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# Civil Engineering Report Development Application

## Stage 2 - 530 Raymond Terrace Road, Thornton

**Prepared for:** LandLink

**Address:** 28-30 Bolton Street, Newcastle

**Project no:** NSW202521

**Date:** 17/05/2022

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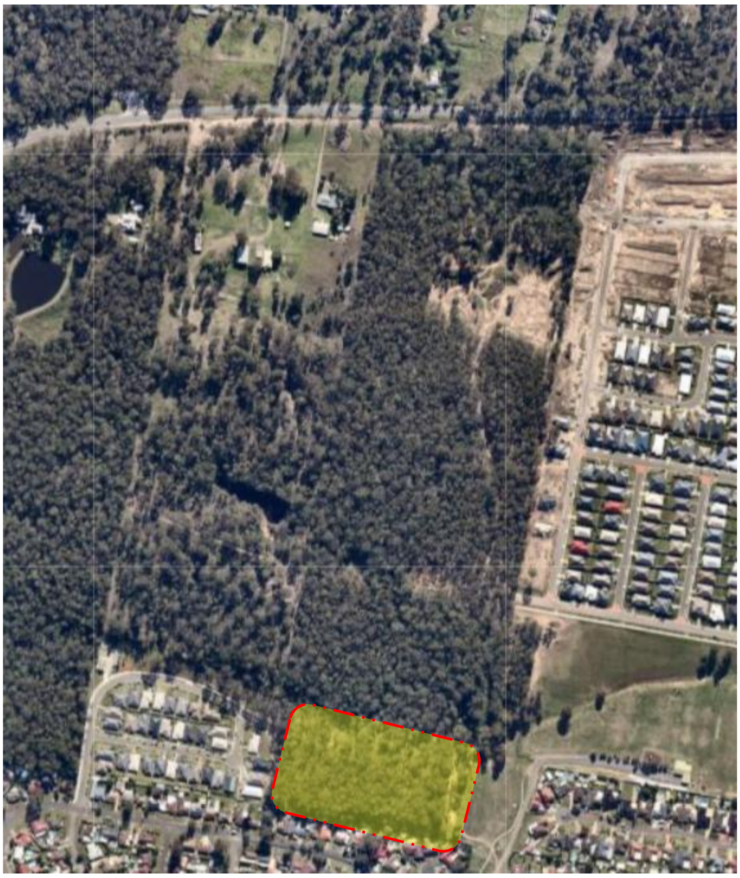

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## Revisions

| Revision | Description | Date | Prepared by | Approved by |
|---|---|---|---|---|
| A | For Approval | 04/12/2020 | Brandon Gathercole | Josh Rhodes |
| B | For Approval | 17/05/2022 | Brandon Gathercole | Josh Rhodes |

## Review Panel

| Division/ office | Name |
|---|---|
| Newcastle | Josh Rhodes, Brandon Gathercole |

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## Appendices

# 1 Introduction

## 1.1 General

ACOR Consultants have been engaged by Landlink to prepare an Engineering Report to support the Development Application for a proposed residential development of Stage 2 of the development at 530 Raymond Terrace Road, Thornton. Stage 2 of the development will join onto the existing Honeymurtle Street to the west.

Engineering items addressed in this report include:

- Preliminary Road Design;
- Site grading and earthworks;
- Stormwater quantity
- Stormwater quality

Stormwater quantity items addressed in this report include:

- Stormwater conveyance/network;
- Stormwater detention

Stormwater quality items to be addressed in this report include:

- Operational water quality management incorporating Water Sensitive Urban Design principles (WSUD);
- Construction water quality management incorporating soil and water management.

# 2 Site

## 2.1 Location

The site is located at 530 Raymond Terrace Road, Thornton. Stage 2 of the development is located at the south of the site, separated from Stage 1 of the subdivision by a first order stream. The Stage 2 site is bounded to the north by the first order stream and to the east, south and west by residential development. Refer to DA101.101 for the locality of the Stage 2 of the development.

## 2.2 Topography

The existing site grades from the south to north. The grades on the site range between 4 to 9%. The levels on the site currently range from approximate RL17.5m AHD at the south western boundary to RL 9 m AHD on the northern boundary of the site. Refer to Existing Topography Plan DA101.201.

## 2.3 Existing/Previous Land Use and Vegetation

The site in its current condition is mostly covered in vegetation. Refer to Existing Site Aerial Photograph Plan DA101.202.

## 2.4 Existing Site Drainage

The site drains from the south to the north towards the first order stream.

## 2.5 External Catchments

There are no external catchments draining to the site. The catchments to the east, south and west have all been developed and have their own independent drainage systems.

# 3 Proposed Development

The proposed development will consist of 31 residential lots ranging from 541m$^2$ to 4.78 hectares (854m$^2$ building area), as well as associated road, stormwater drainage infrastructure and a detention/water quality basin.

Access to the site will be from the extension of Honey Myrtle Street.

The total area of Stage 2 of the proposed development is approximately 2.80 hectares. Refer to DA102.001 for the development layout for the subdivision.

# 4 Concept Civil Design

## 4.1 Concept Road Grading

The concept road grading for the proposed development was undertaken generally following the natural topography of the site. Road gradings range from minimum 0.5% to maximum 9.0%. The road width of the extension of Honeymurtle Street have been adopted from the existing adjoining road reserve configuration. The other internal roads reserves are 17 m as per MCC requirements.

- Figures DA103-001 Are the General Arrangement Plan's for the development.
- Figures DA104-001 to DA104-401 Are the Road Longitudinal Sections for the development.
- Figures DA105-001 & DA105-002 Are the Typical Road Cross Sections for the development.
- Figures DA105-101 to DA105-404 Are the Road Cross Sections Sections for the development.

## 4.2 Bulk Earthworks

The bulk earthworks for the development are detailed in DA108.001 to DA109.103. These include an isopach plan (cut/fill), bulk earthworks grading and earthworks long sections. The Figure provides the cut and fill depths associated with the concept site grading. There is an estimated 7,335 $m^3$ cut and 9,275 $m^3$ of fill. With trenching spoil & bulking, the site earthworks will be approximately balanced. Final site earthworks will be finetuned during the detailed design phase. Refer to DA108.001 for the cut fill plan (isopach plan).

# 5 Stormwater Quantity

## 5.1 Stormwater Conveyance

### 5.1.1 Minor Storm Event Conveyance

Minor system stormwater conveyance for the development will be a via a traditional pit and pipe system. The minor stormwater system will have the capacity to convey the peak flows from a 10% AEP storm event.

- Figures DA110-001 Are the Stormwater Plan's for the development.
- Figures DA110-201 to DA110-205 Are the Stormwater Longitudinal Sections for the development.
- Figures DA110-401 to DA110-411 Are the Catchment Plans for the development.

### 5.1.2 Major Storm Event Conveyance

Major system stormwater conveyance for the proposed development will be via overland flow. This will be via the road carriage way and footpath. The major stormwater system will have the capacity to convey the peak flows from a 1% AEP storm event, containing flows within the road reserve. The overland flows will flow to the stormwater management basin. The peak flows from the basin will be reduced to predeveloped peak flows and discharged to the existing drainage lines.

## 5.2 Stormwater Detention

### 5.2.1 General

Stormwater detention has been provided in the the drainage reserve of the within lot 232, generally in accordance with the stormwater management for the Government Road Precinct by PCB dated October 2016. Stormwater detention has been provided for the development. DRAINS modelling was undertaken adopting the IL/CL modelling procedure with ARR 2019 Data.

### 5.2.2 DRAINS Modelling

DRAINS modelling was undertaken to determine the predeveloped and developed peak flows for a range of AEP's from 20% to 1%, for storm durations ranging from 5 minutes to 4.5 hours for the proposed development. Available volumes from rainwater tanks were not accounted for in the modelling.

The basin will consist of:

- Basin invert: RL 7.85m (bioretention level), RL 8.15m outlet pit level, 0.3m temporary storage for bioretention treatment
- Top of Basin: RL 9.65m
- Outlet from basin:
  - 900mm square surface inlet pit (top of pit RL 8.15m) with 600mm diameter outlet pipe with 500mm orifice plate
  - 900mm square surface inlet pit (top of pit RL 8.45m) with 600mm diameter outlet,
  - Outlet pipe invert at 6.75m (base of bioretention)
- Emergency Weir: 5 m wide, RL 9.15 m

The stage/area for the basin is shown in Table 1 below:

**Table 1: Basin Stage & Volume**

| Height (m) | Surface Area ($m^2$) | Volume ($m^3$) |
|---|---|---|
| 7.85 | 148 | 0 |
| 8.15 | 275 | 62 |
| 8.5 | 395 | 179 |
| 9 | 590 | 424 |
| 9.15 | 654 | 517 |
| 9.5 | 819 | 774 |

### 5.2.3 DRAINS Results

The predeveloped and post developed (without detention) peak flows from the site are shown in Table 2.

**Table 2: Predeveloped vs Developed (without Detention) Peak Flows**

| Storm Event AEP | Peak Discharge $m^3/s$: | | | |
|---|---|---|---|---|
| | Pre-Development | Post Development | Difference | Difference % |
| 20% | 0.544 | 0.706 | 0.162 | 29.78% |
| 10% | 0.843 | 0.913 | 0.07 | 8.30% |
| 5% | 1.061 | 1.104 | 0.043 | 4.05% |
| 2% | 1.368 | 1.225 | -0.143 | -10.45% |
| 1% | 1.656 | 1.317 | -0.339 | -20.47% |

As can be seen in Table 2, the development of Stage 2 of 530 Raymond Terrace Road, Thornton results in peak flows leaving the site which are higher than the predeveloped peak flows for the peak events up to the 2% AEP. Detention is required to limit the peak flows from the development to or below the predeveloped peak flows.

The predeveloped and post developed (with detention) peak flows from the site are shown in Table 3.

**Table 3: Predeveloped vs Developed (with Detention) Peak Flows**

| Storm Event AEP | Peak Discharge $m^3/s$: | | | |
|---|---|---|---|---|
| | Pre-Development | Post Development | Difference | Difference % |
| 20% | 0.544 | 0.544 | 0.000 | 0.00% |
| 10% | 0.843 | 0.675 | -0.168 | -19.93% |
| 5% | 1.061 | 0.871 | -0.190 | -17.91% |
| 2% | 1.368 | 1.097 | -0.271 | -19.81% |
| 1% | 1.656 | 1.275 | -0.381 | -23.01% |

As can be seen from Table 3, by constructing the detention basins with the volume and outlet configuration's discussed above, the peak flows at the outlet points of the development are reduced to below the predeveloped peak flows

### 5.2.4 Detention Basin Spillways

The Basin spillway was to be designed to cater for the entire 1% AEP storm event in the case of the staged discharge being blocked. The proposed weir design (refer design plans for details) more than caters for the

1% event and additional capacity has been provided for safety. Refer to Appendix A for the spillway calculations.

#### 5.2.5 Detention Basin Modelling Conclusion

As can be seen from the above results, by constructing the detention basins with the volume and outlet configuration discussed above, the peak flows for the catchment of the development are reduced to below the predeveloped peak flows. The DRAINS model for the detention modelling has been provided with the submission for Council review

### 5.3 Scour Protection

Scour protection shall be nominated on the design plans for the pipe outlets from the detention basin at detailed design. The scour protection designs shall be in accordance with Catchments & Creek guidelines on rock sizing for both single, multi-pipe outlets and spillways.

# 6 Stormwater Quality - Operational Phase

## 6.1 Objectives

The objectives of the stormwater quality management for the site are:

- Meet the water quality objectives of Maitland City Council for the operational phase of the site by using best practice stormwater treatment measures. The water quality reductions required by Maitland City Council are:
- % Reductions from the developed site of:
  - 80% reduction in Total Suspended Solids (TSS)
  - 45% reduction in Total Phosphorus (TP)
  - 45% reduction in Total Nitrogen (TN)
  - 70% reduction in litter/gross pollutants

## 6.2 Operational Phase Water Quality Management

### 6.2.1 General

To meet the water quality requirements of Maitland City Council a range of water quality improvement devices are proposed. The proposed water quality improvement devices for the site are:

- rainwater tanks
- HumeGard GPT
- Ocean Protect Ocean Guards (Litter Baskets)
- a bioretention basin

The above water quality improvement devices act as a treatment train, progressively reducing pollutants as they pass through each one. Trash racks are proposed in place of GPT units due to the minor size of the development.

### 6.2.2 Stormwater Quality Modelling

#### 6.2.2.1 Introduction

The MUSIC model version 6 was used to assess the pollutant generation from the development and the performance of the stormwater quality treatment train. MUSIC modelling was undertaken in accordance with the Maitland City Council MUSIC Modelling Guidelines and the NSW MUSIC Modelling Guidelines (WBM, 2015).

#### 6.2.2.2 Rainfall Data and Evaporation Data

The rainfall data and evapotranspiration data for the project was adopted from the Port Stephens Council MUSIC link. The Port Stephens Council data was adopted as Maitland Council does not currently have a MUSIC link. The data is from the Williamtown RAAF base. This data was accepted for the Stage 1 water quality modelling.

#### 6.2.2.3 MUSIC Model Source Inputs

The source data for the MUSIC model for the developed model were adopted from the Port Stephens Council MUSIC link (and checked against the NSW MUSIC Model Guideline values) for urban residential. The area for each roof of 250 $m^2$ was adopted for the modelling. An overall lot fraction impervious of 60% was adopted (including the roof area) for lots. A fraction impervious of 70% was adopted for the road catchments.

#### 6.2.2.4 Catchments Pollutant Mean Concentrations

The pollutant Event Mean Concentration (EMC) values for the development were adopted from Port Stephens Council's MUSIC link (and checked against the NSW MUSIC Modelling Guideline values) for both base flows and storm flows. The catchments were divided into roofs, residential lots (remaining yards) and road areas.

#### 6.2.2.5 MUSIC Model Treatment Train

The stormwater quality treatment train consist of three parts; rainwater tanks, trash racks and a bioretention basin. A brief description on each treatment measure is listed below.

**Rainwater Tanks.**

Rainwater tanks receive water from the roof area of each lot. A 4kL rainwater tank was assumed for each standard residential lot. Water captured in the rainwater tanks is expected to be reused for toilet flushing, clothes washing, hot water and garden irrigation. An average of 4 persons was assumed for each house. The reuse per house was adopted from the NSW MUSIC Modelling Guidelines, Table 6-1. The reuse adopted for each lot is shown in Table 4.

**Table 4: Rainwater Tank Reuse (per lot)**

| Rainwater Reuse | |
|---|---|
| Internal (L/day/dwelling) | 425 |
| External (L/day/dwelling) | 151 |
| High flow Bypass ($m^3$/dwelling) | 0.005 |

**Gross Pollutant Traps**

A HumeGard GPT is proposed upstream of each detention basin. These products remove gross pollutants, sediment and attached nutrients. The MUSIC node for the GPT was provided by Humes. The removal efficiencies have been confirmed via independent testing. An equivalent product could be used. The flows to the GPT were limited to the 3-month peak flow (4EY) with larger flows flowing directly into the downstream basin. The design plans for the GPT locations are shown in DA111-001. Information on the GPT's can be found in Appendix B. Table 4 shows the removal efficiencies of the HumeGard GPT.

**Table 4: HumeGard Removal Efficiencies**

| Inflow ($m^3$/s) | Gross Pollutant Removal (%) | TSS Removal (%) | TP Removal (%) | TN Removal (%) |
|---|---|---|---|---|
| 4EY Flow | 90 | 41 | 34 | 24 |

**Ocean Save Ocean Guards (Litter Baskets)**

Ocean Save Ocean Guards (Litter Baskets) The OceanGuard is an in-pit litter trap that aids in the removal of suspended solids and litter from stormwater run-off. The Oceanguards will be placed on the 3 Interallotment pits which bypass the Bioretention Basin. Information on the Litter Baskets can be found in Appendix C. Table 5 shows the removal efficiencies of the HumeGard GPT.

Table 5: Ocean Save Ocean Protect Removal Efficiencies

| Inflow ($m^3/s$) | Gross Pollutant Removal (%) | TSS Removal (%) | TP Removal (%) | TN Removal (%) |
|---|---|---|---|---|
| 0.002 per Unit | 100 | 55 | 25 | 15 |

**Bioretention Basins**

A bioretention basin is the final part of the treatment train for the site. Bioretention systems remove sediments (TSS) as well as nutrients (TN and TP) for the stormwater. The bioretention basin consists of a shallow dry basin with deep rooted vegetation and grass on the surface, over an infiltration/filtration area and an underdrain area. Vegetation in the bioretention basins will be in accordance with Maitland City Council requirements. The design plans for the bioretention basin locations are shown in DA111-001. Details of the bioretention basins are shown in Table 6.

Table 6: Bioretention Basin Details

| Property | Bioretention Details |
|---|---|
| Extended Detention Depth (m) | 0.3 |
| Surface Area ($m^2$) | 210<br>(Surface Area halfway between Basin invert & Bioretention Media) |
| Filter Area ($m^2$) | 50 |
| Unlined Filter Material (m) | 0.01 |
| Saturated Hydraulic Conductivity (mm/hr) | 100 |
| Filter Depth (m) | 0.4 |
| TN Content of Filter Media (mg/kg) | 400 |
| Orthophosphate of Filter Media (mg/kg) | 40 |
| Exfiltration Rate (mm/hr) | 0 |
| Base Lined | Yes |
| Vegetation Properties | Vegetated with Effective Nutrient Removal Plants |
| Overflow Weir Width (m) | 2.7 |
| Under Drain Present | Yes |
| Submerged Zone with Carbon Present | No |

### 6.2.3 Stormwater Quality Modelling Results

The results of the MUSIC model for the total catchment showing the mean annual pollutant loads for the existing and the developed catchment are shown in Table 7.

Table 7: Overall Site MUSIC Model Results

| | Source Load | Residual Load | % Achieved Reduction | % Required Reduction |
|---|---|---|---|---|
| TSS (kg/yr) | 3620 | 667 | 81.6 | 80 |
| TP (kg/yr) | 6.97 | 2.43 | 65.1 | 45 |
| TN (kg/yr) | 47.0 | 23.5 | 50.0 | 45 |
| Gross Pollutants (kg/yr) | 563.00 | 1.76 | 99.7 | 70 |

### 6.2.4 Stormwater Quality Modelling Conclusion

As can be seen from the results in Table 7, the TSS, TN, TP and gross pollutants are reduced below the requirements of Maitland City Council. A copy of the MUSIC model has been submitted to Council.

# 7 Stormwater Quality - Construction Phase

### 7.1.1 General

During the construction phase of the development, an Erosion and Sediment Control Plan will be implemented to minimise the water quality impacts. The erosion and sediment controls will be in accordance with Landcom's Managing Urban Stormwater: Soils and Construction Volume 1, 4$^{th}$ Edition (Landcom, 2004) and the requirements of Maitland City Council. Erosion and sediment controls will be required preconstruction, during construction and post construction until the site is stabilized. The expected erosion and sediment control measures will include stabilized site access, sediment fence, gully pit sediment barriers, rock outlet scour protection and a temporary sediment basin.

Erosion and sediment control plans will be provided for the development at Construction Certificate stage.

### 7.1.2 Pre-Construction Erosion and Sediment Control

Due to the topography of the site, the preconstruction erosion and sediment controls will be limited to stabilized site access, sediment fence and a temporary sediment basin until the initial bulk earthworks is undertaken. The proposed detention/water quality basin will be used as a sediment basin while construction is being undertaken. DA112.001 to DA112.102 shows a concept erosion and sediment control plan for the development.

### 7.1.3 During Construction Erosion and Sediment Control

During the construction phase of the development, the erosion and sediment controls will consist of installed sediment fence, a constructed sediment basin, gully pit sediment barriers and permanent rock outlet scour protection.

Regular inspection and maintenance of the erosion and sediment controls is required during the construction process.

As the soils on site are clay, a sediment basin volume was calculated using the Blue Book for type F soils. The geotechnical report by Douglas Partners indicated that the soils were not dispersive. During construction, if the soils are found to be dispersive, the contractor will need to provide a flocculating agent to ensure discharge from the basin meets the requirements of the Blue Book. The sediment basin calculations are shown in Appendix D.

### 7.1.4 Post Construction Erosion and Sediment Control

The contractor/developer will be responsible for the maintenance of the erosion and sediment control devices from the practical completion of the works for a minimum of 6 months or until stabilization has occurred to the satisfaction of Maitland City Council.

It is proposed to delay the construction of the bioretention filtration media in the basin until a significant proportion of the contributing lots are built on and established to avoid the system being filled with sediments.

# 8 Stormwater Quality Operation & Maintenance Plan

## 8.1 General

Maitland City Council has established a maintenance plan for its existing water quality infrastructure. The proposed infrastructure will be like the existing.

General maintenance will involve implementation of a regular inspection and maintenance schedule. As a minimum, the inspection and maintenance program are to follow any significant rain event. The inspection regime may be increased when housing construction commences to determine if a more frequent maintenance period is required.

## 8.2 Stormwater Quality Summary

Stormwater quality for the development has been modelled in MUSIC. The water quality treatment will consist of rainwater tanks for each lot, and a bioretention in the detention basins

All water is to be piped to the detention facilities where it will pass through a Gross Pollutant Trap prior to entering the basin.

## 8.3 Maintenance of Stormwater Quality Devices

For correct operation and performance regular maintenance of the SQUIDS is paramount. GPT's require clearing and ongoing maintenance of the vegetation and bioretention material in the Basin are critical to the performance of the treatment train for the development.

### 8.3.1 Gross Pollutant Traps – HumeGard GPT

The GPTs proposed to be installed upstream of the basin are HumeGard proprietary products. These proprietary products were specified as it met the requirements of the site by allowing inline treatment and catering for tailwater impacts from the downstream basin. Post construction of the development catchment inspections are recommended quarterly with only an annual requirement for maintenance and cleaning. During construction of the development catchment inspections should be undertaken more regularly with the higher risk of runoff from housing construction. Refer to Appendix E for the HumeGard Inspection and Maintenance Guide

### 8.3.2 Litter Baskets - Ocean Protect Ocean Guards

Trash racks will need to be monitored regularly to ensure they do not become blocked and impact the hydraulic performance of the drainage system. Refer to Appendix F for the OceanGuard Inspection and Maintenance Guide

### 8.3.3 Bioretention Basin

It is proposed that the bioretention and water quality basin construction will be staged. It will act a sediment basin until 90% of the catchment has been development or two years post release of the Subdivision Certificate.

