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CONSTRUCTION STORMWATER MANAGEMENT PLAN

Talbot Ave, Oakleigh

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Climate Change Statement

A wide range of sources, including but not limited to the IPCC, CSIRO and BoM, unanimously agree that the global climate is changing. Unless otherwise stated, the information provided in this report does not take into consideration the varying nature of climate change and its consequences on our current engineering practices. The results presented may be significantly underestimated; flood characteristics shown (e.g. flood depths, extents and hazards) may be different once climate change is taken into account.

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1. Introduction

Afflux Consulting have been engaged by Verve Projects to complete a stormwater management plan for the construction and filling of the existing quarry pit in the south western portion of the former Talbot Quarry site (known as Domain 4) on Talbot Ave, Oakleigh (Figure 1). This will cover the major drainage, flooding and water quality associated with the development. It will include an assessment of associated stormwater drainage assets, regional overland flow paths/creek systems and stormwater conditions within neighbouring properties. The intention of this report is to:

- Provide an assessment of major drainage and flooding associated with site;
- Retention of post development flows to pre-development levels;
- Ensure flooding of the site, or potential off-site impacts are reduced or eliminated;
- Ensure safe conveyance of existing overland flow regimes, if required;
- Meet the EPA best practice environmental management (BPEM) water quality requirements;
- Inclusion and consideration of guidelines and advice for stormwater management in line with Monash Council and Melbourne Water requirements; and
- Identification of mitigation and treatment options, if required.

To meet these requirements a range of hydrological, hydraulic and water quality modelling has been undertaken.

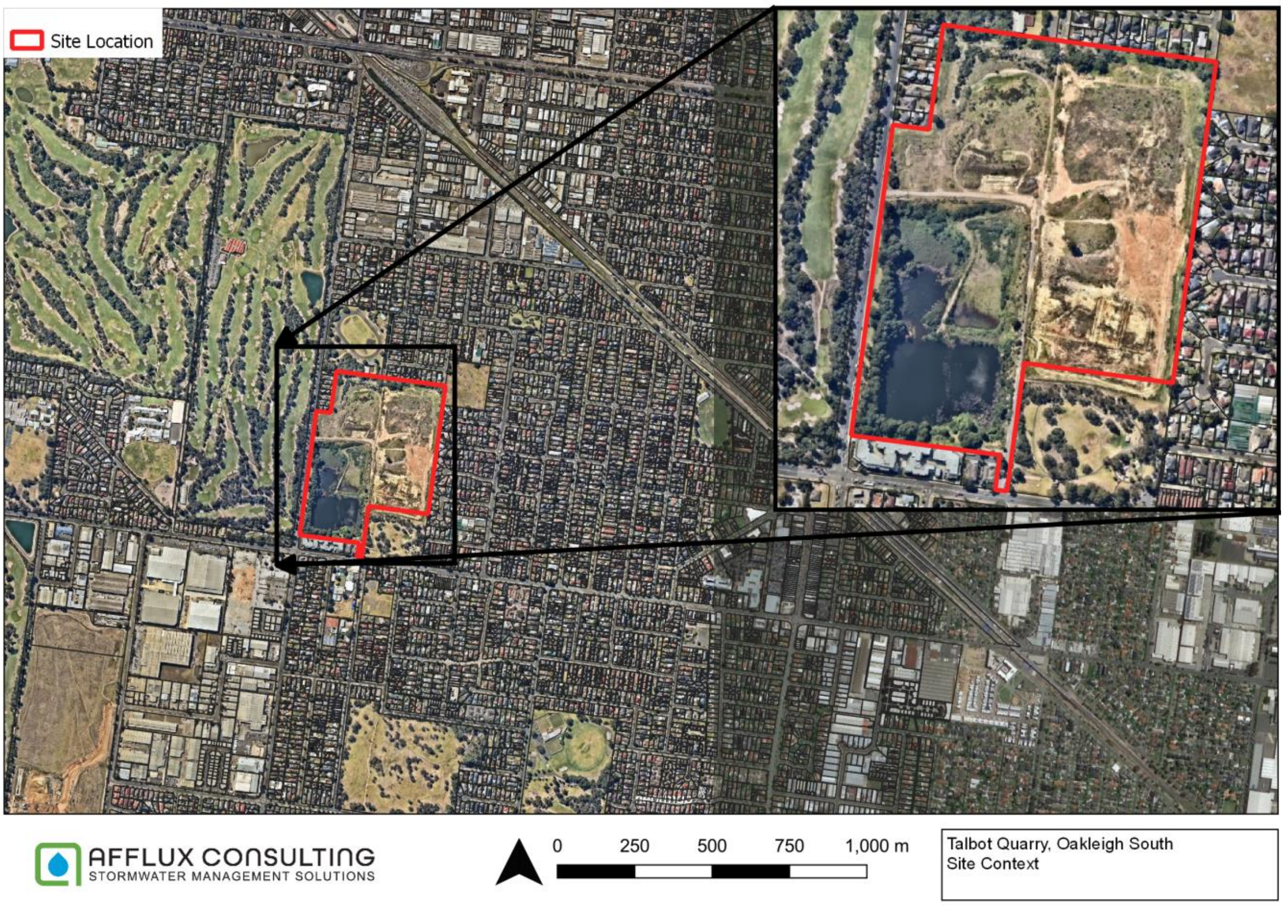

Figure 1. Aerial of site

1.1. Information Sources

A number of information sources have been used in the formation of this strategy; these include:

- Site inspection
- Aerial imagery
- DEPI planning scheme and cadastral information as accessed online 03/05/21
- Design Guidelines and Guidelines for Development
- Various Environmental Planning instruments and Planning Frameworks
- Preliminary plans and Site survey received from client
- Past models and existing infrastructure information
- Historic flood and water quality studies
- Topographic information including required LiDAR data sourced commercially.

2. Existing External Catchment

The existing external catchment delivering flows through to the site and site outlet has been delineated below (Figure 2). The broader catchment drains in a southerly direction, before crossing Centre Road via both pipe and presumably overland flows. The magnitude of the pipe flows and overland flows will be tested in this report.

The catchment to the north of the site generally has a minor network that drains to the north, though some overland flow may drain south. This will be tested in this report.

The catchment shown to the east of the site drains south to Centre Road, though a separate Centre Road pipe connection is utilised and a separate low point within Centre Road will drain the overland flows. Whether there is any cross connection between these catchments will also be tested in this report.

Figure 2. Existing catchments

2.1. Topographic Data

The LiDAR data supplied by Photomapping Services was used as the base information to generate the Digital Elevation Models (DEM), informing surface elevations required for the model. Figure 3 shows the data over the catchment area for the site. LiDAR survey information is shown in Table 1.

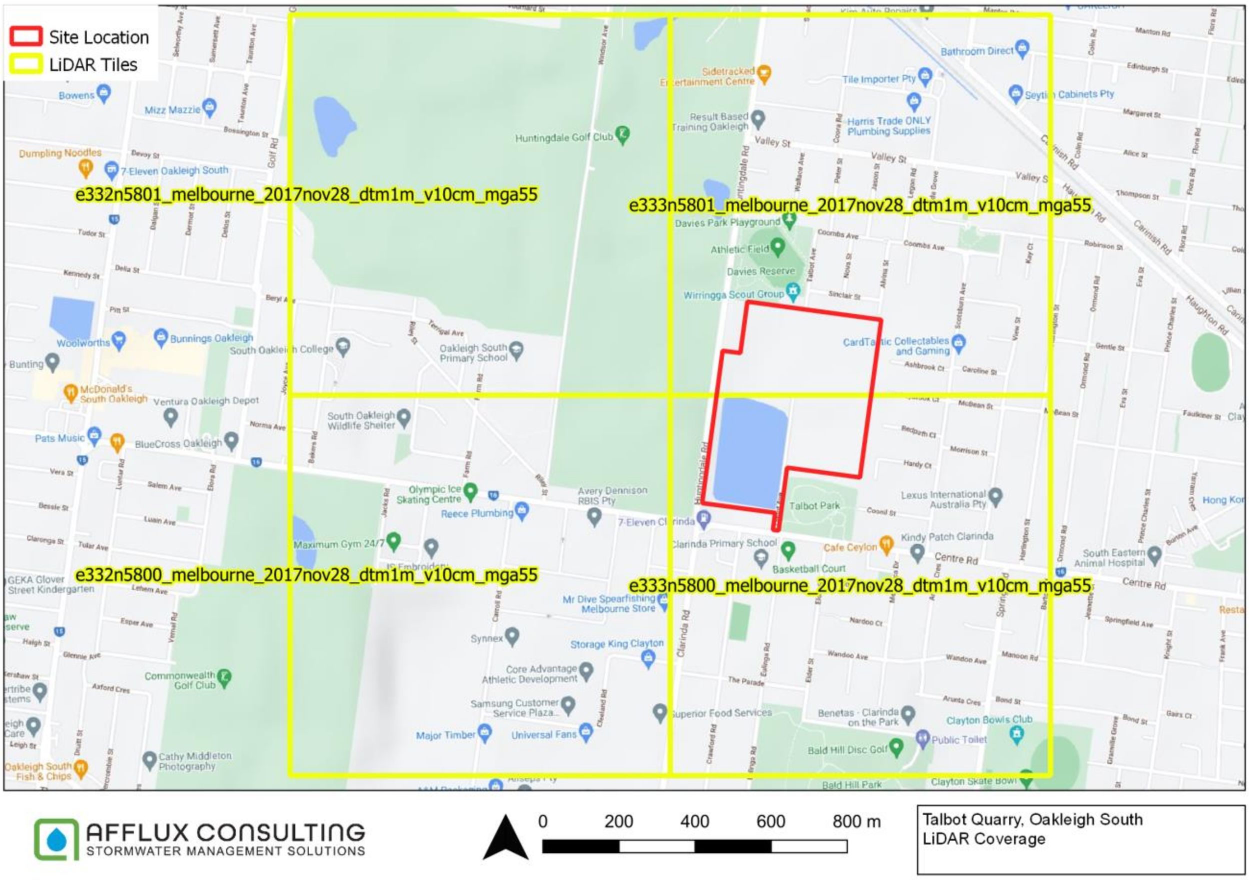

Figure 3. LiDAR Coverage

Table 1. LiDAR survey metadata

LiDAR survey metadata	
Acquisition Start Date	28 November 2017
Acquisition End Date	27 October 2018
Horizontal datum	GDA 94
Vertical datum	AHD
Map projection	MGA zone 55
Horizontal accuracy	0.2 m
Vertical Accuracy	0.1 m

