ATTACHMENT 8

Revised Stormwater Management Report

Prepared by:

Pinnacle Engineering

PINNACLE
ENGINEERING GROUP

SITE BASED STORMWATER MANAGEMENT PLAN

PROPOSED CENTRE DEVELOPMENT
Homestead Drive, Flagstone QLD

BLUEPOINT FLAGSTONE PTY LTD

OCTOBER 2025
REVISION 06

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1 Introduction

Pinnacle Engineering Group (Pinnacle) was engaged by Bluepoint Flagstone Pty Ltd to prepare a site-based stormwater management plan (SBSMP) and undertake the associated investigations as supporting documentation for the proposed development application for a commercial, retail and future residential development located at Homestead Drive, Flagstone QLD located in Logan City Council (LCC) under the authority of Economic Development Queensland (EDQ).

The stormwater management strategy described in the following sections of this report has been developed with reference to, and is generally consistent with, previous design documentation prepared by Peak Urban in 2020 and 2021. Section 2 outlines how these earlier reports have influenced the current strategy, with the original Peak Urban documentation included in Appendix H.

1.1 Scope of Investigation

This report addresses the proposed stormwater management strategy for the aforementioned development, including but not limited to the following elements:

- Nomination of the Lawful Point of Discharge;
- Details of stormwater quantity management strategy for the site;
- Details of the stormwater quality treatment train to be implemented for the site;
- Nomination of maintenance schedules and techniques for each of the proposed stormwater quality improvement devices; and
- Sediment and erosion control plan.

1.2 Site Description

1.2.1 Location

Street Address	-	Homestead Drive, Flagstone QLD
RP Description	-	Lot 25007 and 25009 on SP303120
Total Site Area	-	6.5236 Hectares
Current Zoning	-	Priority Development Area
Proposed Use	-	Commercial, Retail, and Residential (Future) Development Precinct
Local Authority	-	Logan City Council (LCC)
Assessment Authority	-	Economic Development Queensland (EDQ)

Refer to Figure 1.1 for the site location.

1.2.2 Existing Site Conditions and Topography

The subject site is generally clear of significant structures and vegetation. As a result of previous earthworks operations, the site generally grades north, into an existing dam within the northeast corner of the site, and subsequently into the existing dam within the adjacent property to the northeast being Lot 905 on SP216472. The highest elevation of the site of RL50.50m AHD is reached at the southwest corner of the site while the lowest elevation of approximately RL36.25m AHD is reached along the northern property boundary adjacent to the future New Beith Road reserve. The site is currently burdened by an existing easement (EMT M on SP303120) which is aligned along the northern boundary of Lot 25007 on SP303120.

Refer to Figure 1.2 for the existing aerial view of the site with the latest site survey included in Appendix B.

1.2.3 Proposed Development

The proposed development will deliver commercial and retail tenancies across the two existing allotments, along with associated carparking and road infrastructure, and will be delivered in four stages. A residential development is planned for the site's northeastern corner, and is to be delivered as part of a future stage. Access to these developments will be facilitated via the proposed extensions to Hollows Road and New Beith Road.

A 'Reconfiguration of a Lot' (ROL) application is anticipated for Lot 25009 on SP303120 to subdivide the current parcel into eight lots. This subdivision will allocate individual lots to the commercial and retail tenancies T1-T5 and T10, the future residential development, and a road reserve lot for the proposed extension of Hollows Road which will be dedicated to Council. The remaining commercial and retail tenancies T6-9 will occupy a shared lot.

Stage 1 of the proposed development involves delivery of tenancies T4–T9, which includes three fast-food outlets, a car wash, a showroom, a workshop, and the Hollows Road extension. Stage 2 will deliver the remaining fast-food tenancy (T3). Stage 3 will encompass the construction of T1 and T2 showrooms and their associated carparking facilities, while Stage 4 will deliver tenancy T10 and the extension of New Beith Road. The residential development will be delivered separately as part of future works.

Plans detailing the proposed development are included within Appendix A.

1.2.4 Existing Drainage System

Currently, stormwater generated within the subject site, and the external catchments to the south and east are conveyed north, into an existing dam within the site that is adjacent to the intersection of New Beith Road and Parkside Drive.

Adjacent to the site, a pit and pipe stormwater network beneath the Hollows Road and Allis Street Road reserves captures flows from surrounding developments, conveying them into an existing drainage channel within the site via a 750mm diameter pipe and culvert headwall. Similarly, flows generated within the adjacent Flagstone Early Learning Centre are discharged into the site's existing drainage channel via a 450mm diameter pipe and culvert headwall.

Additional stormwater pit and pipe systems are located beneath the Homestead Drive and the Wild Mint Drive road reserves to the south and east of the subject site, respectively.

1.3 Flood Assessment

A review of the Logan City Council (LCC) interactive flood mapping identifies that the subject site is partially affected by inundation from adjacent tributaries. The defined flood level (DFL) for the 1% Annual Exceedance Probability (AEP) event is RL 36.70m AHD, which extends into the northern corner of the site.

1.3.1 Pre Development Scenario

Using available survey and topographic data, Pinnacle developed a digital terrain model (DTM) of the site in 12d Model. The existing flood storage capacity was calculated as 502m³, defined as the volume between the existing ground surface and the 1% AEP DFL (RL 36.70 m AHD).

1.3.2 Post Development Scenario and Mitigation Strategy

The proposed post-development earthworks will raise the northern corner of the site to approximately RL 40.00m AHD, resulting in the loss of the existing 502m³ flood storage. The proposed earthworks required in Lot 905 on SP216472 will restore this flood storage volume and mitigate hydraulic impacts internal and external of the subject site up to the 1% AEP flood event, in accordance with findings of the Hydraulic Impact Assessment (HIA) prepared by Biome Water and Environmental Consultants (report ref: BC-25128, version 1,

2025). Further details are provided in Appendices C and E of the Engineering Services Report by Pinnacle Biome Water and Environmental Consultants (Biome).

1.3.3 Detailed Flood Modelling

Reference is made to the approved Masterplan flooding solution report, *Flagstone City – Masterplan, Flooding Assessment*, by Cardno Limited (now Stantec) for Peet Flagstone City Pty Ltd (report reference: 721743/032/V6, 2014). This report concludes that the implementation of catchment-wide culverts and detention basins results in negligible flood impact both upstream and downstream of the Flagstone City Masterplan development. Analysis of TUFLOW peak water surface levels in Figure B1 confirms that the northern corner of the pre-development site is subject to flooding from adjacent tributaries during the 1% AEP storm event. Conversely, Figures C1 and D1 indicate that post-development, the site remains flood-free under the 1% AEP storm condition, attributed to enhanced routing and storage provided by the proposed culvert and basin system networks within the wider catchment.

As the above reporting is now 10 years old, a subsequent Hydraulic Impact Assessment (report reference: BC-25128) has been undertaken by Biome which incorporates current terrain data and defined flood levels from LCC (1% AEP DFL of RL 36.70m AHD). This study confirmed that the proposed earthworks achieve flood immunity for the proposed building pads, roads and carparks without impacting flood levels external to the site. This report should be consulted for further technical detail.

The relevant LCC Planning Scheme maps are included within Appendix G.

1.4 External Catchments

Several upstream external catchments contribute runoff to the subject site. These include:

- **Southeast commercial/retail development and Flagstone Early Learning Centre** (east, corner of Allis Street and Wild Mint Drive):
  Runoff from these catchments is conveyed into the site via both piped and overland flow. The existing stormwater network beneath Allis Street and Hollows Road discharges into the on-site drainage channel through a 750 mm diameter pipe and culvert, while flows from the childcare facility are discharged via a 450 mm diameter pipe and culvert.
- **Homestead Drive carriageway and adjacent verge** (south of the site):
  While minor flows generated within the road pavement are intercepted by roadside drainage and directed away from the site, bypass flows and major storm overland flows are conveyed down Hollows Road and enter the site. Runoff from the adjacent verge discharges via overland flow either directly into the site or indirectly via the Hollows Road intersection.

These external catchments have been incorporated into the stormwater hydrologic and hydraulic analysis for the proposed development. Flow quantity and quality impacts from these catchments will be mitigated through the regional bioretention and detention basin.

Refer to Section 2 of this report for further discussion, and to Appendices C and E for the catchment plans and stormwater management layouts.

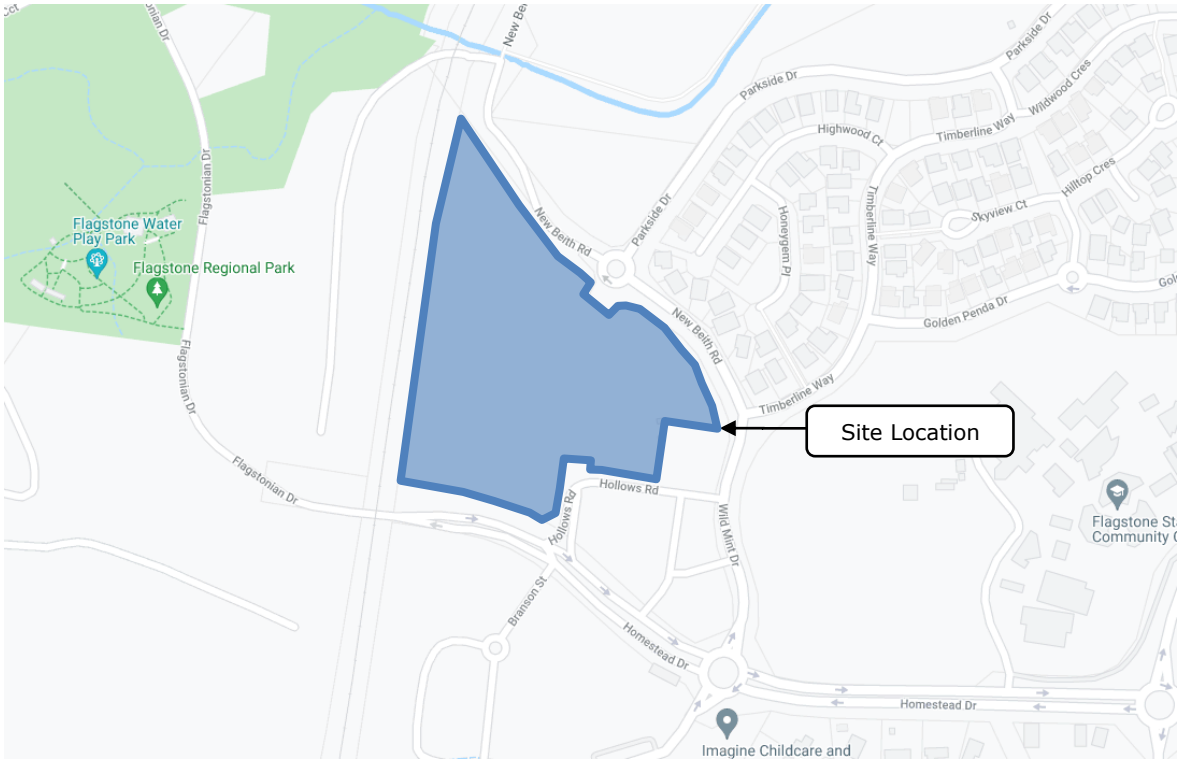

Figure 1.1: Map View (Source: Google Maps)

Figure 1.2: Aerial View (Source: Queensland Globe)

2 Project History

2.1 Flagstone City Masterplan for Peet Limited

Ongoing consultation with Economic Development Queensland (EDQ) has confirmed that the subject site is part of a previously approved Masterplan Development by Peet Limited. A review of the relevant planning and engineering documentation indicates that EDQ has endorsed a Masterplan solution for managing stormwater quantity and flood mitigation across the broader Flagstone East area.

This review also identified a more local stormwater management strategy prepared for the subject site by Peak Urban in 2020 and 2021. The original has been preserved, forming the basis of this report, which remains generally consistent with the previously endorsed documentation. A summary of the previous reports and their key outcomes is provided below, with full copies available from Pinnacle upon request.

2.1.1 Key Reference Reports

- *Flagstone City – Masterplan, Flooding Assessment*, by Cardno Pty Ltd (now Stantec) for Peet Flagstone City Pty Ltd (report reference: 721743/032/V6, 2014).
- *Flagstone City – Stage 7, Stormwater Management Report*, by Cardno Pty Ltd (now Stantec) for Peet Flagstone City Pty Ltd (report reference: 7217/43/R11/V1, 2015).
- *Stormwater Management Plan at Flagstone Stage 7 North*, by Bradlees Civil Consulting (now Meinhardt Australia) for Peet Flagstone City Pty Ltd (report reference: 15-891, Revision A, 2017).
- *Stormwater Infrastructure Master Plan,* by Meinhardt Australia (report reference: Stormwater IMP, version 1.4, 2018).
- *Flagstone Stage 7A-G – Stormwater Management Strategy* Technical Memorandum by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178.TM02.DC.DOCX, 2020)
- *Stormwater Management Plan, Flagstone – Stages 7C/D/G* by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178SMP01-V1, 2021).

2.1.2 Critical Discussion of the Reference Reports

Flagstone City – Masterplan, Flooding Assessment, by Cardno (now Stantec) – 2014

The *Flagstone City – Stage 7, Stormwater Management Report*, prepared by Cardno Pty Ltd in 2014 provides discussion on the proposed regional stormwater management strategy for the Flagstone City Master Development Plan. The report advocates for a Masterplan approach to stormwater quantity management, aiming to enhance infrastructure efficiency across the broader development area while minimising initial and ongoing maintenance costs. Additionally, it recommends the integration of bio-retention systems across Flagstone East (which includes the subject site) to treat post-development runoff. This report was approved by Economic Development Queensland (EDQ) in July 2015, and has informed subsequent detailed studies by Bradlees, Meinhardt, and later Peak Urban, contributing to the ongoing refinement of stormwater management strategies in the area.

Flagstone City – Masterplan, Flooding Assessment, by Cardno (now Stantec) – 2015

The *Flagstone City – Masterplan, Flooding Assessment*, prepared by Cardno Pty Ltd in 2015 provides the most current recommendations for catchment wide stormwater infrastructure within the Flagstone City Master Development Plan. The report recommends that stormwater quantity and flooding be addressed as a Masterplan solution to maximise the efficiency of the infrastructure within the wider development area and to reduce initial and on-going maintenance costs. Importantly, this report concludes that the implementation of catchment-wide culverts and detention basins will resolve flood impacts within the subject site, whilst maintaining negligible impacts both upstream and downstream of the wider development area.

Stormwater Infrastructure Master Plan by Meinhardt Australia – 2018

Meinhardt Australia delivered a consolidated Stormwater Infrastructure Master Plan (IMP) for the wider Flagstone City development area in 2018. In this report, the subject site is clearly identified in Context Area 1 on the Context Area Plan drawing PFP-001 and is noted on the Local Infrastructure Proposed Stormwater Network Plan drawing PFP-003. Importantly, Section 5.2 of this report confirms that the management of stormwater quantity and site flooding will be addressed as a masterplan solution. However, the stormwater quantity infrastructure proposed in this report is specific to major storm events (i.e. the 1% AEP) which facilitated additional reporting by Peak Urban in 2020 and 2021 to assess the minor storms.

This report was approved under DEV2012/209/6/8 in July of 2019 and forms the consolidated groundwork for the most current stormwater quality and quantity management reporting.

Stormwater Management Strategy Technical Memo, Flagstone Stage 7A-G, by Peak Urban – 2020

The *Flagstone Stage 7A-G – Stormwater Management Strategy Technical Memorandum* by Peak Urban in 2020 builds upon previous reporting by Bradlees / Meinhardt, proposing a stormwater strategy incorporating both on-site and off-site bio-retention and detention basins to manage flows from the site and contributing external catchments. The intent of the bio-retention basins is to treat flows within the site and to mitigate the increase in discharge for the lower storm events, with flows generated by major storm events being mitigated by regional infrastructure under the above IMP. This memorandum also establishes delivery timeframes for the off-site basin, with its implementation contingent on the development of adjacent key lots within the subject site, specifically, Lots 25009 and 25021 (as identified in the memorandum). In the context of this report, the construction of the off-site basin depends on the delivery of tenancies T3–T5, which serve as an acceptable substitute for Lot 25021, as Lot 25009 is designated for future residential development.

Stormwater Management Plan, Flagstone – Stages 7C/D/G by Peak Urban – 2021

The *Stormwater Management Plan: Flagstone – Stages 7C/D/G*, prepared by Peak Urban (now Colliers) in 2021, provides the latest framework for stormwater management at the subject site. The report refines historical design documentation by optimising both on-site and off-site basins to effectively manage flows from the site and contributing external catchments. The off-site bio-retention and detention basin was designed to mitigate post-development flows from the entire Flagstone City Stage 7 footprint, which comprises Catchments 7B, 7C, 7Di, 7Dii, 7Gi, 7Gii, 7Giii, and 7Giv. Specifically, the basin was designed to attenuate minor storm flows (up to and including the 10% AEP threshold); with major flows (such as those from a 1% AEP storm) to be managed by the regional infrastructure described in the Meinhardt IMP.

Due to topographical limitations and construction constraints imposed by an existing adjacent dam, an additional on-lot bio-retention basin was incorporated within the strategy to treat flows from the 7Giii catchment before discharging northward into the regional dual-use facility. Key design assumptions associated with the above basin designs include commercial land zoning with an average fraction impervious of 0.8.

2.1.3 Impacts on Current Stormwater Strategy

This report seeks to uphold the original stormwater management strategy for the site, as documented in Peak Urban's 2020 and 2021 reports. The strategy consists of an off-site dual-purpose bioretention and detention basin, supplemented by on-site treatment and detention measures where necessary. Further detail on the implementation of this strategy is provided in the subsequent sections of this report.

3 Stormwater Quantity Assessment

3.1 General Discussion

This report seeks to uphold the original stormwater management strategy for the site, as documented in Peak Urban's 2020 and 2021 reports. The strategy consists of an off-site dual-purpose bioretention and detention basin, supplemented by on-site treatment and detention measures where necessary. Further detail on the implementation of this strategy is provided in the subsequent sections of this report. Consistent with the previous design, the offsite basin shall be located within Lot 905 on SP216472, designed to attenuate post-development flows from the 39.35% AEP event up to the 10% AEP event. Major storm events, including the 1% AEP, will be managed through regional infrastructure in accordance with Meinhardt Australia's Stormwater Infrastructure Master Plan (IMP, Version 1.4, 2018).

For further technical detail, reference should be made to the IMP prepared by Meinhardt Australia.

3.2 Hydrologic Objectives

The hydrologic objectives for the subject site were set in accordance with the requirements of the Queensland Urban Drainage Manual (QUDM, 2016) and the LCC Planning Scheme Policies. These objectives include but are not limited to the following:

- The proposed development shall ensure that all stormwater drainage is directed to the Lawful Point of Discharge in accordance with QUDM Section 3.9;
- Minor System Design for 39.35% AEP (Q_2) storm event;
- Major System Design for 1% AEP (Q_{100}) storm event;
- No adverse impact on adjoining or downstream properties; and
- No increase in post-development stormwater discharge, up to and including the 1% AEP storm event.

3.3 Lawful Point of Discharge

The Lawful Point of Discharge for the subject site is taken as Lot 905 on SP216472, and subsequently the existing adjacent Sandy Creek as documented in previous approved reporting.

3.4 Stormwater Quantity Assessment

The analysis of the stormwater runoff from the subject site was undertaken using the non-linear software package XP-Rafts.

3.4.1 Site Specific Rainfall Data

The design rainfall Intensity Frequency Duration (IFD) data for the storm events up to and including the 1% AEP storm event was derived based on the LCC Planning Scheme Policies and the AR&R.

The design IFD data for the catchment is summarised in Figure 3.1 below.

The rainfall temporal patterns utilised by the XP-Rafts analysis were derived in accordance with Australian Rainfall and Runoff (AR&R), 2016 edition.

