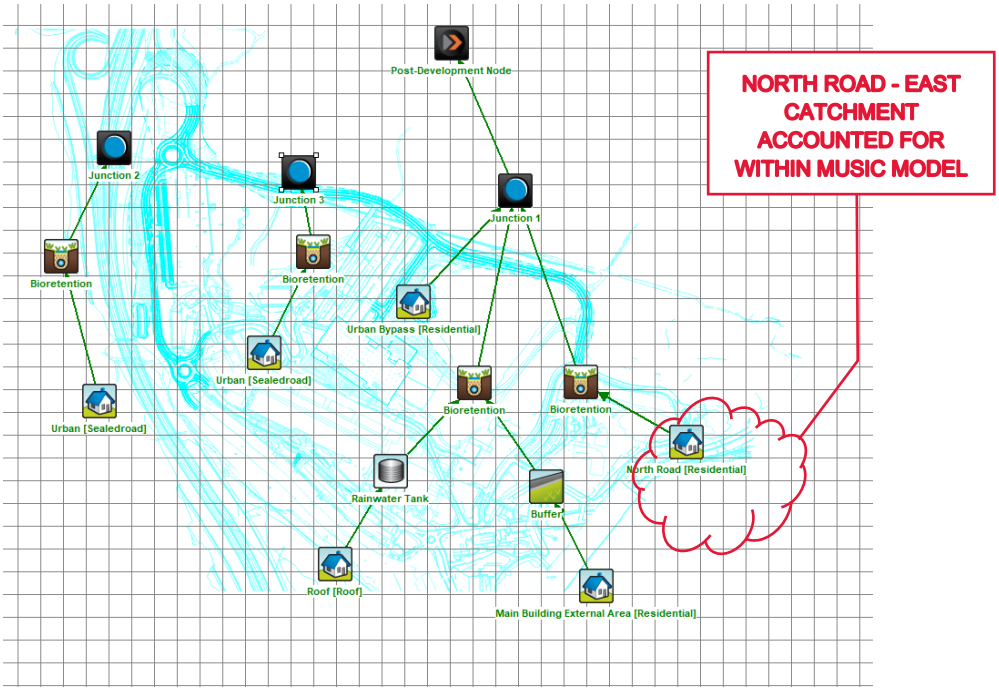

Figure 12 – MUSIC Model Schematic

The source nodes adopted to represent the development were the Urban Sealed Road node, Urban Residential node and Urban Roof node. The impervious percentage of the nodes was calculated from the architectural and civil drawings.

The stormwater treatment train for the treated portion of the site incorporates the following:

- Primary treatment will be provided by a rainwater tank and landscaping buffers.
- Tertiary treatment will be provided via four separate biofiltration basins across the site.

Descriptions of the treatment measures are detailed below:

Landscaping Buffer

Landscaping across the property shall be used as a buffer to filter stormwater while it infiltrates through the ground, before being collected by subsoil drainage and directed to the main stormwater network. This has been modelled using the Buffer node in MUSIC.

Biofiltration Basin

Biofiltration basins have been provided across the multiple catchments found on site. Details of the bio-filtration basin MUSIC node parameters can be seen in Appendix A. Approximate basin locations can be seen in Figure 13 below. Minimum biofiltration basin filter areas to be provided:

- Basin 1 – 180m2.
- Basin 2 – 30m2.
- Basin 3 – 30m2.
- Basin 4 – 120m2.

