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140-204 WESTERN AVENUE, WESTMEADOWS STORMWATER MANAGEMENT STRATEGY

APRIL 2023

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FOR

MAB

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Disclaimer

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Executive Summary

This report outlines the stormwater drainage and management strategy for the proposed development at 140-204 Western Avenue, Westmeadows. The subject site is approximately 29.94 hectares. The site is located within the City of Hume and will be developed such that City of Hume and Melbourne Water stormwater requirements are achieved. The proposal will comprise industrial development following the rezoning of the site.

The subject site is adjacent to and drains to Moonee Ponds Creek. Stormwater from the site will continue to drain to Moonee Ponds Creek following development. Appropriate measures will be included in the development to ensure that developed stormwater runoff is treated prior to being safely discharged to the creek. The creek connection has been minimised to a single outlet located away from the area of highest value habitat identified by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

No cut and fill works are proposed within the Moonee Ponds Creek corridor as part of the proposed development.

Underground drainage will be designed to convey minor event flows up to and including the 10% Annual Exceedance Probability (AEP). Underground drainage will direct stormwater to appropriate stormwater quality treatment and the single connection to Moonee Ponds Creek. Major, overland flow paths will provide safe conveyance of events up to and including the 1% AEP through the subject site and the existing Wright Street, and ultimately discharge to Moonee Ponds Creek.

Major events, including all stormwater events in excess of the capacity of the underground drainage system up to and including the 1% AEP event, will be conveyed safely overland. Safe flow paths that achieve Melbourne Water criteria for safe conveyance of overland flow will be provided through the development's internal roads and the existing Wright Street, before discharging appropriately to Moonee Ponds Creek. The 1% AEP event overland flow paths will be sized during detailed design. The flow paths will be sized and graded such that major flows are conveyed safely, and that appropriate protection is provided to finished floor levels within the development.

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1. Introduction

This report presents the stormwater drainage and management strategy for the subject site development at Western Avenue, Westmeadows. The subject site, as indicated on Figure 3, comprises approximately 29.94 ha and is located within Hume City Council. Hume City Council stormwater requirements must be addressed in the development of the site.

The subject site is bounded by Wright Street to the east, Tullamarine Freeway to the south, Victoria Street to the west, and Moonee Ponds Creek to the north. Existing residential development and a Melbourne Water reserve are located to the east, and Melbourne Airport is located to the southwest. Figure 1 shows the site in the existing condition. Catchment plans are included in Appendix A.

The subject site slopes generally from the south-west to the north-east. In the existing condition, the site grades to Moonee Ponds Creek. Grades across the site are, on average, approximately 1-in-10 to 1-in-20. The steep grades have been considered when preparing the stormwater management strategy for the subject site.

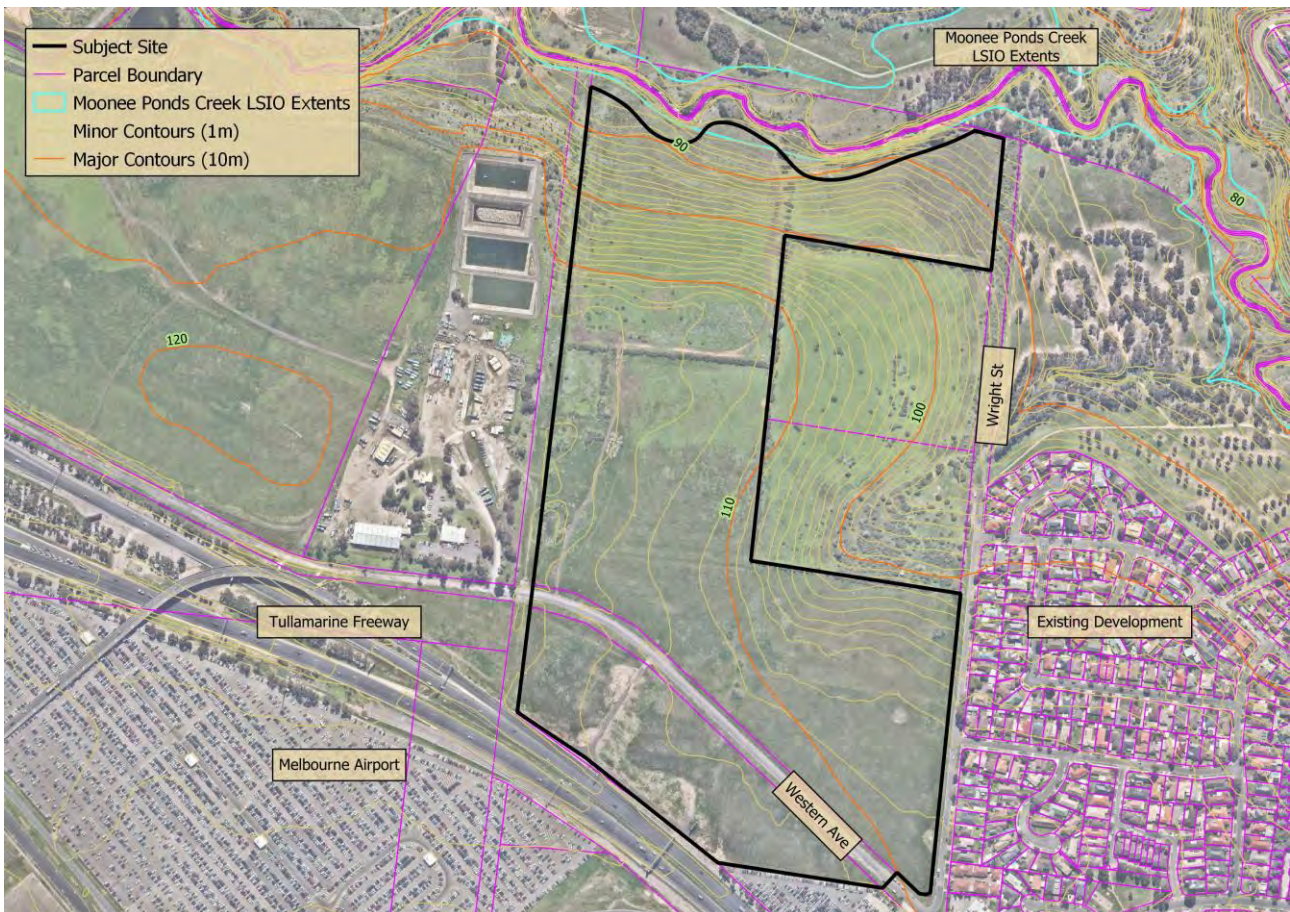


Figure 1: Subject site in existing condition

The subject site is located within Hume City, and as such, the Victorian Planning Authority (VPA) *Engineering Design and Construction Manual (EDCM)* (Growth Areas Authority (GAA), 2011) stormwater requirements apply to the subject site.

As set forth in the *EDCM* (GAA, 2011), stormwater drainage will be managed as part of the development. Minor stormwater flows up to and including 10% AEP flows will be conveyed by underground drainage. Flows greater than the underground drainage flows, up to and including the 1% AEP flow, will be safely conveyed overland through the development.

All calculations and drainage design in this report are compliant with *Australian Rainfall and Runoff 2019 (ARR19)* and reflect industry Best Practice approaches.

2. Site Overview

2.1 Existing Condition

In the existing condition, the subject site is undeveloped. The land is vacant, and no formal drainage infrastructure is visible on the site. A site investigation and Dial Before You Dig (DBYD) information indicates that there is existing underground drainage in Western Avenue and Wright Street. At the northern end of Wright Street, the existing drain connects to an open earth channel and thence to Moonee Ponds Creek.

Figure 2 shows the site in the existing condition. Natural surface contours indicate the subject site slopes steeply to Moonee Ponds Creek. In the existing condition, stormwater runoff sheet flows from the site. Stormwater from the north of the site flows directly to Moonee Ponds Creek. Stormwater from the south and east of the site flows to Moonee Ponds Creek via an existing gully, as shown in Figure 2.

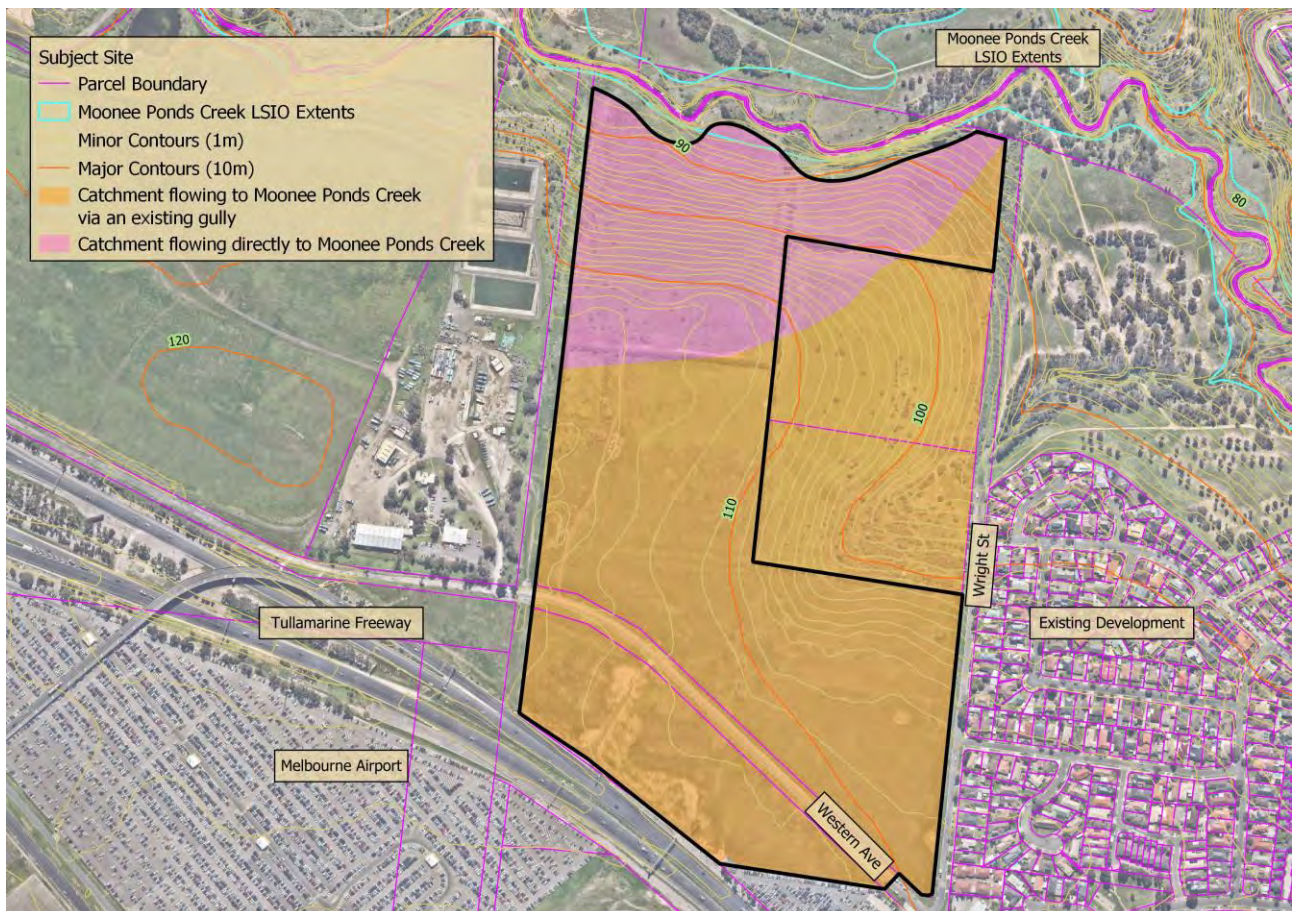


Figure 2: Site topography and existing condition stormwater catchments

While the *EDCM* does not reference Australian Rainfall and Runoff 2019 (ARR19), ARR19 is the Best Practice guideline for stormwater calculations. ARR19 recommends the use of the Regional Flood Frequency Estimation (RFFE) model to determine stormwater flows from undeveloped catchments. The subject site is just smaller than the minimum requirement for the RFFE method

(Subject Site: 0.4 km²; RFFE minimum: 0.5 km²). Nevertheless, RFFE generated flows are included in this report. More refined flow estimation will occur during detailed design.

