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Addendum to Stormwater Management Plan Report and Addendum to Flood Study Report

Proposed Industrial Subdivision and General Industrial Building Development

2 & 10 Bowman Road
MOSS VALE 2577

For

SAAS Pty Ltd
c/o Jackson Environment and Planning
Suite 102, Level 1, 25-29 Berry St
North Sydney NSW 2060

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Introduction and Background

Purpose

The purpose of this addendum to the stormwater management plan is to provide additional information following design changes and revisions to the previously issued stormwater management plan report and flood study report. This document should be read in conjunction with the following listed documentation:

- 10530-002-swmp Revision 5, dated 31 July 2023 (ECLIPSE Consulting Engineers)
- 10530-003-smp Revision 4, dated 31 July 2023 (ECLIPSE Consulting Engineers)
- 10530-004-fs Revision 3, dated 31 July 2023 (ECLIPSE Consulting Engineers)

The sections included in this document supersede the sections in the existing reports. All other sections remain unchanged.

1. Response to Department of Planning and Environment Request for Additional Information

On 5 December 2023, a request for additional information was received by the applicant from the Department of Planning and Environment. Further information was requested on 6 May 2024 regarding the design of the sediment basin. This has been included in section 1.3. The information specific to the submitted flood study report has been included below:

1.1. Stormwater Outlet – Erosion and Overtopping Concerns

Submitted Request

> *The submitted Flood Impact Assessment does not model the risk of overtopping of the upper dam on the southern hydroline/watercourse and the subsequent increased erosion risk, given that the development will generate increased volume of stormwater and the upper dam is proposed to be partially filled, hence decreasing its volumetric storage capacity, leading to more regular overtopping and surface water flows downstream of the upper dam.*
>
> *A revised flood impact assessment is required that models the likelihood of overtopping of the dam at its reduced capacity.*

ECLIPSE Response

The intent of the proposed stormwater outlet design is to replace the existing dam on the southern hydroline/watercourse with a dam of at least equivalent volume of the existing dam. This would be completed during the early site works of the development. As an equivalent volume of storage is to be provided, no additional risk of overtopping is caused by a reduction in volumetric capacity. This proposal is shown in our updated drawings, which have been updated to reflect the intended design more clearly. Please refer to Figure 1.1 below.

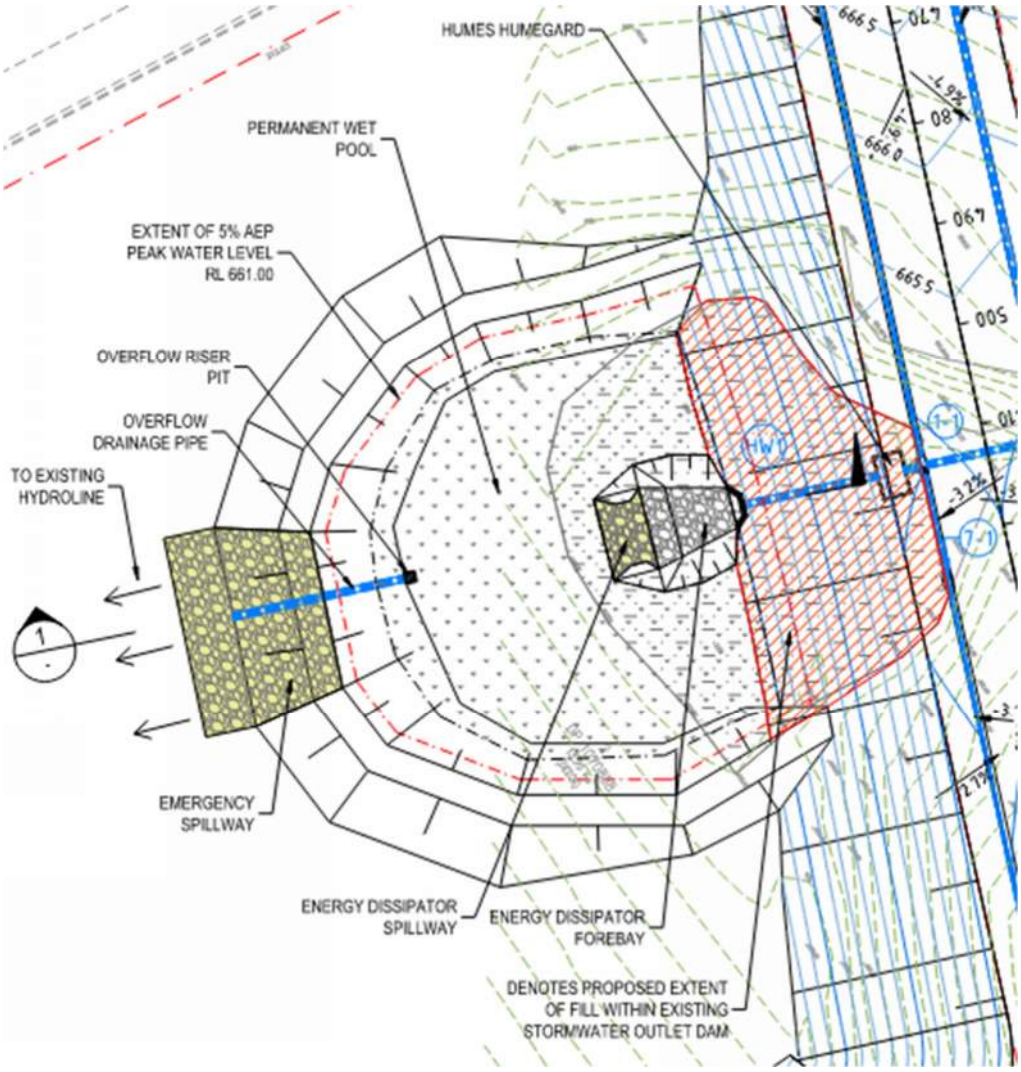


Figure 1.1: Concept design of proposed stormwater outlet (ECLIPSE)

Once constructed, the proposed dam will serve as an outlet location for the stormwater for the entire development. As outlined in the flood study report, the existing dam is the outlet for approximately 45% of the catchment of the existing site. As such, the catchment area for the proposed development will be approximately double that of the existing development, not accounting for effects produced by overland catchments to the north.

Concept detention design has been undertaken for the proposed building developments to ensure that stormwater flows at the catchment outlet do not exceed pre-development flows at the catchment outlet for storm events between 50% AEP and 1% AEP. This design requires the provision of total of 950 m^3 of detention volume across the three building developments. As such, the increased stormwater flows at the proposed outlet location will not exceed the existing stormwater flows at the outlets of the pre-development catchment.

Erosion and soil loss at the proposed outlet location will be limited through the implementation of a Type A Energy Dissipator Outlet. A concept design of the energy dissipator has been developed, with sizing shown in Figure 1.1 above. This outlet design will be adequate to ensure that erosion and soil loss do not occur in the 5% AEP design event. Calculations supporting the energy dissipator design have been included in Appendix A.

The proposed outlet design also includes a concept design for a permanent water volume, with the intent to vegetate this pond to support in increase in downstream water quality. Above this permanent water volume, emergency storage is provided for excess stormwater volume expected in storm events up to the 5% AEP.

DRAINS modelling conducted for the site indicates that a peak flow of 3.3 L/s can be expected in a 20-minute storm in the 5% AEP event. If storage for at least 10 minutes of this storm is required to reduce downstream flows, a storage volume of approximately 2000 m^3 will be required to mitigate downstream flows. With a proposed area of 2000 m^2, this storage volume can be provided through construction of a 1 m high earth bund. A concept cross section of the outlet arrangement is shown in Figure 1.2 below.

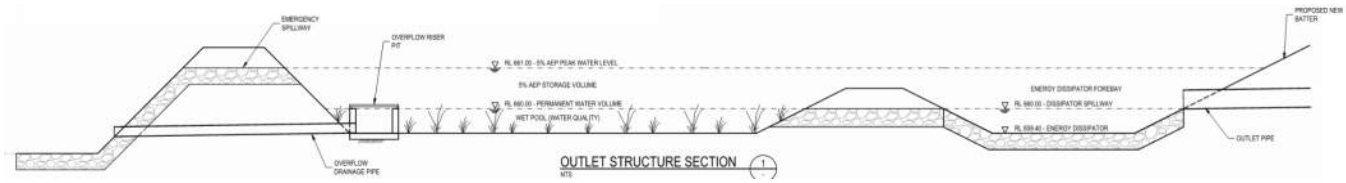


Figure 1.2: Concept outlet structure section

1.2. Hutchison Road Cut and Fill

Submitted Request

> *The submitted cut and fill plan shows 5-6 m of fill at the head of the cul-de-sac on a downhill slope. This does not appear physically possible without a retaining wall. Is a retaining wall part of the scope of construction of Hutchison Road?*

ECLIPSE Response

The proposed fill is intended to be achieved using a batter to meet existing ground levels to the south of the development. The stability of the slope and structural fill requirements will be determined closer to construction stage, following a comprehensive geotechnical investigation of the site. The intent is not to construct a retaining wall at this location unless site constraints require it. Our Bulk Earthworks Cut and Fill Plan has been updated to show cut and fill depths outside the extend of the proposed Hutchinson Road cul-de-sac. Refer to Figure 1.3 below.