2.2. Site Visit

Investigation into the best discharge configuration to meet water management requirements will be undertaken in this report. A number of photos of the existing site can be seen in below.

Source: Low point

Figure 4. Low Point Huntingdale Rd

Source: Afflux Bunding on Huntingdale Rd

Figure 5. Hunting Dale Road interface

Source: Southern Apartments

Figure 6. Southern Boundary Interface with apartmer

Source: Long section

Figure 7. Low Point Huntingdale Rd

Source: Site Western Entrance

Figure 8. Site Western Entrance

Figure 9. Southern Boundary

3. Catchment Design Objectives

All development has the potential to adversely affect downstream environments through the effects of stormwater runoff. Increased impervious areas resulting in increased volumetric and peak flows have been extensively researched and linked to downstream environmental degradation. Contaminants contained in the runoff have also been linked with adverse changes to both water quality and stream ecology. The contribution of increased runoff can be linked to downstream flooding and capacity constraints.
To combat these affects a range hydrological and water quality mitigation measures have been researched and legislated. The design objectives for this catchment are considered below.

3.1. General Considerations

The Victorian State Planning Policy Framework includes provisions incorporating the provisions for stormwater management in its integrated water management clauses. The Monash City Council, as part of its planning requirements, incorporates BPEM water quality targets, setting out objectives for stormwater runoff.

3.2. Water Quality Requirements

Current water quality guidelines require developers to ensure water quality for the site meets best practice load-based reduction targets when compared with the unmitigated developed scenario. As listed by the Victorian EPA Best Practice Environmental Management (BPEM) Guidelines the development must meet:

- 80% Total Suspended Solids (TSS) reduction
- 45% Total Nitrogen reduction
- 45% Total Phosphorus reduction
- 70% Gross Pollutant capture

These water quality requirements will be met in as part of this masterplan.

3.3. Integrated Water Management

Water quality and re-use have interactions relevant to stormwater management requirements. In attempt to reduce potable water consumption and ensure volumetric flow reductions within waterways, stormwater management incorporates consideration of integrated water management strategies as appropriate to site. Generally, when implementation is appropriate, flows from site will be reduced due to reuse and provision of alternative water sources. Recommended water saving and reuse targets must be explored alongside water quality requirements as reuse results in an improved capacity to meet Total Nitrogen removal. Thereby, allowing opportunities to reduce treatment downstream. Provision of water quality requirements alongside reuse opportunities and current planning provisions have been analysed within this report as a part of stormwater management.

3.4. Flood Storage Requirements

The development shall be designed to ensure that flows are not to increase above the pre-development levels. Generally, this would be applied to the 100 year Average Recurrence Interval (ARI) storm only and checked at each of the site discharge points. Attenuation will be applied at the basin to be designed and reductions in flow peak will be determined at the outlet of the basin.

3.5. Flood Protection Requirements

A number of flood protection objectives are set for any development including nominated freeboard above the relevant flood level. These freeboards levels, and objectives are generally:

- 600mm freeboard to floor level above any Riverine or Retarding Basin Top Flood Level
- Local stormwater protection may have a lower level of freeboard (300mm).
- All retardation infrastructure will be designed to be cut into the natural surface avoiding any potential dam wall construction issues.
- Any Basin should be significantly offset from existing infrastructure including the buildings to the south of the site and the Council Park area

4. Hydrology

To evaluate the hydrology of the proposed filling influences and greater catchment a number of hydrological models have been formed and compared. This method has been chosen to best represent hydraulic influences and hydrologic challenges in the area.

Given the complex catchment interactions, hydrology estimation has been achieved through a hybrid of 1d and 2d modelling. In order to generate the full ensemble of storms durations and temporal patterns, a DRAINS model was created representing the catchment as a series of sub-catchments. The features of the DRAINS model are outlined below.

- Ensemble approach all storms for the 1% AEP as per ARR19
- All durations from 10 min to 9hr
- Rainfall data sourced from ARR Datahub and BOM
- IL/CL model applied as per ARR Datahub and ARR19 recommendations:
    - IL: 20mm
    - CL: 3.3 mm/hr
    - Imp IL: 1mm
    - Imp CL: 0mm
    - This local model directs all roof flows directly to the pipe network, whilst non-building areas are applied with direct rainfall (hydrograph distribution).

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4.1. DRAINS Model

A DRAINS model was constructed to model the hydrology in this catchment. A single node Initial Loss/Continuing Loss model was constructed for the entire catchment. The Loss Model assumptions, Time of Concentration assumptions have been listed overleaf. The Time of Concentration pervious catchment was based on Adams Method, with the impervious areas based on a velocity calculation for the catchment.

The peak flow for the golf course catchment can be seen in Figure 11 with the critical storm hydrograph shown in Figure 12. As can be seen the critical duration is the 15-minute storm, with temporal pattern 10. This is a largely expected result with a highly urbanised, relatively steep catchment with the shorter storms dominating the catchment flows.