Existing condition flows have been obtained using the RFFE model for the entire subject site as shown in Table 1. Stormwater catchments in the existing condition are shown in Figure 2. Complete hydrologic calculations are included in Appendix B.

Table 1: Existing flows at the subject site

Catchment	Area (ha)	20% AEP (m³/s)	10% AEP flow (m³/s)	1% AEP flow (m³/s)
Subject Site and external catchment	39.1	0.55	0.75	1.60

2.2 Ultimate Condition

In the ultimate condition, the subject site will be developed for industrial use and will feature an area of public open space along the east of the subject site, as shown in Figure 3.

The northern portion of the site is proposed to be undeveloped land which also includes a proposed GPT, sediment basin and bio-retention basin for stormwater treatment, as outlined in Section 4. The south-eastern portion of the site is proposed to be used as a 40-metre-wide buffer zone for open space. The north-eastern portion of the site will be future development, however the type of development is yet to be confirmed.

A full-size development plan is included as Appendix C.

In the ultimate condition, stormwater runoff from the developed area will increase as a result of the increased imperviousness of the site. Both minor and major flows from the subject site must be catered for in the ultimate condition. The proposed development will include stormwater quality treatment to ensure that runoff from the development meets best practice standards prior to entering Moonee Ponds Creek.

Minor and major drainage from the subject site will be conveyed safely to Moonee Ponds Creek. In the developed condition, 1 EY flows will be directed to a Gross Pollutant Trap (GPT) and sediment basin. The gap flows from the pipe system will be diverted north and outfall to Moonee Ponds Creek. Following treatment by the sediment basin, the 4 EY flows will be discharged to the bio-retention basin. The stormwater quality treatment is outlined on Section 4 and layout plan shown on Figure 6.

Both minor and major flows will ultimately discharge to Moonee Ponds Creek. Developed catchment boundaries are a result of the earthworks required for development. Underground drains will be incorporated into the road reserves, and easement drains will be minimised as much as possible.



Figure 3: Proposed development at the subject site

3. Stormwater Management

The subject site is located within the City of Hume and future development is subject to Council's stormwater guidelines. Major and minor flows have been calculated for both existing and ultimate conditions for the development. Flows have been calculated based on the *EDCM* (GAA, 2011) and *RFFE* (ARR, 2016).

Minor and major flows generated from the subject site have been calculated using the Rational Method with ARR19 inputs. This stormwater management strategy encompasses only the subject site—therefore use of the Rational Method is appropriate.

Applying the terminology from ARR19, the 1-in-10-year ARI event is equivalent to the 10% AEP event. Table 2 shows the changes in terminology between ARR1987/1997 and ARR2019. The current Annual Exceedance Probability (AEP) and Exceedances per Year (EY) terminology has been adopted for this report.

Table 2: ARR19 preferred terminology

ARI (1987/1997) 1 in	AEP (2019) %	EY (2019)
3-month	98.17	4
1-year	63.21	1
4.48-year	20	0.22
5-year	18.13 rounded to 20% AEP	0.20
10-year	10	0.11
20-year	5	0.05
50-year	2	0.02
100-year	1	0.01

The times of concentration adopted in calculations are as per guidance in the *EDCM* (GAA, 2011).

3.1 Minor Event Flows

Minor event flows will be managed at the development level. Minor event flows, up to and including the 10% AEP are proposed to be conveyed safely via the underground drainage system. The catchment layout plan for the minor event flows, which also shows indicative underground drainage alignments, is shown on Figure 4.

3.1.1 Management of Minor Flows

The minor drainage system will be designed to convey stormwater flows under normal operating conditions for minor rainfall events. The minor drainage system will be designed such that any flows in excess of the capacity of the minor drainage system are directed to the major drainage system without compromising the safety of people or resulting in damage to property. The exact configuration of the minor drainage system will be determined during detailed design.

The exact configuration of the underground drainage system, including details of the connections to the Moonee Ponds Creek, will be finalised during detailed design. The design of the underground drainage network will be in accordance with Hume City Council, Melbourne Water, and *EDCM* (GAA, 2011) design standards.

Figure 4 indicates that there are three main catchments within the subject sites. The stormwater management of these catchments are outlined as follows:

- Western catchment: this catchment incorporates sub-catchments A – G, which comprises industrial land and road reserves. The catchment area is approximately 21.4 hectares. The underground drainage system will be sized to convey the 10% AEP flows from these sub-catchments. 10% AEP flows from the western catchment discharges to 'Drain A'. Indicative pipe alignments conveying the 10% AEP flow are shown in Figure 4. The gap flow management in the major event is outlined on Section 3.2.
- Eastern catchment: this catchment incorporates sub-catchments H – K and is approximately 13.6 hectares. Sub-catchment H is to be used as a 40-metre-wide open space area and sub-catchment I will be used for industrial land use. Sub-catchments J and K are external catchments. The type of development in this external catchment area is yet to be confirmed, however for developed condition flow calculations, the land use in these catchments have been assumed to be industrial which is a conservative measure. The 10% AEP flows from these sub-catchments are proposed to drain east to the proposed 'Drain B' which will connect to 'Drain A' at a junction pit, upstream of the GPT. Pipe sizing and details of the pipe network will be undertaken during detailed design. The gap flow management in the major event is outlined on Section 3.2.
- Northern catchment: The northern catchment is proposed to be undeveloped land and has an area of approximately 4.7 hectares. This catchment will sheet flow directly north to Moonee Ponds Creek. Underground drainage and overland flow paths are not required for this catchment.

The two proposed underground main drains, conveying flows from the western and eastern catchments, will connect to a junction pit upstream of the GPT. From this pit, the 1 EY flows will be conveyed to the GPT and the sediment basin. The gap flows (piped flows – 1 EY flow to GPT / Sediment Basin) will be discharged to Moonee Ponds Creek. The minor drainage outlet will be finalised during detailed design. During detailed design, preparation of an *Environmental and Geomorphological Impact Assessment* will be undertaken. The *Assessment* will ensure that the detailed design of the single outlet is appropriate.

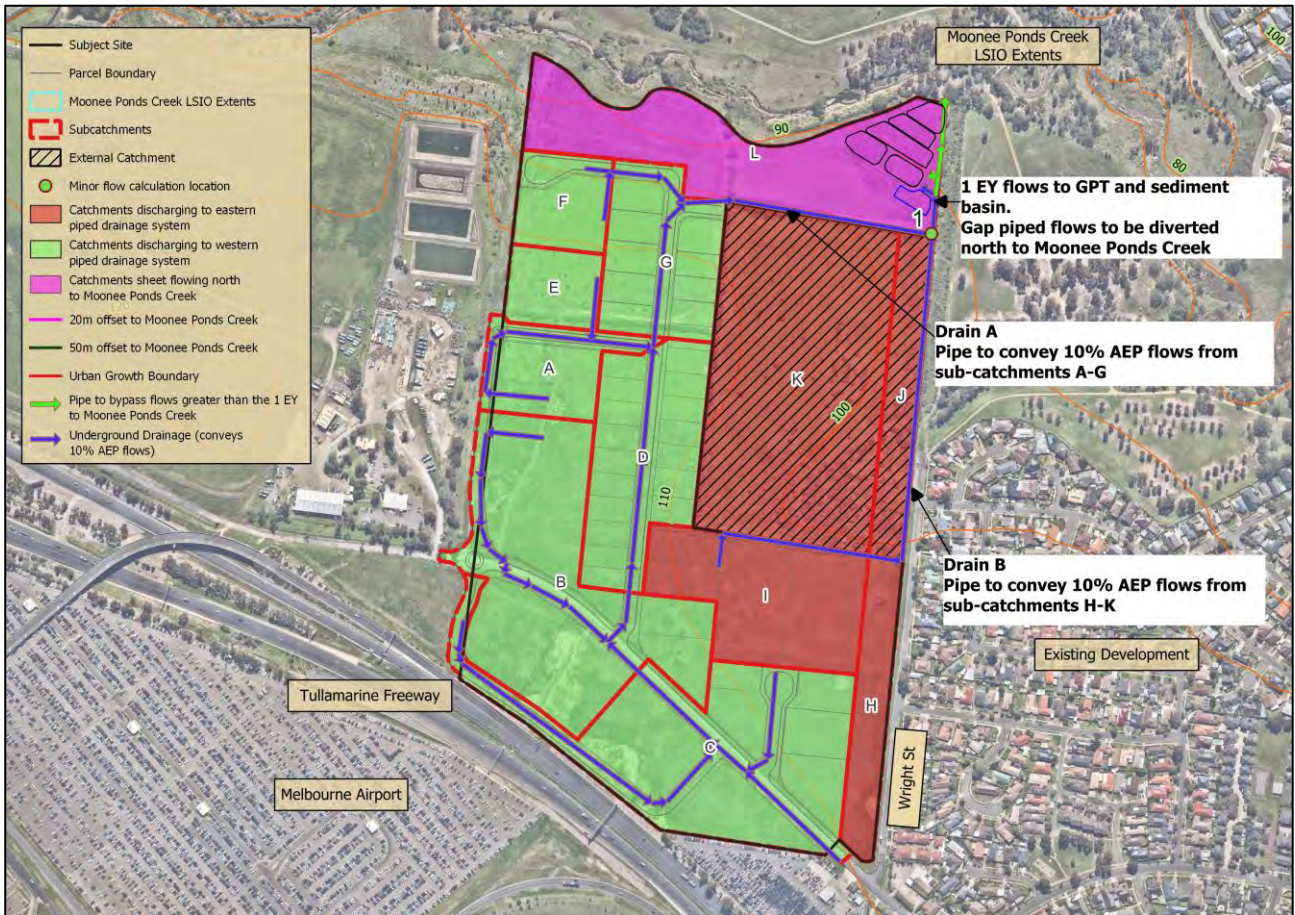


Figure 4: Minor flow events catchment layout plan

3.1.2 Minor Event Flow Calculations

Minor event flows are shown in Table 3. Complete drainage calculations are included in Appendix B. The flows presented in this report will be refined during detailed design.

Table 3: Developed minor flows

Catchment	Upstream Area (ha)	Location 1 – peak flow in pipe (m ³ /s)	1 EY Flow to GPT / Sediment Basin (m ³ /s)	Gap Flow to be diverted north to Moonee Ponds Creek (m ³ /s)
Western Catchment	21.4	3.3	N/A	N/A
Eastern Catchment (including external catchments at sub-catchments J and K)	13.6	1.9	N/A	N/A
Total area to GPT / Sediment Basin	35.0	5.2	2.1 (calculated as 40% of 10% AEP flow)	3.1

3.2 Major Event Flows

Major flows (greater than the 10% AEP) will be conveyed safely overland through the subject site and through Wright Street, east of the subject site and will ensure no damage to property or risk to people. Overland flow will be primarily conveyed within road reserves and drainage reserve / open space areas. The design of the drainage reserves road reserves will be finalised in detailed design, when detailed calculations will be undertaken to ensure that overland flow within the road reserves achieves Melbourne Water design criteria for safe floodway conveyance.