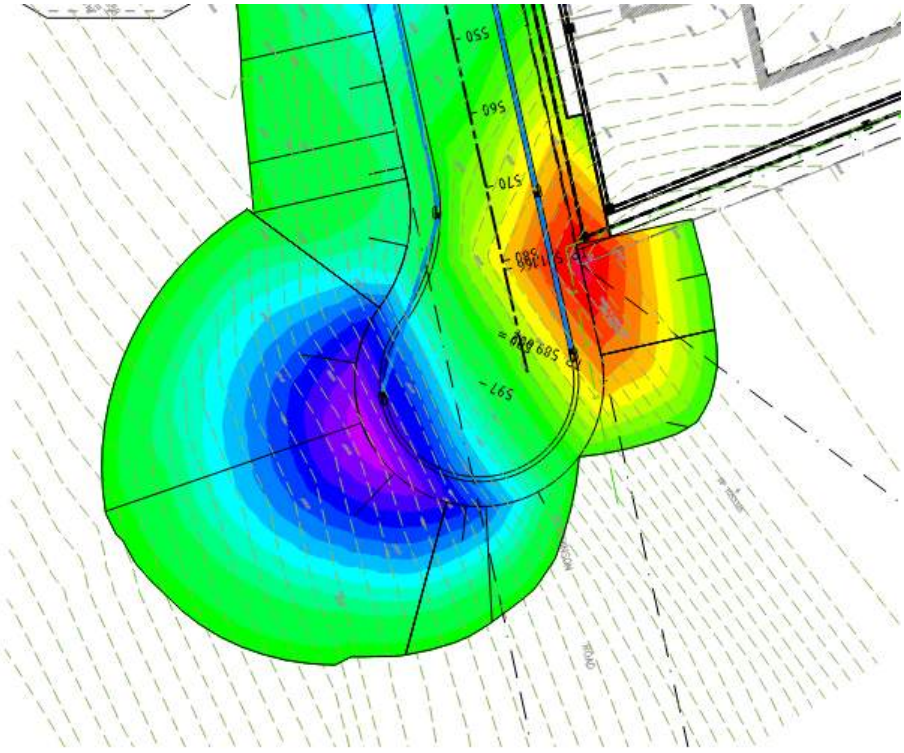


Figure 1.3: Bulk earthworks cut and fill results (ECLIPSE)

As outlined in the project's soil and water management plan report, the external works will result in a very low risk of soil loss during preliminary earthworks. As such, the erosion and sediment controls implemented in this area of the development are adequate to prevent soil loss while these batters are instated. Section 5 of the project's soil and water management plan report outlines revegetation requirements for the proposed development, which are to be implemented in this area at the conclusion of construction works.

1.3. Sediment Basin

Submitted Request #1

> *The submitted Erosion and Sediment Control Plans detail use of the existing dam as a sediment basin during the construction phase, which is against the Controlled Activity Approval Guidelines for Riparian Corridors which state that basins to be used for water quality purposes cannot be located on-line as they can act as a point source of pollution. A revised Erosion and Sediment Control Plan is required that does not show an on-line Sediment Basin.*

ECLIPSE Response #1

As outlined above, the proposed development proposes to infill the existing dam as required and install a new dam with equivalent volume downstream to the south of the existing dam. The intent is to use the new dam as a sediment basin during the earthworks stage of the development and re-develop the dam into an appropriate stormwater outlet and energy dissipator following the installation of the proposed stormwater system.

It should be noted that a temporary sediment basin is not a form of pollution control which disposes water downstream. The basin has been designed with an appropriate volume to store both sediment and runoff in a large rainfall event expected during the development works. As outlined in the project soil and water management plan, the sediment basin is to be pumped out following settling of sediment following large rainfall events, and to be maintained during development works. This is required to prevent soil loss to downstream catchments. Typical arrangements including construction notes and drainage strategies are shown in Figures 1.4 and 1.5 below.

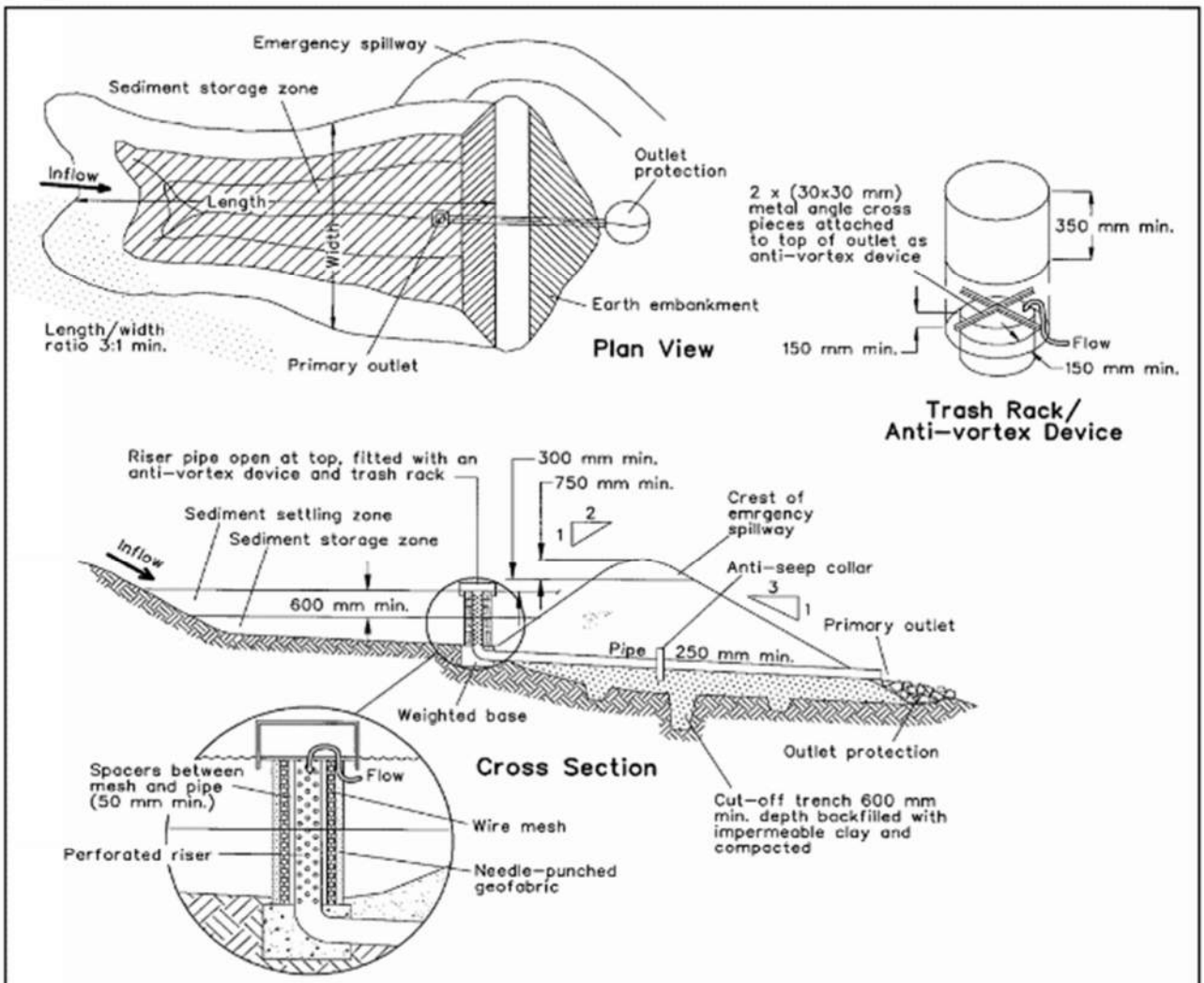
Submitted Request #2

> *The submitted Erosion and Sediment Control Plans detail use of an on-line sediment basin during the construction phase, which is not in accordance with the Department's Controlled Activity Approval Guidelines for Riparian Corridors which state that on-line stormwater basins cannot be used for water quality purposes. A revised Erosion and Sediment Control Plan is required that does not shown an on-line Sediment Basin.*

ECLIPSE Response #2

The proposed development's Soil and Water Management Plan (10530-002-swmp) has identified that a temporary sediment basin of volume 144 m^3 is needed for Building 3 only, due to the expected nature of its catchment during the development works. The catchments of Building 1, Building 2, and the proposed external works have been classified as low risk and do not require the use of a temporary sediment basin.

The development's civil plans have been updated to include a temporary sediment basin wholly within the boundary of Building 3, which is offline of the Riparian Corridor.



