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WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Bowen Hills Concrete Batching Plant – Site Based Stormwater Management Plan

April 2014

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1. INTRODUCTION

Water Technology has been commissioned by Hanson Construction Materials Pty Ltd to prepare a Site Based Stormwater Management Plan (SBSWMP) for a proposed re-development of the former Brisbane City Council's bus depot at 236 Abbotsford Road, Bowen Hills.

It is understood that the Bus Depot operations were discontinued in October 2013. The intention for the re-development is the siting of a new Concrete Batching plant.

The location of the site is shown on Figure 1-1.

Figure 1-1 Site Location (Aerial Imagery Source: Google Earth)

This site falls under the Bowen Hills Priority Development Area (PDA) which covers 108 ha of land as detailed at http://www.dsdip.qld.gov.au/infrastructure-and-planning/bowen-hills.html. Development in this PDA comes under the purview of the Department of State Development Infrastructure and Planning (DSDIP) and Economic Development Queensland (EDQ).

It is noted that this is a working document and shall be updated to incorporate the final design details and any future changes implemented.

2. TERMINOLOGY

This report uses generally accepted engineering industry standard definitions for stormwater, water quality and flooding terminology as provided in Table 2.1 below. This general terminology is based on the glossaries of several documents as provided in the reference section of this report.

Table 2.1 General Terminology

Term	Definition
Annual Exceedance Probability (AEP)	The probability of exceedance of a given discharge within a period of one year. Can be expressed as a percentage (e.g. 1% change in any one year) or 1 in Y [years] (e.g. a probability of 1 in 100). This report will generally use ARI terminology.
Average Recurrence Interval (ARI)	The average or expected period between exceedances of a given discharge expressed in years. This is a another method of expressing the magnitude of a particular event in probabilistic terms (e.g. a "100 year ARI flood" can also be described as a flood with an AEP of "1%" or "1 in 100"). The ARI of a flood event is a statistical estimate that gives no indication of when a flood of that size or larger will occur next.
Backwater	A body or area of water where there is little or no current that is connected to a drainage system or receiving water either above or below ground (pipe drainage). The water level of the backwater area is governed by the adjacent drainage system or receiving water.
Breakout	Breakout flows occur when flow in a river system reaches a level high enough to engage a wider or an alternate flow path other than the normally defined channel.
Catchment	The area of land contributing stormwater runoff to a particular site or point under consideration. It always relates to a particular location and includes the catchments of tributary streams as well as the main stream.
Critical Storm Duration	The duration of the storm event that produces the largest flood discharge at the location of interest. Critical storm duration depends on the catchment size, topography (slope, drainage path, presence of storages or basins), magnitude of storm, land use of the catchment (e.g. urban, rural or forest). In general terms the critical storm duration provides an indication of how long a catchment takes to deliver peak flow to a particular point of interest following rainfall commencement. When the rainfall is not at a constant intensity the timing of the peak flood will depend on the temporal pattern of rainfall.
Drainage System	A system of gully [street or field] inlets, pipes, overland flow paths, open channels, culverts and detention basins used to convey runoff to its receiving waters.
Flood	The covering of normally dry land by water that has escaped or been released from [i.e. has exceeded the capacity of] the normal confines of any lake, or any river, creek or other natural watercourse, whether or not altered or modified; or any reservoir, canal, or dam.

	A flood can be caused by excessive rainfall, storm surge, dambreak or a tsunami.
Local Runoff	Refer to "Runoff" and "Stormwater Flooding".
Minor flood level	Defined by the BoM as a flood level that causes inconvenience. Low-lying areas next to watercourses are inundated which may require the removal of stock and equipment. Minor roads may be closed and low-level bridges submerged.
Moderate flood level	In addition to the above for minor flooding, defined by the BoM as when the evacuation of some houses may be required. Main traffic routes may be covered with flood waters. The area of inundation is substantial in rural areas requiring the removal of stock.
Major flood level	In addition to the above for minor and moderate flooding, defined by the BoM as when extensive rural areas and/or urban areas are inundated. Properties and towns are likely to be isolated and major traffic routes likely to be closed. Evacuation of people from flood affected areas may be required.
Rainfall Intensity	The rate at which rain falls, typically measured in mm/hour. Rainfall intensity varies throughout a storm. This variation is called a temporal pattern.
Receiving Waters	A body of water (normally sea, river, creek or larger drainage system) that receives flow from a generally smaller (tributary) drainage system.
Runoff	That part of rainfall which is not lost to infiltration, evaporation, transpiration or depressions in the ground. We add that for the purposes of investigating or studying a flood it is the amount of rainfall that drains along the surface and into the "drainage system" or directly into receiving waters. Local runoff is that which occurs locally to a point in question (i.e. within a backyard) and has not yet reached a drainage system.
Stormwater (Stormwater Inundation or 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.

In addition to the above standard terms the terminology specific for this report is listed below:

Table 2.2 Specific Terminology

Term	Definition
CBP or Plant	These terms refers to the Concrete Batching Plant being the intended future use of the site.
Council	This term refers to Brisbane City Council
Operator	This term refers to Hanson Construction Materials Pty Ltd
Site	This term refers to the property located at 201-235 Abbotsford Road in Bowen Hills (formerly the Brisbane City Council bus depot).
SBSMP	Site Based Stormwater Management Plan

3. SCOPE OF WORK AND OBJECTIVES OF THE REPORT

This report describes the site, features and proposed use as well as documenting the water quality risks for stormwater discharging off the site for the operational phase of the development. It also discusses the measures proposed to ensure that appropriate environmental standards are adopted and integrated into the future operations.

This SBSMP document will form part of an overall Environmental Management Plan (EMP) for the proposed development. The overall EMP will address other environmental factors such as management of impacts on Air, Noise, Waste and the Construction Phase Erosion and Sediment Control Management Plan (ESCMP). Recommendations for the Construction Phase are provided in Appendix C. Any revisions to the ESCMP required by the contractor during the construction phase of the development will also be required to be documented by the contractor before site construction activities take place.

Broadly the objectives of this SBSMP are:

- Protect and/or enhance downstream environments, by appropriately managing the quality and quantity of stormwater runoff.
- Ensure stormwater and its associated drainage systems are planned, designed and managed with appropriate consideration and protection of community health and safety standards, including potential impacts on pedestrian and vehicular traffic.
- Adopt and promote water sensitive design principles, including appropriately managing stormwater as an integral part of the total water cycle, protecting natural features and ecological processes within urban waterways, and optimising opportunities to use rainwater/stormwater as a resource.

Consequently, this SBSMP specifically provides details of:

a) General issues in relation to the existing site in relation to surface water;
b) Water quality objectives for the receiving waters;
c) Water quality sources and impacts;
d) Water quantity sources and impacts;
e) Discussion on the protection of the development (and high risk pollutant operational areas) from flooding;
f) The stormwater management infrastructure proposed to be installed and operated (measures to minimise harm);
g) Water conservation and recycling;
h) Responsibility and training;
i) Operations Management and maintaining records in relation to stormwater;
j) Procedures to deal with environmental non-compliance and corrective actions;

This SBSMP is prepared based on several Legislative and Policy documents and guidelines as discussed in Section 5.

4. EXISTING SITE DETAILS

4.1 General

The site is located at 236 Abbotsford Road Bowen Hills. It includes 13 lots with a total area of approximately 1.8 ha. The site is adjacent to Breakfast Creek which runs along its eastern boundary and approximately 1 km upstream from the confluence with the Brisbane River.

Ground level elevations in the current Bus Depot development area (i.e. excluding the bank of the creek and internal drainage) range from approximately RL 2.1 to RL 3.0.

The site already includes a number of buildings as part of the bus depot operations and the majority of the remainder of the site consists of open paved surfaces as shown on Figure 4-1.

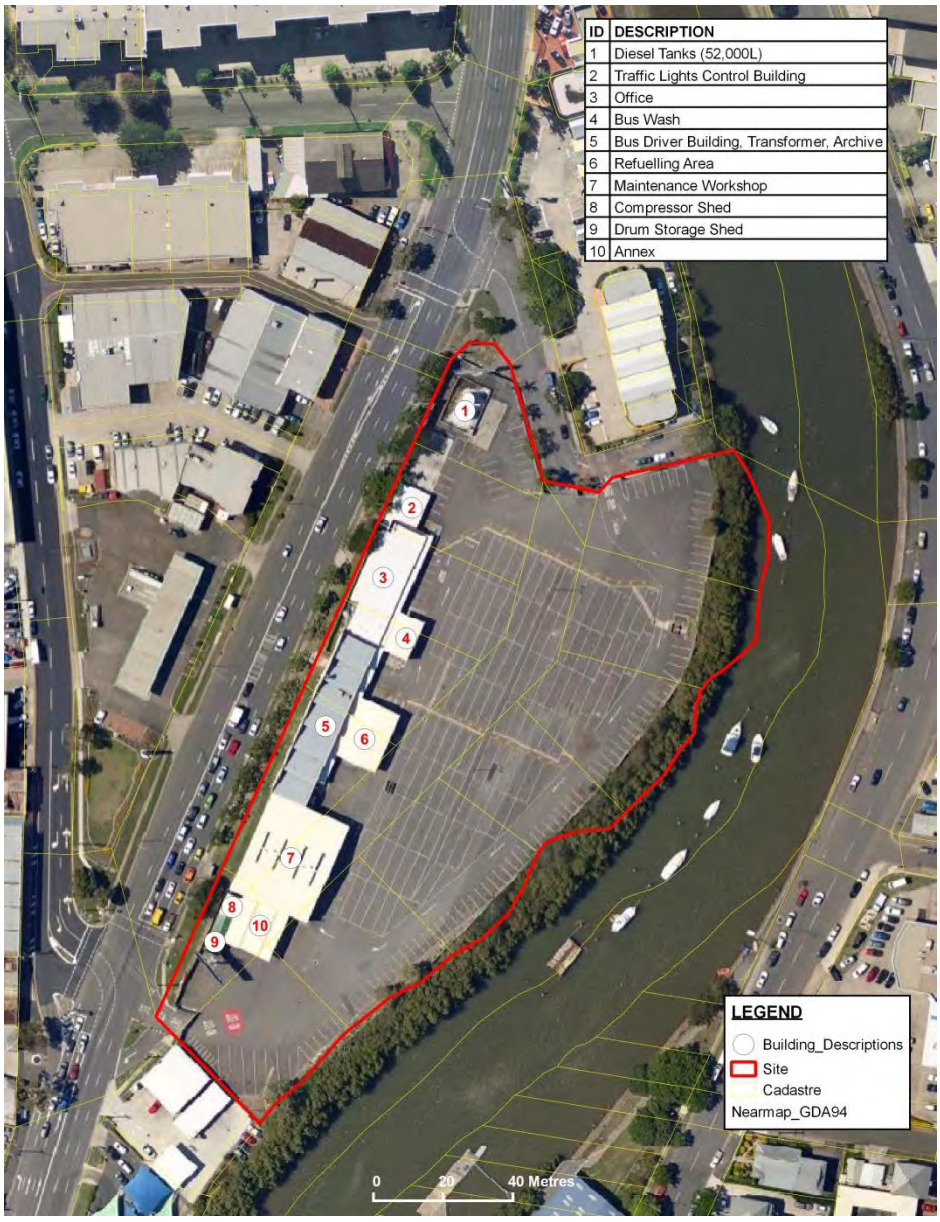

Figure 4-1 Existing Site Buildings

4.2 External Local Stormwater and Flooding Sources

Water Technology has prepared a report entitled, "Bowen Hills Concrete Batching Plant – Flood Investigation Report" which has been submitted as part of this development application. This report outlines details in relation to several sources of inundation for the site and surrounding area. Table 4-1 summarises these inundation sources.

Table 4-1 Flood Inundation Sources

Source	Level (m AHD)	Notes
Brisbane River Flood Inundation - the Defined Flood Level.	2.7	This is the Defined Flood Level based on the January 2011 Flood Event. It is in excess of a 100 year ARI flood event.
Storm Tide 100 year ARI 20 year ARI	 2.5 2.1	These values have been obtained from BCC (2008) and incorporate 300mm for climate change.
Breakfast Creek Flood Inundation - 100 year ARI.	2.5	A 100 year ARI event in Breakfast Creek based on a MHWS tide level in the Brisbane River.
Local Stormwater Inundation – 100 year ARI	2.58	The stormwater drainage system for the local catchment from Abbotsford Road to Breakfast Creek is undersized and there are restricted overland flow routes resulting in pondage occurring on Abbotsford Road to this estimated level for a 100 year local storm event. This ponded stormwater is not able to enter the site due to building and topographic restrictions.
Highest Astronomical Tide (HAT)	1.65	The site has a minimum level of approximately 2.0 m therefore it is above the high water mark and highest astronomical tide level.
Mean High Water Spring (MHWS)	1.06	

Figure 4-2 shows Council's mapped overland flow path areas from the Draft new City Plan Document. It does not show any overland flow paths identified within the site or surrounding area and this has been confirmed in the flood report by Water Technology (refer Water Technology, 2014). Consequently the site is not estimated to receive any stormwater from external sources but is inundated by riverine, stormtide and Breakfast Creek sources.

With minimum pavement ground levels of approximately 2.1 m AHD, the site is estimated to have a 20 year ARI flood immunity.

Figure 4-2 Overland flow flood planning area (Source: BCC Draft new City Plan)

4.3 Internal Stormwater Drainage

Drainage of the site occurs via surface and roof discharge to Abbotsford Road and a small portion to Gebbie Street with the majority of the paved areas draining directly to Breakfast Creek via an internal stormwater drainage network.

BCC eBiMap provides some stormwater drainage details (refer Figure 4-3). It indicates that from Abbotsford Road, there is a 450 mm dia stormwater pipe that conveys stormwater through the site underneath the Staff Amenities building. This pipe transitions to a 525 mm diameter pipe within the site before discharging to Breakfast Creek. The pipe is subject to tidal inundation.