3.2.1 Management of Major Flows

Figure 5 shows indicative major event flow paths. The direction of flow is also noted. The overland flow paths will be designed such that Melbourne Water's *Guidelines for Development in Flood-prone Areas* (Melbourne Water, 2007) criteria for safe overland flow depth (< 0.35 m), velocity (< 1.5 m/s), and depth x velocity (< 0.35 m²/s) criteria are met. The design of the development will ensure protection from 1% AEP flows to finished floor levels.

Detailed hydraulic analysis will occur during detailed design.

Figure 5 indicates the main catchments for the major flows and the indicative major flow paths. The details and major flow management of these catchments as follows:

- Sub-catchments A, D, E, F, G: the 10% AEP flows from these catchments will be piped and flow to 'Drain A', however the major gap flows (1% AEP – 10% AEP) will sheet flow to the northern open space area, towards Moonee Ponds Creek, from the low point in the road reserve (refer location 1).
- Sub-catchments B, C, H, I: gap flows from these sub-catchments are proposed to discharge east to Wright Street, onto the gully and ultimately flow to Moonee Ponds Creek. Although the minor flows from sub-catchments B and C will be piped and connect to 'Drain A', the road reserves in these sub-catchments will be graded such that they flow east towards Wright Street.
- Sub-catchments J and K (external catchments): the gap flow management of this external catchment area is to be confirmed. However, it is possible to grade the road reserves to the north – eastern end of this catchment so that gap flows from the road reserve can sheet flow to the reserve north of Wright Street, and ultimately to Moonee Ponds Creek.
- Sub-catchment L: flows from this catchment sheet flow north to Moonee Ponds Creek.

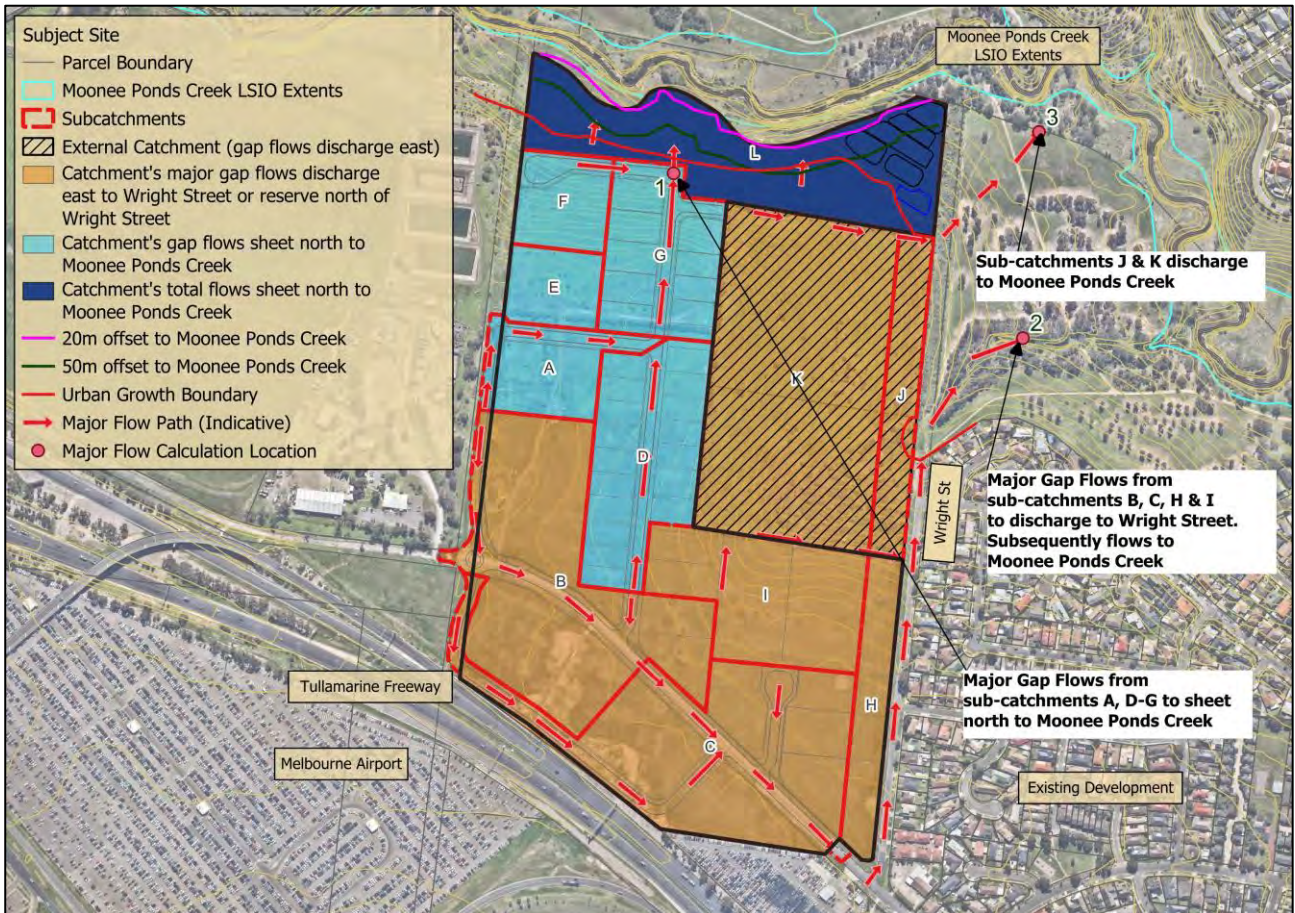


Figure 5: Major event flows catchment layout plan

3.2.2 Major Event Flow Calculations

Major flows from the subject site will be conveyed overland through the proposed internal roads. Gap flow is defined as the 1% AEP – 10% AEP flow in industrial/commercial areas.

The 1% AEP gap flows are shown in Table 4. Complete drainage calculations are included in Appendix B. The gap flows presented in this report are indicative. Once the capacity of the drainage network is finalised in detailed design, the capacity of all minor drainage pipes will be set, and a more exact gap flow can be adopted.

Table 4: Ultimate major flows

Flow Location	Contributing catchments	Upstream Area (ha)	Gap Peak Flow (1 % AEP – 10% AEP piped flow) (m³/s)
1	A, D, E, F, G	9.4	1.7
2	B, C, H, I	16.5	2.0
3	J, K (external catchments)	9.1	1.6

3.3 External Catchments

There are no external catchments upstream of the subject site. Drainage for the Tullamarine Freeway is directed to the south towards Steele Creek.

4. Stormwater Quality

Provision of stormwater quality at the subject site is extremely important to provide adequate protection for Moonee Ponds Creek, the receiving waterway. In accordance with council and planning requirements, stormwater quality treatment for the proposed development must be provided. Stormwater runoff must be treated to best practice standards prior to being discharged to Moonee Ponds Creek.

The unique qualities of the subject site have informed the design of the stormwater quality treatment. The subject site is steep, and the steepest slopes are nearest to Moonee Ponds Creek. Previous stormwater management strategies for the site have explored the construction of a stormwater quality treatment wetland. However, this was not the most appropriate treatment solution due to the constraints of the subject site.

The stormwater quality treatment of the site has been modelled using MUSIC, to ensure that the site treats stormwater to Best Practice Environmental Management Guidelines (BPEMG). That is, treating suspended solids to 80% of annual load, treating phosphorus and nitrogen to 45% of annual load, and litter to 70% of annual load. The MUSIC model details and stormwater quality treatment outputs are shown in Appendix E.

4.1 GPT and Sediment Basin

At the junction pit immediately adjacent to and upstream of the GPT, the 1 EY flows will be diverted to the GPT and then the sediment basin. Gap flows from the pipe system will be diverted north to Moonee Ponds Creek.

Concept design of the sediment basin has been undertaken to ensure that it is sized appropriately to treat the entire subject site. The concept design has also allowed for the required drying area and access tracks required for maintenance of the sediment basin. The sediment basin has been included in MUSIC modelling of the proposed stormwater quality treatment (See Section 4.2).

4.2 Bioretention

Following pre-treatment by the sediment basin, flows up to and including the 4 Exceedances per Year (EY) flow will be directed to a terraced bioretention. The bioretention system will provide tertiary treatment to remove nutrients including nitrogen and phosphorus from stormwater generated by the subject site.

The bioretention design can be incorporated into the steep, landscape adjacent to Moonee Ponds Creek. The design of the bioretention allows for the 20-m offset from the surveyed top of bank of Moonee Ponds Creek. The bioretention asset is completely outside of the 20-m offset. Retaining walls will allow the treatment cells to maximise treatment area within the steep, constrained area adjacent to the creek. Figure 6 shows the concept design of the sediment basin and bioretention system. Note the single outlet that connects to the Moonee Ponds Creek downstream of the existing pond. A full-size plan of the bioretention design, including a section view of the bio-retention basin, is included in Appendix D.

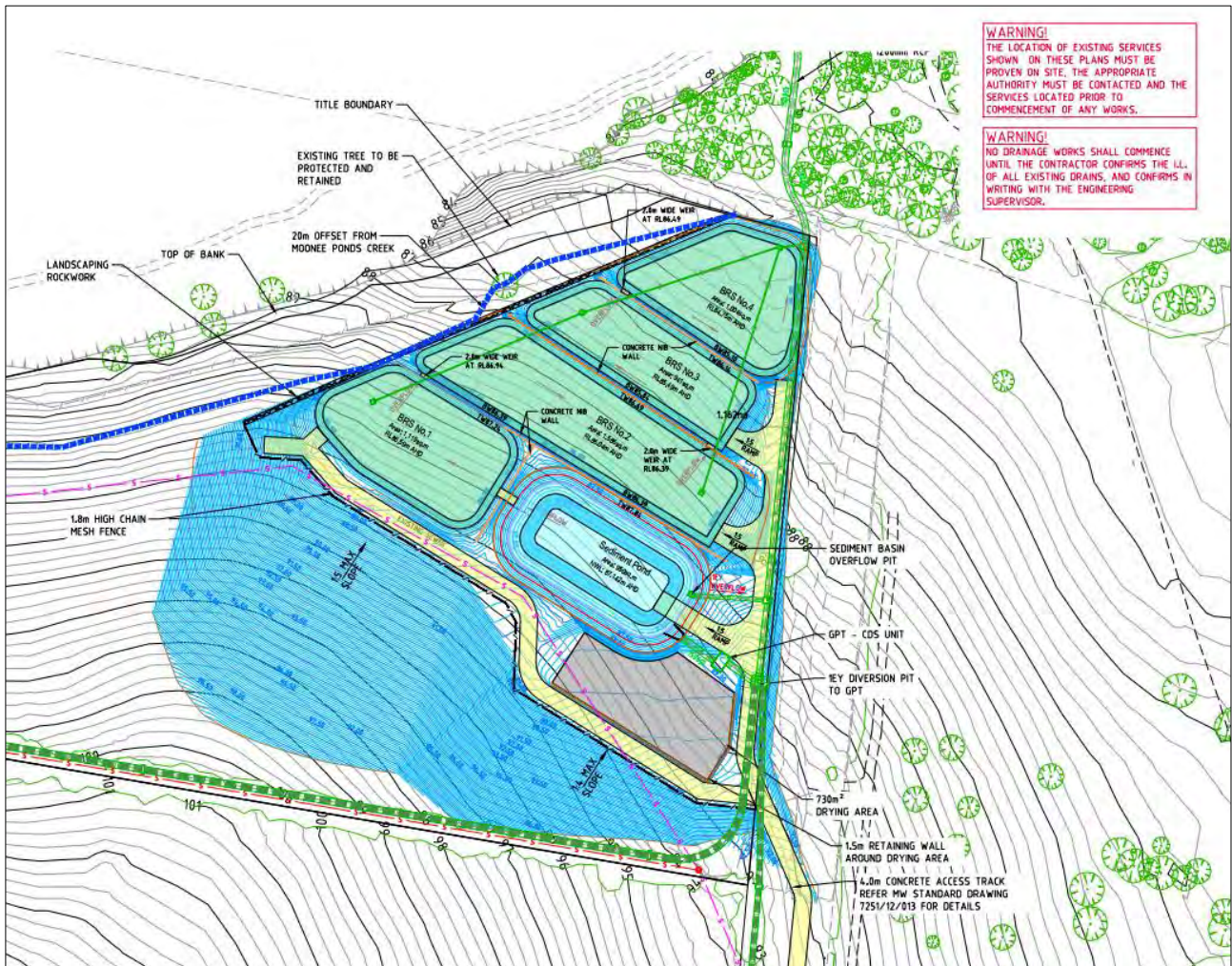


Figure 6: Plan view of the sediment basin and bioretention design

The bioretention system is proposed for this location to achieve a practical method of best practice stormwater quality treatment. Not only does the bioretention system better integrate into the naturally dry landscape than a wetland would, but the bioretention system also poses no danger of attracting birdlife to an area adjacent to Melbourne Airport.