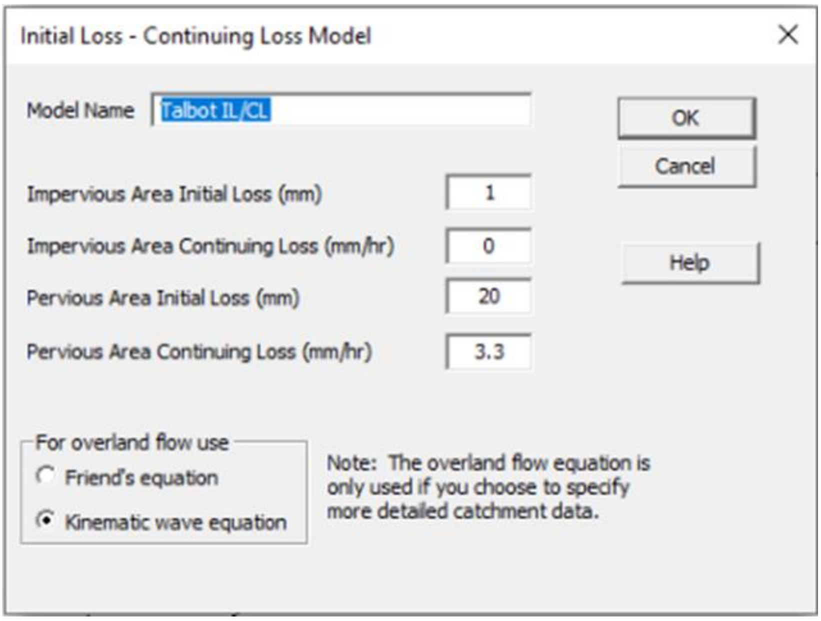
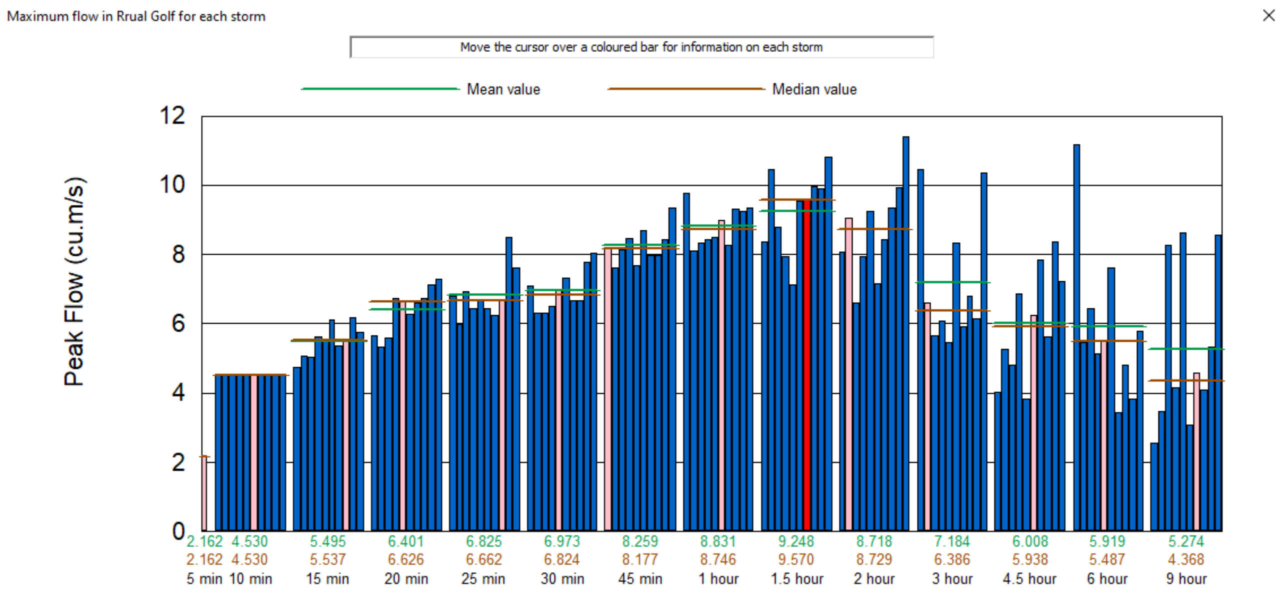
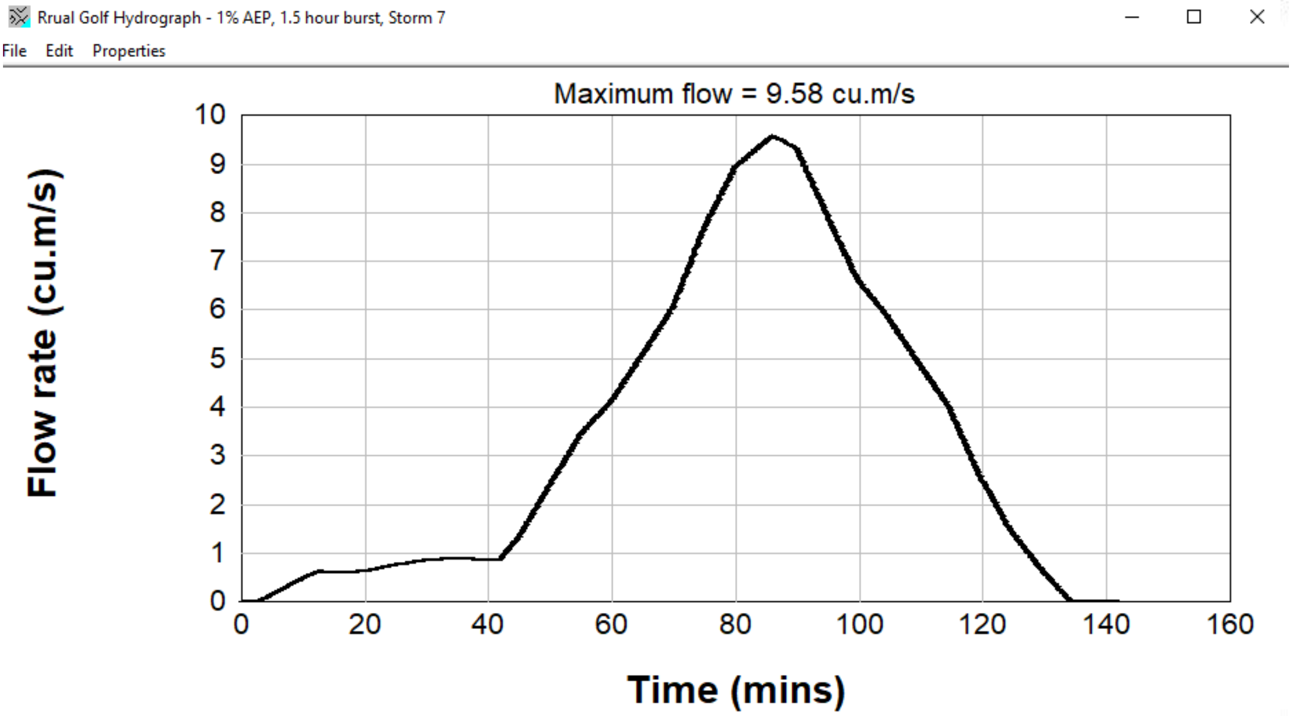


Figure 10. Representation of DRAINS model



Source: TalbotCatchment.drn (Afflux, 2021)

Figure 11. Peak Flows for the Catchment



Source: TalbotCatchment.drn (Afflux, 2021)

Figure 12. Peak Catchment Hydrograph Golf Course Catchment

Initially, the model was run to emulate existing condition considering all storms. This existing conditions model was also used to estimate the existing capacity of the local drainage network. The local network drains are shown in Figure 13 and are shown to connect south of the site through a series of pipes and channels before connecting into the 975 mm pipe under Centre Road. To assess the capacity of this network, the key capacity constraints were analysed. These were identified as:

• The Golf catchment flow upstream of the site is around 9.5 m^3/s. A hydraulic model will be used to assess how much of this flow reaches both the site, and the pipe network

• The Site in Existing condition produced 2.81 m^3/s peak flow rate in current conditions. However, all of this flow is currently captured by the quarry effectively removing this flow from the catchment

These hydraulic controls will be used to assess the masterplan requirements and effectiveness of any mitigation (retarding basin) treatment.