	Annual Exceedance Probability (AEP)						
Duration	63.2%	39.35%	18%	10%	5%	2%	1%
1 min	139	176	224	261	301	354	394
2 min	112	141	180	211	247	294	331
3 min	105	133	170	199	231	275	309
4 min	101	128	163	191	221	262	293
5 min	97.6	123	157	183	212	250	280
10 min	81.2	103	131	153	176	206	228
15 min	68.8	87.4	111	130	149	175	194
20 min	59.6	75.7	96.6	112	130	152	169
25 min	52.7	66.8	85.3	99.4	115	135	150
30 min	47.2	59.9	76.5	89.2	103	121	135
45 min	36.2	45.9	58.7	68.6	79.6	94.1	105
1 hour	29.7	37.5	48.0	56.2	65.4	77.7	87.3
1.5 hour	22.1	27.9	35.7	42.0	49.0	58.6	66.1
2 hour	17.9	22.6	28.9	34.0	39.8	47.8	54.1
3 hour	13.3	16.8	21.5	25.4	29.8	35.9	40.8
4.5 hour	10.0	12.6	16.2	19.1	22.4	27.2	31.0
6 hour	8.24	10.4	13.3	15.7	18.5	22.5	25.7
9 hour	6.32	7.98	10.3	12.2	14.3	17.4	19.9
12 hour	5.28	6.67	8.62	10.2	12.1	14.7	16.8
18 hour	4.12	5.23	6.81	8.11	9.58	11.7	13.4
24 hour	3.46	4.41	5.78	6.90	8.17	9.96	11.4
30 hour	3.02	3.86	5.09	6.09	7.22	8.82	10.1
36 hour	2.69	3.45	4.58	5.49	6.52	7.97	9.14
48 hour	2.24	2.88	3.85	4.63	5.52	6.76	7.77
72 hour	1.69	2.18	2.94	3.56	4.27	5.25	6.05
96 hour	1.35	1.75	2.37	2.88	3.46	4.27	4.94
120 hour	1.12	1.45	1.96	2.39	2.89	3.57	4.13
144 hour	0.953	1.23	1.66	2.03	2.44	3.02	3.51
168 hour	0.823	1.06	1.42	1.74	2.10	2.59	3.01

Figure 3.1: IFD Data for Flagstone, QLD (mm/hr) (-27.8061, 152.9494) (Source: BOM)

3.4.2 XP-Rafts Modelling Inputs

The rainfall loss parameters for each sub-catchment were applied using an initial and continuing rainfall loss model. The design rainfall loss parameters input into the XP-Rafts model are based on the guideline values recommended by the AR&R and other reputable industry standards.

The rainfall loss parameters adopted for this XP-Rafts model are as tabulated below.

Table 3.1: Adopted XP-Rafts Rainfall Loss Parameters

Storm Event	Pervious Areas		Impervious Areas	
AEP (%)	Initial Loss (mm)	Continuing Loss (mm)	Initial Loss (mm)	Continuing Loss (mm)
39.35-18	15	2.5	1	0
10-5	10	2.5	1	0
2-1	2.5	2.5	0	0

3.4.3 XP-Rafts Model Validation

The validation of the XP-Rafts model was undertaken through the comparison of the XP-Rafts generated stormwater discharge rates to the pre-development Rational Method calculations included within Appendix D.

The Rational Method adopted a C_{10} coefficient of runoff of 0.70 for the pre-development catchment (sub catchments A1, A2, B1 and B2, in accordance with Tables 4.5.3 and 4.5.4 of QUDM. As detailed in Table 2.2 below, the stormwater discharge rates calculated using the Rational Method are generally comparable to the stormwater discharge rates calculated using the XP-Rafts model. We can therefore reasonably adopt the stormwater discharge rates generated from the XP-Rafts model.

3.4.4 Critical Duration Analysis

Design storm durations ranging from 10-minutes to 720-minutes were simulated by the XP-Rafts model analysis in order to determine the design stormwater discharge for the subject site.

3.4.5 Existing Discharge Locations

As outlined in the previous sections of this report the subject site generally discharges towards the northern property boundary prior to entering the adjacent Sandy Creek.

3.5 Hydrologic Analysis

3.5.1 Pre-development Scenario

The results obtained from the XP-Rafts model generally show that the critical storm duration throughout the local catchment analysed for all AEP storm events is generally the 15-minute to 30-minute storms.

A fraction impervious area of 0.0 was calculated for the pre-development catchment (sub catchments A1, A2, B1, and B2) from the topographic survey included within Appendix B.

The pre-development catchment discharges for the 39.35%, 18%, 10%, 5%, 2% and 1% AEP storm events are detailed in Table 3.2 below.

Table 3.2: Pre-development Catchment Details and Peak Discharges

Catchment	Area (ha)	Imp. Area (ha)	Ave. Slope (%)	XP-Rafts Results						Rational Method
				39.35% AEP (m^3/s)	18% AEP (m^3/s)	10% AEP (m^3/s)	5% AEP (m^3/s)	2% AEP (m^3/s)	1% AEP (m^3/s)	1% AEP (m^3/s)
A1	1.9384	0.0	4.5	0.263	0.325	0.489	0.607	0.785	0.896	0.828
A2	0.7768	0.0	6.5	0.130	0.206	0.269	0.324	0.388	0.437	0.363
A Total	**2.7152**	**0.0**	**–**	**0.393**	**0.531**	**0.758**	**0.931**	**1.173**	**1.333**	**–**
B1	3.2448	0.0	5.5	0.435	0.529	0.785	0.994	1.293	1.478	1.280
B2	0.5636	0.0	5.0	0.092	0.142	0.188	0.228	0.275	0.310	0.300
B Total	**3.8084**	**0.0**	**–**	**0.527**	**0.671**	**0.973**	**1.222**	**1.568**	**1.788**	**–**
Ext 1	2.3630	1.7726	2.7	0.543	0.823	0.998	1.160	1.465	1.634	–
Ext 2	0.4208	0.2435	2.5	0.061	0.107	0.134	0.158	0.204	0.229	–
Total	**6.5236**	**2.0161**	**–**	**1.292**	**2.066**	**2.793**	**3.411**	**4.358**	**4.935**	**–**
Critical Storm				**90mins**	**30mins**	**25mins**	**25mins**	**15mins**	**15min**	**–**

3.5.2 Post-development Scenario – Unmitigated

Based on the provided architectural drawings, fraction impervious values of 0.84, 0.90, 0.70, and 0.87 for the post-development sub-catchments A1, A2, B1 and B2 respectively. A copy of the architectural drawings is included in Appendix A. The post-development catchment plan is included in Appendix C.

For the purposes of this analysis, the impervious areas were modelled using the second sub-catchment option within XP-Rafts. The total impervious area for each sub-catchment is tabulated below. The results of the XP-Rafts post-development analysis show that the critical storm duration throughout the catchment for all AEP storm events varies between the 15-minute to 90-minute storm events. Table 3.3 summarises the unmitigated peak flow rates for the post-development catchment.

Table 3.3: Catchment Details and Peak Discharges (Unmitigated)

Catchment	Area (ha)	Pervious Area (ha) Ave Slope (%)	Impervious Area (ha) Ave Slope (%)	XP-Rafts Results					
				39.35% AEP (m^3/s)	18% AEP (m^3/s)	10% AEP (m^3/s)	5% AEP (m^3/s)	2% AEP (m^3/s)	1% AEP (m^3/s)
A1	1.9384	0.3018 6.0%	1.6366 3.0%	0.625	0.798	0.959	1.116	1.365	1.516
A2	0.7768	0.0777 1.0%	0.6991 1.5%	0.266	0.324	0.398	0.46	0.542	0.603
A Total	2.7152	0.3795	2.3357	0.891	1.122	1.357	1.576	1.907	2.119
B1	3.2448	0.4120 6.0%	2.8328 3.5%	1.082	1.352	1.637	1.895	2.302	2.558
B2	0.5636	0.0864 1.0%	0.4772 1.5%	0.182	0.225	0.274	0.316	0.379	0.421
B Total	3.8084	0.4984	3.3100	1.264	1.577	1.911	2.211	2.681	2.979
Ext 1	2.3630	0.5904 14.0%	1.7726 3.0%	0.710	0.940	1.055	1.231	1.557	1.731
Ext 2	0.4208	0.1774 0.50%	0.2435 2.5%	0.094	0.118	0.142	0.165	0.208	0.233
Total	**9.3074**	**1.6457**	**2.0161**	**2.915**	**3.745**	**4.526**	**5.262**	**6.332**	**7.037**
Critical Storm Duration				**10min**	**15mins**	**15mins**	**10min**	**15mins**	**15mins**

A comparison of the XP-Rafts results in Tables 3.2 and 3.3 generally indicates increases in stormwater discharge of 1.623m^3/s, 1.679m^3/s, 1.733m^3/s, 1.851m^3/s, 1.974m^3/s and 2.102m^3/s for the 39%, 18%, 10%, 5%, 2% and 1% AEP storm events. This is due to the increased impervious areas observed across the site during the post-development scenario.

Mitigation of increased discharge from Catchments Ext1, Ext2, A1, A2, and B1 is proposed via an offsite dual-purpose bioretention and detention tank, while Catchment B2 will be managed through an onsite underground detention and treatment tank

3.6 Post Development Mitigation Strategy

Based on the above investigation, the following stormwater management strategy is proposed to mitigate the post-development stormwater discharge to the site's pre-development discharge rates. The strategy is designed to remain consistent with the previously approved stormwater management frameworks established by Peak Urban and Meinhardt Australia. Specific reference is made to the following documents:

- Stormwater Infrastructure Master Plan, by Meinhardt Australia (report reference: Stormwater IMP, version 1.4, 2018).
- Flagstone Stage 7A-G – Stormwater Management Strategy Technical Memorandum by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178.TM02.DC.DOCX, 2020)
- Stormwater Management Plan, Flagstone – Stages 7C/D/G by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178SMP01-V1, 2021).

Catchment A, Catchment B1 and External Catchments Ext 1 and Ext 2:

Maintain consistency with the design rational in the previously approved *Stormwater Management Plan, Flagstone – Stages 7C/D/G* by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178SMP01-V1, 2021).

- Attenuation of post-development stormwater discharge via an off-site dual-use detention/bio-retention basin
    - This basin will attenuate minor storm flows (from the 39.35% AEP up to and including the 10% AEP threshold), with major flows (such as those from a 1% AEP storm) to be managed by the regional infrastructure described in the Meinhardt IMP.
- Direct all stormwater runoff to the off-site basin via an internal stormwater reticulation network and overland sheet flow prior to discharge to the Lawful Point of Discharge;
- Discharge the minor (up to the 10% AEP storm event) stormwater runoff to the Lawful Point of Discharge via a piped network;
- Discharge the major (up to the 1% AEP storm event) stormwater runoff to the Lawful Point of Discharge via piped and overland flow;
- Generally, maintain the existing drainage regimes and drainage discharge locations.

Catchment B2:

- Attenuation of post-development stormwater discharge (from the 39.35% AEP up to and including the 1% AEP threshold), via a private on-site underground detention tank;
- Direct all stormwater runoff to the dual-use detention/treatment system via an internal stormwater reticulation network and overland sheet flow prior to discharge to the Lawful Point of Discharge;
- Discharge the minor (up to the 10% AEP storm event) stormwater runoff to the Lawful Point of Discharge via a piped network;
- Discharge the major (up to the 1% AEP storm event) stormwater runoff to the Lawful Point of Discharge via piped and overland flow;
- Generally, maintain the existing drainage regimes and drainage discharge locations.

3.6.1 Detention System Design

The following tables present design details, outflow characteristics, and storage-height relationships for each of the proposed stormwater detention systems to mitigate post-development discharge rates:

- Table 3.4: Offsite Dual-use Detention Basin Design Details and Outflow Characteristics;
- Table 3.5: Offsite Dual-use Detention Basin Height-Storage Relationship;
- Table 3.6: Catchment B2 Detention Tank Design Details and Outflow Characteristics;
- Table 3.7: Catchment B2 Detention Tank Height-Storage Relationship.

Table 3.4: Offsite Dual-use Detention Basin Design Details and Outflow Characteristics

Design Parameter	Details					
Contributing Catchments	A1, A2, B1, Ext 1 and Ext 2					
Basin Outlets	39.35% AEP Low-flow Outlet = 1 x Ø825mm orifice at bottom of pit 39.35% AEP Low-flow Level = at base of detention basin 18.13% AEP Low-flow Outlet = 1 x Ø1,050mm orifice at bottom of pit with RCP beyond 18.13% AEP Low-flow Level = at base of detention basin 10% AEP Intermediate Flow Outlet = 15m wide weir 10% AEP Intermediate Flow Level = 1.10m above base of detention basin					
Basin Geometry	Base Area = 1,000m^2 (min.) Storage Height = 1.3m (min.) Batter Slope = 1 in 4 (max.) Storage Volume = 1,861.50m^3 (min.)					
Basin Modelling Summary	AEP (%)	Peak Outflow (m^3/s)	Stage (m)	AEP (%)	Peak Outflow (m^3/s)	Stage (m)
	39.35	1.157	+0.957	10	2.570	+1.172
	18.13	1.804	+1.048	-	-	-

Table 3.5: Offsite Dual-use Detention Basin Height-Storage Relationship

Basin Height (m)	Basin Storage (m^3)	Basin Height (m)	Basin Storage (m^3)
0.0	0.00	0.7	873.72
0.1	107.95	0.8	1022.20
0.2	221.31	0.9	1176.97
0.3	340.21	1.0	1338.16
0.4	464.78	1.1	1505.90
0.5	595.14	1.2	1680.31
0.6	731.41	1.3	1861.52

Table 3.6: Catchment B2 Detention Tank Design Details and Outflow Characteristics

Design Parameter	Details					
Tank Outlets	Low-flow Outlet = 0.25m wide x 0.2m high rectangular penetration Low-flow Level = base of tank High-flow Outlet = 4m wide internal weir (with Ø375mm pipe beyond) High-flow Outlet Level = 1.0m above base of tank					
Tank Geometry	Base Area = 150m^2 (min.) Storage Height = 1.2 m (min.) Storage Volume = 180m^3 (min.)					
Tank Modelling Summary	AEP (%)	Peak Outflow (m^3/s)	Stage (m)	AEP (%)	Peak Outflow (m^3/s)	Stage (m)
	39.35	0.091	+0.463	5	0.136	+0.859
	18	0.110	+0.609	2	0.217	+1.045
	10	0.122	+0.723	1	0.329	+1.087

Table 3.7: Catchment B2 Detention Tank Height-Storage Relationship

Tank Height (m)	Tank Storage (m^3)	Tank Height (m)	Tank Storage (m^3)
0.0	0	0.7	105
0.1	15	0.8	120
0.2	30	0.9	135
0.3	45	1.0	150
0.4	60	1.1	165
0.5	75	1.2	180
0.6	90	-	-

3.6.1 **Pre-development and Post-development Scenario Comparison**

Tables 3.8, 3.9, and 3.10 below detail the comparison between the pre-development and post-development discharge for the site, as well as for each detention system.

Table 3.8: Pre-development and Post-development Scenario Peak Discharge Comparison – Site Total

Storm Event	Site Total (To Sandy Creek)		Difference (m^3/s)	Difference (%)
	Pre (m^3/s)	Post (m^3/s)		
39% AEP	1.292	1.246	-0.046	-4.0%
18% AEP	2.066	2.072	+0.006	+0.29%
10% AEP	2.793	2.692	-0.101	-4.0%

The results demonstrate that post-development site discharges are generally equal to or less than pre-development rates. For the 18.13% AEP event, the total site discharge increases slightly by 0.006 m³/s (0.29%), which remains within modelling tolerances. It is noted that upstream pipe storage and underground treatment tank storage were not included in the modelling; incorporation of these elements would offset this minor increase. Site discharge results are presented only to the 10% AEP, consistent with the design rationale for the off-site basin established in previously approved Peak Urban reporting.

Table 3.9: Pre-development and Post-development Scenario Peak Discharge Comparison – Offsite Basin

Storm Event	Offsite Basin – Catchments A1, A2, B1, Ext1 and Ext2 (To Sandy Creek)		Difference (m^3/s)	Difference (%)
	Pre (m^3/s)	Post (m^3/s)		
39% AEP	1.204	1.157	-0.047	-4%
18% AEP	1.929	1.962	+0.033	+2%
10% AEP	2.606	2.570	-0.036	-1%

The results presented above demonstrate that the post-development site discharge out of the regional basin is generally less than or equal to the pre-developed rates. It is noted that the total discharge during the 18.13% AEP event increases slightly by 0.033m³/s (2%), however, it is noted that this is largely offset by the attenuation for the Catchment B2 tank (-0.032m³/s), with the site total discharge to the LPoD being within modelling tolerances as per the above. As per above discussion it is noted that upstream pipe storage and underground treatment tank storage were not included in the modelling; incorporation of these elements would offset this minor increase.

Note: basin discharge results are presented only to the 10% AEP, consistent with the design rationale for the off-site basin established in previously approved Peak Urban reporting.

Table 3.10: Pre-development and Post-development Scenario Peak Discharge Comparison – Catchment B2

Storm Event	Catchment B2 (To Sandy Creek)		Difference (m^3/s)	Difference (%)
	Pre (m^3/s)	Post (m^3/s)		
39% AEP	0.092	0.091	-0.001	-1%
18% AEP	0.142	0.110	-0.032	-23%
10% AEP	0.188	0.122	-0.066	-35%
5% AEP	0.228	0.136	-0.092	-40%
2% AEP	0.275	0.206	-0.069	-25%
1% AEP	0.310	0.312	0.002	1%

The results presented above demonstrate that the post-development site discharge is generally less than or equal to the pre-developed rates. The minor increase in outflow observed for the 1% AEP storm event of 0.002m³/s (1%) is within modelling tolerances and will be further mitigated via regional infrastructure as per the design rational for the regional basin.

4 Stormwater Quality Assessment

4.1 General Discussion

This report seeks to uphold the original stormwater management strategy for the site, as documented in Peak Urban's 2020 and 2021 reports. The strategy consists of an off-site dual-purpose bioretention and detention basin, supplemented by on-site treatment and detention measures where necessary.

4.2 Water Quality Objectives

This water quality analysis was undertaken in accordance with Healthy Waterways WSUD Technical Design Guidelines for South East Queensland – Version 1 and the Queensland State Planning Policy.

The pollutant types and the associated Water Quality Objectives that will be evaluated are as follows:

Table 4.1: Water Quality Objective Summary

Pollutant Types	Site Water Quality Objective
Total Suspended Solids (TSS)	80% reduction
Total Phosphorous (TP)	60% reduction
Total Nitrogen (TN)	45% reduction
Gross Pollutants (GP)	90% reduction

4.3 Proposed Treatment Strategy

In order to meet the above Water Quality Objectives, the following strategies are proposed to treat stormwater runoff from the site prior to discharge to the Lawful Point of Discharge.

4.4 Proposed Treatment Measures

The following water quality treatment measures are proposed for this development which include only 'Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) verified products, as required by the local governing authority (Council). Note that if an approved equivalent product is proposed by the Developer, appropriate modelling and testing data shall be provided by the supplier and approved by Council prior to installation to ensure that the water quality objectives for the site can be achieved.

4.4.1 Off-site Bio-retention Basin

The off-site bio-retention basin will accept the 3-month ARI discharge from Catchment A, and External Catchments Ext 1 and Ext 2. For additional details, refer to the *Stormwater Management Plan, Flagstone – Stages 7C/D/G* by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178SMP01-V1, 2021).

The basins will retain this runoff within an extended detention depth of 0.3m and infiltrate this water through the filter media (sandy loam topsoil). Filtered stormwater is then recovered at the base of the filter media via a drainage layer containing perforated pipes. The surface of the bio-retention device is to be heavily planted with locally occurring native ground cover species and shrubs. It is recommended that the vegetation be selected in consultation with a landscape architect and the approved landscaping plans for the site. A typical section of a bio-retention basin is presented in Figure 4.1.

The treatment of the stormwater takes place both on the surface of the bio basin and within the filter media. When large storm inflows cause short-term ponding on the surface of the basin, pollutants are removed from

the stormwater through sedimentation and particulate adhesion onto the stems and leaves of the vegetation. The agitation of the surface layer of the soil caused by movement of the vegetation and the growth of root systems prevents the accreted sediments clogging the filter media. As stormwater infiltrates through the filter media, fine particulates and some soluble pollutants are removed through processes such as adhesion to the surface of the filter media particles, biological transformation of pollutants by bio-films growing on the surface of the filter media particles, and biomass uptake of nutrients and metals through the root systems of the vegetation growing in the basin.

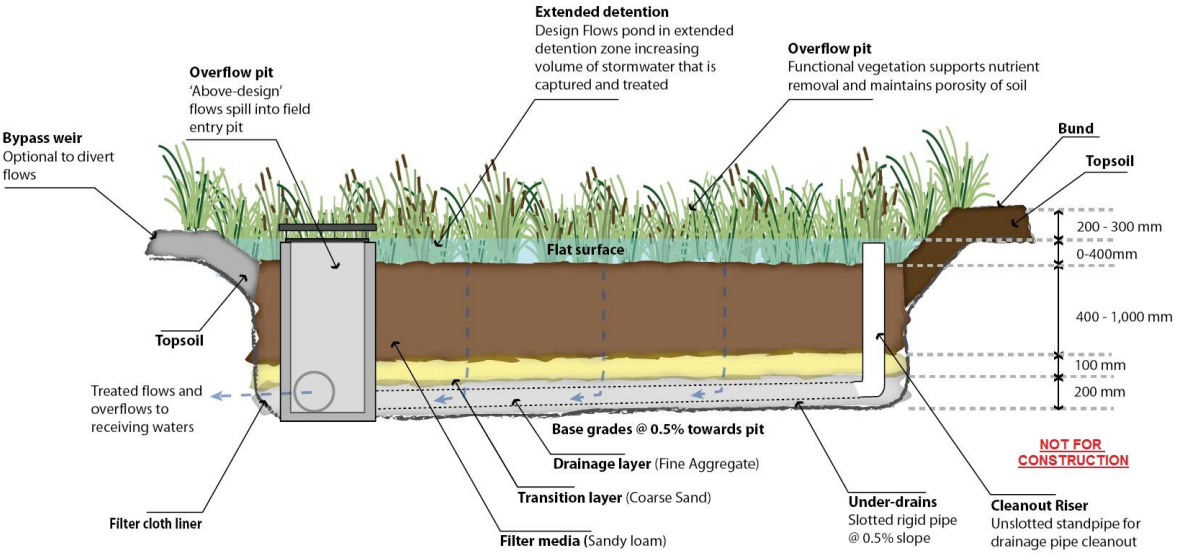

Figure 4.1: Bio-retention Basin – Typical Section (Source: Healthy Waterways WSUD Technical Design Guidelines)

4.4.1 ATLAN Stormwater Water Quality Treatment Products

The treatment option involves utilisation of stormwater pit inserts in each stormwater gully-pit or field inlet which act as primary Gross Pollutant Traps (GPT) before conveying captured stormwater run-off to an underground treatment tank for secondary filtering via a cartridge system.