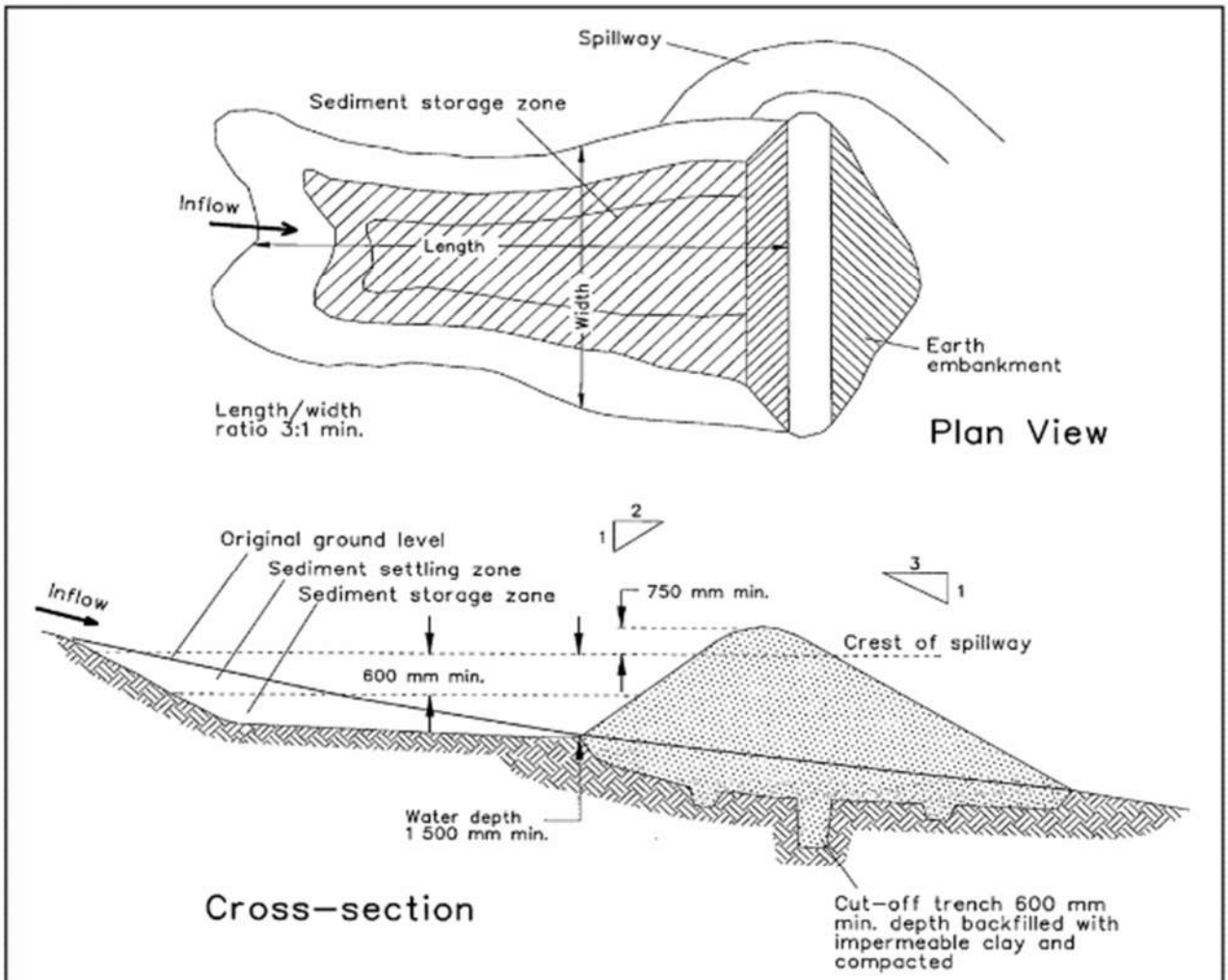
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Form a cut off trench under the centreline of the embankment 600 mm deep and 1,200 mm wide, extending to a point on the watercourse wall above the riser sill level.
3. Maintain the trench free of water and recompact the materials with equipment as specified In the SWMP to 95 per cent Standard Proctor Density.
4. Select fill according to the SWMP that is free from roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond the compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Install the pipe outlet with seepage collars as specified in the SWMP and Standard Drawing 6-3b.
8. Form batter grades at 2(H):1(V) upstream and 3(H):1(V) downstream or as specified in the SWMP

EARTH BASIN - DRY
(APPLIES TO 'TYPE C' SOILS ONLY)

SD 6-3

Figure 1.4: Typical dry earth sediment basin detail (Managing Urban Stormwater)



Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET
(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

Figure 1.5: Typical wet earth sediment basin detail (Managing Urban Stormwater)

2. Response to Water NSW Request for Additional Information

On 7 December 2023, a request for additional information was received by the applicant from Water NSW. The information specific to the submitted flood study report has been included below:

2.1. Proprietary Device MUSIC Modelling

Submitted Request

> *The consultant has used pollution efficiency concentration reductions for Proprietary Device modelling that are not the agreed Water NSW figures within the Drinking Water Catchment. The consultant should contact the manufacturer and get the accepted node values for the Humeceptor and the HumeFilter UPT in the Sydney Drinking Water Catchment.*
>
> *The detailed description of the proposal will comprise: 'an industrial subdivision on the properties at 2 Bowman Road (Lot 1, DP103123 and Lot 2, DP1070888) and 10 Bowman Road, Moss Vale (Lot 51, DP130176). Approval is also sought for the construction industrial buildings and associated office space.'*
>
> *The detailed description doesn't include the proposed roadworks, although the Development Application form does include in proposed roadworks 'Extension to existing Bowman Rd and formation of part of Hutchinson Rd.'*
>
> *NorBE assessment of the proposed road works is required. Clarification is required as to whether council as owner of the road:*
>
> - *Is applying s 171A (3) EP&A Reg where the determining authorities needs to take into account NorBE and the NorBE Guideline.*
> - *has given approval for the road works to be included by the developer in the DA, and NorBE assessment occurs for the road as a Part 4 development (as has happened for the warehouses)*

ECLIPSE Response

Following a phone conversation with Neil Cowley at Water NSW, the following treatment performances have been adopted for the modelling of Humes stormwater treatment devices:

- Humeceptor/Humegard: 75% removal of total suspended solids, 30% removal of total phosphorus, 20% removal of total nitrogen.
- Humefilter: 75% removal of total suspended solids, 45% removal of total phosphorus, 25% removal of total nitrogen.

These performance profiles have been updated in the development's MUSIC model. Revised modelling results are reflected in the current civil drawings.

The addendum to the project's stormwater management plan indicates that a NorBE assessment has been undertaken for the full development site, including the proposed road works. Refer to the following section for details on updated MUSIC modelling reporting.

3. Stormwater Quality Design

3.1. General

The water quality for the proposed development has been designed in accordance with WaterNSW's Water Sensitive Urban Design (WSUD) objectives, which requires that the proposed development has Neutral or Beneficial Effect (NorBE) on receiving waters.

To determine compliance with this requirement, a full analysis of the water quality of the stormwater discharging from the site was undertaken using the Model for Urban Stormwater Quality Improvement Conceptualisation (MUSIC) software modelling package.

The analysis has considered the use of the following stormwater quality improvement devices for the proposed development:

- Rainwater tanks
- Humes Humeceptor
- Humes Humefilter
- Humes Humegard

3.2. MUSIC Input Parameters

Treatment Node Properties

As proprietary stormwater treatment devices have been proposed for this development, the treatment node properties have been determined in accordance with their documentation. The following proprietary devices have been proposed for this development:

- Humes Humeceptor (Class 2), located upstream of the OSD system in each industrial lot.
- Humes Humefilter UPT, located upstream of the OSD system in each industrial lot.
- Humes Humegard, located upstream of the proposed new stormwater outlet and ponding system.

A generic treatment node has also been included in each catchment representing a trash screen. This is intended to be a final physical barrier in the treatment train to prevent the movement of gross pollutant into the detention tank.

The Humes Humegard has been added to the treatment train of the proposed development in response to requests in the approval process to ensure that the entire development site including the proposed external works are examined for compliance with NorBE requirements.

These devices have been assigned treatment efficiencies in MUSIC in accordance with WaterNSW recommendations, summarised in Table 3.1 below.

	Humeceptor				Humefilter			
	TSS	**TP**	**TN**	**GP**	**TSS**	**TP**	**TN**	**GP**
Input (mg/L)	500	5.0	5.0	15	1000	5.0	5.0	15
Output (mg/L)	125	3.5	4.0	1.5	250	2.75	3.75	0

	Trash Screen				Humegard			
	TSS	**TP**	**TN**	**GP**	**TSS**	**TP**	**TN**	**GP**
Input (mg/L)	-	-	-	50	500	5.0	5.0	15
Output (mg/L)	-	-	-	0	255	3.0	3.7	1.5

Table 3.1: Treatment node performance summary (WaterNSW)

The size and model of each device used is determined by the high flow bypass flow node property. The final sizing of each device will be determined in conjunction with Humes prior to construction stage.

3.3. MUSIC Model Summary

Figure 3.1 summarises the MUSIC model layouts for the full catchment on this project.