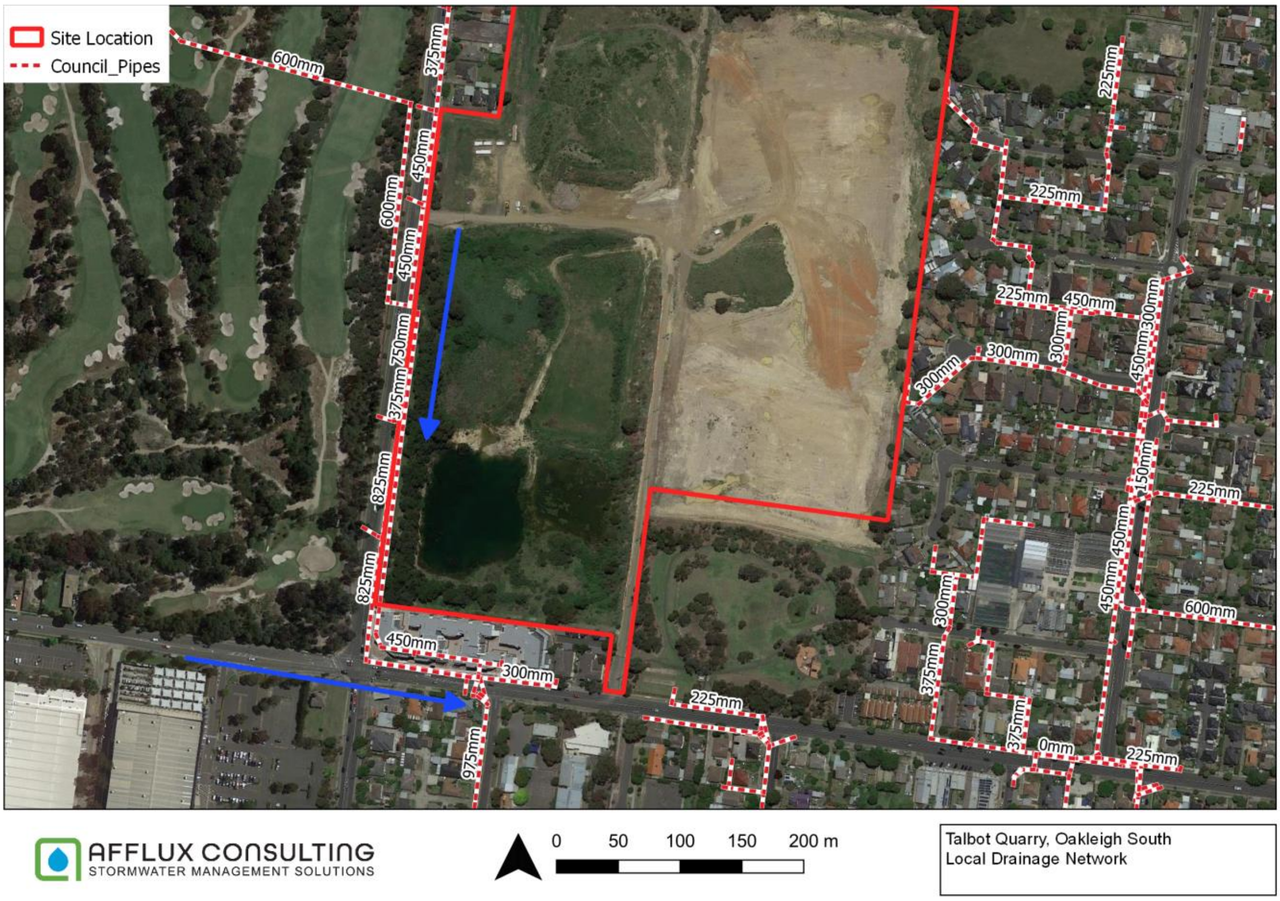


Figure 13. Site Local Drainage Network

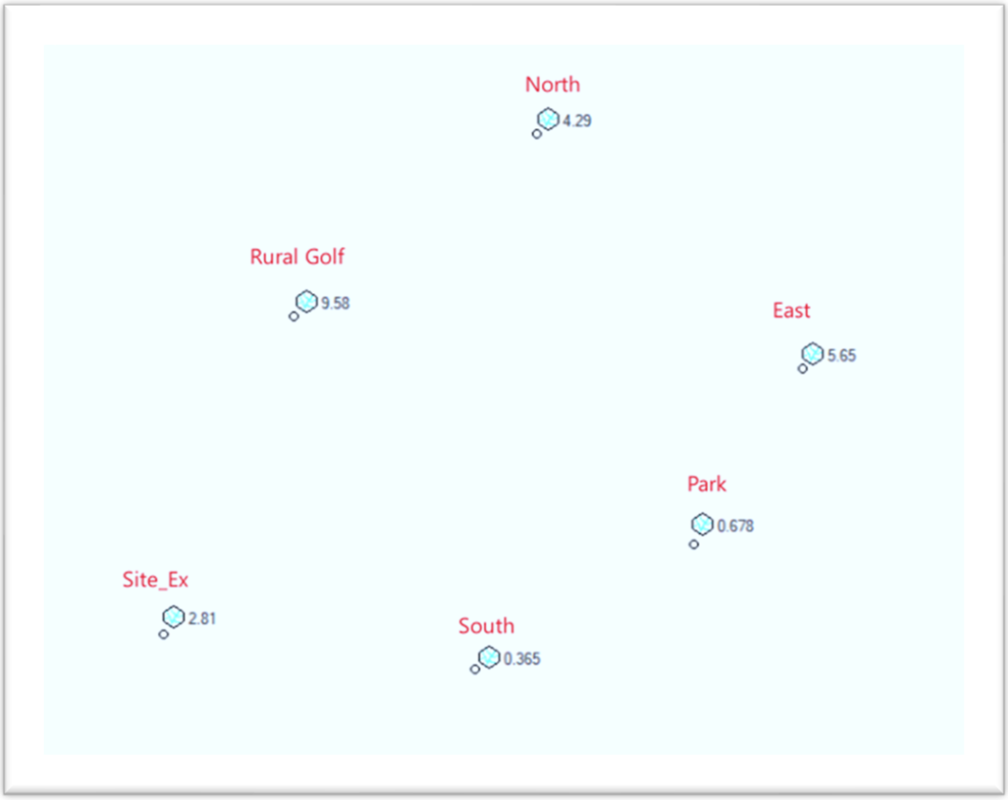


Figure 14. DRAINS model layout for 1% AEP peak flow_ Existing

5. Flood Modelling

As part of flooding investigations for the site, the regional and local stormwater conditions were considered. The major influencing factors include the impact of flooding from rainfall on the immediate catchment as well as interactions with greater regional flows and relevant upstream events. The main considerations include the availability of flood plain storage, safe overland flow conveyance, water surface levels in relation to proposed developed floor levels and any changing impacts to neighbouring properties.

Once the estimated catchment flows were calculated (discussed within Hydrology section), a high definition model was constructed to understand flood mechanisms during a 1% AEP storm event. The model was built and run in TUFLOW using a linked 1d/2d approach, parameters and data sources.

5.1. Model Parameters

Initial model setup for the catchment model involved the accessing survey surface levels and a setup of existing drainage networks for the model area. The model extent is based on topographical catchment boundaries and shown in magenta below (Figure 15) and includes:

- Land use in the model has been determined based on inspection of aerial imagery, planning zones, and visual inspection and has been used to inform Manning's roughness factors in the model.
- Downstream boundary conditions have been established based on an examination of topography.
- Initial water levels have been set for all the major dams in the golf course and on site. Effectively the dams are filled before the model starts
- The flows as derived in Figure 14 have been applied to the model. In catchments where there is a significant pipe network, these flows have been applied directly to the pit network (north, east and south catchments). In catchments with little or no pipe network (Golf Course, Site, Talbot Park) flows have been applied directly to the grid equally.

