STORMWATER MANAGEMENT STATEMENT

To: Mr Alistair Le Plastrier

From: Blake Stephens – Knobel Engineers

Date: 25 September 2020

Re: **STORMWATER MANAGEMENT CONCEPT – 9 CHRISTENSEN ROAD SOUTH, STAYPLTON.**

The following assessment was undertaken in accordance with the following:

- Gold Coast City Plan Version 7;
- IPWEA Queensland Urban Drainage Manual 2017 (QUDM); and
- Gold Coast City Council ArcGIS Online.

INTRODUCTION

Knobel Engineers was engaged by Mr Alistair Le Plastrier to prepare a Technical Memorandum for a Stormwater Management Concept Analysis for the proposed Industrial Development at 9 Christensen Road South, Staplyton.

For the preparation of the Technical Memorandum, the following engineering services were conducted:

- Review of existing information and studies for the site;
- Hydrologic and hydraulic assessment of the site and any influencing catchments (for up to 2 design AEP events) in accordance with Australian Rainfall & Runoff 2019;
- Determination of the site's Lawful Point/s of Discharge (LPOD) in accordance with City of Gold Coast Guidelines;
- Preliminary Peak discharge flow rates based off supplied layout by Clarke's Design & Construct (Q0343/SK-Rev-A);
- Preliminary Sizing of On-Site Detention (OSD) and storage swales (if required);
- Preliminary estimation of stormwater treatment devices to mitigate pollutant loading from the developed site using MUSIC; and
- Preparation of Technical Memorandum and association concept design sketches illustrating preliminary stormwater management measures required for the site.

SITE DESCRIPTION

The current subject site is described as 9 Christensen Road South, Staplyton, formally known as Lot 6 on SP274108. The subject site is bounded by an adjacent lot to the west, Burnside Road to the south, Christensen Road to the east and Sandy Creek to the north. The Subject site is currently zoned as a medium impact industry, with a total combined area of 4.595 ha.

Based on current aerial imagery (taken 05 February 2020) the subject site consists of 4 (four) existing buildings with average grass cover. The site grades to Sandy creek to the north, at approximately 4 %, with LIDAR contours on site ranging from RL 12m AHD within the site to, RL 6m AHD along the northern property boundary. Furthermore, the site grades to Burnside Road to the south, at approximately 3.57 %, with LIDAR contours on site ranging from RL 12m AHD within the site, to RL 7m AHD along the southern site boundary. An aerial image of the site (taken on 05 February 2020) is illustrated in *Figure 1.*

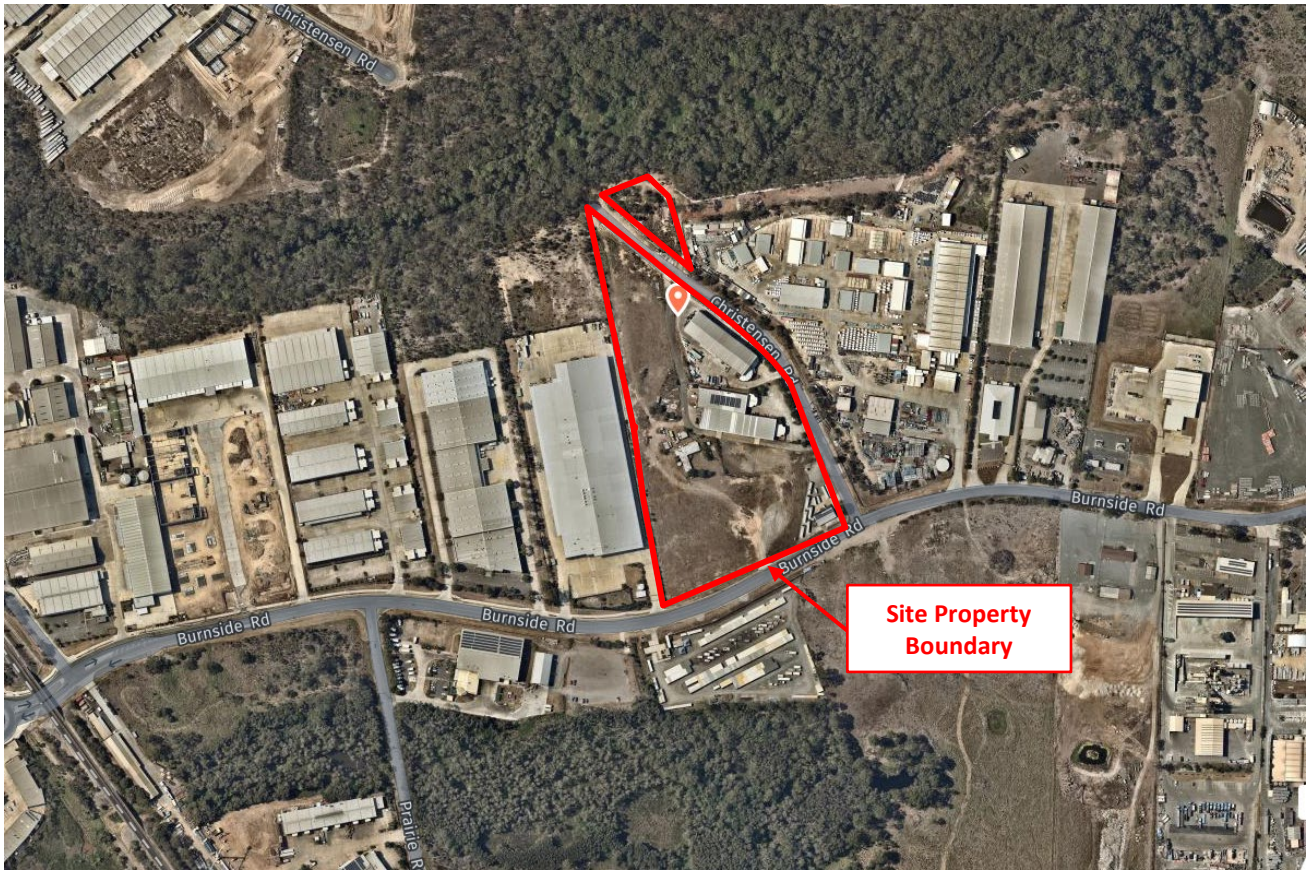


Figure 1: Aerial Image of the site – (Source: Nearmap - Image taken on 5 Feb 2020)

PROPOSED DEVELOPMENT

The proposed development is an industrial estate. There are existing access roads to the south and east of the site boundary, with existing council stormwater infrastructure which will act as the development's LPOD.

