Appendix C

Stormwater Quality Improvement Device (SQID)

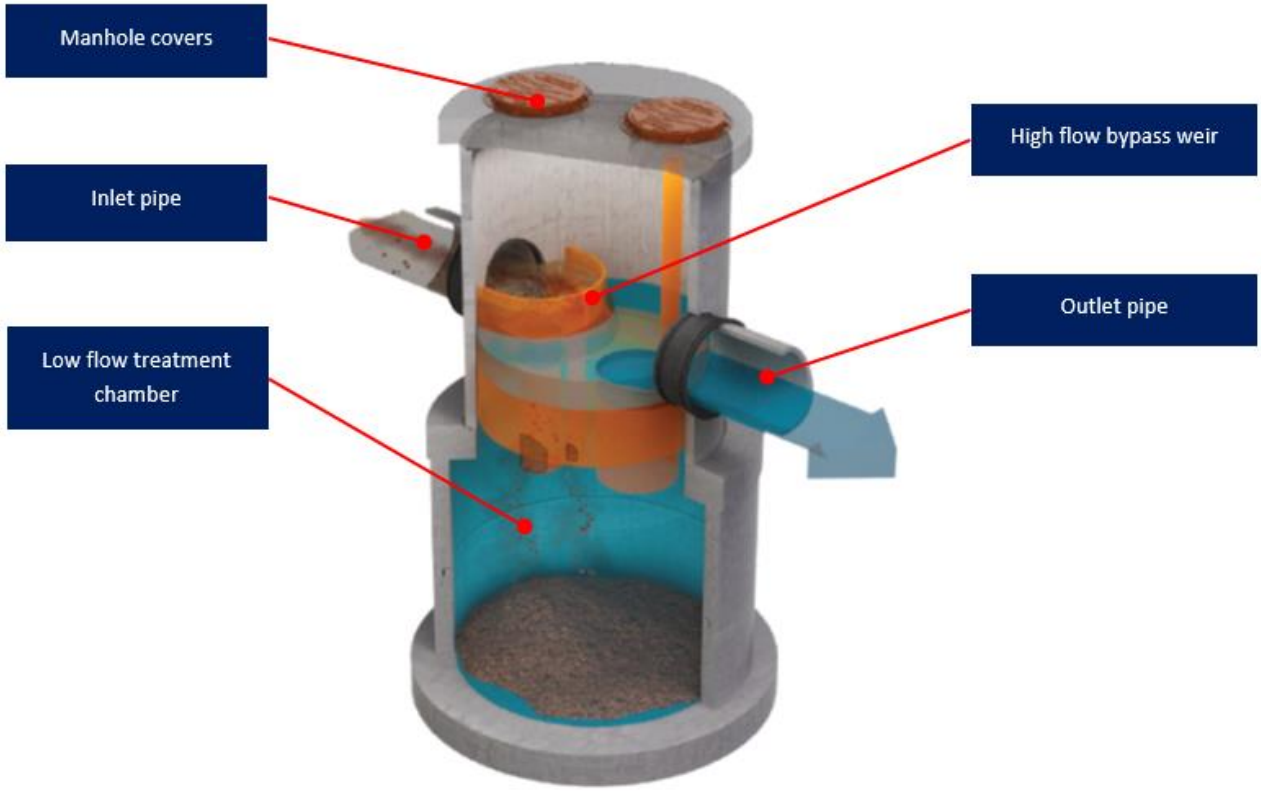
The SICTL terminal design incorporates 49 Stormwater Quality Improvement Devices (SQID) – 36 are currently operational for SICTL, 7 are operational for Patrick Stevedores, and 6 are planned for future SICTL construction phases.

Each SQID unit serves a small stormwater catchment area and traps pollutants within the stormwater flow prior to discharge to Botany Bay or the Penrhyn Estuary.

The SQID devices installed at SICTL are made by two manufacturers: Humes and SPEL.

Humes 'Aquaceptor'

The Humes Aquaceptor utilises hydrodynamic and gravitational separation to efficiently remove Total Suspended Solids (TSS) and entrained hyrocarbons from stormwater runoff. The Humes Aquaceptor has been independently certified to achieve high pollutant removal efficiencies for TSS (>80%) and Total Nutrients (TN) (>30%) on an annual basis. The effective capture of TSS results in the capture of particulate nutrients shown to be >30% of TN and Total Phosphorous (TP).



Cut away diagram of the Humes 'Aquaceptor' separator unit.

How it works:

1. Stormwater flows through the inlet pipe and into the weir area of the bypass chamber.
2. The weir and bypass orifice creates a vortex that sucks floating oils and sediment down into the treatment chamber.
3. During high flow conditions, stormwater in the bypass chamber overflows the weir and is conveyed to the stormwater outlet directly. Water which overflows the weir stabilises the head between the inlet drop pipe and outlet decant pipe ensuring that excessive flow is not forced into the treatment chamber, protecting against scour or re-suspension of settled material.