Following conversion to an operating water quality device the bioretention basin should be inspected regularly. Regular inspections until the vegetation is established and then typically monthly or following significant storm events. Maintenance will be more regular during the initial vegetation establishment period. During this period regular watering, mulching, weeding, soil treatment, removal and replacement of dead/diseased vegetation may be required. An appropriate long-term maintenance frequency can usually be determined after 2 years of operation when the catchment and bioretention measure have stabilised. The typical long-term maintenance frequency varies with aesthetics and seasonal influences. Grass cutting and weeding are typically required either fortnightly or monthly (depending on the species) during spring and summer. Less frequent grass cutting, and weeding (typically every 2 to 3 months) typically occurs during autumn and winter where other factors (e.g. aesthetics, litter removal, erosion, vegetation damage) may control the maintenance frequency.

Testing of the biofiltration media should be undertaken every 2 years to determine the content of orthophosphate and Total Nitrogen.  The media will need to be replaced when the content of each of these nutrients exceeds the recommended levels from the Facility for Advancing Biofiltration (FAWB).

## 8.4 Safety – Inspections & Maintenance

Only suitably qualified and authorised personnel should undertake inspections and maintenance of the Stormwater Quality Improvement Devices. Safe Work Methods Statements are required prior to the commencement of any works, and their correct implantation is the responsibility of all authorised personnel undertaking the works.

# 9 Conclusion

This stormwater management plan addresses the stormwater quantity and quality of the residential development of Stage 2, 530 Raymond Terrace Road, Thornton.

Stormwater quantity and stormwater quality (both operational and construction phases) have been addressed.

Stormwater conveyance for the site will be in accordance with the minor/major system philosophy and the requirements of Maitland City Council. The minor system consisting of surface inlet pits and pipes has been designed for an AEP of 10 %. The major stormwater system will consist of the road reserve and will be designed for an AEP of 1%.

Detention modelling for the site determined that the peak flows from AEPs for 20% to 1% AEP have been reduced to or below the predeveloped peak flows.

Water quality management for the site will consist of a treatment train utilizing rainwater tanks, GPT, swales and a bioretention basin to reduce the pollutant runoff from the site in accordance with the requirements of Maitland City Council.

Construction phase erosion and sediment control will be undertaken in accordance with Landcom's Managing Urban Stormwater and Maitland City Council.

If you have any questions regarding the information provided in this Civil Engineering DA Report, please call the undersigned or Josh Rhodes to discuss

Yours faithfully,

**ACOR Consultants (NSW) Pty Ltd**

**Brandon Gathercole**
**Newcastle Civil Design Manager & Civil Engineer**

# 10 Figures

CONSULTANTS

DA210-102 ...................................................... EROSION AND SEDIMENT CONTROL DETAILS - SHEET 2

# Appendix A Detention Basin Spillway Calculations

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| | | | | | |
|---|---|---|---|---|---|
| **PROJECT NAME:** | Brentwood Stage 2 | **PROJECT NUMBER:** | NSW2102521 | **DISCIPLINE:** | CIV |
| **CLIENT:** | Landlink Pty Ltd | **AUTHOR:** | BJG | **DATE:** | 17/05/2022 |
| **DESCRIPTION:** | Weir Spillway Check | **CHECKER:** | JPR | **ITEM:** | 1 |

## Spillway Check - 1% AEP Event - Staged Outlet 100% Blocked

## WEIR FLOW

Trapezoidal Weir Equation = $Qweir = CLh^{1.5} + C_sSh^{2.5}$

| | | | |
|---|---|---|---|
| C = Weir Coefficent = | 1.67 | Total Weir Flow = | 5.904 $m^3/s$ |
| $C_s$ = Weir Coefficent Side Slope = | 1.67 | Total Weir Velocity = | 0.787 m/s |
| L = Crest Length = | 5 | TOTAL 1% AEP Event flow = 1.383 | |
| h = Height over Wier = | 0.5 | | |
| S = Side Slope 1 in | 10 | | |

# Appendix B HumeGard Technical Manual

Humes

Strength. Performance. Passion.

# HumeGard® GPT Technical manual

Issue 5

# Contents

# HumeGard® GPT

The HumeGard® system is a Gross Pollutant Trap (GPT) that is specifically designed to remove gross pollutants and coarse sediments ≥ 150 microns, from stormwater runoff. A wide range of models are available to provide solutions for normal and super-critical flow conditions.

The HumeGard® GPT incorporates a unique floating boom and bypass chamber to enable the continued capture of floating material, even during peak flows. The configuration also prevents re-suspension and release of trapped materials during subsequent storm events.

The HumeGard® GPT is designed for residential and commercial developments where litter and sediment are the target pollutants. It is particularly useful in retrofit applications or drainage systems on flat grades where low head loss requirements are critical, and in high backwater situations.

The value of the HumeGard® GPT has proven it to be one of the most successful treatment devices in Australia today:

- **The system provides high performance with negligible head loss**
  The HumeGard® GPT has a head loss 'k' factor of 0.2, important for retrofit and surcharging systems.
- **It captures and stores a large volume of pollutants**
  For pollutant export rates reported by Australia Runoff Quality (1 $m^3$/hectare/year), the HumeGard® GPT is sized for maintenance intervals up to annual durations.
- **It uses independently proven technology**
  The system was developed and tested by Swinburne University of Technology, Australia, in 1998, to demonstrate compliance with operational criteria from the Victorian EPA. The ability of the HumeGard® to capture and retain Total Suspended Solids (TSS), Total Phosphorous (TP), and Total Nitrogen (TN), was tested in 2015 by Sunshine Coast University.
- **It has low operational velocities**
  Flow velocity in the storage chamber is <0.2 m/s to ensure the comb self-cleans and improves settling of coarse sediment.
- **It retains floating material even in bypass**
  All GPTs bypass at high flows. The floating boom will capture and retain floating materials even when bypass occurs.
- **It provides cost effective treatment for litter and coarse sediments**
  The system's large capacity and long maintenance intervals reduces the overall lifecycle costs in comparison with other treatment measures.
- **It can reduce the footprint of the stormwater treatment train**
  Installation of a HumeGard® GPT prior to vegetated treatment measures can assist in reducing their overall footprint.
- **It maximises above ground land use**
  The HumeGard® GPT is a fully trafficable solution, so it can be installed under pavements and hardstands to maximise land use on constrained sites. Further, customised HumeGard® models can be designed to accommodate almost any design loads.
- **It is easy to maintain**
  Cleanout of the HumeGard® GPT can be performed safely and effectively from the surface using a vacuum truck. A full maintenance procedure is provided as a separate document.
- **It is made from quality componentry**
  All internal metal components are made from 304 stainless steel or fibreglass, and the system undergoes rigorous quality control prior to dispatch. The standard HumeGard® has a design life of 50 years.

## System 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 that diverts treatable flows into a lower treatment chamber for settling and capturing coarse pollutants from the flow.

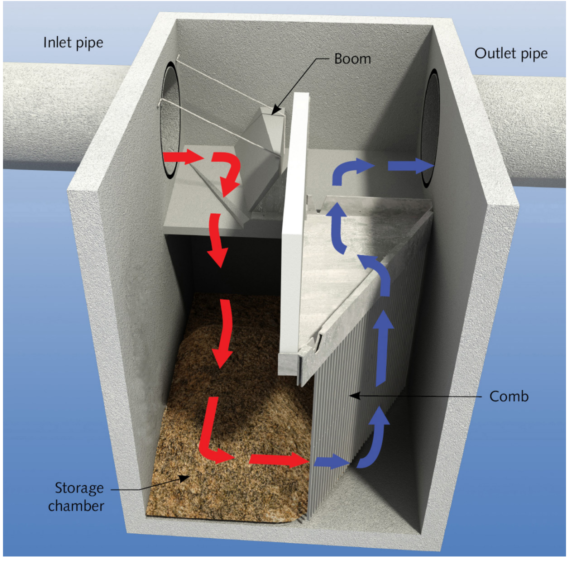
### Bypass chamber

1. Stormwater flows into the inlet (boom) area of the bypass chamber (refer to Figure 1).
2. During flows up to and including the design treatment flowrate, the angled boom, acting as a weir, directs the total flow into the storage/ treatment chamber.
3. The treatment flow rate will be exceeded once the depth of flow entering the HumeGard® has reached 50% of the height of the boom. Even during these higher flow conditions, the angled boom continues to direct all floating litter from the bypass chamber into the storage/treatment chamber. The inlet area of the bypass chamber floor is angled towards the treatment chamber to ensure the bed load sediment material continues to be directed into the storage chamber even when the boom is floating.
4. At peak design flows, the boom remains semi-submerged and enables excess flow to pass underneath, regulating the flow into the storage/ treatment chamber. This ensures that higher flows, which could otherwise scour and re-suspend previously trapped materials, are not forced into the storage/treatment chamber. The floating boom bypass ensures previously trapped floating materials are retained. Each HumeGard® GPT is designed to achieve an operating velocity below 0.2 m/s through the storage chamber to ensure the settling of coarse sediment and keep the comb clean.

### Treatment chamber

1. Once diverted into the treatment chamber, the flow continues underneath the internal baffle wall, passes through the stainless steel comb and flows over the flow controlling weir to the outlet.
2. Pollutants with a specific gravity less than water (S.G.<1) remain floating on the water surface in the storage/treatment chamber. Sediment and other materials heavier than water (S.G.>1) settle to the bottom of the chamber. The design and depth of the chamber minimises turbulent eddy currents and prevents re-suspension of settled material. The comb prevents any neutrally buoyant litter in the treatment chamber from escaping under the baffle wall.

**Figure 1 – Operation during design flow conditions**



## Independent verification testing

Laboratory and field testing of the HumeGard® GPT for hydraulic performance and litter capture was conducted in Australia by Swinburne University of Technology, during 1996 and 1998.

Laboratory and field testing (Waste Management Council of Victoria 1998, Trinh 2007, Woods 2005, Swinburne University of Technology 2000) has proven the performance outlined in Table 1 below.

Further field testing was conducted by the University of the Sunshine Coast from 2013 to 2015, including a minimum of 15 qualifying storm events, to determine TSS, TP and TN removal efficiencies, which are also outlined in Table 1 below.

**Table 1 – HumeGard® GPT performance summary**

| Pollutant | Removal efficiency | Details |
|---|---|---|
| Gross pollutants (litter, vegetation) | 90% | Annually |
| TSS | 49% | Annually (including bypass) |
| Hydrocarbons | 90% | In an emergency spill event |
| TP | 40% | Particulate-bound |
| TN | 26% | Particulate-bound |

**Notes:**

1. Nutrient removal is influenced by individual catchment characteristics and partitioning between dissolved and particulate nitrogen.
2. For further details on performance testing contact Humes.
3. Gross pollutant traps are not specifically designed to capture hydrocarbons, though may do so during emergency spill events. When this occurs, maintenance is required immediately.
4. The unique design of the HumeGard® floating boom allows it to be modified to treat higher flows and capture more gross pollutants and sediment on request.

## System options

A wide range of sizes are available to suit catchment pollutant generation rates and Water Quality Objectives (WQO). Table 2 below presents the standard model dimensions and total storage chamber volume. We recommend that designers contact Humes Water Solutions for detailed sizing on each project and for advice with larger units.

Pollutant export rates detailed in Australian Runoff Quality (Engineers Australia 2006) suggests that a typical urban catchment will produce 1 $m^3$/hectare/year of gross pollutants and sediment. Humes Water Solutions advises that this be taken into account when selecting an appropriate model.

**Table 2 – HumeGard® model range and dimensions**

| HumeGard® model | Treatment flow rate (L/s) | Storage chamber volume ($m^3$) | Pipe DN @ max. pipe grade % | | |
|---|---|---|---|---|---|
| | | | 0 - 1% | > 1 - 2.5% | > 2.5% - 5% |
| HG12 | 85 | 3 | 375 | 300 | 300 |
| HG12A | 100 | 3 | 450 | 375 | 375 |
| HG15 | 130 | 3 | 525 | 450 | 450 |
| HG15A | 150 | 3 | 600 | 525 | 525 |
| HG18 | 600 | 3 | 675 | 600 | 600 |
| HG24 | 1,050 | 8 | 750 | 675 | 675 |
| HG27 | 1,110 | 7 | 900 | 825 | 675 |
| HG30 | 1,330 | 12 | 1050 | 900 | 825 |
| HG30A | 1,160 | 11 | 900 | 900 | 825 |
| HG35 | 1,540 | 12 | 1050 | 1,050 | 900 |
| HG35A | 1,370 | 11 | 1050 | 900 | 900 |
| HG40 | 1,910 | 16 | 1,200 | 1,200 | 900 |
| HG40A | 1,750 | 14 | 1,200 | 1,050 | 1,050 |
| HG40B | 1,580 | 12 | 1,200 | 1,050 | 900 |
| HG45 | 1,960 | 19 | 1,500 | 1,350 | 1,200 |
| HG45A | 1,780 | 19 | 1,350 | 1,350 | 1,200 |
| HG50 and above | Custom | | | | |

**Notes:**

1. The unique design of the HumeGard® floating boom allows it to be modified to treat a wide range of flowrates. Contact Humes for details on the model to suit your project.
2. HumeGard® can be modified to suit a box culvert, larger pipe or skewed outlet. Please contact your Humes Water Solutions Manager.
3. HumeGard® should be sized for either pipe diameter or treatment flow rate.
4. Units listed are standard configurations. Custom units can be provided to meet specific project requirements.
5. For confirmation of HumeGard® sizing or to discuss project specific requirements please contact your Humes Water Solutions Manager.
6. Refer to current Humes Terms and Conditions of Sale.
7. Australian Rainfall Quality recommend a pollutant export rate for a typical residential catchment is up to 1$m^3$/ha/yr of mixed waste and sediment.
8. HumeGard® can be modified to suit typical tail-water effects from downstream areas such as basins. Please contact Humes for design advice.
9. HumeGard® can be modified to suit high groundwater conditions. Please contact Humes for design advice.

## Variants

A number of additional innovations have been made to the HumeGard® GPT to facilitate their effective operation in a wider range of applications:

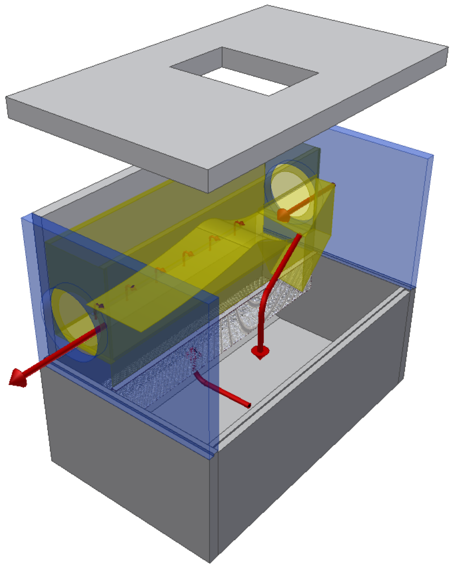
- Super-critical HumeGard® GPT – designed to operate under supercritical flow conditions in steep, high velocity drainage networks.
- Angled HumeGard® GPT – designed to replace a 45° or 90° junction in a drainage network.
- Dual outlet HumeGard® GPT – designed to divert the treatment flow to downstream natural Water Sensitive Urban Design (WSUD) elements such as wetlands and bio-retention whilst bypassing excess flows through a second outlet.

- **Super-critical HumeGard® GPT**

  The super-critical HumeGard® GPT (refer to Figure 2) was borne out of the original HumeGard® GPT, with modifications to deliver even greater performance under super-critical flow conditions. This model replaces the floating boom with a broad-crested weir that diverts the treatment flows into the treatment chamber under super-critical flow (Fr>1) conditions without creating hydraulic jumps and adversely impacting on performance.

  Flow into the treatment chamber passes through a stainless steel screen at a velocity <0.2 m/s and exits the device via a slot beneath the broad-crested weir (refer to the red arrows in Figure 2). The inserts in these models are manufactured from fibreglass for increased durability. The stainless steel screen can be shaped with a curved profile upon request. When the treatment flow rate is exceeded, the excess flow bypasses over the broad-crested weir to the outlet. This maintains the treatment flow into the chamber but protects against scour of captured material.

**Figure 2 – Super-critical HumeGard® GPT**



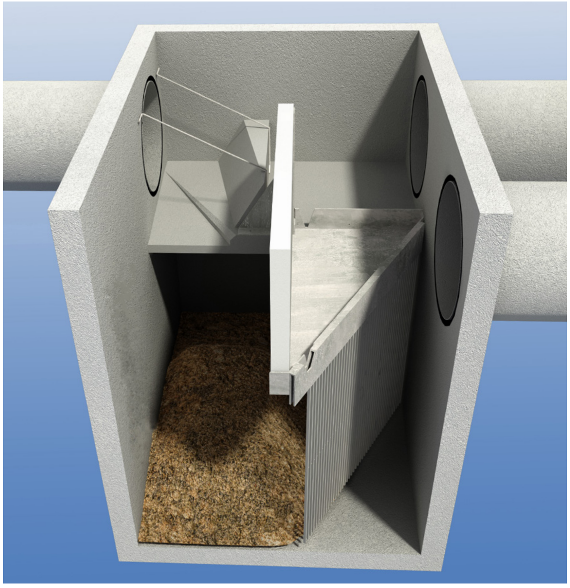
- **Angled HumeGard® GPT**
  The angled HumeGard® GPT (refer to Figure 3), was developed to facilitate the replacement of junction pits while still providing the treatment capabilities of the original HumeGard® device. These units simply alter the outlet location to allow for a change of pipe direction of 45° or 90°. The Angled HumeGard® GPT can be supplied in any of the standard unit sizes, however, the designer must allow for a minor head loss factor 'k' of 1.3 instead of 0.2 (which applies to the standard HumeGard® GPT design).

- **Dual Outlet HumeGard® GPT**
  The Dual Outlet HumeGard® GPT has been designed to operate as a diversion structure upstream of natural WSUD options such as constructed wetlands, ponds, lakes, and bio-retention systems.

  The units are designed such that one outlet conveys the treated flow into the natural WSUD measure and the standard outlet bypasses the excess flow around the downstream system (refer to Figure 4). Dual Outlet HumeGard® units are available in the same sizes as the standard HumeGard® units (refer Table 2 on page 4).

**Figure 3 – Angled HumeGard® GPT**

**Figure 4 – Dual Outlet HumeGard® GPT**



**Inundation/tidal applications**

The boom of the HumeGard® GPT enables the capture of floating pollutants even at peak flows, often when other fixed weir devices are in bypass mode. This unique feature also makes the HumeGard® GPT ideal for applications that are subject to both tidal and tail water effects.

In tidal applications the floating boom effectively traps the floating pollutants and prevents the loss of the gross pollutants from the system. In fixed weir devices, previously trapped floating litter may be backwashed out of the GPTs during the rising phase, to later bypass the GPT during the falling phase of the tide. As this happens twice daily, spring tides could quickly empty devices relying upon a fixed weir.

Marine grade 316 stainless steel is used for all internals in devices installed in tidal applications. In acidic/aggressive environments, these may also be epoxy-coated. Contact Humes Water Solutions for specific designs to suit these applications.

A plinth can also be added to the false floor under the boom to ensure sediment loads are captured and retained during inundation.

## Design information

To design a system suitable for your project it is necessary to review the configuration of the stormwater system, the location and purpose of other stormwater management (WSUD) controls, the catchment area and the hydrology.

### Configuration of the stormwater system

The configuration of the stormwater system is important since the HumeGard® GPT operates with an "in-line", 45° or 90° alignment. Inlet pipe grades between 0.5% and 5% are recommended for at least five pipe diameters upstream of the HumeGard® GPT.  The pipe grade and flow velocity will determine whether a super-critical unit is required.

### Location in the stormwater system

Depending upon the site, the GPT can be oriented to have the treatment chamber on the left or right side of the pipe to suit constraints. Humes Water Solutions can work closely with stormwater designers to select the appropriate location and orientation for their system.

### Catchment area

Research presented in Australian Runoff Quality (Engineers Australia 2006) concluded that roughly 1 $m^3$/hectare/year of gross pollutants and sediment could be expected from a typical residential catchment. Therefore, GPTs designed for an annual maintenance interval should have a pollutant storage capacity roughly equal to the number of hectares of catchment it treats (e.g. 10 hectare catchment = 10 $m^3$ pollutant storage).

### Sizing HumeGard® GPTs

The large storage volumes of the HumeGard® GPT enables more pollutants to be captured before maintenance is required, which greatly reduces its lifecycle costs. In accordance with accepted hydraulic principles the larger volumes in the HumeGard® GPT results in lower velocities through the device, minimising scour and re-suspension of sediment.

Humes Water Solutions has developed a design request form (see page 30) for stormwater designers to complete and return to obtain a detailed design of the appropriate device.

### MUSIC/pollutant export model inputs

Many local authorities utilise MUSIC or other pollutant export models to assist in stormwater treatment train selection, and recommend generic inputs for GPTs. Considering these against the independent research results, the following conservative removal efficiencies (refer to Table 3 below) are recommended for the HumeGard® GPT on an annual basis (i.e. no bypass).

**Table 3 – MUSIC inputs for HumeGard® GPTs**

| Pollutant | Removal efficiency |
|---|---|
| Gross pollutants (litter, vegetation) | 90% |
| TSS | 49% |
| TP | 40% |
| TN | 26% |

## System installation

Top:
Preparing the aggregate base (Step 2)

Middle:
Installing the main bypass chamber (Step 4)

Bottom:
Placing the main chamber lid (Step 7)

The installation of the HumeGard® unit should conform to the local authority's specifications for stormwater pit construction. Detailed installation instructions are dispatched with each unit.

The HumeGard® unit is installed as follows:

1. Prepare the excavation according to plans.
2. Prepare the compacted aggregate base.
3. Install the main treatment chamber section.
4. Install the main bypass chamber section/s (if required).
5. Fit the stainless steel comb (if required).
6. Connect the inlet and outlet pipes.
7. Place the main chamber lid.
8. Install the frame and access covers.
9. Backfill to specified requirements.

## System maintenance

The design of the HumeGard® GPT means that maintenance is best performed by vacuum trucks which avoids entry into the unit.

Additional access covers can be designed upon request.

A typical maintenance procedure includes:

1. Remove access covers.
2. With a vacuum hose, remove the floating litter from the treatment chamber.
3. Determine the depth of water and sediment layers.
4. Insert sluice gate into the upstream manhole.
5. Decant water from the treatment chamber into the upstream manhole until the sediment layer is exposed.
6. Remove the sediment layer with the vacuum hose; jet with a high pressure hose if required.
7. Remove sluice gate from the upstream manhole and allow water to return to the HumeGard® GPT.
8. Replace access covers.