The Atlan Stormwater 'AtlanFilter' cartridge filter system incorporates an upflow treatment process that maximises surface treatment area. Flow through the filter cartridges utilises a self-regulating siphon which results in a low maintenance and high performance stormwater treatment. The automatic backwash at the end of each storm event further lengthens the lifespan of the filter.

Hydraulic pressure forces water through the filter media — causing a constant velocity throughout the filter area realising a consistent media contact time and therefore treatment. Upon completion of a treatment cycle, the filter backwashes and effectively dislodges particulates from the filtration layers.

Figure 4.2 below illustrates a typical Atlan Stormwater treatment train configuration. Additional information on Atlan Stormwater treatment devices is included in Appendix H.

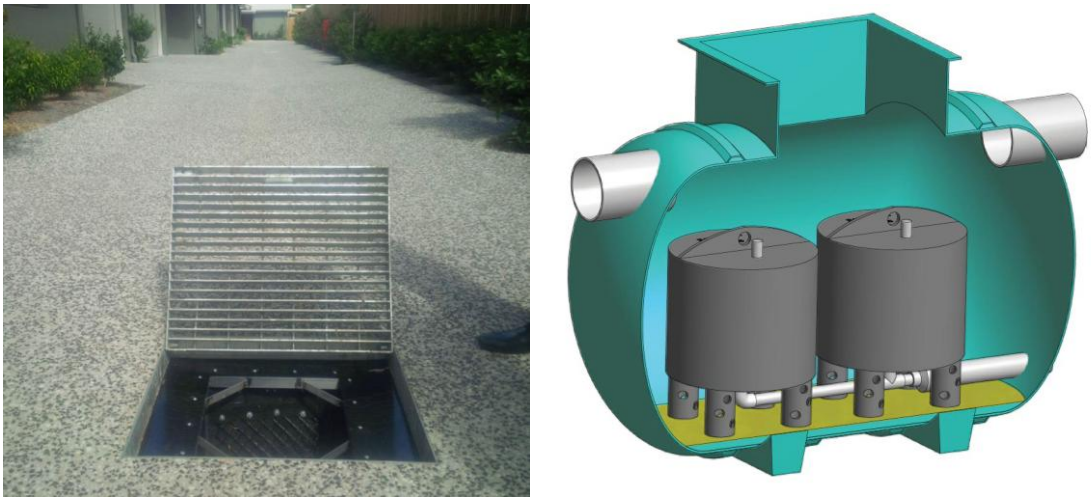

Figure 4.2: Typical Atlan Stormwater Treatment Train Configuration (Source: Atlan Stormwater)

4.5 MUSIC Modelling

The proposed treatment train is detailed in Appendix F with additional details of the modelling procedure described in the following sections.

4.5.1 Meteorological Data

The meteorological data inputs utilised by MUSIC to simulate catchment hydrology processes includes rainfall data (at intervals relevant to the time step being modelled) and average areal potential evapotranspiration (measured in millimetres per day).

The meteorological data adopted for this model was the Greenbank Thompson Road station 40659 (1/1/1980 to 31/12/1999) as outlined in the MUSIC Modelling Guidelines for South-East Queensland.

4.5.2 MUSIC Source Nodes

Source node properties were obtained from the Healthy Waterway MUSIC Modelling Guidelines for South East Queensland and are as follows.

Table 4.2: Pollutant Export Parameter for Lumped Catchment (Log[10] Values)

Mean EMC (mg/L)							
Land Use		TSS		TP		TN	
Development Type		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Commercial	Mean	2.16	0.78	-0.39	-0.60	0.37	0.32
	Std. Deviation	0.38	0.39	0.34	0.50	0.34	0.30
Residential	Mean	2.18	1.00	-0.47	-0.97	0.26	0.20
	Std. Deviation	0.39	0.34	0.32	0.31	0.23	0.20

Table 4.3: Pollutant Export Parameter for Split Catchment (Log[10] Values)

Mean EMC (mg/L)							
Land Use		TSS		TP		TN	
Commercial Development		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Roof	Mean	1.30	0.00	-0.89	0.00	0.37	0.00
	Std. Deviation	0.38	0.00	0.34	0.00	0.34	0.00
Roads	Mean	2.43	0.78	-0.30	-0.60	0.37	0.32
	Std. Deviation	0.38	0.39	0.34	0.50	0.34	0.30
Ground	Mean	2.16	0.78	-0.39	-0.60	0.37	0.32
	Std. Deviation	0.38	0.39	0.34	0.50	0.34	0.30

4.6 Performance Assessment

The site has been modelled as a number of commercial source nodes. The MUSIC model parameters were adopted according to the Healthy Waterway MUSIC Modelling Guidelines for South East Queensland and are outlined in Table 4.4 and Table 4.5.

Table 4.4: Adopted MUSIC Model Source Node Parameters

Parameter	Value
Source Data	
Rainfall data setup	Greenbank Thompson Road station 40659
Rainfall data period	1/1/1980 to 31/12/1989
Model time step	6 Minute
Soil properties (Runoff generation parameter)	Commercial and Residential (MUSIC Modelling Guidelines for South East Queensland)
Site Data	
Catchment A1 – Commercial (Lumped)	1.9384 Ha – Lumped (85% Impervious)
Catchment A2 – Residential (Lumped)	0.7768 Ha – Lumped (90% Impervious)
Catchment Ext1 – Commercial (Lumped)	2.3630 Ha – Lumped (100% Impervious)
Catchment Ext2 – Commercial (Lumped)	0.4208 Ha – Lumped (100% Impervious)
Catchment B1 – Commercial (Split)	1.2203 Ha – Roof (100% Impervious)

Parameter	Value
	1.4599 Ha – Road (100% Impervious) 0.5646 Ha – Ground (27% Impervious)
Catchment B2 – Commercial (Split)	0.2647 Ha – Roof (100% Impervious) 0.2125 Ha – Road (100% Impervious) 0.0864 Ha – Ground (0% Impervious)

Table 4.5: Adopted MUSIC Model Treatment Node Parameters

Parameter	Value
Treatment Devices	
Catchment A1, A2, B1, Ext1 and Ext2 – Offsite Dual-use Bio-Retention Basin	Extended detention depth = 0.3m Storage surface area = 500.0m^2 Filter media surface area = 500.0m^2 Seepage Loss = 0.00mm/hr Median particle diameter = 0.45mm Saturated hydraulic conductivity = 200mm/hr Filter media – sandy loam Filter media depth = 0.40m TN Content of Filter Media = 400mg/kg Orthophosphate Content = 50.00mg/kg
Catchment B1 – ATLAN Stormsack and ATLAN Vault	ATLAN Stormsack Required number = 20 min. High flow bypass = 0.025m^3/s per Stormsack (0.50m^3/s Total) ATLAN Vault (27.0m^2 min) High flow bypass = 100m^3/s Storage surface area = 27.0m^2 min Extended detention depth = 0.85m Low flow pipe diameter = 205mm ATLAN Filter Cartridge Type = Full Height SF.30-EMC Required number = 27 High flow bypass = 0.0810m^3/s (3.0 L/s per cartridge)
Catchment B2 – ATLAN Stormsack and ATLAN Vault	ATLAN Stormsack Required number = 4 min. High flow bypass = 0.025m^3/s per Stormsack (0.10m^3/s Total) ATLAN Vault (6.0m^2 min) High flow bypass = 100m^3/s Storage surface area = 6.0m^2 min Extended detention depth = 0.85m Low flow pipe diameter = 97mm ATLAN Filter Cartridge Type = Full Height SF.30-EMC Required number = 6 High flow bypass = 0.018m^3/s (3.0 L/s per cartridge)

Tables 4.6-4.9 below summarise the load reduction by MUSIC using the WSUD strategy outlined above.

Table 4.6: MUSIC Pollutant Load Assessment – Site Total to LPoD

System	Parameter	Sources	Residual Load	Reduction (%)
Receiving node	Total Suspended Solids (kg/yr)	10,300	1,960	81.0
	Total Phosphorous (kg/yr)	27	8.64	68.0
	Total Nitrogen (kg/yr)	178	83.7	52.9
	Gross Pollutants (kg/yr)	1,450	0	100

Table 4.7: MUSIC Pollutant Load Assessment – Offsite Basin

System	Parameter	Sources	Residual Load	Reduction (%)
Receiving node	Total Suspended Solids (kg/yr)	7,040	1,290	81.6
	Total Phosphorous (kg/yr)	17.9	6.34	64.5
	Total Nitrogen (kg/yr)	101	48.3	52.1
	Gross Pollutants (kg/yr)	840	0	100

Table 4.8: MUSIC Pollutant Load Assessment – Catchment B1 Tank

System	Parameter	Sources	Residual Load	Reduction (%)
Receiving node	Total Suspended Solids (kg/yr)	2,850	565	80.2
	Total Phosphorous (kg/yr)	8.38	2.19	73.8
	Total Nitrogen (kg/yr)	65.2	29.8	54.3
	Gross Pollutants (kg/yr)	520	0	100

Table 4.9: MUSIC Pollutant Load Assessment – Catchment B2 Tank

System	Parameter	Sources	Residual Load	Reduction (%)
Receiving node	Total Suspended Solids (kg/yr)	413	74.1	82.0
	Total Phosphorous (kg/yr)	1.28	0.327	74.4
	Total Nitrogen (kg/yr)	11.1	5.01	55.0
	Gross Pollutants (kg/yr)	88.6	0	100

As illustrated in Tables 4.6-4.9 above, the load reduction objectives of 80% for TSS, 60% for TP, 45% for TN and 90% for GP have been achieved for the post development site through the use of proprietary cartridge systems and gross pollutant traps.

5 Monitoring and Maintenance

5.1 Bio-Retention Basins

5.1.1 Monitoring of Devices

In accordance with the Water by Design Construction and Establishment Guidelines: Swales Bio-retention Systems and Wetlands (C&E Guidelines), a monitoring program will be established for the stormwater treatment devices as outlined below in Table 5.1. All monitoring activities associated with the operation of the vegetated treatment areas, including weed inundation, erosion, vegetation density, determination and inappropriate access shall be included in the general monitoring of the landscaped areas. The below schedules are for guidance only. Routine clean out and maintenance should be scheduled based on the outcome of routine inspection.

Table 5.1: Monitoring Program for Vegetated Bio-retention Basin

Time Frame (Post Construction)	Monitoring Activity	Frequency
0-6 months	Erosion/scour of basin base & batters	Following major storm events> 25mm
	Weed inundation/litter accumulation within basin	3 monthly
	Excessive wear & damage of basin base & batters	3 monthly
	Build up of sediments within basin	3 monthly
	Check vegetation within swale drain	Monthly
>6 months	Erosion/scour of basin base & batters	6 monthly
	Weed inundation/litter accumulation within base	6 monthly
	Excessive wear & damage of basin base & batters	6 monthly
	Build up of sediments within basin	6 monthly
	Check vegetation within swale drain	6 monthly

LCC will be responsible for all monitoring activities associated with the operation of the vegetated bio-retention basin during the operational phase of the development.

5.1.2 Maintenance

The successful long term functionality of bio-retention system will be dependent on the maintenance conducted. A maintenance program as outlined below within Table 5.2 is to be implemented for the stormwater treatment devices.

Table 5.2: Maintenance Program for Vegetated Bio-retention Basin

Time Frame (Post Construction)	Maintenance Activity	Frequency
0-6 months	Repairs to basin profile	As required by monitoring
	Watering, revegetating	As required by monitoring
	Removal of litter, debris, weeds & excessive sediment build up	Monthly or as required
>6 months	Repairs to basin profile	As required by monitoring
	Removal of litter, debris, weeds and excessive sediment build up	As required by monitoring

LCC will be responsible for all maintenance activities associated with the operation of the vegetated bio-retention basin during the operational phase of the development.

5.2 Proprietary Filter Cartridges

5.2.1 Monitoring of Devices

A monitoring program will be established for the stormwater treatment devices as required by the SQIDEP approved proprietary product supplier.

The supplier will be responsible for all monitoring activities associated with the operation of the treatment train which will be undertaken under a maintenance agreement between the supplier and the Developer.

5.2.2 Maintenance of Devices

The ongoing performance of the SQIDEP approved proprietary treatment devices will be dependent on the regular maintenance conducted.

The maintenance program will be as required by the supplier and will be undertaken as part of maintenance agreement between the supplier and the Developer.

6 Erosion and Sediment Control Strategy

The objective of erosion and sediment management on construction sites is to minimise soil erosion and control silt and/or sediment discharge from the sites through the use of suitable control devices during the four primary phases of the project lifecycle being:

1. Pre-construction/Establishment Phase;
2. Bulk Earthworks/Change to Ground Level Phase;
3. Construction Phase; and
4. Post-development/Operational Phase.

Sections 6.2 and 6.3 below outline the typical and industry best practice erosion and sediment control measures that will be implemented throughout the life cycle of this project.

6.1 Development Lifecycle Erosion and Sediment Management

6.1.1 Pre-construction/Establishment Phase

Prior to the commencement of construction, during the site establishment phase of the works, the following sediment and erosion control measures will be implemented in order to minimise site disturbance and ensure that water quality is maintained.

- Silt/Sediment fences will be installed around the proposed bulk earthworks site (along the toe of the batter alignment) and any environmentally sensitive areas; and
- A construction vehicle entry/exit shakedown area will be installed and will comprise of a vibratory cattle grid or gravel/rock pad in accordance with the IEAust Guidelines.

6.1.2 Bulk Earthworks Phase/Change to Ground Level

Excavation during the bulk earthworks/change to ground level phase of the project will be staged in a manner that runoff will generally be directed towards sediment and erosion controls established during the pre-construction phase.

As applicable, sediment basins will be constructed within proposed park/open space areas generally in the location of the proposed bio-retention basins to ensure that all sediment runoff is intercepted and treated prior to discharging from site.

6.1.3 Construction Phase

During the construction phase of the project, the following erosion and sediment controls will be implemented to ensure water quality is maintained.

- Sediment fences will be erected at the base of all batters and stockpiles to prevent sediment transportation offsite;
- All sediment and erosion control structures will be maintained and inspected regularly as well as after each storm event to ensure the ongoing integrity is maintained. No structure is to accumulate sediment above 40% of its capacity; and
- Regular monitoring of water quality will be undertaken to determine the effectiveness of the sediment and erosion control measures. Testing may be required and shall be provided to the Local Authority on request.

6.1.4 Post-development/Operational Phase

Following the completion of the construction phase of the project and the development reaching 'Practical Completion' and/or 'On-maintenance', a monitoring program will be established for the stormwater treatment devices outlined previously within this report, where applicable. The monitoring program will ensure the ongoing integrity and effectiveness of these stormwater treatment devices following the completion of the construction phase of the project.

6.2 Dust Suppression and Erosion Control Measures

The time of disturbance onsite will be kept to a minimum by ensuring that the civil works are undertaken directly following the earthworks phase. Consideration to staging of the works shall be given in order to minimise the area of exposed earthworks at any given time.

Erosion control and dust suppression measures shall be applied to the exposed areas of the site as deemed necessary by the site supervisor in order to prevent the emission of dust from the site.

A number of erosion control measures are available inclusive of but not limited to the following:

- Water spraying (by water truck);
- Dust suppressants;
- Surface stabilisation; and
- Covering of exposed areas.

6.3 Sediment Control Measures

With reference to the IEAust Guidelines and Current Industry Best Practice, there are three (3) fundamental sediment control principles that have been identified for use during construction:

- Construction Vehicle Shakedown and/or Entry/Exit;
- Sediment Fences; and
- Sediment Barriers.

6.3.1 Construction Vehicle Shakedown and/or Entry/Exit

A dedicated construction vehicle shakedown will be installed at the site's entry/exit point for road and construction vehicles. This construction vehicle shakedown area will be established to facilitate the removal of soil, mud, dust and debris from the tyres of vehicles prior to leaving the construction site. The construction shakedown will comprise of a gravel/rock pad designed or a vibratory grid system constructed and maintained in accordance with the IEAust Guidelines. The advantages of the vibratory grid system include ease of movement and ability to reuse for several years at different construction sites.

6.3.2 Sediment Fences

Sediment fencing will be established at the bottom of slopes on any exposed earthworks batters where there is an established risk of contaminated water discharging from the site prior to clearing and earthworks commencing. Sediment fencing may be required at regular spacing down the disturbed slope to limit scour and rutting caused by channelising of stormwater discharge. Sediment fences will be used to protect any temporary stockpile sites as required. Sediment collected from sediment barriers will be regularly removed and either taken offsite as part of the earthworks phase or stockpiled for use during revegetation works.

6.3.3 Sediment Barriers

Sediment barriers will be constructed around all stormwater drainage gully pits and field inlets where contaminated water may enter the existing and proposed stormwater network. The provision of these sediment barriers will facilitate the settlement of sediments prior to entering the downstream stormwater drainage network. Sediment barriers will generally comprise of gravel wrapped in geotextile 'sausage', sediment fences around field inlets or similar approved products.

6.4 Monitoring and Maintenance

The site supervisor will be responsible for the following regular monitoring and maintenance activities during the various phases of the development:

1. Inspection of downstream stormwater network as well as sediment and erosion controls will be conducted at the end of each construction day and after each rainfall event greater than 25mm.
2. If any established complaints by neighbouring property owners and/or local authority or evidence of water quality deterioration is reported downstream of the works site the following actions are to be taken immediately:
   a. locate source of stormwater quality deterioration.
   b. construct temporary erosion and sediment controls to prevent the continuing short term stormwater quality deterioration.
   c. repair existing erosion and sediment controls, modify construction procedures or construct additional controls to prevent further deterioration.

7 Conclusions and Recommendations

This report outlines the stormwater drainage management strategy developed to manage potential impacts due to the proposed commercial, retail and future residential development located at Homestead Drive, Flagstone.

Following the investigation, the following stormwater quality management strategy has been adopted for the subject site. The strategy is designed to remain consistent with the previously approved stormwater management frameworks established by Peak Urban and Meinhardt Australia. Specific reference is made to the following documents:

- Stormwater Infrastructure Master Plan, by Meinhardt Australia (report reference: Stormwater IMP, version 1.4, 2018).
- Flagstone Stage 7A-G – Stormwater Management Strategy Technical Memorandum by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178.TM02.DC.DOCX, 2020)
- Stormwater Management Plan, Flagstone – Stages 7C/D/G by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178SMP01-V1, 2021).

Catchment A, and External Catchments Ext 1 and Ext 2:

- **Treatment and Attenuation:**
  - Utilise an off-site dual-use detention/bio-retention basin to treat and attenuate minor storm flows (from the 39.35% AEP up to and including the 10% AEP threshold, consistent with existing approved design rational by Peak Urban);
  - Major flows (e.g., those from a 1% AEP storm) will be managed by the regional infrastructure described in the Meinhardt IMP (this is consistent with existing approved design rational by Peak Urban).
- **Runoff Routing:**
  - Direct all stormwater runoff to the off-site basin via an internal stormwater reticulation network and overland sheet flow prior to discharge to the Lawful Point of Discharge;
  - Discharge the minor (up to the 10% AEP storm event) stormwater runoff to the Lawful Point of Discharge via a piped network;
  - Discharge the major (up to the 1% AEP storm event) stormwater runoff to the Lawful Point of Discharge via piped and overland flow;
- **General Measures:**
  - Generally, maintain the existing drainage regimes and drainage discharge locations.

Catchment B1:

- **Attenuation:**
  - Utilise an off-site dual-use detention/bio-retention basin, designed to attenuate minor storm flows (from the 39.35% AEP up to and including the 10% AEP threshold, consistent with existing approved design rational by Peak Urban);
  - Major flows (e.g., those from a 1% AEP storm) will be managed by the regional infrastructure described in the Meinhardt IMP (this is consistent with existing approved design rational by Peak Urban).
- **Treatment:**
  - Treatment of post-development stormwater discharge via an on-site (local) treatment train consisting of gross pollutant traps and proprietary filter cartridges within an underground tank;

- **Runoff Routing:**
    - Direct all stormwater runoff initially to treatment tank prior to the off-site basin via an internal stormwater reticulation network and overland sheet flow prior to discharge to the Lawful Point of Discharge;
    - Discharge the minor (up to the 10% AEP storm event) stormwater runoff to the Lawful Point of Discharge via a piped network;
    - Discharge the major (up to the 1% AEP storm event) stormwater runoff to the Lawful Point of Discharge via piped and overland flow;
- **General Measures:**
    - Generally, maintain the existing drainage regimes and drainage discharge locations.