ADOPTED RAINFALL DATA

Rainfall intensity data has been obtained from the Australian Bureau of Meteorology's 2016 Design IFD Rainfall System. The data has been extracted for the nearest grid cell at Latitude 27.7375 (S) and Longitude 153. 2375 (E). The IFD data and average rainfall intensities used in this Tech Memo are in accordance with the procedures outlined in Geosciences Australia, *Australian Rainfall and Runoff 2019.*

DATA

Data which has been sourced or provided, in order to prepare this report for the site, was gathered from the following sources:

- JDASS Consulting Surveyors Survey Plan (ref: 03920_Pad_Sketch, July 2020);
- LIDAR data for the subject site sourced from Australian Government Elevation and Depth Foundation Spatial Data (ELVIS), Date Source: 2014, DEM Data;
- Rainfall and Meteorological 2016 IFD Data by the Australian Bureau of Meteorology;
- Information extracted from CoGC City Planning Interactive Mapping – Version 7; and
- Aerial Imagery by Nearmap (Accessed on 5th February 2020).

SITE HYDROLOGY AND HYDRAULICS

The following sections define the method and parameters utilised within the hydrologic and hydraulic modelling of the site, in order to establish a simulation of the anticipated flow regime and peak discharge at the Lawful Point of Discharge (LPOD). The modelling has been undertaken in Drains for both the pre- and post-development scenarios, and a Rational Method calculation has been provided for a comparison.

The Rational Method (Section 4.3 of the Queensland Urban Drainage Manual - QUDM 2017) is a suitable estimation technique, given its flexibility in its data requirements and is able to produce satisfactory estimates of peak site discharges based on the following data input:

- specific intensity frequency duration (IFD) data;
- length/type of flow path;
- contributing catchment areas; and
- coefficient of discharge.

Note that the hydrologic and hydraulic assessment undertaken has been for the portion of the site undergoing development, which is approximately 3.06ha. As the area to the south of Sandy creek (Catchment D) is not undergoing development, and there is no proposed land disturbance for the area where the existing building exist (Catchment C), therefore these two catchments have been excluded as part of this assessment.

PRE DEVELOPMENT

The pre development subject site has been analysed and delineated as two (2) internal sub-catchments for the pre development scenario based on the existing flow regime of the proposed development area. The Stormwater catchments for the pre development site have been termed Catchments A-B and are detailed on Knobel Engineers, *Pre Development Catchment Plan* (Ref: K5176/P001) included as *Attachment 2.*

The areas, Times of Concentrations (TOC) and Coefficient of Runoff adopted for each pre development catchment is detailed in *Table 1*. It is noted that the calculated parameters for each catchment have been carried out in accordance with Queensland Urban Drainage Manual (QUDM) section 4.6.6 – Overland Flow. Friend's Equation ($t = (107n\ L^{0.333})/S^{0.2}$) has been used to calculate the initial travel time using sheet flow.

Table 1: Pre Development Catchments – Adopted Parameters

Catchment ID	Area (ha)	Time of Concentration t_c	Coefficient of Runoff (C_{10})
A	1.950	15	0.66
B	1.065	15	0.66

Design storms of 39%, 10% and 1% (corresponding to the 2, 10 and 100 year ARI storms) for the pre development case using design rainfall intensities from the Bureau of Meteorology. The Rational Method ($Q = 2.78 \times 10^{-3}$ CIA) has been used to estimate the peak flow rates for the subject site. The predevelopment peak flows for the subject site are presented in *Table 2.*

Table 2: Pre Development Estimated Peak Flow Rate – Rational Method

CATCHMENT A				
Annual Exceedance Probability	AEP	39%	10%	1%
Coefficient of Runoff	**C**	0.56	0.66	0.79
Area of Catchment (ha)	**A**	1.95	1.950	1.950
Average Rainfall Intensity (mm/h)	**I**	97	139	204
Peak Flow Rate (m^3/s)	**Q**	0.296	**0.500**	**0.876**
CATCHMENT B				
Annual Exceedance Probability	**AEP**	39%	10%	1%
Coefficient of Runoff	**C**	0.56	0.66	0.79
Area of Catchment (ha)	**A**	1.065	1.065	1.065
Average Rainfall Intensity (mm/h)	**I**	97	139	204
Peak Flow Rate (m^3/s)	**Q**	0.161	0.272	0.477
TOTAL Peak Flow Rate (m^3/s)	**Q_t**	0.457	0.772	1.352

POST DEVELOPMENT

The post development subject site has been analysed and delineated as four (4) internal sub-catchments based on the drainage strategy proposed for the site. The Stormwater catchments undergoing disturbance for the post development site have been termed A1-B1. Catchments which remain undeveloped and sheet flow direct to the road reserves are termed A2-B2 and are detailed on Knobel Engineers, *Post Development Catchment Plans* (Ref: K5176/P002) included as *Attachment 3.*

The areas, Times of Concentrations (TOC) and Coefficient of Runoff adopted for each post development catchment is detailed in *Table 1*. Note that the calculated parameters for each catchment have been carried out in accordance with QUDM section 4.6.6 – Overland Flow.