Left:
Floating litter captured in the treatment chamber

## FAQs

- **Can the boom become stuck?**
The boom can weight up to hundreds of kilograms depending on the model, with the smallest boom in the HG18 weighing in at 35 kg. Unless there is a large branch, car wheel, or other large item carried through the drainage network, the mass of the boom will ensure it returns to the floor.
- **Will the gross pollutants bypass when the boom floats?**
All treatment measures are designed to treat a specific flow. Once this is exceeded, any entrained pollutants in the flow will bypass the treatment chamber. Often this is less than 5% of the annual load. A significant quantity of gross pollutants are buoyant when entering a GPT and, unlike fixed weir systems which bypass these floatable items, the HumeGard® boom provides continuous treatment of them, even in bypass.
- **Will the retention of water in the treatment chamber lead to the release of nutrients as pollutants break down?**
Over time, captured organic materials will breakdown and release nutrients in all treatment measures whether natural or manufactured. As part of a treatment train, downstream vegetated measures can remove the small proportion of nutrients released during dry weather flows. A regular maintenance program will reduce the amount of breakdown occurring.
- **What is the design life of a HumeGard® GPT?**
The entire product is designed to last a minimum of 50 years.
- **Why is the HumeGard® GPT larger than other GPTs?**
The design of the HumeGard® GPT is to ensure a velocity through the treatment chamber <0.2 m/s to ensure the comb self-cleans and the coarse sediments settle in the sump. From engineering principles, a larger cross-sectional area is required to reduce the loading rate. As proven by Stokes Law, lower chamber velocities mean smaller sediment particles can be captured.
- **Why would I use a HumeGard® GPT upstream of a biofilter?**
Using a HumeGard® GPT upstream of a biofilter acts as a sediment forebay and removes litter, containing it to a confined location for easy removal by a vacuum truck. This protects the biofilter, lengthens its lifespan and reduces the ongoing maintenance costs.

## References

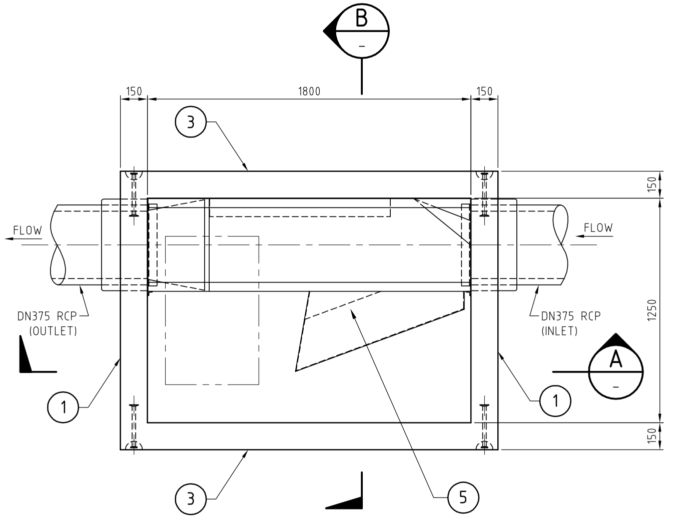

- Waste Management Council of Victoria (1998) “Inline Litter Separator: Installation and Monitoring Project”, EcoRecycle, Victoria.
- Trinh, N. An Investigation into the Trapping Efficiencies of Gross Pollutant Traps. Thesis. Brisbane, Queensland: Queensland University of Technology, 2007.
- Woods, S. Performance Evaluation of an In-Line Separator. Masters Thesis. Melbourne, Victoria: Swinburne University of Technology, 2005.
- Swinburne University of Technology (2000) “HumeGard® In-line Litter Separator Sediment Capture Testing”, School of Engineering and Science.
- Engineers Australia (2006) “Australian Runoff Quality”.
- Lucke, T. 2015, Characterisation of Water Quality Improvement Processes by GPTs at University of the Sunshine Coast (Humegard HG27 Monitoring Program), School of Science and Engineering, University of the Sunshine Coast, QLD, Australia.
- Nichols P., & Lucke T., 2016, Field Evaluation of the Nutrient Removal Performance of a Gross Pollutant Trap (GPT) in Australia, Sustainability, 8, 669; doi:10.3390/su8070669

# Appendix

HumeGard® GPT technical drawings

| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 2 | GENERAL REVISION, REISSUED FOR MANUFACTURE | MZ | — | RM |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL | HG12-20 |
| 2 | BASE SLAB | HG12-21 |
| 3 | SIDE WALL | HG12-22 |
| 4 | PRECAST LID | HG12-07 |
| 5 | GRP INSERT ASSEMBLY DETAILS | HG12A/L-08 |

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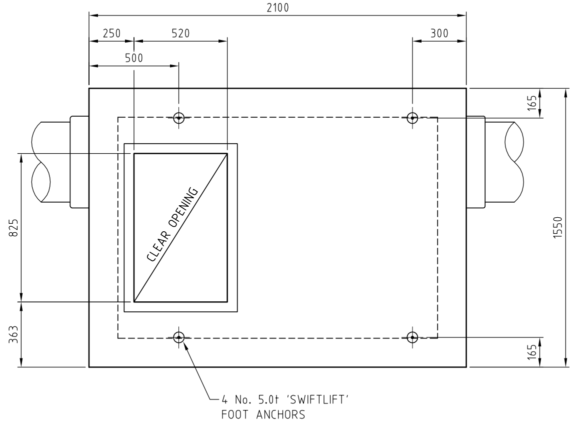


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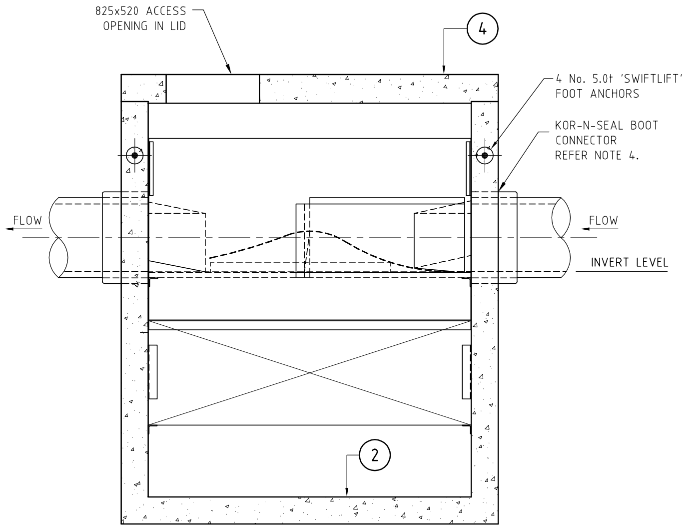


SECTION A
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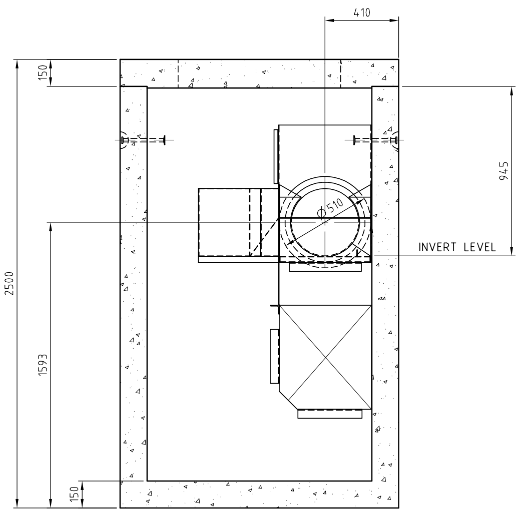


SECTION B
SCALE 1:20

## NOTES

1. GRP INSERT MANUFACTURED FROM 5mm GRP.
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.0t (WITHOUT LID)
   LID = 1.2t
4. KOR-N-SEAL BOOT CONNECTOR P/N = S106-20WP
5. SEE DRAWING HG-CAST 2 FOR CASTING SEQUENCE

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH M1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES
BRISBANE, QUEENSLAND

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| DSN. | WST | 02-09-10 |
| DWN. | MZ | 02-09-10 |
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| SUPERSEDES | HG12A/L-01 ISSUE 1 | |

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG12A/L
DN375/DN375 RCP
GENERAL ASSEMBLY

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| 2 | GENERAL REVISION | MZ | — | RM |

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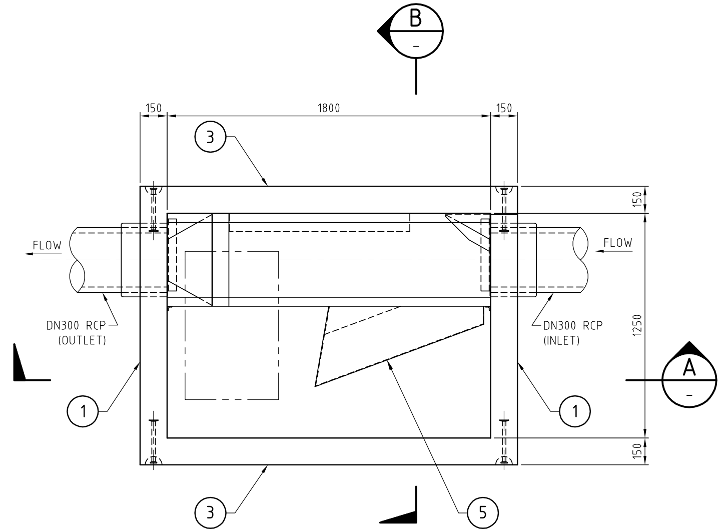
| 1 | END WALL | HG12-20 |
| 2 | BASE SLAB | HG12-21 |
| 3 | SIDE WALL | HG12-22 |
| 4 | PRECAST LID | HG12-07 |
| 5 | GRP INSERT ASSEMBLY DETAILS | HG12/L-08 |

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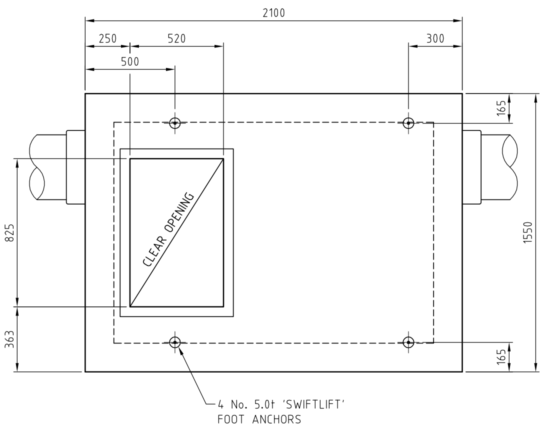


PLAN ON LID
SCALE 1:20

## NOTES

1. GRP INSERT MANUFACTURED FROM 5mm GRP.
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.0t (WITHOUT LID)
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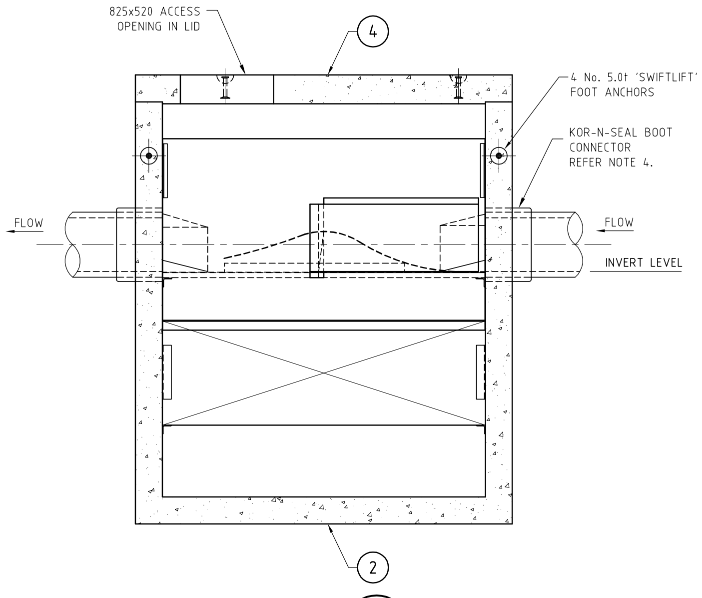
. SEE DRAWING HG-CAST 2 FOR CASTING SEQUENCE

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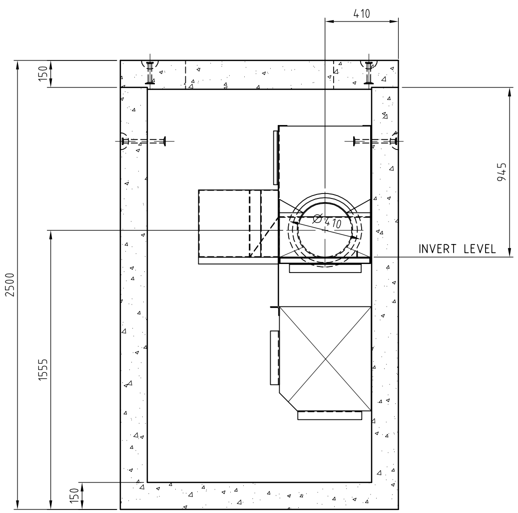


SECTION B
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## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH M1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES
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| DSN. | WST | 14-03-07 |
| DWN. | MZ | 14-03-07 |
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HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG12/L
DN300/DN300 RCP
GENERAL ASSEMBLY

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| 2 | GENERAL REVISION | MZ | — | RM |

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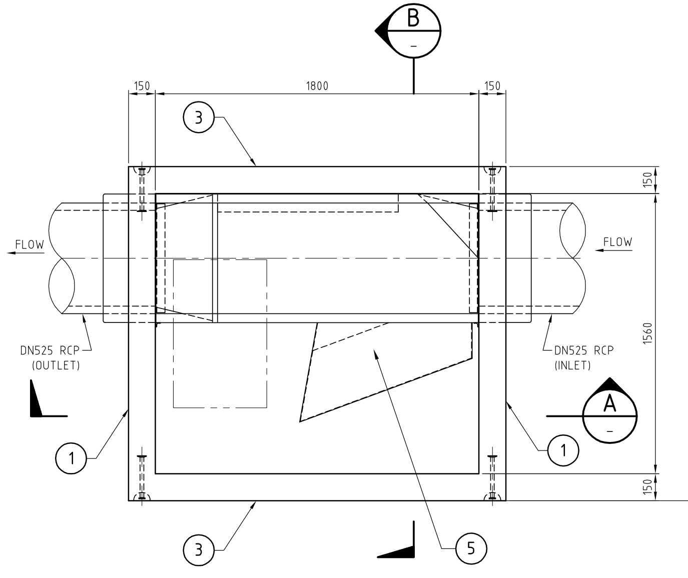
| 2 | BASE SLAB | HG15-21 |
| 3 | SIDE WALL | HG15-22 |
| 4 | PRECAST LID | HG15-07 |
| 5 | GRP INSERT ASSEMBLY DETAILS | HG15A/L-08 |

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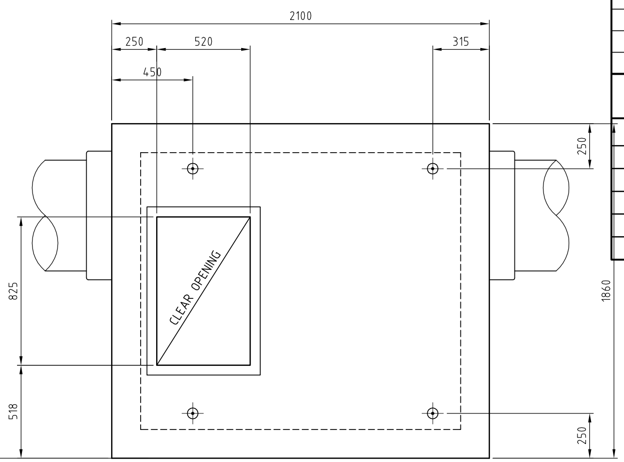


## PLAN ON LID
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## NOTES

1. GRP INSERT MANUFACTURED FROM 5mm .
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.7t (WITHOUT LID)
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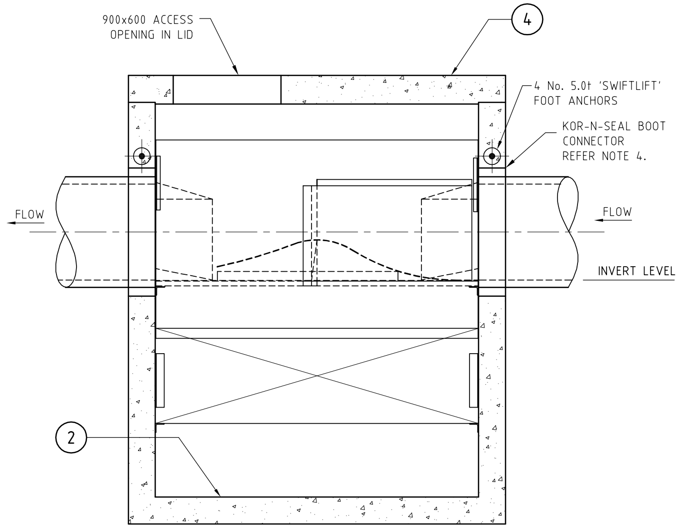


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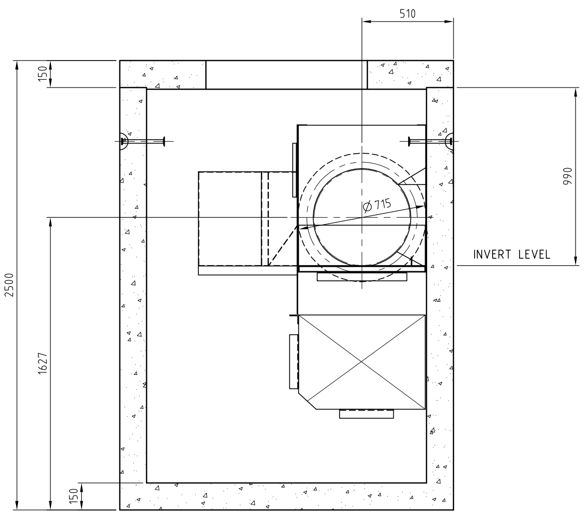


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## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES
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| DSN. | WST | 07-09-10 |
| DWN. | MZ | 07-09-10 |
| CKD. | RM | — |
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| SUPERSEDES | HG15A/L-01 ISSUE 1 | |

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG15A/L
DN525/DN525 RCP
GENERAL ASSEMBLY

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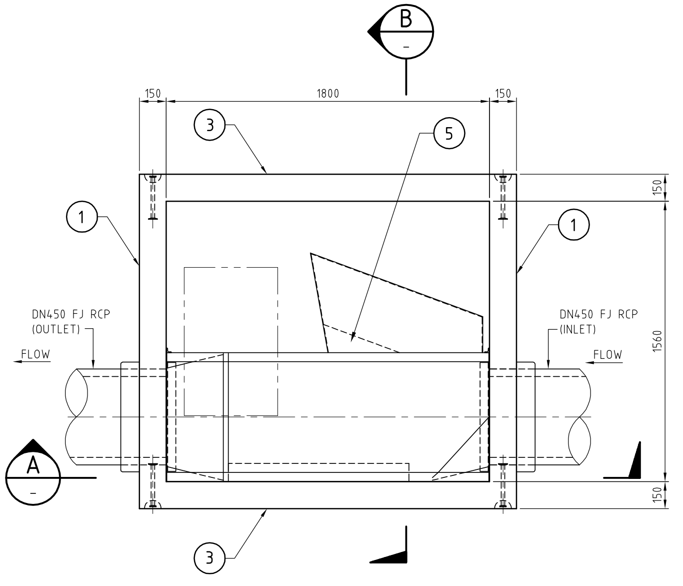
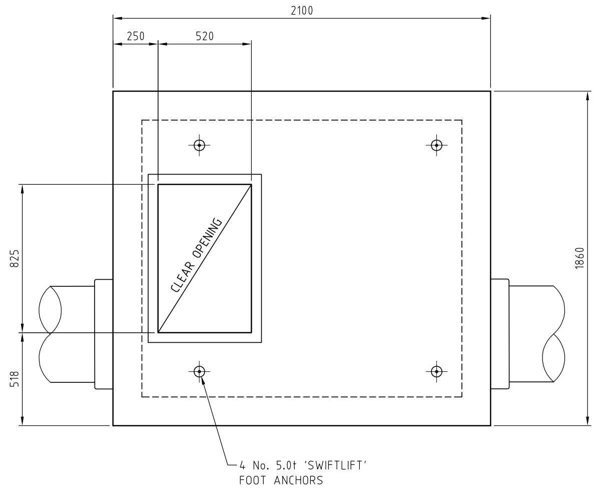


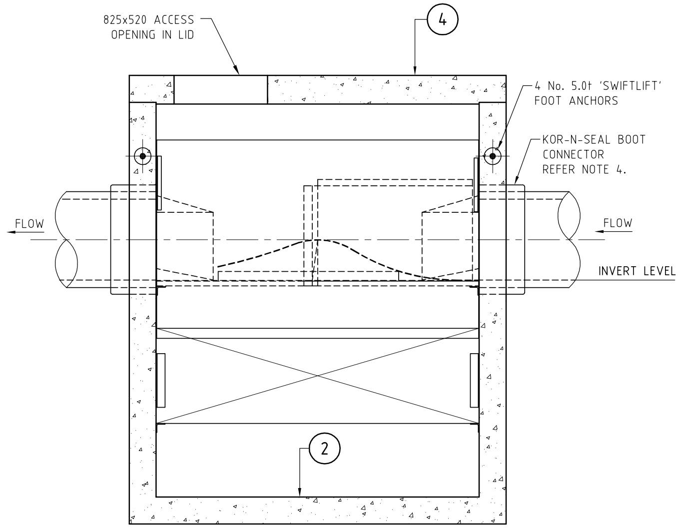

PLAN VIEW (LID REMOVED)
SCALE 1:20



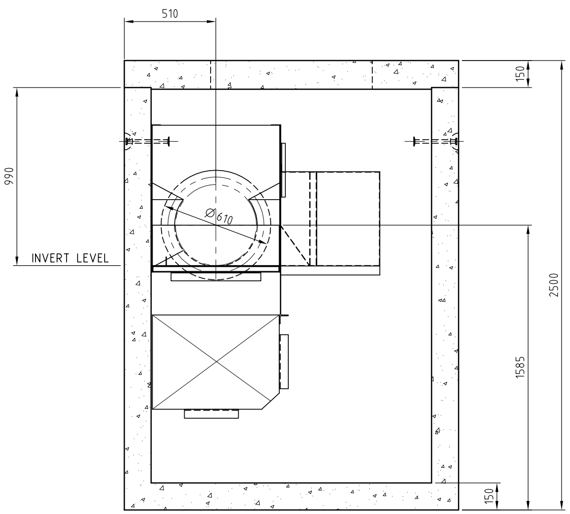

PLAN ON LID
SCALE 1:20

## NOTES

1. GRP INSERT MANUFACTURED FROM 5mm GRP.
2. ALL CONCRETE COMPONENTS TO BE HANDLED VIA CAST-IN SWIFTLIFT ANCHORS AT ALL TIMES.
3. UNIT MASS: CHAMBER (ASSEMBLED) = 7.7t (WITHOUT LID)
   LID = 1.5t
4. KOR-N-SEAL BOOT CONNECTOR P/N = S106-24WP
5. SEE DRAWING HG-CAST 2 FOR CASTING SEQUENCE