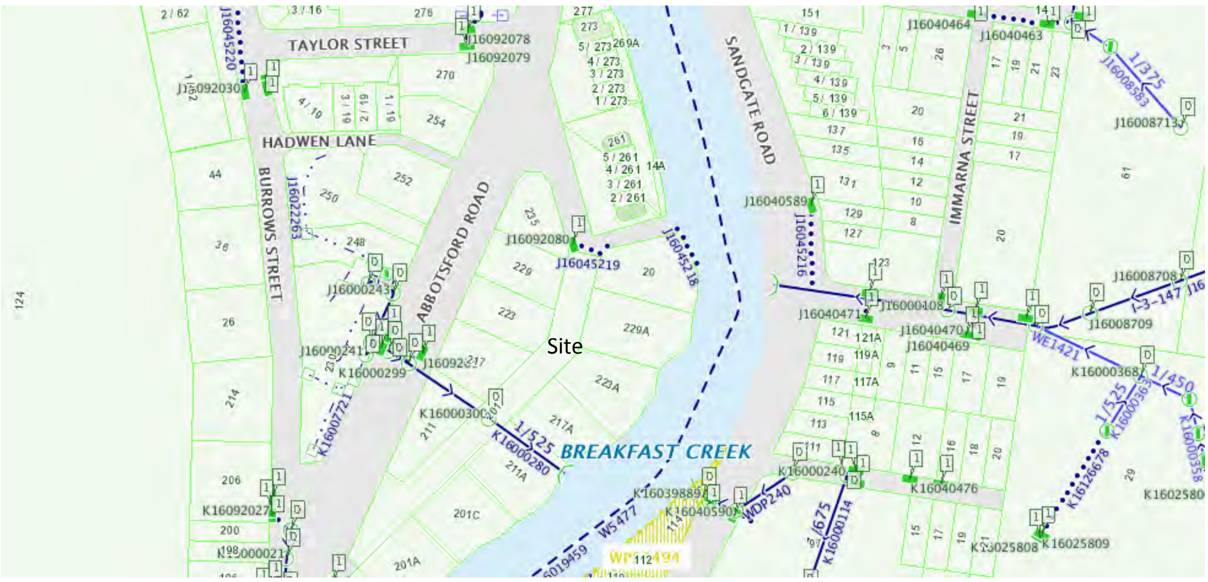

Figure 4-3 Stormwater Drainage in the Area (Source: BCC eBimap)

Apart from this there is only limited additional information of the internal stormwater drainage system. Estimates have therefore been made of local catchments and drainage infrastructure from a site inspection, survey (including manhole inspections and marking made by the surveyor), as well as other reports, namely Golder (2013).

Appendix A provides photos of the existing site inspection.

From these sources the following indication of the existing stormwater drainage system and water sensitive urban design features are provided on Figure B.1 in Appendix B and comments are provided below:

- Given the previous use as a bus depot, there is already a range of existing water management infrastructure at the site and this includes water quality measures such as water sensitive urban design and reuse features in addition with environmental protection measures. These existing measures include: -
  a) Stormwater reuse tanks.
  b) Existing bunding around diesel refuelling tanks and
  c) Oil separators and gross pollution devices.
- Basically the western third of the site (the existing buildings that front Abbotsford Road) all discharges towards Abbotsford Road and into the BCC stormwater drainage system. In particular this includes:
  a) Roofwater from the existing Bus Depot Staff building: Discharges via several downpipes into open grates, then to manholes which have recently been constructed in the grassed area out the front of the building. These then direct the roofwater to the Abbotsford Road stormwater drainage system (refer Photos P11 to P15 in Appendix A).
  b) The existing demountable office building: Discharges west to an open concrete drain which then flows south to an inlet grate and into the Abbotsford Road stormwater system (refer Photos P22 to P24 in Appendix A).
  c) The southern maintenance shed (Building 7 on Figure 4-1): A portion of its roof water was directed to a rainwater tank however this has now been removed. All discharge is picked up by surface inlets and directed to Abbotsford Road (refer photos P69 to P76 in Appendix A).
  d) Other sheds and annexes in this area (Buildings 8, 9, 10): All drain to an open concrete channel that runs south along the western property line towards the southern gate entrance before discharging to Abbotsford Road (refer photos P79 to P89 in Appendix A).
- The remaining two thirds of the site (the eastern portion) generally discharges eastward towards Breakfast Creek via stormwater drainage pipes.

Stormwater drainage features are presented on the Existing Stormwater Details Plan provided in Appendix A.

4.4 Waterway Corridors

There is also a waterway corridor present on the site, however it only affects a small width of the site along the right bank of Breakfast Creek as shown on Figure 4-4.

Figure 4-4 Waterway Corridor Extents (Source: BCC PDOnline)

5. LEGISLATION, POLICY AND GUIDELINES

5.1.1 Federal Legislation

The primary environmental legislation relevant to the SBSMP is the *Environmental Protection Act 1994 (EP Act).* The *EP Act* protects environmental values through development and implementation of the environmental protection policies and regulates environmentally relevant activities prescribed in the *Environmental Protection Regulation 1998.*

The *Environmental Protection (Water) Policy 1997 (EPP Water)* ensures protection of environmental values from activities that may result in the release of contaminates to waterways or stormwater drains.

5.1.2 State Legislation

The single State Panning Policy (SPP) came into effect on the 2nd December 2013. The SPP defines the Queensland Government's policies about matters of state interest in respect to land use planning and development which enables development, protects our natural environment and allows communities to grow and prosper.

SPP (2013) considers a site a state interest if there is a development application for any of the following for "receiving waters": -

(1) a material change of use for urban purposes that involves a land area greater than 2500 square metres that: -

(a) will result in an impervious area greater than 25 per cent of the net developable area, or

(b) will result in six or more dwellings, or

(2) reconfiguring a lot for urban purposes that involves a land area greater than 2500 square metres and will result in six or more lots, or

(3) operational works for urban purposes that involve disturbing more than 2500 square metres of land.

SPP (2013) specifically includes matters pertaining to water quality with the overall purpose to ensure that the environmental values and quality of Queensland waters are protected and enhanced. The SPP provisions have been assessed in the Planning Assessment Report prepared by Groundwork Plus.

5.1.3 Local Government Requirements

Whilst development of the site is administered under the State, the Brisbane City Council (BCC) Local Government requirements have also been reviewed for compliance. All building and development in Brisbane is directed by the Brisbane City Plan 2000 (City Plan) and stormwater management is a key requirement under the provisions of the City Plan.

5.1.4 Summary

A summary of the standards and guidelines referenced as part of this report are listed below:

a) "State Planning Policy", State of Queensland, Department of State Development, Infrastructure and Planning, December 2013.
b) The Environmental Protection Act, 2004 and Environmental Protection (Water) Policy, 2009.
c) "Urban Stormwater Quality Planning Guidelines", Department of Environment and Resource Management, 2010.
d) "Urban Stormwater – Queensland best practice environmental management guidelines – Technical Note: Derivation of Design Objectives", Environmental Protection Agency, January 2009.
e) "MUSIC Modelling Guidelines – Version 1.0 – 2010" produced under the Water by Design Program by the South East Queensland Healthy Waterways Partnership 2010.
f) "Queensland Urban Drainage Manual", 2008, Queensland Government Natural Resources and Water.
g) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ARMCANZ and ACZECC, October 2000

As noted, this proposed development is also cognisant of and aims to integrate with the local Council requirements. Consequently guidelines from the following documents will also be used to assist in the site compliance requirements:

a) BCC City Plan 2000 – Volume 1 incorporating the new Brisbane Interim Flood Response section of 16 May 2013.
b) BCC's Subdivision and Development Guidelines (BCC, 2008)
c) "Guidelines on Identifying and Applying Water Quality Objectives in Brisbane City", BCC, Version 1, 2000.

6. WATER QUALITY OBJECTIVES

As part of SPP (2013) the development will be required to: -

(1) avoid or otherwise minimises adverse impacts on the environmental values of receiving waters, arising from: -

(a) altered stormwater quality or flow; and

(b) wastewater (other than contaminated stormwater and sewage); and

(c) the creation or expansion of non-tidal artificial waterways; and

(2) comply with the SPP code: Water quality (Appendix 2).

With regard to Council requirements, the development is classified as a high risk site in accordance with Council's Subdivision and Development Guidelines, Part C Water Quality Management Guidelines. Council Water Quality Guidelines indicate that water quality objectives need to be identified and measures proposed to ensure that the objectives will be met.

Council's Guidelines on Identifying and Applying Water Quality Objectives indicates that the site is located within planning unit B/040 of the Breakfast Creek catchment and Environmental Value sets A, B and C apply for a tidal waterway. The Water Quality Objectives from Table 2 from Appendix 5 of the Guidelines is presented as Table 6-1.

Table 6-1 WQO's for Combined Wet and Dry Periods involving land-disturbing, vehicle-related and acid sulphate soil-related activities (Source – BCC, 2000)

	SET A Environmental values (EVs)	SET B EVs	SET C EVs
Indicator	**Modified ecosystem, wildlife, cultural heritage, secondary & visual recreation, industry, stock and irrigation**	**Human consumer (except oysters)**	**Primary contact**
pH [1]	6.5-8.5		
Dissolved oxygen [1]	80 to 100 percent saturation		
Organic matter	NR		
Total phosphorus [1]	60 µg/L		
Total nitrogen [1]	450 µg/L		
Chlorophyll-a [1]	10 µg/L		
Turbidity [1]	20 NTU		
Secchi depth [1]	> 0.5 m		> 1.2 m
Suspended solids	30 mg/L for combined wet and dry periods [1] 90%ile < 100 mg/L for wet weather periods [2]		
Total aluminium	NR		
Total iron	NR		
Total dissolved iron [8]	0.5 µg/L if secchi > 1 metre or NR if secchi <1 metre		
Total arsenic [3]	50 µg/L		
Total cadmium [3]	2 µg/L		
Total chromium [3]	50 µg/L		
Total copper [3]	5 µg/L	1.0 µg/L (tainting)	
Total nickel [3]	15 µg/L		
Total lead [3]	5 µg/L		
Total zinc [3]	50 µg/L	5.0 µg/L (tainting)	
TPH [5,6]	NR		
Oils and grease [3]	No visible films or odour		
PAH [3]	3 µg/L		
Faecal coliforms [3]	1000 organisms/100 mL (minimum of 5 samples taken at regular intervals not exceeding one month, with 4 of 5 not exceeding 4000 organisms/100 mL)		150 organisms/100 mL (minimum of 5 samples taken at regular intervals not exceeding one month, with 4 of 5 not exceeding 600 organisms/100 mL)
Total chlorine [6]	0.02 mg/L		
Litter/gross pollutants [7]	No anthropogenic (man-made) material greater than 5mm in any dimension		
Riparian vegetation & habitat	Protect & restore consistent with Council policy and plans (see Council's City Plan)		
Cultural heritage	Protect & restore consistent with Council policy and plans (see Council's City Plan)		

Notes:

- WQOs are upper limits for median values or ranges in which medians should lie, unless otherwise stated.
- If a parameter relevant to a particular activity (e.g. an organophosphorus pesticide for a pesticide formulator) is not given in the above table please refer to *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC, 1992).
- NR: No WQO can be recommended at this stage.

(1) Derived from *Draft Queensland Water Quality Guidelines* (EPA, 1998).
(2) Derived from local and interstate information. A wet weather period is defined as "any period where stormwater runoff leaves the site".
(3) Taken from *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC, 1992).
(4) Derived from Canadian Water Quality Guidelines (1991), *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC, 1992) and *Draft Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC/ARMCANZ, 1999).
(5) Taken from *Draft Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC/ARMCANZ, 1999).
(6) Taken from *Report on Chlorinated Discharges to Urban Stormwater* (Brisbane City Council, 1999)

(7) A BCC interpretation of what is acceptable to the community in terms of visual impact. Litter definition derived from information provided by the CRC for Catchment Hydrology.
(8) Derived from the *Moreton Bay Catchment Interim Scientific Report* (MBS, 1998).

BCC also adopts stormwater quality pollutant load reduction requirements based on SPP(2013) and DERM(2010). These water quality objectives for the development are detailed in Table 6-2. These targets are calculated as reductions in total pollutant load to be achieved as compared to the theoretical runoff of untreated stormwater from the proposed development.

Table 6-2 Pollutant Reduction Objectives for South East Queensland (Source – BCC City Plan and SPP2013)

Pollutant	Water Quality Objectives
Total Suspended Solids (TSS)	80% reduction in average annual load of pollutants
Total Phosphorus (TP)	60% reduction in average annual load of pollutants
Total Nitrogen (TN)	45% reduction in average annual load of pollutants
Gross Pollutants (GP) (> 5mm)	90% reduction in average annual load of pollutants

7. THE PROPOSED DEVELOPMENT

7.1 General

The proposed development is the construction of a concrete batching plant. The purpose of the plant is:

a) to receive, store and dispense cementitious materials for transport via concrete agitator trucks to offsite locations;
b) to provide facilities for staff to operate the facility;
c) to receive and recycle, where possible, surplus concrete from returning agitator trucks;
d) to store vehicles and equipment when not in use.

The proposed development will generally use as much of the existing infrastructure as possible. Details of the existing infrastructure remaining and the modifications required are presented on Figure 7-1 and described below. Existing Building numbers are presented on Figure 4-1 shown previously. Additional plans of the development are also provided in Appendix B.

Existing Construction and Modifications

- The Existing Bus Driver Building will remain (Existing Building 5).
- The Demountable Building (Existing Building 3) will be removed for additional parking and stormwater that previously ran to Abbotsford Road will now be collected internally.
- The Existing Bus Refuelling Bay (Existing Building 6) to be retained as a Truck Wash.
- The Existing Bus Garage (Existing Building 7) to be retained and extended into the Existing Annex Area (Existing Building 10) to house and recycle returned concrete.
- The Existing Annex (Existing Building 10) will be removed.
- Existing Staff Carparking south of Existing Building 10 will remain.
- The Diesel Tanks will remain in the north-west of the Site (shown as ID 1 on Figure 4-1).
- Apart from the new batching facilities described below, the remaining paved surfaces will remain for truck manoeuvring and parking.

New Construction

Additional construction for the concrete batching activities is presented on Figure 7-1. It includes:

- A new shed covering the 6 x slump stands at the northern end of the site.
- A new aggregate handing facility and dispenser in the middle of the site. Fill will be required to raise the ground level in this area from approximately 2.5-2.6 m AHD up to 2.8 m AHD. This will ensure this area is above the Defined Flood Level.
- The incorporation of several water reuse tanks (number and size to be determined as part of detailed design).
- The installation of several waste collection sumps to capture runoff from internal operations areas for reuse.

Access to the site will be via Gebbie Street for the trucks and via the southern entrance for staff carparking areas. The carparking areas are proposed to make use of existing paved surfaces to the south. Raw material delivery trucks will also exit the site via the southern gate.

The proposed layout does not indicate any encroachment on the waterway corridor and a 10 m buffer from the Mean High Water Spring (MHWS) tidal extent will be maintained for any structures.

Operating hours will be 24 hours per day Monday to Friday. Some work on weekends may occur as required.