4. Water flows through the treatment chamber to the decant pipe which is submerged similar to the drop pipe.
5. Hydrocarbons and other entrained substances with a specific gravity less than water will rise in the treatment chamber and become trapped beneath the fibreglass insert since the decant pipe is submerged.
6. Sediment will settle to the bottom of the chamber by gravity forces. The large volume of the treatment chamber assists in preventing high velocities and promoting settling.
7. Water flows up through the decant pipe based on the head differential at the inlet weir, and is discharged back into the bypass chamber downstream of the weir.

The Humes Aquaceptor model has been additionally designed with a weir extension to increase the level at which flows bypass the treatment chamber, and accommodate downstream tail water levels or periodic inundation (e.g. tidal situations).

To maintain the hydrocarbon capture capabilities, an additional “high level” inlet pipe is also fitted. This facilitates the formation of the surface vortex from the bypass chamber into the treatment chamber and draws floating hydrocarbons into the unit.

Performance Analysis:

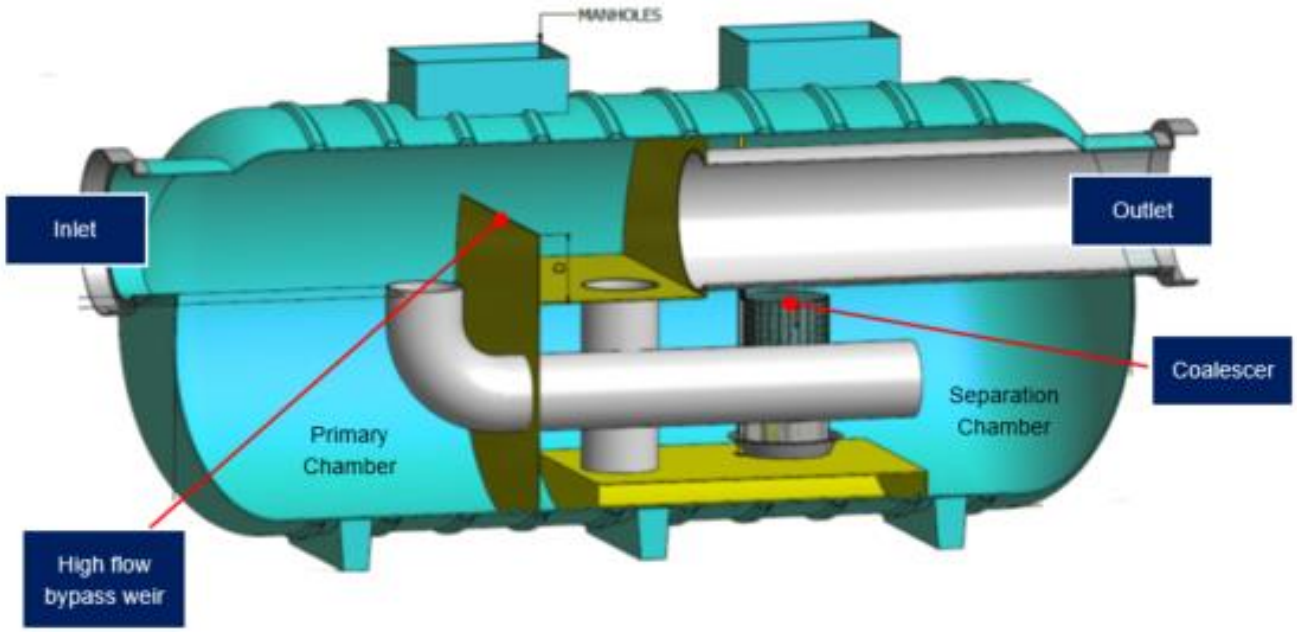
Pollutant	Average removal efficiency
Total Suspended Solids (TSS)	80%
Total Nutrients (TN)	53%
Total Phosphorous (TP)	37%
Chromium	44%
Copper	29%
Total Petroleum Hydrocarbon (TPH)	65% <10 ppm inflow concentration 95% 10ppm – 50ppm inflow concentration (typical stormwater) 99% >500ppm inflow concentration (emergency spills)

SPEL ‘Stormceptor”

The SPEL Stormceptor is a horizontally configured, gravitational passive stormwater treatment device that treats stormwater through two chambers. Low velocity flow produces quiescent conditions enabling separation of the pollutants in all flow events. Contaminated water cannot flow directly across the surface before effective separation has taken place.

The design, facilitated by a retention period of approximately 6 minutes generates quiescent conditions within the secondary chamber, efficiently promoting the separation of total suspended solids (TSS), light liquids and pollutants.

The SPEL Stormceptor design keeps the turbulence within the separation chamber to a minimum which avoids agitating the pollutants held.