DCE has designed and managed the construction of a large stormwater quality treatment bioretention system at a similarly constrained riparian site adjacent to the Merri Creek at North Park Estate (810 Cooper Street, Somerton), an industrial development within Hume City in 2016. The bioretention at North Park Estate is well-established and performs its treatment function appropriately. Photographs of the North Park Estate bioretention system taken immediately after construction and during a follow-up site inspection in October 2019 are shown in Figure 7 and Figure 8 respectively. The vegetation within the bioretention system (right of photo in Figure 8) has established well, and the bioretention provides amenity and habitat as well as stormwater quality treatment.



Figure 7: North Park Estate Bio-Retention System following construction of the treatment asset



Figure 8: North Park Estate BRS with established plants in a steep, riparian setting

4.3 Waterway protection

The proposed design of the subject site incorporates Melbourne Water advice regarding required offsets. The proposed bioretention is located entirely outside of the 20-m offset from the top of bank of the Moonee Ponds Creek requested by Melbourne Water in 2020. The development, including lots and the proposed extension of Wright Street, are outside of the 50-m offset requested in 2021.

Additional investigations to protect the high-value Moonee Ponds Creek waterway will be undertaken during the design process:

- It is suggested that a *Water Quality Risk Assessment* be undertaken as building permits are issued for the commercial/industrial portion of the development. Once the nature of the future businesses is known, an *Assessment* can be appropriately completed.
- It is proposed that an Environmental and Geomorphological Impact Assessment be undertaken during the detailed design of the single outlet to Moonee Ponds Creek. The Assessment will be completed during detailed design to ensure that the design of the outlet adequately protects the waterway.
- No cut and fill works are proposed within the Moonee Ponds Creek waterway.

5. Melbourne Water's Requirements for Development

Melbourne Water has provided comments and development conditions for the previous proposed development at the subject site. This letter received from Melbourne Water, dated 28 October 2021, is attached in Appendix F. It is expected that these comments and conditions for development will still be applicable for the current proposed development that this SWMS is based on. As the design progresses to the detailed design stage, these Melbourne Water requirements will be met.

However, it is to be noted that development condition two (2) in Melbourne Water's letter: '*All areas outside of building envelopes must be set at natural surface level to maintain for the conveyance of flows through the site*' has been superseded by information from an email received from Melbourne Water dated 12 November 2021 (Appendix G) which states that Melbourne Water '*can agree to deletion of this condition for the Development Plan as the catchment is less than 60 hectares and Hume City Council are subsequently responsible for managing this local drainage network. Per the advice (conveyance) in MW's response, we encourage Council to consider overland flow paths for new roads and reserves within the subject site.*'

6. Conclusion

This report outlines the stormwater drainage and management strategy for the proposed development of the subject site at 140-204 Western Avenue, Westmeadows. The 29.94-hectare subject site will comprise industrial development. The subject site drains directly to Moonee Ponds Creek, and the development must manage stormwater such that the high-value waterway is protected.

In minor events, up to 10% AEP event the underground drainage network will safely convey stormwater from the proposed development to the proposed stormwater quality treatment infrastructure and thence to Moonee Ponds Creek via a single outlet. The detail of the creek connection will be finalised in detailed design.

In major events, up to and including the 1% AEP event, when the capacity of the minor drainage network is exceeded, safe overland flow paths will be provided. Major event flows from the developed site will be conveyed either through the future road network, underground drains, the existing road east of the subject site – Wright Street, and through reserves and open space areas.

Development of the subject site must ensure that stormwater is treated to best practice standards prior to being discharged to Moonee Ponds Creek. A GPT, sediment basin and terraced bioretention system incorporating retaining walls is proposed to fit the unique location and topography of the subject site. The concept design of the stormwater quality treatment has been informed by MUSIC modelling.

This stormwater drainage and management strategy has been developed in accordance with Hume City Council, Melbourne Water and *EDCM* (GAA, 2011) guidelines. This strategy incorporates concept drainage designs and will be refined further during detailed design.

Appendices

Appendix A: Site Location and Catchment Plans

- Subject Site
- Parcel Boundary
- Moonee Ponds Creek LSIO Extents
- Minor Contours (1m)
- Major Contours (10m)

Site Location Plan

Moonee Ponds Creek
LSIO Extents



Tullamarine Freeway

Melbourne Airport

Wright St

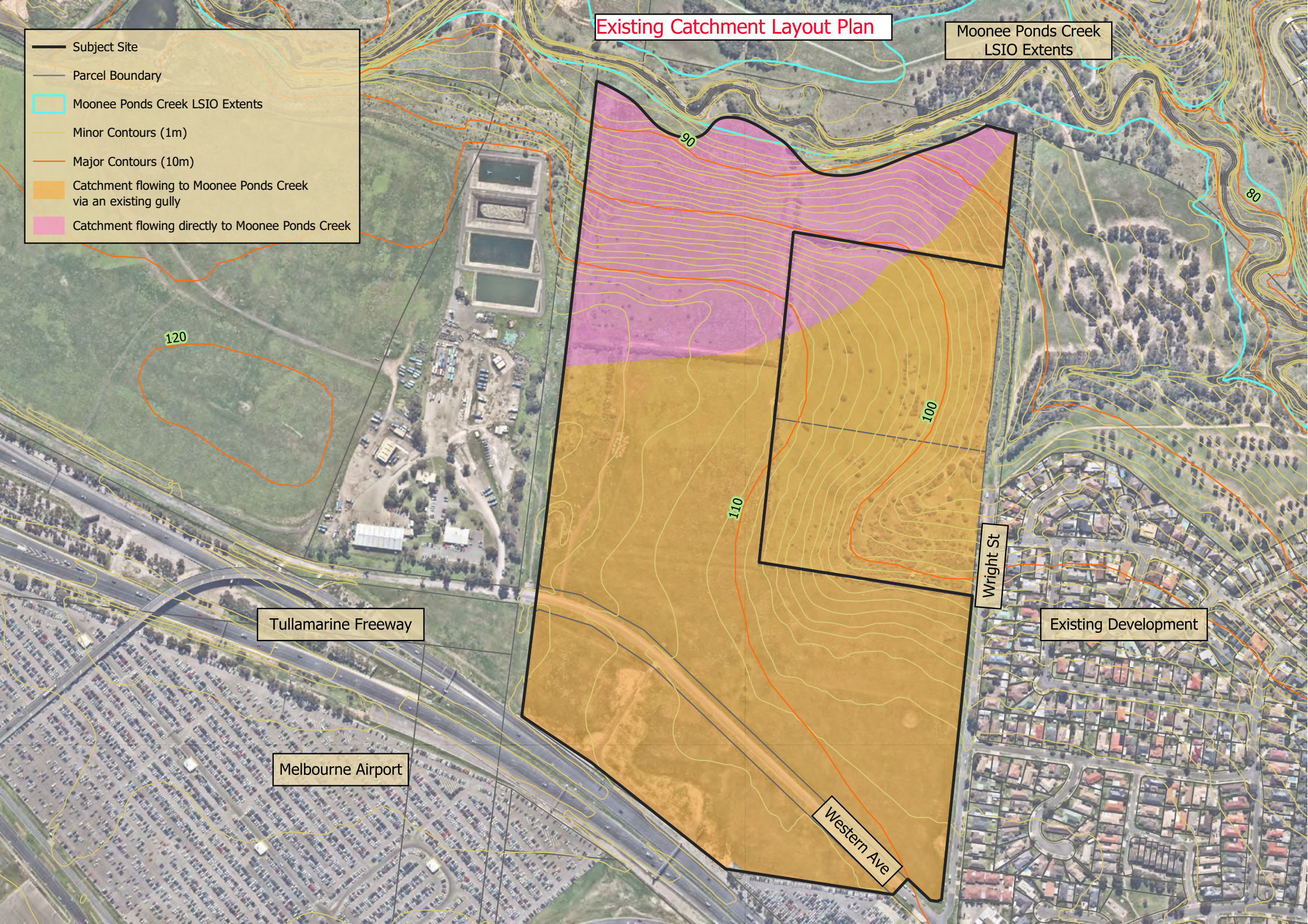
Western Ave

Existing Development

Existing Catchment Layout Plan

Moonee Ponds Creek
LSIO Extents

- Subject Site
- Parcel Boundary
- Moonee Ponds Creek LSIO Extents
- Minor Contours (1m)
- Major Contours (10m)
- Catchment flowing to Moonee Ponds Creek via an existing gully
- Catchment flowing directly to Moonee Ponds Creek



Tullamarine Freeway

Melbourne Airport

Wright St

Existing Development

Western Ave

Proposed Development Layout Plan

Moonee Ponds Creek
LSIO Extents

- Subject Site
- Parcel Boundary
- Moonee Ponds Creek LSIO Extents
- 20m offset to Moonee Ponds Creek
- 50m offset to Moonee Ponds Creek
- Urban Growth Boundary
- Industrial Development
- Open Space
- Open Space (flowing direct to Moonee Ponds Creek)

Bio-retention Basin

Sediment Basin

Sediment Dry-Out Area

Tullamarine Freeway

Melbourne Airport

Wright St

Existing Development

Western Ave



Minor Catchment Flows Layout Plan

- Subject Site
- Parcel Boundary
- Moonee Ponds Creek LSIO Extents
- Subcatchments
- External Catchment
- Minor flow calculation location
- Catchments discharging to eastern piped drainage system
- Catchments discharging to western piped drainage system
- Catchments sheet flowing north to Moonee Ponds Creek
- 20m offset to Moonee Ponds Creek
- 50m offset to Moonee Ponds Creek
- Urban Growth Boundary
- Pipe to bypass flows greater than the 1 EY to Moonee Ponds Creek
- Underground Drainage (conveys 10% AEP flows)