Parameters for the model area are included shown in Figure 16

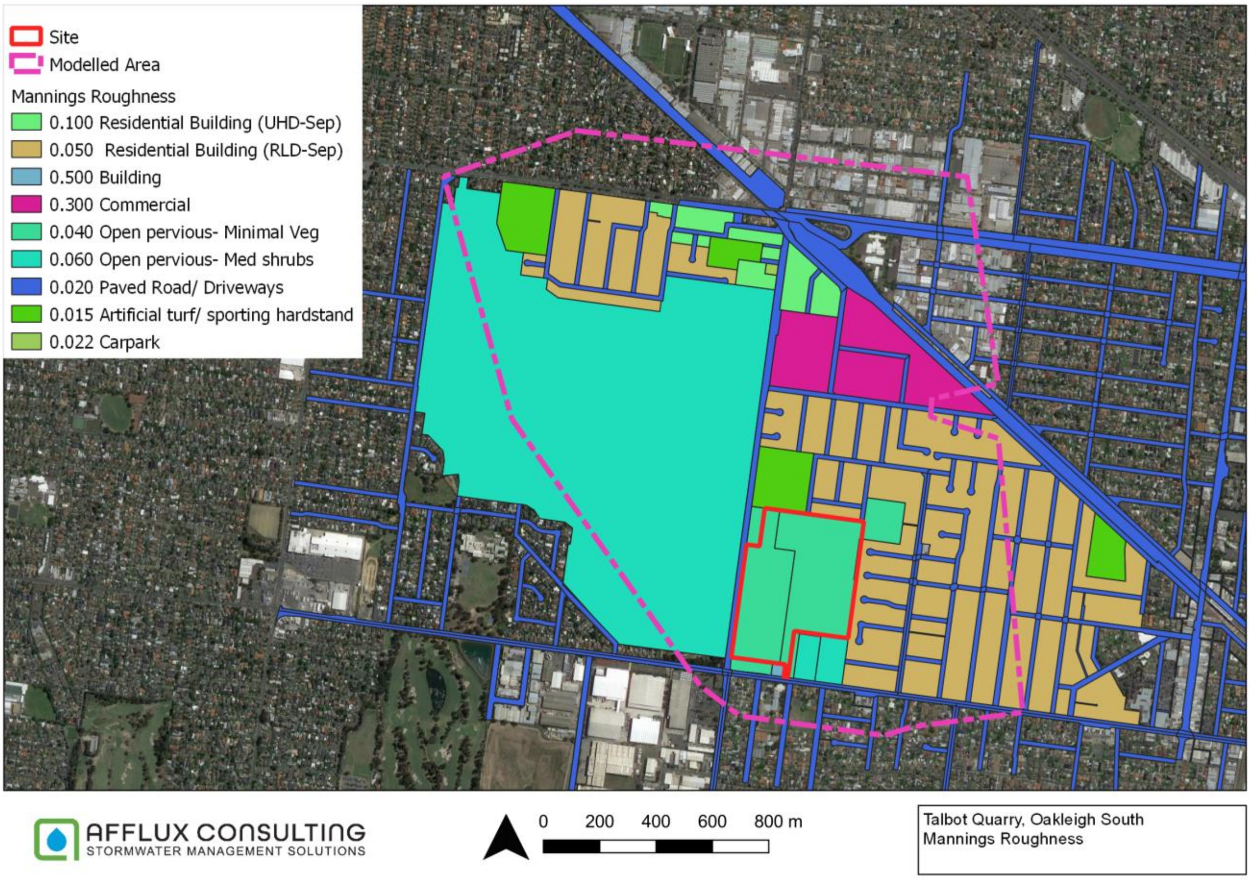


Figure 15. Manning's Roughness

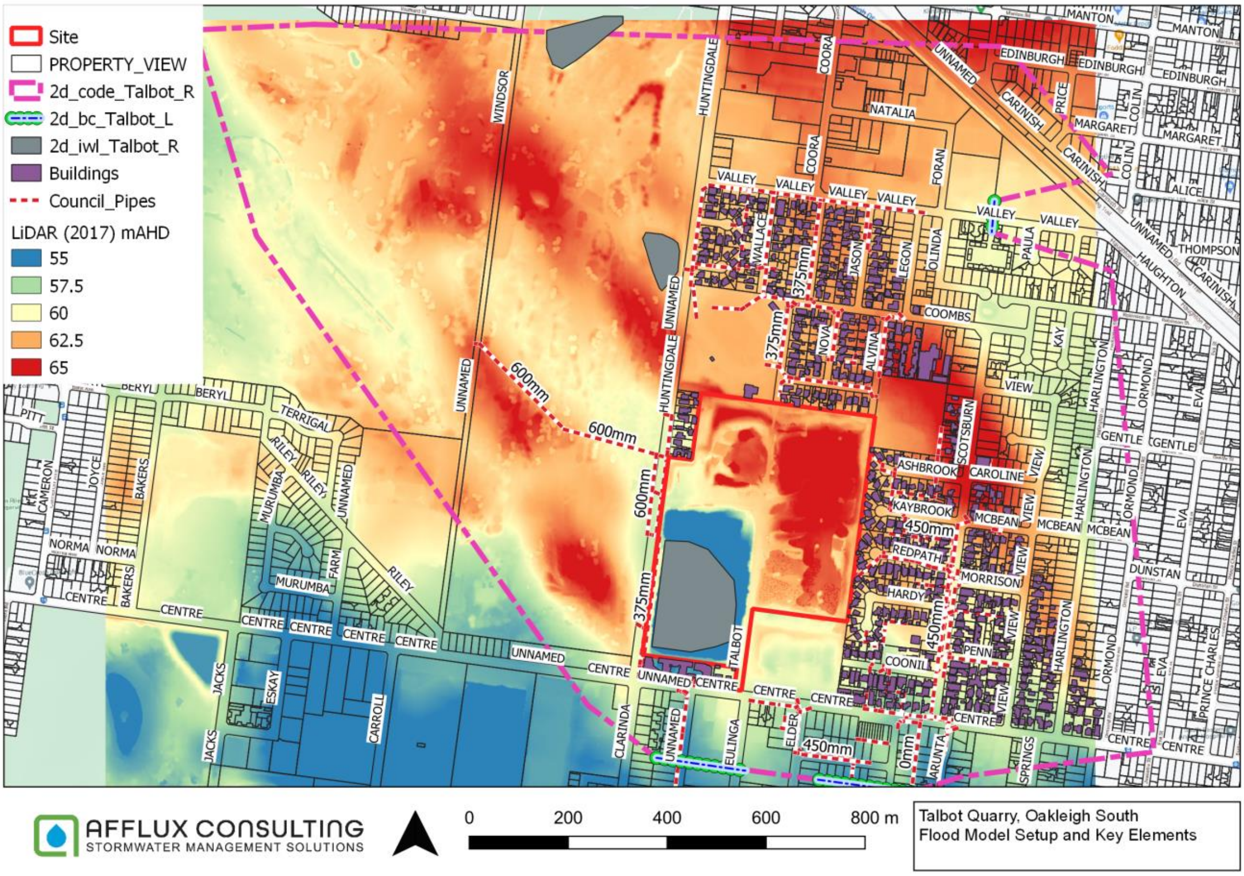


Figure 16. Model parameters and setup

5.2. Model Reporting and Analysis

The model has been set up to report the following key indicators:

- Water Surface Elevation (WSE) showing the water level relative to a datum (m AHD) at each model grid cell.
- Maximum water depths for each model grid cell.
- Maximum water depths at defined reporting cross sections immediately onto and off the site.

Analysis of results will show WSE and water depth based on flood conditions and will be used to establish flood extents on the property. Water Level Difference maps will be provided to show afflux changes between existing and developed conditions. Additional maps will be produced to provide an assessment of the proposed masterplan against safety criteria. Based on the assessment of these results recommendations for floor levels, site access and treatments will be made.

5.3. Existing Conditions

The existing conditions flood model can be seen in Figure 17 below. A number of key catchment understandings have been highlighted by this modelling, these include:

- There is significant catchment storage within the Huntingdale golf course. All dams within the course have been filled with water before the model starts, and as such most of this storage is within the course greens and fairways

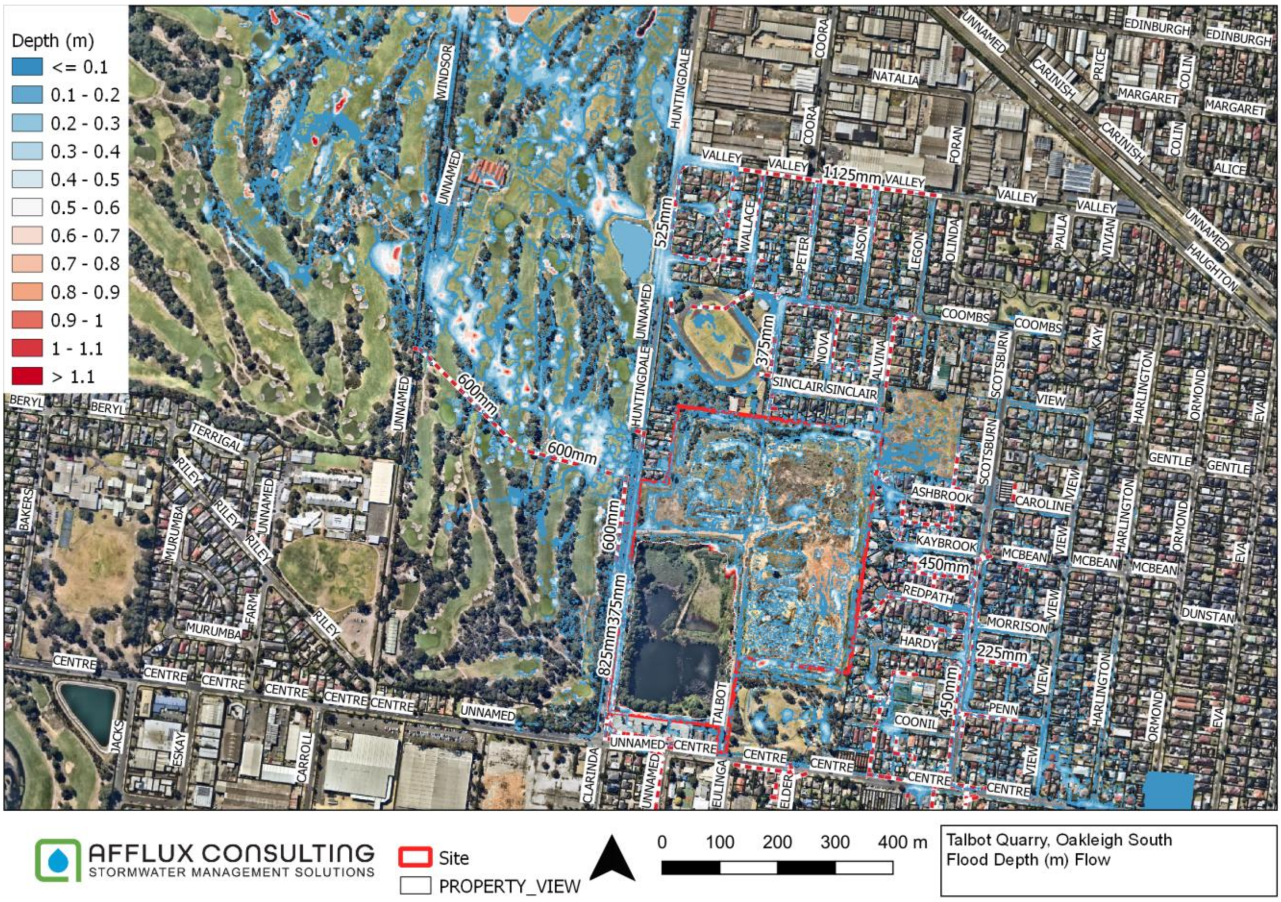


Figure 17. Existing conditions flood depth

5.4. Flow Checks

The key flow locations for the catchment have been recorded and are presented here. In this case this includes the flows crossing of Huntingdale Road (Figure 18), the pipe flow running along Huntingdale Road (Figure 19), and the pipe flow crossing Centre Road (Figure 20).

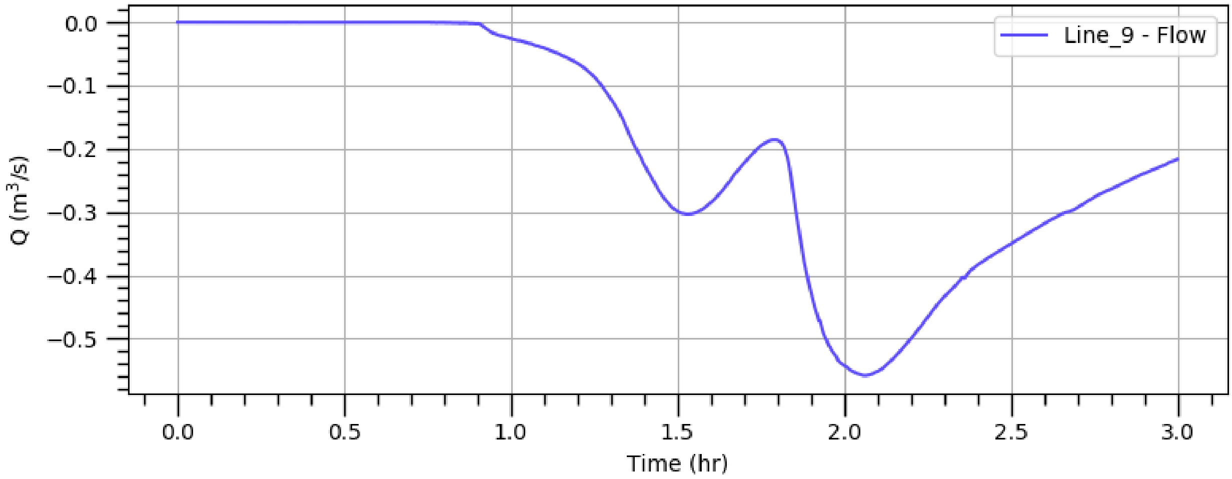
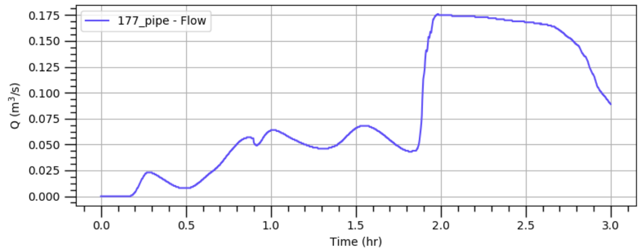
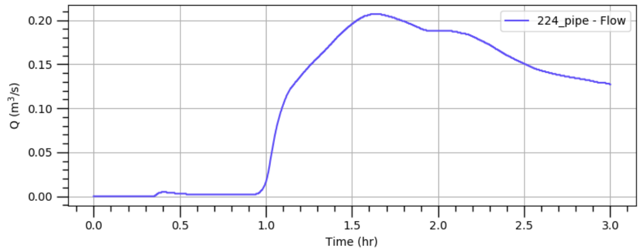


Figure 18. Huntingdale Road Peak Flows (Absolute Values)



Source: *Talbot_v02_h_Max*

Figure 19. Peak Pipe flow Huntingdale Rd



Source: *Talbot_v02_h_Max*

Figure 20. Peak Flow Crossing Centre Road

These flows indicate the significant under utilisation of the large pipes both crossing Huntingdale Road, but also conveying flows around to Centre Road. This is primarily associated with the identified significant catchment storage located in the golf course. This finding has significant implications for the site development, as additional capacity of the downstream system should be available.

