infrastructure & development consulting

Edmondson Park Precinct 3

Stormwater Management Report

May 2024

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Project Number	22-514	**Date**	28 May 2024
Project Name	Edmondson Park Precinct 3	**Status**	Final
Client	Landcom	**Revision**	C
Author	R. Higgisson	**Reviewed**	D. Reilly

1 Introduction

Infrastructure & Development Consulting (IDC) have been commissioned by Landcom to prepare a Stormwater Management Report in support of the proposed "Precinct 3" residential subdivision at Edmondson Park.

This report will be lodged with Liverpool City Council to support the Development Application (DA) and details the modelling procedures and results obtained in preparing the proposed stormwater management strategy for the site.

The results as outlined in this report and documented on the IDC drawings address the following items:

- Review the existing stormwater flow conditions for the site and establish requirements for post-development flows from Council guidelines
- Design a suitably sized stormwater pipe network to convey flows throughout the site to appropriate discharge points
- Assess the safety of overland flows throughout the development
- Identify appropriate measures to meet Council's temporary water quality and quantity requirements and determine the location and land area required to implement the measures

The following studies have taken into consideration the economical, engineering, environmental and social aspects of the works through the implementation of appropriate stormwater controls and best management practices.

2 Site Description & Proposed Works

The proposed development site is located approximately 40km to the south-west of the Sydney CBD at Lot 5 DP1272931 Campbelltown Road and Lots 2-3 DP1272931 Zouch Road, Edmondson Park, and is situated within the Liverpool City Council local government area. The site, which is zoned R1 Residential and RE1 Public Recreation, covers an approximate area of 21 hectares and is bound by Macdonald Road to the east, Campbelltown Road to the south, Zouch Road to the west and undeveloped bushland to the north.

Figure 1 - Site Boundary

The proposed works are to consist of the creation of 158 new residential lots and 8 superlots, open space and associated infrastructure as well as a new local access road network to link the development to the surrounding road system.

The development area generally falls south-north away from Campbelltown Road and can be split into two (2) main sub-catchments with respect to stormwater runoff as follows:

- *Western Catchment* – which is defined by those areas of the site that drain informally overland to a first-order tributary which currently flows north-east through the site before eventually continuing downstream through the undeveloped bushland to the north; and
- *Eastern Catchment* – which drains overland to a first-order tributary that originates at the northern boundary of the development area. From here, flows continue through the undeveloped bushland to the north before draining to a confluence point with Maxwell's Creek and the first-order tributary from the *Western Catchment* further downstream.

We note that this catchment split is to generally be maintained in the post-developed scenario, with the two (2) existing watercourses to remain as the proposed discharge points for stormwater flows generated by the proposed development.

Figure 2 – Proposed Layout

Source: Urbanco

3 Data

3.1 Topography

Topographic information for the site was obtained from a combination of detailed site survey prepared by Calibre and aerial Lidar data.

3.2 Rainfall Data

3.2.1 Intensity-Frequency-Duration

IFD data obtained from Council's *Handbook for Drainage Design Criteria* for "Liverpool – Western South Creek" was utilised for the subject site, with the IFD data for durations longer than the 60 minute interval interpolated based on the IFD polynomial coefficients supplied by Council (see table below for details).

Table 1 - Rainfall Intensities for "Liverpool - Western South Creek"

Duration	5 Year	20 Year	100 Year
5min	125.88	166.8	220.7
10min	96.36	127.7	169.1
15min	80.40	106.4	140.8
20min	69.94	92.52	122.4
25min	62.43	82.58	109.2
30min	56.71	75.02	99.27
45min	45.41	60.11	79.58
1hr	38.57	51.09	67.65
1.5hrs	30.50	40.40	53.52
2hrs	25.76	34.12	45.20
3hrs	20.28	26.85	35.55

Source: Liverpool Council's Handbook for Drainage Design Criteria

3.2.2 Pluviograph Data

Pluviography data from 67035 Liverpool (Whitlam Centre – 6 minute interval) was utilised within the proposed MUSIC model as per Council's *WSUD Technical Guidelines*.