Catchment B2:

- **Treatment and Attenuation:**
    - Utilisation of a private on-site dual-use detention/treatment tank system, supported by upstream gross pollutant traps, to manage post-development stormwater discharge.
- **Runoff Routing:**
    - Direct all stormwater runoff to the dual-use detention/treatment system via an internal stormwater reticulation network and overland sheet flow prior to discharge to the Lawful Point of Discharge;
    - Discharge the minor (up to the 10% AEP storm event) stormwater runoff to the Lawful Point of Discharge via a piped network;
    - Discharge the major (up to the 1% AEP storm event) stormwater runoff to the Lawful Point of Discharge via piped and overland flow;
- **General Measures:**
    - Generally, maintain the existing drainage regimes and drainage discharge locations.

Following the completion of this investigation we can conclude that the development site, with the implementation of the stormwater quality management strategy outlined in this report, will result in a 'no worsening' effect of the current stormwater quality upstream or downstream of the site.

8 Reference Documentation

LCC Planning Scheme Policies (LCC, 2015)

Institution of Engineers, Australia (2001) "Australian Rainfall and Runoff – A Guide to Flood Estimation"

Institute of Public Works Engineers Australia (Queensland Division) (2016) “Queensland Urban Drainage Design Manual (QUDM)”, Fourth Edition

The State of Queensland: Department of State Development, Infrastructure and Planning, July 2017. State Planning Policy

Water by Design (2018) “MUSIC Modelling Guidelines” – Consultation Draft, November 2018

Flagstone City – Masterplan, Flooding Assessment, by Cardno Pty Ltd (now Stantec) for Peet Flagstone City Pty Ltd (report reference: 721743/032/V6, 2014)

Flagstone City – Stage 7, Stormwater Management Report, by Cardno Pty Ltd (now Stantec) for Peet Flagstone City Pty Ltd (report reference: 7217/43/R11/V1, 2015)

Stormwater Management Plan at Flagstone Stage 7 North, by Bradlees Civil Consulting (now Meinhardt Australia) for Peet Flagstone City Pty Ltd (report reference: 15-891, Revision A, 2017)

Stormwater Infrastructure Master Plan, by Meinhardt Australia (report reference: Stormwater IMP, version 1.4, 2018)

Flagstone Stage 7A-G – Stormwater Management Strategy Technical Memorandum by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178.TM02.DC.DOCX, 2020)

Stormwater Management Plan, Flagstone – Stages 7C/D/G by Peak Urban (now Colliers) for Peet Flagstone City Pty Ltd (report reference: 20-0178SMP01-V1, 2021)

Hydraulic Assessment, Flagstone Town Centre, by Biome Water and Environmental Consulting (report reference: BC-25128, version 1, 2025)

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Appendix A

Proposed Development Plans

D.A ISSUE

PROPERTY DESCRIPTION

LOTS 25007 & 25009 on SP303120
LOCALITY: FLAGSTONE
COUNCIL: LOGAN CITY COUNCIL

DEVELOPMENT ASSESSMENT

SITE AREA (APPROX) - 65,945m²

DEVELOPMENT AREA - 57,470m²
INCLUDES HOLLOWS ROAD EXTENSION WORKS
EXCLUDES NEW BEITH ROAD EXTENSION WORKS

BUILDING AREAS

- T1 - SHOWROOM - 9,066.5m²
- T2A - SHOWROOM - 3,111.5m²
  EXCLUDES LIFT/STAIR LOBBY - 25m2
- T2B - SHOWROOM - 661.5m²
  EXCLUDES LIFT/STAIR LOBBY - 25m2
- T3 - FOOD & DRINK - 278m²
  INCLUDES REFUSE - 30m2
  EXCLUDES ALFRESCO - 46m2
- T4 - FOOD & DRINK - 250m²
- T5 - FOOD & DRINK - 270m²
  INCLUDES INTERNAL REFUSE - 15m2
- T6 - FOOD & DRINK - 150m²
  INCLUDES INTERNAL REFUSE - 10m2
- T7 - CARWASH - 63.5m²
  UNENCLOSED WASH BAYS - 248m2
- T8 - SHOWROOM - 928m²
- T9 - WORKSHOP - 308.5m²
- T10 - SELF STORAGE - 10,400m²
  4 STOREY BUILDING - APPROX. NLA - 7,900m2

TOTAL BUILDING GFA - 25,487.5m²

EXTERNAL STRUCTURES

- T3 REFUSE/SERVICES - 30m²
- T4 REFUSE/SERVICES - 42.5m²
- T6 REFUSE/SERVICES - 10m²
- T7 REFUSE/SERVICES - 18.5m²
- T8/9 REFUSE/SERVICES - 30m²

CAR PARKING

- T1-5 PARKING REQ. - TBC
- T1-5 PARKING PROV. - 397
- T6-9 PARKING REQ. - TBC
- T6-9 PARKING PROV. - 40
- T10 PARKING REQ. - TBC
- T10 PARKING PROV. - 15

D/THRU QUEUE

- T3 D/THRU - 16
- T4 D/THRU - 13
- T5 D/THRU - 11
- T6 D/THRU - 11

IMPERVIOUS AREA

- PRE-DEVELOPMENT - 0m²
- POST-DEVELOPMENT - 49,382.5m²

LANDSCAPE AREA

- PRE-DEVELOPMENT - 65,945m²
- POST-DEVELOPMENT - 16,562.5m²

LEGEND:
PS PYLON SIGN

Consulting Engineer

VERVE DESIGN GROUP
BUILDING DESIGNERS LICENCE No. 1002212 PH: 07 3857 0942
OFFICE 2, LEVEL 1, 488 LUTWYCHE ROAD, LUTWYCHE QLD 4030 E: info@vervedesigngroup.com.au
imagine ▫ create ▫ deliver

▫ commercial / industrial / retail
▫ fast food restaurant design
▫ travel centre / service stations
▫ project concept to completion

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Revision and approvals				
Code	Date	Drn	Description	Dwn
A	23.06.2025	SS	DA ISSUE	
P5	12.06.2025	SS	PRELIMINARY ISSUE FOR COMMENT	
B	13.10.2025	SS	DA ISSUE - RESPONSE TO COUNCIL IR.	

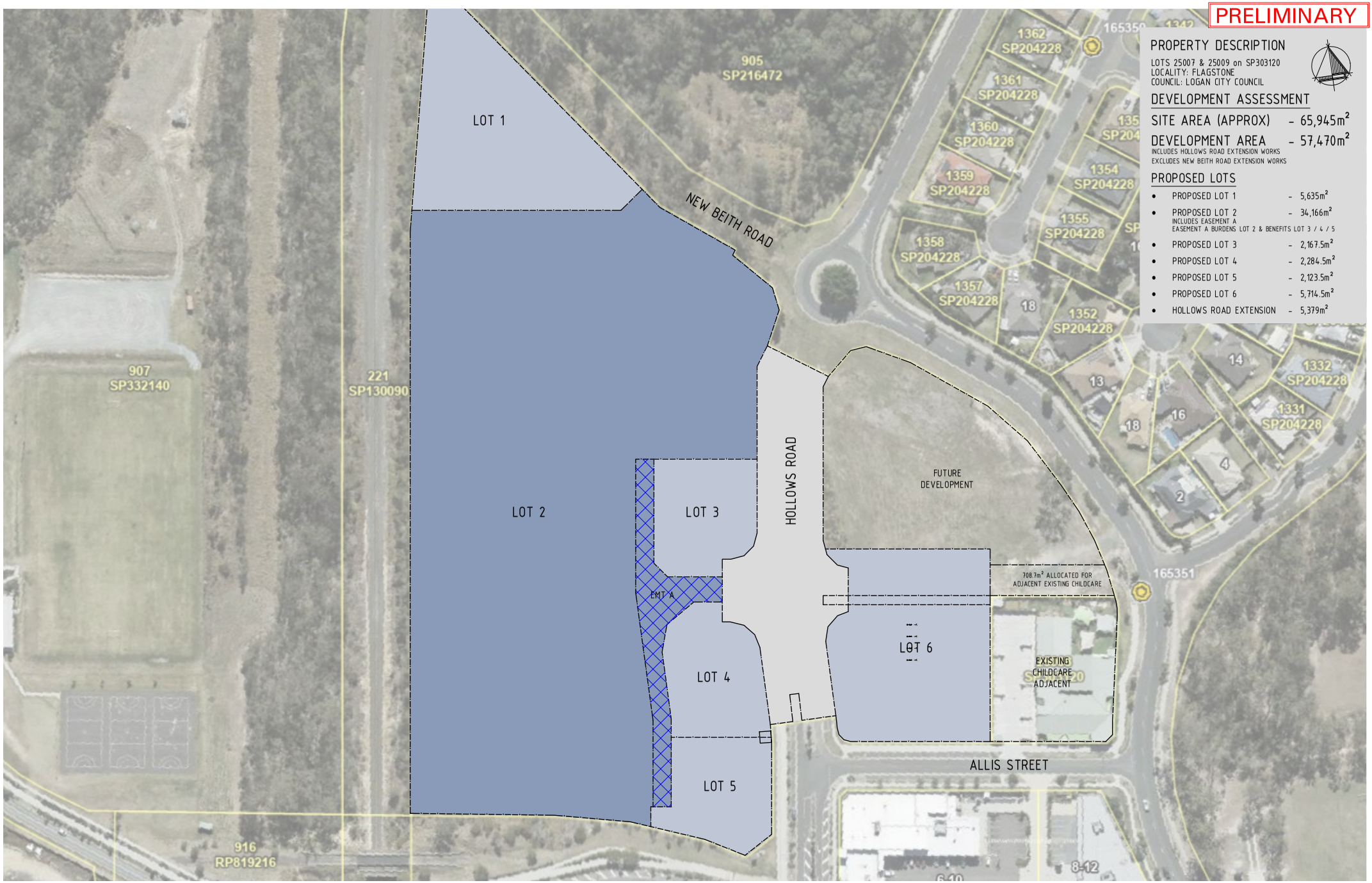
Project Description
PROPOSED MIXED USE DEVELOPMENT
HOLLOWS ROAD, FLAGSTONE

Drawing Title
PROPOSED SITE PLAN

Scale: 1:750 @ A1 / 1:1500 @A3
Drawn: SS
Approved:
Issued:

Drawing Number: 24072-DA01
Revision: B

PRELIMINARY



PROPERTY DESCRIPTION

LOTS 25007 & 25009 on SP303120
LOCALITY: FLAGSTONE
COUNCIL: LOGAN CITY COUNCIL

DEVELOPMENT ASSESSMENT

SITE AREA (APPROX) - 65,945m²

DEVELOPMENT AREA - 57,470m²
INCLUDES HOLLOWS ROAD EXTENSION WORKS
EXCLUDES NEW BEITH ROAD EXTENSION WORKS

PROPOSED LOTS

- PROPOSED LOT 1 - 5,635m²
- PROPOSED LOT 2 - 34,166m²
  INCLUDES EASEMENT A
  EASEMENT A BURDENS LOT 2 & BENEFITS LOT 3 / 4 / 5
- PROPOSED LOT 3 - 2,167.5m²
- PROPOSED LOT 4 - 2,284.5m²
- PROPOSED LOT 5 - 2,123.5m²
- PROPOSED LOT 6 - 5,714.5m²
- HOLLOWS ROAD EXTENSION - 5,379m²

Consulting Engineer

VERVE DESIGN GROUP
BUILDING DESIGNERS LICENCE No. 1002212 PH: 07 3857 0942
OFFICE 2, LEVEL 1, 488 LUTWYCHE ROAD, LUTWYCHE QLD 4030 E: info@vervedesigngroup.com.au
imagine □ create □ deliver

□ commercial / industrial / retail
□ fast food restaurant design
□ travel centre / service stations
□ project concept to completion

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Revision and approvals					
Code	Date	Drn	Description	Dwn
P2	19.06.2025	SS	PRELIMINARY ISSUE FOR COMMENT	
P1	20.05.2025	SS	PRELIMINARY ISSUE FOR COMMENT	

Project Description
PROPOSED MIXED USE DEVELOPMENT
HOLLOWS ROAD, FLAGSTONE

Scale: 1:750 @ A1 / 1:1500 @A3
Drawn: SS
Approved:
Issued:

Drawing Title
PROPOSED LOT PLAN

Drawing Number: 24072-DA03
Revision: P2

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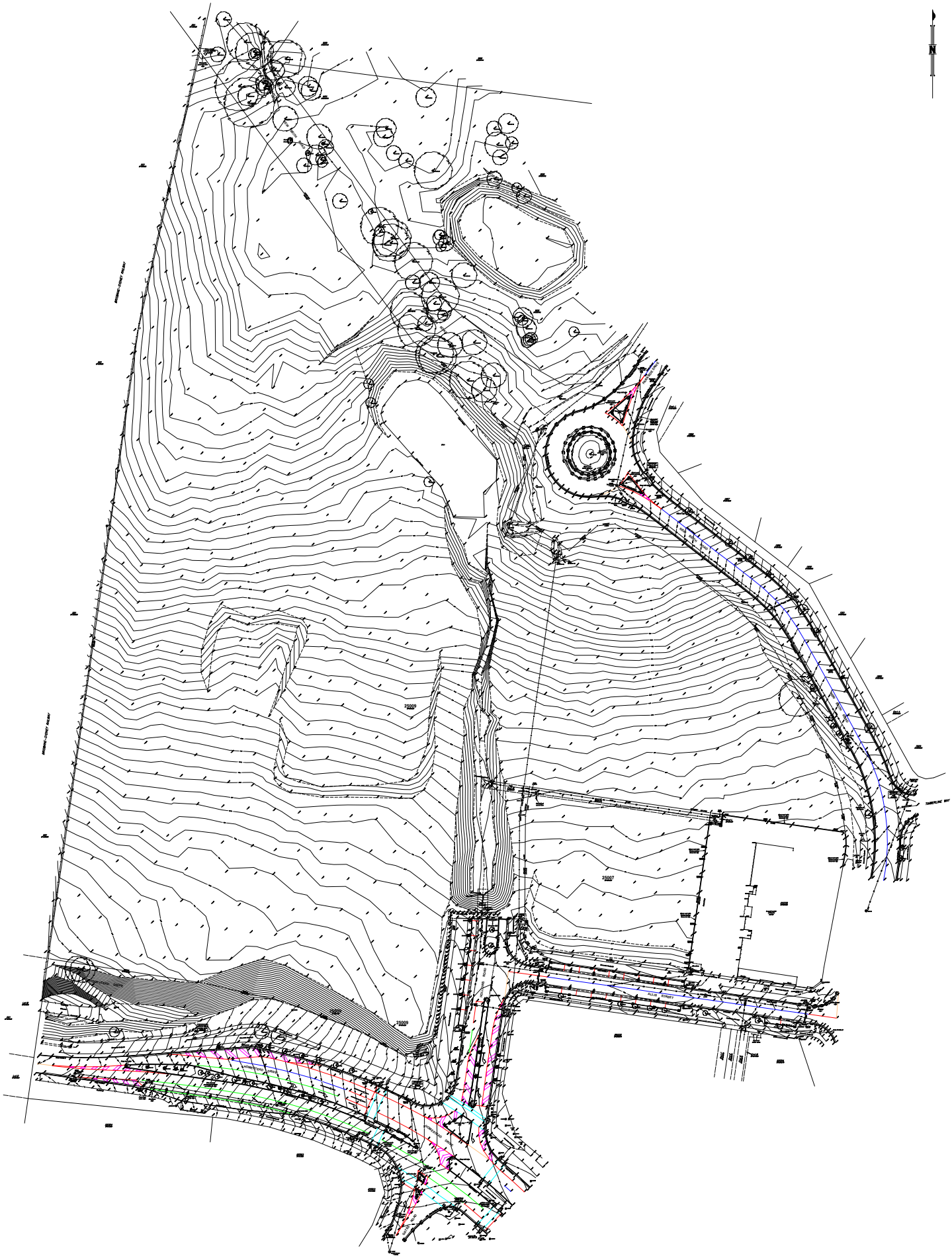
Appendix B

Topographic Survey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25009
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Appendix C

Catchment Layouts

LEGEND

- EXISTING TELSTRA CABLE
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING OVERHEAD ELECTRICAL
- EXISTING UNDER GROUND ELECTRICAL
- SEWER RETICULATION FLOW DIRECTION
- EXISTING BOUNDARY
- EXISTING NOMINAL KERB LINE
- INDICATIVE WORKS AREA
- EXISTING SURFACE CONTOURS (0.5m)
- EXISTING FEATURE TO BE DEMOLISHED
- ROOF / BUILDING HARDSTAND AREA
- CONCRETE DRIVEWAY / PAVED AREA
- PERVIOUS AREA
- ONSITE TREATMENT
- OFFSITE TREATMENT
- OVERLAND FLOW DIRECTION
- CATCHMENT BOUNDARY
- A — CATCHMENT LABEL
- EXTERNAL CATCHMENT BOUNDARY
- EXT 1 — EXTERNAL CATCHMENT LABEL

CATCHMENT TABLE (PRE)

CATCHMENT AREA - A	2.7152 ha
CATCHMENT AREA - B	3.8084 ha
CATCHMENT AREA - EXT1	2.3630 ha
CATCHMENT AREA - EXT2	0.4208 ha

NOTES

1. THE LOCATION OF THE EXISTING SERVICES HAS BEEN PLOTTED FROM SURVEY AND RECORDS AND IS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. HISTORICAL AERIAL PHOTOGRAPHY HAS BEEN USED TO VALIDATE SURVEY DATA AND ESTABLISH PRE-DEVELOPMENT CATCHMENTS.

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UNDERGROUND PUBLIC UTILITY PLANT EXISTS IN THIS VICINITY. THE CONTRACTOR IS ADVISED TO CONTACT THE RELEVANT AUTHORITIES TO CONFIRM THE EXACT LOCATION OF PUBLIC UTILITY PLANT ON SITE PRIOR TO THE COMMENCEMENT OF ANY EXCAVATION OR CONSTRUCTION WORKS.

CATCHMENT DATA	A	B	EXT1	EXT2
BUILDING / ROOF AREA	N/A	N/A	0.4902 ha	0.1453 ha
HARDSTAND / DRIVEWAY	N/A	N/A	1.2824 ha	0.0982 ha
GARDEN / PERVIOUS AREA	2.7152 ha	3.8084 ha	0.5904 ha	0.1773 ha
TOTAL IMPERVIOUS AREA	N/A	N/A	1.7726 ha	0.2435 ha
TOTAL PERVIOUS AREA	2.7152 ha	3.8084 ha	0.5904 ha	0.1773 ha

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REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	J.H.	26.11.2021
B	REVISED LAYOUT	J.W.	15.04.2025
C	REVISED LAYOUT	J.W.	26.05.2025
D	REVISED LAYOUT AND STORMWATER STRATEGY	J.W.	13.06.2025
E	REVISED DESIGN	J.W.	07.10.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		26.11.2021
DESIGN	H. WEBBER		26.11.2021
DRAWN	J. HARDMAN		26.11.2021

SCALE 10 0 10 20 30 40 50 1:1000

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: BLUEPOINT FLAGSTONE PTY LTD

PROJECT: PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE: PRE-DEVELOPMENT CATCHMENT LAYOUT

STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

APPROVED RPEQ No

DRAWING NUMBER: PEG0810-DA-SK07

REVISION: E

R:\PEG\0810-DA-SK07 PRE-DEVELOPMENT CATCHMENT LAYOUT.dwg 07.10.2025 Letter (8.50 x 11.00 Inches) Hans Jan Vinkers

LEGEND

- EXISTING TELSTRA CABLE
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING OVERHEAD ELECTRICAL
- EXISTING UNDER GROUND ELECTRICAL
- EXISTING BOUNDARY
- EXISTING NOMINAL KERB LINE
- INDICATIVE WORKS AREA
- ONSITE TREATMENT
- OFFSITE TREATMENT
- FUTURE RESIDENTIAL AREA (LUMPED)
- PROPOSED DUAL-USE BASIN
- PROPOSED DUAL-USE TANK
- OVERLAND FLOW DIRECTION
- CATCHMENT BOUNDARY
- A1 — CATCHMENT LABEL
- EXTERNAL CATCHMENT BOUNDARY
- EXT 1 — EXTERNAL CATCHMENT LABEL

NOTES

1. THE LOCATION OF THE EXISTING SERVICES HAS BEEN PLOTTED FROM SURVEY AND RECORDS AND IS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. THE DETAILED DESIGN OF THE DISCHARGE PIPE WORK IS THE SUBJECT OF THE SEPARATE PLUMBING AND DRAINAGE APPLICATION.
3. FUTURE DEVELOPMENT CATCHMENT B AREA BREAKDOWN ASSUMED BASED UPON STANDARD FRACTION IMPERVIOUS FOR DEVELOPMENT ZONING of 90%.
4. CATCHMENT 'A4-S1' WAS EXCLUDED FROM DETENTION AND TREATMENT MODELING AS IT WILL BE DEDICATED TO COUNCIL AND WILL NOT FORM PART OF OUR SITE.