Cut away diagram of the SPEL Environmental 'Stormceptor' separator unit.

How it works:

1. Under normal conditions, low flow or first flush is through the primary chamber where sediment is collected. The flow then passes into the secondary separation chamber, where the quiescent conditions and the high-reticulated coalescing unit traps and separates find particulate suspended solids and hydrocarbons. Clean water flows from the separation chamber to the bypass chamber and thence to the outlet.
2. During a storm (high flow conditions) the level in the primary chamber rises and the storm water passes upwards from the cleanest zone over the weir via the storm cover duct into the bypass chamber and to the outlet.

Performance Analysis:

The SPEL Stormceptor device has undergone rigorous and comprehensive testing for total suspended solids, and hydrocarbons. The reduction values listed below are from flow tests conducted by the University of South Australia Hydraulics Research Laboratory (UNISA)

Pollutant	Average removal efficiency
Total Suspended Solids (TSS)	>97% at particle size >75um >55% at particle size <75um
Total Petroleum Hydrocarbon (TPH)	<0.1ppm (based on a constant inflow concentration of 5000ppm)

Location and type of SQID installed at SICTL terminal:

SQID number	Description	SQID type
1, 2, 4, 5, 7, 8 ***(6, 11, 12, 13, 14 are planned for future construction phases)***	Quay apron catchment draining to Botany Bay through quay wall.	H
3	Diesel refuelling area (connects to SQID 17)	S
9	Manual container stacks and Quarantine inspection area draining to Botany Bay.	S
10	Dangerous Goods Spill Containment Area draining to Botany Bay.	H+
15, 16	Main buildings, internal roadways and general parking area catchments draining to the Flushing Channel.	H
17	Truck Entrance and Maintenance exterior and Diesel refuelling area draining to the Flushing Channel.	H+
18, 19, 20, 21	Truck Marshalling Area, manual truck services and access roads.	H
22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35 ***(32 is planned for future construction phases)***	All Automated Stacking Area catchments draining to Penrhyn Estuary.	H
36, 37, 38, 39, 40 ,41, 42	All Rail siding area catchments draining to Penrhyn Estuary.	H
43, 44, 45, 46, 47, 48, 49	Outlets from Patricks Stevedores catchments interleaved with SICTL Rail siding outlets discharging into Penrhyn Estuary. Patrick's SQIDs are located within the SICTL Lease area and are coloured brown to set them apart from the SICTL SQIDs coloured blue. SICTL does not control or manage the monitoring, inspection, cleanout, maintenance or sampling for these devices. These devices will be serviced by contractors to Patrick Stevedores.	H

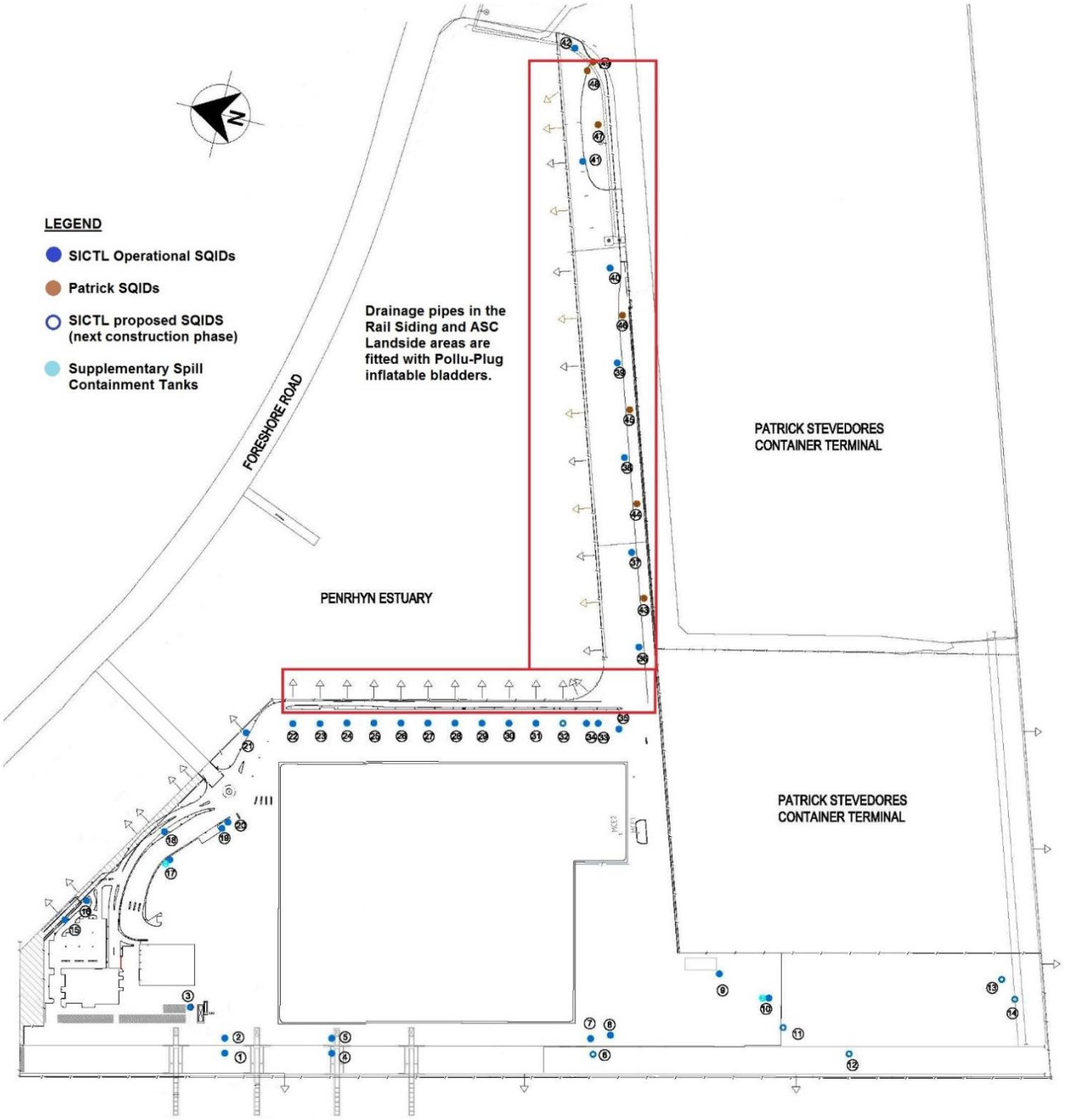
Overview of SQID catchments and discharge points.