Moonee Ponds Creek
LSIO Extents

**1 EY flows to GPT and sediment basin.
Gap piped flows to be diverted north to Moonee Ponds Creek**

**Drain A
Pipe to convey 10% AEP flows from sub-catchments A-G**

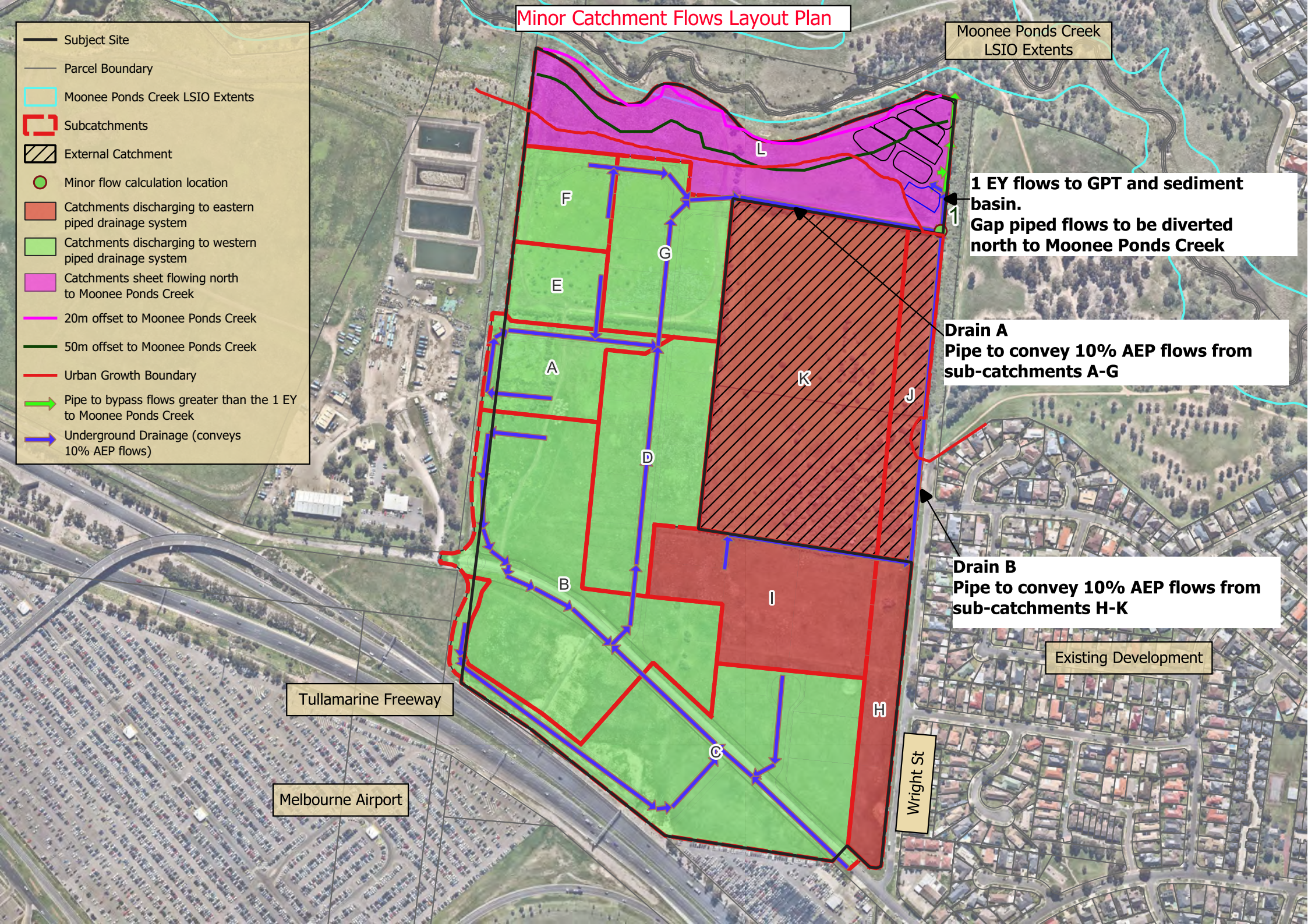
**Drain B
Pipe to convey 10% AEP flows from sub-catchments H-K**

Tullamarine Freeway

Melbourne Airport

Existing Development

Wright St



Major Catchment Flows Layout Plan

- Subject Site
- Parcel Boundary
- Moonee Ponds Creek LSIO Extents
- Subcatchments
- External Catchment (gap flows discharge east)
- Catchment's major gap flows discharge east to Wright Street or reserve north of Wright Street
- Catchment's gap flows sheet north to Moonee Ponds Creek
- Catchment's total flows sheet north to Moonee Ponds Creek
- 20m offset to Moonee Ponds Creek
- 50m offset to Moonee Ponds Creek
- Urban Growth Boundary
- Major Flow Path (Indicative)
- Major Flow Calculation Location

Moonee Ponds Creek
LSIO Extents

Sub-catchments J & K discharge
to Moonee Ponds Creek

Major Gap Flows from
sub-catchments B, C, H & I
to discharge to Wright Street.
Subsequently flows to
Moonee Ponds Creek

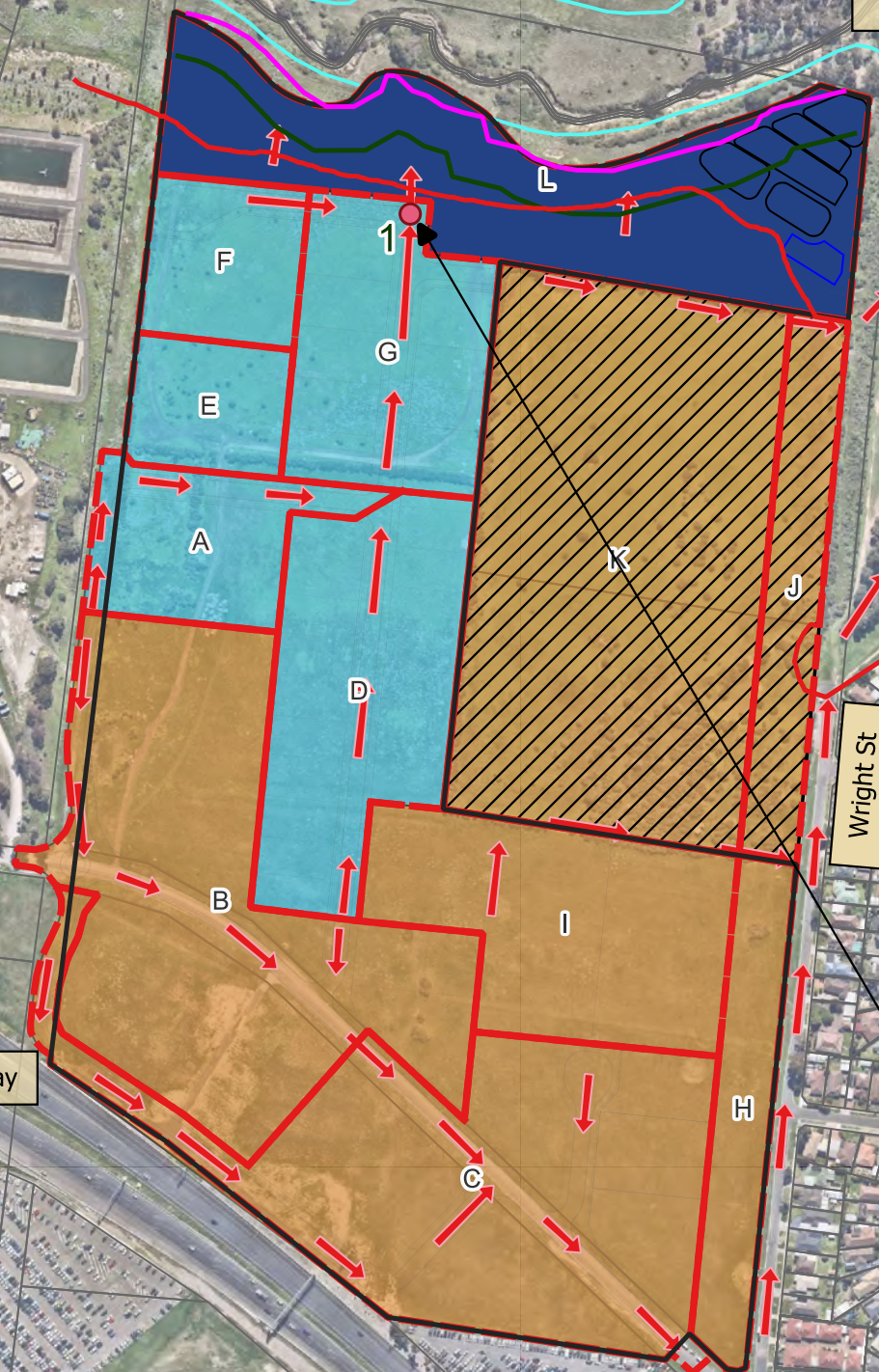
Major Gap Flows from
sub-catchments A, D-G to sheet
north to Moonee Ponds Creek

Existing Development

Tullamarine Freeway

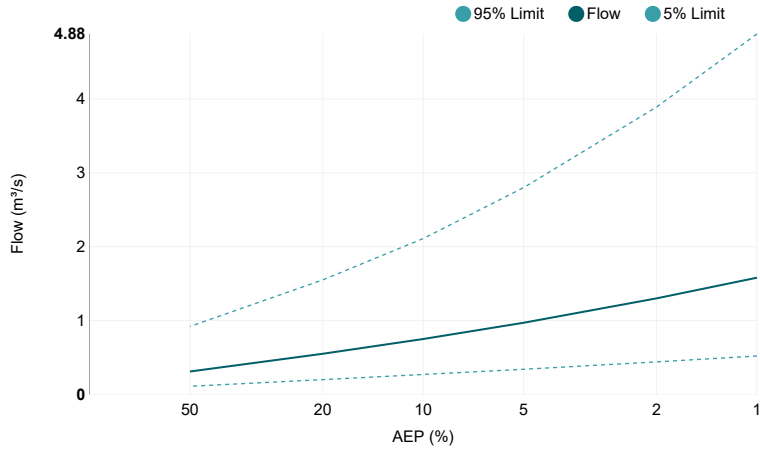
Melbourne Airport

Wright St



Appendix B: Hydrologic Calculations

Results | Regional Flood Frequency Estimation Model



*The catchment is outside the recommended catchment size of 0.5 to 1,000 km². Results have lower accuracy and may not be directly applicable in practice.

AEP (%)	Discharge (m ³ /s)	Lower Confidence Limit (5%) (m ³ /s)	Upper Confidence Limit (95%) (m ³ /s)
50	0.310	0.110	0.920
20	0.550	0.200	1.55
10	0.750	0.270	2.11
5	0.970	0.340	2.80
2	1.30	0.440	3.89
1	1.58	0.520	4.88

Statistics

Variable	Value	Standard Dev
Mean	-1.100	0.683
Standard Dev	0.669	0.204
Skew	0.095	0.029

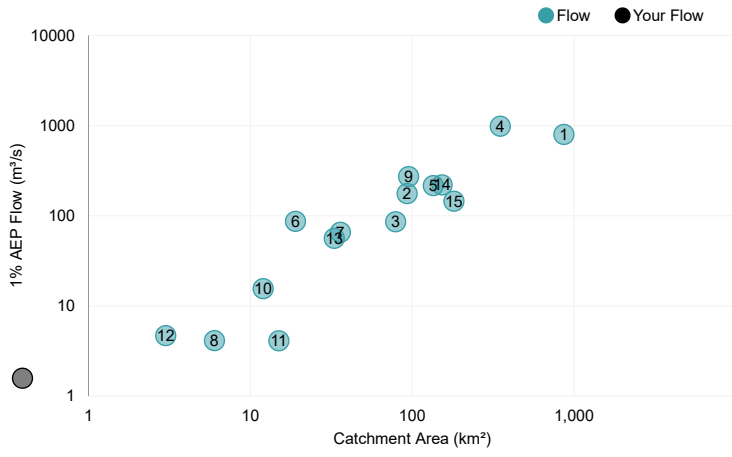
Note: These statistics come from the nearest gauged catchment. Details.