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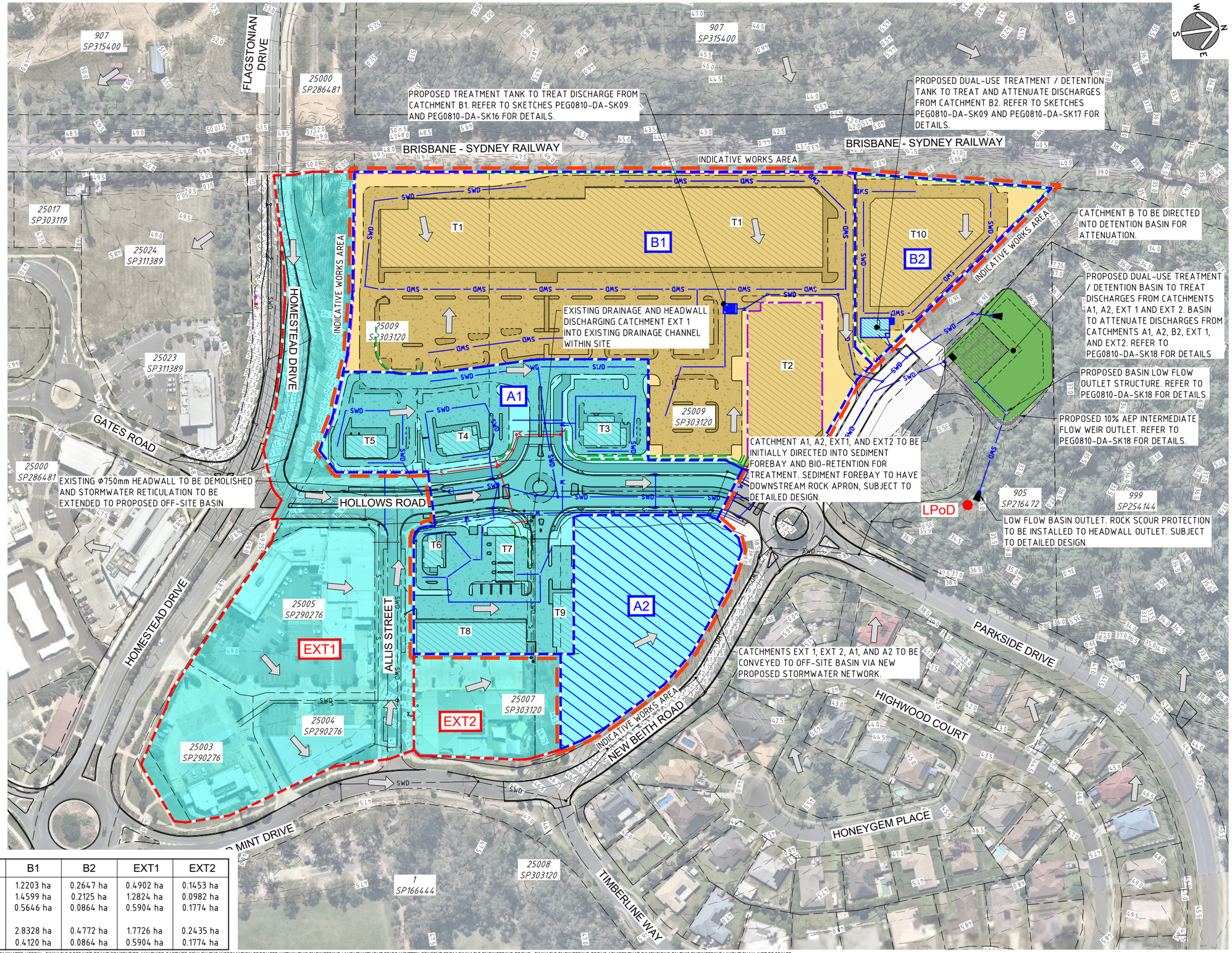

CATCHMENT TABLE (POST)

CATCHMENT AREA - A1 (COMMERCIAL / ROAD)	1.9384 ha
CATCHMENT AREA - A2 (FUTURE RESIDENTIAL)	0.7768 ha
CATCHMENT AREA - B1 (COMMERCIAL)	3.2448 ha
CATCHMENT AREA - B2 (COMMERCIAL)	0.5636 ha
CATCHMENT AREA - EXT1 (COMMERCIAL)	2.3630 ha
CATCHMENT AREA - EXT2 (COMMERCIAL)	0.4208 ha

CATCHMENT DATA	A1	A2	B1	B2	EXT1	EXT2
BUILDING / ROOF AREA	0.2704 ha	0.3884 ha	1.2203 ha	0.2647 ha	0.4902 ha	0.1453 ha
DRIVEWAY	1.1334 ha	0.3107 ha	1.4599 ha	0.2125 ha	1.2824 ha	0.0982 ha
HARDSTAND / PERVIOUS AREA	0.5346 ha	0.0777 ha	0.5646 ha	0.0864 ha	0.5904 ha	0.1774 ha
TOTAL IMPERVIOUS AREA	1.6366 ha	0.6991 ha	2.8328 ha	0.4772 ha	1.7726 ha	0.2435 ha
TOTAL PERVIOUS AREA	0.3018 ha	0.0777 ha	0.4120 ha	0.0864 ha	0.5904 ha	0.1774 ha

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REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	J.W.	13.06.2025
B	DESIGN REVISIONS	J.W.	07.10.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		13.06.2025
DESIGN	J. WATERS		13.06.2025
DRAWN	J. WATERS		13.06.2025

SCALE
10 0 10 20 30 40 50
SCALE 1:1000
(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT
BLUEPOINT FLAGSTONE PTY LTD

PROJECT
PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE
POST DEVELOPMENT TREATMENT CATCHMENTS

STATUS
PRELIMINARY
(NOT TO BE USED FOR CONSTRUCTION)

APPROVED RPEQ No

DRAWING NUMBER PEG0810-DA-SK08

REVISION B

R:\PEG\PEG0810-DA-SK08 POST DEVELOPMENT TREATMENT CATCHMENTS.dwg 27/10/2025 Mon at 8:30 AM By Ashley Howe Jin Waters

LEGEND

- EXISTING TELSTRA CABLE
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING OVERHEAD ELECTRICAL
- EXISTING UNDER GROUND ELECTRICAL
- EXISTING BOUNDARY
- EXISTING NOMINAL KERB LINE
- INDICATIVE WORKS AREA
- ROOF AREA
- ROAD / DRIVEWAY AREA
- PERVIOUS GROUND AREA
- IMPERVIOUS GROUND AREA
- FUTURE RESIDENTIAL AREA (LUMPED)
- PROPOSED DUAL-USE BASIN
- PROPOSED DUAL-USE TANK
- OVERLAND FLOW DIRECTION
- CATCHMENT BOUNDARY
- A1 — CATCHMENT LABEL
- EXTERNAL CATCHMENT BOUNDARY
- EXT 1 — EXTERNAL CATCHMENT LABEL

NOTES

1. THE LOCATION OF THE EXISTING SERVICES HAS BEEN PLOTTED FROM SURVEY AND RECORDS AND IS TO BE CONFIRMED PRIOR TO CONSTRUCTION.
2. THE DETAILED DESIGN OF THE DISCHARGE PIPE WORK IS THE SUBJECT OF THE SEPARATE PLUMBING AND DRAINAGE APPLICATION.
3. FUTURE DEVELOPMENT CATCHMENT B AREA BREAKDOWN ASSUMED BASED UPON STANDARD FRACTION IMPERVIOUS FOR DEVELOPMENT ZONING of 90%.
4. CATCHMENT 'A4-S1' WAS EXCLUDED FROM DETENTION AND TREATMENT MODELING AS IT WILL BE DEDICATED TO COUNCIL AND WILL NOT FORM PART OF OUR SITE.

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The Essential First Step.

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CATCHMENT TABLE (POST)

CATCHMENT AREA - A1 (COMMERCIAL / ROAD)	1.9384 ha
CATCHMENT AREA - A2 (FUTURE RESIDENTIAL)	0.7768 ha
CATCHMENT AREA - B1 (COMMERCIAL)	3.2448 ha
CATCHMENT AREA - B2 (COMMERCIAL)	0.5636 ha
CATCHMENT AREA - EXT1 (COMMERCIAL)	2.3630 ha
CATCHMENT AREA - EXT2 (COMMERCIAL)	0.4208 ha

CATCHMENT DATA	A1	A2	B1	B2	EXT1	EXT2
BUILDING / ROOF AREA	0.2704 ha	0.3884 ha	1.2203 ha	0.2647 ha	0.4902 ha	0.1453 ha
DRIVEWAY	1.1334 ha	0.3107 ha	1.4599 ha	0.2125 ha	1.2824 ha	0.0982 ha
HARDSTAND / PERVIOUS AREA	0.5346 ha	0.0777 ha	0.5646 ha	0.0864 ha	0.5904 ha	0.1774 ha
TOTAL IMPERVIOUS AREA	1.6366 ha	0.6991 ha	2.8328 ha	0.4772 ha	1.7726 ha	0.2435 ha
TOTAL PERVIOUS AREA	0.3018 ha	0.0777 ha	0.4120 ha	0.0864 ha	0.5904 ha	0.1774 ha

THIS ENGINEERING LAYOUT WAS PRODUCED FOR THE EXCLUSIVE USE OF PINNACLE ENGINEERING GROUP'S CLIENT AS NOMINATED HEREIN. PINNACLE DOES NOT GRANT CONSENT TO ANY THIRD PARTY TO RELY ON THE INFORMATION PRODUCED WITHIN THIS ENGINEERING LAYOUT WITHOUT PRIOR WRITTEN CONSENT FROM PINNACLE ENGINEERING GROUP. PINNACLE ENGINEERING GROUP ADVISES THAT DIMENSIONS ON THIS ENGINEERING LAYOUT SHALL NOT BE SCALED.

PINNACLE ENGINEERING GROUP
LEVEL 1 19 SHORT STREET, SOUTHPORT QLD 4215
(PO BOX 517, PARADISE POINT QLD 4216)
WWW.PINNACLEENG.COM.AU

REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	J.H.	26.11.2021
B	REVISED LAYOUT FOR COMMENT	J.W.	27.02.2025
C	REVISED LAYOUT FOR COMMENT	J.W.	16.04.2025
D	REVISED LAYOUT FOR COMMENT	J.W.	26.05.2025
E	REVISED LAYOUT AND STORMWATER STRATEGY	J.W.	13.06.2025
F	REVISED DESIGN	J.W.	07.10.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		22.11.2021
DESIGN	H. WEBBER		22.11.2021
DRAWN	H. WEBBER		22.11.2021

SCALE

SCALE 10 0 10 20 30 40 50 1:1000

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: BLUEPOINT FLAGSTONE PTY LTD

PROJECT: PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE: POST DEVELOPMENT CATCHMENT LAYOUT

STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

APPROVED

RPEQ No

DRAWING NUMBER: PEG0810-DA-SK08

REVISION: F

PEG0810-DA-SK08 POST DEVELOPMENT CATCHMENT LAYOUT dwg 07/10/2025 14:08:17 @ A0 x 1:1000 by Nicholas Hoare for Pinnacle Engineering Group

PINNACLE ENGINEERING GROUP

Appendix D

Rational Method Calculations

RATIONAL METHOD CALCULATIONS

Project:	PEG0810_Flagstone Community Precinct
Date:	1-Oct-25
Designed:	J. Waters
Comments:	Catchment A1 - Pre-development

PARAMETERS	VALUE		
Catchment Name	A1		
Catchment Size	1.9384	ha	
C10 Coefficient of Runoff	0.70		(QUDM Tables 4.5.3 & 4.5.4) (fi = 0.0, 1I10 = 56.2))
Total Time of Concentration			QUDM Figure 4.07
Total time of Conentration **(tc)**	**17.0**	**mins**	150m flow path, 4.5% average slope over grassed surface
Rational Method for Peak Catchment flow			Q = 0.00278 x C x I x A

AEP	Rainfall Intensity (mm/h)	Rainfall Depth (mm)	Fy	Coefficient of Runoff	Discharge (m^3/s)
3 month					0.098
63	64.80	18.36	0.80	0.56	0.195
39	74.20	21.02	0.85	0.60	0.238
18	103.00	29.18	0.95	0.67	0.369
10	122.00	34.57	1.00	0.70	0.460
5	141.00	39.95	1.05	0.74	0.558
2	165.00	46.75	1.15	0.81	0.715
1	183.00	51.85	1.20	0.84	0.828

RATIONAL METHOD CALCULATIONS

Project:	PEG0810_Flagstone Community Precinct
Date:	1-Oct-25
Designed:	J. Waters
Comments:	Catchment A2 - Pre-development

PARAMETERS	VALUE		
Catchment Name	A2		
Catchment Size	0.7768	ha	
C10 Coefficient of Runoff	0.70		(QUDM Tables 4.5.3 & 4.5.4) (fi = 0.0, 1I10 = 56.2))
Total Time of Concentration			QUDM Figure 4.07
Total time of Conentration **(tc)**	**14.0**	**mins**	85m flow path, 6.5% average slope over grassed surface
Rational Method for Peak Catchment flow			Q = 0.00278 x C x I x A

AEP	Rainfall Intensity (mm/h)	Rainfall Depth (mm)	Fy	Coefficient of Runoff	Discharge (m^3/s)
3 month					0.043
63	71.00	16.57	0.80	0.56	0.086
39	81.20	18.95	0.85	0.60	0.104
18	113.00	26.37	0.95	0.67	0.162
10	134.00	31.27	1.00	0.70	0.202
5	154.00	35.93	1.05	0.74	0.244
2	180.00	42.00	1.15	0.81	0.313
1	200.00	46.67	1.20	0.84	0.363

RATIONAL METHOD CALCULATIONS

Project:	PEG0810_Flagstone Community Precinct
Date:	1-Oct-25
Designed:	J. Waters
Comments:	Catchment B1 - Pre-development

PARAMETERS	VALUE		
Catchment Name	B1		
Catchment Size	3.2448	ha	
C10 Coefficient of Runoff	0.70		(QUDM Tables 4.5.3 & 4.5.4) (fi = 0.0, 1I10 = 56.2))
Total Time of Concentration			QUDM Figure 4.07
Total time of Conentration **(tc)**	**20.0**	**mins**	280m flow path, 5.5% average slope over grassed surface
Rational Method for Peak Catchment flow			Q = 0.00278 x C x I x A

AEP	Rainfall Intensity (mm/h)	Rainfall Depth (mm)	Fy	Coefficient of Runoff	Discharge (m^3/s)
3 month					0.150
63	59.60	19.87	0.80	0.56	0.301
39	75.70	25.23	0.85	0.60	0.406
18	96.60	32.20	0.95	0.67	0.579
10	112.00	37.33	1.00	0.70	0.707
5	130.00	43.33	1.05	0.74	0.861
2	152.00	50.67	1.15	0.81	1.103
1	169.00	56.33	1.20	0.84	1.280

RATIONAL METHOD CALCULATIONS

Project:	PEG0810_Flagstone Community Precinct
Date:	11-Jun-25
Designed:	J. Waters
Comments:	Catchment B2 - Pre-development

PARAMETERS	VALUE	
Catchment Name	B2	
Catchment Size	0.5636 ha	
C10 Coefficient of Runoff	0.70	(QUDM Tables 4.5.3 & 4.5.4) (fi = 0.0, 1I10 = 56.2))
Total Time of Concentration		QUDM Figure 4.07
Total time of Conentration **(tc)**	**10.0 mins**	75m flow path, 5% average slope over grassed surface
Rational Method for Peak Catchment flow		Q = 0.00278 x C x I x A

AEP	Rainfall Intensity (mm/h)	Rainfall Depth (mm)	Fy	Coefficient of Runoff	Discharge (m^3/s)
3 month					0.036
63	81.20	13.53	0.80	0.56	0.071
39	103.00	17.17	0.85	0.60	0.096
18	131.00	21.83	0.95	0.67	0.136
10	153.00	25.50	1.00	0.70	0.168
5	176.00	29.33	1.05	0.74	0.203
2	206.00	34.33	1.15	0.81	0.260
1	228.00	38.00	1.20	0.84	0.300

Appendix E

Stormwater Management Layout

LEGEND

- EXISTING TELSTRA CABLE
- EXISTING SEWERAGE RETICULATION
- EXISTING WATER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING OVERHEAD ELECTRICAL
- EXISTING UNDER GROUND ELECTRICAL
- EXISTING BOUNDARY
- EXISTING NOMINAL KERB LINE
- INDICATIVE WORKS AREA
- ROOF / BUILDING HARDSTAND AREA
- CONCRETE DRIVEWAY / PAVED AREA
- PERVIOUS AREA
- PROPOSED DUAL-USE BASIN
- PROPOSED FILTER MEDIA
- PROPOSED RESIDENTIAL AREA (LUMPED)
- PROPOSED DUAL-USE TANK
- OVERLAND FLOW DIRECTION
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- A1 — CATCHMENT LABEL
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NOTES

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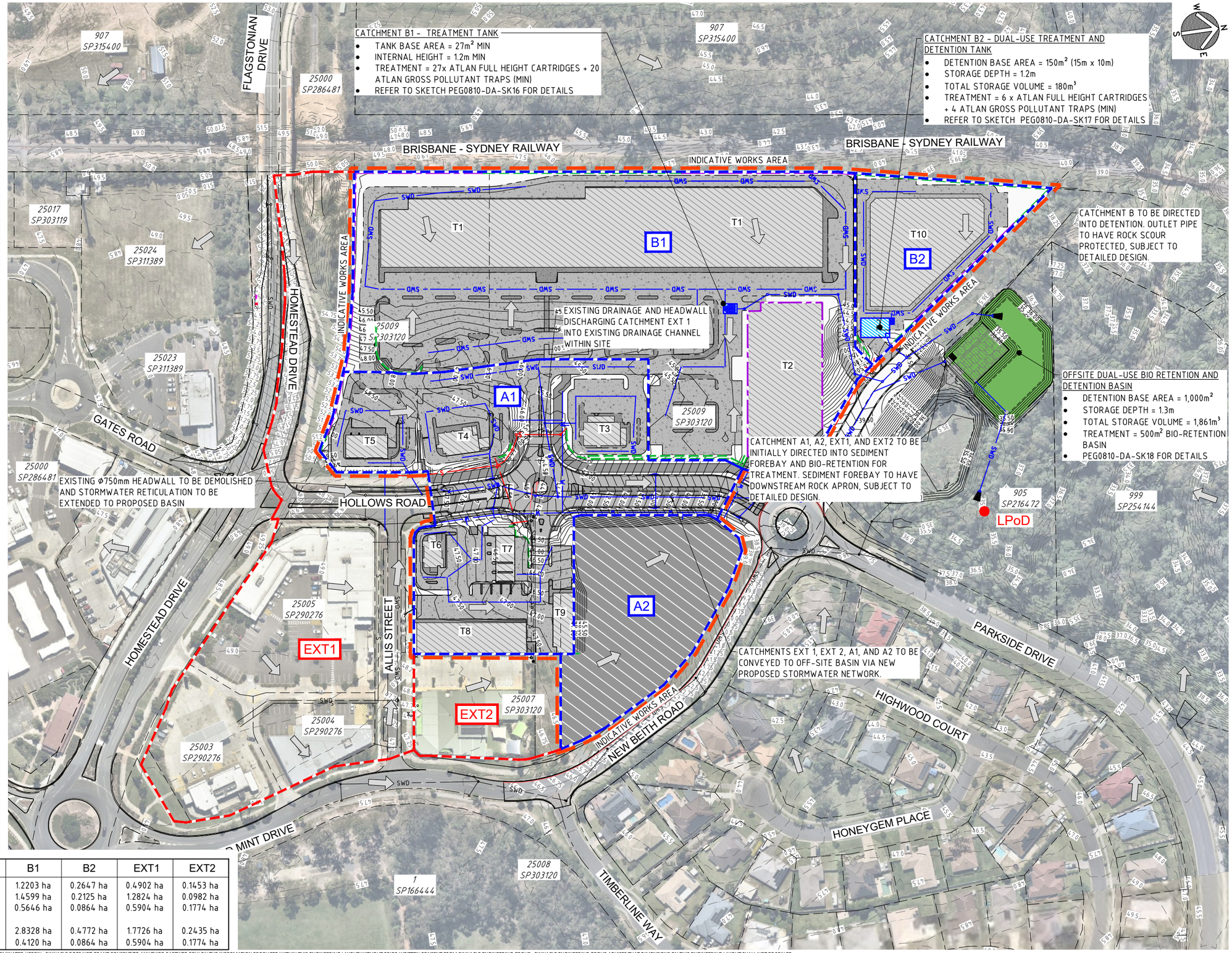

CATCHMENT TABLE (POST)