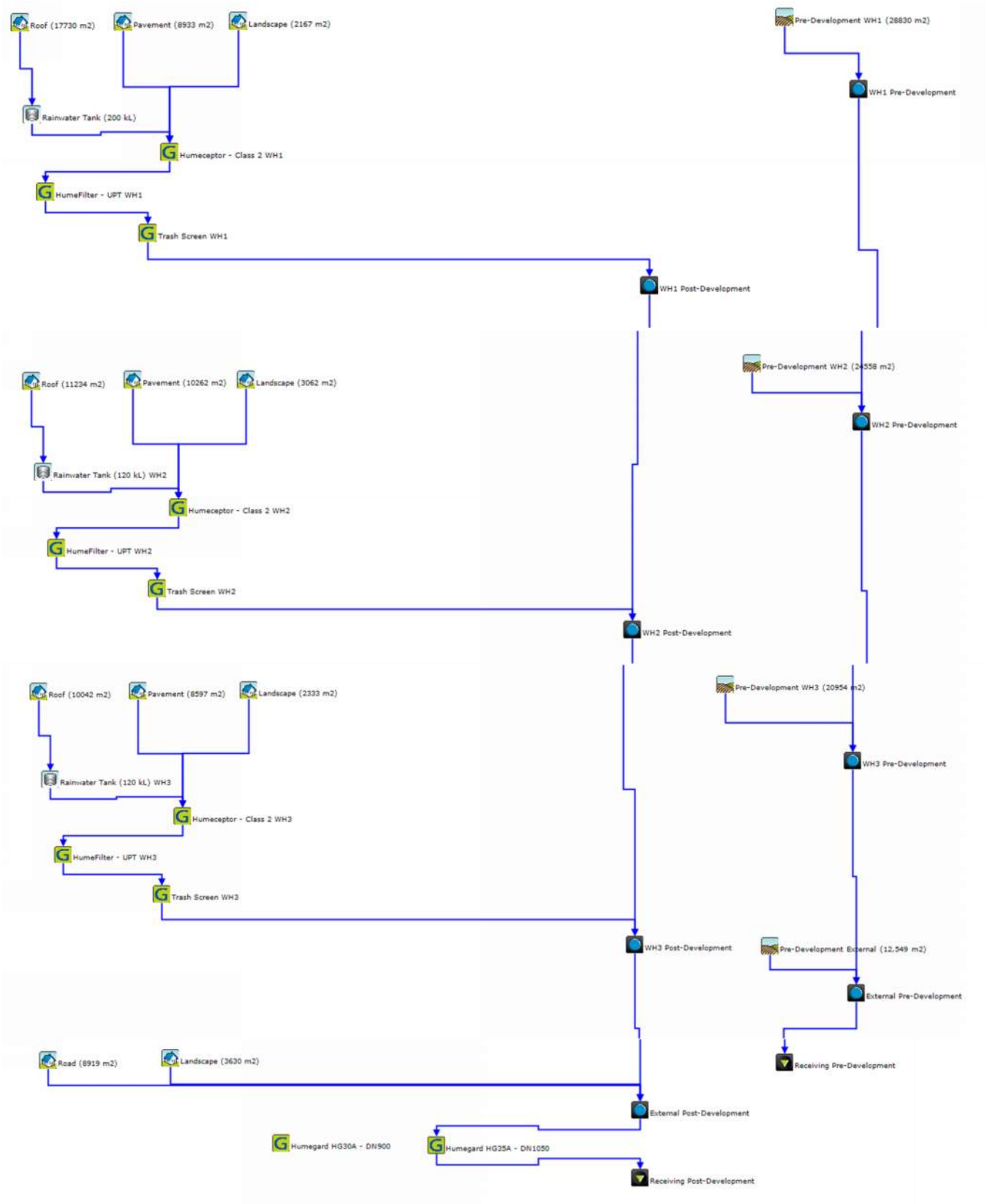


Figure 3.1: Full catchment MUSIC model layout

3.4. MUSIC Model Output

The annual treatment train residual pollutant loads for post-development at each building has been compared to the pre-development scenario. These results have been summarised in Table 3.2 below.

Pollutant	Pre-Development Residual Load	Post-Development Residual Load	Reduction (%)
Flow (ML/year)	20.246	57.171	-183
Total Suspended Solids	3343.276	1427.862	57
Total Phosphorus	9.259	5.038	46
Total Nitrogen	67.014	61.547	8
Gross Pollutants	104.097	17.302	83

Table 3.2: Full catchment treatment train performance

The results above indicate that on a mean annual load basis, neutral or beneficial effect has been achieved for the full development site.

Figures 3.2 to 3.4 below show the flow-based cumulative frequency curves for each of total suspended solids, total phosphorus, and total nitrogen between the 50th and 98th percentiles.