Correlation

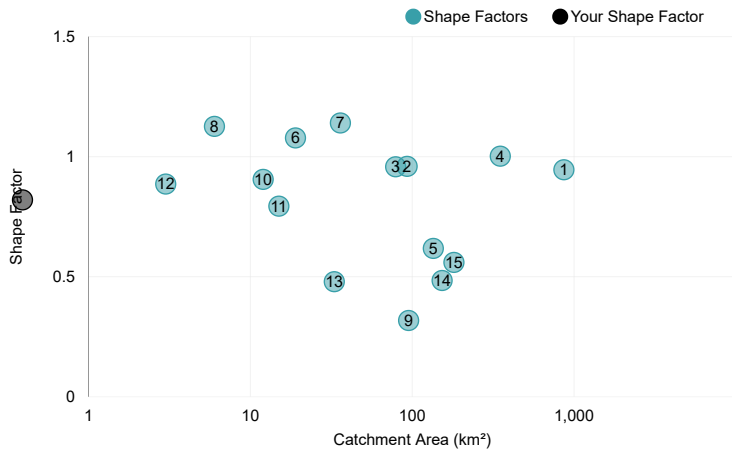
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

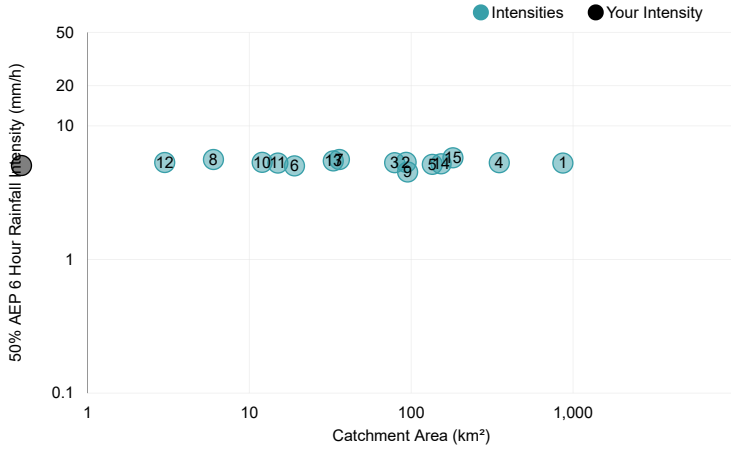
1% AEP Flow vs Catchment Area



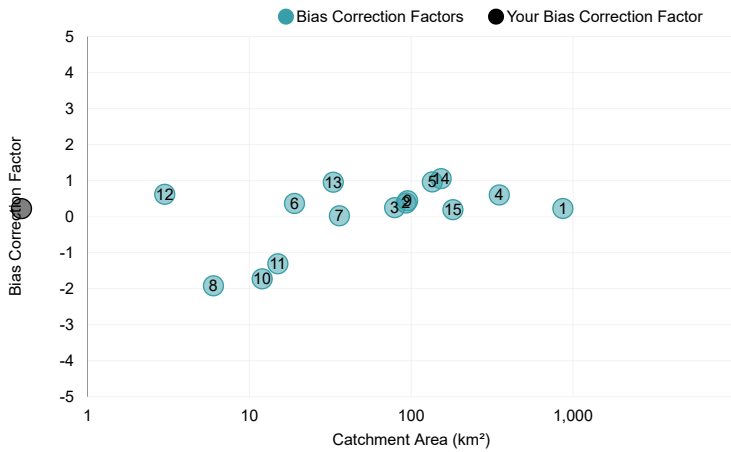
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



Download

- [TXT](#)
- [Nearby](#)
- [JSON](#)

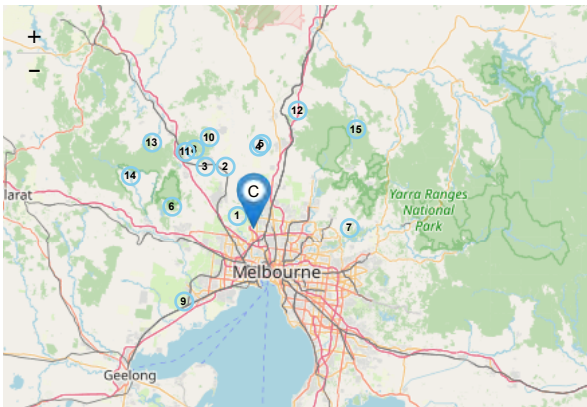
Input Data

Date/Time

2022-08-26 10:31

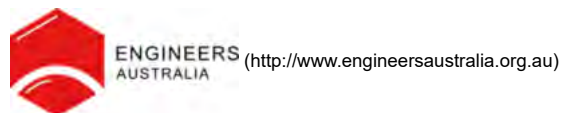
Input Data

Catchment Name	Western Avenue
Latitude (Outlet)	-37.671394
Longitude (Outlet)	144.873181
Latitude (Centroid)	-37.67512
Longitude (Centroid)	144.869748
Catchment Area (km ²)	0.391*
Distance to Nearest Gauged Catchment (km)	7.92
50% AEP 6 Hour Rainfall Intensity (mm/h)	5.049602
2% AEP 6 Hour Rainfall Intensity (mm/h)	12.785901
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.82
Interpolation Method	Natural Neighbour
Bias Correction Value	0.224



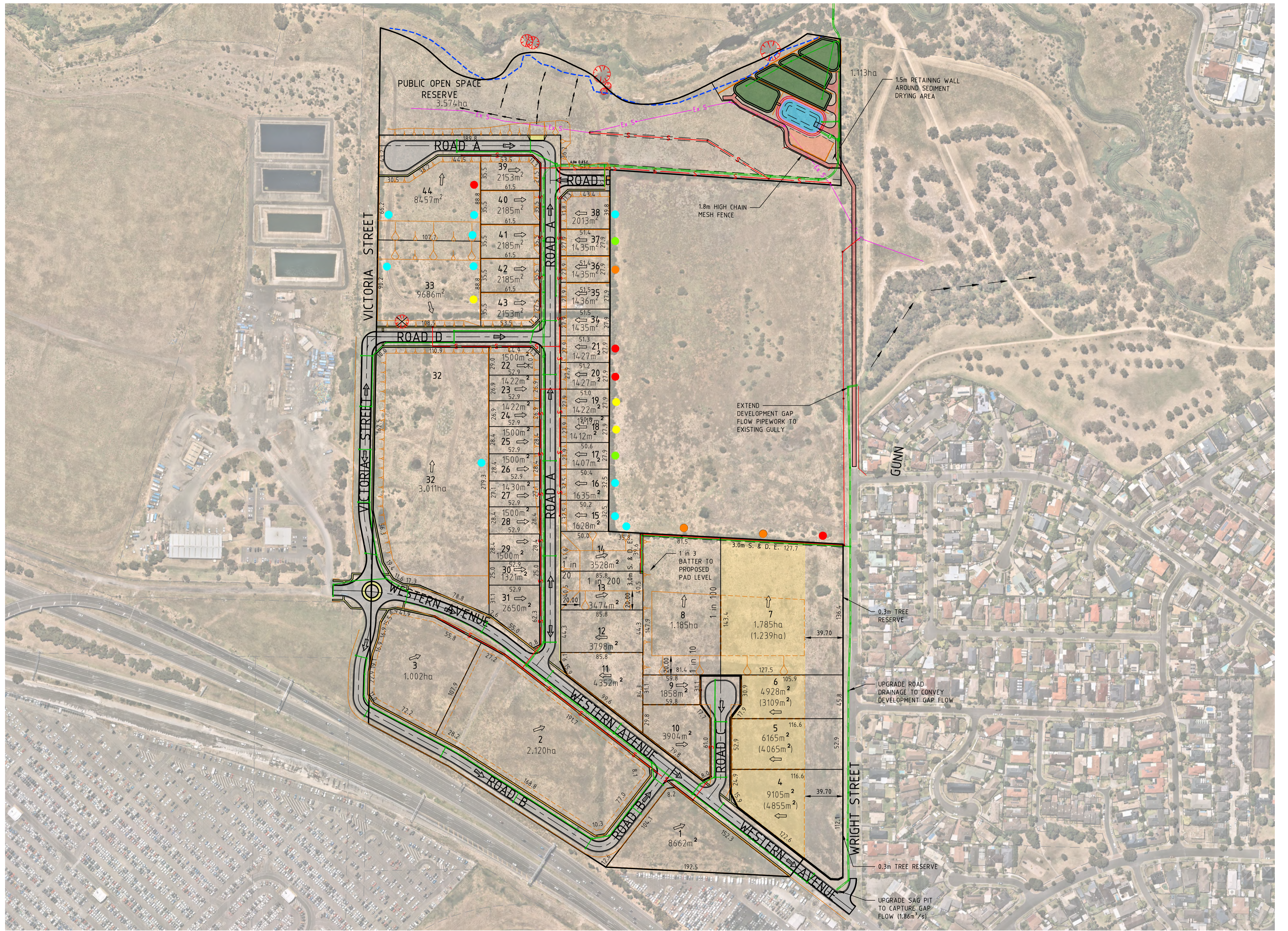
Leaflet (<http://leafletjs.com>) | © OpenStreetMap (<http://osm.org/copyright>) contributors

Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (<http://arr.ga.gov.au/revision-projects/project-list/projects/project-5>) on the ARR website. Send any questions regarding the method or project here (<mailto:admin@arr-software.org>).



Appendix C: Development Plan

Drawing File: C:\2d\Synergy\delta\delta\ENERGY-MEL\172201-Clonney St, Western Avenue, Tullamarine_1254\1_03_GENERAL\CONCEPT PLANS\May 2022\172201_02_CLP01.dwg - [P] - 12:32pm
 Date/Time: Tue Feb 21, 2023 - 12:32pm
 User: mcs@dceng.com.au



RETAINING WALL SCHEDULE		
HT OF RETAINING WALL (m)	NO. OF LOTS	LEGEND
0-1	4	●
1-1.5	3	●
1.5-2	3	●
2-2.5	2	●
2.5-3	9	●

SITE ANALYSIS TABLE (ha)	
TOTAL SITE AREA	28.593
ROAD RESERVE AREA	3.532
PUBLIC OPEN SPACE RESERVE	3.574
DRAINAGE RESERVE	1.113
TREE RESERVE	0.0104
NET SALEABLE AREA	20.370

NOT TO BE USED FOR CONSTRUCTION					
REV	DESCRIPTION	DATE	AMEND	APP'D	AN
G	REVISED LAYOUT	15/02/23	WI	TL	AN
F	REVISED LAYOUT	31/01/23	WI/PB	TL	AN
E	AMENDED RESERVE AND LOT 1 BOUNDARY	29/08/22	BS	TL	AN
D	ISSUED TO CLIENT	09/08/22	MH/BS	TL	AN
C	ISSUED TO CLIENT	20/07/22	MH/BS	TL	AN
B	PRELIMINARY ISSUE	01/07/22	MH	TL	AN
A	PRELIMINARY ISSUE	10/06/22	MH/BS	TL	AN

Drawn Date AN
 Designed Date TL
 Checked Date TL
 Approved Date TL
 AN

© Dalton Consulting Engineers Pty Ltd
 Written dimensions to take precedence over scale. Contractor shall check and verify all dimensions on site. Discrepancies to be brought to the attention of the Superintendent.