Developed catchments A1-B1 have utilized Friend's Equation ($t = (107n\ L^{0.333})/S^{0.2}$) to calculate the initial travel time using a sheet flow length of 50m and concrete surface channel flow length appropriate to the catchment to calculate concentrated flow time.

Table 3: Post Development Catchments – Adopted Parameters

Catchment ID	Area (ha)	Time of Concentration t_c	Coefficient of Runoff (C_{10})
A1	2.303	8.5	0.88
A2	0.042	5	0.66
B1	0.555	7.6	0.88
B2	0.157	5	0.66

Design storms of 39%, 10% and 1% (corresponding to the 2, 10 and 100 year ARI storms) for the post development case using design rainfall intensities from the Bureau of Meteorology. The Rational Method ($Q = 2.78 \times 10^{-3}$ CIA) has been used to estimate the peak flow rates for the subject site. The post development peak flows for the subject site are presented in *Table 4.*

Table 4: Post Development Estimated Peak Flow Rates – Rational Method

CATCHMENT A1				
Annual Exceedance Probability	**AEP**	0.5 EY	10%	1%
Coefficient of Runoff	**C**	0.75	0.88	1.00
Area of Catchment (ha)	**A**	2.303	2.303	2.303
Average Rainfall Intensity (mm/h)	**I**	121	175	257
Peak Flow Rate (m^3/s)	**Q**	**0.580**	**0.984**	**1.741**
CATCHMENT B1				
Annual Exceedance Probability	**AEP**	0.5 EY	10%	1%
Coefficient of Runoff	**C**	0.75	0.88	1.00
Area of Catchment (ha)	**A**	0.555	0.555	0.555
Average Rainfall Intensity (mm/h)	**I**	126	182	271
Peak Flow Rate (m^3/s)	**Q**	**0.146**	**0.248**	**0.441**
CATCHMENT A2				
Annual Exceedance Probability	**AEP**	0.5 EY	10%	1%
Coefficient of Runoff	**C**	0.56	0.66	0.79
Area of Catchment (ha)	**A**	0.042	0.042	0.042
Average Rainfall Intensity (mm/h)	**I**	139	204	310
Peak Flow Rate (m^3/s)	**Q**	**0.009**	**0.016**	**0.029**
CATCHMENT B2				
Annual Exceedance Probability	**AEP**	0.5 EY	10%	1%
Coefficient of Runoff	**C**	0.56	0.66	0.79
Area of Catchment (ha)	**A**	0.157	0.157	0.157
Average Rainfall Intensity (mm/h)	**I**	139	204	310
Peak Flow Rate (m^3/s)	**Q**	**0.041**	**0.071**	**0.130**
TOTAL Peak Flow Rate (m^3/s)	**Q_t**	**0.777**	**1.319**	**2.340**

CHANGE IN PEAK FLOW RATES

The difference in peak flow rates calculated from the total pre and post developed site has been analysed via The Rational Method,with the results detailed in *Table 5.*

Table 5: Change in Peak Flow Rates Estimation – Rational Method

Annual Exceedance Probability	**AEP**	0.5 EY	10%	1%
Pre Developed Peak Flow Rate (m^3/s)	**Q**	0.457	0.772	1.352
Post Developed Peak Flow Rate (m^3/s)	**Q**	0.777	1.319	2.340
Change in Peak Flow Rate (m^3/s)	**Q**	**0.319**	**0.547**	**0.988**

The proposed development has demonstrated via a Rational Method assessment, that there is an anticipated increase in peak flow rates discharging from the site to Burnside Road (LPOD A), with an anticipated decrease in peak flow rates for Christensen Street (LPOD B). This is a result of the proposed post development grading strategy, which drains a larger catchment area to Burnside Road to the south. Therefore, On-Site Detention (OSD) is deemed necessary to mitigate peak flow rates for LPOD A (Burnside Road), with no mitigation deemed necessary for LPOD B (Christensen Street).

EXTERNAL CATCHMENTS

External contours and infrastructure surroundings have been analysed to determine that there is an external catchment to the north west of the site (based on 2014 lidar and site survey). To provide potential relief from the incoming flows into the site, external catchment stormwater infrastructure has been provided, as outlined in Knobel Engineers, *Stormwater Management Plan* and *Knobel Engineers* (Ref: K5176/P003/A) in *Attachment 4* for details of the swale and indicative location. The final location onsite and construction levels will be determined at detailed design stage.

The areas, Times of Concentrations (TOC) and Coefficient of Runoff adopted for each External catchment is detailed in *Table 6*. Note that the calculated parameters for each catchment have been carried out in accordance with QUDM section 4.6.6 – Overland Flow. Friend's Equation ($t = (107n\ L^{0.333})/S^{0.2}$) has been used to calculate the initial travel time using sheet flow.

Table 6: External Catchment – Adopted Parameters

Catchment ID	Area (ha)	Time of Concentration t_c	Coefficient of Runoff (C_{10})
Ext 1	0.091	5	0.66

Design storms of 39%, 10% and 1% (corresponding to the 2, 10 and 100 year ARI storms) for the post development case using design rainfall intensities from the Bureau of Meteorology. The Rational Method ($Q = 2.78 \times 10^{-3}$ CIA) has been used to estimate the peak flow rates for the subject site. The External catchment peak flows for the subject site are presented in *Table 7.*

Table 7: External Catchment Estimated Peak Flow Rates – Rational Method

Annual Exceedance Probability	**AEP**	0.5 EY	10%	1%
Coefficient of Runoff	**C**	0.56	0.66	0.79
Area of Catchment (ha)	**A**	0.091	0.091	0.091
Average Rainfall Intensity (mm/h)	**I**	139	204	310
Peak Flow Rate (m^3/s)	**Q**	0.020	0.034	0.062

STORMWATER DETENTION

Hydrological & Hydraulic Software

To assess the storage and outlet requirements of the proposed detention tank, the industry standard modelling software Drains, has been selected for the hydrologic and hydraulic analysis. Details of the model set-up, detention tank design and model results are summarised in the following sections for the consolidated sites LPOD.