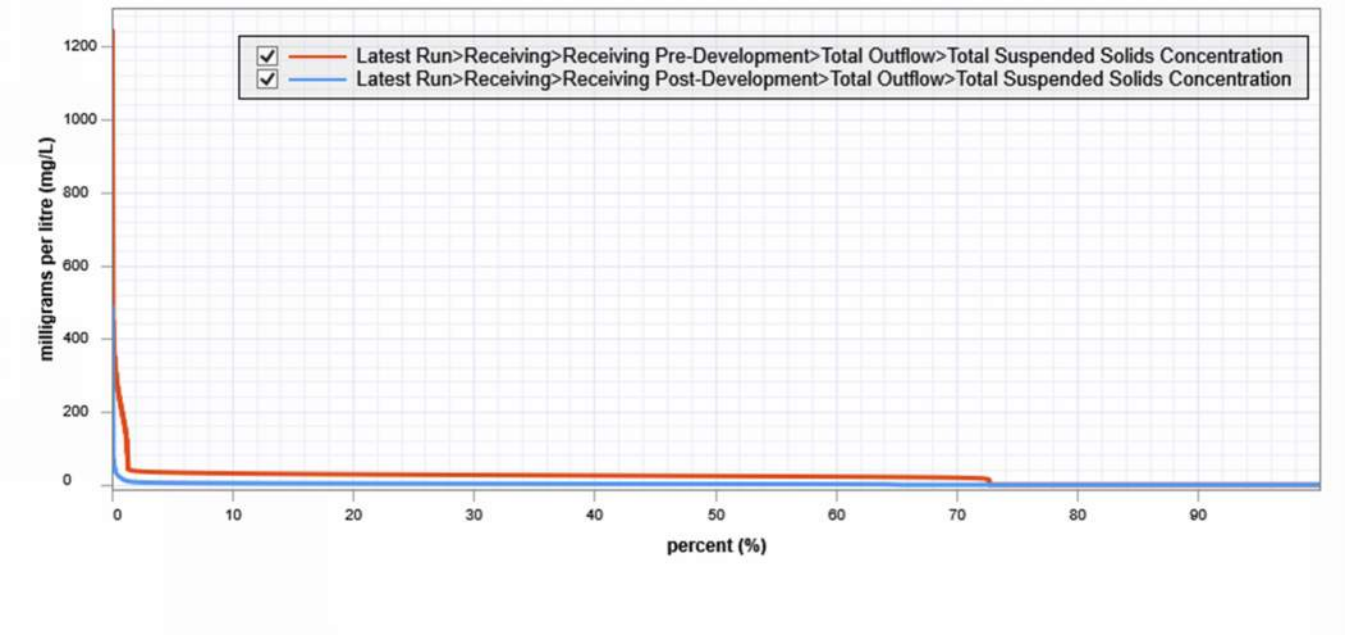


Figure 3.2: Flow-based cumulative frequency - Total suspended solids

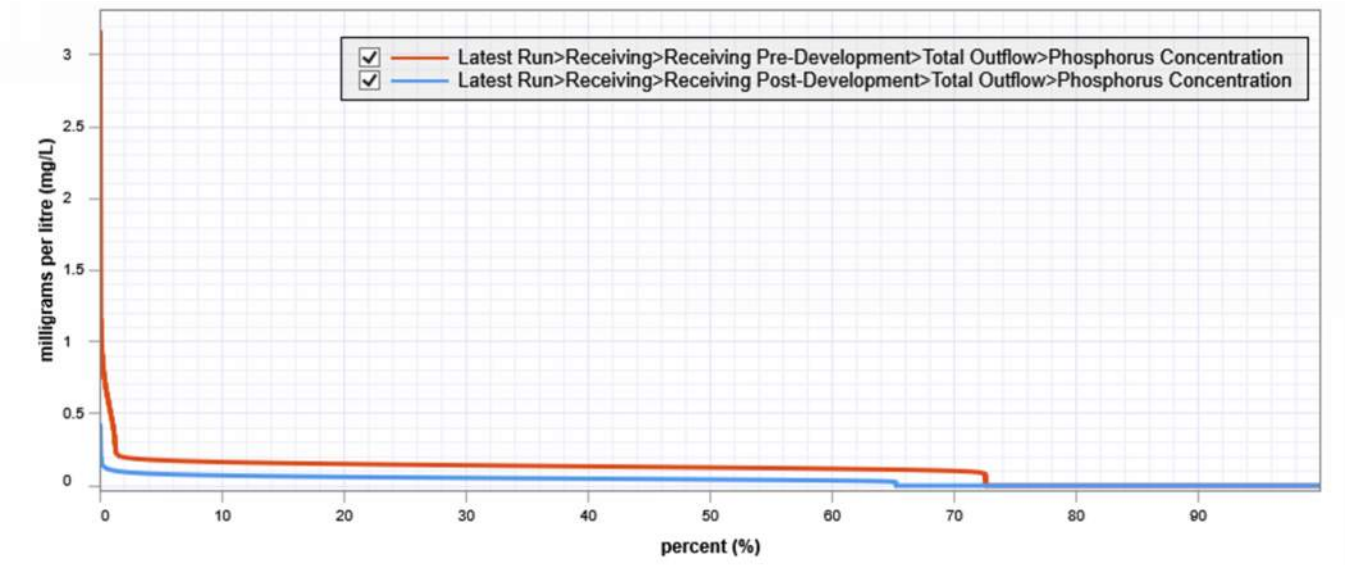


Figure 3.3: Flow-based cumulative frequency - Total phosphorus

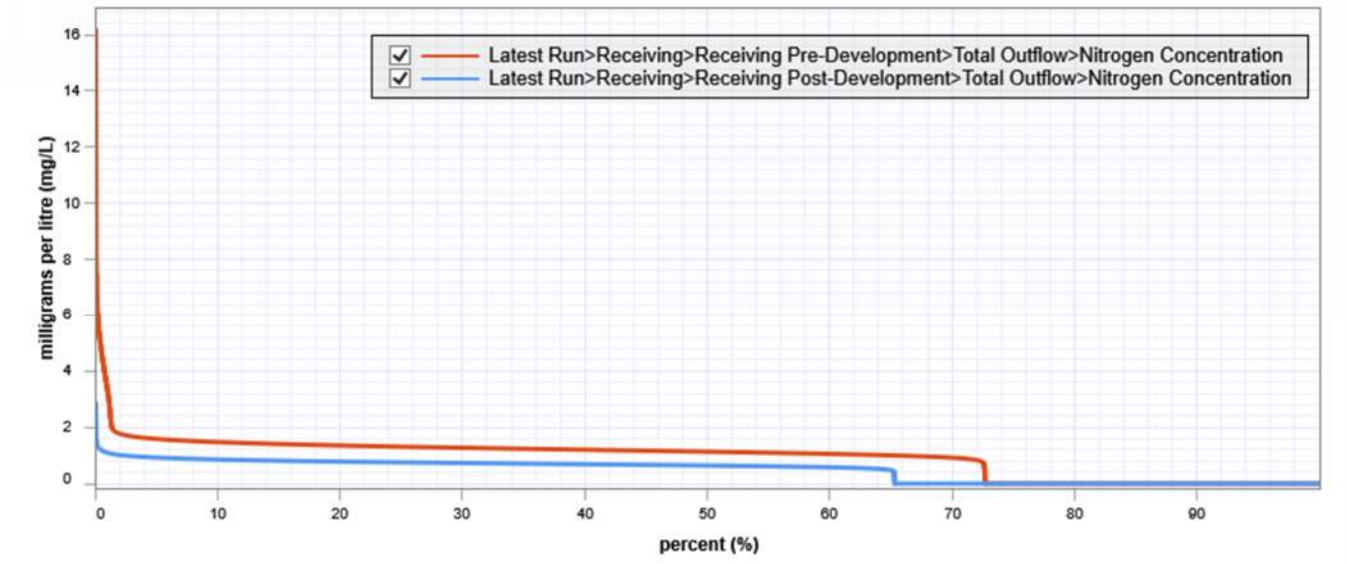


Figure 3.4: Flow-based cumulative frequency - Total nitrogen

For each pollutant type at each building, the flow-based cumulative frequency charts indicate that the post-development pollutant loads are lower than the pre-development scenario between the 50th and 98th percentiles. As such, the proposed development is considered to meet the NorBE requirements provided by WaterNSW.

Appendix A – Energy Dissipator Calculations

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Type A (Riprap) Energy Dissipator Design

Anthony Healey, 2015

Project No.: 10530 **2 Bowman Rd, Moss Vale** **Date:** Thursday, 4 April 2024

Culvert Properties

Culvert Type =	circular	
Culvert Diameter (Ø) =	1200	mm
Culvert Area (A) =	1.131	m^2

Flow Properties

Flow Rate (Q) =	3.272	m^3/s
Flow Velocity (v) =	3.742	m/s
Flow Area (A_0) =	0.874	m^2
Flow Height (y_0) =	866	mm

Culvert Calculations

Manning's Roughness Coefficient (n) =	0.013	
Culvert Slope (S_0) =	0.01	(m vert/m hor)

Wetted Perimeter (P_0) =	2437	mm
Hydraulic Radius (R_0) =	0.359	m
Culvert Outlet Velocity (V_0) =	3.911	m/s

Dissipator Design

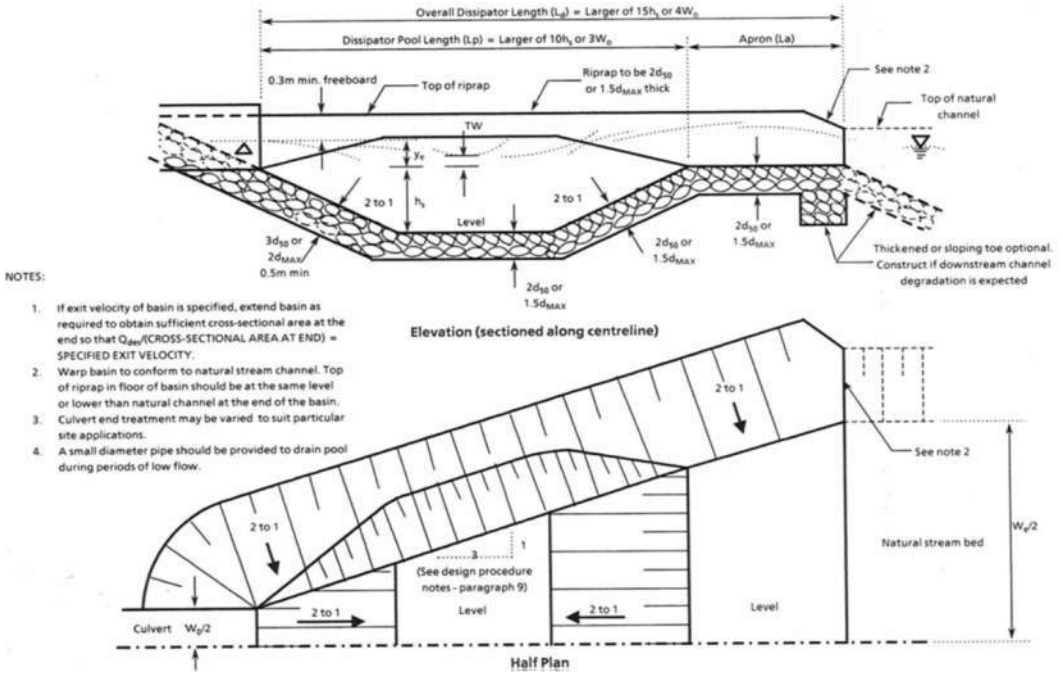
Tailwater Height (TW) =	0	mm
Median Rock Size (d_{50}) =	300	mm

Froude Number (Fr) =	1.440	
Equivalent Flow Height (y_e) =	752	mm
TW/y_0 =	0.000	
d_{50}/y_e =	0.399	
h_s/d_{50} =	2.09	

Disspator Dimensions

Depth of Basin (h_s) =	626	mm
Minimum Dissipator Length (L_d) =	9390	mm
Miniumum Pool Length (L_p) =	6260	mm
Exit Width (W_e) =	7460	mm

Figure 8.2.6



Appendix B – Humegard Operations and Maintenance Manual

Humes

Strength. Performance. Passion.

HumeGard® GPT Installation guide

Issue 2

Purpose of this guide

This guide outlines the construction procedures and requirements for the installation of the HumeGard® GPT. This document should be reviewed by supervisory personnel prior to commencing any HumeGard® GPT installation.

The following information is of a general nature only and is not intended to be exhaustive or impose or imply any paticular requirements and should be read in conjunction with project-specific documents including the contract, project specifications and project drawings. This guide is not a substitute for the project documentation.

For typical installation requirements please refer to the Humes general assembly standard drawings or Humes project-specific drawings. These are system assembly drawings only and do not constitute and should not be construed as a site layout; the site layout should be specified in project documents provided by the consulting engineer who has been engaged by the asset owner.

Where the contents of this guide differ from project specifications and drawings, supervisory personnel should consult with a Humes engineer. In the event of any conflict between the information in this guide and local legislative requirements, the legislative requirements will take precedence.

It is the responsibility of the site owner and its contractors and consulting engineers to determine the site's suitability for construction, including access for plant, equipment and other issues.

Nothing in this guide is to be construed as a representation, endorsement, promise, guarantee or warranty whether expressed or implied.

Humes makes no representation or warranty, implied or otherwise that, amongst others, the content of this guide is free from errors or omissions or in relation to the adequacy of the information contained in this guide and where appropriate you will seek verification from an independent third party before relying on any information in this guide. Humes is not liable or responsible to any person for any use or reliance of any information arising out of or in connection with this guide.