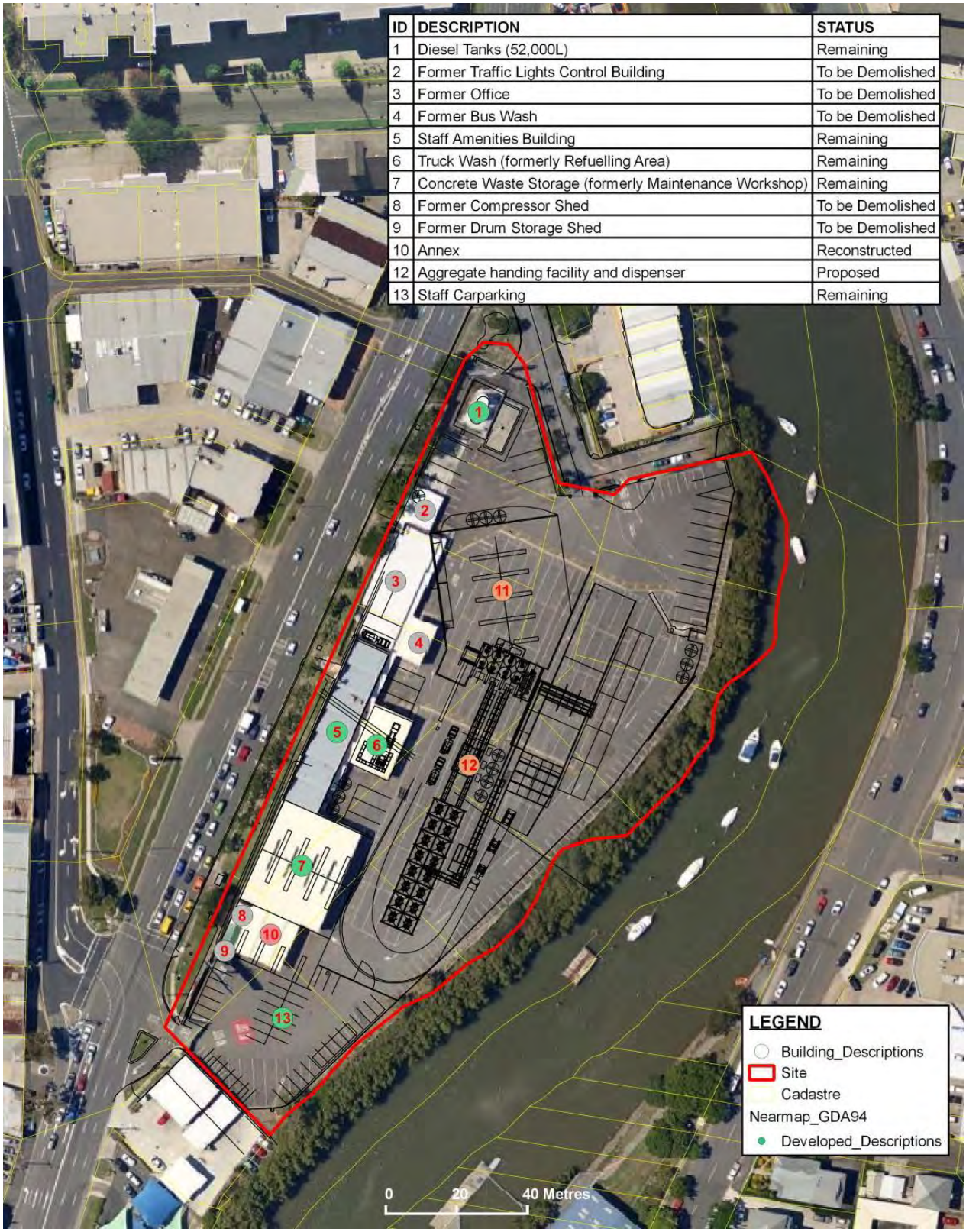

Figure 7-1 Proposed Development (Source: Hanson Construction Materials)

7.2 Stormwater Quality Treatment

Stormwater management for the site, including the identification of water quality issues and risks as well as the opportunities for management, are dependent on:

a) The size of any catchment
b) The ground cover and drainage features
c) The type of activity occurring in the catchment
d) The sensitivity of the discharge receiving waters
e) The opportunity for management measures

A catchment plan outlining the primary catchment areas and discharge locations including stormwater infrastructure is provided in Appendix C.

The stormwater management tasks and actions identified for the appropriate management of stormwater from each of the site catchment areas is discussed separately as follows.

7.2.1 Catchment A1

Catchment A1 has an area of approximately 6400 m^2 and is associated with the fuel storage area and pavement areas located in the mid-eastern and northern area of the site.

The fuel storage comprises two above ground diesel storage tanks each with a safe storage volume of 52,500 litres (combined diesel 105,000 litres).

Management measures and actions for this catchment are summarised as follows: -

- **Capturing fuel leaks and spills.** A blockwork bunding system is already provided for the above ground diesel storage areas and this will function to capture and contain any fuel leakages from the area. The bunding system comprises a besser-block retaining wall constructed to a height of approximately 1 metre. The existing bunding system has dimensions of approximately 9m x 13.5m and provides a volumetric storage capacity of approximately 122,000 litres. The existing bunding therefore provides sufficient capacity to contain the diesel fuel storage provisions at the site. The diesel storage will be retained as part of the site development. It has been noted by Golder (2013) that the bunding system may be receiving stormwater infiltration from the adjacent hardstand areas which is potentially a result of water ingress occurring between the various courses of brickwork in the lower areas of the bund wall. This should be rectified to not only prevent stormwater ingress into the bund but moreover to prevent the potential leakage of diesel fuel from within the bund itself.

- **Limiting or preventing stormwater entering the refuelling area:** Surface drainage is already prevented from contributing to this area by way of a containment rollover bund. This reduces the quantity of stormwater runoff that can be potentially contaminated and is an appropriate source control measure. The existing bunding system will be retained as part of the future site operations.

- **Treatment of stormwater discharge from the refuelling area:** This occurs via a sub-surface stormwater pipe to a pit mounted oil and water separator located in the pavement hardstand area. The oil and water separator is a 3000 litre capacity Eco-Stop proprietary device manufactured by Rocla. The Eco-Stop is an oil-spill hydrocarbon spill management system which employs an automatic shut-off stop valve arrangement to prevent the discharge of fuel from the tank. A copy of the Eco-Stop operations and maintenance manual

is included in Appendix C. The Eco-Stop device is an appropriate measure to prevent the discharge of fuel to the receiving waters and should therefore be retained.

Stormwater discharge from the Eco-Stop flows via a sub-surface drainage to a 5000 litre capacity Downstream Defender proprietary device manufactured by Rocla. The Rocla Downstream Defender is a vortex separator used to separate settleable solids and additionally also includes an oil and floatables trap. Discharge from the device is then directed to Breakfast Creek via a sub-surface stormwater pipe.

- **Treatment of Paved Surfaces:** The Downstream Defender will also receive stormwater from the paved surfaces of the catchment. The Downstream Defender is an appropriate measure for water quality treatment prior to discharge to Breakfast Creek and should be retained for this function.

- **Reuse Measures for the Catchment:** A stormwater re-use and capturing system will also be restored and augmented for this catchment. It is co-located with the Rocla Downstream Defender and will be augmented with additional above ground water storage tanks.

  The re-use system includes two open sump areas with an associated oil water separator proprietary device manufactured by Fox Environmental Systems. Fox Environmental has been contacted to provide operational details and these will be included in Appendix C.

  It is understood that the sumps are used to collect stormwater which is subsequently treated via the oil water separator and then pumped to an underground holding tank.

7.2.2 Catchment A2 – Slump Stand Area

Catchment A2 was formerly a hardstand area that will now be enclosed by a building that will incorporatethe slump stands. This area (approx. 1400 m^2) will be free from all flood sources to a Q100 standard and any internal contaminates from the slump stand operations will be collected to a waste pit and pumped to the washout pit for recycling. No water will be released to the external stormwater drainage system.

The roof area drainage will be directed to stormwater reuse tanks located at the northern end of the building. Overflow from these tanks will sheet flow down to the inlet pit at A5 and into the GPT and reuse system.

7.2.3 Catchment B – Aggregate Handling and Conveyors

Similarly with Catchment A2, Catchment B was formerly a hardstand area that will now be the location of a new aggregate handling facility and dispenser and well as the location of the raised cement silos. These areas will be partially roofed and the ground surfaces also modified to drain internally to waste pits.

The preparation of concrete batches will occur within this area with the subsequent mix dispensed to concrete delivery trucks.

This area (approx. 1200 m^2) will also be free from all flood sources to a Q100 standard. Any internal runoff will be collected to the waste pits and not be released to the external stormwater drainage system.

The waste pits and reuse tanks will be designed to ensure runoff capture during a Q3mth storm event before overflow occurs.

The roof area drainage will be directed to stormwater reuse tanks within this area as shown in Appendix B. Overflow from these tanks will sheet flow down to the inlet pit at A5 and into the GPT and reuse system.

7.2.4 Catchment C

Catchment C is approximately 1250 m^2 in area. This catchment includes the central hardstand areas at the site as well as some parking areas.

All stormwater runoff from this existing hardstand and vehicle manoeuvring area will be directed to the existing underground GPT and tank system.

The stormwater reuse system will be retained for the purposes of minimise discharge from the site while also promoting on-site water reuse.

Excess discharge from this system is directed to the main stormwater drainage line and to Breakfast Creek.

7.2.5 Catchment D

Catchment D is approximately associated with 1550 m^2 of roof area from the proposed waste storage area (Building 7) and Truck Wash Building (cited within the former bus refuelling complex).

The proposed tasks and actions for this catchment are summarised as follows: -

- All stormwater from roofed areas within this catchment will be collected and directed where practical to the existing underground and proposed above ground stormwater tanks for water reuse for truck washing and the preparation of concrete batches. Existing drainage systems should be reviewed and additional piping installed to aid in maximising reuse potential within this catchment.
- The truck wash area will retain the existing bunding system in-place as part of the former bus re-fuelling complex for containment of wash water. All wash water collected in the grated floor drainage system will be collected in underground tanks and treated. The truck wash facility will be operated as a self-contained system; that is, water is treated and re-used for truck washing will not discharged to the stormwater system. A copy of the operational and maintenance manual for this device will be included in Appendix C when designed.
- The internal area of concrete waste facility building is housed to prevent contamination of stormwater with concrete waste recycling operations.

7.2.6 Catchment E

Catchment E will be paved for truck manoeuvring. A sediment forebay will be constructed in this area to capture sediment and concrete/cement dust in runoff before discharge to the Abbotsford Road stormwater drainage system.

7.2.7 Catchment F

Catchment F includes the existing staff building roof area and some external paved surfaces. Drainage for these areas is already constructed and directs discharge to the Abbotsford Road stormwater drainage system. There is minimal proposed change in catchment area, use or treatment for this area.

7.2.8 Catchment G

Catchment G currently includes the paved and roof areas of the site in the south-western corner adjacent to Abbotsford Road. All runoff from this catchment currently discharges untreated to Abbotsford Road adjacent to the south western gate.

Management measures for this area include the redirection of all roof areas internally for reuse. This has reduced the external discharge of Catchment G from approximately 1250 m^2 down to 600 m^2 to facilitate an improvement in discharge of pollutants offsite.

7.2.9 Catchment IK

Catchment IK includes the southern areas of the site which discharges to Breakfast Creek via an existing GPT and stormwater outlet. This catchment has a contributing area of approximately 1100 m^2 and includes primarily hardstand areas of the site such as existing car parking areas. A strip of landscaping exists along the southern fenceline. Stormwater from this area flows primarily as overland flow.

The landscaping strip is a significant source of leaf matter which is currently clogging the stormwater inlets.

Apart of maintenance of the inlets and GPT there is no proposed change in catchment area, use or treatment for this area.

7.2.10 Catchment L

Catchment L is an internal catchment that collects pavement runoff for storage and reuse. Overflow is directed to Breakfast Creek.

It is proposed to maintain this system unchanged however the catchment area may be reduced by the extended roof area of the concrete waste recycling building and annex.

During detailed design it will be determined whether discharge of these roof areas will be directed to the underground tank in this catchment or to the tanks proposed within Catchment F.

7.3 Stormwater Quantity

The site has previously been developed as a bus depot. Future use of the site as a concrete batching plant will not involve any discernible change in site imperviousness including runoff and flow characteristics. The site also has a legal point of discharge directly to Breakfast Creek. Impacts from stormwater quantity changes as part of the development works are therefore anticipated to be negligible.

Accordingly, no water quantity management at the site is required to minimise any impacts with regard to peak flow rates and volumes.

8. OPERATIONAL PHASE STORMWATER MANAGEMENT

8.1 Risks

In respect to water quality management, the future use of the site as a concrete batching plant represents a change in use compared to the former use as a bus depot, however with adequate containment/prevention of stormwater involving the batching operations, pollutants at most risk of discharging from the site are likely to be similar e.g. those related predominately to vehicular activities.

Details of the proposed site development have been discussed previously in Section 7 and plans of the development are provided in Appendix B.

The following summarises the key development features and site activities associated with the concrete batch plant: -

- **Material storage and transfer -** This includes loading areas and storage bins for bulk aggregates, sands, gravels and the like and are used in the preparation of concrete mixes and conveyors for transfer.
- **Cement storage and dispensing -** All cement material is stored within sealed and raised silos to aid in dispensing directly into mixing trucks.
- **Truck wash-down area**.
- **Fuel storage and dispensing area**.
- **Waste concrete disposal area -** Area are used for the disposal of waste concrete including concrete not to the required specification as well as any returned concrete from trucks not taken up from a delivery.
- **Offices and amenities and control rooms -** These areas include site administration and control as well as staff amenities.
- **Paved internal road network and parking areas.**

Water discharged from concrete batching plants associated with the above activities has the potential to detrimentally affect the quality of receiving waters. Accordingly, the following risks are therefore identified in respect to water quality at the site: -

- Spillage during concrete mixing operations including loading of the concrete mixer delivery trucks;
- Runoff from material storage dispensing areas;
- The discharge of water from truck wash areas;
- Water discharge from with waste concrete storage areas;
- General water discharge from hardstand and manoeuvring areas;
- Discharge of water and/or fuel from fuel storage areas and associated re-fuelling activities;
- Transport of pollutants during flooding of the site.

8.2 Objective

Appropriately manage the quality and quantity of stormwater runoff, thereby causing no adverse impact on the surrounding land uses and the natural features and ecological processes within adjacent urban waterways.

8.3 Performance Indicators

The following site performance indicators for discharge from all catchment areas include: -

- No direct release of contaminated stormwater from the site;
- A non-worsening in water quality discharge off the site following development; and
- The Plant and Operations Manager for the site will be responsible for ensuring that all waters discharged from the site meet legislative requirements.

8.4 Monitoring

The water quality of the receiving waters may be detrimentally affected by direct discharge of stormwater from the site. The following parameters are therefore suggested for monitoring as indicators of potential contamination: -

- pH;
- Suspended Solids;
- Turbidity;
- Dissolved Oxygen;
- Hydrocarbons;
- Litter and Gross Pollutants.

Water quality monitoring of the above water quality parameters should be undertaken at all discharge locations from the site preferably during a rainfall event. The monitoring frequency and performance targets are detailed in Table 8-1.