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CATCHMENT AREA - EXT1 (COMMERCIAL)	2.3630 ha
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REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	J.H.	26.11.2021
B	REVISED LAYOUT FOR COMMENT	J.W.	16.04.2025
C	REVISED LAYOUT FOR COMMENT	J.W.	26.05.2025
D	REVISED LAYOUT AND STORMWATER STRATEGY	J.W.	13.06.2025
E	REVISED DESIGN	J.W.	03.10.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		22.11.2021
DESIGN	H. WEBBER		22.11.2021
DRAWN	H. WEBBER		22.11.2021

SCALE 10 0 10 20 30 40 50 1:1000

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: BLUEPOINT FLAGSTONE PTY LTD

PROJECT: PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE: STORMWATER MANAGEMENT LAYOUT

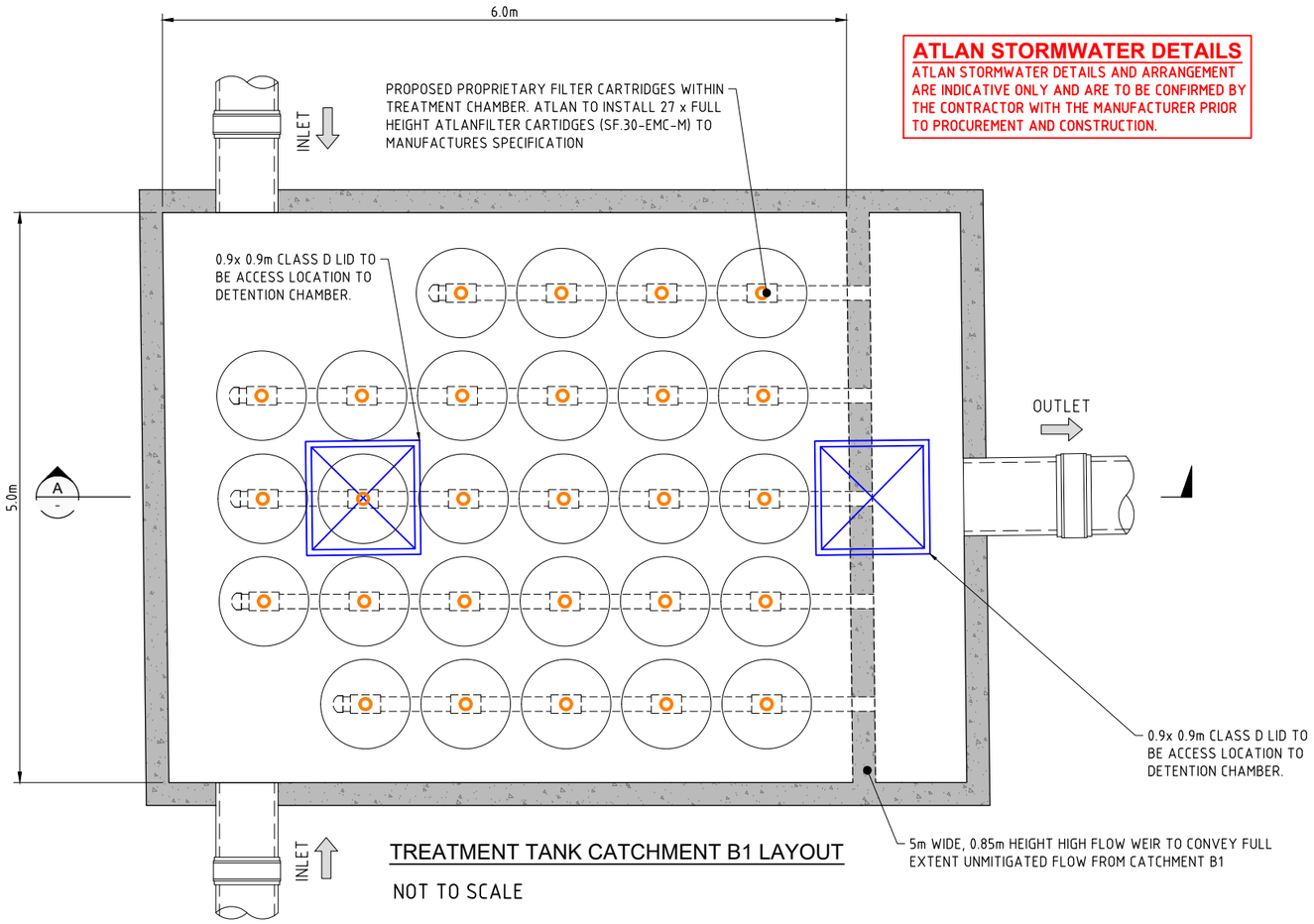
STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

APPROVED: RPEQ No:

DRAWING NUMBER: PEG0810-DA-SK09

REVISION: E

P:\0810\DA-SK\0 STORMWATER MANAGEMENT LAYOUT.dwg 07/10/2025 Letter (8.50 x 11.00 Inches) Anne Jai Willems

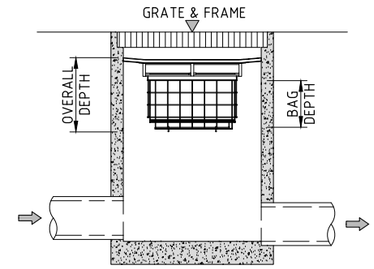


TREATMENT TANK CATCHMENT B1 LAYOUT

NOT TO SCALE

ATLAN STORMWATER DETAILS

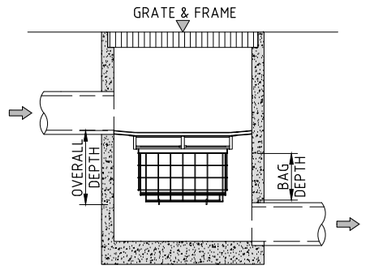
ATLAN STORMWATER DETAILS AND ARRANGEMENT ARE INDICATIVE ONLY AND ARE TO BE CONFIRMED BY THE CONTRACTOR WITH THE MANUFACTURER PRIOR TO PROCUREMENT AND CONSTRUCTION.



TYPICAL DETAIL

ATLAN STORMSACKS SURFACE FLOW CONFIGURATION

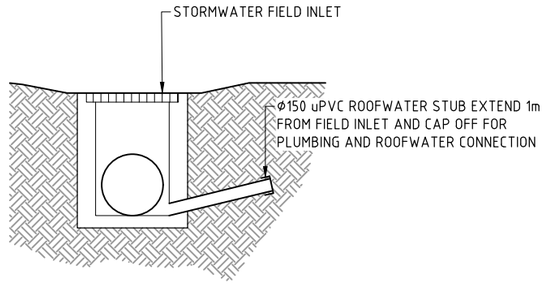
SCALE N.T.S.



TYPICAL DETAIL

ATLAN STORMSACKS PIPE FLOW CONFIGURATION

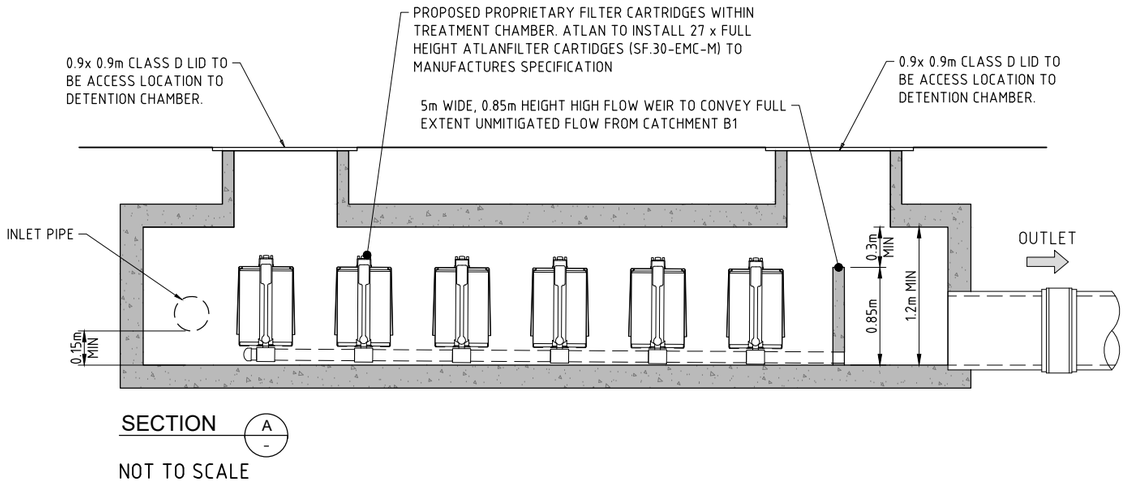
SCALE N.T.S.



TYPICAL DETAIL

ROOFWATER DRAINAGE CONNECTION

SCALE 0.5 0 0.5 1.0 1:25



SECTION A -

NOT TO SCALE

TANK B1 QUALITY TREATMENT DETAILS	
CATCHMENT B1 - ATLAN VAULT	
STORAGE SURFACE AREA	= 27.0m² (MIN)
EXTENDED DETENTION DEPTH	= 0.85m
LOW FLOW PIPE DIA.	= 205mm
CATCHMENT B1 - ATLAN FILTER	
ATLANFILTER CARTRIDGE TYPE	= 850mm SF.30-EMC-M
REQUIRED NUMBER	= 27
HIGH FLOW BYPASS	= 0.0810m³/s
CATCHMENT B1 - ATLAN STORMSACK (GPT)	
TYPE	= STORMSACKS
REQUIRED NUMBER	= 20 (MIN)

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B	REVISED LAYOUT AND STORMWATER STRATEGY	J.W.	13.06.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		16.04.2025
DESIGN	J. WATERS		16.04.2025
DRAWN	J. WATERS		16.04.2025

SCALE

AS SHOWN

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT

BLUEPOINT FLAGSTONE PTY LTD

PROJECT

PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE

STORMWATER MANAGEMENT DETAILS SHEET 1 OF 3

STATUS

PRELIMINARY

(NOT TO BE USED FOR CONSTRUCTION)

APPROVED

RPEQ No

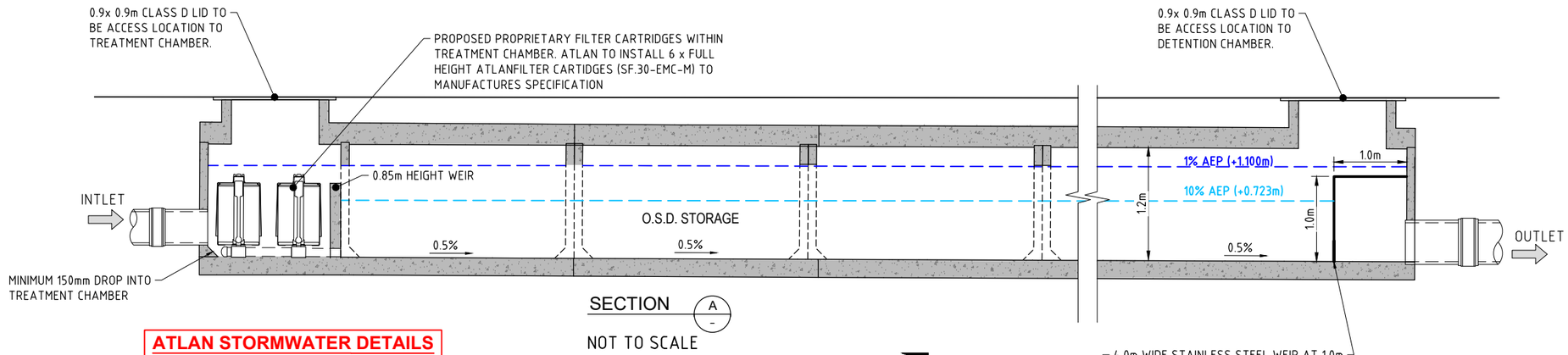
DRAWING NUMBER

PEG0810-DA-SK16

REVISION

B

R:\0810\DA-SKS STORMWATER MANAGEMENT DETAILS SHEET 1 OF 3.dwg 27/11/2025 Letter (8.50 x 11.00 Inches) Hana.Jia.Vickers



SECTION A

NOT TO SCALE

ATLAN STORMWATER DETAILS

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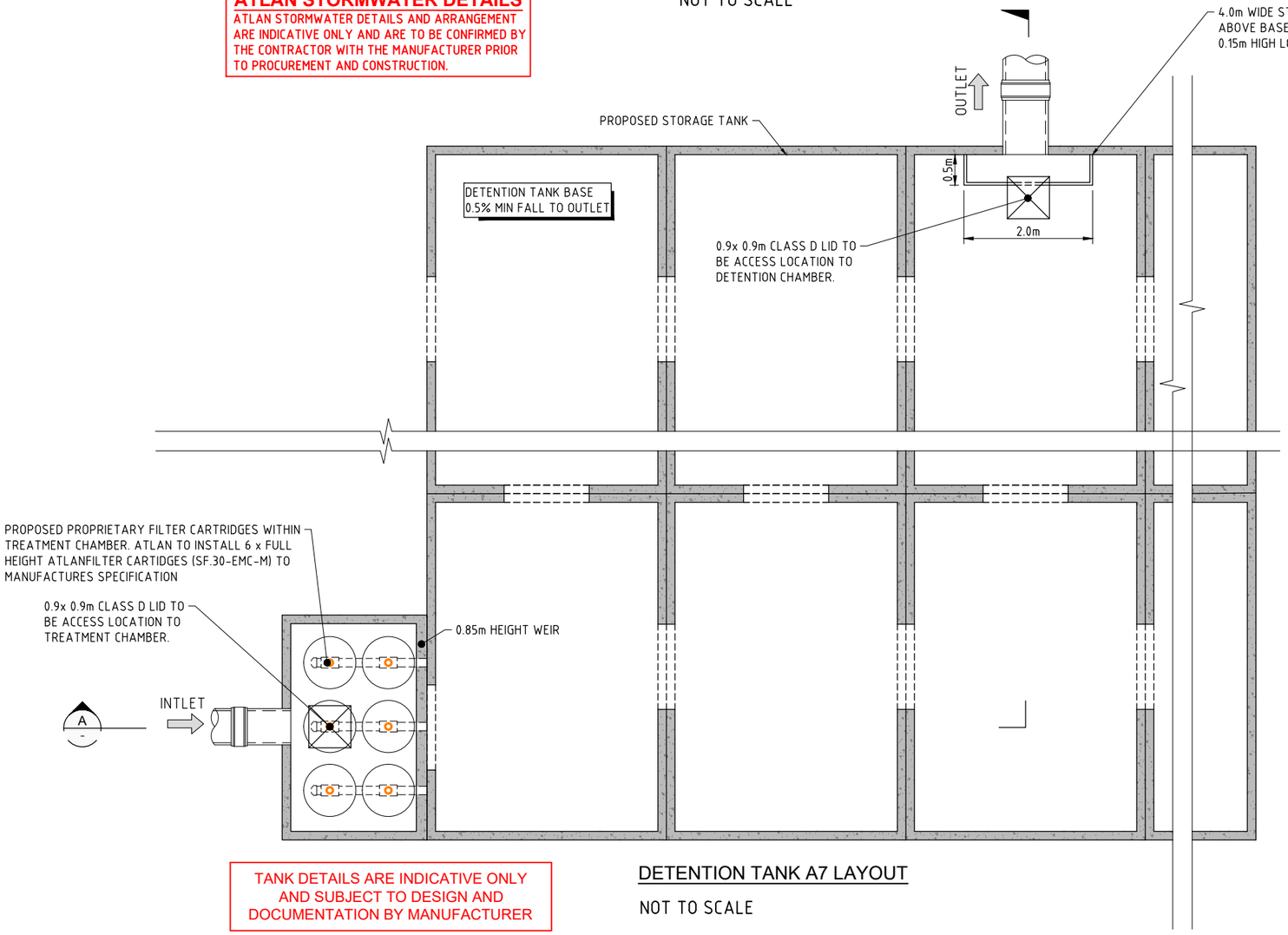
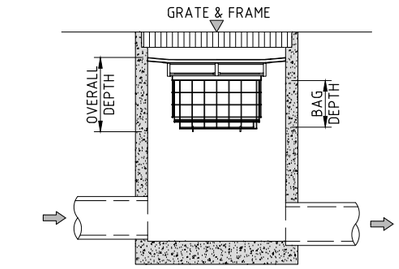


TANK DETAILS ARE INDICATIVE ONLY AND SUBJECT TO DESIGN AND DOCUMENTATION BY MANUFACTURER

DETENTION TANK A7 LAYOUT

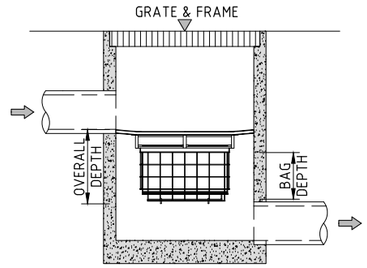
NOT TO SCALE



TYPICAL DETAIL

ATLAN STORMSACKS SURFACE FLOW CONFIGURATION

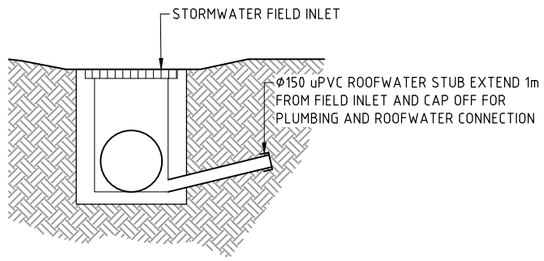
SCALE N.T.S.



TYPICAL DETAIL

ATLAN STORMSACKS PIPE FLOW CONFIGURATION

SCALE N.T.S.



TYPICAL DETAIL

ROOFWATER DRAINAGE CONNECTION

SCALE 0.5 0 0.5 1.0 1:25

TANK B2 QUALITY TREATMENT DETAILS

CATCHMENT B2 - ATLAN VAULT	
STORAGE SURFACE AREA	= 6.0m² (MIN)
EXTENDED DETENTION DEPTH	= 0.85m
LOW FLOW PIPE DIA.	= 97mm
CATCHMENT B2 - ATLAN FILTER	
ATLANFILTER CARTRIDGE TYPE	= 850mm SF.30-EMC-M
REQUIRED NUMBER	= 6
HIGH FLOW BYPASS	= 0.0180m³/s
CATCHMENT B2 - ATLAN STORMSACK (GPT)	
TYPE	= STORMSACKS
REQUIRED NUMBER	= 4 (MIN)

TANK B2 DETENTION DETAILS

PARAMETERS	TANK (CATCHMENT B2)
TANK OUTLETS	
LOW FLOW OUTLET	= 0.30m WIDE x 0.15m HIGH ORIFICE
LOW FLOW OUTLET LEVEL	= AT BASE OF TANK
HIGH FLOW OUTLET	= 4.0m WIDE WEIR
HIGH FLOW OUTLET LEVEL	= +1.0m ABOVE BASE OF TANK
TANK GEOMETRY	
STORAGE AREA	= 150m² MIN.
STORAGE HEIGHT	= 1.2m
STORAGE VOLUME	= 180m³
TANK MODELLING SUMMARY	
39%AEP PEAK OUTFLOW	= 0.091m³/s
39%AEP PEAK STAGE	= +0.463m
10%AEP PEAK OUTFLOW	= 0.122m³/s
10%AEP PEAK STAGE	= +0.723m
1%AEP PEAK OUTFLOW	= 0.312m³/s
1%AEP PEAK STAGE	= +1.100m

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(PO BOX 517, PARADISE POINT QLD 4216)
WWW.PINNACLEENG.COM.AU

REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	J.W.	16.04.2025
B	REVISED LAYOUT AND STORMWATER STRATEGY	J.W.	13.06.2025
C	REVISED DESIGN	J.W.	07.10.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		16.04.2025
DESIGN	J. WATERS		16.04.2025
DRAWN	J. WATERS		16.04.2025

SCALE: AS SHOWN

(SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: BLUEPOINT FLAGSTONE PTY LTD

PROJECT: PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE: STORMWATER MANAGEMENT DETAILS SHEET 2 OF 3

STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

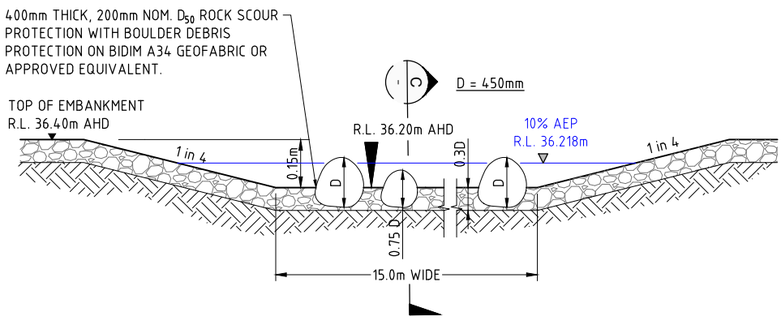
APPROVED

RPEQ No

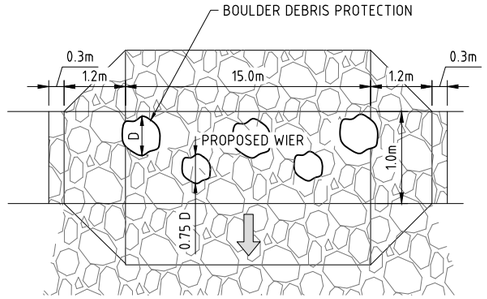
DRAWING NUMBER: PEG0810-DA-SK17

REVISION: C

PEG0810-DA-SK17 STORMWATER MANAGEMENT DETAILS SHEET 2 OF 3.dwg 07/10/2025 Lutfor 埃及x 11.00 inches Hans Jan Vlieters



OVERFLOW WEIR SECTION
SCALE N.T.S.