Key: H Humes Aquaceptor

H+ Humes Aquaceptor plus an additional supplementary tank

S SPEL Stormceptor

Illustration showing the locations of SQID units and Pollu-Plug units:



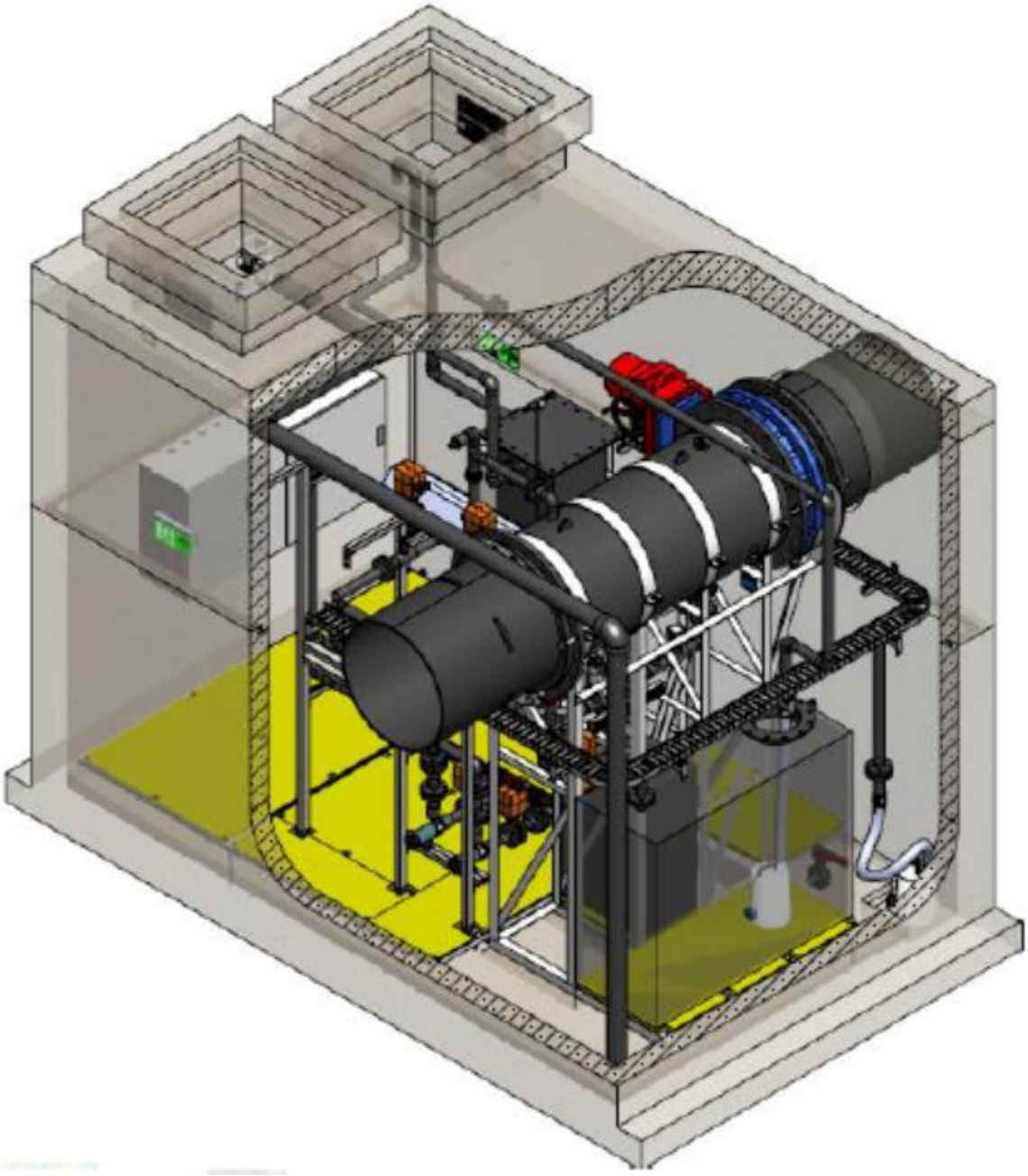
Liquid Detention Unit (LDU)