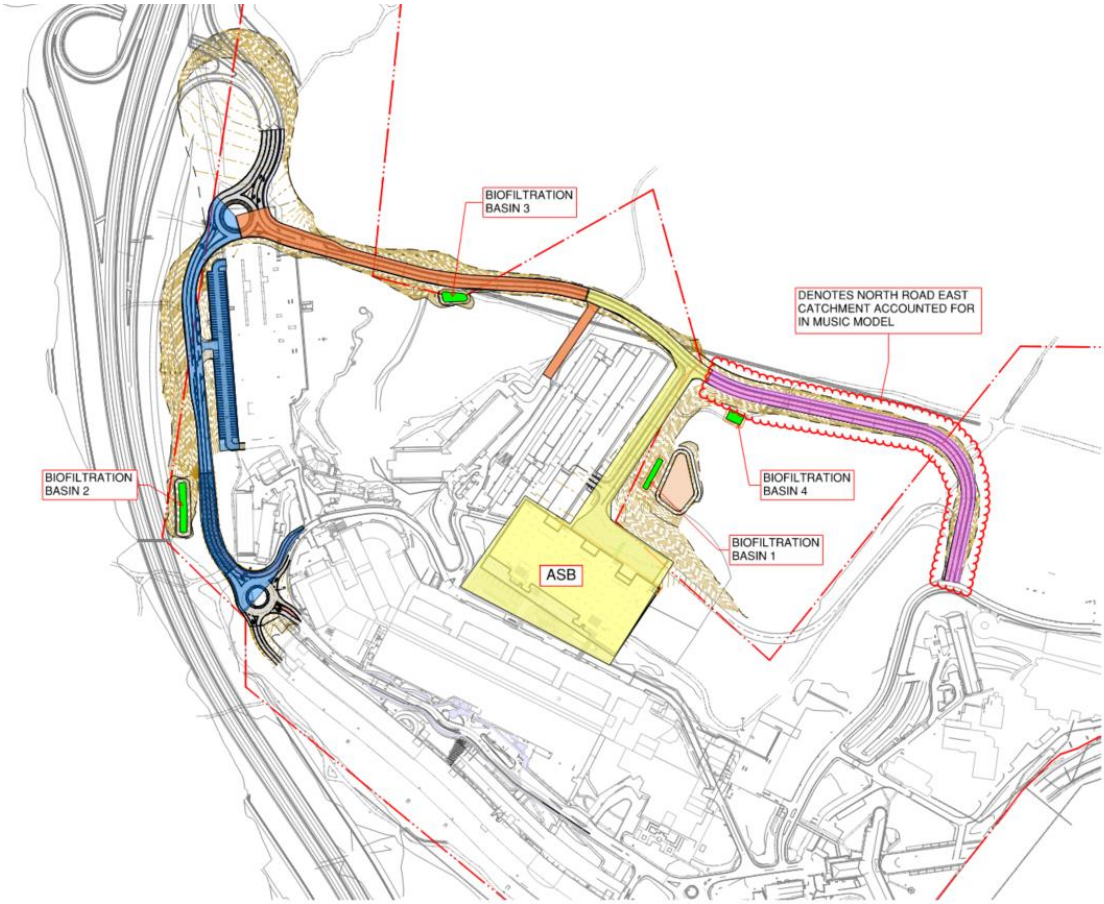

Figure 13 – MUSIC Model Schematic

Rainwater Tank

In accordance with Council's DCP Coastal Wetlands Catchment requirements a rainwater harvesting tank has been provided to meet hydrology objectives for the development. In accordance with DCP Section 7.06.02 Part 1 (C) the deemed to comply rainwater storage volume is calculated as:

- Minimum tank size = roof area x 0.04
- 4,497m^2 x 0.04 = 180m^3

It is noted that this section of the DCP stipulates that the storage volume of rainwater tanks may be reduced when a large-scale storage solution (OSD) is provided downstream of the rainwater tank. The development proposes to provide 1980m^3 of OSD volume downstream of the ASB building and nominated rainwater tank. Given the significant OSD provision incorporated into the development the proposed 50m^3 rainwater reuse tank volume is seen as satisfying the intent of the Coastal Wetlands Catchment objectives for this development.

Harvested roof runoff conveyed to the 50kL reuse tank is proposed to be reticulated for use in the cooling tower systems provided as part of the mechanical installations of the ASB building. The high reuse demand (112kL/day) of these towers are seen to easily satisfy the intent of water reticulation of the DCP, and therefore harvested roof runoff is not proposed to be reticulated for other uses.

Furthermore, due to the high reuse demand for the cooling tower systems it is not proposed to provide the top 50% of the reuse tank as leaky tank volume in accordance with Council's Coastal Wetland Catchments as the tank will not remain full for extended periods, rendering the provision ineffective. Furthermore, given the low percentage of roof area within the site catchment (approx. 6%) environmental flows sustaining the downstream Coastal Wetland would be better incorporated elsewhere on site. As an alternative, it is proposed to provide a leaky pipe from the proposed biofiltration basins located downstream of the development, in order to replicate this provision.