SECTION A
SCALE 1:20




SECTION B
SCALE 1:20

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH M1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

**CEMEX Australia Pty Limited** ABN 87 099 732 297



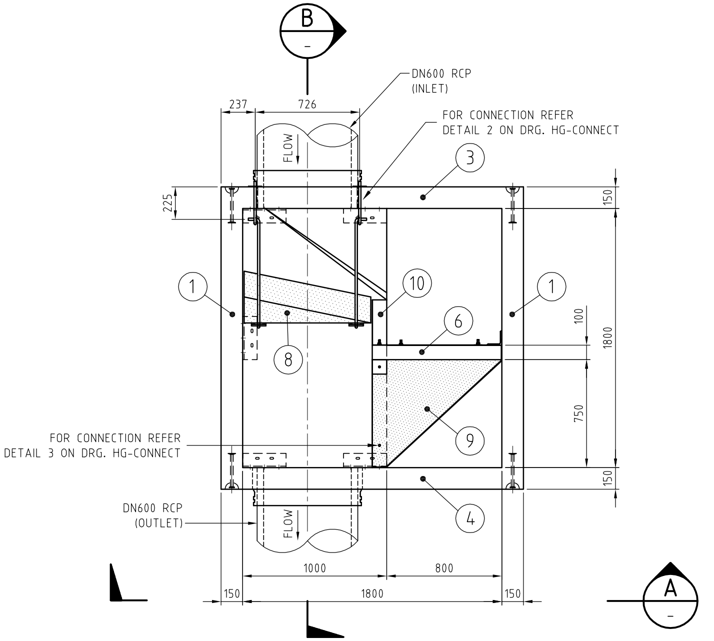
DSN. DFW 10-07-08
DWN. MZ 10-07-08
CKD. DFW
APP. WST
SUPERSEDES HG15/R-01 REV 1

HUMES
STANDARD DRAWING
HUMEGARD HG15/R
DN450/DN450 FJ RCP
GENERAL ASSEMBLY

PLOT SCALE 1:1 | SIZE A2 | DRG. NO. HG15/R-01 | ISSUE 2

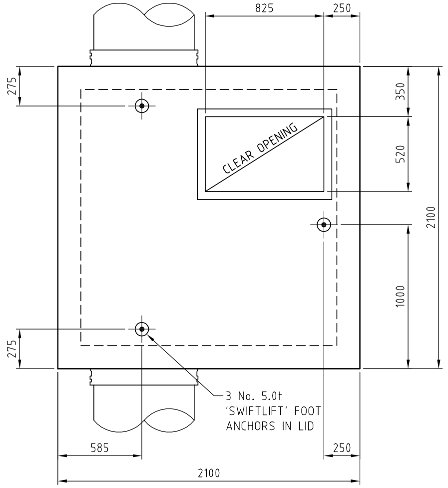
| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 3 | REFERENCE DWG No. REVISED – REISSUED FOR MANUFACTURE | MZ | 24-11-10 | RM |

| ITEM No | DRAWING DESCRIPTION | DWG No |
|---|---|---|
| 1 | END WALL | HG18-02 |
| 2 | BASE SLAB | HG18-03 |
| 3, 4 | SIDE WALL | HG18-04 |
| 5 | FALSE FLOOR | HG18/L-05 |
| 6 | CONCRETE BAFFLE WALL | HG18/L-05 |
| 7 | PRECAST LID | HG18/L-06 |
| 8 | FLOATING BOOM | HG18/L-07 |
| 9 | WEIR | HG18/L-08 |
| 10 | BAFFLE SIDE WALL | HG18/L-09 |
| 11 | COMB | HG18/L-10 |



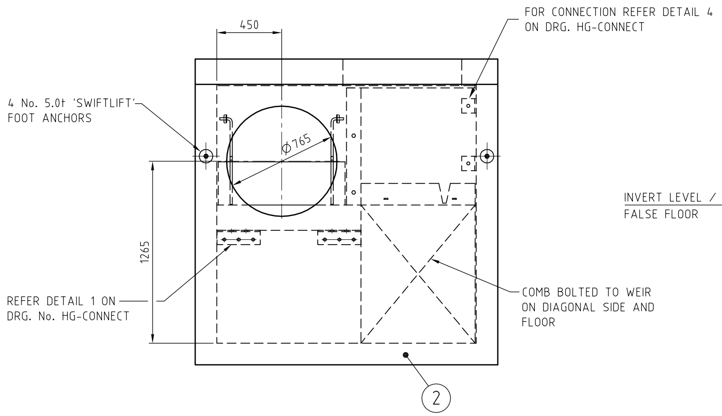

## PLAN VIEW (LID REMOVED)

SCALE 1:25



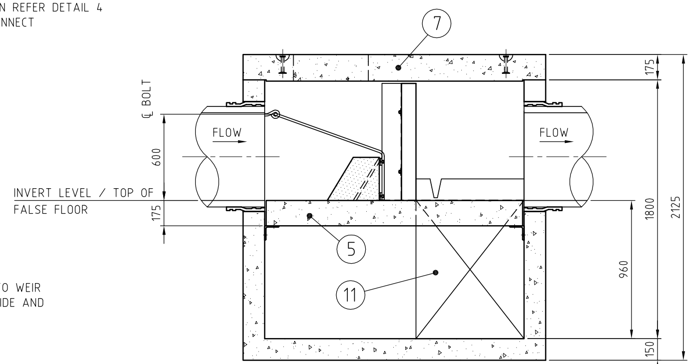

## PLAN ON LID

SCALE 1:25




## VIEW A

SCALE 1:25




## SECTION B

SCALE 1:25

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 7.8 t (WITHOUT LID). MASS OF LID = 1.9 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-30L (INLET & OUTLET)

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND



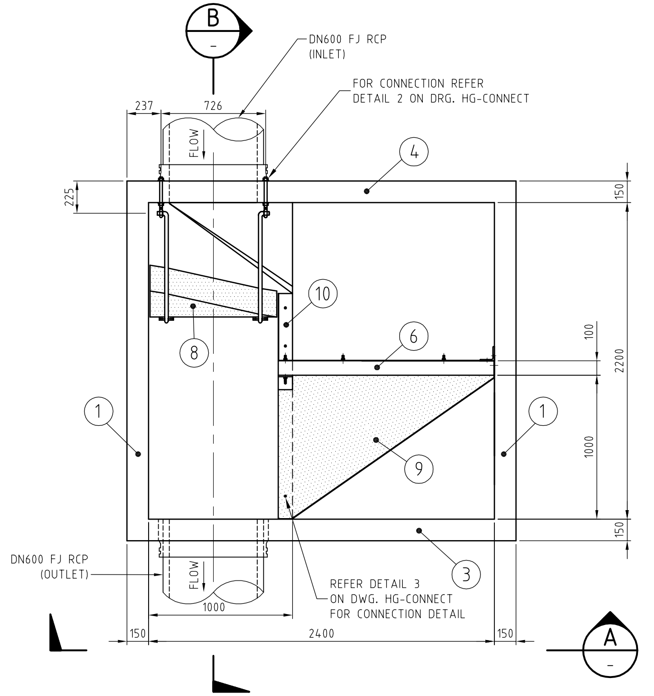
| | | |
|---|---|---|
| DSN. | WST | 24-11-10 |
| DWN. | MZ | 24-11-10 |
| CKD. | RM | 24-11-10 |
| APP. | WST | 24-11-10 |

SUPERSEDES HG18/L-01 REV. 2

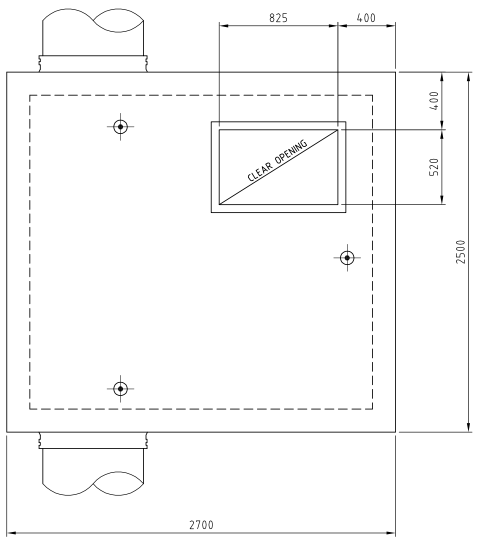
HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG18/L
DN600/DN600 RCP
GENERAL ASSEMBLY

| PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|
| 1:1 | A2 | HG18/L-01 | 3 |

| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 1 | GENERAL REVISION - ISSUED FOR MANUFACTURE | MZ | 12-03-07 | DFW |
| | | | | |
| | | | | |
| | | | | |
| | | | | |




## PLAN VIEW (LID REMOVED)
SCALE 1:25




## PLAN ON LID
SCALE 1:25

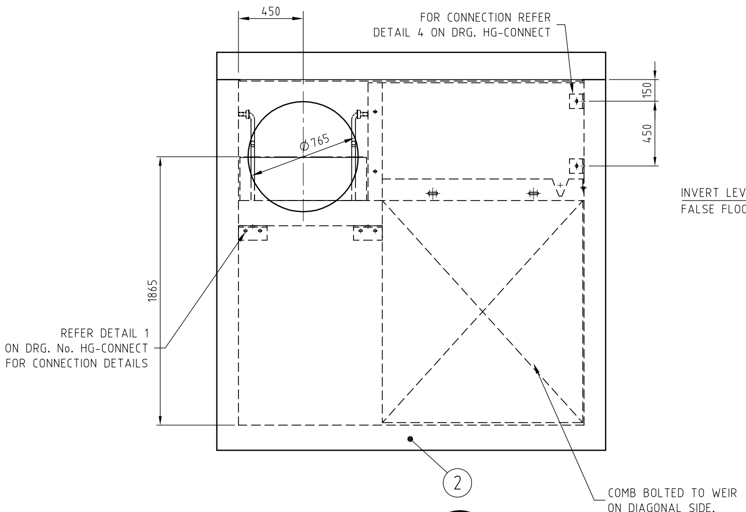
| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL | HG24/L-02 |
| 2 | BASE SLAB | HG24/L-03 |
| 3, 4 | SIDE WALL | HG24/L-04 |
| 5 | FALSE FLOOR | HG24/L-05 |
| 6 | CONCRETE BAFFLE WALL | HG24/L-05 |
| 7 | PRECAST LID | HG24/L-06 |
| 8 | FLOATING BOOM | HG24/L-07 |
| 9 | WEIR | HG24/L-08 |
| 10 | BAFFLE SIDE WALL | HG24/L-09 |
| 11 | COMB | HG24/L-10 |
| | SITE LAYOUT | HG24/L-11 |

NOTES:

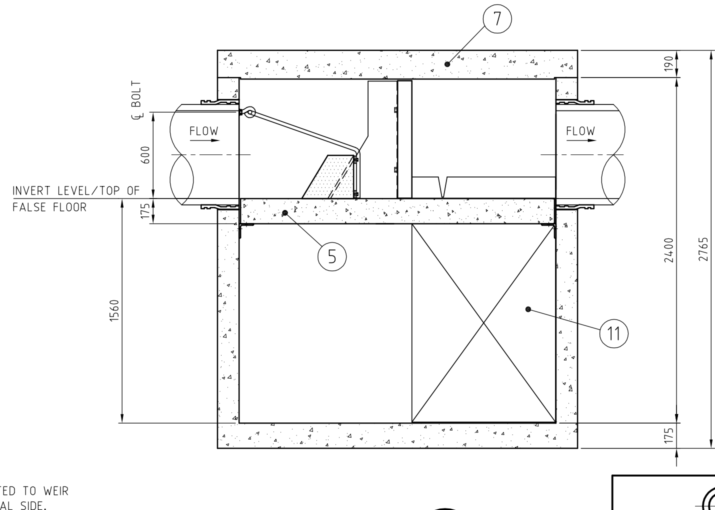
1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 13.0 t (WITHOUT LID).
   MASS OF LID = 3.2 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-30L (INLET & OUTLET)

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.




## VIEW A
SCALE 1:25




## SECTION B
SCALE 1:25

Humes
TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

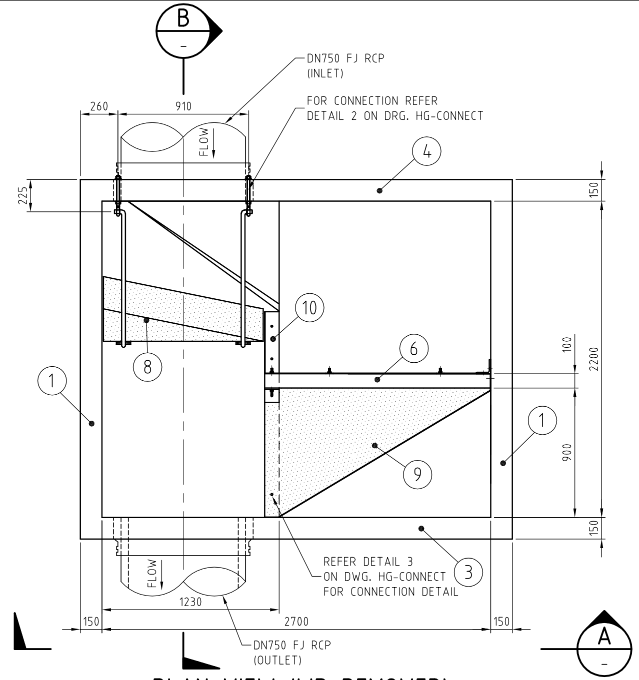
**Rinker Australia Pty Limited** ABN 87 099 732 297



| | | |
|---|---|---|
| DSN. | DFW | 12-03-07 |
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | DFW | 12-03-07 |

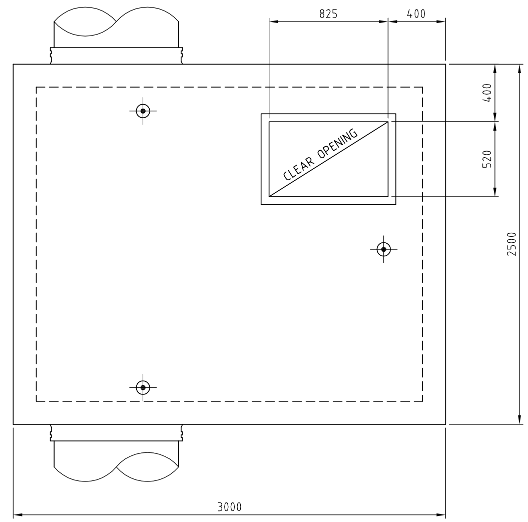
HUMES
STANDARD DRAWING
HUMEGARD HG24/L
DN600/DN600 FJ RCP
GENERAL ASSEMBLY

| SUPERSEDES | PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|---|
| HG24/L-01 REV. 0 | 1:1 | A2 | HG24/L-01 | 1 |



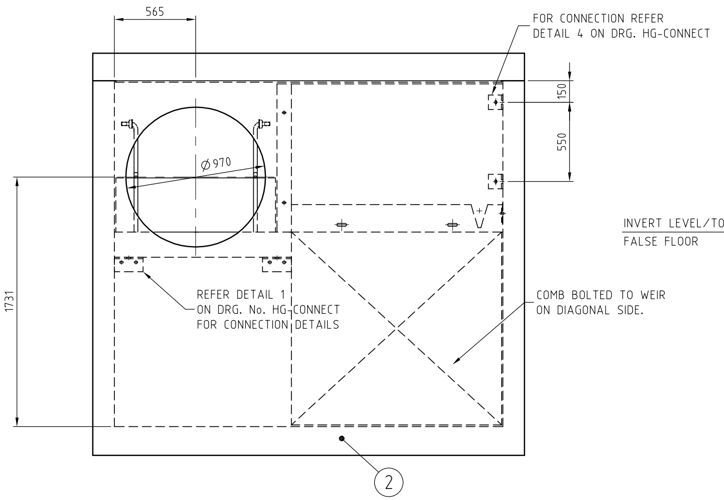

## PLAN VIEW (LID REMOVED)

SCALE 1:25



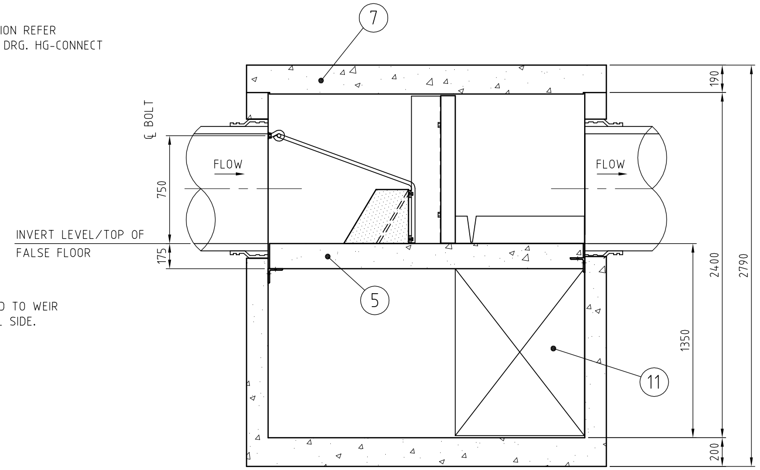

## PLAN ON LID

SCALE 1:25




## VIEW A

SCALE 1:25




## SECTION B

SCALE 1:25

| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 1 | GENERAL REVISION - REISSUED FOR MANUFACTURE | MZ | 12-03-07 | DFW |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL | HG27/L-02 |
| 2 | BASE SLAB | HG27/L-03 |
| 3, 4 | SIDE WALL | HG27/L-04 |
| 5 | FALSE FLOOR | HG27/L-05 |
| 6 | CONCRETE BAFFLE WALL | HG27/L-05 |
| 7 | PRECAST LID | HG27/L-06 |
| 8 | FLOATING BOOM | HG27/L-07 |
| 9 | WEIR | HG27/L-08 |
| 10 | BAFFLE SIDE WALL | HG27/L-09 |
| 11 | COMB | HG27/L-10 |
| | SITE LAYOUT | HG27/L-11 |

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 14.4 t (WITHOUT LID).
   MASS OF LID = 3.6 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-38 (INLET & OUTLET)

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

**Rinker Australia Pty Limited** ABN 87 099 732 297



| | | |
|---|---|---|
| DSN. | DFW | 12-03-07 |
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | SG | 12-03-07 |

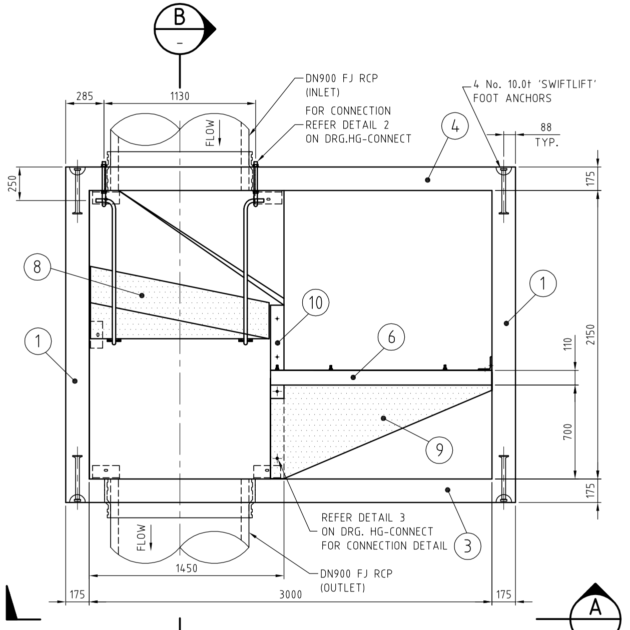
SUPERSEDES HG27/L-01 REV. 0

HUMES
STANDARD DRAWING
HUMEGARD HG27/L
DN750/DN750 FJ RCP
GENERAL ASSEMBLY

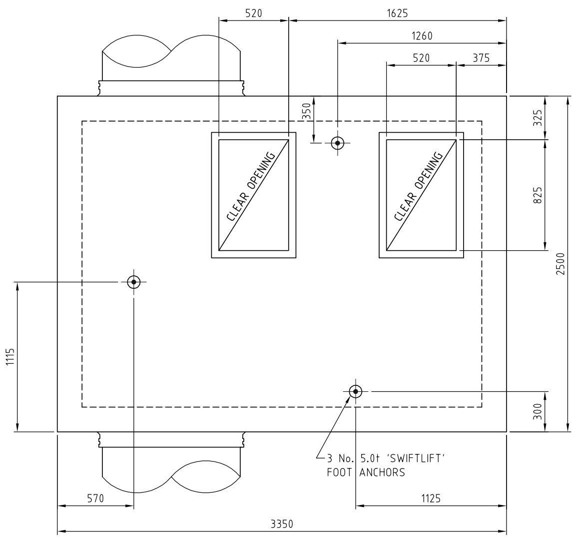
| PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|
| 1:1 | A2 | HG27/L-01 | 2 |

| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 2 | REFERENCE DWG No. REVISED, REISSUED FOR MANUFACTURE | MZ | — | RM |

| ITEM No. | DRAWING DESCRIPTION | DWG No. |
|---|---|---|
| 1 | END WALL | HG30A-02 |
| 2 | BASE SLAB | HG30-04 |
| 3, 4 | SIDE WALL | HG30A-05 |
| 5 | FALSE FLOOR | HG30A/L-07 |
| 6 | CONCRETE BAFFLE WALL | HG30A/L-07 |
| 7 | PRECAST LID | HG30A/L-08 |
| 8 | FLOATING BOOM | HG30A/L-09 |
| 9 | WEIR | HG30A/L-10 |
| 10 | BAFFLE SIDE WALL | HG30A/L-11 |
| 11 | COMB | HG30A/L-12 |
| | CONNECTION DETAILS | HG-CONNECT |
| | CASTING SEQUENCE | HG-CAST |