The stormwater drainage system servicing Automated Stacking Crane (ASC) blocks 1, 3 and 5 (handling Dangerous Goods solids, liquids and gaseous cargo) will additionally be fitted with a Liquid Detention Unit (LDU) which has been designed to protect the health of the adjoining Penrhyn Estuary habitat.

The LDU uses a combination of physical, biological and chemical type sensors to

- evaluate the treatability of the waste-stream through the Stormwater Quality Improvement Device (SQID) at the estuary discharge point, and
- provide an isolation point for stormwater potentially containing spilled materials from import/export goods containers.

The combination of the LDU and SQID working together form an interactive Water Quality Station.



How it works:

The gravity fed LDU with isolation valve has been installed within a concrete pit located beneath the surface of ASC blocks 1, 3 and 5. The sensor data generated from sampling events is sent to a PLC (programmable logic centre) where pre-set acceptance ranges for each set of data will determine if isolation is required of stormwater or spill materials from the SQID/Penrhyn Estuary discharge. The main isolation valve is to be operated as a normally closed arrangement.

Three consecutive PASS samples must be recorded before the main isolation valve can release preset volumes of stormwater to the SQID. Rates of release are also controlled by partial opening of the main valve which protects the SQID from surge flows. A rain sensor is also utilised to validate stormwater flow events, which also engages a storm mode of control within the PLC enabling suitable management of significant stormwater volumes.

PLC programming provides the necessary interpretation of data; resulting in the generation of appropriate operator alarms and isolation of contaminated waste within the stormwater collection network. Trigger values are designed to assist in identifying the chemical/physical characteristics of a detected contaminant; these values are therefore diagnostic only.

The LDU essentially operates automatically until a significant event occurs resulting in flow isolation (spill or otherwise). The LDUs are also operated and monitored remotely via the contracted service provider and the Engineering Department. Identified volumes of contaminated stormwater can then be pumped to tanker trucks for disposal offsite.

Performance Analysis:

	Detection Range	Alarm	Warning
pH (Acidity/Alkalinity)	0 – 14 pH	≥8.5 or ≤6.5	>8 or <7
Turbidity (NTU)	0.001 to 100 NTU	≥10 or ≤2	≥9 or ≤2
Dissolved Oxygen (DO)	0 to 12 (mg/L)	≥10 mg/L or ≤2 ug/L	≥9.5 mg/L or ≤5 ug/L
Hydrocarbons/oil in water	0.1 to 2000 (mg/L)	≥350 ug/L	≥300 ug/L
Electroconductivity (TDS total dissolved solids)	0.1uS to 500mS/cm	n/a	≥500 mS/cm or ≤0 mS/cm
Oxidation and reduction potential	-2000 to +2000 (mV)	n/a	≥2000 mV or ≤-2000 mV

Alarm = valve remains closed therefore isolating stormwater from SQID and estuary discharge; Engineering Department and contracted service provider is notified (via text and email) and FAIL value logged.

Warning = valve opens to allow stormwater discharge to SQID and estuary, however testing frequency is doubled; Engineering Department and contracted service provider is notified (via text and email) of potential breach.

Note: Electroconductivity and Oxidation/reduction potential figures must be analysed in conjunction with other readings, therefore it will only trigger a warning for the Engineering Department and the contracted service provider to review.