SECTION C
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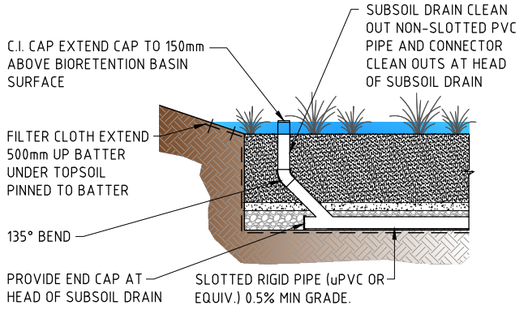
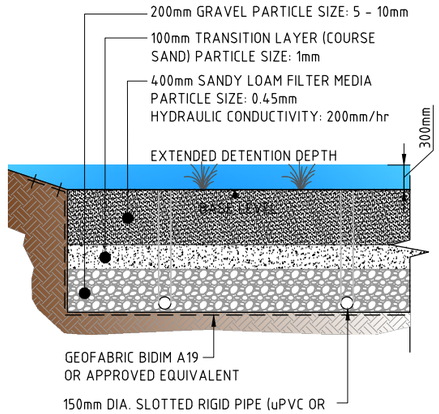


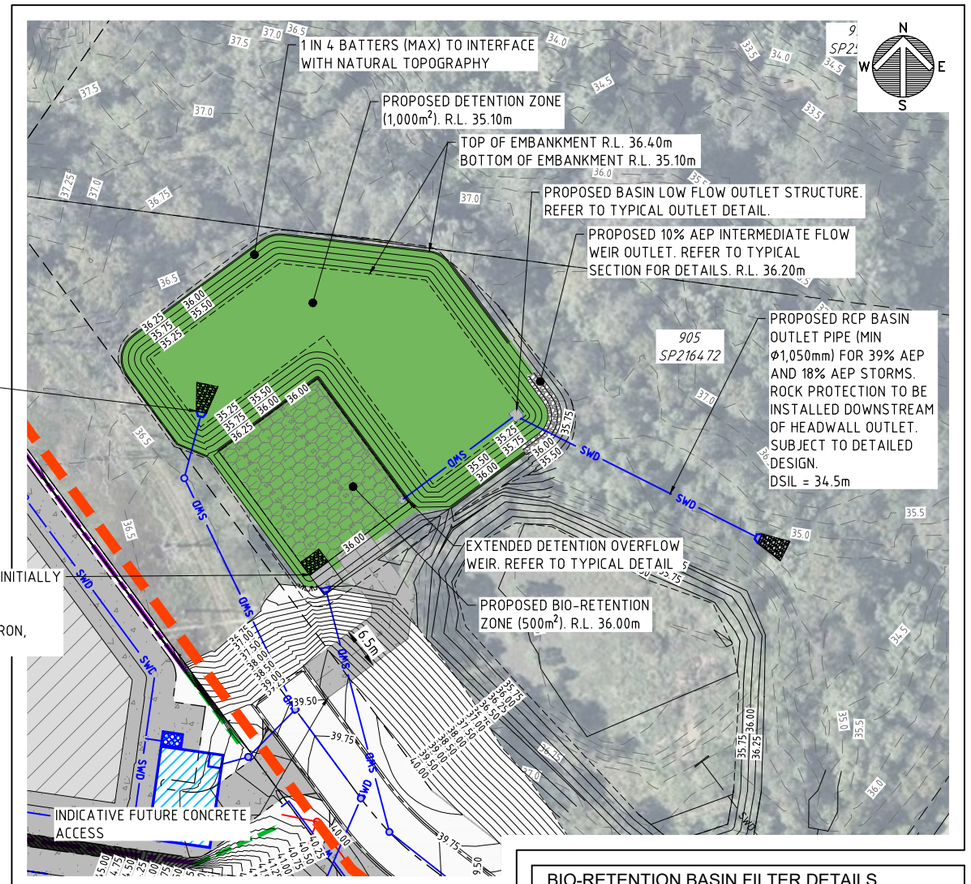
SUBSOIL DRAIN CLEAN OUT DETAIL
SCALE: N.T.S.



BIO-RETENTION BASIN
SCALE: N.T.S.

PROPOSED HEADWALL INLET INTO DUAL-USE BASIN FROM CATCHMENTS B1 AND B2. ROCK SCOUR PROTECTION TO BE INSTALLED TO HEADWALL. SUBJECT TO DETAILED DESIGN.

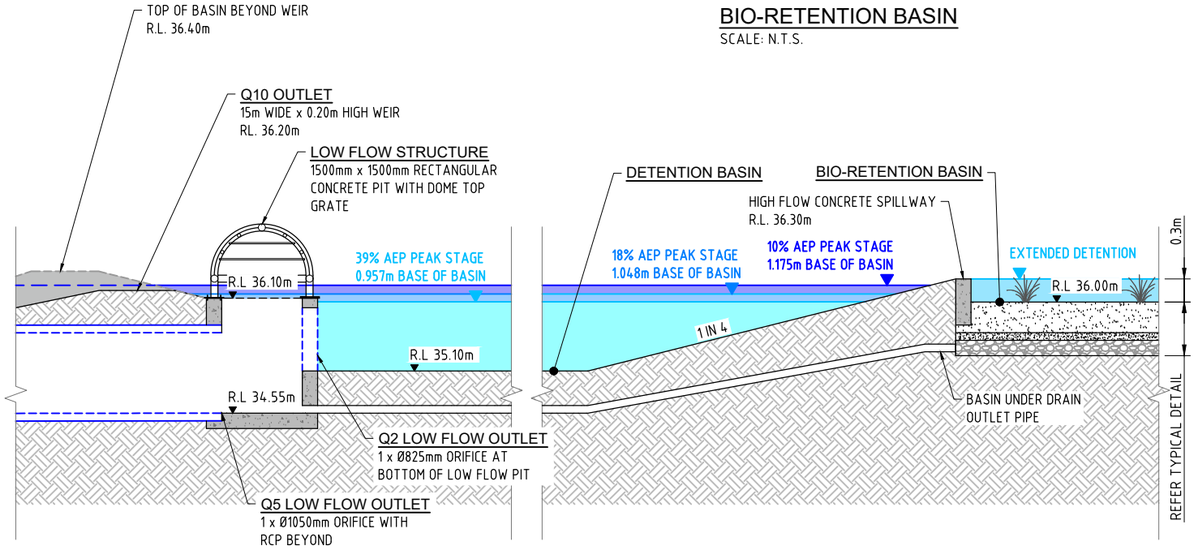
CATCHMENT A1, A2, EXT1, AND EXT2 TO BE INITIALLY DIRECTED INTO SEDIMENT FOREBAY AND BIO-RETENTION FOR TREATMENT. SEDIMENT FOREBAY TO HAVE DOWNSTREAM ROCK APRON, SUBJECT TO DETAILED DESIGN.



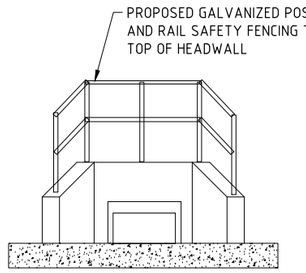
BIO RETENTION BASIN LAYOUT
SCALE 10 0 10 20 1:500

BIO-RETENTION BASIN FILTER DETAILS

PARAMETERS	OFFSITE BIO-BASIN
EXTENDED DETENTION DEPTH	= 0.3m
STORAGE SURFACE AREA	= 500.0m² (MIN.)
FILTER MEDIA SURFACE AREA	= 500.0m² (MIN.)
SEEPAGE LOSS	= 0.00mm/hr
MEDIAN PARTICLE DIAMETER	= 0.45mm
SATURATED HYDRAULIC CONDUCTIVITY	= 200mm/hr
FILTER MEDIA	= SANDY LOAM
FILTER MEDIA DEPTH	= 0.4m
ORTHOPHOSPHATE CONTENT	= 400mg/kg
TN CONTENT OF FILTER MEDIA	= 50mg/kg



TYPICAL OUTLET DETAIL
SCALE: N.T.S.



TYPICAL STORMWATER OUTLET SAFETY FENCING ELEVATION
SCALE: N.T.S

TABLE 2: BASIN DETENTION DETAILS

PARAMETERS	OFFSITE BASIN
BASIN OUTLETS	
39% AEP LOW FLOW OUTLET	= 1 x Ø825mm ORIFICE AT BOTTOM OF LOW FLOW PIT
39% AEP LOW FLOW OUTLET LEVEL	= BASE OF BASIN
18% AEP LOW FLOW OUTLET	= 1 x Ø1,050mm ORIFICE AT BOTTOM OF 1.5m x 1.5m PIT WITH RCP BEYOND
18% AEP LOW FLOW OUTLET LEVEL	= TOP OF PIT AT +1.00m ABOVE BASE OF BASIN (+1.55m ABOVE BASE OF PIT)
10% AEP DISCHARGE STRUCTURE OUTLET	= 15m WIDE WEIR x 0.2m HIGH
10% AEP DISCHARGE STRUCTURE LEVEL	= +1.1m ABOVE BASE OF BASIN
BASIN GEOMETRY	
STORAGE HEIGHT	= 1.3m
STORAGE AREA	= 1,000m²
STORAGE VOLUME	= 1,861.5m³
SIDE BATTERS	= 1 IN 4 (MAX)
BASIN MODELLING SUMMARY	
39% AEP PEAK OUTLFOW	= 1.157m³/s
39% AEP PEAK STAGE	= 0.957m
18% AEP PEAK OUTLFOW	= 1.804m³/s
18% AEP PEAK STAGE	= 1.048m
10% AEP PEAK OUTFLOW	= 2.570m³/s
10% AEP PEAK STAGE	= 1.172m

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REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE FOR COMMENT	J.W.	07.10.2025

TASK	BY	INITIAL	DATE
REVIEW	B. POPA		03.10.2025
DESIGN	J. WATERS		03.10.2025
DRAWN	J. WATERS		03.10.2025

SCALE: AS SHOWN (SCALE ABOVE DENOTES ORIGINAL SHEET SIZE - A1)

CLIENT: BLUEPOINT FLAGSTONE PTY LTD

PROJECT: PROPOSED COMMERCIAL DEVELOPMENT 'FLAGSTONE' - PRECINCT 1 (LOT 25007 & 25009 ON SP303120)

DRAWING TITLE: STORMWATER MANAGEMENT DETAILS SHEET 3 OF 3

STATUS: PRELIMINARY (NOT TO BE USED FOR CONSTRUCTION)

APPROVED RPEQ No

DRAWING NUMBER: PEG0810-DA-SK18

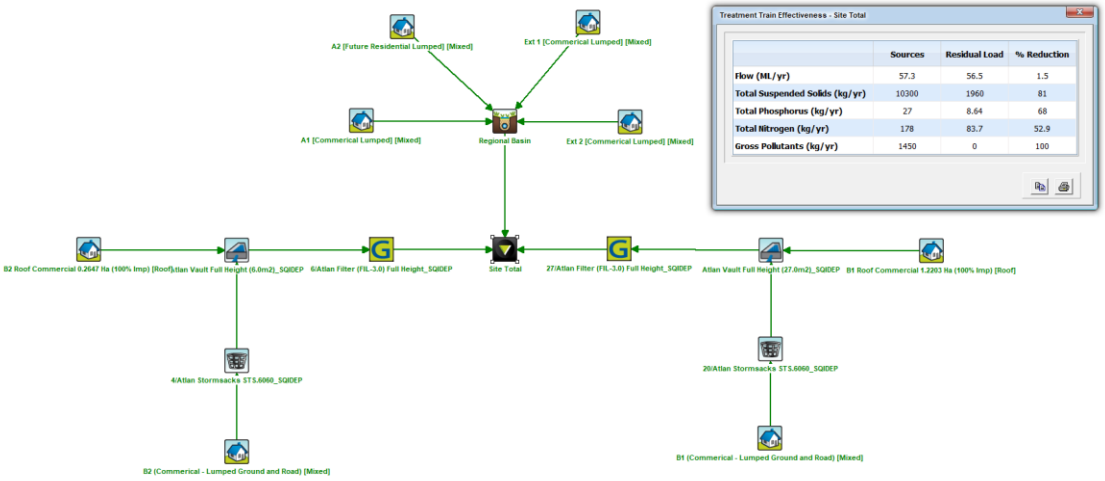
REVISION: A

P:\PEG\0810-DA-SK18 STORMWATER MANAGEMENT DETAILS SHEET 3 OF 3.dwg 03.10.2025 Letter (8.50 x 11.00 inches) Home Jet Wireless

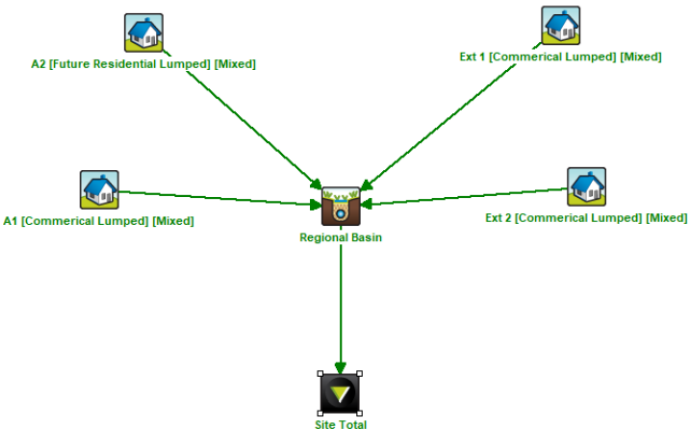
Appendix F

MUSIC Model Results

Site Total to Sandy Creek (LPoD)



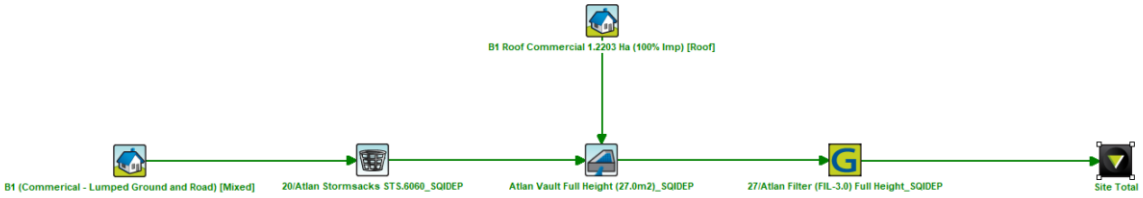
Offsite Bio-Basin (Catchments A1, A2, Ext1 and Ext2)



Treatment Train Effectiveness - Site Total

	Sources	Residual Load	% Reduction
Flow (ML/yr)	33.2	32.4	2.5
Total Suspended Solids (kg/yr)	7040	1290	81.6
Total Phosphorus (kg/yr)	17.9	6.34	64.5
Total Nitrogen (kg/yr)	101	48.3	52.1
Gross Pollutants (kg/yr)	840	0	100

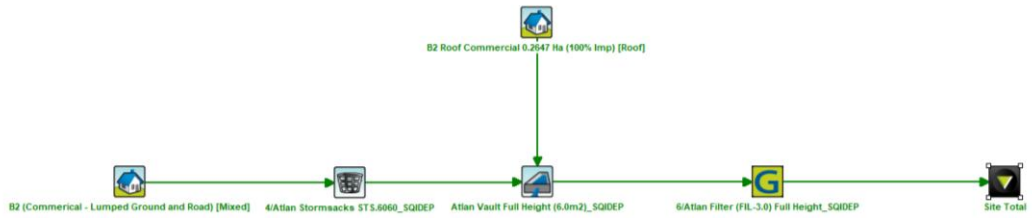
Catchment B1 Treatment Tank



Treatment Train Effectiveness - Site Total

	Sources	Residual Load	% Reduction
Flow (ML/yr)	20.6	20.6	0
Total Suspended Solids (kg/yr)	2850	565	80.2
Total Phosphorus (kg/yr)	8.38	2.19	73.8
Total Nitrogen (kg/yr)	65.2	29.8	54.3
Gross Pollutants (kg/yr)	520	0	100

Catchment B2 Treatment Tank



Treatment Train Effectiveness - Site Total

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.52	3.52	0
Total Suspended Solids (kg/yr)	413	74.1	82
Total Phosphorus (kg/yr)	1.28	0.327	74.4
Total Nitrogen (kg/yr)	11.1	5.01	55
Gross Pollutants (kg/yr)	88.6	0	100

PINNACLE ENGINEERING GROUP

Appendix G

LCC Maps

CITY OF LOGAN

PROPERTY FLOOD REPORT

Property Details

Address: Lot 25009 Hollows Road FLAGSTONE QLD 4280

Lot/Plan: Lot 25009 SP 303120

Size/Area: 61,402 m^2

Property Key: 390590

Catchment(s): Logan River, Sandy Creek

View Logan's catchments and waterways map (PDF)

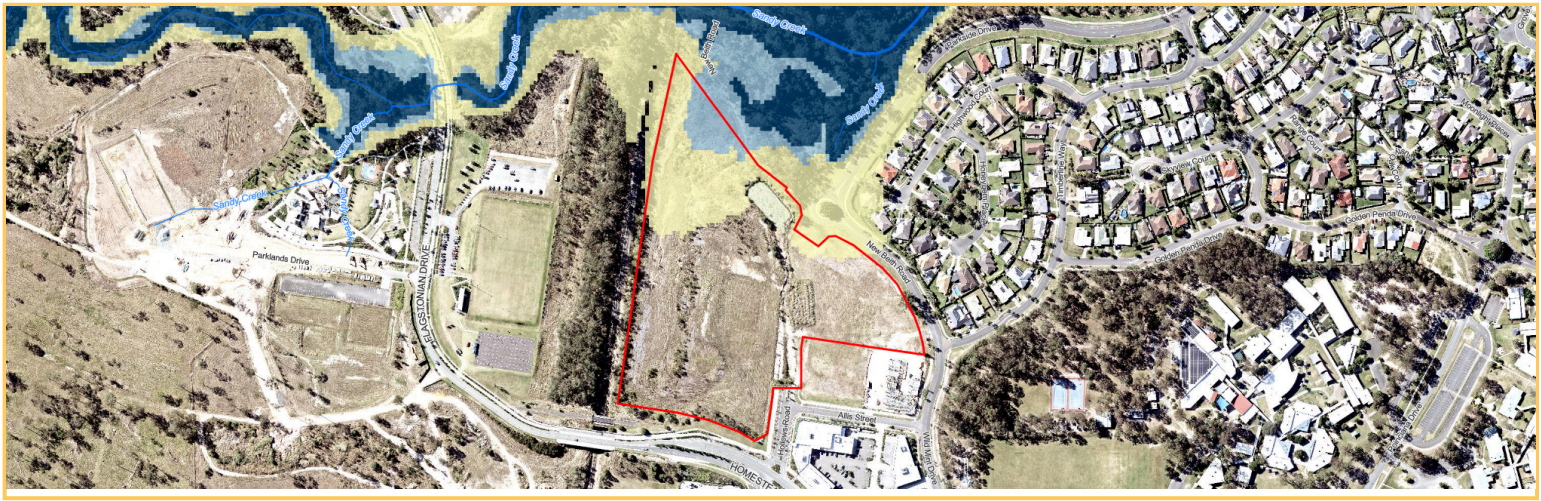
Summary Flood Assessment

The table below presents the flood risks applicable to the selected property. There may be multiple studies and flood scenarios affecting the property, particularly for larger sites.

Assessment	Details
Other information	GREATER FLAGSTONE - This property is in the Greater Flagstone Priority Development Area (PDA). Please contact Economic Development Queensland Development for advice about development. This report is for flood risk awareness only. EDQ PDA - Greater Flagstone
Risk area(s)	Moderate, Low
Investigation area	Not applicable
Isolation risk	Not applicable
River flooding	Not applicable
Creek flooding	1% chance of a flood this size or larger happening in any given year
Overland flow	Applies. It is possible that flooding from a local waterway which has not yet been studied may also impact the property. Please contact Council for further advice. Overland flow is water (stormwater run-off) that travels over land during heavy rainfall events. It generally occurs quickly and for short durations.

Latest Flood Risk

The extract below comes from the flood risk map based on the latest (most recent) flood studies accepted by Council applicable for this property.



LEGEND

High

Floodwaters may be deep or fast flowing, or have a relatively high chance of occurrence (e.g. 80% chance in 30 years). Conditions may pose a risk to life and cause damage to buildings, possibly severe. Limited development may be considered if not increasing the flood risk exposure for people or property. These areas are generally better suited to environmental, recreational and some agricultural uses.