Results

The results from the MUSIC modelling are presented in Table 6.

Table 6 - MUSIC Model Result Summary

	Basin 1 & 4 Outlet Percentage Reduction	Basin 2 Outlet Percentage Reduction	Basin 3 Outlet Percentage Reduction	Target Objectives
Total Suspended Solids (TSS)	92 %	86.1 %	85.0 %	85 %
Total Phosphorous (TP)	73.5 %	73.8 %	73.0 %	65 %
Total Nitrogen (TN)	66.5 %	50.1 %	49.4 %	45 %
Gross Pollutants	100 %	100 %	100 %	90 %

Table 6 indicates that the proposed stormwater management strategy is predicted to achieve the load reduction targets set out in Council's DCP 2012, as estimated by MUSIC.

MUSIC Link files for the 3 receiving nodes have been included with this letter. The MUSIC model can be provided upon request.

3. Department of Planning, Industry and Environment

DPIE Recommendation 2 – Alternate Road alignment.

- Consideration should be given to the use of the temporary construction access road location as an alternative future connection to the wider hospital precinct to avoid and minimise the biodiversity impacts and offset requirements associated with the future construction of the eastern portion of the Northern Road. Details of those considerations should be provided.

Northrop Response:

It is not recommended that the temporary access be utilised as a main road network in the future for the following reasons:

1. It is not practical to have the final road network and construction access along the same alignment as it would cause significant delays to the delivery of the ASB as construction vehicles would not be able to access the building zone whilst roadworks are being completed. Postponing access to the ASB until the completion of North Road Construction in order to avoid installing the construction access will result in significant time delays to the ASB delivery which cannot be accommodated.
2. The alignment contains tight bends which do not afford adequate sight distances for a primary road network in accordance with Australian standards.
3. Currently the construction access is generally placed over the existing fire trail and only requires minor additional clearing to facilitate construction access. Upgrading this track to provide compliant road widths would greatly increase the extent of battering and clearing required, likely requiring a similar extent of clearing as the proposed northern road.

In summary, whilst we acknowledge the desire to reduce clearing, we do not believe utilising the construction access for a future road will achieve this outcome as upgrading to meet design standards would subsequently increase the associated clearing, rendering the provision ineffective at reducing biodiversity impacts.

4. Newcastle City Council

NCC Comment 2 – Flood Management.

- Due to the sensitivity of downstream receiving waters, flood mitigation measures are to be considered as part of the proposal to mitigate downstream flood impacts

Northrop Response:

Northrop have completed a stormwater drainage design for the proposed development in accordance with the requirements of Section 7.06 of Newcastle Councils DCP. This design includes the provision of onsite detention (OSD) measures to ensure that post development runoff does not exceed predevelopment levels hence addressing local catchment flooding as required by the DCP.

Figure 1 below taken from Draft Newcastle Floodplain Risk Management Study Map Series 4 – 1% AEP Flood Impact Categories (BMT WBM 2012) indicates the site is not affected by the 1% AEP storm event. Furthermore, given the topography of the area the site is outside of the flood planning areas which would be defined as the 1% AEP plus 500mm.