4 Design Controls & Guidelines

The stormwater network for the site has been designed to comply with the following guidelines:

- Liverpool City Council Development Control Plans
  - Liverpool City Council Development Control Plan (2008) – Part 1, General Controls
  - Liverpool Growth Centre Precincts Development Control Plan (2014) – Schedule 1, Austral and Leppington North Precincts
- Liverpool City Council – Development Design Specification D5: Stormwater Drainage Design Guidelines (2003)
- Liverpool City Council – Handbook for Drainage Design Criteria;
- Liverpool City Council – WSUD Technical Guidelines;
- Edmondson Park South Part 3A Concept Plan – Watercycle Management Plan (2010) by J.Wyndham Prince;
- Australian Rainfall and Runoff; and
- Managing Urban Stormwater: Soils and Construction

5 Stormwater Management Strategy

5.1 Sediment & Erosion Control

Prior to any works commencing on site, erosion and sediment control measures will be put in place generally in accordance with Managing Urban Stormwater: Soils and Construction 4th Edition, March 2004. These measures include:

- Installation of a 1.8m high chain wire fence covered with geotextile fabric to the perimeter of the work site area
- Sediment basins situated towards the low points of the site for the collection of stormwater runoff during construction
- The use of appropriate sediment diverting methods to minimise sediment in Council's stormwater drainage network
- Locations for temporary stockpiling
- Provision of a temporary truck wash down facility for vehicles exiting the site during construction

Refer to the Sediment and Erosion Control Plans 22-514-DA-C120-C122 by IDC for details.

5.2 Water Quantity Management

5.2.1 Major/Minor System Drainage

The major/minor approach to stormwater drainage is the recognized drainage concept for urban catchments within the Liverpool City Council local government area.

The minor drainage system is comprised of the below ground pit and pipe network within the new local roads and is designed to control nuisance flooding and enable effective stormwater management for the site. Council's Development Controls requires that the minor system be designed for a minimum 5-year ARI for residential areas.

The major drainage system incorporates overland flow routes through proposed road, hardstand and landscaped areas and is assessed against the 100-year ARI design storm event. The major system also exists to cater for minor system failures. In accordance with council's requirements, the major drainage system is to be designed in a manner that ensures that personal safety is not compromised. As such, all overland flow routes for the site are to be designed so that the maximum velocity-depth product shall not exceed $0.4m^2/s$ in accordance with standard engineering practice.

5.2.2 Detention Strategy

As outlined in the "Water Cycle Management Plan" prepared by J. Wyndham Prince (2010) for Edmondson Park, we note that provision of additional on-site stormwater detention facilities is not required as part of this proposal as un-detained post-developed flows from the proposed DA

development area have already been accounted for in the design of the Maxwell's Creek Regional Detention Basin (40,500m^3).