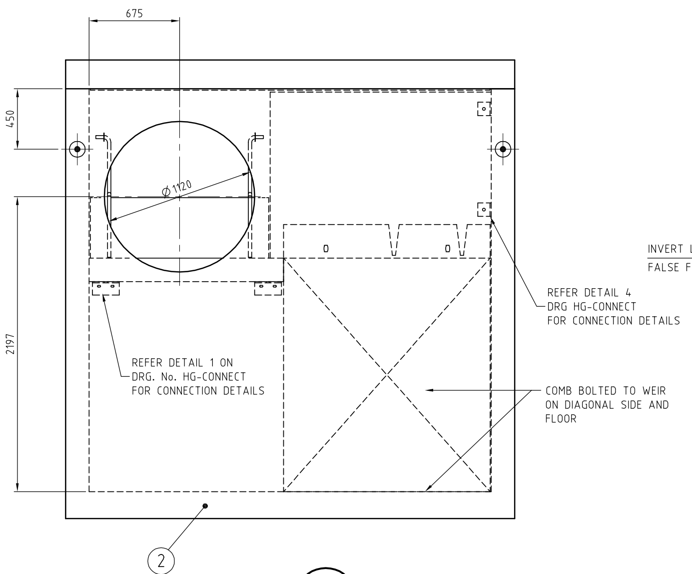

## PLAN
SCALE 1:25



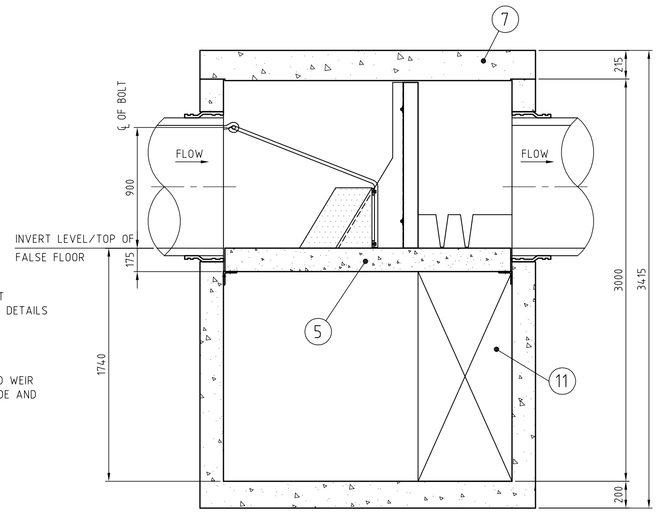

## PLAN ON LID
SCALE 1:25

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 20.2 t (WITHOUT LID).
   MASS OF LID = 4.3 t
   (SELF WEIGHT CONCRETE @ 2500 kg/m3)
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44 (INLET & OUTLET)




## VIEW A
SCALE 1:25




## SECTION B
SCALE 1:25

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

**SITE LIFT:**
LID - 3 No. 5 t SWIFTLIFT FOOT ANCHORS
HUMEGARD UNIT - 4 No. 10 t SWIFTLIFT FOOT ANCHORS

Humes
TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

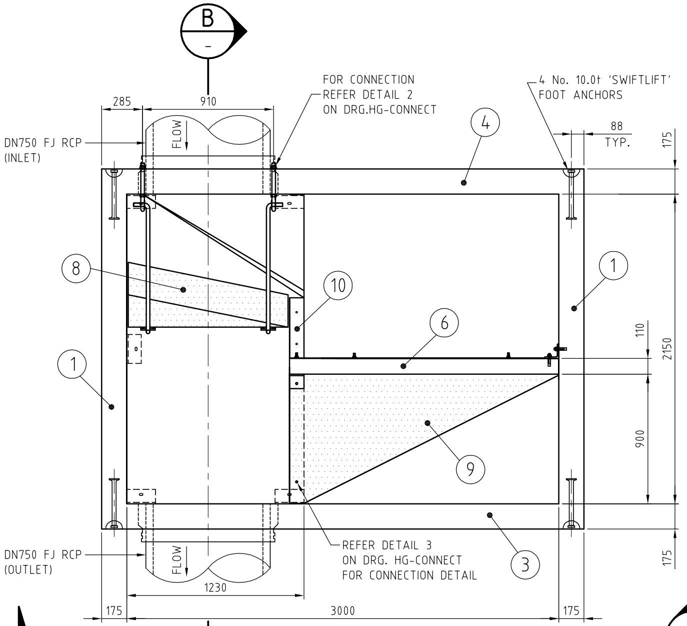
**CEMEX Australia Pty Limited** ABN 87 099 732 297



| | | |
|---|---|---|
| DSN. | DFW | 06-08-08 |
| DWN. | MZ | 06-08-08 |
| CKD. | DFW | — |
| APP. | WST | — |

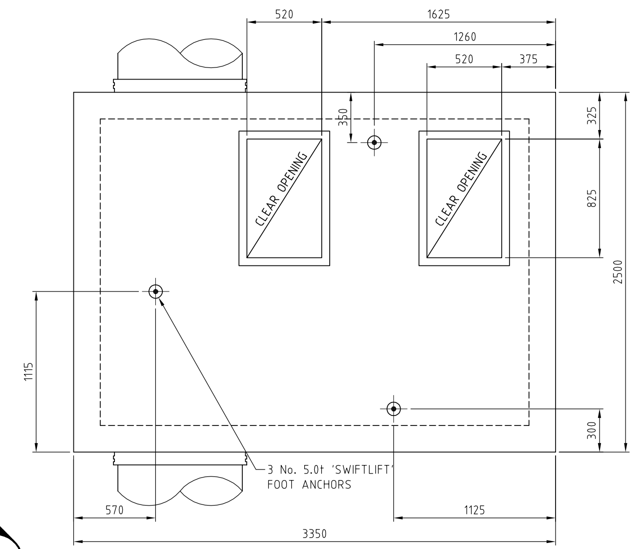
HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG30A/L
DN900/DN900 FJ RCP
GENERAL ASSEMBLY

| SUPERSEDES | PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|---|
| HG30A/L-01 REV 1 | 1:1 | A2 | HG30A/L-01 | 2 |



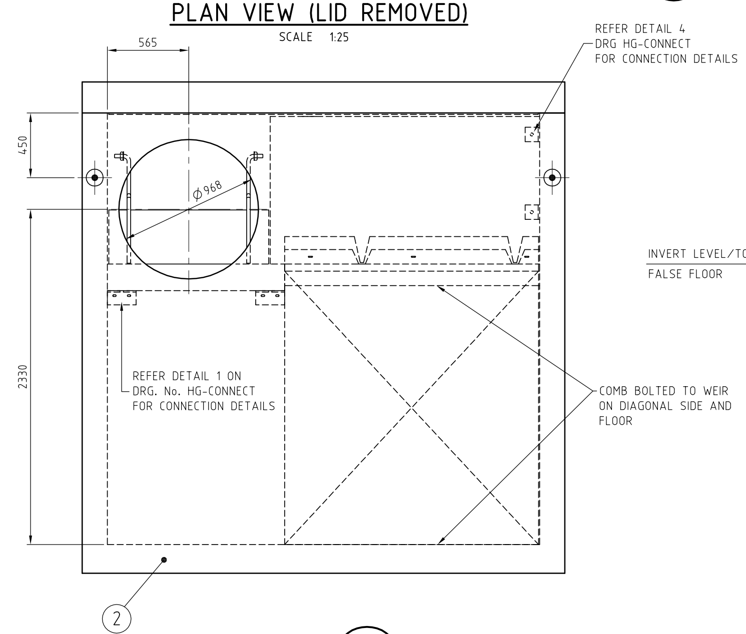

## PLAN VIEW (LID REMOVED)

SCALE 1:25



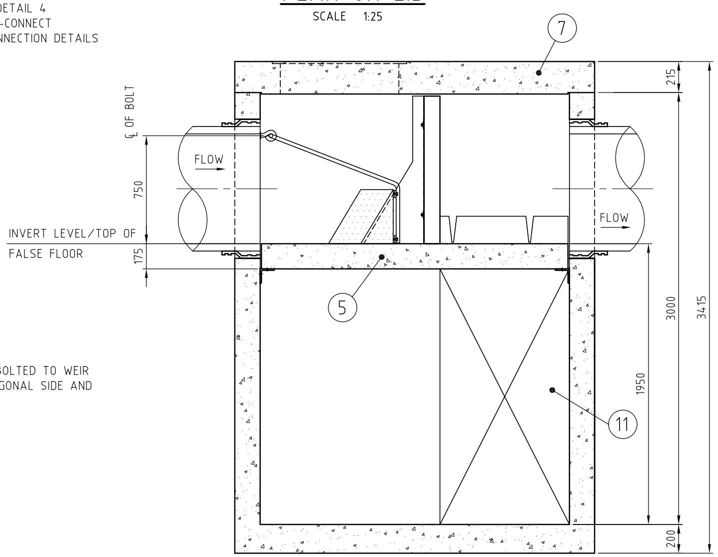

## PLAN ON LID

SCALE 1:25




## VIEW A

SCALE 1:25




## SECTION B

SCALE 1:25

| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 2 | REFERENCE DWG No. REVISED, REISSUED FOR MANUFACTURE | MZ | — | RM |

| ITEM No. | DRAWING DESCRIPTION | DWG No. |
|---|---|---|
| 1 | END WALL | HG30-02 (2) |
| 2 | BASE SLAB | HG30-04 |
| 3, 4 | SIDE WALL | HG30-05 |
| 5 | FALSE FLOOR | HG30/L-07 |
| 6 | CONCRETE BAFFLE WALL | HG30/L-07 |
| 7 | PRECAST LID | HG30-08 |
| 8 | FLOATING BOOM | HG30/L-09 |
| 9 | WEIR | HG30/L-10 |
| 10 | BAFFLE SIDE WALL | HG30/L-11 |
| 11 | COMB | HG30/L-12 |
| | CONNECTION DETAILS | HG-CONNECT |
| | CASTING SEQUENCE | HG-CAST |

2

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 20.3 t (WITHOUT LID).
   MASS OF LID = 4.3 t
   (SELF WEIGHT CONCRETE @ 2500 kg/m3)
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-38 (INLET & OUTLET)

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

SITE LIFT:
LID - 3 No. 5 t SWIFTLIFT FOOT ANCHORS
HUMEGARD UNIT - 4 No. 10 t SWIFTLIFT FOOT ANCHORS

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

**CEMEX Australia Pty Limited** ABN 87 099 732 297

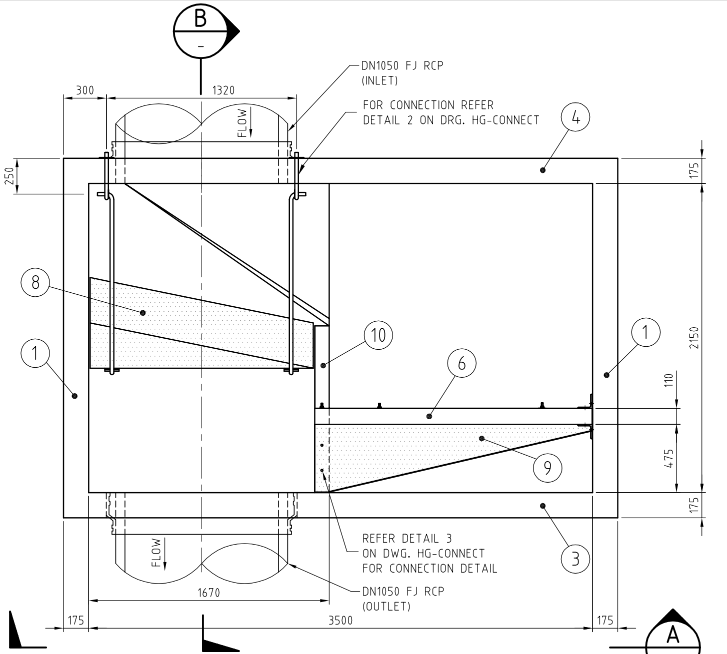


| DSN. | DFW | 12-03-07 |
|---|---|---|
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | DFW | 12-03-07 |

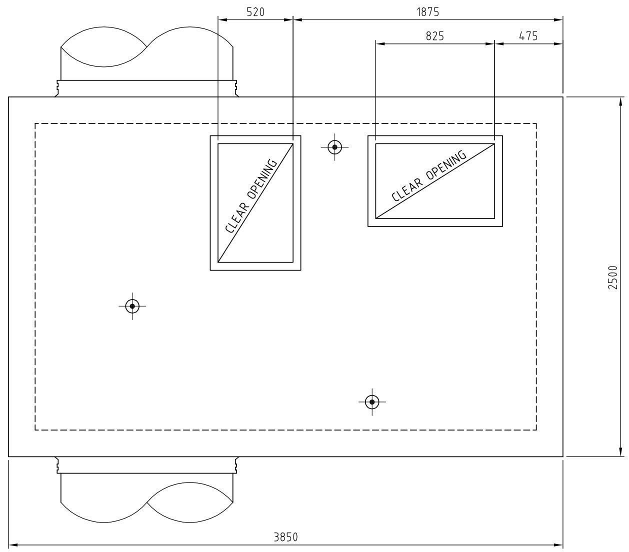
HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG30/L
DN750/DN750 FJ RCP
GENERAL ASSEMBLY

| SUPERSEDES | PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|---|
| HG30/L-01 REV 1 | 1:1 | A2 | HG30/L-01 | 2 |

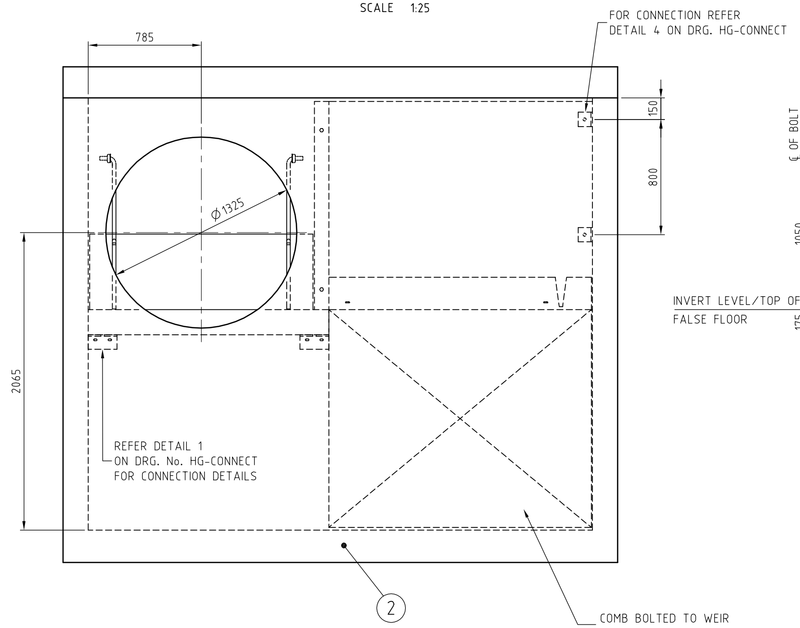
| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 1 | GENERAL REVISION, REISSUED FOR MANUFACTURE | MZ | 12-03-07 | DFW |



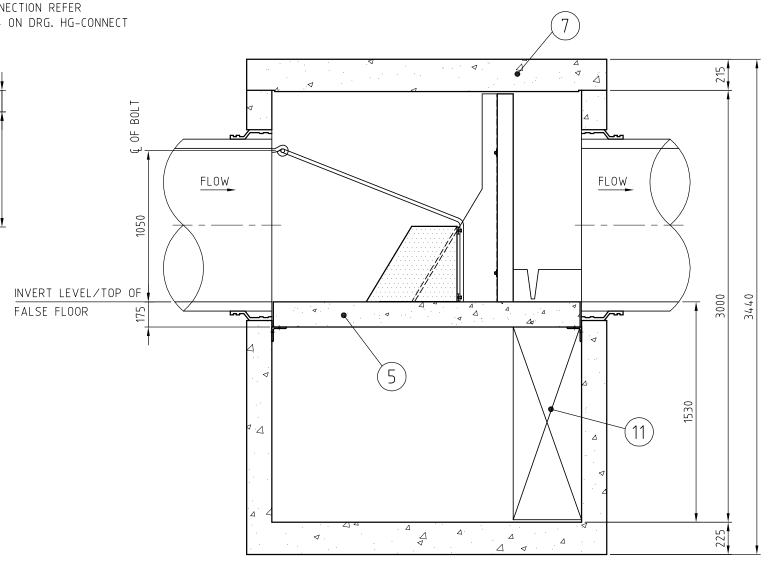

PLAN VIEW (LID REMOVED)
SCALE 1:25




PLAN ON LID
SCALE 1:25




VIEW A
SCALE 1:25




SECTION B
SCALE 1:25

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL | HG35A/L-02 |
| 2 | BASE SLAB | HG35A/L-04 |
| 3, 4 | SIDE WALL | HG35A/L-05 |
| 5 | FALSE FLOOR | HG35A/L-07 |
| 6 | CONCRETE BAFFLE WALL | HG35A/L-07 |
| 7 | PRECAST LID | HG35A/L-08 |
| 8 | FLOATING BOOM | HG35A/L-09 |
| 9 | WEIR | HG35A/L-10 |
| 10 | BAFFLE SIDE WALL | HG35A/L-11 |
| 11 | COMB | HG35A/L-12 |
|  | SITE LAYOUT | HG35A/L-13 |

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 22.9 t (WITHOUT LID). MASS OF LID = 5.0 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-52 (INLET & OUTLET)

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

**Rinker Australia Pty Limited** ABN 87 099 732 297

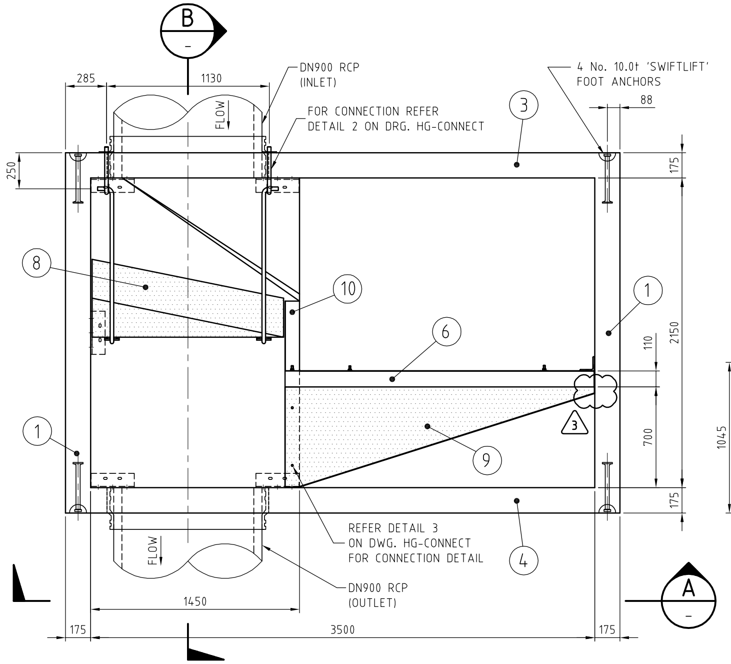


| | | |
|---|---|---|
| DSN. | DFW | 12-03-07 |
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | DFW | 12-03-07 |

SUPERSEDES HG35A/L-01 REV 0

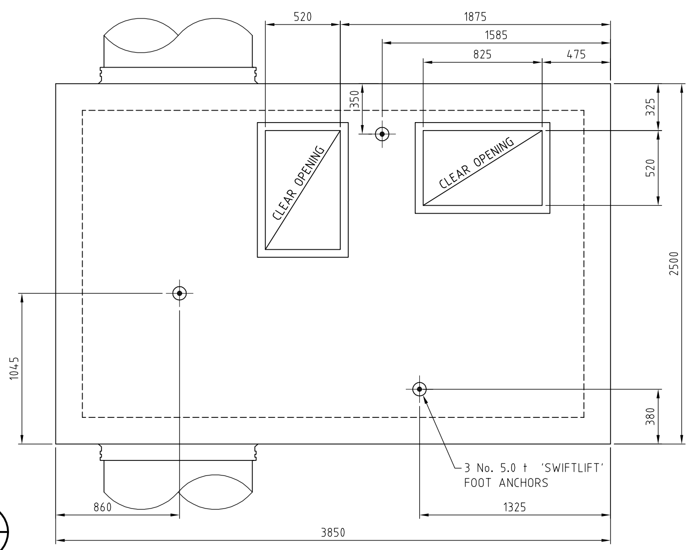
HUMES STANDARD DRAWING
HUMEGARD HG35A/L
DN1050/DN1050 FJ RCP
GENERAL ASSEMBLY

| PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|
| 1:1 | A2 | HG35A/L-01 | 1 |



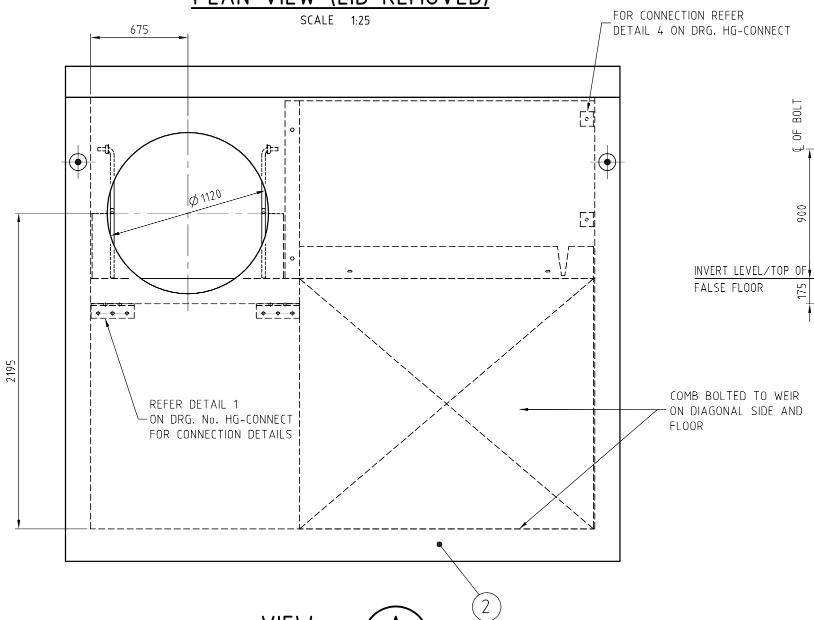

## PLAN VIEW (LID REMOVED)

SCALE 1:25



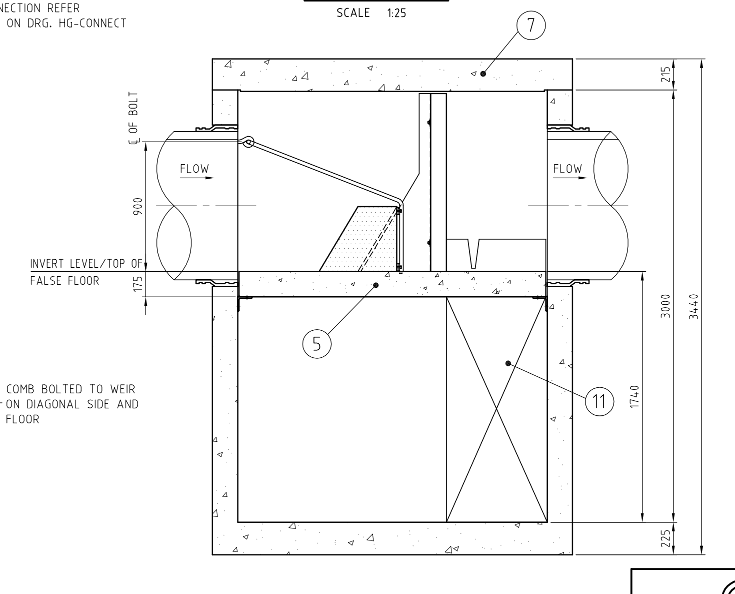

## PLAN ON LID

SCALE 1:25




## VIEW A

SCALE 1:25




## SECTION B

SCALE 1:25

| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 3 | REFERENCE DWG No. REVISED, BRACKET REMOVED, REISSUED FOR MANUFACTURE | MZ | — | RM |

| ITEM No. | DRAWING DESCRIPTION | DWG No. |
|---|---|---|
| 1 | END WALL | HG35-02 (3) |
| 2 | BASE SLAB | HG35-04 |
| 3, 4 | SIDE WALL | HG35-05 |
| 5 | FALSE FLOOR | HG35/L-07 |
| 6 | CONCRETE BAFFLE WALL | HG35/L-07 |
| 7 | PRECAST LID | HG35-08 (3) |
| 8 | FLOATING BOOM | HG35/L-09 |
| 9 | WEIR | HG35/L-10 |
| 10 | BAFFLE SIDE WALL | HG35/L-11 |
| 11 | COMB | HG35/L-12 |
| | CONNECTION DETAILS | HG-CONNECT |
| | CASTING SEQUENCE | HG-CAST |