Model Set-up

Rainfall data for the subject site has been obtained from the Australian Bureau of Meteorology's 2016 Design IFD Rainfall System. The data has been extracted for the nearest grid cell at Latitude 27.7375 (S) and Longitude 153. 2375 (E). The IFD data and average rainfall intensities used in this report are in accordance with the procedures outlined in IEAust, Australian Rainfall and Runoff 2016. Several storm events have been included in the modelling with durations ranging from 10 min to 2 hrs.

Model Validation

The pre development model was development by assigning a singular runoff node for the pre development of individual catchments A-B. The runoff nodes from each catchment were connected via a dummy link, to allow the total peak flow rate from the subject site to be calculated at the consolidated LPOD.

For the post development (unmitigated) model, two (2) runoff nodes were assigned to each post development catchment A1 – B1. One runoff node represents the developable portion of the site, which is proposed to be conveyed to the detention tank. The other node represents the regions within the defined post development catchments, that are proposed to bypass the proposed detention tank. Similarly, dummy links were modelled to connect each post development catchment to the LPOD, allowing the total site runoff to be calculated in the same manner as the predevelopment flows, to provide a reasonable comparison.

The pre and post development flow rates for the total subject site (at various consolidated LPOD) for the critical storm durations are detailed within *Table 8.*

Table 8: Anticipated Peak Flow Rates at LPOD (m^3/s) – DRAINS

Northern LPOD	0.5 EY (2yr ARI)	10 % AEP (10yr ARI)	1% AEP (100yr ARI)
Pre Development	0.188	0.317	0.567
Post Development (Unmitigated)	0.169	0.285	0.478
Southern LPOD	**0.5 EY (2yr ARI)**	**10 % AEP (10yr ARI)**	**1% AEP (100yr ARI)**
Pre Development	0.324	0.544	0.981
Post Development (Unmitigated)	0.575	0.961	1.590

In the mitigated scenario, storage nodes were assigned to the post development runoff nodes intended to be conveyed to detention tank. The node representing the bypassing portion of the post development catchments remained unchanged in the mitigated model. Dummy nodes where again modelled from each mitigated catchment to the LPOD, to allow the total site runoff to be calculated.

The tank is sized iteratively and optimised to attenuate outflow such that the total flow discharging to the designated LPOD did not exceed the pre development peak flow rates for each critical design storm. As the earthworks design for the site is yet to be finalised, the design levels used within the model were set arbitrability from an invert depth and will be refined at the detailed design phase.

Detention Tank Parameters

The detention storage parameters are detailed below in Table 9, and were adopted to achieve the target mitigated pre development peak flow rates to LPOD A (Burnside Road) via Catchment A. Note that the following parameters provide details for the detention component of the tank only, with the water quality components being detailed below of this report.

The detention tank outlets have been as modelled as a pit riser structures within the tank with an orifice low flow and a high flow weir.

Table 9: Adopted Detention Tank Parameters

Minimum Detention Surface Area for Catchment A:	**275 m²**
Modelled Detention Tank Height:	**3.0 m**
Recommended Detention Tank Height (including 300mm freeboard)	**3.0 m**
Outlet Configuration	
Low Flow Outlet (at invert of detention component of tank)	**1 x 420mm Orifice Plate over a 525mm Outlet Pipe**
High Flow Weir @ 2.5m above invert of detention component of tank	**1 x 3m wide weir (600x900 internal riser pit with 3m perimeter opening)**
Minimum 1% AEP Detention Volume (excl. Freeboard):	**729 m³**
Total Tank Detention Volume (Incl. Freeboard):	**810 m³**

For A Summary of Post Developed Mitigated peak flow rates refer to *Table 10* Below:

Table 10: Anticipated Mitigated Peak Flow Rates at LPOD (m³/s) – DRAINS

Southern LPOD	39% AEP (2yr ARI)	10 % AEP (10yr ARI)	1% AEP (100yr ARI)
Pre Development	0.324	0.544	0.981
Post Development (Mitigated)	0.313	0.441	0.97

STORMWATER QUALITY MODELLING

Stormwater Pollutant modelling for the development has been generated using the modelling program 'Model for Urban Stormwater Improvement Conceptualisation' (MUSIC), version 6.3.0, adhering to the prescribed Water by Design MUSIC modelling guidelines Version 1.0, 2010 (WBDMG). A CoCG MUSIC Link model template has been utilised in the development of this model. The source nodes for the catchment has been modelled as "Industrial" to reflect the post development site use, in accordance with MUSIC modelling guidelines Version 1.0, 2010 (WBDMG).

Note that the existing area designated as Catchment C and D has not been included as part of the sites MUSIC assessment, as it is not anticipated to undergo any development as part of the proposed mixed-use industrial development. As there is no land disturbance envisaged to this area of the site, and the pre and post development condition will remain the same, this area is deemed to not require stormwater quality treatment.