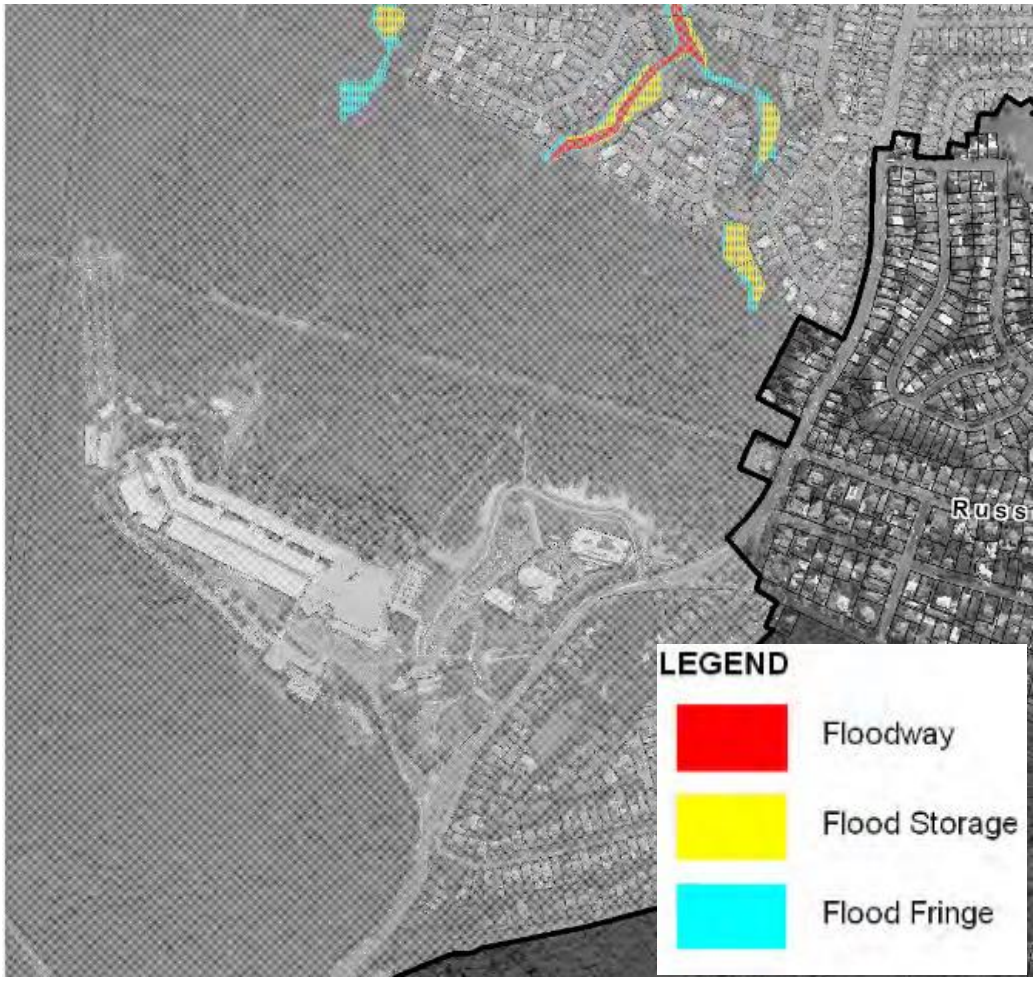

Figure 1 – 1% AEP flood extent

As the site is not located within a flood planning area and is not flood affected by regional catchment flooding it is our understanding that a regional catchment assessment is not required by the DCP and as such has not been undertaken as part of the submission. Given the site is seen to be only affected by localised flooding (i.e. site runoff) the drainage measures being implemented as part of the development, i.e. onsite detention, stormwater diversions and new drainage infrastructure are seen to be sufficient to appropriately manage the localised flood risk found on site.

Should Council have additional regional flooding information that they would like to be included within the drainage design for the site we would be happy to consider its implementation as part of the detailed design.

NCC Comment 3 – Stormwater Management.

- It is recommended hydrologic objectives are achieved for the hospital development so that the Stream Erosion Index (SEI) is to be no greater than 2.

Northrop Response:

As outlined in the response to BDC recommendation 7 above, the Stream Erosion Index for the development has been calculated as 0.7, which is compliant with Council's requirement for SEI to be no greater than 2.

5. Transport for NSW

TfNSW Recommendation – Stormwater Drainage.

- Stormwater Management – A combined sediment / biofiltration / detention basin - number 2 - is located immediately upstream of the NICB (located on the eastern side). Discharged stormwater from this system shall not exceed the capacity of the stormwater drainage system identified in the current design, which is for swale / catch drain and stormwater culvert system. This civil infrastructure is identified at Chainage 8630 of the concept Aurecon Design.

Northrop Response:

Forums are being utilised to coordinate the respective TfNSW and JHHIP designs including Stormwater. Further design coordination will occur as both projects continue into Design Development and Finalisation to reach suitable outcome acceptable by both parties. Notwithstanding, Northrop confirm that the above ground detention and water quality basin has been designed to reduce post development runoff to pre-development flow rates. Pre and post development flow rates for relevant storm events as detailed in the SSDA submission is provided below.