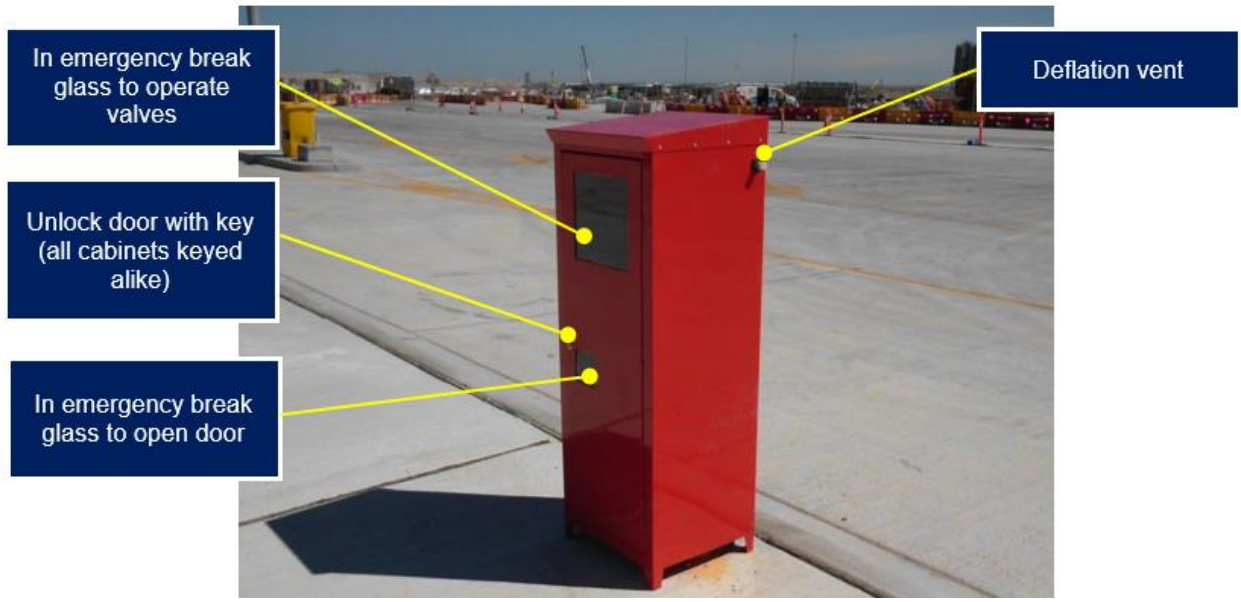
The Pollu-Plug system

"Pollu-Plug" is the name of a drainage shutoff system that uses a bladder installed at the downstream end of a stormwater drainage pipe to contain contaminated water and prevent pollution of the environment.

SICTL has installed the Pollu-Plug system on all drainage lines servicing the ASC and the Rail Siding Area to protect the Penrhyn Estuary.

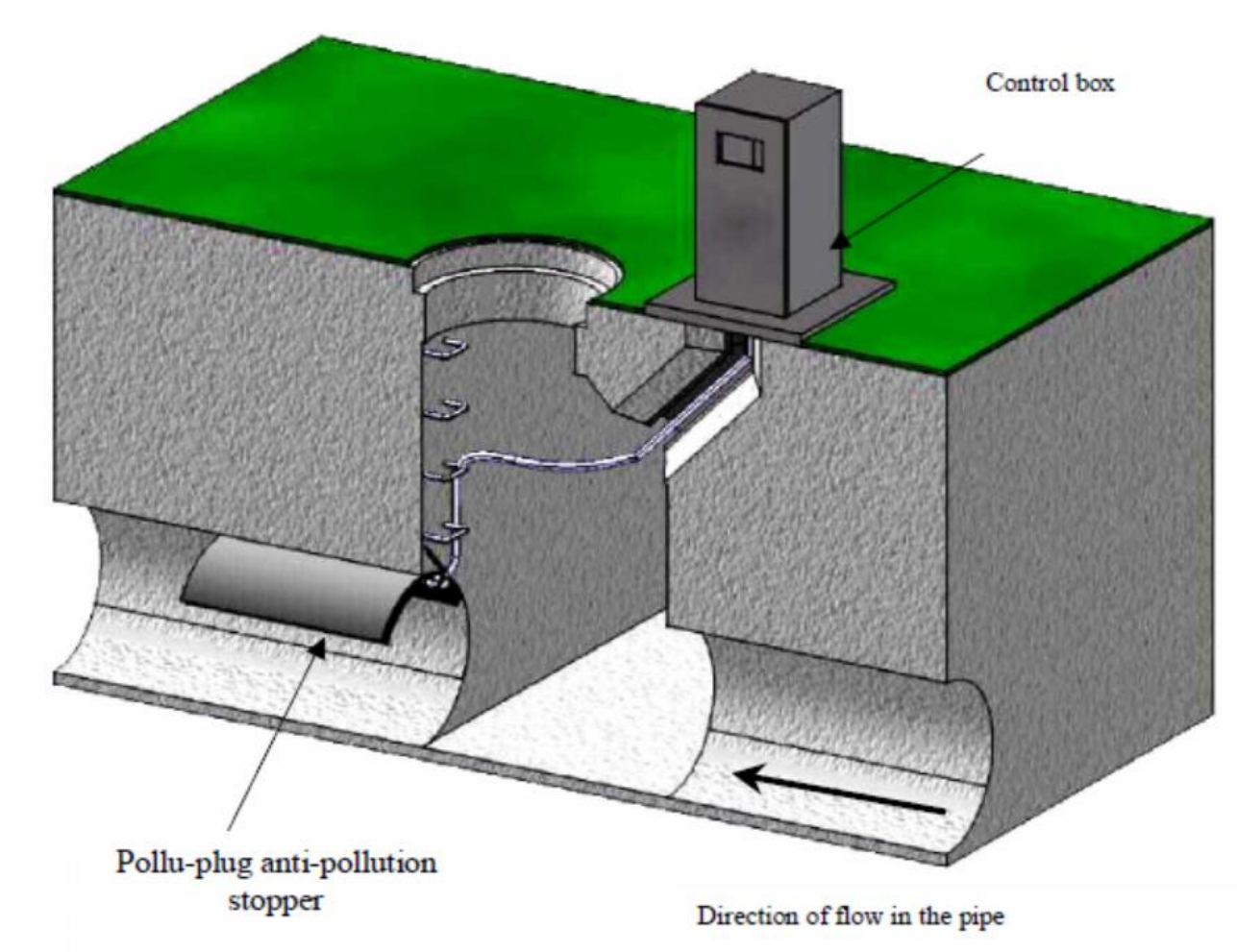
The Pollu-Plug bladder is made from an elastomer-coated fabric which is hot volcanized in an autoclave and has been designed to remain permanently inside the pipes without disturbing the natural flow of stormwater. In the event of a spill or other emergency, the bladder merely needs to be inflated via the manual control system.