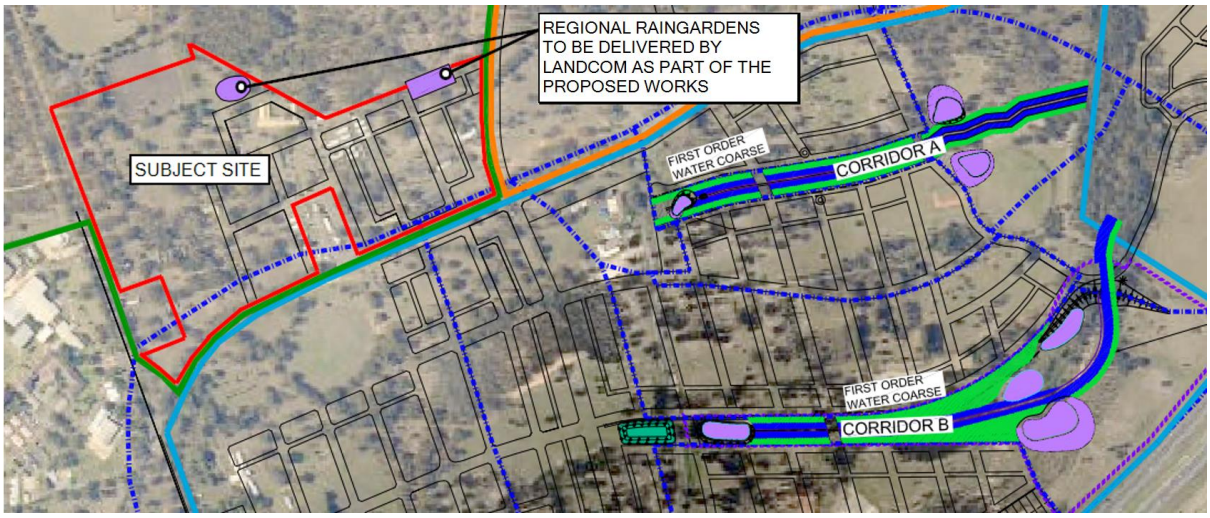
5.2.1 Flooding

We note the subject site is not impacted by mainstream flooding and is located outside the 1% AEP flood extent as shown in the report *Design for the Modification of Creeks in Edmondson Park* dated June 2014 by Storm Consulting.

5.3 Water Quality Management

In accordance with the outcomes of Council's Water Cycle Management Plan, we note that water quality requirements for the development area are to be accommodated via two (2) regional "raingardens" that will be delivered by Landcom as part of this proposal.

Figure 3 – Bioretention "Raingardens"



Source: Edmondson Park South Part 3A Concept Plan – Watercycle Management Plan (2010) by J.Wyndham Prince

As outlined in the J. Wyndham Prince Report, the raingardens are to have a minimum treatment area of 750m^2 (Basin No. 1) and 950m^2 (Basin No. 2) respectively and are to be integrated as part of the proposed Landscape Masterplan for the site.

In accordance with Council requirements, we note that the following targets have been set in relation to post-developed water quality improvement targets:

- 85% reduction in the post development mean annual load of Total Suspended Solids (TSS);
- 65% reduction in the post development mean annual load of Total Phosphorus (TP);
- 45% reduction in the post development mean annual load of Total Nitrogen (TN); and
- 90% reduction in the post development mean annual load for Gross Pollutants (GP) greater than 5mm.

As such, for the purposes of this study, a concept treatment train of the proposed works has been modelled in MUSIC to ensure that the statutory post-developed water quality targets are achieved for the site in accordance with Council requirements.

6 Stormwater Modelling

A hydrological model of the catchment was formulated using the DRAINS software package and was analysed to assess the performance of the site stormwater network. The DRAINS program typically performs design and analysis calculations for urban stormwater systems and models the runoff behaviour on both rural and urban catchments.