Offsite Flood Management During Filling stages

Currently this external flow (~0.6m³/s) is excluded from the site by the bunding along Huntingdale Road and then ponds at the low point of Huntingdale Rd. This low point is at an elevation of approximately 58.5m AHD. The lowest outlet from the site (Talbot Rd) has an outfall level of approximately 59.5m AHD, at least 1m higher. As such no flow path can be provided through the site, particularly with the southern interface completely blocked by an existing development.

Given that the flow magnitude at the low point is measured to be approximately 0.6m^3/s, with significant attenuation within the neighbouring golf club, a number of methods are suggested to protect the development parcel in the future from this flow path, these include:

- The inlet capacity at the low point of Huntingdale Road should be improved as part of these development works. The current single throat pits at ~50m intervals are the limiting factor for flows. Double pits (ideally with enlarged throats) should be installed at each of these low point locations to maximise the capture flow. These pits should be designed to collectively capture at least $0.6m^3/s$ at less than 350mm depth. The pipe in this location is at least a 750mm and should have capacity for this maximum flow.

- The outfall from this site should be limited to around 0.4-0.5 m^3/s to minimise the impact on the Centre Road crossing. This outfall (a 975mm RCP) has a capacity of around 1 m^3/s. The 0.6 m^3/s from the low point on Centre Rd plus the site outfall and catchment with timing effects (it is expected the local development will discharge well before the Huntingdale GC flow) should therefore minimise any impact on Centre Road.

Initial treatments

Given that the site currently has no external discharge, flow management will be needed for the initially backfilling phase (i.e., it cannot be delayed to a later phase of work). At this stage we would require a storage basin capable of growth and integration. A storage solution could thus be constructed in a staged approach, and in that case, flows must be limited to < 0.5-0.6 m^3/s at all times through construction.

It is recommended that geotechnical advice be sought to ensure that all proposed stormwater solutions presented within this report be undertaken as standard practice.

Temporary Requirements During Filling

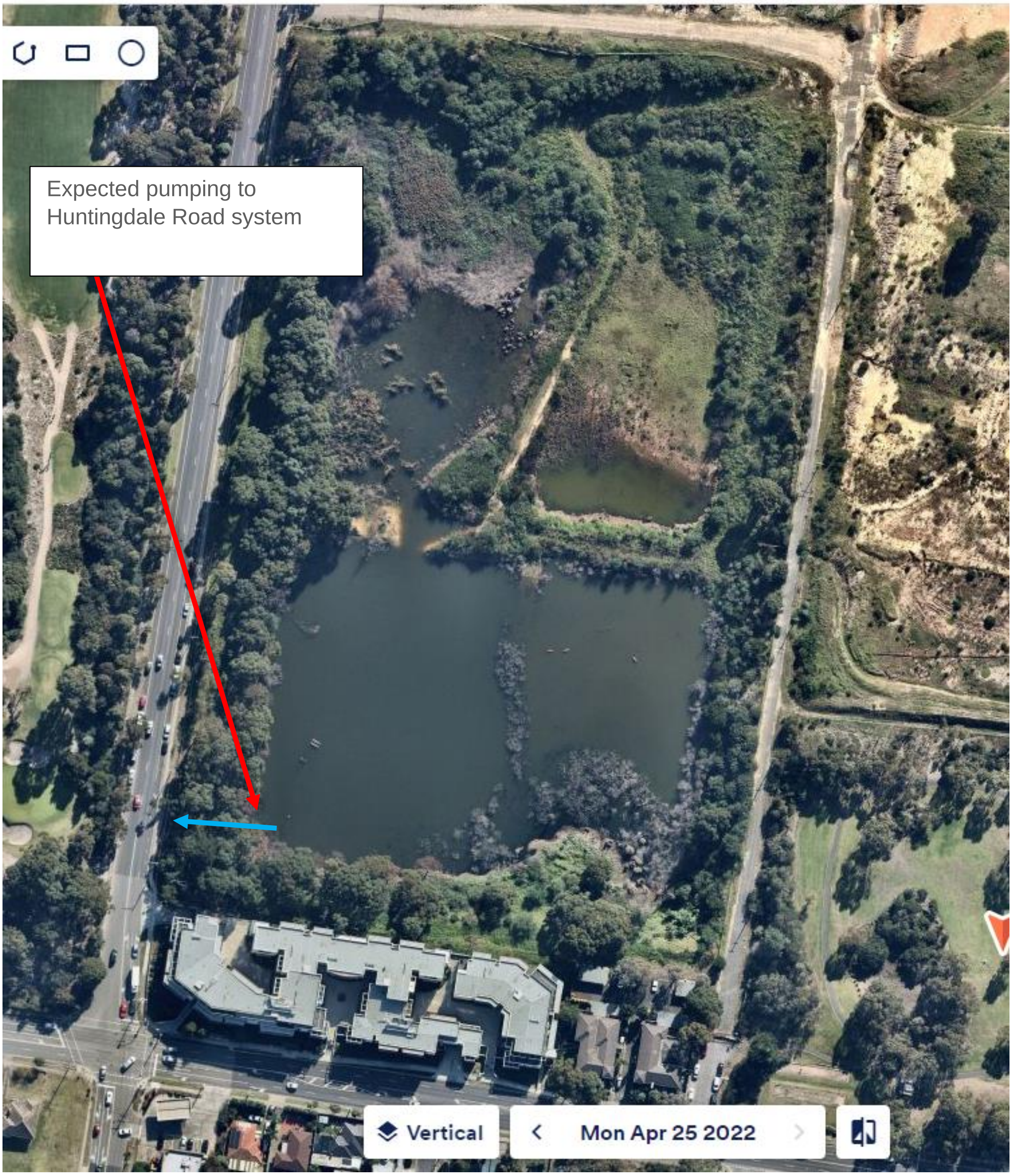
To develop the site, substantial draining, filling, and settlement enhancement techniques will be required. This can be extensive and as such, a stormwater staging strategy is required throughout this process. The envisaged stages and treatments are included below.

Stage 1 – Draining of existing ponds

The existing ponds will need to be drained as part of the filling works. The following requirements should be applied to this stage:

- The pumped flow rate should be limited to a proportion of the downstream pipe network. As shown in Figure 22 it is expected that the bulk of this pumping will be directly to the Huntingdale Road stormwater network. Either directly to the 825mm main line, or more likely to the 375-sub line closer to the property. As a general rule, the pump rate should not exceed ~ half of the capacity of the pipe system therefore:
  - If using the **825mm** main line the pump rate should be limited to **400L/s**
  - If using the local **375mm** line the pump rate should be limited to **200L/s**
- The pumped water will need to meet the requirements of the EPA publication 275 *Construction techniques for sediment pollution control (EPA, 2019).* This states a TSS discharge requirement of no more than 10mg/l or an increase of less that 10% from existing conditions (whichever the larger).
- Council approval for the discharge point (Legal point of Discharge) will need to be applied for and approved.

Figure 21. Local Pipe Network



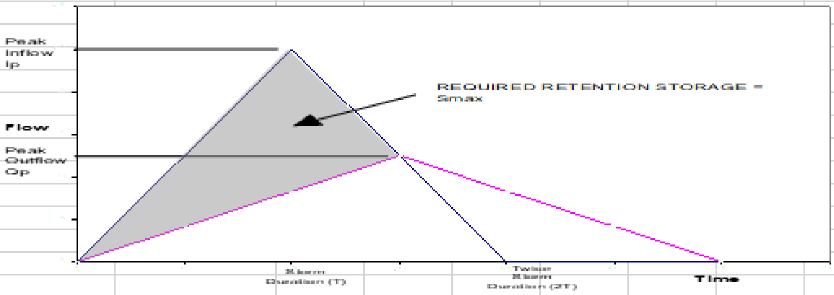
Source: Afflux Concept December 2021

Figure 22. Proposed Treatment Concept

Stage 2 – Backfill Domain 4

The fill and settlement stages are expected to take a number of years, with the aim to produce a developable surface once complete. In doing so, the surrounding areas need to be directed to a centralised controlled outlet such as a retarding basin.