(3)

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF COMPLETE UNIT = 22.8 t (WITHOUT LID).
   MASS OF LID = 5.0 t
   (SELF WEIGHT CONCRETE @ 2500 kg/m3
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

**SITE LIFT:**
LID - 3 No. 5 t SWIFTLIFT FOOT ANCHORS
HUMEGARD UNIT - 4 No. 10 t SWIFTLIFT FOOT ANCHORS

**Humes** TECHNICAL SERVICES
BRISBANE, QUEENSLAND



| | | |
|---|---|---|
| DSN. | WST | 25-11-10 |
| DWN. | MZ | 25-11-10 |
| CKD. | RM | |
| APP. | WST | |

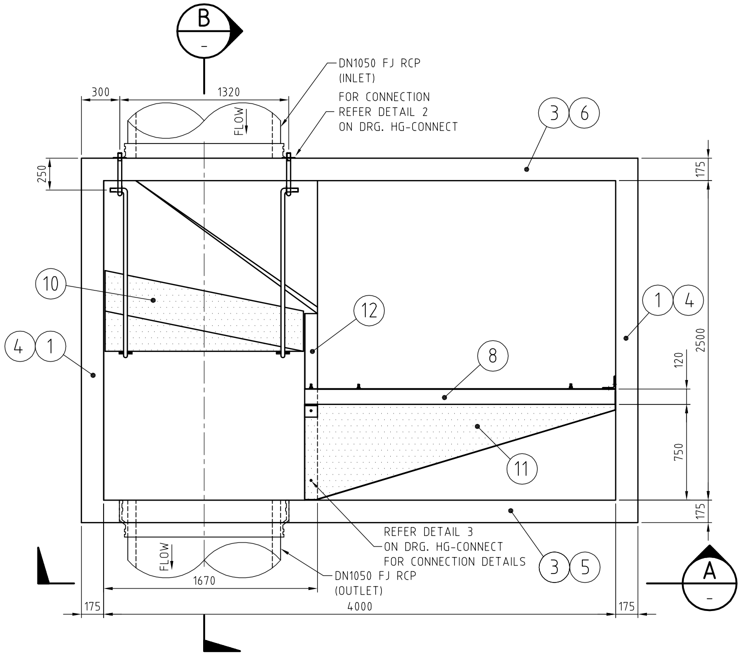
SUPERSEDES HG35/L-01 REV 2

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG35/L
DN900/DN900 FJ RCP
GENERAL ASSEMBLY

| PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|
| 1:1 | A2 | HG35/L-01 | 3 |

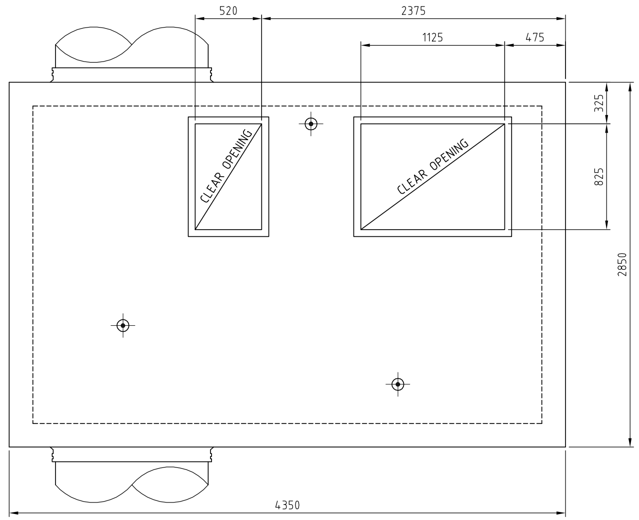
| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 0 | ISSUED FOR MANUFACTURE | MZ | 12-03-07 | DFW |
| 1 | GENERAL REVISION | MZ | —— | DFW |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL - BOTTOM UNIT | HG40B/L-02 |
| 2 | BASE SLAB | HG40B/L-04 |
| 3 | SIDE WALL - BOTTOM UNIT | HG40B/L-05 |
| 4 | END WALL - TOP UNIT | HG40B/L-03 |
| 5,6 | SIDE WALL - TOP UNIT | HG40B/L-06 |
| 7 | FALSE FLOOR | HG40B/L-07 |
| 8 | CONCRETE BAFFLE WALL | HG40B/L-07 |
| 9 | PRECAST LID | HG40B/L-08 |
| 10 | FLOATING BOOM | HG40B/L-09 |
| 11 | WEIR | HG40B/L-10 |
| 12 | BAFFLE SIDE WALL | HG40B/L-11 |
| 13 | COMB | HG40B/L-12 |



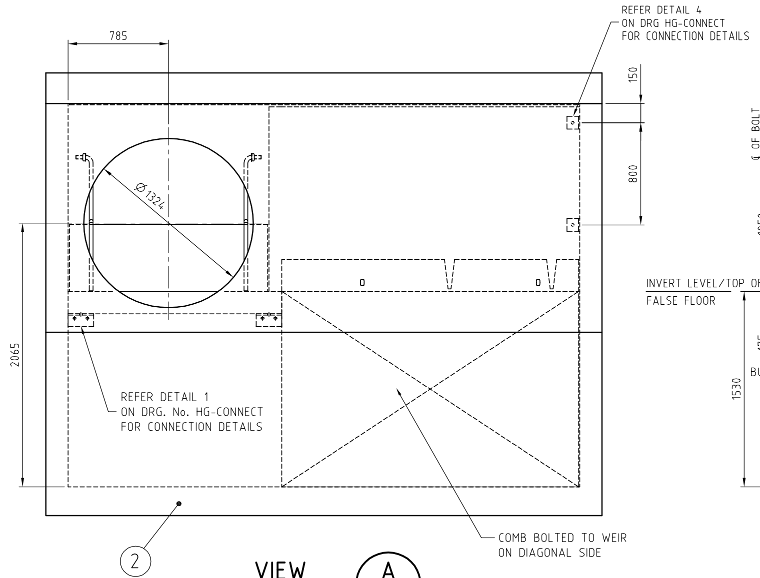

PLAN VIEW (LID REMOVED)

SCALE 1:20



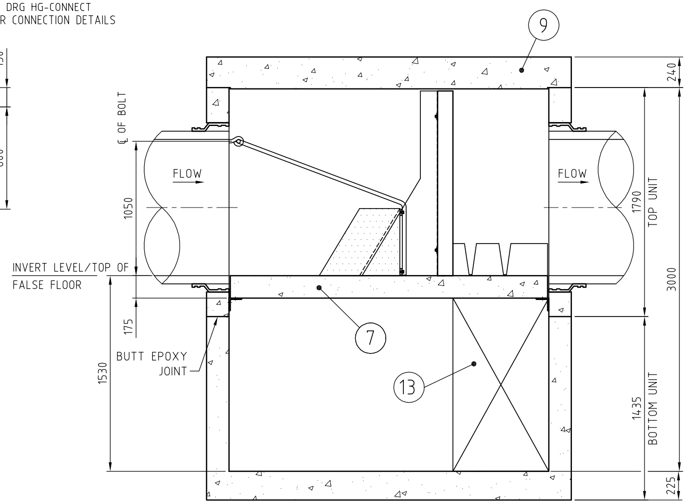

PLAN ON LID

SCALE 1:20




VIEW A

SCALE 1:20




SECTION B

SCALE 1:20

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 14.8 t
   MASS OF TOP UNIT = 12.9 t
   MASS OF LID = 7.0 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44 (INLET & OUTLET)

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

CEMEX Australia Pty Limited ABN 87 099 732 297



| DSN. | DFW | 12-03-07 |
|---|---|---|
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | DFW | 12-03-07 |

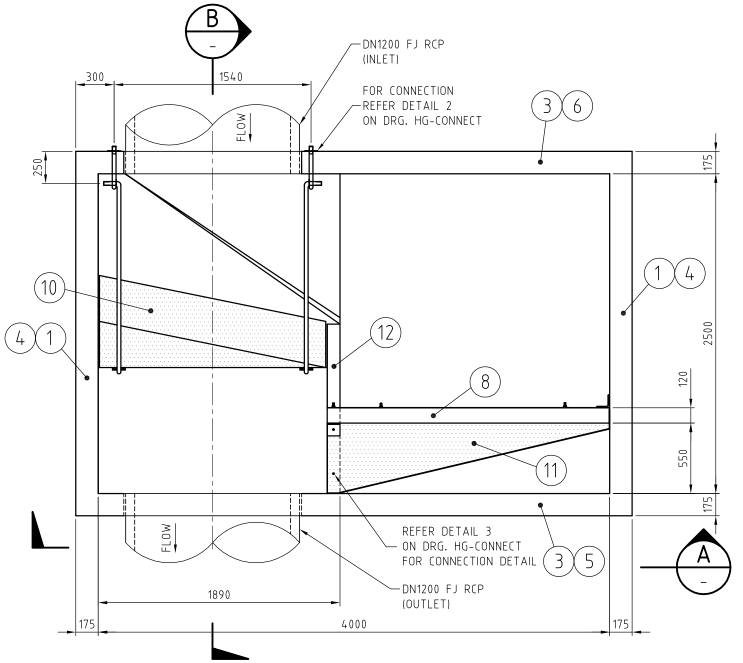
SUPERSEDES

HUMES
STANDARD DRAWING
HUMEGARD HG40A/L
DN1050/DN1050 FJ RCP
GENERAL ASSEMBLY

| PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|
| 1:1 | A1 | HG40A/L-01 | 1 |

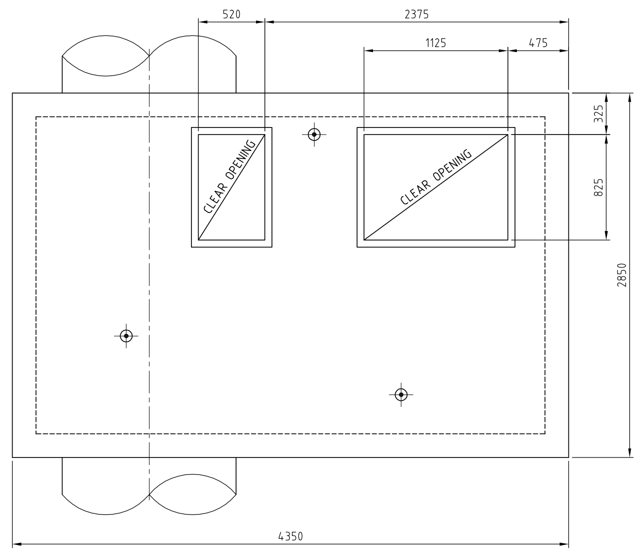
| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 0 | ISSUED FOR MANUFACTURE | MZ | 12-03-07 | DFW |
| 1 | GENERAL REVISION | MZ | — | DFW |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL - BOTTOM UNIT | HG40B/L-02 |
| 2 | BASE SLAB | HG40B/L-04 |
| 3 | SIDE WALL - BOTTOM UNIT | HG40B/L-05 |
| 4 | END WALL - TOP UNIT | HG40B/L-03 |
| 5,6 | SIDE WALL - TOP UNIT | HG40B/L-06 |
| 7 | FALSE FLOOR | HG40B/L-07 |
| 8 | CONCRETE BAFFLE WALL | HG40B/L-07 |
| 9 | PRECAST LID | HG40B/L-08 |
| 10 | FLOATING BOOM | HG40B/L-09 |
| 11 | WEIR | HG40B/L-10 |
| 12 | BAFFLE SIDE WALL | HG40B/L-11 |
| 13 | COMB | HG40B/L-12 |



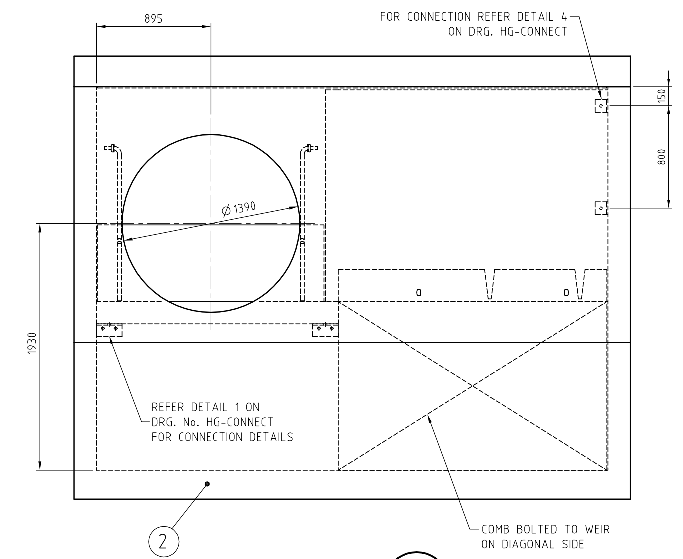

## PLAN VIEW (LID REMOVED)

SCALE 1:20



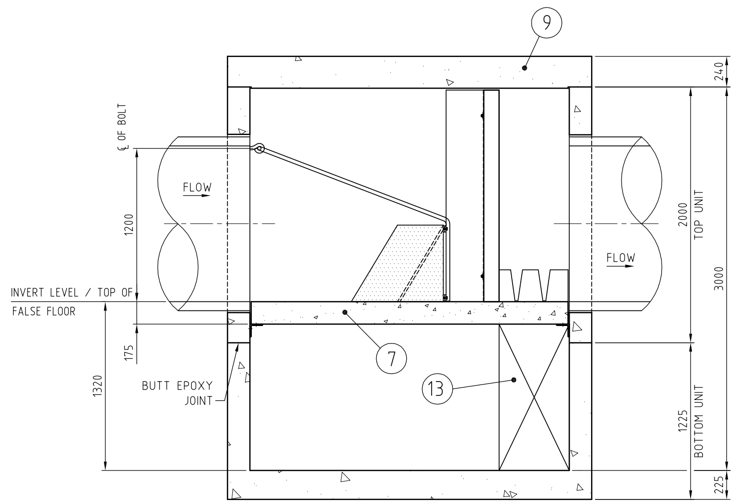

## PLAN ON LID

SCALE 1:20




## VIEW A

SCALE 1:20




## SECTION B

SCALE 1:20

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 13.4 t
   MASS OF TOP UNIT = 14.4 t
   MASS OF LID = 7.0 t
6. PIPE HOLE SIZE ALLOWS FOR PIPE MORTAR CONNECTION.

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND



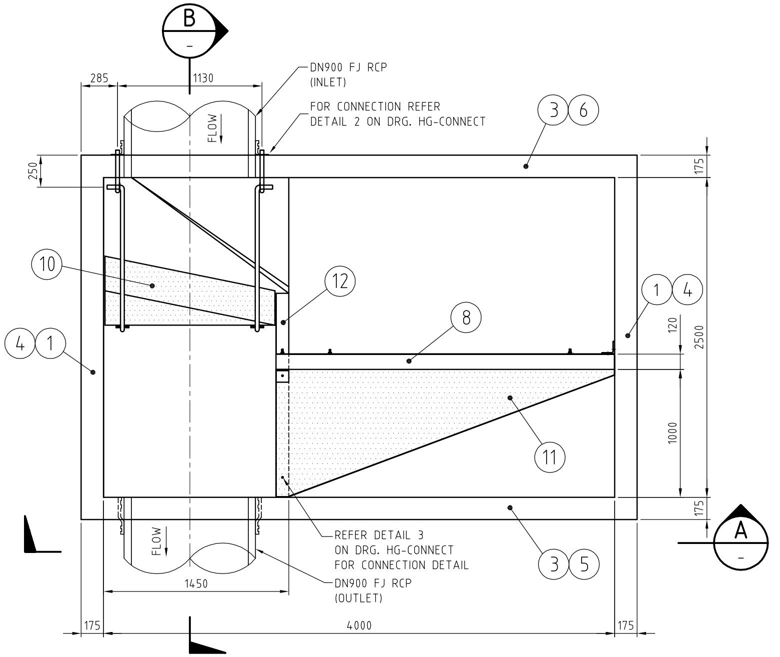
| DSN. | DFW | 12-03-07 |
|---|---|---|
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | DFW | 12-03-07 |

HUMES
STANDARD DRAWING
HUMEGARD HG40B/L
DN1200/DN1200 FJ RCP
GENERAL ASSEMBLY

| SUPERSEDES | PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|---|
| HG40B/L-01 REV. C | 1:1 | A1 | HG40B/L-01 | 1 |

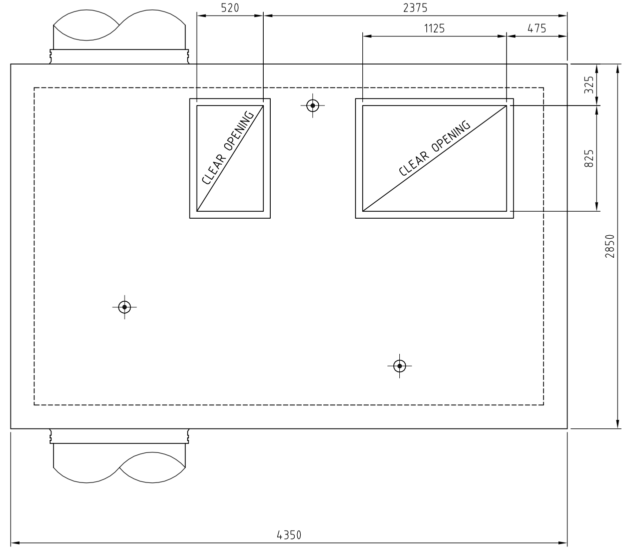
| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 1 | GENERAL REVISION - REISSUED FOR MANUFACTURE | MZ | 12-03-07 | DFW |
| 2 | ITEM NUMBERS REVISED, REISSUED FOR MANUFACTURE | MZ | — | DFW |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL - BOTTOM UNIT | HG40B/L-02 |
| 2 | BASE SLAB | HG40B/L-04 |
| 3 | SIDE WALL - BOTTOM UNIT | HG40B/L-05 |
| 4 | END WALL - TOP UNIT | HG40B/L-03 |
| 5,6 | SIDE WALL - TOP UNIT | HG40B/L-06 |
| 7 | FALSE FLOOR | HG40B/L-07 |
| 8 | CONCRETE BAFFLE WALL | HG40B/L-07 |
| 9 | PRECAST LID | HG40B/L-08 |
| 10 | FLOATING BOOM | HG40B/L-09 |
| 11 | WEIR | HG40B/L-10 |
| 12 | BAFFLE SIDE WALL | HG40B/L-11 |
| 13 | COMB | HG40B/L-12 |



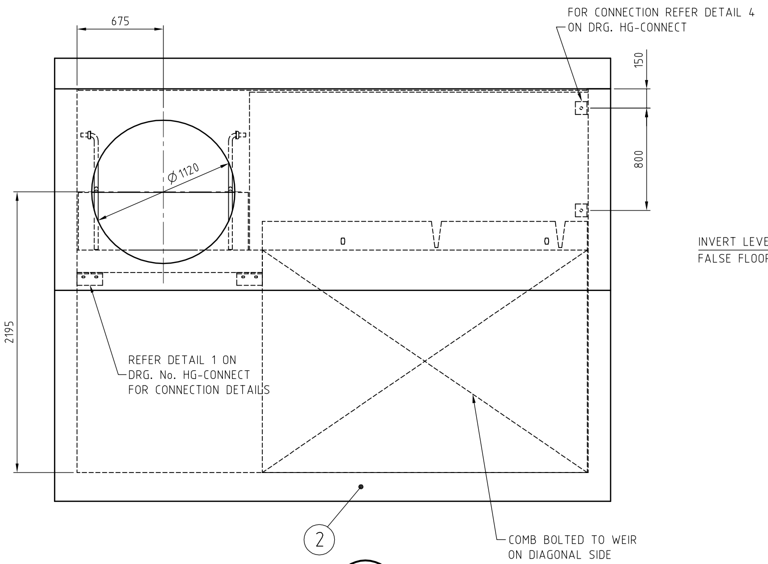

PLAN VIEW (LID REMOVED)

SCALE 1:20



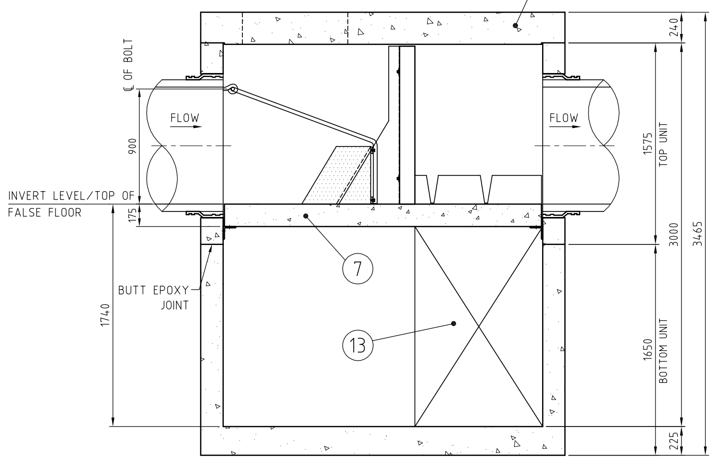

PLAN ON LID

SCALE 1:20




VIEW A

SCALE 1:20




SECTION B

SCALE 1:20

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 16.2 t
   MASS OF TOP UNIT = 11.6 t
   MASS OF LID = 7.0 t
6. KOR-N-SEAL BOOT CONNECTOR P/N = S206-44 (INLET & OUTLET)