Table 8-1 Water Quality Monitoring

Parameter	Minimum Frequency	Performance Target
pH	Monthly	6.5 – 8.5
Suspended Solids	Monthly for first 12 months to establish relationship with in situ monitoring of NTU	<30 mg/l for combined wet and dry periods 90%ile < 100 mg/l for wet weather periods
Turbidity	Monthly	<20 NTU
Dissolved Oxygen	Monthly	80 to 100% saturation
Oils and Grease	Monthly	No visible films or odour
Litter/Gross Pollutants	Monthly	No anthropogenic (man-made) material greater than 5 mm in any dimension

8.5 Operation and Maintenance

The following operation and management strategy for stormwater quality management at the site has been developed and is detailed below: -

8.5.1 Prior to Commencement of Use

System Audit

The water quality management strategies defined in this document are reliant on:

a) Some reuse of existing stormwater management infrastructure and treatment devices already installed at the site; and

b) The installation of rainwater tanks to maximise stormwater reuse within the facility.

Given that the previous use has since ceased in addition with infrastructure changes being proposed to aid in the new use of the site as a concrete batch plant, it is appropriate that an audit is initially undertaken on all existing measures at the site. This audit aims to: -

- Ensure that all stormwater water quality measures to be relied on as part of the new use are confirmed as available and in good working condition;
- Confirm that the existing stormwater measures at the site are well understood in respect to their operations.
- Any items that are not in working condition are rehabilitated; replaced or decommissioned in lieu of an alternative, as necessary;

The following specific tasks should therefore be undertaken as part of this audit: -

- Undertake an infrastructure review of all site measures to provide an updated site plan for all drainage and water quality related infrastructure. This is also likely to involve a detailed survey and CCTV to specifically define and locate all existing stormwater piping and arrangements at the site. Some of this information may also be available from Brisbane City Council as the previous site owner.
- Collect any previous operational and maintenance records that may be available from Brisbane City Council in respect to the previous stormwater management operations performed at the site. Water Technology has made initial enquiries with Brisbane City Council and understands that operational and maintenance manuals may not exist for the stormwater measures at the site. However, further contact should be made with Council to exhaust all potential information sources. This may also include making contact with the former site manager for operations as well as potentially arranging a site meeting to obtain further information on the stormwater management system at the site.
- For proprietary devices (i.e. Rocla and Fox Environmental Solutions), arrange for the device manufacturer to undertake a pre-operational inspection and maintenance of the devices to ensure future serviceability and performance objectives. Any deficiencies, rectification or replacement works should be undertaken at this time based on the manufacturer advice and the future intended use and intensity of use.
- Ensure that current versions of operations and maintenance manuals are obtained for all proprietary stormwater management devices installed on the site and that they be incorporated into an overall Site Stormwater Operations Manual.

Retro-Fit New Measures

Prior to the commencement of use at the site, stormwater management modification and improvement measures as detailed in this management plan should be implemented at the site.

8.5.2 Site Operational Phase

Water quality monitoring shall be undertaken at the site as detailed in this SBMP. The water quality monitoring parameters and frequencies should be periodically reviewed and amended or revised as required based on the outcomes of prior monitoring results.

All proprietary stormwater management devices at the site shall be operated and maintained in accordance with the manufacturer specified operations and maintenance manuals. Copies of operations and maintenance manuals are included in Appendix C of this report.

The stormwater management plan should be periodically reviewed and amended or revised as required.

8.6 Corrective Actions

Hanson shall assume responsibility for implementation of this SBMP. Where Hanson becomes aware of a site or operational condition that does not comply with stated performance indicator(s) of this SBMP, the following corrective actions shall be initiated: -

- Undertake such immediate works as may be necessary to prevent, contain or limit the further release of pollutants to the environment;
- Identification of the cause and source of the non-compliance;
- Implementation of appropriate mitigation measures as determined by Hansen and/or appointed specialist or independent party; and
- Undertake relevant validation monitoring to confirm that the nominated corrective actions have been effective and/or modify the water quality monitoring frequency and parameters tested accordingly.

Hanson shall implement the corrective actions as required within a reasonable timeframe.

Hanson is also required to maintain a register of Corrective Actions, which shall demonstrate that appropriate actions have been completed within a suitable timeframe.

It is the responsibility of Hanson Management to notify the relevant authority (for example DERM, Council, etc) in the event of a notifiable incident or complaint in accordance with legislative requirements.

In some instances, further investigation or monitoring may be required in order to address the corrective action. In these instances, Hanson Management may be required to conduct these further investigations using an independent party, such as a Consultant, to carry out the assessment.

8.7 Reporting and Review

Hanson shall maintain all water quality monitoring records at the site and make these available for inspection by the relevant authorities upon request.

Hanson shall be responsible for operating and maintaining all environmental and water quality management measures at the site including the operation and maintenance of all existing installed infrastructure. Operation and maintenance for all proprietary stormwater management devices should be undertaken in accordance with manufacturer recommendations.

Hanson shall be responsible for reporting the actions taken in respect to any corrective actions identified in respect to water quality management at the site. Hanson shall make available any corrective actions and associated reporting for inspection and review by the relevant authorities upon request.

9. DISCLAIMERS

The information contained in this report is subject to the following disclaimers:

- This report has been prepared for the sole use by the Client stated on Page (i) and no responsibility is accepted by Water Technology with regard to any third party use of the whole, or of any part of the contents of this report. Neither the whole or any part of this report or any reference there to may be included in any document, circular or statement without Water Technology's written approval for the form and context in which it would appear.
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- It is noted that this report may need to be revised as part of the detailed design phase of this development.

10. REFERENCES

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APPENDIX A - EXISTING SITE DETAILS


Legend
Site Photo Locations
Site
Cadastre
Nearmap_GDA94
BowenHills_Google_Satellite
0
20
40 Metres
1:700
Coordinates: GDA94 Zone 56
Water Technology Pty Ltd
Hanson Bowen Hills CBP
Site Photo Locations Plan


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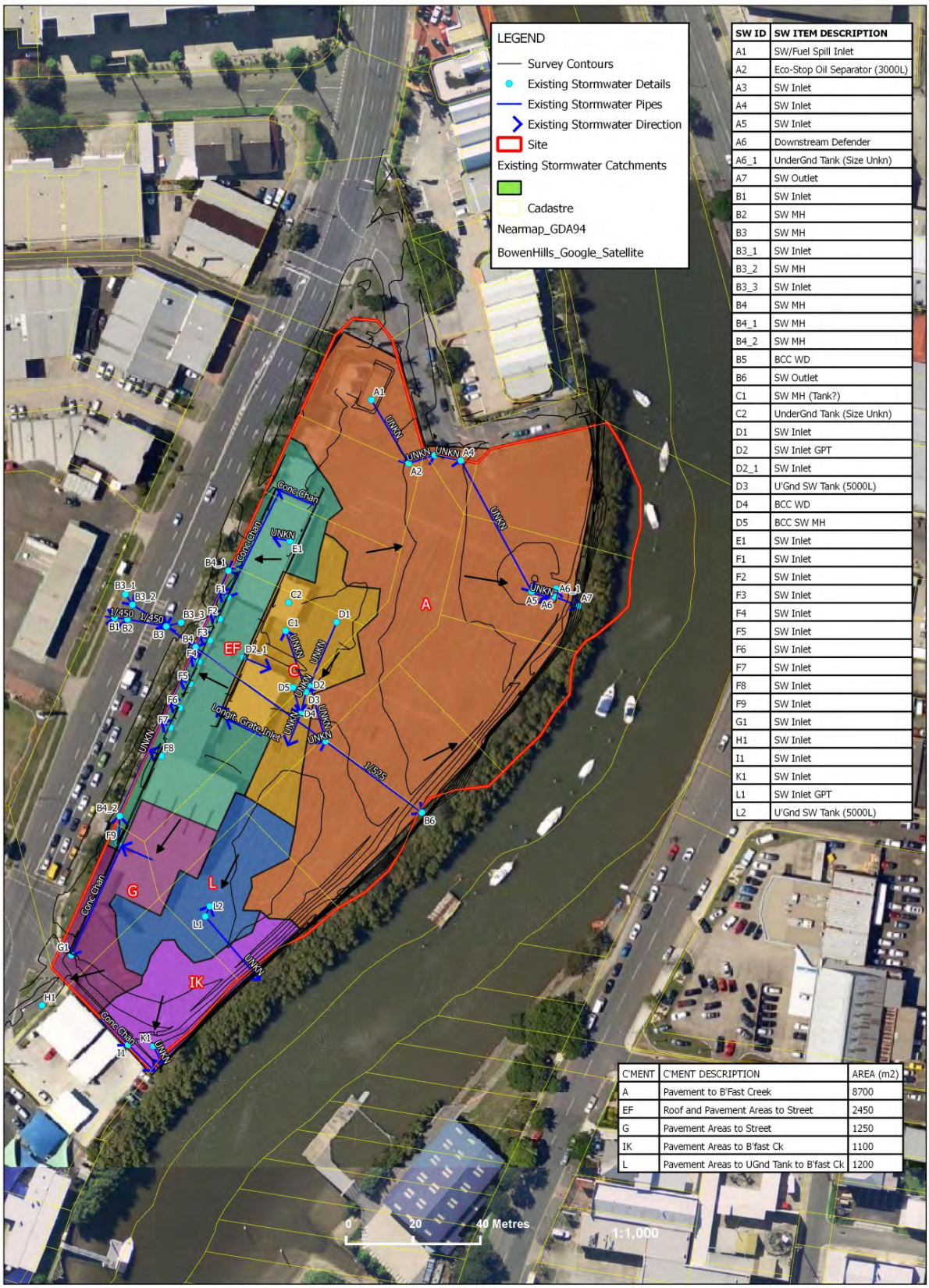


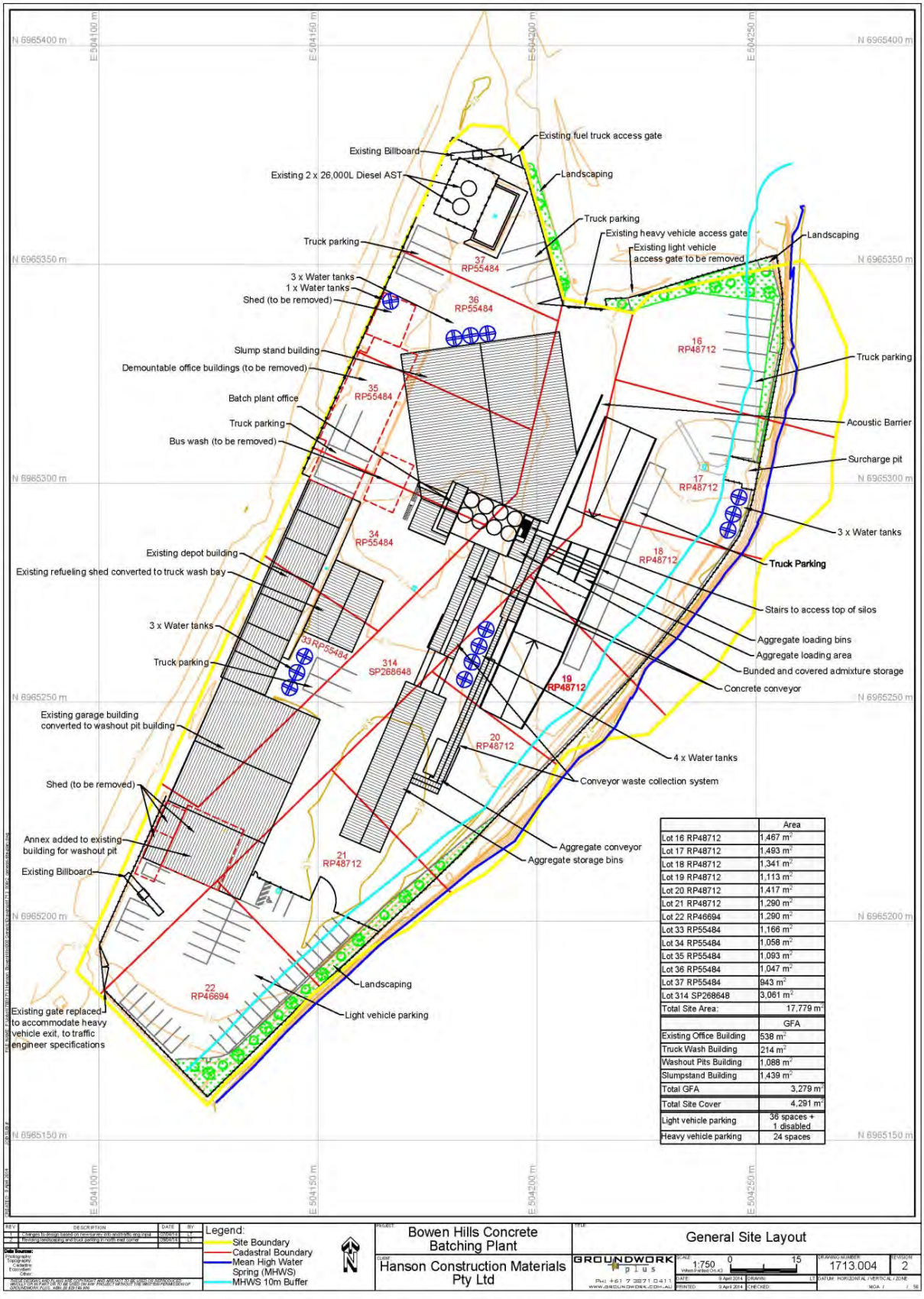
SW ID	SW ITEM DESCRIPTION
A1	SW/Fuel Spill Inlet
A2	Eco-Stop Oil Separator (3000L)
A3	SW Inlet
A4	SW Inlet
A5	SW Inlet
A6	Downstream Defender
A6_1	UnderGnd Tank (Size Unkn)
A7	SW Outlet
B1	SW Inlet
B2	SW MH
B3	SW MH
B3_1	SW Inlet
B3_2	SW MH
B3_3	SW Inlet
B4	SW MH
B4_1	SW MH
B4_2	SW MH
B5	BCC WD
B6	SW Outlet
C1	SW MH (Tank?)
C2	UnderGnd Tank (Size Unkn)
D1	SW Inlet
D2	SW Inlet GPT
D2_1	SW Inlet
D3	U'Gnd SW Tank (5000L)
D4	BCC WD
D5	BCC SW MH
E1	SW Inlet
F1	SW Inlet
F2	SW Inlet
F3	SW Inlet
F4	SW Inlet
F5	SW Inlet
F6	SW Inlet
F7	SW Inlet
F8	SW Inlet
F9	SW Inlet
G1	SW Inlet
H1	SW Inlet
I1	SW Inlet
K1	SW Inlet
L1	SW Inlet GPT
L2	U'Gnd SW Tank (5000L)

C'MENT	C'MENT DESCRIPTION	AREA (m2)
A	Pavement to B'Fast Creek	8700
EF	Roof and Pavement Areas to Street	2450
G	Pavement Areas to Street	1250
IK	Pavement Areas to B'fast Ck	1100
L	Pavement Areas to UGnd Tank to B'fast Ck	1200