A preliminary Boyd's calculation suggests that storage for the site to maintain the 0.5m³/s (as defined earlier in this letter) is less than 1,000m³ (Figure 23).



$$S_{max} = V_1 (1 - Q_p/I_p)$$

S_{max} = Maximum Volume of temporary Storage (m^3)
V_1 = Volume of inflow flood (m^3)
I_p = Peak discharge of inflow hydrograph (m^3/s)
Q_p = Peak discharge of outflow hydrograph (m^3/s)

To be input by user
Calculated by spreadsheet

Catchment Area (A) =	18	ha
Runoff Coefficient (100 Year) =	0.2	
100 Year Effective Catchment Area = ∑CA =	3.60	ha
Restricted outflow requirement =	0.5	m^3/s

Storage requirement is highest value of S_{max} calculated in the table below
Critical storm duration is the storm duration when S_{max} occurs

Continue table until a clear Smax is calculated

Storm Duration (min)	100 Year Intensity (mm/hr)	I_p (m^3/s)	Q_p (m^3/s)	V_1 (m^3)	S_{max} (m^3)
30	76	0.76	0.50	1368	468
45	57.4	0.57	0.50	1550	200
60	46.5	0.47	0.50	1674	-126
90	34.4	0.34	0.50	1858	-842
120	27.7	0.28	0.50	1994	-1606

Source: Afflux June 2022

Figure 23. Boyd's Retention requirement

Expected Staging and placement of storages in Stage 2 works

Practically, during the filling stages it is expected that a number of temporary pond locations will be used as filling occurs in different areas of the site (it is expected that filling and settlement will take a number of years and occur in a number of phases.).The key requirement is that at least 1,000m³ of airspace storage is maintained at all times during the backfilling operations. As backfilling of each part of the Domain 4 area is completed, and the next stage of filling the basin is proposed, a new storage location will need to be constructed to maintain this requirement. A conceptual possible staging representation of this is shown below.

***CONCEPTUAL LOCATIONS ONLY**

Figure 24. Conceptual Staging of possible storages

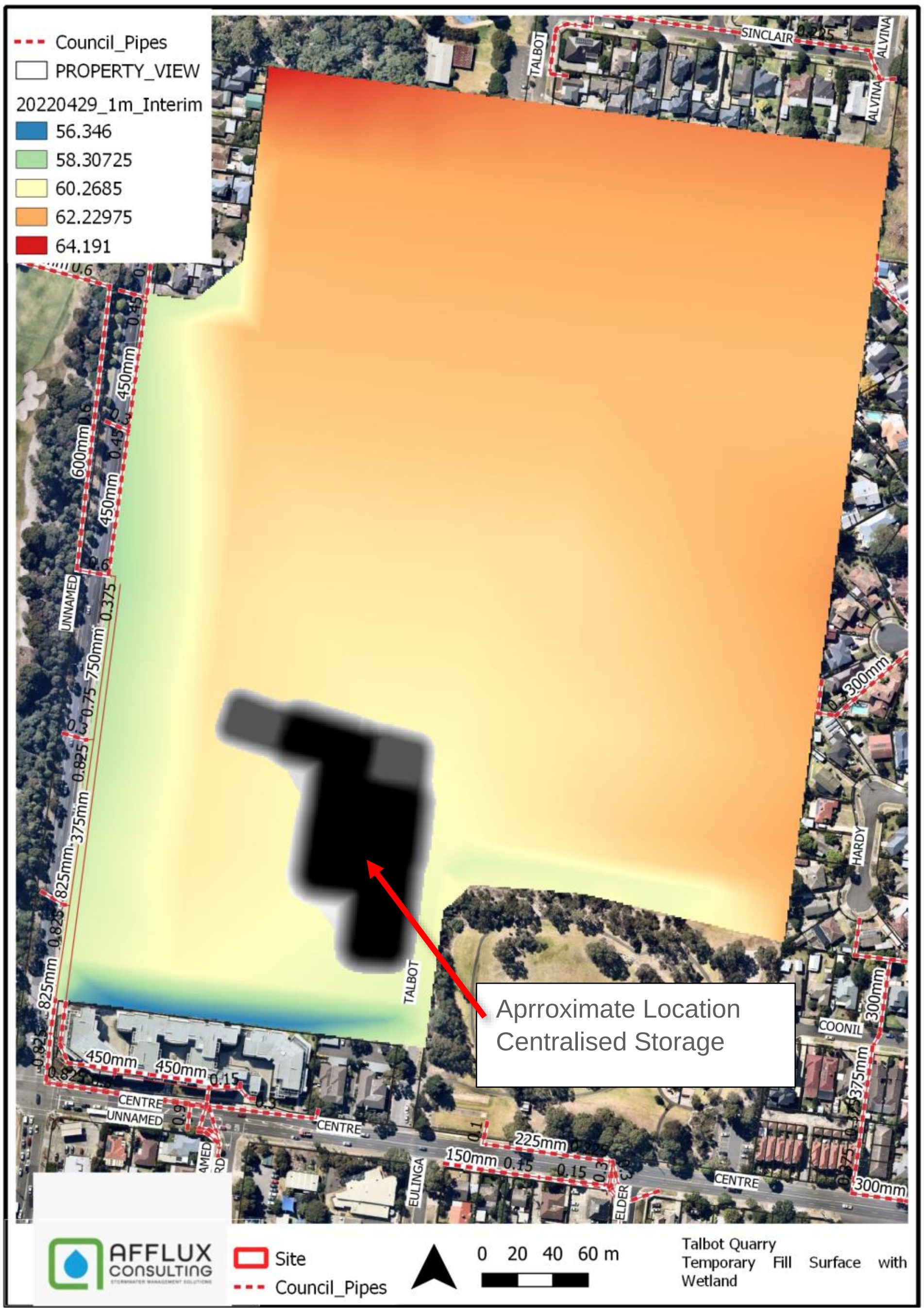
A number of operational rules regarding the storages should be in place at all times, these include:

- The storages should always limit site flows to ~0.5m³/s. As shown above this requires a minimum 1,000m³ of free draining storage at any time
- The storages should be located close to either a pumped outfall, or overland flow location. In the initial stages this is Huntingdale Road and Talbot Ave. In the latter stages Talbot Ave is the only possible outfall
- The discharge of waters will meet the EPA construction site requirements as stated earlier
- There is a trapped low point in the latter stages between Talbot park and the subject site. Drainage methods for this area will need further negotiation between Council and the proponent. There are a number of methods to exclude flooding of this area including upstream storage, better conveyance (pipes etc), or filling of the land.
- There are a number of site constraints that need to be considered at all times, these include:
  - The Apartments and buildings to the south of the site should maintain a the minimum distance of 50m offset to any temporary storage location or in line with specific getotechnical advice at that time. This is in line with good dam design and construction practice.
  - There are a number of significant trees outside of the quarry pit that need to be maintained and protected
  - Flow paths from the northern and eastern interfaces in particular need to be maintained through the filling stages.

Stage 3 – Backfill Early Works Completion

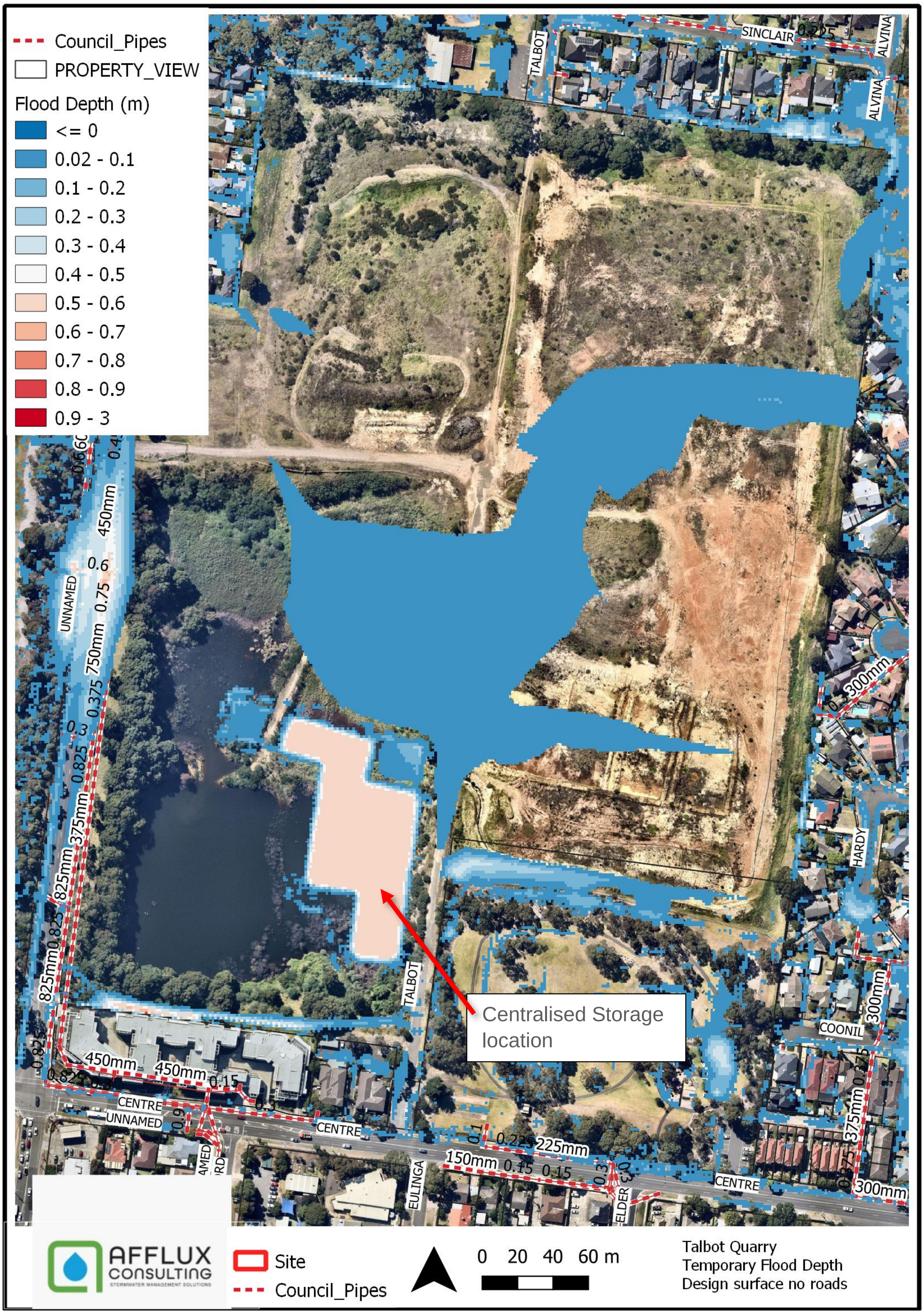
At completion of the bulk filling of Domain 4, when the final layers of fill have been installed, a more permanent retarding basin is to be constructed in a more central location. This will replace the retarding basins established in Stage 2 outlined earlier in this letter. This more permanent retarding basin has been proposed as shown in the darker shades on Figure 7 below.