Moderate

Less frequently affected by flooding or if more frequent, with shallow or slower moving floodwater. Conditions may pose an unacceptable risk to people or property if not mitigated. Development may be tolerable if measures are taken to address flood impacts, protect people and limit damage.

Low

Extremely unlikely chance of flooding (1% chance or less over a 30 year period) and/or relatively shallow or benign flooding conditions. Development is generally acceptable except for essential community infrastructure (e.g. emergency services). Vulnerable uses (e.g. childcare, aged care) may be ok subject to building, site access and safe shelter mitigation measures. Shows the full floodplain under the largest flood that could conceivably occur.

Investigation area

Locations where a current flood study has not been delivered and information to determine flood risk is not available. The approximation of the floodplain in these areas is based on a citywide overland flow study. Development should avoid these areas until further investigation (updated flood study or localised risk assessment) is completed.

The flood studies this map is based on consider the impacts of climate change, as required by Queensland's planning legislation and policies. The map considers the whole floodplain for Logan and reflects a risk-based approach that takes into account:

- How likely a flood of a given size is in any given year, and
- What the impact or level of danger of that flood is.

Flood Levels

The table below displays flood levels from the most recently accepted flood studies affecting this property. To view the flood study documents please see the Flood page on Council's website.

The levels are measured in Australian Height Datum (AHD), where sea level is approximately zero (0) metres. The level displayed in the table below is the maximum flood level on the property for that event (likelihood). For some properties, particularly large properties or those on a significant slope, flood levels can vary significantly.

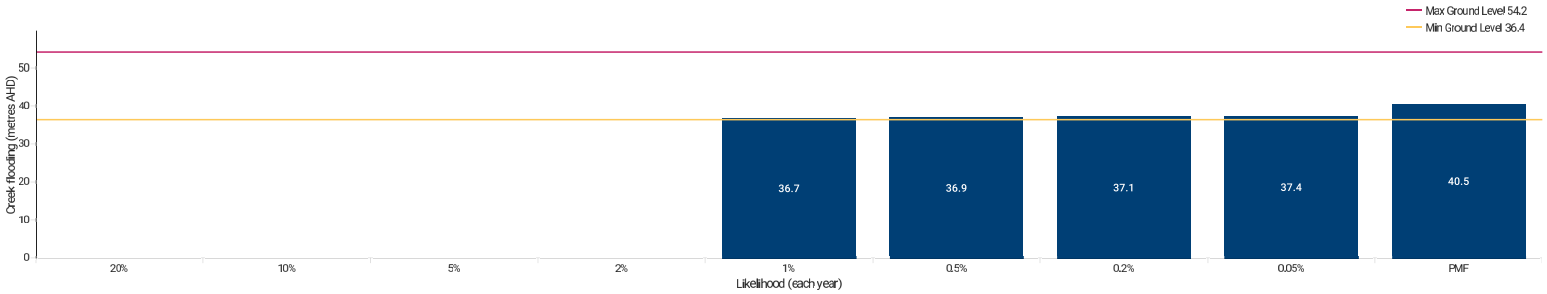
The most likely flood scenarios is shown at the top of the table, with the Probable Maximum Flood (PMF) at the bottom, being the least likely but most serious flood scenario.

Some properties may be impacted by only river flooding or only creek flooding, and some may be impacted by both. There may also be other sources of inundation that may impact the property and affect flood levels, based on overland flow or local creeks where studies have not yet been completed.

Study: Flagstone & Sandy Creeks Flood Study 2025

Likelihood (each year)	Creek flooding
20% chance	Not applicable
10% chance	Not applicable
5% chance	Not applicable
2% chance	Not applicable
1% chance	36.7 metres AHD
0.5% chance	36.9 metres AHD
0.2% chance	37.1 metres AHD
0.05% chance	37.4 metres AHD
PMF	40.5 metres AHD

Flood and Ground Levels in metres AHD



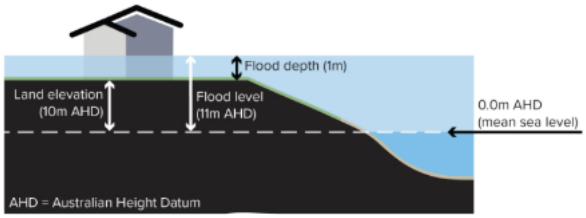
Ground Levels

Ground levels are based on an aerial LiDAR (Light Detection and Ranging) survey, which uses millions of laser point measurements to build a model of the ground surface. The source of the data is displayed in the table below so that you know when the survey was conducted.

Ground level	Details
Minimum ground level	36.4 metres AHD
Maximum ground level	54.2 metres AHD

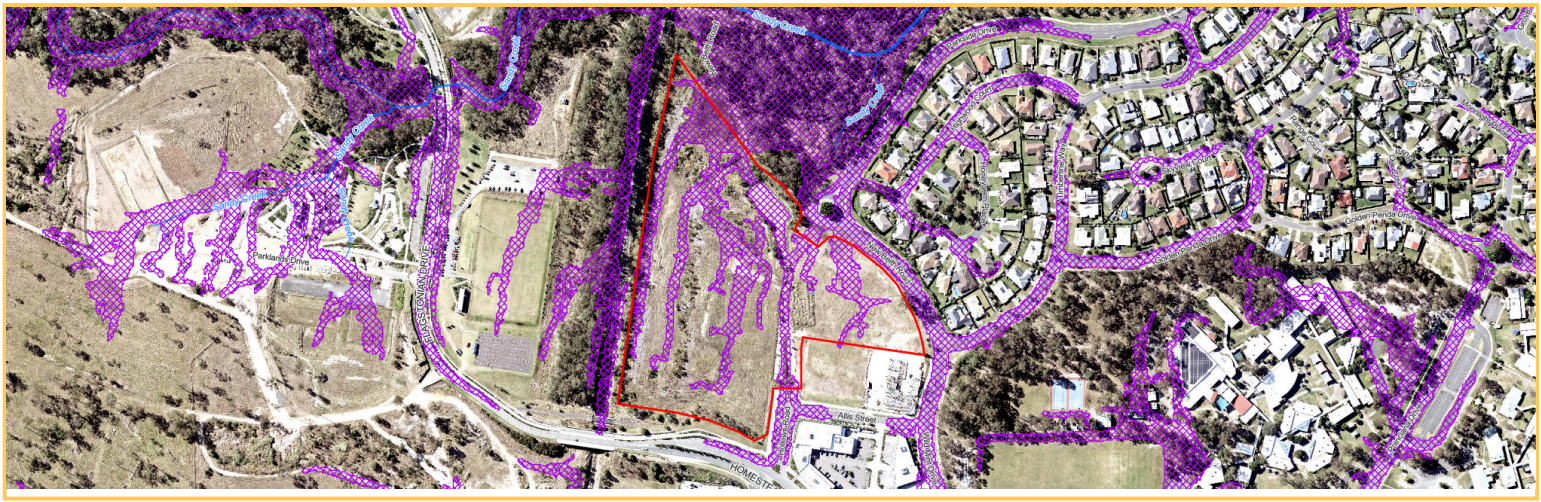
Source: 2021 Digital elevation model (1 metre grid)

The projected flood depth (how deep the water may be above ground, in metres) is the difference between the flood levels in the section above and the ground levels in this table. The diagram below provides an example (land elevation is ground level).



Overland Flow

Overland flow is water (stormwater/rainfall run-off) that exceeds the capacity of drains, pipes and channels during heavy rainfall events and travels over land towards waterways. It generally occurs quickly and for shorter periods of time. The impact of overland flow is dependent on local conditions, so the mapping is a guide only. It is possible that flooding from a local waterway which has not yet been studied may also impact the property. Please contact Council for further advice.

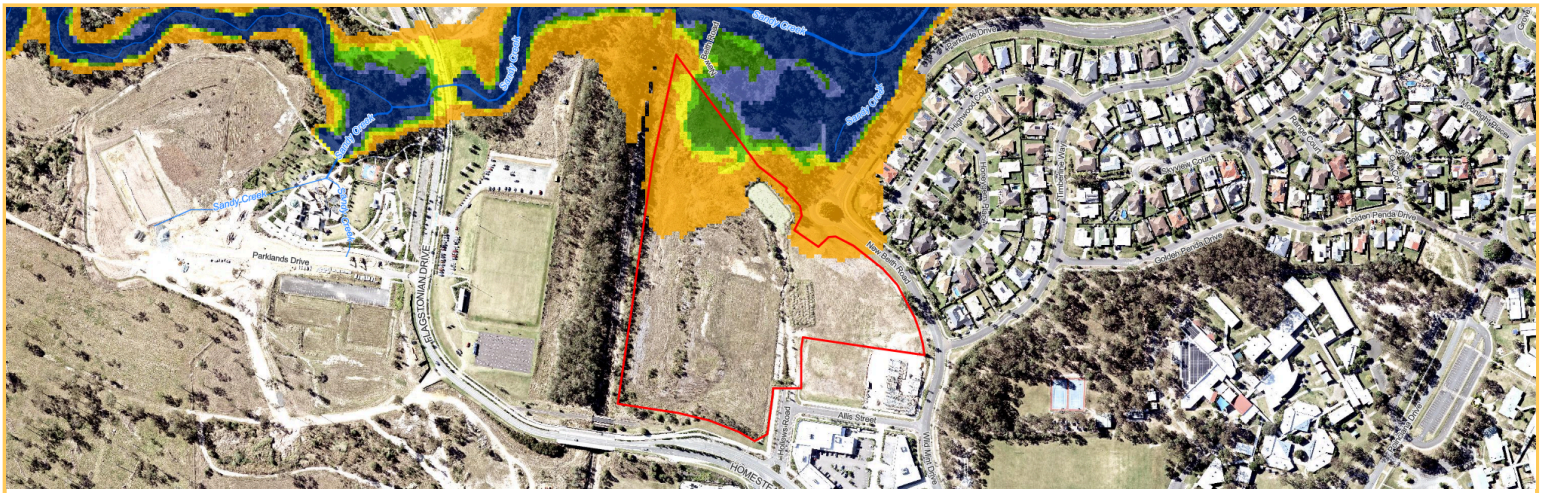


LEGEND

Overland flow extent (areas possibly impacted)

Future Climate Scenarios

This extract comes from the map showing the projected extent of flooding (affected areas) for multiple flood scenarios for all relevant flood studies, **including the projected impacts of climate change**. This map corresponds with the flood levels provided in the table above for the 5%, 2%, 1%, 0.5%, 0.05% and Probable Maximum Flood (PMF) scenarios.



LEGEND

5% chance
The areas modelled to be impacted by a flood that has a 5% (or 1 in 20) chance of happening in any given year, or 80% chance over a 30 year period, which is the common term of a mortgage. This modelling **includes the impacts of climate change** and represents our understanding of future risk.

2% chance
The areas modelled to be impacted by a flood that has a 2% (or 1 in 50) chance of happening in any given year, or 45% chance over a 30 year period, which is the common term of a mortgage. This modelling **includes the impacts of climate change** and represents our understanding of future risk.

1% chance
The areas modelled to be impacted by a flood that has a 1% (or 1 in 100) chance of happening in any given year, or 25% chance over a 30 year period, which is the common term of a mortgage. This modelling **includes the impacts of climate change** and represents our understanding of future risk.

0.5% chance
The areas modelled to be impacted by a flood that has a 0.5% (or 1 in 200) chance of happening in any given year, or 15% chance over a 30 year period, which is the common term of a mortgage. This modelling **includes the impacts of climate change** and represents our understanding of future risk.

0.05% chance
The areas modelled to be impacted by a flood that has a 0.05% (or 1 in 2000) chance of happening in any given year. This is an extremely unlikely flood event with a 1% chance of happening over a 30 year period, not including the impacts of climate change.

PMF
The PMF or probable maximum flood scenario represents the full extent of the floodplain, or the most serious flood that could be expected to occur. This is usually estimated based on the probable maximum rainfall, not including the impacts of climate change.

Investigation area
Locations where a current flood study has not been delivered and information to determine flood risk is not available. The approximation of the floodplain in these areas is based on a citywide overland flow study. Further investigation is needed.

Current Climate Scenarios

This extract comes from the map showing flood affected areas **without** considering the impacts of climate change. This map represents modelled flooding under current conditions, and can be used for insurance purposes.

LEGEND

5% chance
The areas modelled to be impacted by a flood that has a 5% (or 1 in 20) chance of happening in any given year, or 80% chance over a 30 year period, which is the common term of a mortgage. This modelling is based on **current (present day) conditions** and does not take into account the impacts of climate change.

2% chance
The areas modelled to be impacted by a flood that has a 2% (or 1 in 50) chance of happening in any given year, or 45% chance over a 30 year period, which is the common term of a mortgage. This modelling is based on **current (present day) conditions** and does not take into account the impacts of climate change.

1% chance
The areas modelled to be impacted by a flood that has a 1% (or 1 in 100) chance of happening in any given year, or 25% chance over a 30 year period, which is the common term of a mortgage. This modelling is based on **current (present day) conditions** and does not take into account the impacts of climate change.

0.5% chance
The areas modelled to be impacted by a flood that has a 0.5% (or 1 in 200) chance of happening in any given year, or 15% chance over a 30 year period, which is the common term of a mortgage. This modelling is based on **current (present day) conditions** and does not take into account the impacts of climate change.

0.05% chance
The areas modelled to be impacted by a flood that has a 0.05% (or 1 in 2000) chance of happening in any given year. This is an extremely unlikely flood event with a 1% chance of happening over a 30 year period, not including the impacts of climate change.

PMF
The PMF or probable maximum flood scenario represents the full extent of the floodplain, or the most serious flood that could be expected to occur. This is usually estimated based on the probable maximum rainfall, not including the impacts of climate change

Investigation area
Locations where a current flood study has not been delivered and information to determine flood risk is not available. The approximation of the floodplain in these areas is based on a citywide overland flow study. Further investigation is needed.

Historic Flood Events

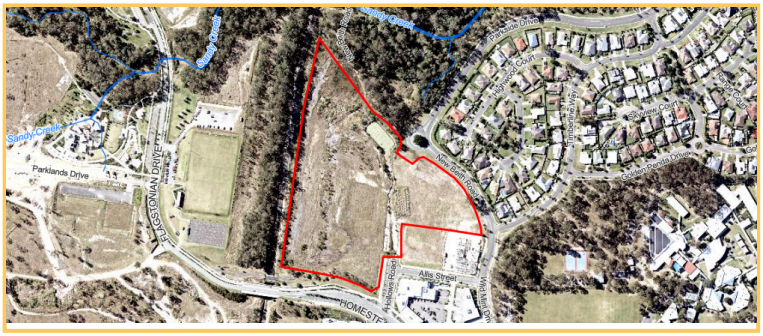
Based on the best information available to Council, the table below indicates whether or not the selected property may have been impacted by significant historic flood events. It is possible that other creek flooding or overland flow, which is not included in Council's mapping of these events, may have impacted the property.

Flood event	Property impacted
1974	No
2017 (after ex Tropical Cyclone Debbie)	No
2022 (late February / early March)	No

Planning Scheme Maps

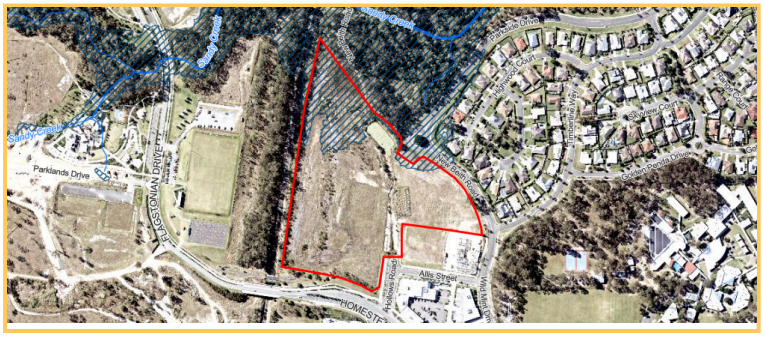
The selected property is shown below on an extract of the Flood Overlay Maps from the Logan Planning Scheme 2015 V9.1 with TLPI No. 1/2024. Various provisions of the planning scheme which refer to properties affected by the Flood Overlay Maps will apply to the flood affected areas for the purposes of planning and development. This may include, for example, raised building floor levels and achieving safe vehicle access to the road network.

OM-05.01 Isolated islands



OM-05.02 High flow area

OM-05.04 Flood risk areas



MAP LEGEND

High

Floodwaters may be deep or fast flowing, or have a relatively high chance of occurrence (e.g. 80% chance in 30 years). Conditions may pose a risk to life and cause damage to buildings, possibly severe. Limited development may be considered if not increasing the flood risk exposure for people or property. These areas are generally better suited to environmental, recreational and some agricultural uses.

Moderate

Less frequently affected by flooding or if more frequent, with shallow or slower moving floodwater. Conditions may pose an unacceptable risk to people or property if not mitigated. Development may be tolerable if measures are taken to address flood impacts, protect people and limit damage.

Low

Extremely unlikely chance of flooding (1% chance or less over a 30 year period) and/or relatively shallow or benign flooding conditions. Development is generally acceptable except for essential community infrastructure (e.g. emergency services). Vulnerable uses (e.g. childcare, aged care) may be ok subject to building, site access and safe shelter mitigation measures. Shows the full floodplain under the largest flood that could conceivably occur.

Investigation area

Locations where a current flood study has not been delivered and information to determine flood risk is not available. The approximation of the floodplain in these areas is based on a citywide overland flow study. Development should avoid these areas until further investigation (updated flood study or localised risk assessment) is completed.

CITY OF LOGAN

MAP LEGEND

High flow area
High hazard areas of flooding where significant (deeper, faster) flow of water occurs and in which a building is vulnerable to structural damage or failure from floodwater. Classified as H5 or H6 in the Australian Institute of Disaster Resilience (AIDR) Guideline 7-3 'Flood Hazard'.

High flood island
Areas which are isolated from flood-free land (surrounded by floodwater) but retain a portion of the area as flood free in a probable maximum flood (PMF).

Low flood island
Areas which are surrounded by floodwater and at first isolated from flood-free land, then completely inundated by floodwater (submerged) as the flood continues to rise.

Meadowbrook flood assessment area
Area where the function of important community infrastructure needs to be maintained. Flood mitigation measures and comprehensive emergency management planning is required to adequately manage the risk for flood events.

If more recent flood studies have been completed and accepted by Council, the Latest Flood Risk Map shown at the top of this report may be different from the planning scheme map. The latest flood information should be used to inform development decisions and will be incorporated into the planning scheme in a future amendment.

Further Information

1. Floods are highly unpredictable and variable, and properties may be affected by other sources of potential flooding. Each flood and its impact is different. Areas that were not flooded previously may be affected by future events. Areas that have been previously flooded may be impacted in different ways. This online report cannot take all of this into account.
2. The flood mapping and levels in this report are based on data from flood studies undertaken at a particular time and are subject to change. For example, if the method for calculating flood levels is updated, industry guidelines are updated or more recent information becomes available, this may result in changes to the information in this report. In areas where development is ongoing, the flood mapping and levels may not reflect developed conditions.
3. Flood studies do not create risk. They help us to understand the risk, based on relevant legislation and Queensland Government policies and guidelines. Flood studies also consider a range of other factors such as rainfall and river level information from recent events, climate change and trends, the impacts of development, changes to catchment conditions, new technologies and industry best practice (which help to improve accuracy).
4. Flood studies and models are developed from the best information available at the time. They do not tell you how the flood waters might behave, how quickly they may rise, or how dangerous the flooding will be. The models also cannot represent changes that have occurred since they were developed which may impact flood behaviour, such as earthworks, new developments or road infrastructure.
5. This report is not a substitute for independent professional advice. You should engage the services of a Registered Professional Engineer of Queensland (RPEQ) to get site specific information regarding the flood risk to your property, and how that might affect any proposed building or development work.
6. While Logan City Council takes reasonable care in producing this report, it does not guarantee that the information is accurate, complete or current. Logan City Council does not accept any responsibility for any loss or damage (however it was caused) in connection with the use of or reliance on the information in this report.

Contact Information

Where to go for further information depends on the type of information you need. Please refer to the Flood Risk Fact Sheet or contact Council using the details below.

Topic	Contact Details
Flood studies and modelling information, and the flood risk on your property	Contact Council on 07 3412 3412 or email council@logan.qld.gov.au. Further information about flooding and flood studies is available on the Flood page on Council's website.
Planning and development enquiries or proposals	Contact Council on 07 3412 3412 or email development@logan.qld.gov.au. Before lodging a development application, pre-lodgement advice is recommended.
Building information	Contact Council on 07 3412 3412 or email council@logan.qld.gov.au. You can also contact a private building certifier.
Properties in Priority Development Areas	Contact Economic Development Queensland. Council is not the planning authority for these properties.
Independent advice about flooding on your property	Contact a registered engineer through the Board of Professional Engineers of Queensland: Phone: 07 3210 3100 Email: admin@bpeq.qld.gov.au Web: Home - Board of Professional Engineers Queensland (bpeq.qld.gov.au)

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