OSD Basin 2 DRAINS results

Storm Event	Pre-development Peak discharge (m^3/s)	Post-Development Peak discharge (m^3/s)
0.2EY (5 Year ARI)	0.114	0.112
10% AEP	0.148	0.129
5% AEP	0.192	0.148
2% AEP	0.248	0.197
1% AEP	0.296	0.296

We would expect the Aurecon design to cater for the undeveloped upstream catchment runoff as a minimum, and as such expect compliance with this requirement would already be satisfied by the concept stormwater design. Final outflows and downstream allowances will be confirmed with TfNSW and Aurecon during the detailed design phase of the project.

Should you have any further queries please feel free to contact the undersigned.

Yours sincerely,

Chris Smith
Principal | Civil Engineer
BEng (Civil) MIEAust CPEng NER RPEQ

THE CITY OF NEWCASTLE

MUSIC-*link* Report

Project Details		Company Details	
Project:	JHHIP	**Company:**	Northrop Consulting Engineers
Report Export Date:	23/07/2021	**Contact:**	R Jeans
Catchment Name:	NL191366_MUSIC DA [rev 4]	**Address:**	Level 1 215 Pacific Highway Highway Charlestown
Catchment Area:	3.802ha	**Phone:**	(02) 49431777
Impervious Area*:	55.47%	**Email:**	rjeans@nothrop.com.au
Rainfall Station:	61078 WILLIAMTOWN		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1995 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
Evapotranspiration:	1735mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.33		
Study Area:	Newcastle		
Scenario:	Newcastle		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness

Node: Post-Development Node	Reduction
Flow	17.2%
TSS	92%
TP	73.5%
TN	66.5%
GP	100%

Treatment Nodes

Node Type	Number
Bio Retention Node	4
Buffer Node	1
Rain Water Tank Node	1

Source Nodes

Node Type	Number
Urban Source Node	6

Comments

% Reuse demand met not achieved due to high reuse demend requested from cooling towers

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	0.5
Post	Post-Development Node	% Load Reduction	None	None	17.2
Post	Post-Development Node	GP % Load Reduction	90	None	100
Post	Post-Development Node	TN % Load Reduction	45	None	66.5
Post	Post-Development Node	TP % Load Reduction	65	None	73.5
Post	Post-Development Node	TSS % Load Reduction	85	None	92
Urban	Main Building External Area	Area Impervious (ha)	None	None	1.052
Urban	Main Building External Area	Area Pervious (ha)	None	None	0.537
Urban	Main Building External Area	Total Area (ha)	None	None	1.59
Urban	North Road	Area Impervious (ha)	None	None	0.606
Urban	North Road	Area Pervious (ha)	None	None	0.874
Urban	North Road	Total Area (ha)	None	None	1.481
Urban	Roof	Area Impervious (ha)	None	None	0.45
Urban	Roof	Area Pervious (ha)	None	None	0
Urban	Roof	Total Area (ha)	None	None	0.45
Urban	Urban	Area Impervious (ha)	None	None	0.522
Urban	Urban	Area Impervious (ha)	None	None	0.586
Urban	Urban	Area Pervious (ha)	None	None	0
Urban	Urban	Area Pervious (ha)	None	None	0
Urban	Urban	Total Area (ha)	None	None	0.522
Urban	Urban	Total Area (ha)	None	None	0.586
Urban	Urban Bypass	Area Impervious (ha)	None	None	0
Urban	Urban Bypass	Area Pervious (ha)	None	None	0.281
Urban	Urban Bypass	Total Area (ha)	None	None	0.281

Only certain parameters are reported when they pass validation

Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Rain	Rainwater Tank	% Reuse Demand Met	70	None	8.95285

Only certain parameters are reported when they pass validation

THE CITY OF NEWCASTLE

MUSIC-*link* Report

Project Details		Company Details	
Project:	JHHIP	**Company:**	Northrop Consulting Engineers
Report Export Date:	23/07/2021	**Contact:**	R Jeans
Catchment Name:	NL191366_MUSIC DA [rev 4]	**Address:**	Level 1 215 Pacific Highway Highway Charlestown
Catchment Area:	0.586ha	**Phone:**	(02) 49431777
Impervious Area*:	100%	**Email:**	rjeans@nothrop.com.au
Rainfall Station:	61078 WILLIAMTOWN		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1995 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
Evapotranspiration:	1735mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.33		
Study Area:	Newcastle		
Scenario:	Newcastle		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Junction 2	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	1.38%	Bio Retention Node	4	Urban Source Node	6
TSS	86.1%	Buffer Node	1		
TP	73.8%	Rain Water Tank Node	1		
TN	50.1%				
GP	100%				