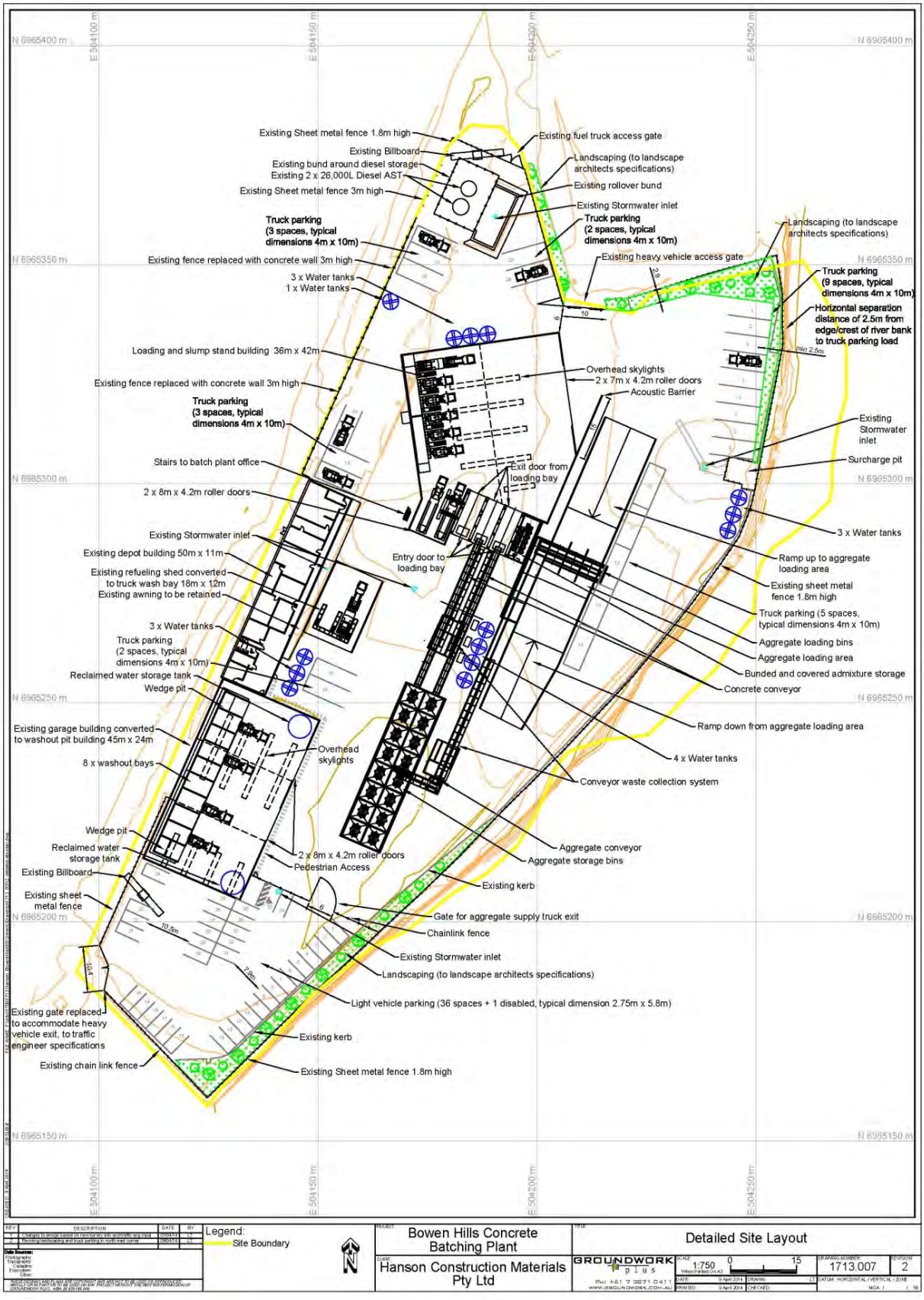
Coordinates: GDA94 Zone 56
Water Technology Pty Ltd

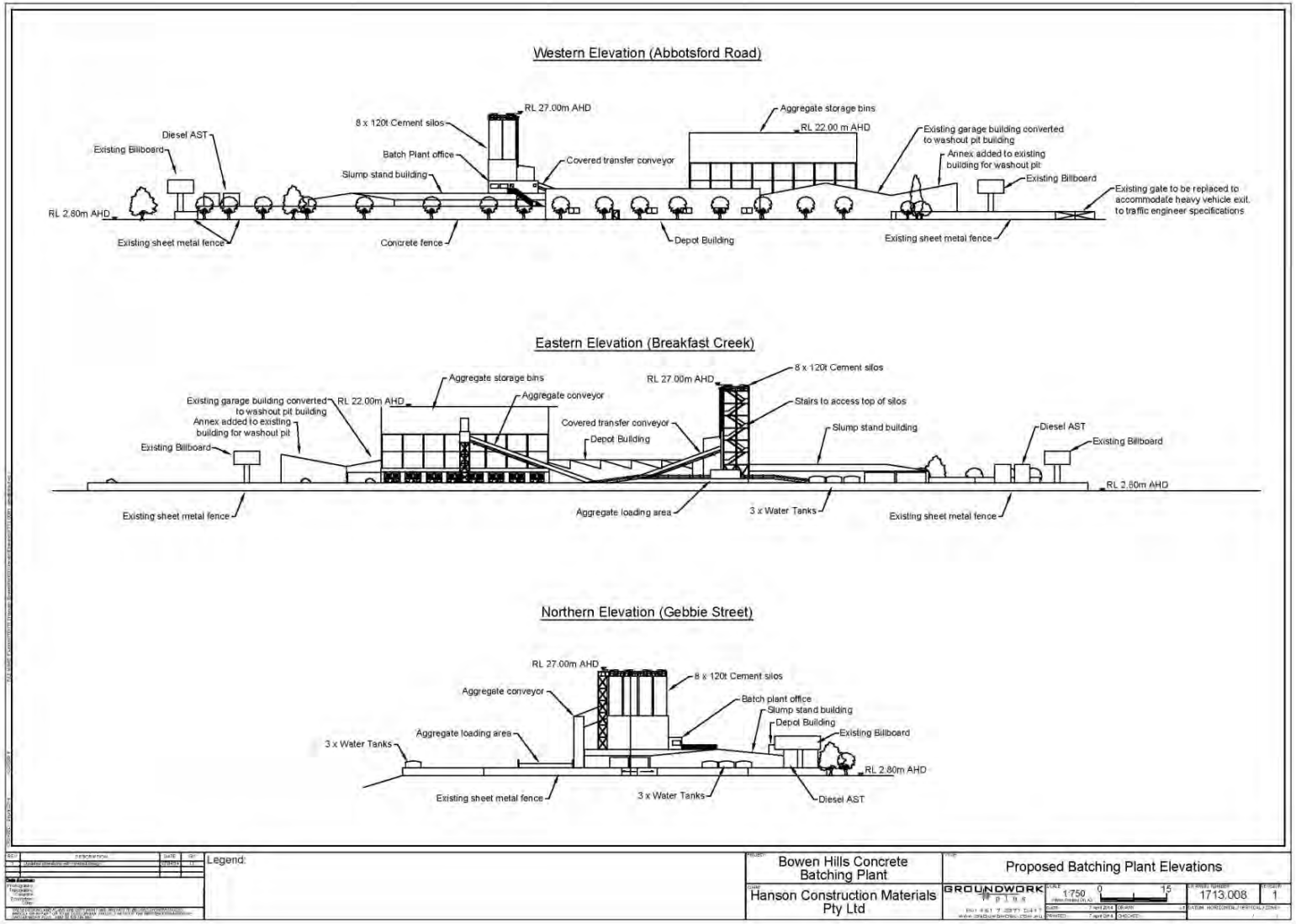
Hanson Bowen Hills CBP
EXISTING STORMWATER DETAILS

APPENDIX B - PROPOSED DEVELOPMENT PLANS



	Area
Lot 16 RP48712	1,467 m²
Lot 17 RP48712	1,493 m²
Lot 18 RP48712	1,341 m²
Lot 19 RP48712	1,113 m²
Lot 20 RP48712	1,417 m²
Lot 21 RP48712	1,290 m²
Lot 22 RP46694	1,290 m²
Lot 33 RP55484	1,166 m²
Lot 34 RP55484	1,058 m²
Lot 35 RP55484	1,093 m²
Lot 36 RP55484	1,047 m²
Lot 37 RP55484	943 m²
Lot 314 SP268648	3,061 m²
Total Site Area:	17,779 m²
	GFA
Existing Office Building	538 m²
Truck Wash Building	214 m²
Washout Pits Building	1,088 m²
Slumpstand Building	1,439 m²
Total GFA	3,279 m²
Total Site Cover	4,291 m²
Light vehicle parking	36 spaces + 1 disabled
Heavy vehicle parking	24 spaces


Existing Sheet metal fence 1.8m high
Existing Billboard
Existing bund around diesel storage
Existing 2 x 26,000L Diesel AST
Existing Sheet metal fence 3m high
Truck parking (3 spaces, typical dimensions 4m x 10m)
Existing fence replaced with concrete wall 3m high
3 x Water tanks
1 x Water tanks
Loading and slump stand building 36m x 42m
Existing fence replaced with concrete wall 3m high
Truck parking (3 spaces, typical dimensions 4m x 10m)
Stairs to batch plant office
2 x 8m x 4.2m roller doors
Existing Stormwater inlet
Existing depot building 50m x 11m
Existing refueling shed converted to truck wash bay 18m x 12m
Existing awning to be retained
3 x Water tanks
Truck parking (2 spaces, typical dimensions 4m x 10m)
Reclaimed water storage tank
Wedge pit
Existing garage building converted to washout pit building 45m x 24m
8 x washout bays
Wedge pit
Reclaimed water storage tank
Existing Billboard
Existing sheet metal fence
Existing gate replaced to accommodate heavy vehicle exit, to traffic engineer specifications
Existing chain link fence
Existing fuel truck access gate
Landscaping (to landscape architects specifications)
Existing rollover bund
Existing Stormwater inlet
Truck parking (2 spaces, typical dimensions 4m x 10m)
Existing heavy vehicle access gate
Overhead skylights
2 x 7m x 4.2m roller doors
Acoustic Barrier
Exit door from loading bay
Entry door to loading bay
Overhead skylights
2 x 8m x 4.2m roller doors
Pedestrian Access
Existing kerb
Existing Sheet metal fence 1.8m high
Landscaping (to landscape architects specifications)
Truck parking (9 spaces, typical dimensions 4m x 10m)
Horizontal separation distance of 2.5m from edge/crest of river bank to truck parking load
min 2.5m
Existing Stormwater inlet
Surcharge pit
3 x Water tanks
Ramp up to aggregate loading area
Existing sheet metal fence 1.8m high
Truck parking (5 spaces, typical dimensions 4m x 10m)
Aggregate loading bins
Aggregate loading area
Bunded and covered admixture storage
Concrete conveyor
Ramp down from aggregate loading area
4 x Water tanks
Conveyor waste collection system
Aggregate conveyor
Aggregate storage bins
Gate for aggregate supply truck exit
Chainlink fence
Existing Stormwater inlet
Landscaping (to landscape architects specifications)
Light vehicle parking (36 spaces + 1 disabled, typical dimension 2.75m x 5.8m)
Existing kerb
Existing Sheet metal fence 1.8m high
N 6965400 m
N 6965350 m
N 6965300 m
N 6965250 m
N 6965200 m
N 6965150 m
E 504100 m
E 504150 m
E 504200 m
E 504250 m
Legend:
Site Boundary
Bowen Hills Concrete Batching Plant
Hanson Construction Materials Pty Ltd
Detailed Site Layout
GROUNDWORK plus
1:750
1713.007
2