Safety advice

The HumeGard® GPT must be installed in accordance with all relevant health and safety requirements, including the use of PPE and fall protection where required.

Confined space entry

Installation of the unit may require confined space entry. All equipment and training must comply to SHE regulations. It is the responsibility of the contractor or person/s entering the unit to proceed safely at all times.

Personal safety equipment

The contractor is responsible for the provision of appropriate personal protection equipment including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment. Make sure all equipment is used by trained and certified personnel, and is checked for proper operation and safety features prior to use.

Handling

The customer is responsible for unloading of the precast components from the delivery vehicle. The customer should familiarise themselves with the site conditions, having regard for suitable space above and around the excavation in order to install the unit safely. Particular attention should be given to safety hazards such as overhead power lines and other services in the vicinity when considering positioning of cranes.

1. Excavation

Excavate to form a trench allowing adequate space to accommodate the HumeGard® GPT. Shore or bench the excavation if required.

If this is a retrofit installation, once excavation reaches the level of the pipeline, carefully remove a number of pipe lengths in order to provide an unobstructed opening for further excavation. This practice will ensure pipe ends are not damaged during lowering of the HumeGard® GPT into the trench.

2. Bedding

It is important that the base of the excavation is properly prepared with regard to line, level and degree of compaction.

Humes recommends the use of 200 mm minimum depth of compacted crushed rock as adequate bedding for the HumeGard® GPT in most situations. It is important to ensure that the bedding layer is well compacted and levelled correctly so that the openings in the HumeGard® GPT will accurately coincide with the inlet/outlet pipes once fully installed.

The correct level of the bedding layer can be established via the dimension depicted on the project drawing (vertical distance from pipe invert to surface of bedding layer).

3. Delivery

In most cases, the HumeGard® GPT will be delivered in the following parts:

- a main chamber (encasing the boom, weir, baffles, retention comb, internal slab). In the case of high chamber mass (over 15 t) the main chamber may consist of two parts (base and top section)
- a lid
- access covers and frames
- in the case of a two part chamber, loose stainless steel retention comb components

A crane and lifting gear will be required to unload the delivery vehicle. The crane must be of adequate capacity to lift and lower the components into position. The crane should be located to allow manoeuvrability of the components into their correct position.

The main chamber and lid are designed for a maximum sling angle of 60 degrees preferably using a differential spreader beam connected via four lifting anchors on the component. The size of the lifting anchors is shown on the HumeGard® product drawing and must be advised to the crane operator when booking the crane.

4. Placing the components

The chamber is supplied with inlet and outlet sides clearly marked and the pipe ends should be cut to suit. The position of the pipe centreline should be marked on both the pipe end and the chamber surface to ensure correct alignment relative to line and level through the HumeGard® GPT.

It is important for the operation of the unit that the base of the unit remains level and square horizontally after positioning in the excavation. This should be carefully checked particularly in the case of two part chambers where dimensions of each part are measured before set out and lowering into the excavation.

For two part chambers a sealed joint must be created between the bottom and top sections. This can be accomplished by placing either a mastic bead or a two part epoxy resin (either will be supplied), along the joint surface of the bottom component. The epoxy resin should be approximately 80 mm wide and at least 6 mm thick.

5. Initial backfill

Once the main chamber is correctly positioned within the excavation, backfill the sides of the excavation with a suitable material to just below the inlet and outlet openings. This will create a safe working platform to enable the installation of the inlet and outlet pipes and fitting of rubber connectors (if supplied).

6. Inspection of internal elements

For HumeGard® models that are supplied with some or all of the stainless steel components separate, a Humes representative should be consulted regarding their correct fitting and adjustments.

7. Lid alignment and sealing

The lid must be joined to the main chamber using a cement mortar layer approximately 10 mm in thickness or suitable mastic sealant over the entire top surface of all bearing walls. This will secure the lid to the main chamber and ensure an even transfer of load stresses down through the unit. The openings in the lid must be positioned relative to the inlet and outlet sides of the chamber as shown on the construction drawing supplied with the large opening above the storage /retention area on the inlet side.

8. Completing the installation

Once the lid is secure, if required, access chambers can be constructed from the level of lid openings to the finished surface level. Unless clearly stated otherwise, the supply of these items is not included with the HumeGard® components. The contractor is required to fit, cast-in or bolt the access covers supplied to the top of access chambers.

On most occasions the penetrations for the inlet and outlet pipes will have sufficient clearance to allow the pipes to be inserted easily. The resultant gap between the pipe wall the wall of the Humegard will need to be filled with a non-shrink cementitious grout.

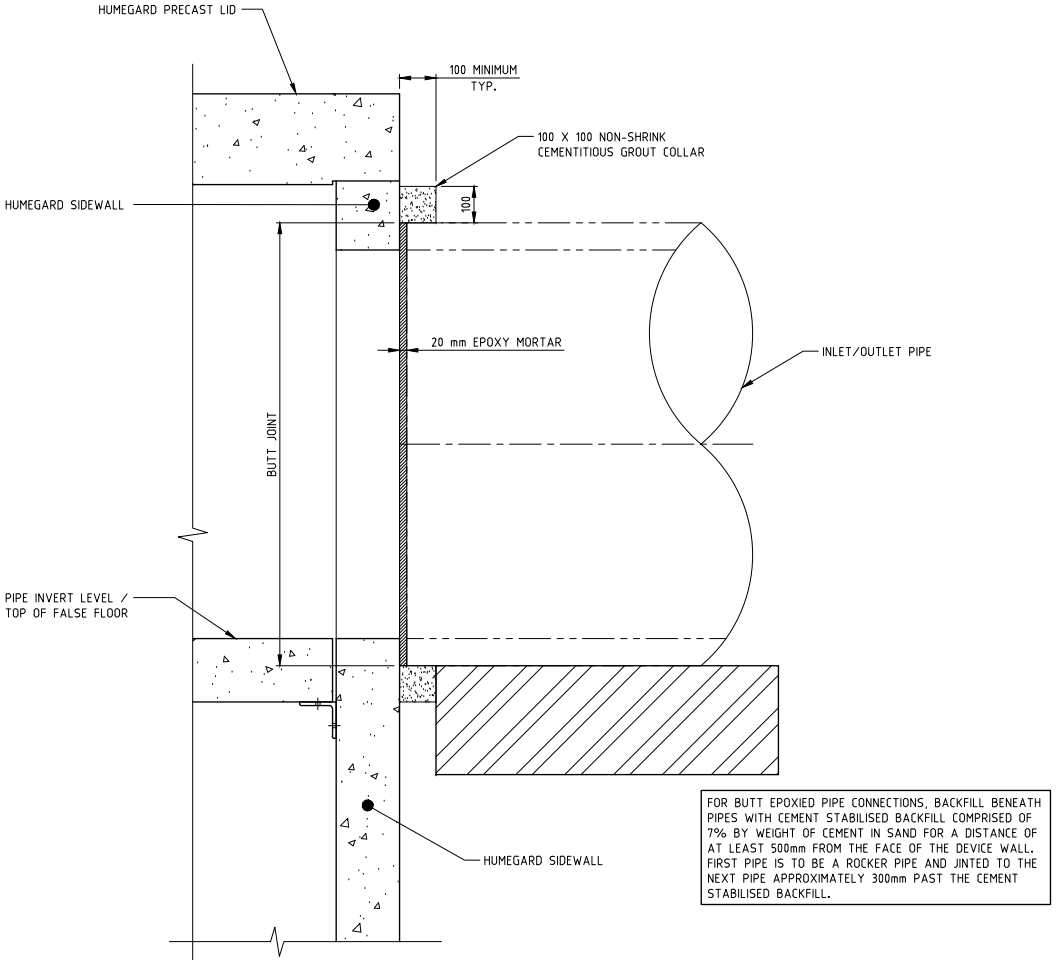
On some occasions it might be necessary to supply the HumeGard® with penetrations that only match the inside diameter of the pipes; this might be due to structural needs or limited depth to invert levels. If this is the case an epoxy butt joint connect will be required between the pipe and the HumeGard®. An example of an epoxy butt joint connection is included in the Appendix. As always, the installation contractors should liaise with the design consulting engineers to check this connection detail for suitability.

The remainder of the excavation can now be backfilled and suitably compacted to the finished surface level.

Appendix

Epoxy butt joint connection example

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	ISSUED FOR MANUFACTURE	YML	29-06-20	KRB



FOR BUTT EPOXIED PIPE CONNECTIONS, BACKFILL BENEATH PIPES WITH CEMENT STABILISED BACKFILL COMPRISED OF 7% BY WEIGHT OF CEMENT IN SAND FOR A DISTANCE OF AT LEAST 500mm FROM THE FACE OF THE DEVICE WALL. FIRST PIPE IS TO BE A ROCKER PIPE AND JINTED TO THE NEXT PIPE APPROXIMATELY 300mm PAST THE CEMENT STABILISED BACKFILL.