Adopted SQID Design Parameters

A Bioretention stormwater quality improvement devices (SQID's) will be utilised to treat stormwater runoff from the site, as it is deemed the most suitable for the proposed site use. The proposed SQID's have been provided for modelling purpose only and is subject to council approval. The Bioretention is designed to pond stormwater allowing it to percolate through a layer of filter media. Runoff passing through the filter media is collected with a perforated pipe discharging to the downstream council's drainage stormwater infrastructure. Detailed Design of these component to be included in the CSWMP of the proposed development. Bioretention design parameters are in accordance with WBDMG recommendations, key parameters are listed below in *Table 11:*

Table 11: Adopted MUSIC Model Treatment Device Parameters

Catchment ID	Extended Detention Depth (m)	Filter Area (m2)	Surface Area (m2)	Hydraulic Conductivity (mm/hr)	Filter Depth (m)	TN Content of Filter Material (mg/kg)	Orthophosphate Content of Filter Media (mg/kg)
Bioretention Basin	0.3	As Per Table 8	Equal to Filter Area	200	0.4	400	30

The total assessable site area for the purpose of stormwater quality modelling is 3.06ha. The adopted catchment parameters for the MUSIC Catchment areas are detailed in *Table 12.*

Table 12: Adopted MUSIC Model Catchment Parameters

Catchment ID	Subcatchment Breakdown	Area (ha)	Typical Fraction Impervious	Treatment Method	Filter Area (m2)
A1	A1 Ground	0.216	0.8	Bioretention Basin A	240 m^2
	A1 Road	0.576	0.75		
	A1 Roof	1.512	1		
A2	A2 Ground (Landscaping)	0.042	0.1	Bypasses Treatment	-
B1	B1 Ground	0.055	0.8	Bioretention Basin B	67 m^2
	B1 Road	0.111	0.75		
	B1 Roof	0.388	1		
B2	B2 Road (Existing Road)	0.096	0.9	Bioretention Basin B	As Above
	B2 Ground (Landscaping)	0.065	0.1	Bypasses Treatment	-

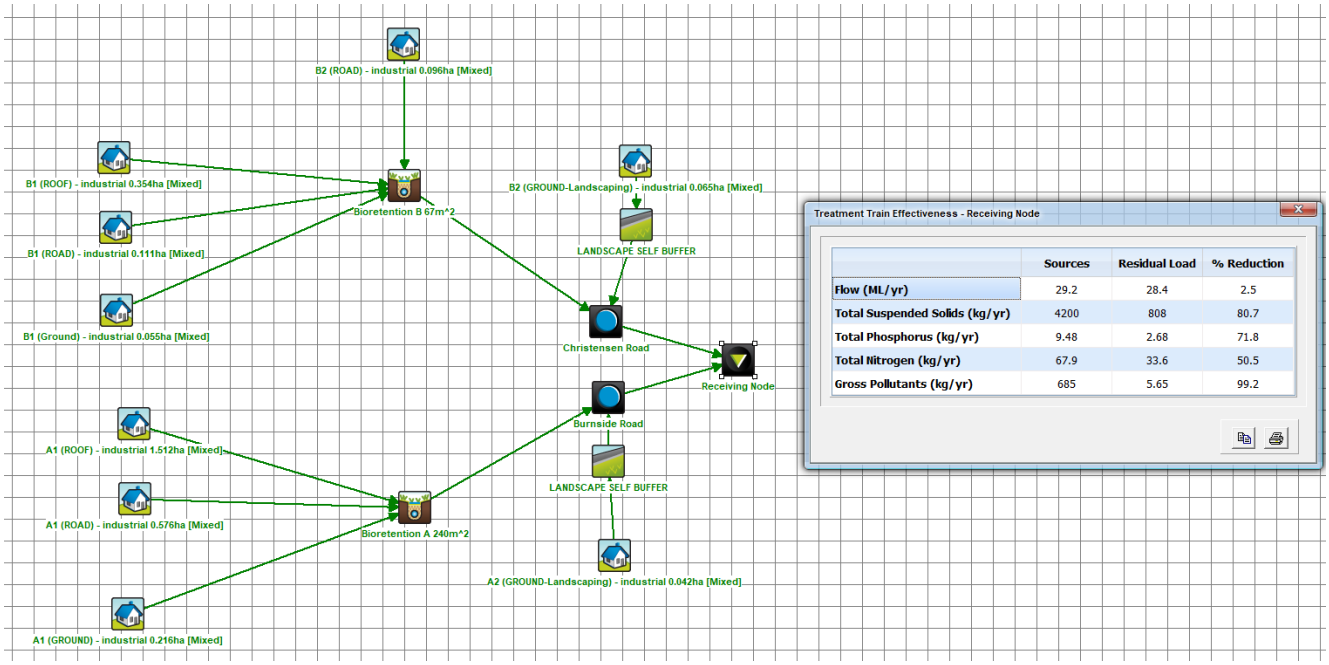


Figure 2: Operational Phase Treatment Train (sourced: MUSIC model)

Stormwater Quality Assessment

Stormwater pollution is likely to occur from the site during the construction phase and operational phase, due to erosion and sediment transportation off site to the receiving environment. Most of this risk results from construction activities disturbing the site and exposing areas of soil to the direct erosive influence of the environment.

The following section outlines potential key pollutants and performance criteria to be attained on site during the construction phase. Furthermore,

Key Pollutants

The key pollutants have been identified for the Construction Phase of this development.

Table 13: Stormwater Quality Key Pollutants, Construction Phase

Pollutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, material off cuts.
Sediment	Exposed soils and stockpiles during earthworks and building works.
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas.
Toxic Materials	Cement slurry, asphalt primer, solvents, cleaning agents, and wash waters (e.g., from tile works).
Acids or Alkaline substances	Acid sulphate soils, cement slurry and wash waters.

Performance Criteria

The following site discharge pollutant criteria have been adopted for water quality monitoring during the construction phase of the development.

Table 14: Construction Phase, Water Quality Performance Criteria

Pollutant	Criteria
Total Suspended Solids	80% hydrological effectiveness to 50mg/L
pH	6.5 – 8.5
Dissolved Oxygen	90th %ile >80% saturation or 6mg/L
Hydrocarbons	No visible sheen on receiving waters
Litter	No visible litter washed from site.
Cations and Anions	As recommended by Acid Sulphate Soil Management Plan (If Applicable to Development).
Contaminants	Dispose of waste containing contaminants at authorised facilities.