Comments

% Reuse demand met not achieved due to high reuse demend requested from cooling towers

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	0.5
Post	Post-Development Node	% Load Reduction	None	None	17.2
Post	Post-Development Node	GP % Load Reduction	90	None	100
Post	Post-Development Node	TN % Load Reduction	45	None	66.5
Post	Post-Development Node	TP % Load Reduction	65	None	73.5
Post	Post-Development Node	TSS % Load Reduction	85	None	92
Urban	Main Building External Area	Area Impervious (ha)	None	None	1.052
Urban	Main Building External Area	Area Pervious (ha)	None	None	0.537
Urban	Main Building External Area	Total Area (ha)	None	None	1.59
Urban	North Road	Area Impervious (ha)	None	None	0.606
Urban	North Road	Area Pervious (ha)	None	None	0.874
Urban	North Road	Total Area (ha)	None	None	1.481
Urban	Roof	Area Impervious (ha)	None	None	0.45
Urban	Roof	Area Pervious (ha)	None	None	0
Urban	Roof	Total Area (ha)	None	None	0.45
Urban	Urban	Area Impervious (ha)	None	None	0.522
Urban	Urban	Area Impervious (ha)	None	None	0.586
Urban	Urban	Area Pervious (ha)	None	None	0
Urban	Urban	Area Pervious (ha)	None	None	0
Urban	Urban	Total Area (ha)	None	None	0.522
Urban	Urban	Total Area (ha)	None	None	0.586
Urban	Urban Bypass	Area Impervious (ha)	None	None	0
Urban	Urban Bypass	Area Pervious (ha)	None	None	0.281
Urban	Urban Bypass	Total Area (ha)	None	None	0.281

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Rain	Rainwater Tank	% Reuse Demand Met	70	None	8.95285

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THE CITY OF NEWCASTLE

MUSIC-*link* Report

Project Details		Company Details	
Project:	JHHIP	**Company:**	Northrop Consulting Engineers
Report Export Date:	2/08/2021	**Contact:**	R Jeans
Catchment Name:	NL191366_MUSIC DA [rev 4]	**Address:**	Level 1 215 Pacific Highway Charlestown NSW 2290
Catchment Area:	0.59ha	**Phone:**	(02) 49431777
Impervious Area*:	100%	**Email:**	rjeans@northrop.com.au
Rainfall Station:	61078 WILLIAMTOWN		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1995 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
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MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.33		
Study Area:	Newcastle		
Scenario:	Newcastle		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Junction 3	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	1.37%	Bio Retention Node	4	Urban Source Node	6
TSS	85%	Buffer Node	1		
TP	73.3%	Rain Water Tank Node	1		
TN	49.4%				
GP	100%				

Comments

% Reuse demand met not achieved due to high reuse demand requested from cooling towers

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Buffer	Buffer	Proportion of upstream impervious area treated	None	None	0.5
Post	Post-Development Node	% Load Reduction	None	None	17.2
Post	Post-Development Node	GP % Load Reduction	90	None	100
Post	Post-Development Node	TN % Load Reduction	45	None	66.7
Post	Post-Development Node	TP % Load Reduction	65	None	73.4
Post	Post-Development Node	TSS % Load Reduction	85	None	92.1
Urban	Main Building External Area	Area Impervious (ha)	None	None	1.052
Urban	Main Building External Area	Area Pervious (ha)	None	None	0.537
Urban	Main Building External Area	Total Area (ha)	None	None	1.59
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Urban	Roof	Area Pervious (ha)	None	None	0
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Urban	Urban	Area Impervious (ha)	None	None	0.586
Urban	Urban	Area Pervious (ha)	None	None	0
Urban	Urban	Area Pervious (ha)	None	None	0
Urban	Urban	Total Area (ha)	None	None	0.59
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Urban	Urban Bypass	Area Impervious (ha)	None	None	0
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Urban	Urban Bypass	Total Area (ha)	None	None	0.281

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Node Type	Node Name	Parameter	Min	Max	Actual
Rain	Rainwater Tank	% Reuse Demand Met	70	None	8.95285

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