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND



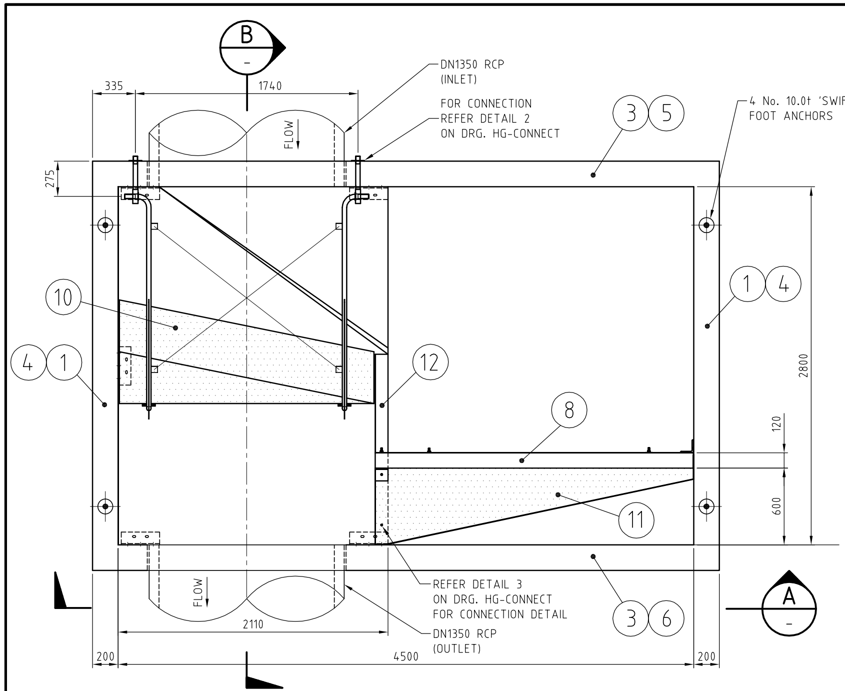
| DSN. | DFW | 12-03-07 |
|---|---|---|
| DWN. | MZ | 12-03-07 |
| CKD. | DFW | 12-03-07 |
| APP. | DFW | 12-03-07 |

HUMES
STANDARD DRAWING
HUMEGARD HG40/L
DN900/DN900 FJ RCP
GENERAL ASSEMBLY

| SUPERSEDES | PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|---|
| HG40/L-01 REV. 1 | 1:1 | A1 | HG40/L-01 | 2 |

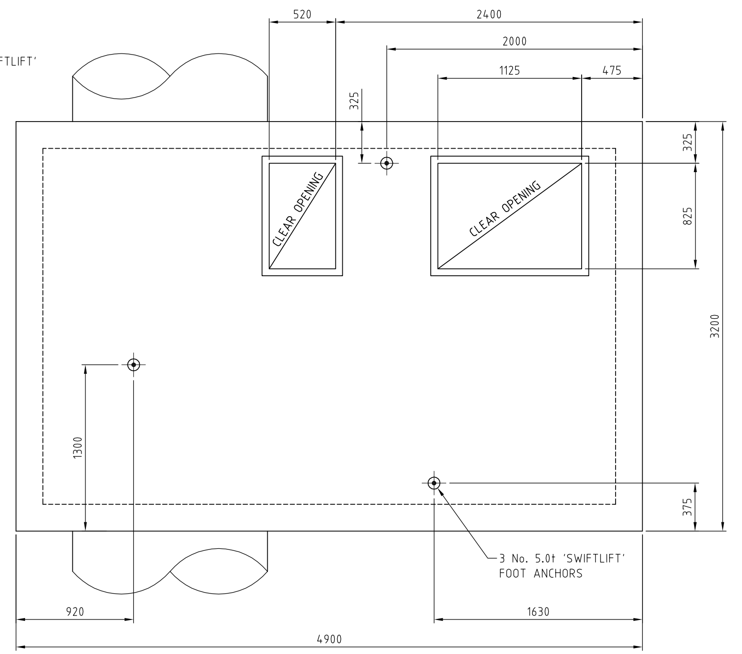
| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 1 | GENERAL REVISION, REISSUED FOR MANUFACTURE | MZ | 15-12-10 | RM |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL - BOTTOM UNIT | HG45A-02 |
| 2 | BASE SLAB | HG45A-04 |
| 3 | SIDE WALL - BOTTOM UNIT | HG45A-05 |
| 4 | END WALL - TOP UNIT | HG45A-03 |
| 5,6 | SIDE WALL - TOP UNIT | HG45A-06 |
| 7 | FALSE FLOOR | HG45A/L-07 |
| 8 | CONCRETE BAFFLE WALL | HG45A/L-07 |
| 9 | PRECAST LID | HG45A/L-08 |
| 10 | FLOATING BOOM | HG45A/L-09 |
| 11 | WEIR | HG45A/L-10 |
| 12 | BAFFLE SIDE WALL | HG45A/L-11 |
| 13 | COMB | HG45A/L-12 |



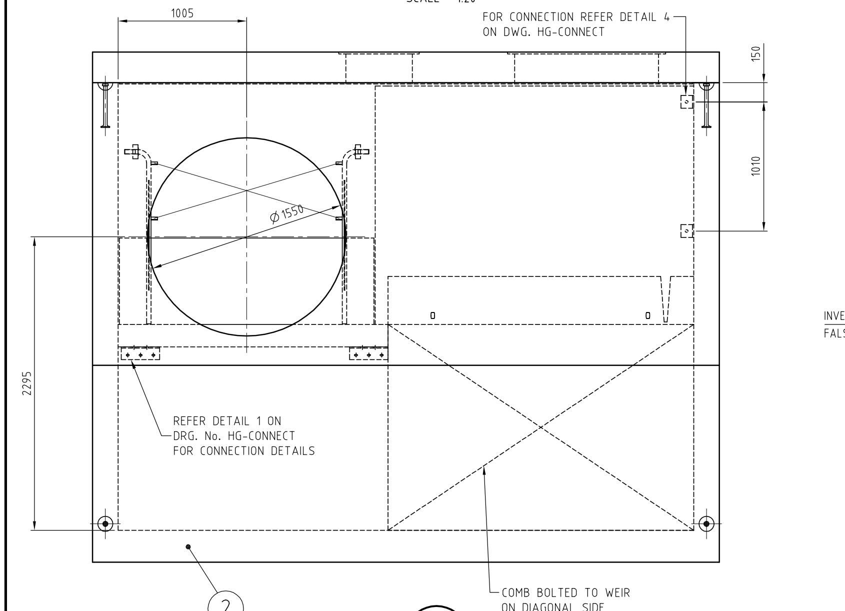

PLAN VIEW (LID REMOVED)

SCALE 1:20



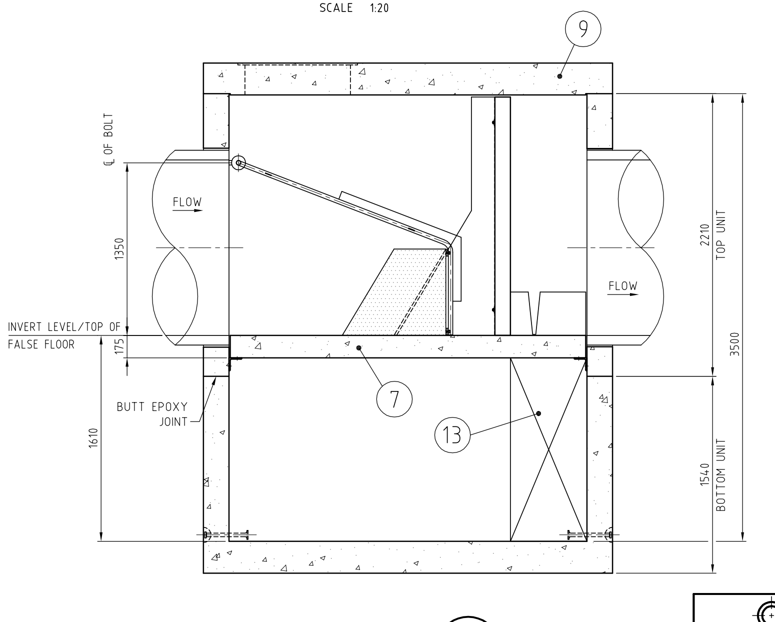

PLAN ON LID

SCALE 1:20




VIEW A

SCALE 1:20




SECTION B

SCALE 1:20

## NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 20.7 t
   MASS OF TOP UNIT = 19.7 t
   MASS OF LID = 9.1 t
6. PIPE HOLE SIZE ALLOWS FOR PIPE MORTAR CONNECTION.

## DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

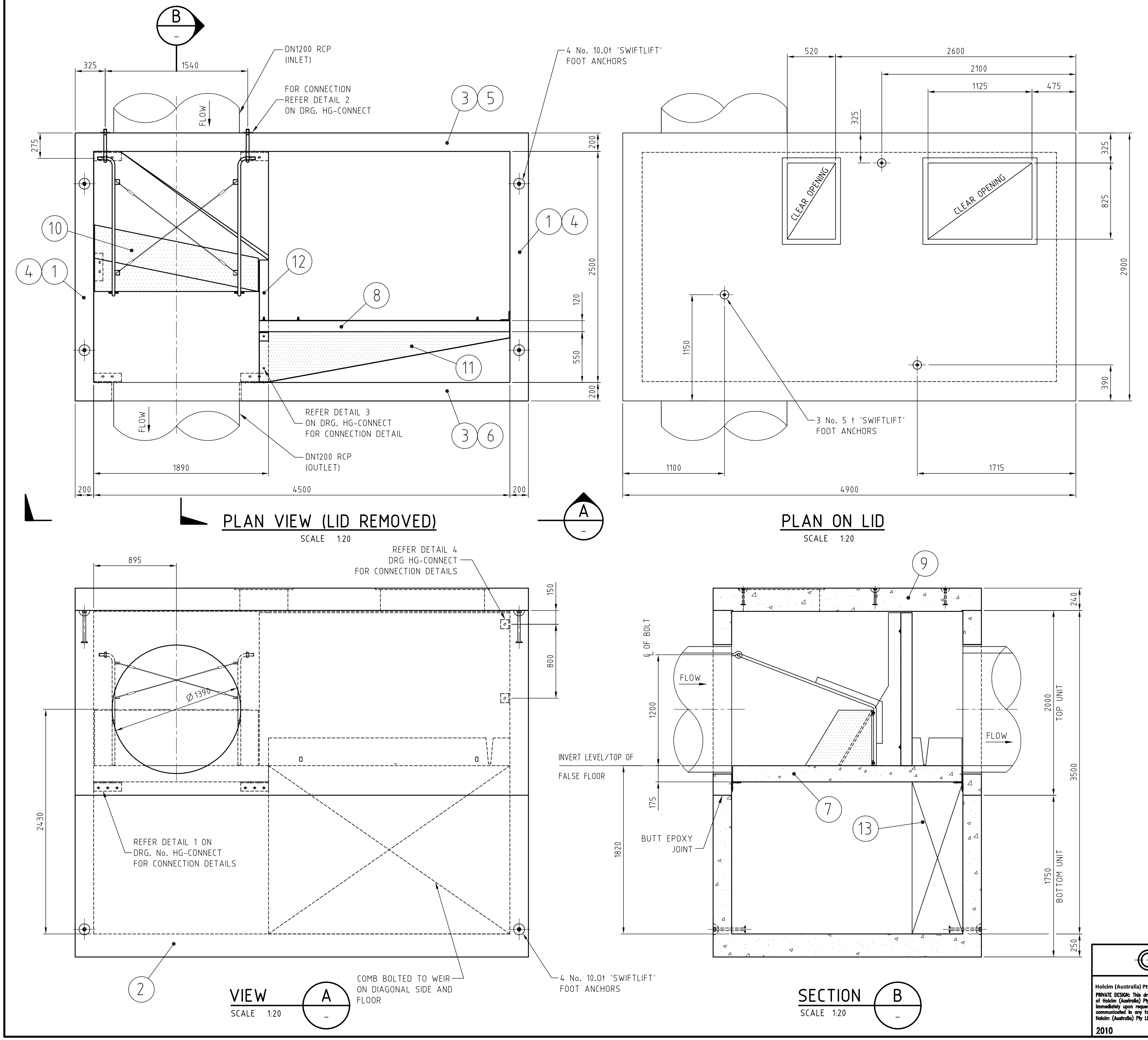
TECHNICAL SERVICES
BRISBANE, QUEENSLAND

| | | |
|---|---|---|
| DSN. | WST | 07-12-10 |
| DWN. | MZ | 07-12-10 |
| CKD. | RM | 15-12-10 |
| APP. | WST | 15-12-10 |

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG45A/L
DN1350/DN1350 RCP
GENERAL ASSEMBLY



SUPERSEDES HG45A/L-01 REV. 0 | PLOT SCALE 1:1 | SIZE A1 | DRG. NO. HG45A/L-01 | ISSUE 1




| ISSUE | DETAILS OF ALTERATIONS | DWN | DATE | CKD |
|---|---|---|---|---|
| 1 | GENERAL REVISION, REISSUED FOR MANUFACTURE | MZ | 15-12-10 | RM |

| ITEM No | DWG DESCRIPTIONS | DWG No |
|---|---|---|
| 1 | END WALL - BOTTOM UNIT | HG45-02 |
| 2 | BASE SLAB | HG45-04 |
| 3 | SIDE WALL - BOTTOM UNIT | HG45-05 |
| 4 | END WALL - TOP UNIT | HG45-03 |
| 5,6 | SIDE WALL - TOP UNIT | HG45-06 |
| 7 | FALSE FLOOR | HG45/L-07 |
| 8 | CONCRETE BAFFLE WALL | HG45/L-07 |
| 9 | PRECAST LID | HG45/L-08 |
| 10 | FLOATING BOOM | HG45/L-09 |
| 11 | WEIR | HG45/L-10 |
| 12 | BAFFLE SIDE WALL | HG45/L-11 |
| 13 | COMB | HG45/L-12 |

NOTES:

1. WHEN LIFTING ENTIRE UNIT FROM FOOT ANCHORS, SPREADER BEAM MUST BE USED TO ENSURE 4 POINT LIFT.
2. ALL METAL COMPONENTS ARE TO BE MADE FROM 304-GRADE STAINLESS STEEL.
3. SEE DRAWING HG-CAST FOR CASTING SEQUENCE.
4. SEE DRAWING HG-CONNECT FOR ALL CONNECTION DETAILS.
5. MASS OF BOTTOM UNIT = 20.8 t
   MASS OF TOP UNIT = 17.3 t
   MASS OF LID = 8.1 t
6. PIPE HOLE SIZE ALLOWS FOR PIPE MORTAR CONNECTION.

DESIGN BASIS

1. DESIGN SPECIFICATION AS3600 CONCRETE STRUCTURES.
2. DESIGN LOADS 0-2m FILL WITH SM1600 VEHICLE LOAD TO AS5100 BRIDGE DESIGN.
3. DESIGN FOR UP TO B2 EXPOSURE CLASSIFICATION TO AS3600 CONCRETE STRUCTURES.

Humes

TECHNICAL SERVICES
BRISBANE, QUEENSLAND



| | | |
|---|---|---|
| DSN. | WST | 01-12-10 |
| DWN. | MZ | 01-12-10 |
| CKD. | RM | 15-12-10 |
| APP. | WST | 15-12-10 |

HUMES WATER SOLUTIONS
STANDARD HUMEGARD
HUMEGARD HG45/L
DN1200/DN1200 FJ RCP
GENERAL ASSEMBLY

| SUPERSEDES | PLOT SCALE | SIZE | DRG. NO. | ISSUE |
|---|---|---|---|---|
| HG45/L-01 REV 0 | 1:1 | A1 | HG45/L-01 | 1 |

# Precast solutions

**Stormwater**

Stormwater treatment

Primary treatment

HumeGard® Gross Pollutant Trap

Secondary treatment

HumeCeptor® hydrodynamic separator

Detention and infiltration

StormTrap® system

Soakwells

Harvesting and reuse

RainVault® system

ReserVault® system

RainVault® Mini system

Precast concrete cubes

Segmental shafts

Stormwater drainage

Steel reinforced concrete pipes – trench

Steel reinforced concrete pipes – salt water cover

Steel reinforced concrete pipes – jacking

Box culverts

Uniculvert® modules

Headwalls

Stormwater pits

Access chambers/Manholes

Kerb inlet systems

Floodgates

Geosynthetics

**Sewage transfer and storage**

**Bridge and platform**

**Tunnel and shaft**

**Walling**

**Potable water supply**

**Irrigation and rural**

**Traffic management**

**Cable and power management**

**Rail**


Top:
StormTrap® system


Middle:
RainVault® system

Bottom:
Segmental shaft

# Contact information

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humes.com.au
info@humes.com.au

## Head Office

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Fax: (07) 3364 2963

## Queensland

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Fax: (07) 3814 9014

**Rockhampton**
Ph: (07) 4924 7900
Fax: (07) 4924 7901

**Townsville**
Ph: (07) 4758 6000
Fax: (07) 4758 6001

## New South Wales

**Grafton**
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Fax: (02) 6644 7313

**Newcastle**
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Fax: (02) 4032 6822

**Sydney**
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Fax: (02) 9625 5200

**Tamworth**
Ph: (02) 6763 7300
Fax: (02) 6763 7301

## Victoria

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# Appendix C OceanGuard Technical Manual

OceanGuard

# Technical Design Guide

# Table of Contents



***Rev:*** *1* ***Last Updated:*** *March 2019*

## Introduction

The OceanGuard technology is a gully pit basket designed to fit within new and existing stormwater pits targeting pollution in stormwater runoff. The system is offered with a choice of filtration bag liners, designed to remove gross pollutants, total suspended solids and attached pollutants. It can be adopter as a stand-alone technology or as part of a treatment train with our StormFilter or Jellyfish filtration products.

The filtration bag, filtration cage and flow diverter work together to maximise the flow treated, pollutant capture, hydraulic efficiency and ultimately retaining captured pollutants dry. OceanGuard pit inserts are highly effective, easy to install and simple to maintain.

## Operational Overview

The OceanGuard is installed into field or kerb inlet gully pits. The flow diverter at top of the unit has a rigid recycled plastic HDPE skirt that is installed against the walls directing all incoming stormwater flows into the filtration bag.

The stormwater is then filtered via direct screening through the filtration bag liner ensuring that any debris larger than the openings in the filtration bag are captured and retained.

During large storm events the water elevation in the filtration bag can rise and peak flows are internally bypassed through slots created in the flow diverter which has no moving parts that may prematurely fail.

At the end of the storm event debris and stormwater rest at the base of the filtration bag where the stored material will start to dry until the next storm event.

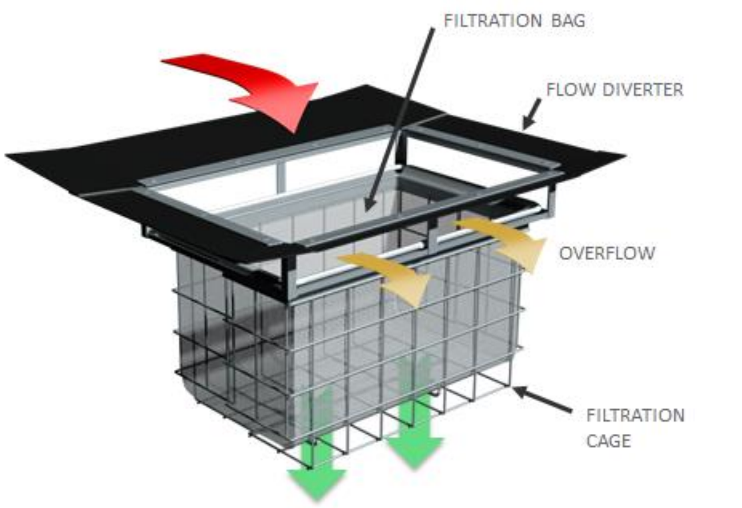


*Figure 1: OceanGuard components*

## Features

The OceanGuard technology has the following features:

- Flow Diverter
  Directs flow into the unit for filtration of stormwater flows and includes an in-built rigid bypass to divert stormwater overflows in high-intensity and peak storm flows.
- Filtration Bag
  Removable coarse (gross pollutant removal) and fine grade (200micron) filtration bags.
- Filtration Cage
  The supporting cage that allows for the use of larger filtration bags.

The OceanGuard can also be fitted with an oil/hydrocarbon adsorbent material (optional) to capture and retain oil and grease. The adsorbent material is contained in socks that are designed to ensure maximum contact with stormwater as it enters the gully pit.

The OceanGuard is designed to be easily retrofitted into new and existing stormwater pits, requiring no construction or land take. The OceanGuard is often the most practical solution and reduces the pollutant load and maintenance burden on downstream infrastructure.

## Configurations

The OceanGuard can fit a range of pits typically found in Australia including, kerb entry, rear entry with grated drain entry as well as field gully pits. There are multiple sizes to suit pits ranging in plan dimensions of *450 x 450mm – 1200 x 1200mm*. Additional custom sizes are available to suit circular and non-standard pits.

The standard OceanGuard configuration treats surface flow only, see figure 2. In some instances, it may be necessary to treat pipe flow, see figure 3. Remember to limit the upstream catchment to the basket to no more than 1000m$^2$ (or DN300mm pipe) otherwise the peak flows may cause structural damage to the OceanGuard. Furthermore, to assist design checks by a suitable qualified engineer need to be undertaken to ensure the upstream catchment is not excessively large. Please note that the OceanGuard technology is not a replacement for an in-line gross pollutant trap.