Sediment and Erosion Controls

Adequate procedures necessary to minimise erosion and control sediment during construction in accordance with the International Erosion Control Association (IECA) Best Practice ESC Document. Sediment and Erosion Control devices (S&EC) employed on the site shall be designed and constructed in accordance with the *International Erosion Control Association (IECA) Best Practice ESC Document.* The Design and Details of these components will be provided in the CSWMP of the Proposed Development.

CONCLUSION

Knobel Engineers was engaged by Mr Alistair Le Plastrier to prepare a Technical Memorandum for the proposed Industrial Development at 9 Christensen Road South, Staplyton. This Technical Memorandum provides a review and analysis of the subject site and influencing catchment, and provides preliminary advice on the size of on-site detention deemed required to mitigate site flows to the pre development condition and a potential stormwater Quality management treatment train demonstrated via using MUSIC model.

A hydrological analysis demonstrated that the anticipated post development peak flow rates discharging from the site are higher than the pre development peak flow rates. A hydraulic model was built using the DRAINS software program, to estimate the required detention volume and arrangement to mitigate post development flow rates back to pre development flow rates. This analysis defines the preliminary size and layout of the proposed combined open Bioretention/detention tank. A minimum total detention volume of **810 m^3**, was modelled for Catchment A, which demonstrates no additional or actionable nuisance associated with the increased runoff rate on downstream properties and infrastructure.

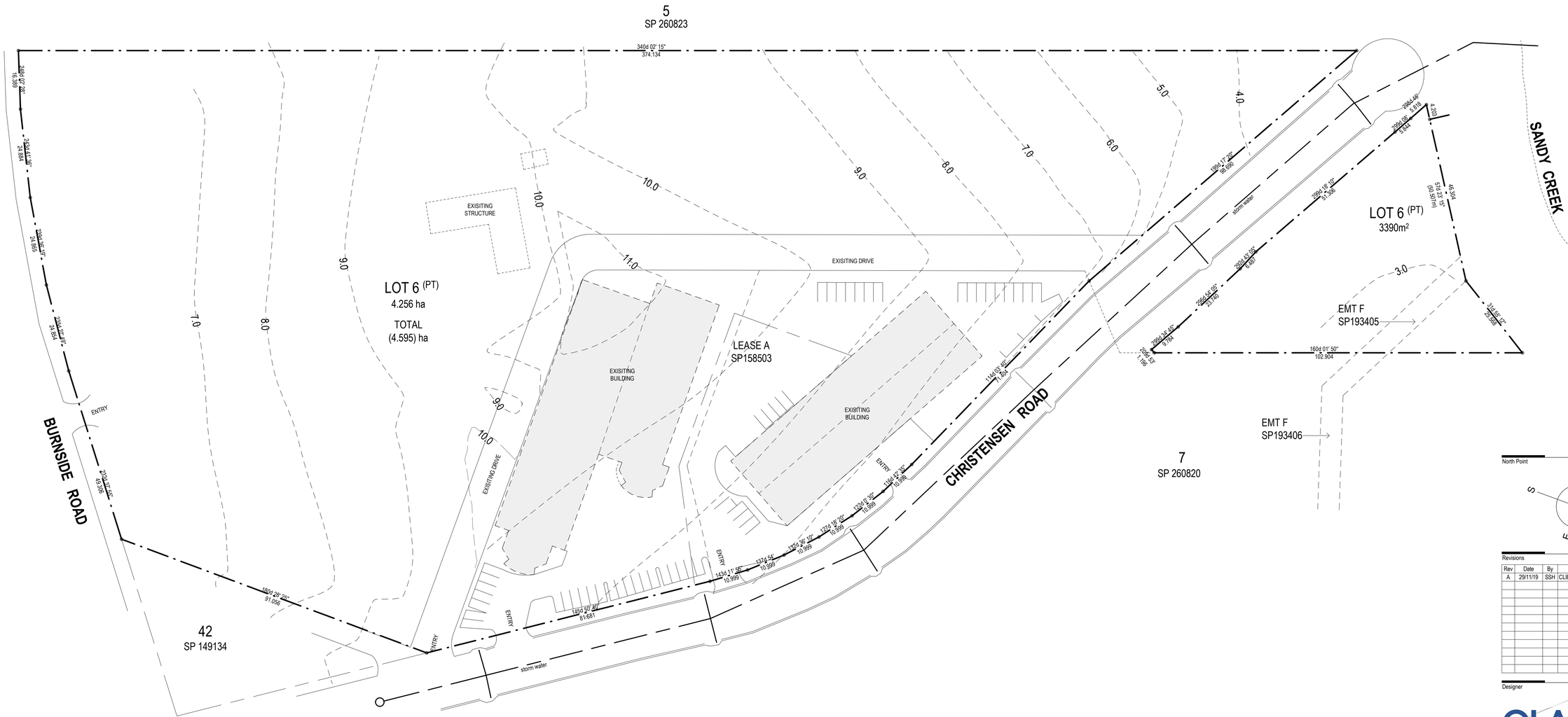
Knobel Engineers has adopted a Water Sensitive Urban Design (WSUD) approach, in accordance with the State Planning Policy 2017, to managing the stormwater runoff from the proposed development by treating stormwater runoff within a Bioretention tank. A filter area of **240 m^2** and **67 m^2** has been modelled for the site's LPOD A (Burnside Road) and LPOD B (Christensen Street) respectively and deemed to be the required areas to achieve water quality reduction targets. Propriety devices to manage gross pollutants and hydrocarbons have also been recommended as part of the stormwater quality approach for the site during the operational phase of development.