TYPICAL BUTT EPOXY PIPE CONNECTION

SCALE 1:10

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

Holcim (Australia) Pty Ltd ABN 87 099 732 297

DSN.	KRB	19-06-20
DSN CKD.	STK	19-06-20
DWN.	YML	29-06-20
CKD.	KRB	29-06-20
APP.	MJE	29-06-20

SUPERSEDES

PLOT SCALE 1:1

HUMES NATIONAL STANDARD DRAWING

PIPE CONNECTION DETAIL BUTT EPOXY JOINT

FABRICATION DETAILS

SIZE	DRG. NO.	ISSUE
A2	EP-HG-PIPE-01	0

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Humes

Strength. Performance. Passion.

HumeGard® GPT
Inspection and maintenance guide

Issue 1

Purpose of this guide

This guide outlines the maintenance procedures and requirements for HumeGard® GPT units.

Where the contents of this guide differ from project specifications and drawings, supervisory personnel should consult with a Humes engineer. In the event of any conflict between the information in this guide and local legislative requirements, the legislative requirements will take precedence.

It is the responsibility of the site owner and its contractors to determine the site's suitable access and location for maintenance plant and equipment.

Nothing in this guide is to be construed as a representation, endorsement, promise, guarantee or warranty whether expressed or implied.

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Safety advice

The HumeGard® GPT must be maintained in accordance with all relevant health and safety requirements, including the use of PPE and fall protection where required.

Confined space entry

Maintenance of the HumeGard® should not require entry, however, if entry into the unit is required, then the device is deemed a confined space. As such, if entering the unit, all equipment and training must comply to SHE regulations. It is the responsibility of the contractor or person/s entering the unit to proceed safely at all times.

Personal safety equipment

The contractor is responsible for the provision of appropriate personal protection equipment including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment. Make sure all equipment is used by trained and certified personnel, and is checked for proper operation and safety features prior to use.

Handling

The customer, or their contractor, is responsible for the removal of access lids from the HumeGard® unit. The customer or contractor should familiarise themselves with the device and site constraints, and particular attention should be given to safety hazards such as overhead power lines and other services in the vicinity when considering the position of plant and equipment.

Maintenance overview

To ensure ongoing long-term environmental protection HumeGard® needs to be maintained (generally annually). The actual on-going maintenance frequency requirements will be determined through quarterly inspections undertaken during the first year. However, only an annual maintenance period is anticipated for most HumeGard® units installed within drainage infrastructure.

Inspection can be performed by anyone, and procedures for inspection are provided in this document.

Generally, comprehensive maintenance is performed from the surface via vacuum truck. Companies capable of performing this maintenance can be found in the Yellow Pages or online by searching sewer cleaning or liquid waste removal.

Additionally large litter items may also be removed utilizing the optional stainless steel basket arrangement within the HumeGard®. Alternatively the litter can be removed during eduction/vacuum clean out, which will be required in order to remove the sediment component of the stormwater pollution.

HumeGard® operation

The HumeGard® GPT utilises the processes of physical screening and floatation/sedimentation to separate the litter and coarse sediment from stormwater runoff. It incorporates an upper bypass chamber with a floating boom (or broad-crested weir for small units) that diverts treatable flows into a lower treatment chamber for settling and capturing coarse pollutants from the flow. There are two types of HumeGard® - the super-critical version, which incorporates a broad-crested weir approach for treatment flow diversion, and a larger, standard version, which incorporates a floating boom arrangement to divert treatable flows.

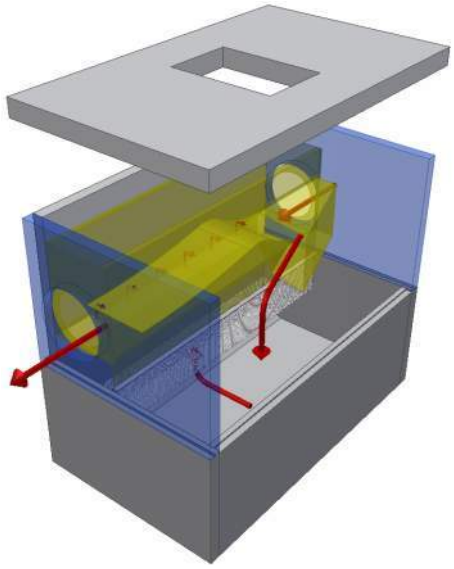
Super-critical HumeGard® (HG12 & HG15)

The super critical Humegard® consists of an internal broad crested weir and holding chamber.

A specially designed patented broad crested weir diverts material entrained in the flow into the adjacent holding chamber. This consists of the holding sump and another baffle/weir/channel arrangement designed to retain floating material while guiding flow through to the outlet.

- **Low/Treatment flow operation**
  During low to moderate flows, the weir diverts all flows into the sump area where pollutants are captured and retained. The velocity in this sump is controlled and never exceeds a maximum average velocity of 0.2m/s.
- **High/Bypass flow operation**
  During high flows, the weir diverts up to the treatable flowrate into the sump and any excess flow is able to flow over the hump and through to the outlet. This ensures that the previously caught pollutants are not disturbed, resuspended and diverted out of the outlet pipe.

Figure 1 – Super-critical HumeGard® GPT



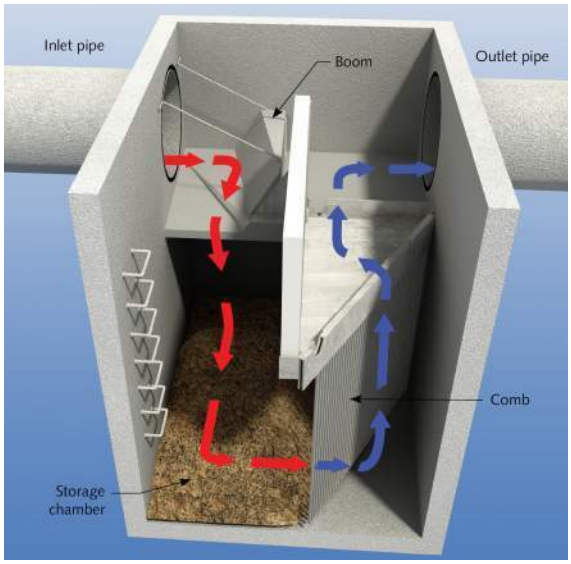
Standard HumeGard® (HG18 – HG45)

The standard HumeGard® consists of an internal separation channel and holding chamber.

A specially shaped boom, which is supported by hangers hinged to the upstream wall, diverts material entrained in the flow from the separator to the adjacent, off line, holding chamber. This consists of the holding sump and another baffle/weir/channel arrangement designed to retain floating material while guiding flow through to the outlet.

- **Low/Treatment flow operation**
  During low to moderate flows, the boom remains on the floor of the separation channel and imparts an upward and sideways motion to the incoming flow. This action causes deflection into the holding chamber, where heavy and saturated materials settle to the bottom of the sump, while buoyant material is trapped behind the baffle wall arrangement.
- **High/Bypass flow operation**
  During infrequent high flows, the boom lifts, which permits the flow to pass beneath it while continuing to deflect buoyant material to the holding chamber. Once the pipeline flows full, the boom lifts clear, allowing unobstructed flow through the unit, whilst at the same time retaining the floating materials on the upstream side of the device.

Figure 2 – Standard HumeGard® - low flow conditions



Maintenance frequency

It is recommended and good practice for an inspection of the HumeGard® to be carried out on a quarterly basis. The quarterly inspection is to check the operation of the boom, volume of pollutants in the holding sump, etc. But generally, only an annual maintenance period for cleaning is anticipated.

It is important during the quarterly inspections to check that the operation of the boom is satisfactory. The boom should not be impeded by large pieces of litter i.e. logs, etc. or have objects lodged underneath the boom or between it and the baffle plate that may prevent it from rising, or sitting flat on the false floor.

Cleaning maintenance frequency requirements will vary with the amount of stormwater pollution generated in your catchment (amount of litter, sediment, etc.). So it is recommended that as the 3-monthly inspections are performed, the frequency of maintenance be increased or reduced based on local conditions and pollutant capture rates.

The need for maintenance can be determined easily by inspecting the unit from the surface by:

- Checking if litter can be readily seen in the holding chamber once the cover has been removed.
- Using a dipstick or sludge judge (sediment sampling tube) to assess how much sediment or organic material has been captured in the bottom of the holding chamber. A sediment depth over 400mm would indicate cleaning is recommended to minimise the potential for scour.

Sediment sampling tubes are available for purchase from Humes (contact your local sales rep for more details).

Occasionally it may be beneficial to only remove captured litter and not siphon the entire contents of the holding chamber.

Maintenance procedure

Maintenance of Humegard® units is generally performed using vacuum/eduction trucks.

No entry into the unit is required for maintenance. The vacuum service industry is a well-established sector, that services underground tanks, sewers and catch basins.

HumeGard® units are cleaned by adhering to the following steps:

1. Complete a Job Hazard Analysis (JHA) and a Work Method Statement (WMS) before undertaking the maintenance procedure.
2. Prepare the site around the Humegard for cleaning. This involves establishing the job site (traffic control if required), assembling cleaning equipment, positioning the vacuum truck and ensuring correct equipment is available to use (including PPE).
3. Remove the rectangular lid above the holding chamber and conduct a visual inspection to assess the condition of the Humegard® and note if there are any blockages or lodged debris.
4. Lower the suction hose to the surface of the water in the holding tank and skim across the top to capture floating litter.
5. Lower the suction hose to the base of the holding chamber to remove sediment, organic matter and litter which has sunk.
6. Dislodge materials trapped in the screen using a water jet or brush/broom.
7. Remove the second rectangular access cover over the diversion boom and ensure there is no debris trapped underneath the boom.
8. Clean the interior of the pit using water jet.
9. Replace lids, ensuring they are firmly and securely in place.