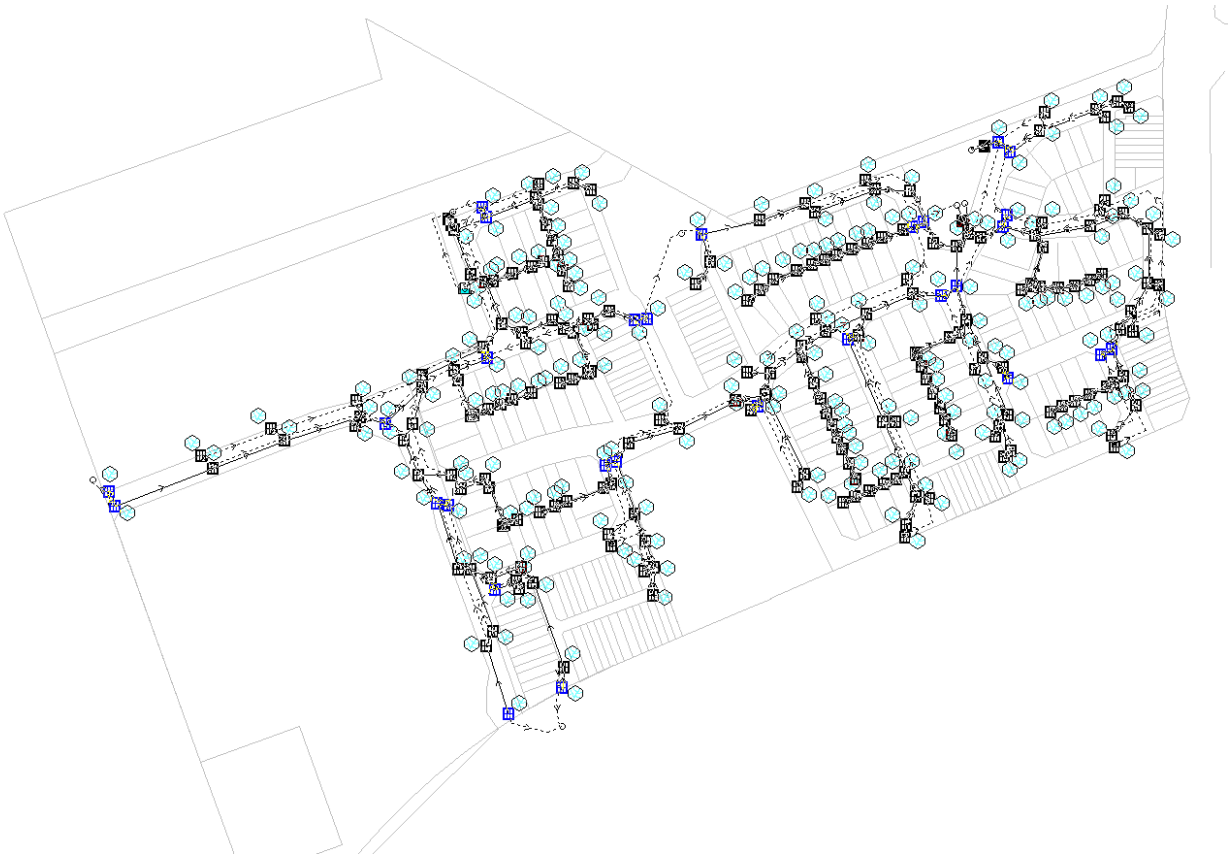
The user data inputs required by DRAINS include catchment areas, flow path lengths, time of concentration, pervious and impervious areas, IFD rainfall intensities and flow path roughness. Modelling is performed through the development of a network of pipes, pits and nodes to represent both the proposed and existing scenarios on site.

6.1 DRAINS Modelling

The DRAINS model for the proposal was developed based on the following methodology:

- Stormwater flows are to ultimately drain via a new below ground pipe system to the two regional raingardens that are to be constructed on the downstream side of the site, with the existing catchment split between the western and eastern portions of the site to generally be maintained in the post-developed scheme. From here, flows will discharge from the basins as sheet flow to the existing downstream first-order tributaries as per the current flow regime;
- An indicative pit and pipe network was developed for the proposed siteworks (refer to IDC Drawing 20-514-DA-C200-C209 for details);
- Tailwater conditions at the inlets to each of the proposed basins has been set at the top of pipe obvert in accordance with general engineering practice. These levels are considered appropriate as they assume the worst-case scenario for the catchment and have been specified to simulate a charged system downstream in order to verify the capacity of the proposed piped network for stormwater flows generated during the design storm events;
- In accordance with Council's Handbook for Drainage Design Criteria, an impervious fraction of 90% was adopted for the new medium-density residential lots within the development area in accordance with Liverpool City Council requirements;
- Contributing flows from the future upstream playing fields and existing Bardia Barracks immediately to the west and south of the development area have also been considered in the modelling process to verify the capacity of the proposed stormwater network and to minimise the number of future connections to the system. The catchment division for the upstream lots was generally based on the current ILP layout, with the overall impervious percentage assumed based on the recommended values for different land use categories as outlined in Council's *Handbook for Drainage Design Criteria*; and
- 5 year and 100 year ARI events were considered for all standard durations.