Yours faithfully

BLAKE STEPHENS | **DIRECTOR**
Knobel Engineers

Attachment 1

Clarke's Design & Construct
9 Christensen Street South, Staplyton
(Ref: Q0343/SK-REV-A)



1 SITE PLAN
SCALE 1 : 600

FOR APPROVAL
NOT FOR CONSTRUCTION

North Point

Revisions

Rev	Date	By	Description
A	29/11/19	SSH	CLIENT APPROVAL

Designer

CLARKE'S design & construct
Industrial and Commercial Builders
PO Box 18
Arundel MDC, QLD 4214
Ph: 1300 11 25 11
Web: www.clarkes.net.au
ABN: 716 186 319 31 QBSA LIC: 15054063

Project
SITE INFORMATION

Address
9 CHRISTENSEN ROAD, SOUTH STAPYLTON QLD 4207

Client
TAYLEX INDUSTRIES

Drawing Title
SITE PLAN

Scale	Drawn	Checked	Approved
1 : 600	SSH	PT	AC

Date	Project Reference No.
NOV 2018	Q0343

Revision	Phase	Sheet No.
A	SK	A100

Attachment 2

Knobel Engineers
Conceptual Pre Development Stormwater Catchment Plan
(Ref: K5176/P001/3)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- 5.60 EXISTING CONTOURS (LIDAR)
- ● LPOD LAWFUL POINT OF DISCHARGE
- FLOW DIRECTION

EXISTING SERVICES LEGEND

- SWD EXISTING STORMWATER PIPE
- S EXISTING SEWER PIPE
- W EXISTING WATER PIPE
- SWD EXISTING STORMWATER PIPE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (ha)
A	1.950
B	1.065
C	1.341
D	0.339
EXT	0.091
TOTAL	4.686

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

N

NOTE:
CATCHMENT D NOT ASSESSED AS PART OF CONCEPT SMP

NOTE:
CATCHMENT C NOT ASSESSED AS PART OF CONCEPT SMP

CATCHMENTS D AND E ARE NOT ASSESSED AS PART OF THIS DEVELOPMENT

ISSUE No.	DATE	AMENDMENT
3	11-09-20	ISSUED FOR INFORMATION
2	07-08-20	ISSUED FOR INFORMATION
1	07/02/20	ISSUED FOR INFORMATION

KNOBEL ENGINEERS
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GOLD COAST | BRISBANE | BALLINA | ROCKHAMPTON

CLIENT: MR ALISTAIR LE PLASTRIER

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
9 CHRISTENSEN ROAD SOUTH
STAPYLTON, QLD 4207

DESIGN	DRAWN	APPROVED
HH	HH	

TITLE: CONCEPTUAL PRE DEVELOPMENT STORMWATER CATCHMENT PLAN

SCALE: 1:625 AT A1, 1:1250 AT A3 (0 10 20 30 40 50m)

PROJECT NO. K5176

DWG NO. P001

ISSUE 3

Attachment 3

Knobel Engineers
Conceptual Post Development Stormwater Catchment Plan
(Ref: K5176/P002/3)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- 5.60 EXISTING CONTOURS (LIDAR)
- ● LPOD LAWFUL POINT OF DISCHARGE
- FLOW DIRECTION
- FUTURE ROAD REGRADING TO FLOW TO TREATMENT DEVICE AT TIME OF RECONSTRUCTION.

EXISTING SERVICES LEGEND

- SWD EXISTING STORMWATER PIPE
- S EXISTING SEWER PIPE
- W EXISTING WATER PIPE
- SWD EXISTING STORMWATER PIPE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (ha)
A1	2.303
A2	0.042
B1	0.555
B2	0.157
C	1.249
D	0.339
EXT	0.091
TOTAL	4.686

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

LOT 5
SP256149

LOT 6
SP274108

LOT 7
SP260820

LOT 42
SP149134

CHRISTENSEN ROAD SOUTH

BURNSIDE ROAD

Bitumen Road

Bitumen Road

LOT 6
NOTE:
CATCHMENT D NOT ASSESSED AS PART OF CONCEPT SMP

BIO-RETENTION SIZING TO TREAT FUTURE RECONSTRUCTED ROAD.

NOTE:
CATCHMENT C NOT ASSESSED AS PART OF CONCEPT SMP

Large Concrete Panel Industrial Sheds.

CATCHMENTS C AND D ARE NOT ASSESSED AS PART OF THIS DEVELOPMENT

ISSUE No.	DATE	AMENDMENT
3	11-09-20	ISSUED FOR INFORMATION
2	07-08-20	ISSUED FOR INFORMATION
1	07/02/20	ISSUED FOR INFORMATION

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PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
9 CHRISTENSEN ROAD SOUTH
STAPYLTON, QLD 4207

DESIGN	DRAWN	APPROVED
HH	HH	

TITLE: CONCEPTUAL POST DEVELOPMENT STORMWATER CATCHMENT PLAN

SCALE: 1:625 AT A1, 1:1250 AT A3 (0 10 20 30 40 50m)

PROJECT NO. K5176

DWG NO. P002

ISSUE 3

Attachment 4

Knobel Engineers
Conceptual Stormwater Management Plan
(Ref: K5176/P003/3)

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- SITE BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- 5.60 EXISTING CONTOURS (LIDAR)
- ● LPOD LAWFUL POINT OF DISCHARGE
- FLOW DIRECTION
- FUTURE ROAD REGRADING TO FLOW TO TREATMENT DEVICE AT TIME OF RECONSTRUCTION.
- PROPOSED BIO DETENTION TANK (WATER QUALITY COMPONENT)
- PROPOSED DETENTION TANK (WATER QUANTITY COMPONENT)
- PROPOSED PIT RISER STRUCTURE
- PROPOSED DROP STRUCTURE
- SWD PROPOSED STORMWATER PIPE
- SWD EXISTING STORMWATER PIPE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (ha)
A1	2.303
A2	0.042
B1	0.555
B2	0.157
C	1.249
D	0.339
EXT	0.091
TOTAL	4.686

N

EXTERNAL CATCHMENT TO DISCHARGE AS SHEET FLOW ONTO SITE AS PER EXISTING CONDITION.
IF DEVELOPABLE IN FUTURE, PROVIDE SWALE DRAIN TO DISCHARGE TO ROAD.