Western Elevation (Abbotsford Road)
RL 27.00m AHD
8 x 120t Cement silos
Aggregate storage bins
RL 22.00 m AHD
Diesel AST
Existing Billboard
Batch Plant office
Covered transfer conveyor
Existing garage building converted to washout pit building
Annex added to existing building for washout pit
Slump stand building
Existing Billboard
Existing gate to be replaced to accommodate heavy vehicle exit, to traffic engineer specifications
RL 2.80m AHD
Existing sheet metal fence
Concrete fence
Depot Building
Existing sheet metal fence
Eastern Elevation (Breakfast Creek)
Aggregate storage bins
RL 27.00m AHD
8 x 120t Cement silos
Existing garage building converted to washout pit building
RL 22.00m AHD
Aggregate conveyor
Stairs to access top of silos
Annex added to existing building for washout pit
Covered transfer conveyor
Depot Building
Slump stand building
Diesel AST
Existing Billboard
Existing Billboard
RL 2.80m AHD
Existing sheet metal fence
Aggregate loading area
3 x Water Tanks
Existing sheet metal fence
Northern Elevation (Gebbie Street)
RL 27.00m AHD
8 x 120t Cement silos
Aggregate conveyor
Batch plant office
Slump stand building
Depot Building
Aggregate loading area
Existing Billboard
3 x Water Tanks
RL 2.80m AHD
Existing sheet metal fence
3 x Water Tanks
Diesel AST
Legend:
Bowen Hills Concrete Batching Plant
Hanson Construction Materials Pty Ltd
Proposed Batching Plant Elevations
GROUNDWORK
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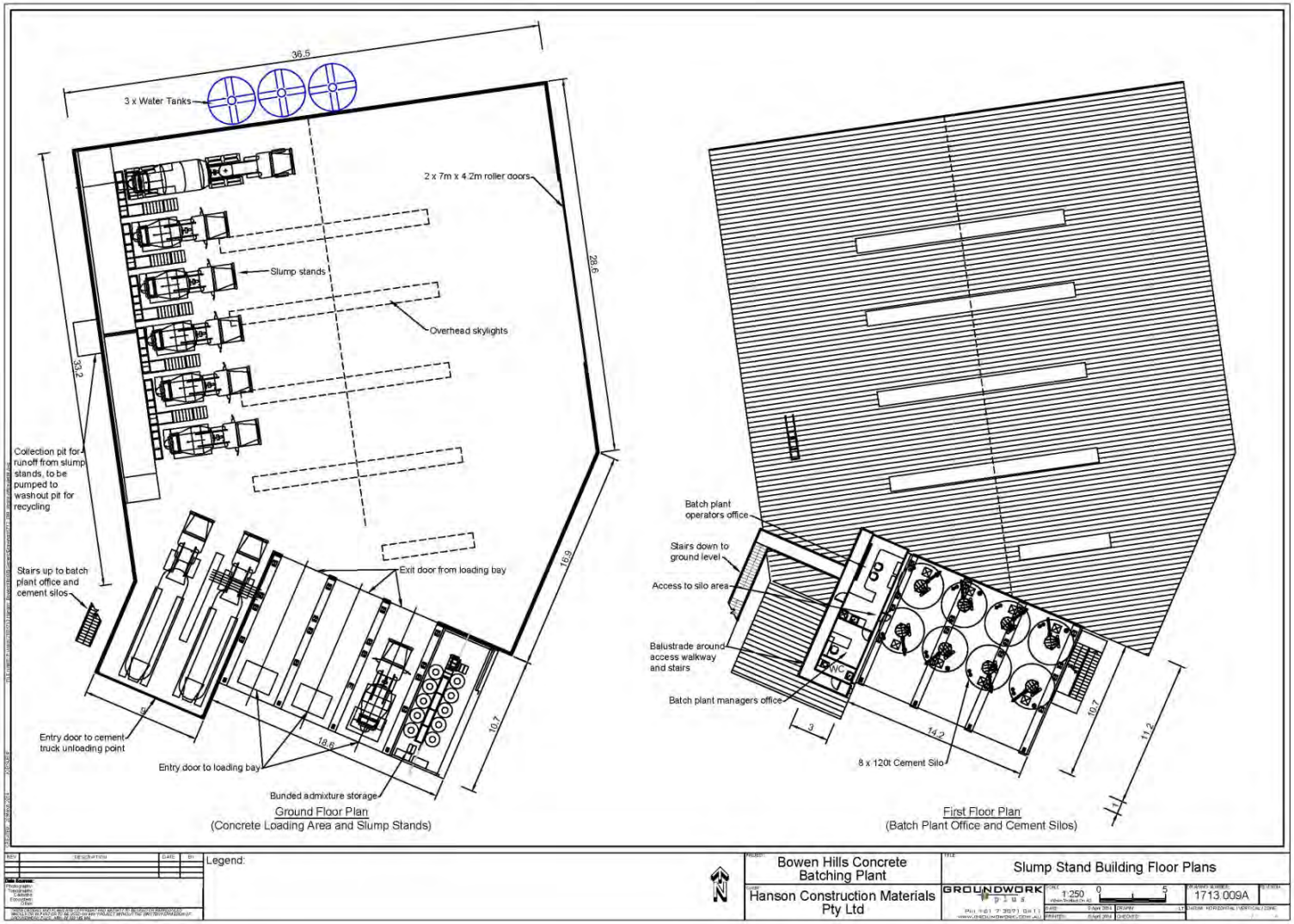
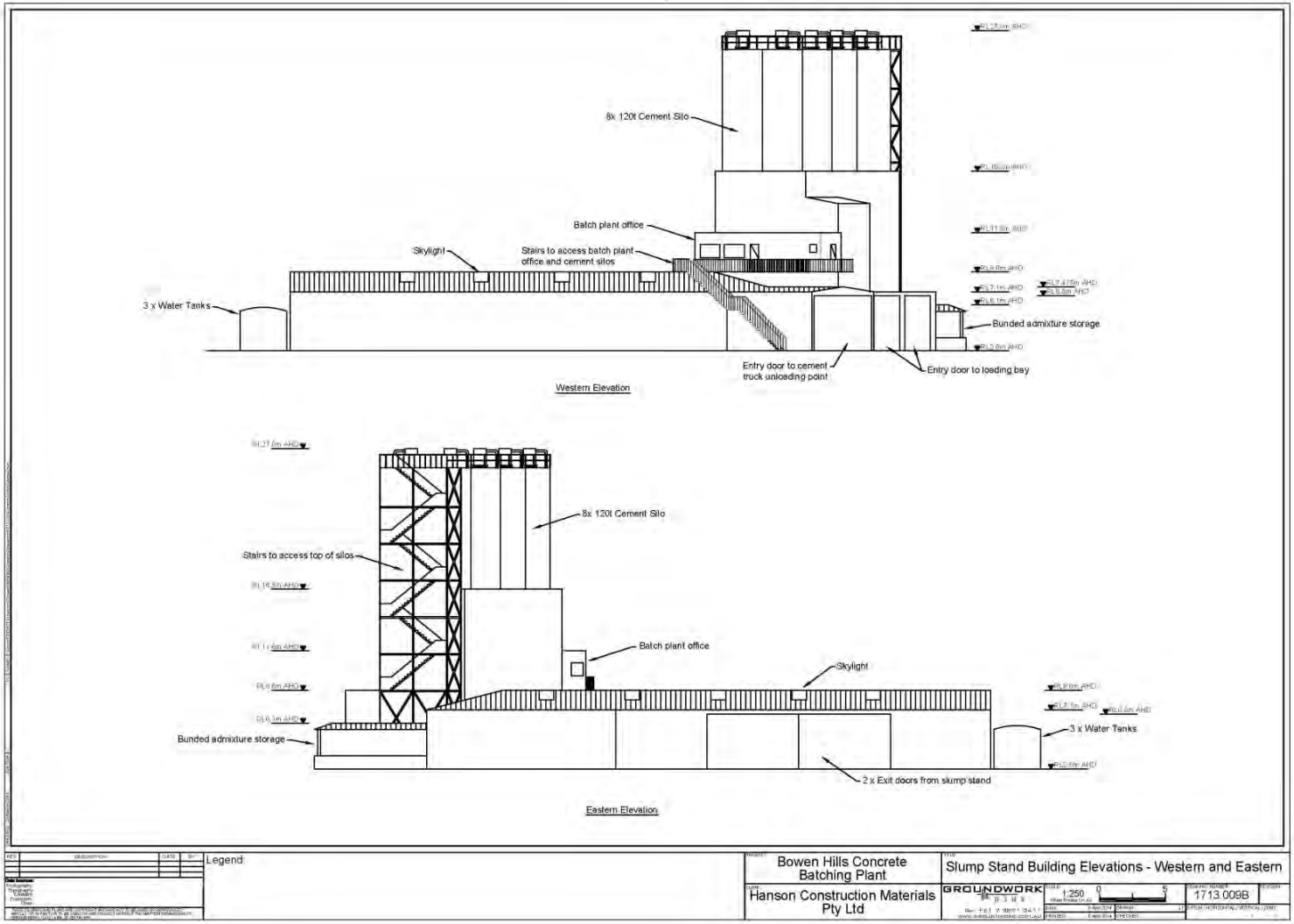
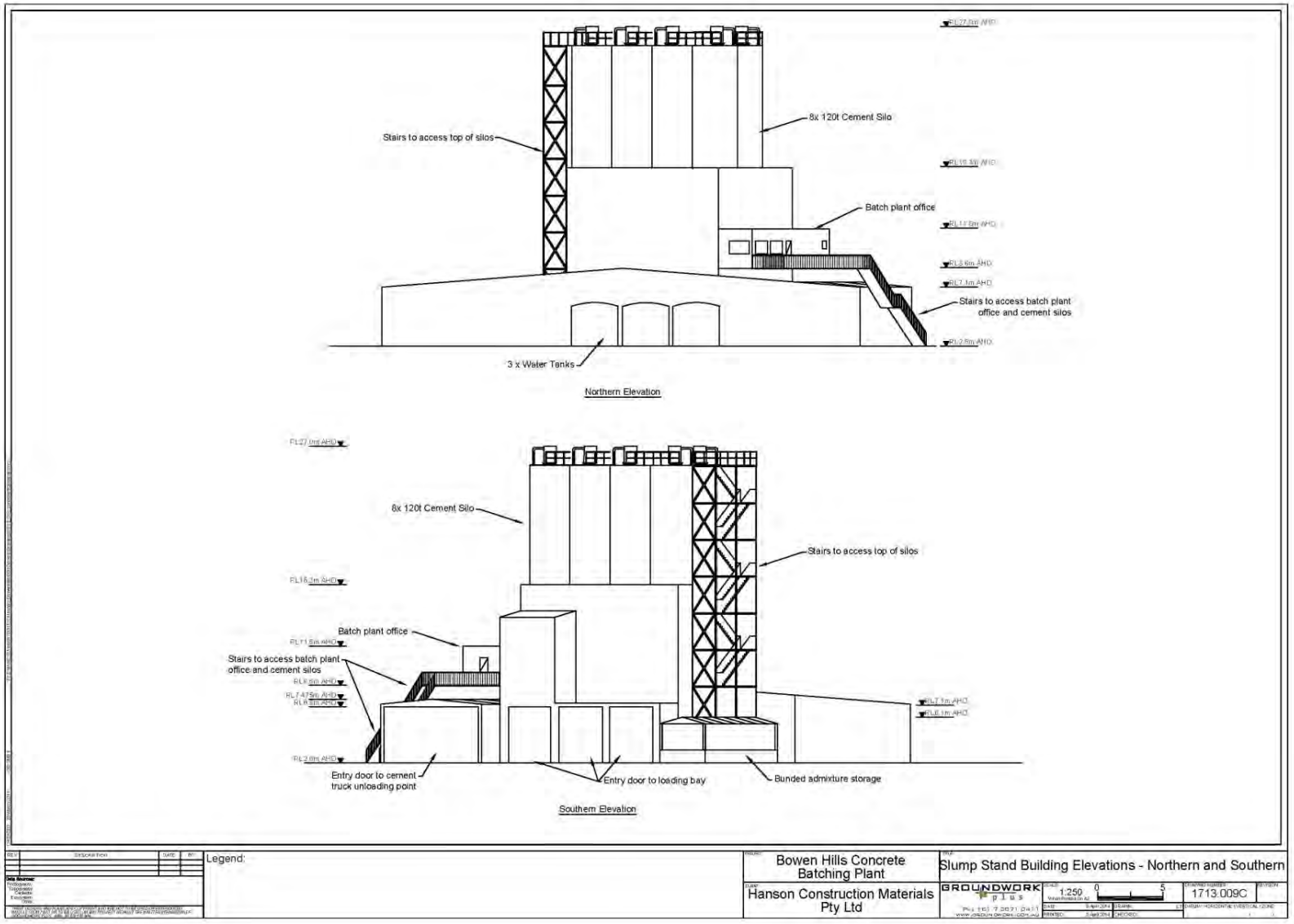
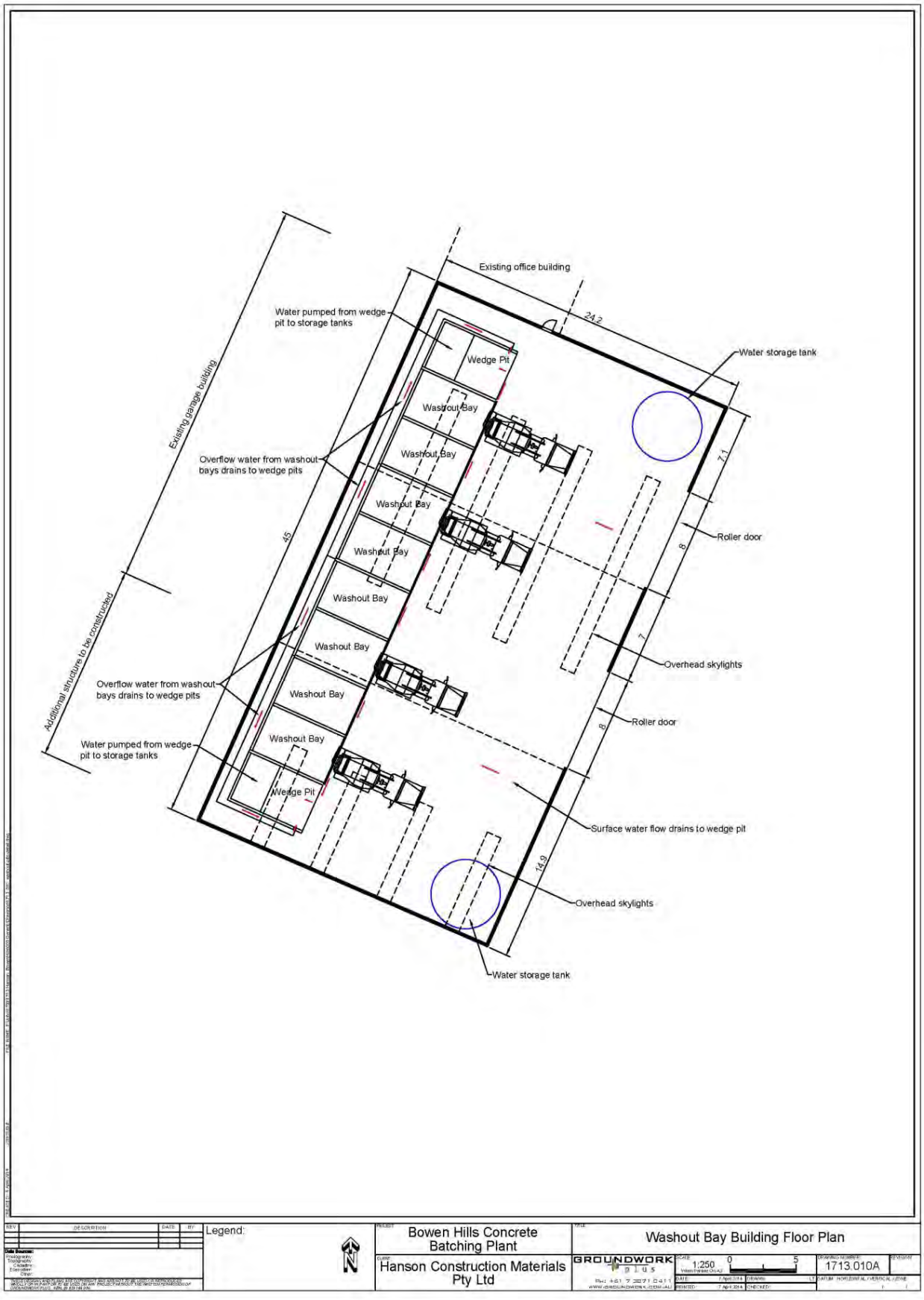
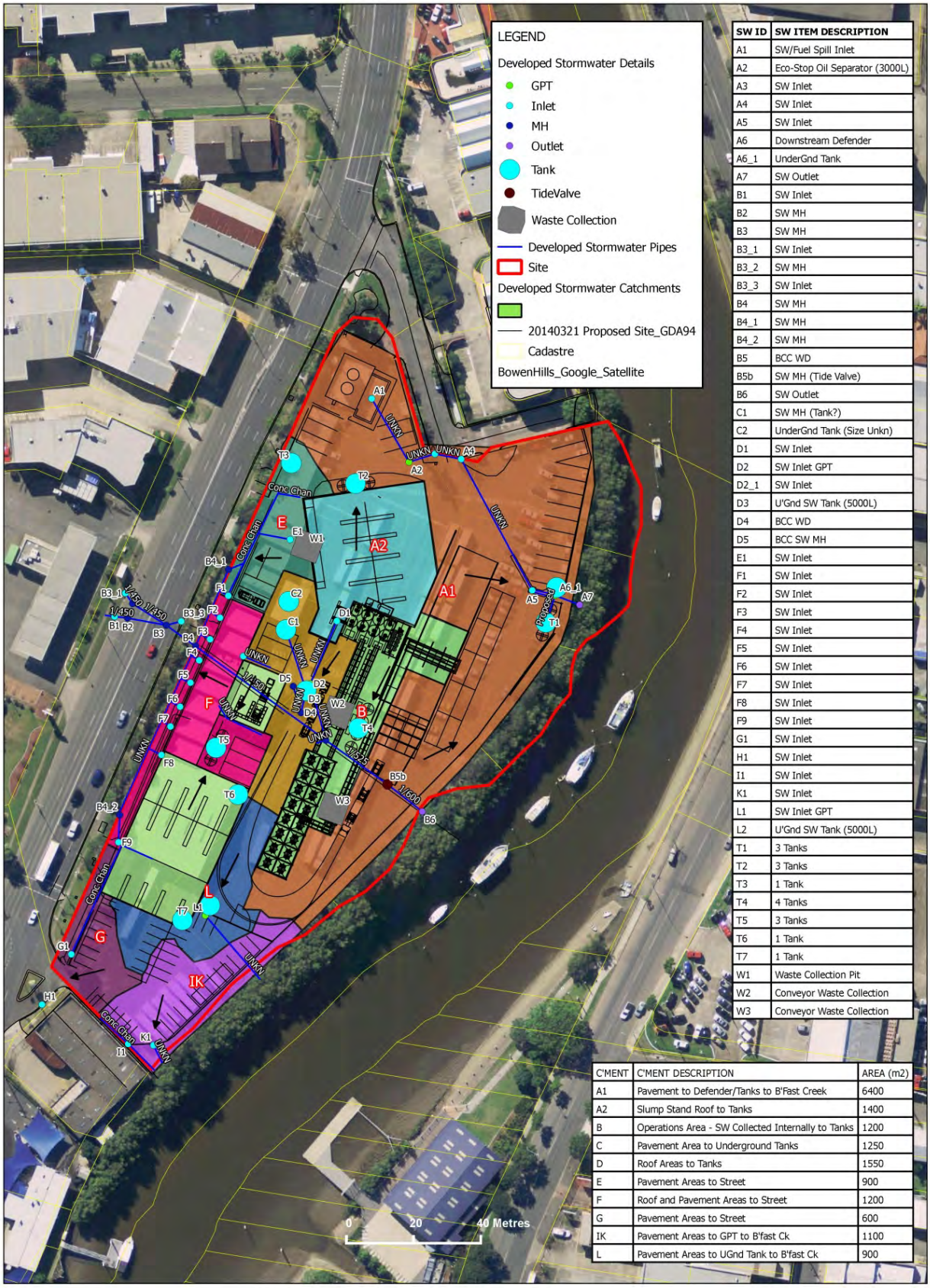
1713.008
1