Figure 4 – Proposed DRAINS Model



Note: Pit, Catchment and Overland Flow Details have not been shown for clarity

6.1.1 DRAINS Results

Iterations were performed in the DRAINS model to determine the size of the proposed piped network in order to satisfy major / minor system requirements in accordance with Liverpool Council standards.

The proposed piped drainage system has been designed to cater for a minimum of the 1 in 5 year ARI event leading to the outlets to the downstream watercourses. A provision for overland flows greater than the 1 in 5 year ARI event were also considered.

Results of the DRAINS assessment indicate that:

- Site discharge is conveyed directly to the existing downstream watercourses in accordance with Council requirements;
- The proposed pit and pipe drainage network has been designed to accommodate the fully developed upstream catchment for flows up to and including the 1% AEP; and
- Major / minor system requirements are satisfied at all proposed pits in the development area and that the piped system sufficiently conveys minor storm flows with safe provision for major system flows;

6.2 MUSIC Modelling

Modelling of the proposed development was undertaken using Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software.

The following methodology and parameters were incorporated into the MUSIC modelling for the proposed site:

- The post-developed site was consolidated into three (3) main sub-catchment areas based on the proposed lot and drainage layout as follows, with provision also made for contributing flows from upstream catchments to ensure that downstream water quality targets are achieved for the entire catchment in accordance with Council requirements:

Table 2 - MUSIC Sub-Catchment Summary

MUSIC Sub-Catchment	Description	Area (Ha)
M1	Western Catchment draining to Basin No 1 (750m^2)	11.18
M2	Eastern Catchment draining to Basin No 2 (950m^2)	7.69
M3	Lot areas bypassing Raingardens	0.18
Total		**19.05**

- Catchments were than separated into "Road Reserve", "Residential", "Open Space" and "Upstream" areas as per the latest lot layout for the site.

Table 3 – MUSIC Catchment Breakdown

MUSIC Sub-Catchment	Road Reserve (Ha)	Residential (Ha)	Open Space (Ha)	Upstream Playing Fields (Ha)	Upstream Barracks Site (Ha)	Upstream Bushland (Ha)	Total Area (Ha)
M1	2.44	1.66	0.49	3.82	-	2.77	**11.18**
M2	2.56	3.85	0.21	-	1.07	-	**7.69**
M3	0.03	0.15	-	-	-	-	**0.18**
Total	**5.03**	**5.66**	**0.70**	**3.82**	**1.07**	**2.77**	**19.05**

- The pollutant concentration parameters used within the model were based on the recommended model defaults for different land use categories as specified in Council's *WSUD Technical Guidelines*. These are summarised in the following table:

Table 4 - MUSIC Node Classification

MUSIC Node	Classification
Residential	"Residential"
Road Reserve	"Road Areas"

Open Space	"General Urban"
Upstream Playing Fields	"General Urban"
Upstream Bardia Barracks Site	"General Urban"
Upstream Bushland	"Forest"

- The soil properties for the pervious areas of the catchment were defined based on the recommended default parameters for "Clay Type" soils listed in Council's *WSUD Technical Guidelines*.

6.2.1 Water Quality Treatment Train

The following treatment train has been proposed for the site:

- Rainwater Tanks are to be provided within each new lot to collect roof water for re-use on-site within the new dwellings and for irrigation of garden areas, with overflows to be directed to the new street drainage system. It should be noted that for the purposes of this study that Rainwater Tank treatments have been excluded from the proposed MUSIC model – this is considered appropriate as it assumes the worst-case scenario for the catchment. Moving forward, the exact type, size and location of the rainwater tanks are to be assessed as part of each of the subsequent individual Development Applications for the new residential lots. This will also allow for different options to be explored to achieve higher standards (including BASIX requirements) where feasible;
- Runoff from the new road reserve and lot areas are to be collected within the below-ground pit and pipe network before being conveyed to the downstream raingardens;
- Gross Pollutant Traps (GPT) are proposed immediately upstream of each raingarden to provide pre-treatment of larger pollutants and sediments prior to discharge to the basin; and
- Two (2) bioretention "raingardens" are proposed as an end-of-line treatment prior to discharge to the downstream watercourses.