PROPOSED Ø525 SW PIPE TO CONNECT INTO EXISTING STORMWATER INFRASTRUCTURE GULLY PIT AT
IL:4.77m AHD
APPROX DEPTH: 1.40m
(FROM COUNCIL RECORDS)

PROPOSED BIORETENTION BASIN

PROPOSED DIMENSION: 6m x 11m
EXTENDED DETENTION DEPTH: 0.3m
BIOFILTER AREA: 67m²
TOTAL BASIN AREA: 67m² (VERTICAL WALLS)

BASIN TO CONNECT INTO EXISTING STORMWATER INFRASTRUCTURE GULLY PIT AT IL:5.87m AHD (FROM COUNCIL RECORDS)

LOT 5
SP256149

TANK DETAILS & OUTLET:
HIGH FLOW: 2.5m WIDE WEIR @2.5m ABOVE TANK INVERT
LOW FLOW: Ø525 CLASS 3 RCP WITH 420mm ORIFICE PLATE.
TANK IL: 4.89m AHD
FINISH SURFACE ABOVE TANK: 8.39m AHD
TOP OF TANK RL: 7.89m AHD

PROPOSED 2m WIDE MAINTENANCE ACCESS RAMP.

PROPOSED DETENTION TANK

PROPOSED DIMENSION: 5.5m x 50m
TANK AREA: 275m²
TANK DEPTH: 3m
TOTAL TANK VOLUME (INC FREEBOARD): 825m³

TANK TO CONNECT INTO EXISTING STORMWATER INFRASTRUCTURE GULLY PIT AT IL:4.69m AHD (FROM COUNCIL RECORDS)

Ø525 SW PIPE TO CONNECT INTO EXISTING STORMWATER INFRASTRUCTURE GULLY PIT AT
IL:4.69m AHD
APPROX DEPTH: 0.84m
(FROM COUNCIL RECORDS)

PROPOSED BIORETENTION BASIN

PROPOSED DIMENSION: 5.5m x 43.6m
EXTENDED DETENTION DEPTH: 0.3m
BIOFILTER AREA: 240m²
TOTAL BASIN AREA: 240m² (VERTICAL WALLS)

BASIN TO CONNECT INTO PROPOSED DETENTION TANK.

PROPOSED 2.0m WIDE MAINTENANCE ACCESS RAMP

LOT 42
SP149134

LOT 6
SP274108

NOTE:
CATCHMENT D NOT ASSESSED AS PART OF CONCEPT SMP

BIO-RETENTION SIZING TO TREAT FUTURE RECONSTRUCTED ROAD EXTENT.

LOT 7
SP260820

NOTE:
CATCHMENT C NOT ASSESSED AS PART OF CONCEPT SMP

CHRISTENSEN ROAD SOUTH

BURNSIDE ROAD

SANDY CREEK

LPOD

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

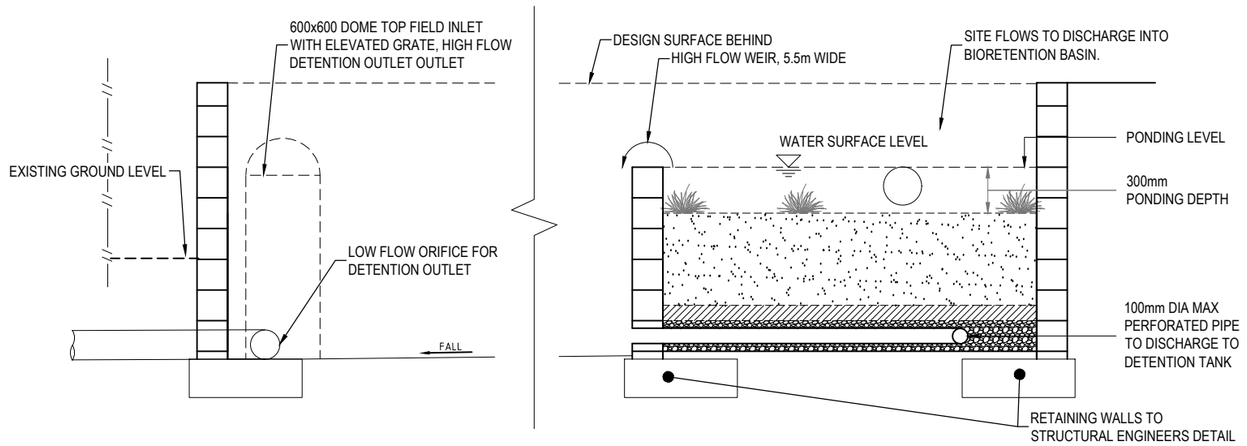
CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

CATCHMENTS C AND D ARE NOT ASSESSED AS PART OF THIS DEVELOPMENT

PROPOSED STORMWATER MANAGEMENT TREATMENT AREAS SHOWN ARE IN ACCORDANCE WITH CoGC HEALTHY WATER CODE

BIORETENTION LEGEND:

- FILTRATION LAYER, DEPTH = 400mm
- TRANSITION LAYER, DEPTH = 100mm
- DRAINAGE LAYER, DEPTH = 200mm



STORMWATER TREATMENT AND DETENTION TYPICAL SECTION
NTS

ISSUE No.	DATE	AMENDMENT
3	22-09-20	ISSUED FOR INFORMATION
2	07-08-20	ISSUED FOR INFORMATION
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CLIENT: MR ALISTAIR LE PLASTRIER

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
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STAPYLTON, QLD 4207

DESIGN	DRAWN	APPROVED
HH	HH	22-09-20

TITLE: CONCEPTUAL STORMWATER MANAGEMENT PLAN

SCALE: 1:625 AT A1, 1:1250 AT A3 (0 10 20 30 40 50m)

PROJECT NO.: K5176
DWG NO.: P003
ISSUE: 3