The gas supply and inflation valves are located in **red Pollu-Plug control cabinets** on the raised median between the out-gate and weigh-in-motion station opposite the ASC area. The units are numbered 1-13. In the Rail Siding, the units are situated on the raised median adjacent to the Patrick Stevedores fenceline. These units are numbered R1-R5.



Red Pollu-Plug control cabinet containing the gas inflation valves

Inflated Pollu-Plug from within the access chamber of the concrete drainage pit (photo taken during construction phase)



In the event of an emergency (such as a dangerous goods spill or fire), the decision to activate the Pollu-Plug unit shall rest with the Chief Warden or the Senior Manager, HSEQ. Full inflation of the Pollu-Plug bladder takes approximately 15minutes.

Sufficient numbers of Operations, Maintenance, HSEQ and Security staff have been trained and will be refreshed in the correct activation and deactivation of the Pollu-Plug, and will keep in contact with the Chief Warden during any emergency.

The instruction guide to operate the Pollu-Plug valves has also been affixed to the inner door of each Pollu-Plug unit.

Keys to the Pollu-Plug units are kept with Security and Engineering (in case of emergency, the units is also able to be accessed by breaking the glass window).

Spill Management Equipment

Spill Containment Area

In the case of a container leaking liquid, SICTL may move the container from the quay apron to the spill containment area see below. This is a purpose-built area capable of containing the volume of a leaking container in a collection trench.

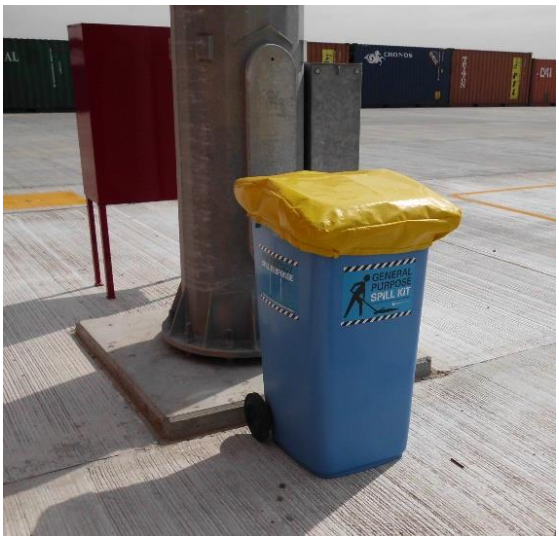
In cases where the wind direction at the time of the emergency could cause off-site impacts by gases originating from the designated Spill Containment Area, the leaking container will stay on board the bunded Spill Trailer and be moved to an area of the terminal where off-site effects would be mitigated.

Spill Trailer

SICTL has a purpose built bunded trailer that will be kept on standby within the terminal and may be used for the movement of leaking DG containers within the terminal (shown below). This bunded trailer will be towed by yard truck and is large enough to carry one 40' or one 45' container or up to two 20' containers at once. In the event that more than one container is leaking an incompatible class of DG at the same time SICTL may choose to send one class of DGs in the spill containment area and have the other class remain on the bunded trailer, thus maintaining separation.