Bioretention

In developing the MUSIC model for the post-developed site, the following assumptions have been made regarding the bioretention systems:

Table 5 - MUSIC Sub-Catchment Summary

Parameter	Basin No 1 (Western Catchment M1)	Basin No 2 (Eastern Catchment M2)
Treatable Flow Rate (3-month ARI)	0.432m^3/s	0.605m^3/s
Filter Area (m^2)	750	950
Extended Detention Depth (m)	0.3	0.3
Filter Depth (m)	0.4	0.4
Saturated Hydraulic Conductivity (mm/hr)	100	100

For the saturated hydraulic conductivity, we note that a minimum rate of 200mm/hr has been specified on the DA plans for the sandy loam filter media (Benedicts M165 SmartMix or equivalent) in accordance with Council requirements. However, for the purposes of this study, a conservative 50% value of 100mm/hr has been adopted in the MUSIC model - this is to allow for compaction and the accumulation of fine sediment particles within the bioretention system over time and is considered appropriate as it assumes the worst-case scenario for the catchment.

We note that the remaining bioretention parameters are as per the recommended model defaults listed in Council's *WSUD Technical Guidelines*.

Gross Pollutant Trap

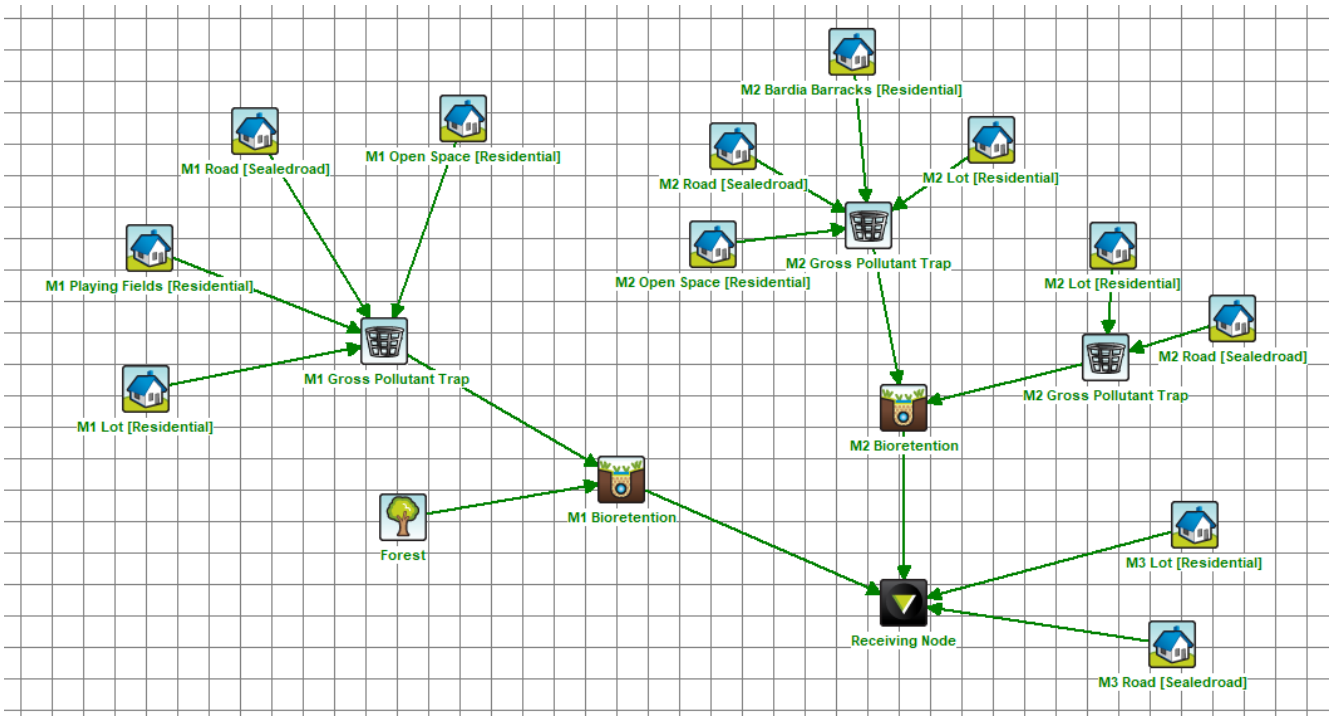
Pollutant removal rates utilised in the MUSIC model for the GPTs have been based on a generic CDS style system and have been summarised in the table below:

- Treatable Flow Rate = 3-month ARI

Table 6 – GPT MUSIC Parameters

Pollutant	Input	Output	Reduction
Total Suspended Solids	100	30	70%
Total Phosphorus	100	70	30%
Total Nitrogen	50	50	0%
Gross Pollutants	100	2	98%

Figure 5 - Proposed MUSIC Model



6.2.2 MUSIC Results

The results of the MUSIC analysis are summarised in the table below:

Table 7 - MUSIC Results

Pollutant	Generation (kg/yr)	Output (kg/yr)	Removal Rate	Target Removal Rate
Total Suspended Solids	21,800	2,080	90.5%	85%
Total Phosphorus	35.7	7.35	79.4%	65%
Total Nitrogen	199	96.9	51.4%	45%
Gross Pollutants	2,360	46.6	98.0%	90%

Based on the results of the MUSIC analysis, we note that the proposed treatment train will provide adequate improvements to satisfy the water quality improvement objectives set out in Council's DCP. As such, the water quality objectives have been achieved for both the proposed development and the local catchment.

A copy of the MUSIC-link summary report has also been included in Appendix A for reference.

Appendix A – MUSIC Link Data

LIVERPOOL CITY COUNCIL

music@link

MUSIC-*link* Report

Project Details		Company Details	
Project:	Ed Park P3	**Company:**	
Report Export Date:	24/05/2024	**Contact:**	
Catchment Name:	230123 Ed Park P3 MUSIC Model	**Address:**	
Catchment Area:	19.05ha	**Phone:**	
Impervious Area*:	54.96%	**Email:**	
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1967 - 31/12/1976 11:54:00 PM		
Mean Annual Rainfall:	857mm		
Evapotranspiration:	1171mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Liverpool Clay Soil		
Scenario:	Liverpool Development		

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

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	3.65%	Bio Retention Node	2	Urban Source Node	14
TSS	90.5%	Rain Water Tank Node	1	Forest Source Node	1
TP	79.4%	GPT Node	3		
TN	51.4%				
GP	98%				