LEGEND

	RETAINING WALL		RESERVE/OPEN SPACE AREA
	MW 20m BUFFER		Q100 LEVEL
	EXISTING TREES TO BE REMOVED		WATER QUALITY TREATMENT
	EX. SEWER MAIN & MH		LOTS 4 - 7 BUILDING ENVELOPES
	SW DRAIN & PIT		ACCESS TRACK
	REGRADE LOT (MIN 1:50)		SEWER MAIN & MANHOLE
	BENCHING		BATTER
	GAP FLOW DIRECTION		0.3m TREE RESERVE

Coords: MGA Levels: AHD

 www.byda.com.au

Scale @ A1/A3 1:2000 / 1:4000

HAYSTONE INDUSTRIAL SUBDIVISION
 140-204 WESTERN AVENUE, WESTMEADOWS
HUME CITY COUNCIL
LAYOUT PLAN
 Drawing No. 17220.2CLP01 Rev G
 Sheet No. 02 of 53

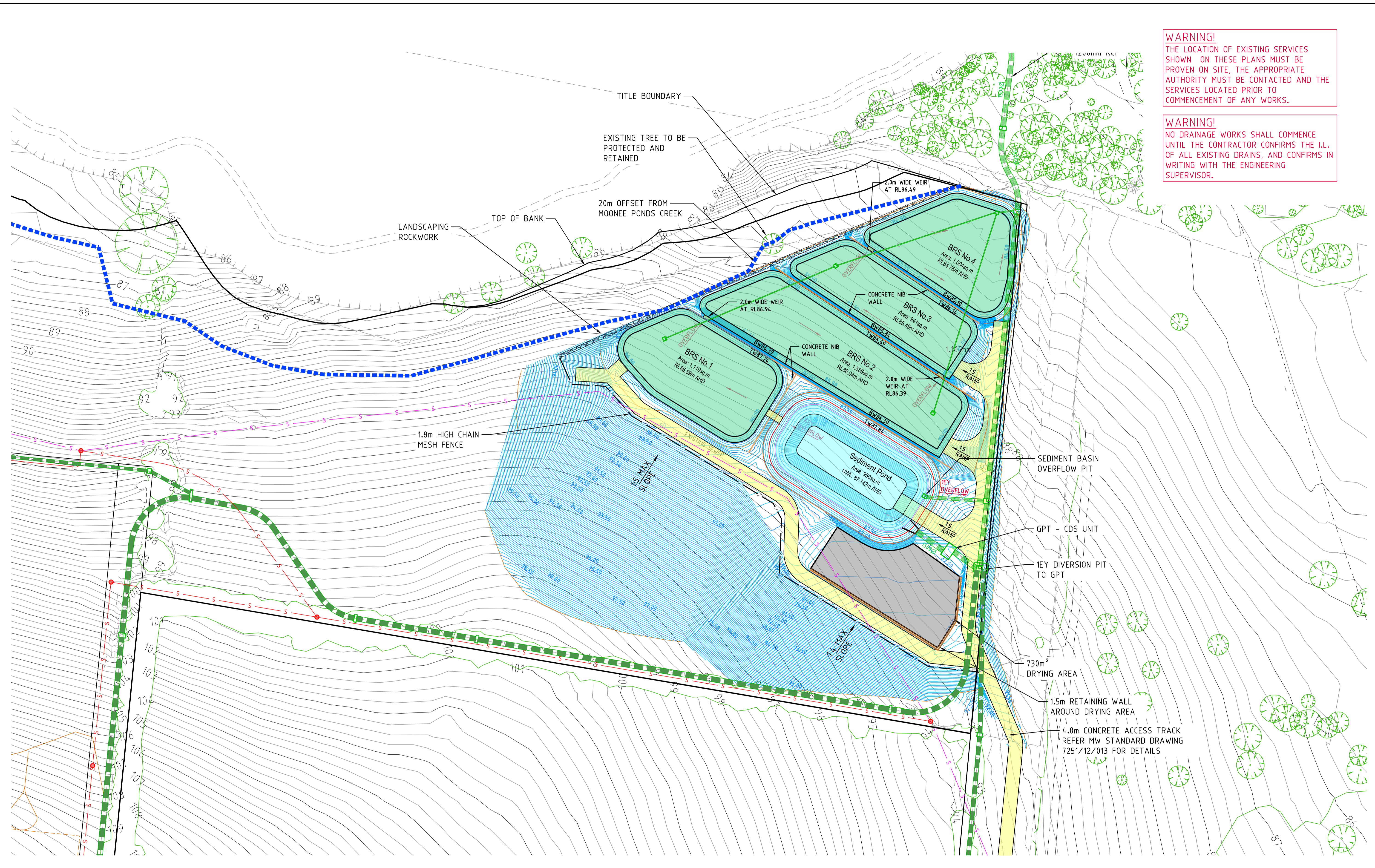
DALTON CONSULTING ENGINEERS
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 brisbane turrbal
 dceng.com.au
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 T +61 3 5246 1700
 T +61 7 3374 9000
 E info@dceng.com.au

CONCEPT

Appendix D: Stormwater Quality Treatment Detail Plan

WARNING!
THE LOCATION OF EXISTING SERVICES SHOWN ON THESE PLANS MUST BE PROVEN ON SITE, THE APPROPRIATE AUTHORITY MUST BE CONTACTED AND THE SERVICES LOCATED PRIOR TO COMMENCEMENT OF ANY WORKS.

WARNING!
NO DRAINAGE WORKS SHALL COMMENCE UNTIL THE CONTRACTOR CONFIRMS THE I.L. OF ALL EXISTING DRAINS, AND CONFIRMS IN WRITING WITH THE ENGINEERING SUPERVISOR.



Drawing File: C:\2d_Synergy\delta\17220\17220-1\22201-03_GENERAL_CONCEPT_PLANS\BIO_RETENTION_2021\17220-1\17220-1\17220-1.dwg
 Date: 05/08/22
 Drawn by: AN
 Checked by: AN
 Approved by: AN
 Project: 17220-1

NOT TO BE USED FOR CONSTRUCTION

REV	DESCRIPTION	DATE	AMEND	APP'D
E	AMENDED LAYOUT	05/08/22	MH	TL
D	AMENDED LAYOUT	15/7/22	MH	TL
C	MW COMMENTS	13/07/20	WJ	TL
B	WATER QUALITY TREATMENT POSITIONING AMENDED	31/03/20	JB/JB	TL
A	PRELIMINARY ISSUE	13/11/19	AM/MC	TL

Drawn Date: AN
 Designed Date: AN
 Checked Date: AN
 Approved Date: AN

Written dimensions to take precedence over scale. Contractor shall check and verify all dimensions on site. Discrepancies to be brought to the attention of the Superintendent.

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LEGEND

	CONCRETE TRACK		Q100 FLOOD LEVEL
	SEDIMENT POND		FINISHED SURFACE CONTOUR - MINOR
	BRS AREA		FINISHED SURFACE CONTOUR - MAJOR
	SEDIMENT DRYING AREA		SW DRAIN & PIT
	BORERHOLE		BATTER
	TREE TO BE REMOVED		EXISTING TREE
	MW 20m BUFFER		

Coords: MGA Levels: AHD

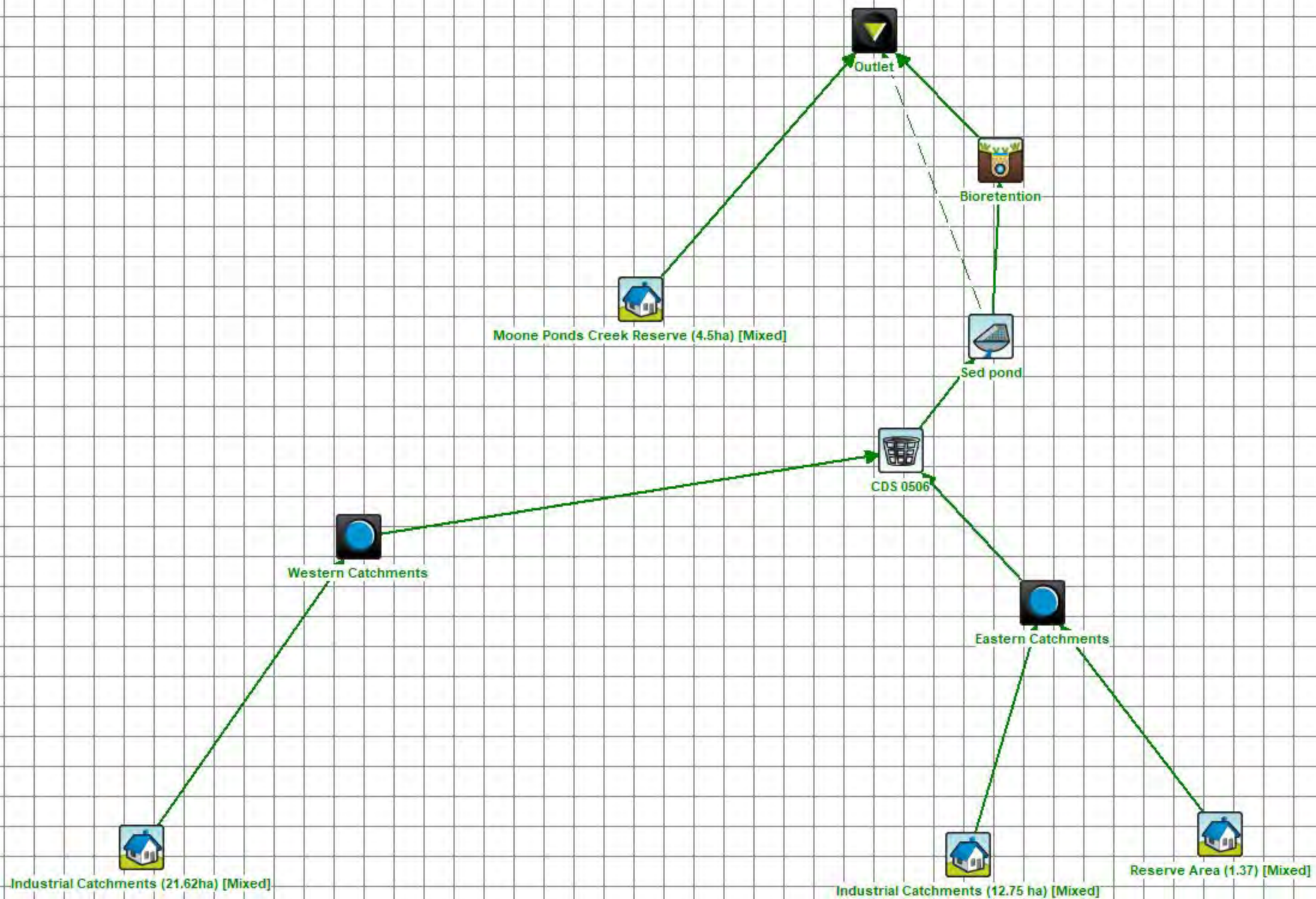
 www.byda.com.au

Scale @ A1/A3 1:500 / 1:1000

HAYSTONE INDUSTRIAL SUBDIVISION
 104-204 WESTERN AVENUE, WESTMEADOWS
HUME CITY COUNCIL
DETAIL PLAN
 Drawing No. 17220.1CWDP01 Rev E
 Sheet No. 03 of 03

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 ABN 78 429 221 049
 VICTORIA T 61 3 9813 7400 W dceng.com.au
 QUEENSLAND T 61 7 3374 9000 E info@dceng.com.au
CONCEPT

Appendix E: MUSIC Modelling Outputs



Properties of Sed pond



Location

Inlet Properties

Low Flow By-pass (cubic metres per sec)

High Flow By-pass (cubic metres per sec)

Storage Properties

Surface Area (square metres)

Extended Detention Depth (metres)

Permanent Pool Volume (cubic metres)

Initial Volume (cubic metres)

Exfiltration Rate (mm/hr)

Evaporative Loss as % of PET

Outlet Properties

Equivalent Pipe Diameter (mm)

Overflow Weir Width (metres)

Notional Detention Time (hrs)

Use Custom Outflow and Storage Relationship



Define Custom Outflow and Storage

Defined

Properties of Bioretention

Location  Products >>

Inlet Properties

Low Flow By-pass (cubic metres per sec)

High Flow By-pass (cubic metres per sec)

Storage Properties

Extended Detention Depth (metres)

Surface Area (square metres)

Filter and Media Properties

Filter Area (square metres)

Unlined Filter Media Perimeter (metres)

Saturated Hydraulic Conductivity (mm/hour)

Filter Depth (metres)

TN Content of Filter Media (mg/kg)

Orthophosphate Content of Filter Media (mg/kg)

Infiltration Properties

Exfiltration Rate (mm/hr)

Lining Properties

Is Base Lined? Yes No

Vegetation Properties

- Vegetated with Effective Nutrient Removal Plants
- Vegetated with Ineffective Nutrient Removal Plants
- Unvegetated

Outlet Properties

Overflow Weir Width (metres)

Underdrain Present? Yes No



Submerged Zone With Carbon Present? Yes No

Depth (metres)

Fluxes...