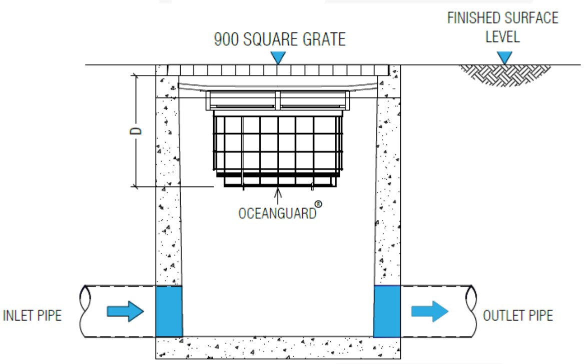


*Figure 2: Standard configuration – surface flow*

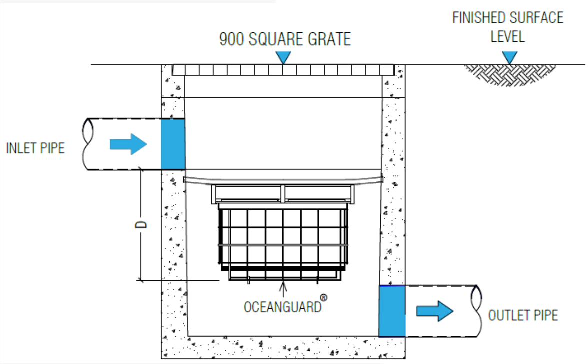


*Figure 3: Example configuration – pipe flow*

Another typical configuration required, is where the runoff collected by grated strip or trench drains needs to be treated, see figure 4.

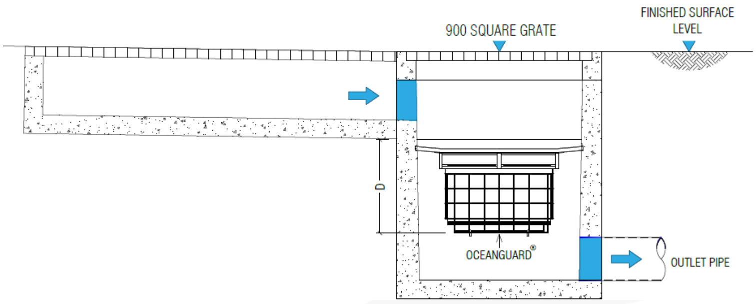


*Figure 4: Example configuration – Grated strip/trench drain*

## Performance

Typically, laboratory testing provides a means to generate hydraulic and basic performance data, but it should also be complemented with long-term field data. Gully pit baskets that operate under unrestricted flows require both a combination lab and field studies to accurately understand performance.

Ocean Protect has and is undertaking field testing locally in Australia and copies of the supporting articles are available upon request from Ocean Protect.

Gully pit baskets and associated technology have been available in Australia and overseas for more than 20 years. The OceanGuard technology has design elements and removal performance that are the same as some off-patent technologies, such as the previous generation EnviroPod previously sold by Stormwater360 Australia (Now Ocean Protect) under licence.

The OceanGuard meets all previous performance data and current approvals across Australia in terms of pollutant removal, flow rate and head loss. Please contact your Ocean Protect representative for more information.

Please contact your Ocean Protect representative to obtain the StormFilter approval status in your area.

## Maintenance

Maintenance of the OceanGuard is simple effective and seldom requires confined space entry or specialised equipment, often being completed by hand without the need of vacuum equipment. Simply remove the OceanGuard from the pit with the tags provided and invert the bag into a waste bin. Inspect the liner and brush by hand or spray with a pressure washer if required to rejuvenate the filtration bag. Record the information and replace the filtration bag.

*Inspection & Cleaning*

The Ocean Guard® system should be inspected at regular intervals from 1-2 months during the first year of installation to ensure optimum performance. The frequency at which the OceanGuard will need to be maintained will depend on site activities, land uses, catchment area and this size of OceanGuard installed, 1-6 times annually (3-4 typ.).

For further information please refer to the OceanGuard Operations and Maintenance Manual.

# Design Basics

The design requirements of any OceanGuard system is detailed in 3 typical steps.

1. Hydraulic Design & Configuration
2. Water Quality Design
3. Mass Load Design

## 1. Hydraulic Design & Configuration

All OceanGuard inserts must be designed to ensure that the hydraulic requirements of the system are met without adversely impacting the upstream hydraulics (limiting the likelihood of localised flooding).

## 2. Water Quality Design

Ocean Protect recommends and uses the widely endorsed Model for Urban Stormwater Improvement Conceptualisation (MUSIC), which makes it easy to correctly sizing an appropriate StormFilter system for your site.

A complimentary design service which includes MUSIC modelling is provided by the Ocean Protect engineering team. Simply email your project details to design@oceanprotect.com.au or alternatively you can always call one of our engineers for a discussion or to arrange a meeting in your office. The team will provide you with an efficient design containing details of the devices required to meet your water quality objectives together with budget estimates, product drawings and the MUSIC (.sqz) file.

Alternatively, you can download the MUSIC treatment nodes for the Ocean Protect products from our website (www.oceanprotect.com.au).

When designing/modelling an OceanGuard system for water quality purposes in MUSIC, a single GPT node is utilised. The GPT node is utilised with relevant removal efficiencies inserted. These parameters can vary based on the jurisdiction (authority) of your project, relevant details can be obtained from Ocean Protect. When modelling, the high-flow bypass is modified in node by adding the total number of Ocean Guards installed and multiplying this number by 20L/s, eg 10 x Ocean Guards = 0.2m$^3$/s.

All details such as drawings, specifications and maintenance manuals can also be downloaded for integration into your project's documentation. Additionally the Ocean Protect team is available to review your model and provide additional assistance and guidance on the configuration of the OceanGuard system(s) for your project.

## 3. Mass Load Design

Always be mindful of the magnitude of upstream catchment areas pay particular attention to perceived dirty or high loading sites. The Ocean Protect team can provide assistance and details on this process.

# Appendix D Sediment Basin Calculations

**Note: These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.**

## 1. Site Data Sheet

**Site name:** Raymond Terrace Road, Thornton Stage 2

**Site location:** Thornton

**Precinct:** Thornton -> Maitland City Council

**Description of site:** Rural to Residential Development

| Site area | Site | | | | | | Remarks |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| Total catchment area (ha) | 3.201 | | | | | | |
| Disturbed catchment area (ha) | 3.201 | | | | | | |

**Soil analysis**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil landscape | | | | | | | DIPNR mapping (if relevant) |
| Soil Texture Group | F | | | | | | Sections 6.3.3(c), (d) and (e) |

**Rainfall data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Design rainfall depth (days) | 5 | | | | | | See Sections 6.3.4 (d) and (e) |
| Design rainfall depth (percentile) | 85 | | | | | | See Sections 6.3.4 (f) and (g) |
| x-day, y-percentile rainfall event | 31 | | | | | | See Section 6.3.4 (h) |
| Rainfall intensity: 2-year, 6-hour storm | 8.78 | | | | | | See IFD chart for the site |
| Rainfall erosivity (R-factor) | 1780 | | | | | | Automatic calculation from above data |

**Comments:**

# 2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Qy = 0.00278 \times C_{10} \times F_Y \times I_{y,\,tc} \times A$$

where:

- $Q_y$ is peak flow rate (m$^3$/sec) of average recurrence interval (ARI) of "Y" years
- $C_{10}$ is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
- $F_y$ is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
- A is the catchment area in hectares (ha)
- $I_{y,\,tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration ($t_c$) = $0.76 \times (A/100)^{0.38}$ hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

## Peak flow calculations, 1

| Site | A (ha) | tc (mins) | Rainfall intensity, I, mm/hr | | | | | | $C_{10}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | $1_{yr,tc}$ | $5_{yr,tc}$ | $10_{yr,tc}$ | $20_{yr,tc}$ | $50_{yr,tc}$ | $100_{yr,tc}$ | |
| 1 | 3.201 | 12 | 67.3 | 114 | 130 | 150 | 178 | 200 | 0.76 |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |

## Peak flow calculations, 2

| ARI yrs | Frequency factor ($F_y$) | Peak flows | | | | | | Comment |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| | | (m$^3$/s) | (m$^3$/s) | (m$^3$/s) | (m$^3$/s) | (m$^3$/s) | (m3/s) | |
| $1_{yr,\,tc}$ | 0.8 | 0.364 | | | | | | |
| $5_{yr,\,tc}$ | 0.95 | 0.732 | | | | | | |
| $10_{yr,\,tc}$ | 1 | 0.879 | | | | | | |
| $20_{yr,\,tc}$ | 1.05 | 1.065 | | | | | | |
| $50_{yr,\,tc}$ | 1.15 | 1.384 | | | | | | |
| $100_{yr,\,tc}$ | 1.2 | 1.623 | | | | | | |

# 4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

## Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-\%ile, x-day}} \ (m^3)$$

where:

10 = a unit conversion factor

$C_v$ = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

## Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)), in which case the "Detailed Calculation" spreadsheets should be used.

## Total Basin Volume

| Site | $C_v$ | R x-day y-%ile | Total catchment area (ha) | Settling zone volume ($m^3$) | Sediment storage volume ($m^3$) | Total basin volume ($m^3$) |
|---|---|---|---|---|---|---|
| 1 | 0.51 | 31 | 3.201 | 506.0781 | 253 | 759.11715 |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |

# Appendix E  HumeGard Inspection and Maintenance Guide

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.

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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.

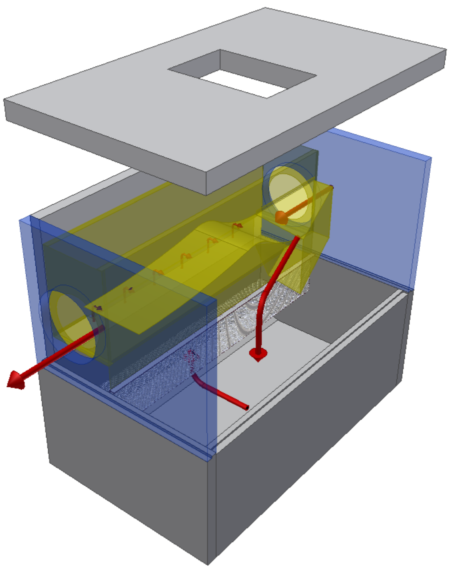
**Super-critical HumeGard® (HG12 & HG15)**

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**



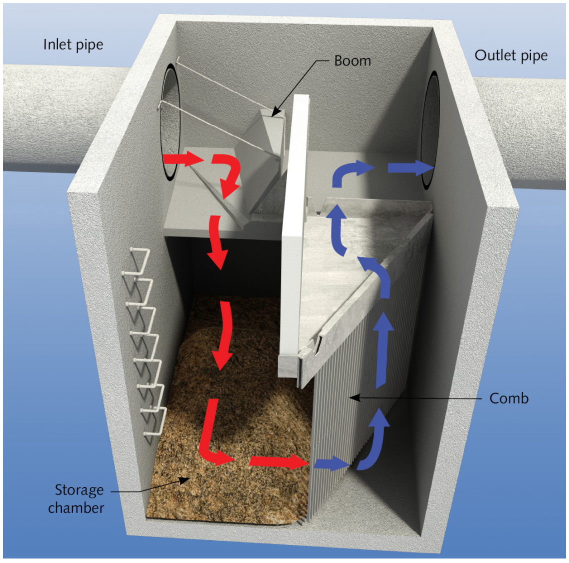
### Standard HumeGard® (HG18 – HG45)

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)

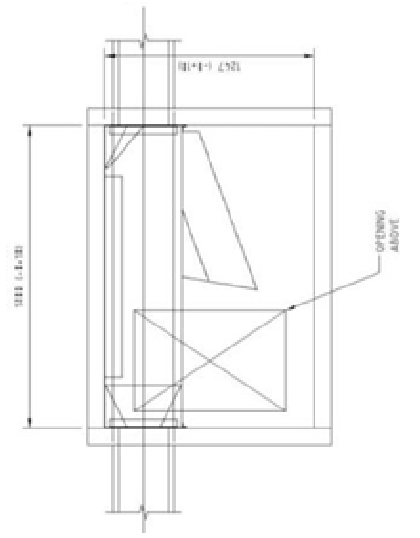
The following JSA/WMS is a guide only. It is the responsibility of the cleaning contractor or asset owner to develop their own JSA/WMS in line with their own WHS requirements and constraints. It also assumes that there will be no entry into the unit during maintenance.

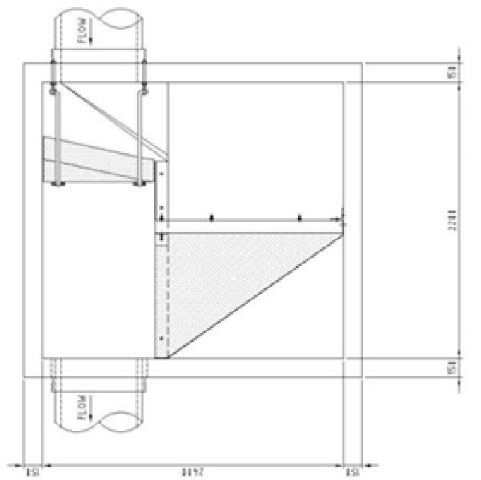
| | | | | | |
|---|---|---|---|---|---|
| **Project/ Address:** | | | | **Date:** | |
| **Job:** Clean out of HumeGard unit | | | | **Operator:** | |
| **Risk Level:** | 1 - Extreme | 2 - High | 3 - Medium | 4 – Low | 5 - Negligible |
| **Consequence:** | Likely to cause very serious harm | Clear potential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

# Appendix F  Oceanguard Inspection and Maintenance Guide

OCEAN PROTECT

OceanGuard™

# Operations & Maintenance Manual

# Table of Contents



***Rev:*** *1* ***Last Updated:*** *March 2019*

# Introduction

The primary purpose of stormwater treatment devices is to capture and prevent pollutants from entering waterways, maintenance is a critical component of ensuring the ongoing effectiveness of this process. The specific requirements and frequency for maintenance depends on the treatment device and pollutant load characteristics of each site. This manual has been designed to provide details on the cleaning and maintenance processes as recommended by the manufacturer.

The OceanGuard technology is a gully pit basket designed to fit within new and existing gully pits to remove pollution from stormwater runoff. The system has a choice of Filtration liners, designed to remove gross pollutants, total suspended solids and attached pollutants as either a standalone technology or as part of a treatment train with our StormFilter or Jellyfish Filtration products. OceanGuard pit baskets are highly effective, easy to install and simple to maintain.

## Why do I need to perform maintenance?

Adhering to the maintenance schedule of each stormwater treatment device is essential to ensuring that it functions properly throughout its design life.

During each inspection and clean, details of the mass, volume and type of material that has been collected by the device should be recorded. This data will assist with the revision of future management plans and help determine maintenance interval frequency. It is also essential that qualified and experienced personnel carry out all maintenance (including inspections, recording and reporting) in a systematic manner.

Maintenance of your stormwater management system is essential to ensuring ongoing at-source control of stormwater pollution. Maintenance also helps prevent structural failures (e.g. prevents blocked outlets) and aesthetic failures (e.g. debris build up), but most of all ensures the long term effective operation of the OceanGuard.

# Health and Safety

Access to pits containing an OceanGuard typically requires removing (heavy) access covers/grates, but typically it is not necessary to enter into a confined space. Pollutants collected by the OceanGuard will vary depending on the nature of your site. There is potential for these materials to be harmful. For example, sediments may contain heavy metals, carcinogenic substances or sharp objects such as broken glass and syringes. For these reasons, there should be no primary contact with the waste collect and all aspects of maintaining and cleaning your OceanGuard require careful adherence to Occupational Health and Safety (OH&S) guidelines.

It is important to note that the same level of care needs to be taken to ensure the safety of non-work personnel, as a result it may be necessary to employ traffic/pedestrian control measures when the device is situated in, or near areas with high vehicular/pedestrian activity.

## Personnel health and safety

Whilst performing maintenance on the OceanGuard pit insert, precautions should be taken in order to minimise (or when possible prevent) contact with sediment and other captured pollutants by maintenance personnel. In order to achieve this the following personal protective equipment (PPE) is recommended:

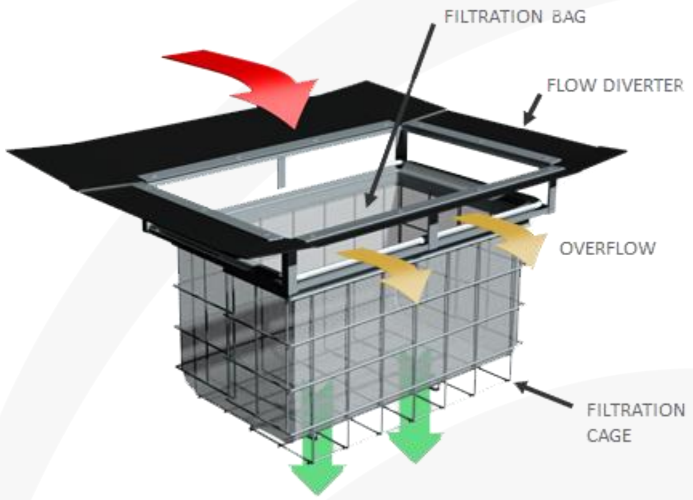
- Puncture resistant gloves
- Steel capped safety boots,
- Long sleeve clothing, overalls or similar skin protection
- Eye protection
- High visibility clothing or vest

During maintenance activities it may be necessary to implement traffic control measures. Ocean Protect recommend that a separate site specific traffic control plan is implemented as required to meet the relevant governing authority guidelines.

The OceanGuard pit insert is designed to be maintained from surface level, without the need to enter the pit. However depending on the installation configuration, location and site specific maintenance requirements it may be necessary to enter a confined space occasionally. It is recommended that all maintenance personnel evaluate their own needs for confined space entry and compliance with relevant industry regulations and guidelines. Ocean Protect maintenance personnel are fully trained and carry certification for confined space entry.

## How does it Work?

OceanGuard is designed to intercept stormwater as it enters the stormwater pits throughout a site. The OceanGuard has diversion panels that sit flush with the pit walls, this ensures that as stormwater enters at the top of the pit it is directed to the middle of the insert where the Filtration bag is situated. The filtration bag allows for screening to occur removing 100% of pollutants greater than the opening of the filtration material (200micron, 1600micron bags available).




During larger rain events the large flows overflow slots in the flow diverter of the OceanGuard ensure that the conveyance of stormwater is not impeded thus eliminating the potential for surface flooding. As the flow subsides, the captured pollutants are held in the OceanGuard Filtration bag dry. The waste then starts to dry which reduces the magnitude of organic material decomposition transitioning between maintenance intervals.

## Maintenance Procedures

To ensure that each OceanGuard pit insert achieves optimal performance, it is advisable that regular maintenance is performed. Typically the OceanGuard requires 2-4 minor services annually, pending the outcome of these inspections additional maintenance servicing may be required.

### Primary Types of Maintenance

The table below outlines the primary types of maintenance activities that typically take place as part of an ongoing maintenance schedule for the OceanGuard.

| | Description of Typical Activities | Frequency |
|---|---|---|
| **Minor Service** | Filter bag inspection and evaluation<br>Removal of capture pollutants<br>Disposal of material | 2-4 Times Annually |
| **Major Service** | Filter Bag Replacement<br>Support frame rectification | As required |

Maintenance requirements and frequencies are dependent on the pollutant load characteristics of each site. The frequencies provided in this document represent what the manufacturer considers to be best practice to ensure the continuing operation of the device is in line with the original design specification.

## Minor Service

This service is designed to return the OceanGuard device back to optimal operating performance. This type of service can be undertaken either by hand or with the assistance of a Vacuum unit.

### Hand Maintenance

1. Establish a safe working area around the pit insert
2. Remove access cover/grate
3. Use two lifting hooks to remove the filtration bag
4. Empty the contents of the filtration bag into a disposal container
5. Inspect and evaluate the filtration bag
6. Inspect and evaluate remaining OceanGuard components (i.e. flow diverter, filtration cage and supporting frame)
7. Rejuvenate filtration bag by removing pollutant build up with a stiff brush, additionally the filtration bag can be washed using high pressure water
8. Re-install filtration bag and replace access cover/grate

### Vacuum Maintenance

1. Establish a safe working area around the pit insert
2. Remove access cover/grate
3. Vacuum captured pollutants from the filtration bag
4. Remove filtration bag
5. Inspect and evaluate the filtration bag
6. Inspect and evaluate remaining OceanGuard components (i.e. flow diverter, filtration cage and supporting frame)
7. Rejuvenate filtration bag by removing pollutant build up with a stiff brush, additionally the filtration bag can be washed using high pressure water
8. Re-install filtration bag and replace access cover/grate

## Major Service (Filter Bag Replacement)

For the OceanGuard system, a major service is a reactionary process based on the outcomes from the minor service.

| Trigger Event from Minor Service | Maintenance Action |
|---|---|
| Filtration bag inspection reveals damage | Replace the filtration bag[1] |
| Component inspection reveals damage | Perform rectification works and if necessary replace components[1] |

[1] Replacement filtration bags and components are available for purchase from Ocean Protect.

## Additional Reasons of Maintenance

Occasionally, events on site can make it necessary to perform additional maintenance to ensure the continuing performance of the device.

### Hazardous Material Spill

If there is a spill event on site, all OceanGuard pits that potentially received flow should be inspected and cleaned. Specifically all captured pollutants from within the filtration bag should be removed and disposed in accordance with any additional requirements that may relate to the type of spill event. All filtration bags should be rejuvenated (replaced if required) and re-installed.

### Blockages

The OceanGuards internal high flow bypass functionality is designed to minimise the potential of blockages/flooding. In the unlikely event that flooding occurs around the stormwater pit the following steps should be undertaken to assist in diagnosing the issue and implementing the appropriate response.

1. Inspect the OceanGuard flow diverter, ensuring that they are free of debris and pollutants
2. Perform a minor service on the OceanGuard
3. Remove the OceanGuard insert to access the pit and inspect both the inlet and outlet pipes, ensuring they are free of debris and pollutants

### Major Storms and Flooding

In addition to the scheduled activities, it is important to inspect the condition of the OceanGuard pit insert after a major storm event. The inspection should focus on checking for damage and higher than normal sediment accumulation that may result from localised erosion. Where necessary damaged components should be replaced and accumulated pollutants disposed.

## Disposal of Waste Materials

The accumulated pollutants found in the OceanGuard must be handled and disposed of in a manner that is in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. If the filtration bag has been contaminated with any unusual substance, there may be additional special handling and disposal methods required to comply with relevant government/authority/industry regulations.

# Maintenance Services

With over a decade and a half of maintenance experience Ocean Protect has developed a systematic approach to inspecting, cleaning and maintaining a wide variety of stormwater treatment devices. Our fully trained and professional staff are familiar with the characteristics of each type of system, and the processes required to ensure its optimal performance.

Ocean Protect has several stormwater maintenance service options available to help ensure that your stormwater device functions properly throughout its design life. In the case of our OceanGuard system we offer long term pay-as-you-go contracts, pre-paid once off servicing and replacement filter bags.

For more information please visit www.OceanProtect.com.au