It may be convenient on larger units to de-water some of the water in the holding chamber. This will minimise maintenance costs as disposal of essentially clean stormwater can be avoided. Often this can be done onto adjacent ground or into the council sewer system. However, this should only be done with the appropriate authorities' consent.

If a HumeGard® has been fitted with an optional removable basket, the basket can be used to periodically remove litter in between scheduled eduction/vacuum maintenance visits. The baskets must also be removed prior to vacuuming/educting the HumeGard® for the sediment load.

Maintenance cost

The costs to clean out a HumeGard® will vary based on the size of the unit, pollutant volume/type and transportation distances.

A typical cost (equipment and personnel) is estimated to be approximately $1500-$3500 (based on best information at time of installation) - exclusive of disposal costs.

This estimated cost is based on the clean out of a single unit. Economies of scale will be achieved where there are multiple units for a given location. The time to clean a single unit is approximately 3-4 hours (including transportation and cleaning).

Disposal costs are estimated to be in the order of $350-$600 dependent upon volume and type of pollutants removed from the holding sump.

Removal of hazardous material

A wide range of hazardous materials may be intercepted by the HumeGard® gross pollutant trap, although instances of this have been minimal. Hazardous materials may include high levels of heavy metals accumulated within the collected sediments, certain inorganic chemicals, used syringes, glass, and other matter.

As noted, the potential presence of hazardous material is primarily the reason why eduction is the preferred cleaning method, since this minimises the potential for maintenance personnel and nearby communities to come into contact with such material. Where baskets are required, the majority of the collected material will fall from the basket into the maintenance truck upon opening of the trap door. Any and all contact with the basket should be undertaken with suitable protective clothing, including heavy duty hand protection. If material is caught within the basket, it should be removed using suitable equipment.

Removal of this material by hand is not recommended. It is noted that it is not necessary to have the sumps/baskets completely clean. The removal of 95% of the material is satisfactory, and the prospect of completely removing every piece of material increases the occupational health and safety risks.

The presence of certain toxicants may need to be considered for the disposal of material and appropriate locations. If elevated levels of toxicants are suspected, then analytical screening of material should be completed to determine an appropriate disposal response according to local and state government regulations.

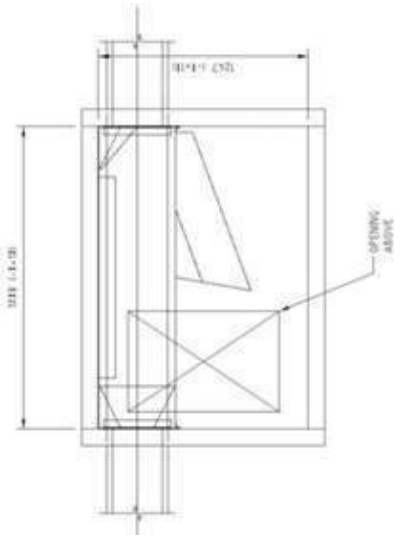
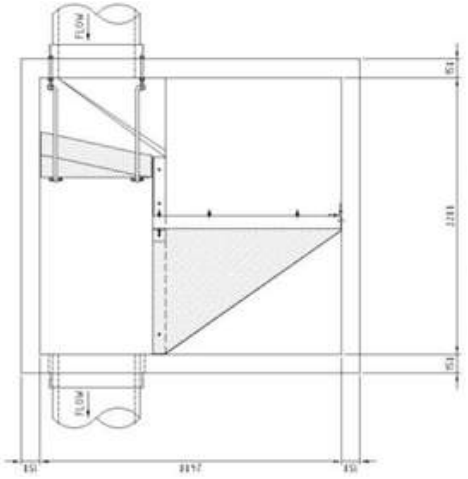
Example Job Safety Analysis (JSA)/Work Method Statement (WMS)

The following JSA/WMS is a guide only. It is the responsibility of the cleaning contractor or asset owner to develop their own JSA/WMS in line with their own WHS requirements and constraints. It also assumes that there will be no entry into the unit during maintenance.

Project/ Address:				**Date:**	
Job: Clean out of HumeGard unit				**Operator:**	
Risk Level:	1 - Extreme	2 - High	3 - Medium	4 – Low	5 - Negligible
Consequence:	Likely to cause very serious harm	Clear potential for serious harm	Similar to risk of driving a car	Little likelihood of any harm	Virtually Harmless
Response:	STOP THE JOB	STOP and Reassess to find better way	Control & ensure controls work	Monitor to ensure risk remains low	Continue work

PROCEDURE	POSSIBLE HAZARDS	INITIAL RISK	CONTROLS	PERSON RESPONSIBLE	END RISK
1. Preliminaries: • Confirm GPT locations and types • Familiarise with GPT technical manual	Nil	-	Refer to relevant manuals	Operator	-
2. Plan the Job: • Room to access & work on the GPT without impacting other property or vehicles • Consider water flows & if excessive note & move onto next job • Condition & status of GPT • Identify water fill point • Identify waste dump point	• Climbing in/out/around of truck • All GPT have a high risk of containing syringes	3 4	• Refer to safety plan on moving around vehicles • Wear PPE and never reach into or lift accumulated matter with hands. If a needle stick injury occurs, wash the affected area with soap & water & report the incident to the branch and seek medical attention ASAP.	Operator	4 5
3.Establish Job Site: • Over 60 km/hr will require traffic management • Within 6.4m of overhead power lines will require spotter	• Traffic • Pedestrians • Overhead power lines	3	• Devise a relevant Traffic Management WMS • Ensure barriers and signs redirect pedestrians • Ensure spotter is present	Operator	5
4. Assemble Cleaning Equipment • Position vacuum hose to remove debris from GPT	• Infection • Sharp edges • Manual handling • Falling equipment • High pressure water	3	• Personal hygiene (wash hands prior to smoking/eating) • Wear gloves & remove sharp edges/burrs on equipment • Follow a manual handling WMS • Store equipment securely on vehicle • Inspect vacuum hose fittings firmly secured • Inspect hose daily 7 ensure it has been tested (6 monthly) • Never cap jetting hose • Inspect jetting hose for damage • Never adjust pump pressures or regulators • Maximum reducer on 1" hose is ¾" • No reducers on ½" hose • Fittings to be firmly secured using a spanner	Operator	5
5. Open the GPT Cover • Remove lid using the manhole lifting procedure • If lid is mass concrete & exceeds safe lifting limits, use mechanical lifting device	• Manual Handling • Open Manholes	3	• Refer to a SWP for manual handling • Refer to a SWP for manhole lifting	Operator	5
6. Start Cleaning • Position bottom end of vacuum hose to remove debris from GPT • Run vacuum prior to remove debris • If there is any requirement to enter the pit for any reason, confined Space Entry Procedure is to be followed • Vacuum all material out of the sump until empty clear 7 clean • Dislodge materials trapped in the screen using water jet ot brush/broom • Remove access cover over diversion boom/weir, ensure there are no debris trapped underneath boom/around weir • Clean the interior of the pit using water jet &/or brush/broom • Vacuum all materials out of the pit	• Manual handling • Eye injury from flying debris • Noise • People inside exclusion zone • Confined Space Entry (If required)	3	• Follow a SMP for manual handling • Wear eye protection • Wear hearing protection • Stop operation until area clear. Only essential personnel within exclusion zone • Ensuring minim slack in hose to prevent whipping • Refer to confined space manuals and SWPs	Operator	5
7. Finish Cleaning • Replace lid ensuring it is fimly & securely in place • Ensure all waste is vacuumed and site is clean prior to packing up • Complete the CWS recording all details and any problems	• Manual handling	3	• Follow a SMP for manual handling	Operator	5

HumeGard® unit maintenance record

Customer details			
Company		Phone	
Contact name		Email	
Address		Date	
State		Operator name	
HumeGard® unit details			
Model		Type (circle one)	Small (weir) | Standard (boom)
Cleaning method (circle one)	Vacuum | Eduction	Lid type	
Plan view (circle one)			
Small HumeGard® (weir)		Standard HumeGard® (boom)	
			

Pollutant removal results			
Estimated volume of water removed (L)		Litter (%)	
Estimated volume of pollutants (m^3)		Vegetation (%)	
Percentage of pollutant content (%)		Sediments (%)	
Percentage of pollutant capacity (%)		**Total volume (%)**	

Any evidence of hydrocarbons (grease/oil) contamination?	YES	NO
Any evidence of sewage contamination?	YES	NO
Any evidence of any other unexpected contamination?	YES	NO
Describe unexpected contamination (if any):		
Any problems cleaning the HumeGard® unit (describe briefly):		
If problems were experienced were they thenresolved satisfactorily (describe briefly):		

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