As a final check, the filled surface was reviewed with this more centralised single retarding basin. At this point it is suggested that the basin be constructed with sediment management (but no planting or sophisticated outfalls). This scenario is shown below. The flood management can be seen in Figure 26 and as can be seen no offsite flood issues are foreseen.



Source: 20220429_1m_Interim with prelim wetland

Figure 25. Temporary Fill Surface



Source: Talbot_v06_d_Max

Figure 26. Temporary Flood management with central retarding basin

6. Conclusions

A set of temporary flood management requirements have been set for the former Talbot Quarry site Domain 4 backfill works. These flood management items should be used to ensure the site does not impact neighbouring residencies. To complete the temporary management scenarios, the following permit conditions are suggested:

- A designed temporary settlement surface in line with the one modelled in the Temporary Requirements document should be used
- At least 1,000m^3 of storage should be provided on the site during the temporary management stages at all times
- Any discharge from the site during the draining stages should meet the flow rates and provisions outlined earlier in the document (ie no more than 0.5m^3/s).

7. Abbreviations and glossary

For clarification, provided are terms referred to within this report and their definitions as applicable to stormwater and water engineering.

TERM (Abbreviation)	DEFINITION
Afflux	A measure of the increase in water elevation (or flood level difference) at a given location, relative to the water elevation that would have occurred.
Alluvium\alluvial material	Extensive deposits of sand, silt and/or clay formed by a river or flood, typically forming a floodplain. Alluvium is generally unconsolidated.
Annual Exceedance Probability (AEP)	The likelihood of a storm event or flood occurring or being exceeded within any year. Where, $$AEP = 1 - e^{(\frac{-1}{ARI})}$$
Attenuation	Reduction in the magnitude of a flood peak
Australian Rainfall and Runoff (ARR)	Australian Rainfall and Runoff guidelines document.
Average Recurrence Interval (ARI)	A statistical estimate of the average length of time (in years) between equivalent (or larger) flood events. Note. Events do not occur at regular intervals. This is an average and not the expected elapsed time until the next exceedance. e.g. a “100 year ARI flood event” has a 1% exceedance probability each year.
Australian Height Datum (AHD)	Vertical height in meters above the mean sea level.
Baseflow	The slow component of catchment runoff, not immediately in response to a storm event. Encompasses interactions with seepage and groundwater discharge into a waterway.
BPEM	Best practice environmental management guidelines used for planning, designing or managing stormwater systems or urban land uses
Catchment	The upstream land and water surface area that drains to a specified location under consideration.
Consequence	Outcome or impact of an event.
Critical Storm Duration	The length of time of a rainfall event that results in the peak flow or level at a particular location of interest for a given AEP.
Cumec	An abbreviation of cubic meters per second, a unit of discharge (m^3/s)
Drainage Network **or System**	A system of natural or constructed flow paths within a catchment used to convey runoff to its outlet. This may include surface or subsurface systems such as pipes, channels, gutters, overland flow paths, culverts, water storages, etc.

Design Event	A probabilistic or statistical flood or rainfall event used for flood/flow estimation processes for a given AEP.
DELWP	Department of Environment, Land, Water and Planning
EPA	Environmental protection agency
Extended Detention	Distance above normal water level in where stormwater is temporarily stored
Evaporation	The transfer of water, as vapour, from a water surface to the air
Evapotranspiration	The transfer of water, as vapour, from near the earth's surface to the air. Includes open water surfaces, ice, frost, soil and transpiration from plants.
Freeboard	The difference in height between the calculated water surface elevation and the top, obvert, crest of a structure or the floor level of a building, provided for the purpose of ensuring a safety margin above the calculated design water elevation.
Flood	Inundation of normally dry land by water that has exceeded the capacity of the normal confines of waterbodies, water storages or watercourses.
Flood Frequency	Descriptor for the annual exceedance probability or average recurrence interval of a flood
Floodplain	The land area which experiences flooding during high discharge events.
Hazard	Potential for damage or harm. Considered alongside consequence and likelihood of occurrence.
Hydrological Analysis	Developing and understanding a set of relationships to determine how rainfall is converted into runoff or streamflow (includes consideration of climate, losses, soil types, etc).
Hydraulic Design	The process of numerically analysing actual or expected flow conditions (such as water surface elevation and velocity) associated with a given hydraulic structure or overland flow.
Infiltration	The downward movement of water into a catchment surface or infiltration system. Largely governed by soil conditions, vegetation and antecedent moisture content.
Loss rate	Removal (loss) of water from the rate of rainfall that occurs during the process of forming stormwater runoff. Usually measured in units of mm/hr. The assumed loss rate usually varies across the drainage catchment in accordance with known or assumed surface conditions.
Local Authority	Any local or regional external authorities (including local and State Governments or non-government authorities) that have a legal interest in the regulation or management of a given activity, or the land on which the activity is occurring, or is proposed to occur.
Manning's 'n' Roughness Coefficient	The numerical representation of the hydraulic roughness of a conduit, flow path or channel as used in the Manning's formula.
Rainfall Excess	The portion of rainfall that contributes to streamflow
Rainfall Intensity	The rate at which rain falls, typically measured in mm/hour.

Runoff	The part of rainfall (or snow/hail) not lost to infiltration, evaporation, transpiration or depression storage that flows from the catchment area past a specified point.
Sedimentation Basin	A basin or tank in which sediment collects primarily through the actions of gravitational settlement. The basin facilitates low-velocity, low-turbulent flows to facilitate the settling of coarse sediment particles from stormwater runoff.
Soil Erosion	The detachment and transportation of soil and its deposition at another site by wind, water or gravitational effects. Although a component of natural erosion, it becomes the dominant component of accelerated erosion as a result of human activities, and includes the removal of chemical materials.
Stage	Elevation of the water surface in a stream measure to some convenient datum
Storm	In hydrology this includes any rainfall event. Unlike common usage implying a period of extreme weather with intense rain and strong wind.
Stormwater Flooding	Inundation by local runoff caused by heavier than usual rainfall. Stormwater inundation is caused by local runoff before it has entered a watercourse or joined watercourse flow. In a rural setting and within large rural allotments, we define stormwater flooding as sheet flow caused by local runoff before it has concentrated into a watercourse, including a drainage channel, stream, gully, creek, river, estuary, lake or dam, or any associated water holding structure.
Surface Water or Inundation	Any water collecting on the ground or in an open drainage system or receiving water body. In this report we use these terms to discuss water before it is categorised into flood, stormwater or other.
Temporal pattern	The time sequence of rainfall intensity. A representation of the variability of rainfall throughout a storm event.
Water Balance	An account of all the water in a specified system. Includes measurement of all inflows, outflows and changes in stored water volumes.
Wetland	A natural or constructed area of land inundated temporarily or permanently with shallow water that is usually slow moving or stationary

8. References

Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick, M., and Testoni, I. (Editors). (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia: Geoscience Australia.

Coombes, P. and Roso, S. (Editors). (2019). *Runoff in Urban Areas, Book 9 in Australian Rainfall and Runoff - A Guide to Flood Estimation*, Commonwealth of Australia: Geoscience Australia.

Melbourne Water. (2007). *Principles for Provision of Waterway and Drainage Services for Urban Growth*, Melbourne Water

Melbourne Water. (2013). *Waterway Corridors: Guidelines for greenfield development areas within the Port Phillip and Westernport Region*, Melbourne Water

Melbourne Water. (2019). *Flood Mapping Projects Guidelines and Technical Specifications*, Melbourne Water Corporation

Melbourne Water. (2020). *Constructed wetlands design manual*. Melbourne Water Corporation

The State of Victoria Department of Environment, Land, Water and Planning. (2019). *Guidelines for Development in Flood-prone Areas*, Department of Environment, Land, Water and Planning

Victoria Stormwater Committee. (1999). *Urban Stormwater: Best Practice Environmental Management Guidelines*, CSIRO.

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