Notes...

More

 Cancel Back Finish

	Sources	Residual Load	% Reduction
Flow (ML/yr)	148	140	5.3
Total Suspended Solids (kg/yr)	29500	2690	90.9
Total Phosphorus (kg/yr)	61.3	32.2	47.4
Total Nitrogen (kg/yr)	430	132	69.3
Gross Pollutants (kg/yr)	5740	125	97.8

**Appendix F: Melbourne Water Development Conditions Letter (28
October 2021)**

28 October 2021

Andrea Taylor
Hume City Council
PO Box 119
Dallas VIC 3047

Dear Andrea,

Proposal: Planning scheme amendment – Changes to Zoning and creation of a site specific Development Plan

Site location: 140-204 Western Avenue, 47-67 Wright Street and 69-99 Wright Street, Westmeadows

Melbourne Water reference: MWA-1215639

Date amended proposal received: 14/10/2021

Thank you for the opportunity to comment on the proposed planning scheme amendment C250 which seeks to rezone land within the Urban Growth Boundary from Farming Zone – Schedule 3 (FZ3) to General Residential Zone – Schedule 1 (GRZ1) and Industrial 3 Zone (IN3Z) and apply the Development Plan Overlay – Schedule 33 (DPO33) to the whole of the land.

Melbourne Water is the designated caretaker of waterway health for the Port Phillip and Westernport region, and the regional drainage and floodplain management authority. Melbourne Water has floodplain management functions under the *Water Act 1989*, with related functions under the *Planning and Environment Act 1987* and the *Building Regulations 2018*. Melbourne Water has a number of broad functions and obligations which include to:

- ***provide advice about flooding and controls on development to local councils;***
- ***protect and enhance drainage systems and waterways;***
- ***implement programs for the protection and enhancement of in-stream uses;***
- ***and improve water quality in drainage systems.***

Melbourne Water's interest in this site arises from its regional drainage and waterway management responsibilities under the Water Act 1989 (Vic). These functions are broad and include obligations to protect and enhance drainage systems and waterways; implement programs for the protection and enhancement of in-stream uses; and improve water quality in drainage systems.

Where land is affected by overland flows associated with Melbourne Water's drainage system, applications to develop the land are assessed by Melbourne Water against the *Guidelines for Development in Flood Affected Areas* (DELWP 2019). Under these Guidelines, development in or adjacent to a floodplain will only be acceptable where the new development is protected from flooding (flood levels are constructed to the identified Nominal Flood Protection Level); has safe access to and around the development (in considering flood depths and velocities); and does not interfere with the passage and storage of floodwaters. Developments in areas affected by flooding must not obstruct the passage of flood flows or reduce floodplain storage as this may cause flood levels and velocities to increase and adversely impact surrounding properties. While the site is not directly subject

to flooding from Melbourne Water's drainage system, the Council's drainage system overflows to the Moonee Ponds Creek naturally in a storm event.

Decision

Melbourne Water is supportive of the proposal as shown, subject to the following conditions being included in the Development Plan Overlay – Schedule 33 (DPO33):

Melbourne Water

1. All and any new development associated with the Development Plan (including **retaining walls and treatment assets**) must maintain the setbacks as shown on '140 – 204 Western Ave, Westmeadows, Proposed Residential and Industrial Subdivision **Development Plan**' (plan reference CDP01 Rev A MAB). This plan must form part of the Development Plan Overlay – Schedule 33 (DPO33) documentation within the Hume Planning Scheme.
2. All areas outside of building envelopes must be set at natural surface level to maintain for the conveyance of flows through the site.
3. Prior to the commencement of any works occurring on site in accordance with the Development Plan, a copy of the Environmental Assessment approved by the EPA must be submitted to Melbourne Water for our records.
4. Prior to the commencement of any works occurring on site in accordance with the **Development Plan, an 'Environmental and Geomorphological Impact Assessment'** must be submitted to Melbourne Water for review and approval. This assessment is required to be undertaken by a suitably qualified person and must investigate the threat to physical form, riparian vegetation and fauna as a result from the proposed development. **Any recommendations of the 'Environmental and Geomorphological Impact Assessment'** must also be shown to be incorporated into the final Storm Water Management Plan for the development site.
5. Prior to the commencement of any works occurring on site in accordance with the **Development Plan a 'Landscape Plan' prepared for the Moonee Ponds Creek Reserve** must be provided to Melbourne Water for review and approval. The Plan should include, but not be limited to;
 - a) A survey of all existing indigenous vegetation
 - b) A survey of priority weeds and a weed management program, including the following information: location; method of control and timing of control;
 - c) Details of surface finishes located on recreational pathways, maintenance access or any other pathways near waterways;
 - d) A planting schedule of all proposed trees, shrubs and ground covers, including: pot sizes; quantities of each plant; planting density (plants per square metre); planting zones/locations (in plan and cross-section form in colour). Note that planting zones must match with those in the planting schedule and that local indigenous plants should only be used;
 - e) Landscape treatments with specifications of products such as mulching, erosion control matting, and rock beaching.

6. Any new or modified stormwater connection to Melbourne Water's drainage system must obtain separate approval from Melbourne Water.

Advice

Asset Protection and waterway setback

The Moonee Ponds Creek is located along the northern boundary of the subject site. This **reach of the Moonee Ponds Creek contains one of few remaining intact 'chain of ponds'**. These are a high value feature and provide key habitat for the EPBC listed *Litoria raniformis* Growling Grass Frog. The Moonee Ponds Creek in this location is a priority vegetation reach YAR6124 and a high priority vegetation establishment reach in the Healthy Waterways Strategy.

Flood Flow & Flood Storage

Any new development associated with the Development Plan must not reduce or impact floodwater storage and conveyance capacity. This requirement is designed to prevent higher flood levels and velocities that would occur if the available storage volume is reduced and the overland flow path is obstructed. Higher flood levels and velocities would affect other properties adjacent, upstream or downstream of the proposed development.

Conveyance

Consideration should be given to the alignment of roads and reserves with any adjoining estates, to ensure continuity and provide uninterrupted conveyance of overland flows. These overland flow paths will need to be designed in accordance with the safety criteria requirements of Council.

Sediment Pond

The capture of pollution events within storm water assets is an effective tool in mitigating pollution entering waterways. Melbourne Water recommends that Council considers a design of the sediment ponds of the stormwater treatment asset that is effective for the capture of pollution in an emergency response.

Freeboard

Freeboard is the difference between the floor level of a building and the 100-year flood level. Freeboard requirements are designed to ensure that valuable buildings, their contents and the people in them are safely above the 100-year flood level. All new lots should be filled to a minimum of 300mm above the applicable flood level as determined by the Council.

Water Quality

To protect our waterways and bays, new development is required to meet best practice standards for stormwater quality. Water quality treatment works should be provided onsite **to Council's satisfaction.**

New Asset Ownership

Melbourne Water will not take ownership of the proposed new assets to be constructed within this subdivision and development plan area.

For general development enquiries contact our Customer Service Centre on 131722.

Regards,



Ashlee Gaunt
Area Manager
Development Planning Services

Appendix G: Melbourne Water Email (12 November 2021)

From: Ashlee Gaunt <Ashlee.Gaunt@melbournewater.com.au>
Sent: Friday, 12 November 2021 12:24 PM
To: Chris Engert <cengert@mab.com.au>
Subject: RE: Planning scheme amendment - 104-204 WESTERN AVENUE WESTMEADOWS amended MW response

Hi Chris – thanks for chatting with me yesterday. MW have considered your request to remove Point 2 (*All areas outside of building envelopes must be set at natural surface level to maintain for the conveyance of flows through the site*) of our response to C250 relating to requirements for any Development Plan for the subject site.

This is a standard condition included to maintain for conveyance of overland flows through the site as it develops. It does not relate to identified building envelopes/parcels earmarked for residential development but for areas of open space, parklands and the road network (to align with the existing roads to the east).

In this instance, MW can agree to deletion of this condition for the Development Plan as the catchment is less than 60 hectares and Hume City Council are subsequently responsible for managing this local drainage network.

Per the advice (*conveyance*) in MW's response, we encourage Council to consider overland flow paths for new roads and reserves within the subject site.

Regards,

Ashlee Gaunt | Area Manager , Development Planning Services | Melbourne Water
T: (03) 9679 7517 | 990 La Trobe Street, Docklands, VIC 3008 | PO Box 4342
Melbourne VIC 3001 | melbournewater.com.au

Did You Know: You can now submit your development applications online via the '[Apply Online](#)' section of the Melbourne Water website. This is now our preferred channel for receiving development applications. When contacting us about an application, please put your Melbourne Water reference number (eg. MWA-1234567) in the subject line of the email and send it to DevConnect@melbournewater.com.au

Enhancing Life and Liveability

From: Chris Engert <cengert@mab.com.au>
Sent: Wednesday, 10 November 2021 5:00 PM
To: Kate Kinsella <kate.kinsella@melbournewater.com.au>
Subject: FW: Planning scheme amendment - 104-204 WESTERN AVENUE WESTMEADOWS amended MW response

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi Kate,

I tried calling you earlier to have a chat about the below condition included in MW's response from 28 October.

2. All areas outside of building envelopes must be set at natural surface level to maintain for the conveyance of flows through the site.

This condition is problematic as natural surface level will be unable to be achieved given intended development and land use foreshadowed by the amendment.

Can you confirm what MW's is seeking to achieve by including this condition? Our preference is that it be deleted.

Please give me a call when you can. Thanks

Chris Engert

T: 03 8681 2217
M: 0421 115 722



www.merrifieldmelbourne.com.au



From: Melbourne Water <No_reply@melbournewater.com.au>

Sent: Thursday, 28 October 2021 1:13 PM

To: andreat@hume.vic.gov.au

Cc: Chris Engert <cengert@mab.com.au>

Subject: Planning scheme amendment - 104-204 WESTERN AVENUE WESTMEADOWS amended MW response

Dear Andrea Taylor,

Please refer to the attached correspondence in regards to the following application:

Your Melbourne Water reference number: MWA-1230113

Application purpose: Planning scheme amendment C250

Amended documentation received: 14/10/2021

Location: 104-204 WESTERN AVENUE WESTMEADOWS

To respond to us regarding this application, please use DevConnect@melbournewater.com.au quoting MWA-1230113 in the subject line.

This email is sent from a notification-only email address that does not accept incoming email.

For general development enquiries contact our Customer Service Centre on 131 722.

Regards,

Development Planning Services | Melbourne Water

T: 131 722 | 990 La Trobe Street, Docklands, VIC 3008 | PO Box 4342 Melbourne VIC 3001 | melbournewater.com.au

Enhancing Life and Liveability

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