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	M1 Bioretention	Exfiltration Rate (mm/hr)	0	None	0
Bio	M1 Bioretention	Hi-flow bypass rate (cum/sec)	0	None	0.432
Bio	M1 Bioretention	Orthophosphate Content in Filter (mg/kg)	0	55	30
Bio	M1 Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	M1 Bioretention	Total Nitrogen Content in Filter (mg/kg)	1	800	600
Bio	M2 Bioretention	Exfiltration Rate (mm/hr)	0	None	0
Bio	M2 Bioretention	Hi-flow bypass rate (cum/sec)	0	None	0.605
Bio	M2 Bioretention	Orthophosphate Content in Filter (mg/kg)	0	55	30
Bio	M2 Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	M2 Bioretention	Total Nitrogen Content in Filter (mg/kg)	1	800	600
Forest	Forest	Area Impervious (ha)	None	None	0
Forest	Forest	Area Pervious (ha)	None	None	2.77
Forest	Forest	Total Area (ha)	None	None	2.77
GPT	M1 Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	0.432
GPT	M2 Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	0.555
GPT	M2 Gross Pollutant Trap	Hi-flow bypass rate (cum/sec)	None	99	0.05
Rain	Rainwater Tank	% Reuse Demand Met	None	None	0
Receiving	Receiving Node	% Load Reduction	None	None	3.65
Receiving	Receiving Node	GP % Load Reduction	90	None	98
Receiving	Receiving Node	TN % Load Reduction	45	None	51.4
Receiving	Receiving Node	TP % Load Reduction	65	None	79.4
Receiving	Receiving Node	TSS % Load Reduction	85	None	90.5
Urban	M1 Lot	Area Impervious (ha)	None	None	1.324
Urban	M1 Lot	Area Pervious (ha)	None	None	0.335
Urban	M1 Lot	Total Area (ha)	None	None	1.66
Urban	M1 Open Space	Area Impervious (ha)	None	None	0.071
Urban	M1 Open Space	Area Pervious (ha)	None	None	0.418
Urban	M1 Open Space	Total Area (ha)	None	None	0.49
Urban	M1 Playing Fields	Area Impervious (ha)	None	None	0.556
Urban	M1 Playing Fields	Area Pervious (ha)	None	None	3.263
Urban	M1 Playing Fields	Total Area (ha)	None	None	3.82
Urban	M1 Road	Area Impervious (ha)	None	None	2.203
Urban	M1 Road	Area Pervious (ha)	None	None	0.236
Urban	M1 Road	Total Area (ha)	None	None	2.44
Urban	M2 Bardia Barracks	Area Impervious (ha)	None	None	0.752
Urban	M2 Bardia Barracks	Area Pervious (ha)	None	None	0.317
Urban	M2 Bardia Barracks	Total Area (ha)	None	None	1.07
Urban	M2 Lot	Area Impervious (ha)	None	None	2.847
Urban	M2 Lot	Area Impervious (ha)	None	None	0.223
Urban	M2 Lot	Area Pervious (ha)	None	None	0.722

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	M2 Lot	Area Pervious (ha)	None	None	0.056
Urban	M2 Lot	Total Area (ha)	None	None	3.57
Urban	M2 Lot	Total Area (ha)	None	None	0.28
Urban	M2 Open Space	Area Impervious (ha)	None	None	0.030
Urban	M2 Open Space	Area Pervious (ha)	None	None	0.179
Urban	M2 Open Space	Total Area (ha)	None	None	0.21
Urban	M2 Road	Area Impervious (ha)	None	None	2.095
Urban	M2 Road	Area Impervious (ha)	None	None	0.216
Urban	M2 Road	Area Pervious (ha)	None	None	0.224
Urban	M2 Road	Area Pervious (ha)	None	None	0.023
Urban	M2 Road	Total Area (ha)	None	None	2.32
Urban	M2 Road	Total Area (ha)	None	None	0.24
Urban	M2 Roof	Area Impervious (ha)	None	None	0.085
Urban	M2 Roof	Area Impervious (ha)	None	None	0.085
Urban	M2 Roof	Area Pervious (ha)	None	None	0
Urban	M2 Roof	Area Pervious (ha)	None	None	0
Urban	M2 Roof	Total Area (ha)	None	None	0.085
Urban	M2 Roof	Total Area (ha)	None	None	0.085
Urban	M3 Lot	Area Impervious (ha)	None	None	0.119
Urban	M3 Lot	Area Pervious (ha)	None	None	0.030
Urban	M3 Lot	Total Area (ha)	None	None	0.15
Urban	M3 Road	Area Impervious (ha)	None	None	0.027
Urban	M3 Road	Area Pervious (ha)	None	None	0.002
Urban	M3 Road	Total Area (ha)	None	None	0.03

Only certain parameters are reported when they pass validation