Spill Kits & Locations

SICTL has invested in spill control measures to bund, absorb, stabilise and remove DG/ non-hazardous liquids spilt within the terminal. Some examples typical of the spill response equipment is shown below. The bag-type spill control kits are portable and are kept in vehicles, larger bin-type spill kits have been deployed within the maintenance building, on the quay cranes and in key locations around the terminal where plant usually operates.



The spill kits feature absorbent materials and Personal Protective Equipment for the cleanup of small spills. An ongoing monitoring and replenishment program is implemented so the spill kits have the correct type and quantity of contents.

Blue / Yellow Wheelie Bin Contents	Min. Amount	Spill Bag Contents	Min. Amount
4 x bags of absorbent granules	2 x bags	1 x bag of absorbent granules	1
6 x mini booms	4	2 x mini booms	2
50 - 100 x absorbent square pads	25	10 x absorbent square pads	5
2 x pairs PVC gloves	1 pair	1 x pair PVC gloves	1 pair
6 x disposal bags	2	1 x disposal bag	1

Additional portable bunds are available from Maintenance storage

Diesel Tank – shut off valve and bunding containment area

Bunding for the on-site diesel storage and refuelling area is achieved through two methods:

- Bunding of the actual storage tank to contain spills or leaks in the event of tank failure, and
- Bunding of the refuelling area to contain spills from refuelling vehicles and plant.

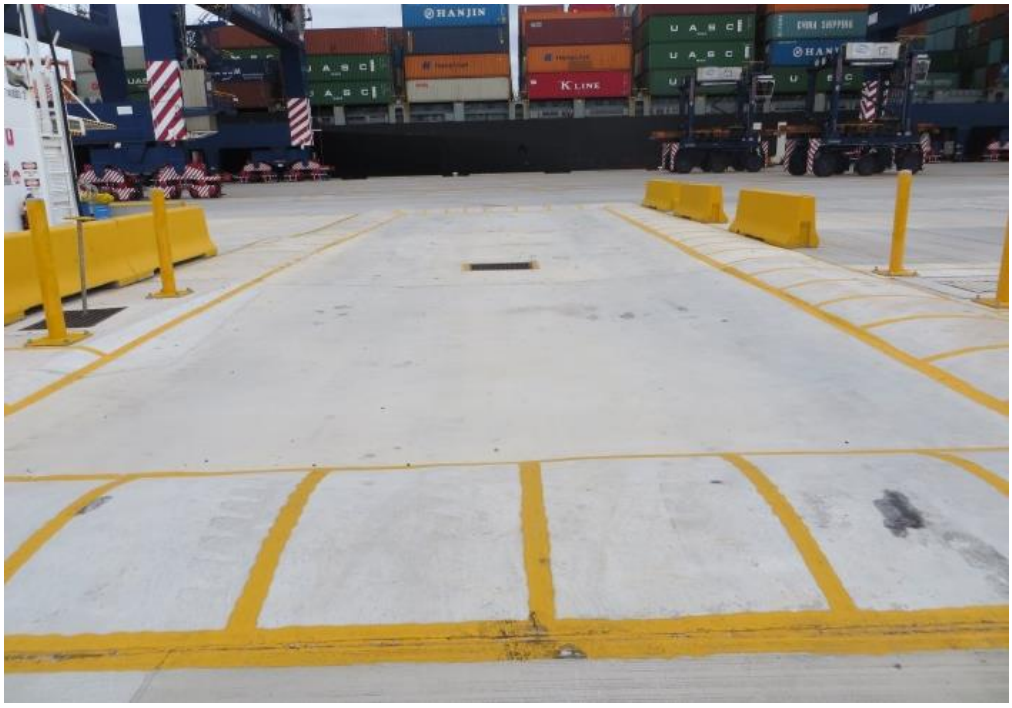
The system chosen for the SICTL terminal is a proprietary system incorporating integrated fuel storage and delivery manufactured by TransTank. This unit is a double-walled, self-bunded tank with capacity of up to 67,120L (safe fill volume), shown below.

The Transtank self-bunded diesel storage unit.

The refuelling areas adjacent to the diesel tank will also be bunded to contain any spills from plant or light vehicles during refuelling (for instance in the case of over-fills or leaking bowser guns/ hoses). The light vehicle refuelling side will feature prefabricated trays with grates fitted on top that are cast into the concrete slab to be flush with the finished surface level as shown below.

The tray and grate bund system for refuelling light vehicles

The heavy plant refuelling side will feature a ‘speed-hump’ style perimeter bund with a central drainage pit. This area can be isolated by closing the stop valve fitted to the drainage junction pit. These fixtures are shown below.



The ‘speed-hump’ style perimeter bund and central collection pit for the heavy plant refuelling area.

The handwheel for the isolation valve at the junction pit.

Any fluids caught in these bunds will be pumped out and disposed by an approved contractor. The TransTank system will also feature a leak detection capability connected to the fuel management system with alerts.