36.5
3 x Water Tanks
2 x 7m x 4.2m roller doors
26.6
Slump stands
Overhead skylights
33.2
Collection pit for runoff from slump stands, to be pumped to washout pit for recycling
Stairs up to batch plant office and cement silos
Exit door from loading bay
16.9
10.7
Entry door to cement truck unloading point
18.6
Entry door to loading bay
Bunded admixture storage
Ground Floor Plan
(Concrete Loading Area and Slump Stands)
Batch plant operators office
Stairs down to ground level
Access to silo area
Balustrade around access walkway and stairs
WC
Batch plant managers office
3
14.2
10.7
11.2
8 x 120t Cement Silo
First Floor Plan
(Batch Plant Office and Cement Silos)
Legend:
Bowen Hills Concrete Batching Plant
Hanson Construction Materials Pty Ltd
Slump Stand Building Floor Plans
GROUNDWORK PLUS
1:250
1713.009A


8x 120t Cement Silo
Batch plant office
Skylight
Stairs to access batch plant office and cement silos
3 x Water Tanks
Bunded admixture storage
Entry door to cement truck unloading point
Entry door to loading bay
Western Elevation
8x 120t Cement Silo
Stairs to access top of silos
Batch plant office
Skylight
Bunded admixture storage
3 x Water Tanks
2 x Exit doors from slump stand
Eastern Elevation
Legend
Bowen Hills Concrete Batching Plant
Hanson Construction Materials Pty Ltd
Slump Stand Building Elevations - Western and Eastern
GROUNDWORK
1:250
1713.009B


Stairs to access top of silos
8x 120t Cement Silo
Batch plant office
Stairs to access batch plant office and cement silos
3 x Water Tanks
Northern Elevation
8x 120t Cement Silo
Stairs to access top of silos
Batch plant office
Stairs to access batch plant office and cement silos
Entry door to cement truck unloading point
Entry door to loading bay
Bunded admixture storage
Southern Elevation
Legend:
Bowen Hills Concrete Batching Plant
Hanson Construction Materials Pty Ltd
Slump Stand Building Elevations - Northern and Southern
GROUNDWORK plus
1:250
1713.009C


Existing office building
24.2
Water pumped from wedge pit to storage tanks
Wedge Pit
Washout Bay
Washout Bay
Washout Bay
Washout Bay
Washout Bay
Washout Bay
Washout Bay
Washout Bay
Washout Bay
Wedge Pit
Water storage tank
Existing garage building
Overflow water from washout bays drains to wedge pits
45
7.1
8
Roller door
7
Overhead skylights
Overflow water from washout bays drains to wedge pits
8
Roller door
Additional structure to be constructed
Water pumped from wedge pit to storage tanks
Surface water flow drains to wedge pit
14.9
Overhead skylights
Water storage tank
Legend:
Bowen Hills Concrete Batching Plant
Hanson Construction Materials Pty Ltd
Washout Bay Building Floor Plan
GROUNDWORK PLUS
1:250
1713.010A



SW ID	SW ITEM DESCRIPTION
A1	SW/Fuel Spill Inlet
A2	Eco-Stop Oil Separator (3000L)
A3	SW Inlet
A4	SW Inlet
A5	SW Inlet
A6	Downstream Defender
A6_1	UnderGnd Tank
A7	SW Outlet
B1	SW Inlet
B2	SW MH
B3	SW MH
B3_1	SW Inlet
B3_2	SW MH
B3_3	SW Inlet
B4	SW MH
B4_1	SW MH
B4_2	SW MH
B5	BCC WD
B5b	SW MH (Tide Valve)
B6	SW Outlet
C1	SW MH (Tank?)
C2	UnderGnd Tank (Size Unkn)
D1	SW Inlet
D2	SW Inlet GPT
D2_1	SW Inlet
D3	U'Gnd SW Tank (5000L)
D4	BCC WD
D5	BCC SW MH
E1	SW Inlet
F1	SW Inlet
F2	SW Inlet
F3	SW Inlet
F4	SW Inlet
F5	SW Inlet
F6	SW Inlet
F7	SW Inlet
F8	SW Inlet
F9	SW Inlet
G1	SW Inlet
H1	SW Inlet
I1	SW Inlet
K1	SW Inlet
L1	SW Inlet GPT
L2	U'Gnd SW Tank (5000L)
T1	3 Tanks
T2	3 Tanks
T3	1 Tank
T4	4 Tanks
T5	3 Tanks
T6	1 Tank
T7	1 Tank
W1	Waste Collection Pit
W2	Conveyor Waste Collection
W3	Conveyor Waste Collection

C'MENT	C'MENT DESCRIPTION	AREA (m2)
A1	Pavement to Defender/Tanks to B'Fast Creek	6400
A2	Slump Stand Roof to Tanks	1400
B	Operations Area - SW Collected Internally to Tanks	1200
C	Pavement Area to Underground Tanks	1250
D	Roof Areas to Tanks	1550
E	Pavement Areas to Street	900
F	Roof and Pavement Areas to Street	1200
G	Pavement Areas to Street	600
IK	Pavement Areas to GPT to B'fast Ck	1100
L	Pavement Areas to UGnd Tank to B'fast Ck	900

Coordinates: GDA94 Zone 56
Water Technology Pty Ltd

Hanson Bowen Hills CBP
PROPOSED STORMWATER MANAGEMENT PLAN

APPENDIX C - STORMWATER QUALITY MANAGEMENT MANUALS AND MAINTENANCE CHECKLISTS

C.1 Construction Phase Recommendations

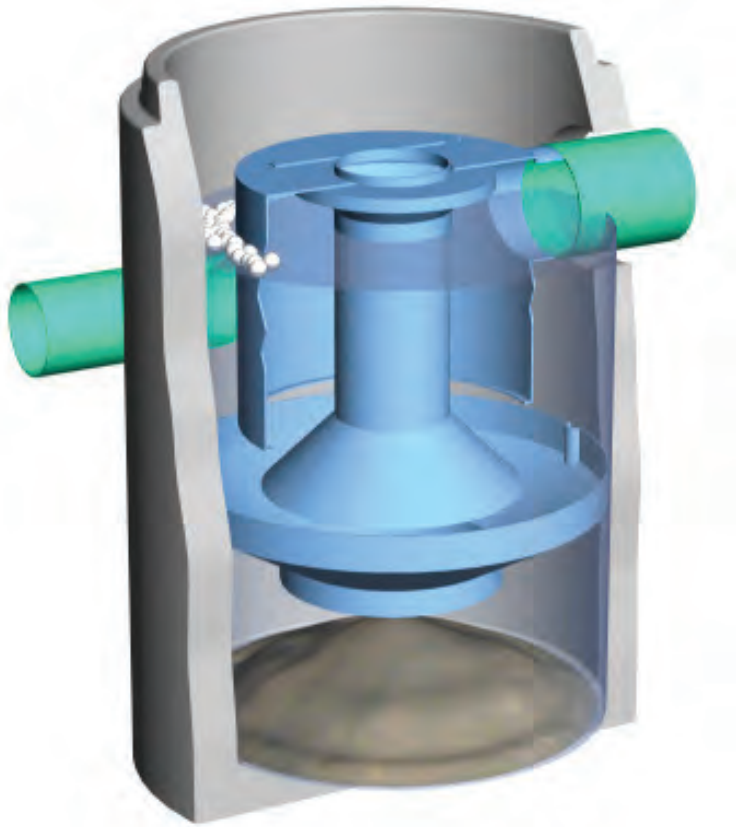
Sediment erosion and control measures will be determined by the project's civil engineer prior to construction.

The works shall be conducted in accordance with the following Construction Phase Management Plan. It shall be the responsibility of the developer, through their principal contractor, to ensure that temporary sediment and erosion controls are installed and maintained correctly as detailed below. This Construction Phase Water Quality Management Plan prepared for this site must take into account the specific characteristics of this site.

No external catchments pass through the site, and as the entire site drains towards the site boundary, this allows opportunities for sediment control at locations between driveway entrances and around the property boundary.

Sediment control should be able to be achieved by applying the following best sediment and erosion control management practices during the construction phase.

1. Establish a single stabilised entry/exit point for the site works, preferable not in the location of the proposed permanent driveway;
2. Construct a shake-down grid at the entrance to facilitate the removal of sediment from trucks leaving the site. The access road extending form the kerb to the grid should comprise a 150-200mm deep pad of 40mm crushed rock;
3. Install sediment fences along each boundary of the site;
4. Install bins and/or wind-proof litter areas on-site to minimise the dispersion of gross pollutants;
5. Maintain stockpiles on site of all materials necessary for the emergency repair lf all erosion control devices. This includes silt fences, clean crushed rock for reapplication to the entrance road and for replacement of rock within temporary drainage channels;
6. Following each days construction works, ensure that any material on road surfaces is swept from the road, and not permitted to be washed down the gutters and piped drainage systems.



Downstream Defender®

Stormwater Treatment System

Operation and Maintenance Manual

Table of Contents

Downstream Defender® by Rocla Water Quality

The Downstream Defender is an advanced Hydrodynamic Vortex Separator designed to provide high removal efficiencies of settleable solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

The Downstream Defender has unique, flow-modifying internal components developed from extensive full-scale testing, CFD modeling and over thirty years of hydrodynamic separation experience in wastewater, combined sewer and stormwater applications. These internal components distinguish the Downstream Defender from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and headlosses, enhancing separation, and preventing washout of previously stored pollutants.

The high removal efficiencies and inherent low headlosses of the Downstream Defender allow for a small footprint making it a compact and economical solution for the treatment of non-point source pollution.

Benefits of the Downstream Defender

- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide ranges of flows
- Easy to install
- Low maintenance

Applications

- New developments and retrofits
- Utility yards
- Streets and roadways
- Parking lots
- Pre-treatment for filters, infiltration and storage
- Industrial and commercial facilities
- Wetlands protection

DOWNSTREAM DEFENDER COMPONENTS

1. **Central Access Port**
2. **Floatables Access Port (DD1800, DD2400 and DD3000 models only)**
3. **Dip Plate**
4. **Tangential Inlet**
5. **Center Shaft**
6. **Center Cone**
7. **Benching Skirt**
8. **Floatables Lid**
9. **Outlet Pipe**
10. **Floatables Storage**
11. **Isolated Sediment Storage Zone**

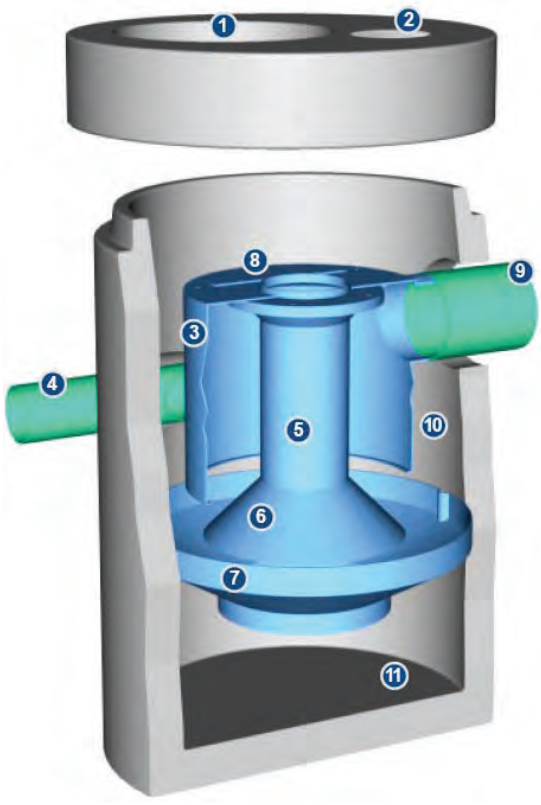


Figure 1 – *Downstream Defender Components*

Operation

INTRODUCTION

The Downstream Defender operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The Downstream Defender has been designed to allow for easy and safe access for inspection/monitoring and clean-out procedures. Entry into the unit or removal of the internal components is not necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

POLLUTANT CAPTURE AND RETENTION

The internal components of the Downstream Defender have been designed to protect the oil, floatables and sediment storage volumes so that separator performance is not reduced as pollutants accumulate between clean-outs. Additionally, the Downstream Defender is designed and installed into the storm drain system so that the vessel remains wet between storm events. Oil and floatables are stored on the water surface in the outer annulus separate from the sediment storage volume in the sump of the unit providing the option for separate oil disposal, and accessories such as adsorbent pads. Since the oil/floatables and sediment storage volumes are isolated from the active separation region, the potential for re-suspension and washout of stored pollutants between clean-outs is minimized.

WET SUMP

The sump of the Downstream Defender retains a standing water level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. The clean-out procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.

BLOCKAGE PROTECTION

The Downstream Defender has large clear openings and no internal restrictions or weirs, minimizing the risk of blockage and hydraulic losses. In addition to increasing the system headloss, orifices and internal weirs can increase the risk of blockage within the unit.

Maintenance

OVERVIEW

The Downstream Defender protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the Downstream Defender. The Downstream Defender will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1 (Page 5).

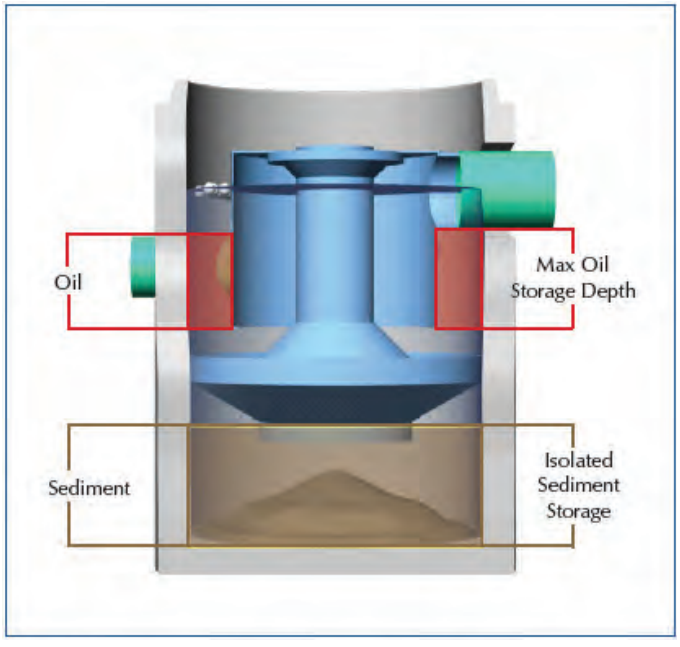


Figure 2 – *Downstream Defender Maximum Storage Depths*

The Downstream Defender allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned vacuum truck is used to remove captured sediment and floatables. Access ports are located in the top of the manhole. On the DD1800, DD2400 and DD3000 units, the floatables access port is above the outlet pipe between the concrete manhole wall and the dip plate. The sediment removal access ports for all Downstream Defender models are located directly over the hollow center shaft.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the Downstream Defender, nor do they require the internal components of the Downstream Defender to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

DETERMINING YOUR MAINTENANCE SCHEDULE

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple sediment probe can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil/floatables removal, for a DD1800 Downstream Defender typically takes less than 30 minutes and removes a combined water/oil volume of about 1,895 Litres.

INSPECTION PROCEDURES

Inspection is a simple process that does not involve entry into the Downstream Defender. Maintenance crews should be familiar with the Downstream Defender and its components prior to inspection.

SCHEDULING

- It is important to inspect your Downstream Defender every six months during the first year of operation to determine your site-specific rate of pollutant accumulation.
- Typically, inspection may be conducted during any season of the year

RECOMMENDED EQUIPMENT

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe*

* Sediment probe or staff is a simple measuring staff that is used to measure the depth from the ground surface to the bottom of the Downstream Defender sump. The length of the staff required to reach the solids stored in the sump is compared to the actual depth of the sump when empty as shown on the site specific drawing for the system.

- Trash bag for removed floatables
- Downstream Defender Maintenance Log

DOWNSTREAM DEFENDER POLLUTANT STORAGE CAPACITIES and MAX. CLEANOUT DEPTHS

Unit Diameter	Total Oil Storage	Oil Clean-out Depth	Total Sediment Storage	Sediment Clean-out Depth	Max. Liquid Volume Removed
(millimetres)	(Litres)	(millimetres)	(Litres)	(millimetres)	(Litres)
1200	265	<400	550	<455	1450
1800	870	<580	1600	<610	4700
2400	1990	<830	3550	<750	10900
3000	3975	<1060	6650	<900	20900

Table 1 – Clean-Out Depths

NOTES

1. Refer to Downstream Defender Clean-out Detail (Fig. 2) for measurement of depths.

2. Oil accumulation is typically less than sediment, however, removal of oil and sediment during the same service is recommended.

3. Remove floatables first, and then remove sediment storage volume.

Figure 3 – *Inspection and Maintenance Covers*

Figure 4 – Checking *Sediment using a Probe*

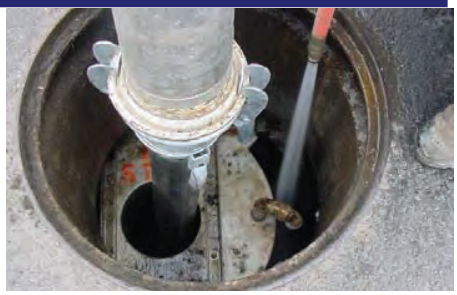


Figure 5 – *Vacuuming Sediment Sump*

INSPECTION PROCEDURES

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the lids to the manhole. Figure 3. (NOTE: The DD1200 Downstream Defender will only have one lid).

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Figure 6 and 7 for typical inspection views.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.

5. Using a sediment probe, measure the depth of sediment that has collected in the sump of the vessel. Figure 4.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Rocla Water Quality of any irregularities noted during inspection.

FLOATABLES AND SEDIMENT CLEANOUT

Floatables cleanout is typically done in conjunction with sediment removal. A commercially or municipally owned vacuum truck is used to remove captured sediment and floatables. Figure 6.

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

SCHEDULING

- Floatables and sump cleanout are typically conducted once a year during any season.

- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.

Figure 6: *View over Center Shaft into sediment storage Zone*

Figure 7: *View of outer annulus of floatables and oil collection zone*

RECOMMENDED EQUIPMENT

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe
- Vacuum truck (flexible hose recommended)
- Downstream Defender Maintenance Log

FLOATABLES AND SEDIMENT CLEAN OUT PROCEDURES

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being carried out.

2. Remove the lids to the manhole (NOTE: The DD1200 Downstream Defender will only have one lid).

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Using the Floatables Port for access, remove oil and floatables stored on the surface of the water with the vactor hose or the skimmer net. Figure 8.

5. Using a sediment probe, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vacuum hose to the base of the sump via the Central Access Port. Vacuum out the sediment and gross debris off the sump floor. Refer Figure 5.

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Rocla (Page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

9. Securely replace the grate or lid.

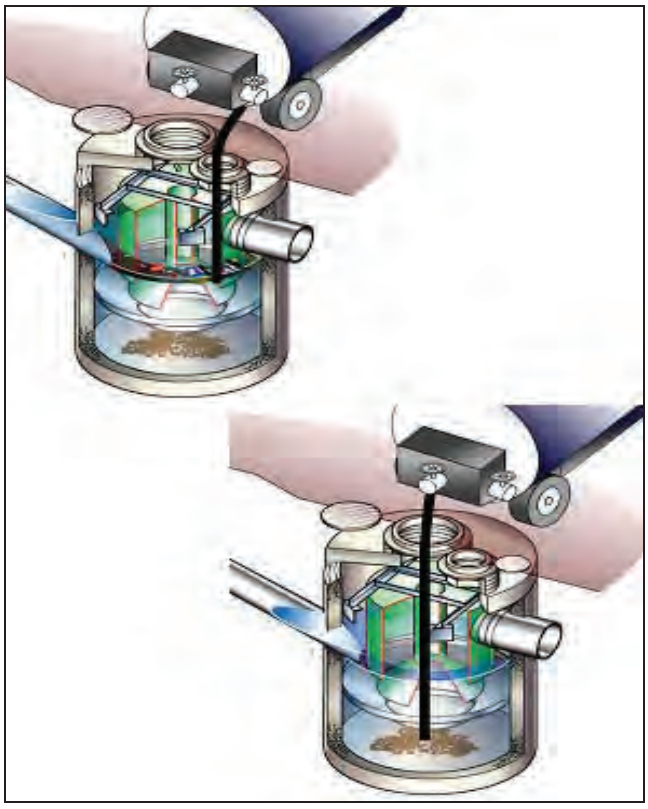


Figure 8: *Floatables and sediment are removed with a vactor hose*

Maintenance at a Glance

Table 2

ACTIVITY	FREQUENCY
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most cleanouts it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils / floatables and the sediment storage volume is required.	

Downstream Defender® Hydrodynamic Separator Installation Log

ROCLA WATER QUALITY SERIAL NUMBER: (Data Plate located on baffle lid inside the unit) **DD AU**.....	
SITE NAME:	
SITE LOCATION:	
OWNER:	**CONTRACTOR:**
CONTACT NAME:	**CONTACT NAME:**
COMPANY NAME:	**COMPANY NAME:**
ADDRESS:	**ADDRESS:**
TELEPHONE:	**TELEPHONE:**
FAX:	**FAX:**

INSTALLATION DATE: / /

MODEL (CIRCLE ONE): **DD1200** **DD1800** **DD2400** **DD3000** **CUSTOM**

Downstream Defender® Hydrodynamic Separator
Inspection and Maintenance Log

DATE	INITIALS	DEPTH OF FLOATABLES AND OILS	SEDIMENT DEPTH MEASURED	VOLUME OF SEDIMENT REMOVED	SITE ACTIVITY AND COMMENTS

NOTES

NOTES

ROCLA WATER QUALITY
DOWNSTREAM DEFENDER®
HYDRODYNAMIC SEPARATORS

For further information on Rocla Downstream Defender® Hydrodynamic Separators or other products from Rocla Water Quality

Call Rocla on

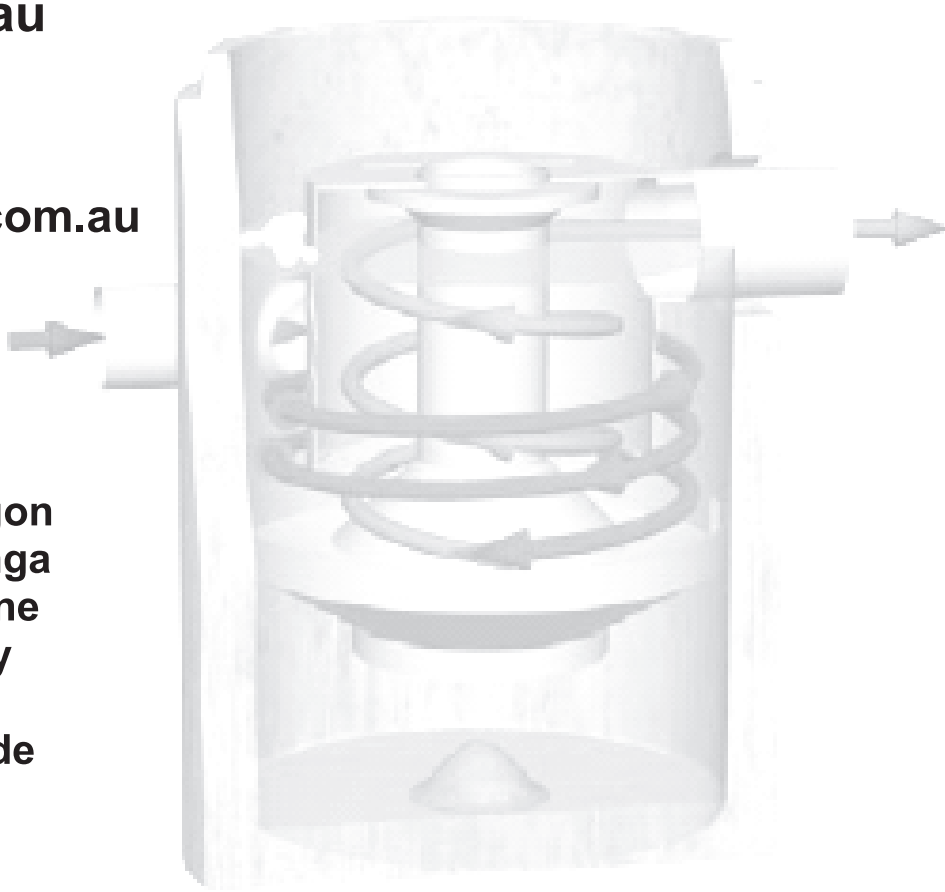
131 004

E-mail your inquiry

solutions@rocla.com.au

Visit our website

www.waterquality.rocla.com.au



- **Sydney**
- **Dapto**
- **Dubbo**
- **Newcastle**
- **Glen Innes**
- **Grafton**
- **Canberra**
- **Melbourne**
- **Avoca**
- **Traralgon**
- **Wodonga**
- **Brisbane**
- **Mackay**
- **Cairns**
- **Adelaide**
- **Perth**

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Rocla Pty Limited
ABN 31 000 032 191
Trading as Rocla Water Quality
A member of the Fletcher Building Group

Rocla Water Quality

Rocla
Water Quality

ecoStop®

Spill control system

Operating and Maintenance Manual

ecoStop®

Spill control system

Rocla
Water Quality

1. Technical description

1.1 OIL SPILL CONTROL

The automatic shut-off valve stops the flow from an above-grade area either when the maximum oil storage capacity is reached or when a certain liquid level in the separation chamber is exceeded.

In its closed position, the valve is tight up to 50kPa (5m-head) pressure. This makes the Rocla ecoStop® spill prevention system the only spill control system to provide maximum security for the facility owner against unexpected, unpredictable and catastrophic petroleum spills.

2. Maintenance and Operation

2.1 MAINTENANCE OF SPILL CONTROL VALVE AND FLOAT

The spill control valve at the inlet operates in two working conditions:

- Open valve: Float lever is in a horizontal position, the float is floating in water.
- Closed valve: Float lever is pointing downwards, the float is submerged.

During operation the valve is open, water is admitted to the gravity separator.

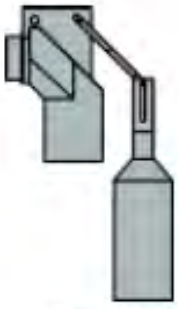
The automatic shut-off valve stops the flow from upstream either when the maximum oil storage capacity is reached or when a certain liquid level in the separation chamber is exceeded.

In the event of a major spill the storage and drainage system upstream of the Rocla ecoStop® spill prevention system must be cleaned first.

To set the valve back to its operating condition after a spill, remove the float pin and detach the float from the float lever. Lift out and empty the float. Pump the accumulated oil in the separation chamber and refill the system with fresh water. Use the float pin to connect the float to the float lever again. Make sure to release the float carefully so that it is not sinking. The valve should now be in its operating condition again.

Smoking or naked flames should not be allowed in the vicinity the Rocla ecoStop® spill prevention system, particularly in the event of a spill or when the access covers are open.

Open Valve



Closed Valve

2.1.1 Standard Maintenance:

Detach the float from float lever by removing the float pin (see picture).

Check whether the float lever is free moving and the valve can be opened and closed easily.

Check the condition of the gasket.

To clean the inside of the valve remove lid and rinse with high pressure water.

If necessary, lubricate moving parts.

ecoStop®

Spill control system

Rocla Water Quality

3. Maintenance Sheet

Page No.

Working Site:

Rocla ecoStop® spill control system

Date	Depth of grit in vessel bottom [mm]	Detection of visible sheen in vessel	Inspection, Pump-out and other maintenance work, remarks	Signature