

Network Standard

Document No.
NS189

Title:
Oil Containment for Major Substations

Approved Date	7/06/2024	Revision	5	
Lifecycle Stage	Design	Internal Use	<input checked="" type="checkbox"/>	External Use <input checked="" type="checkbox"/>
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Revision

No	Date	Description	Technical Approver	Authorised By
5	7/06/2024	Conversion to new template and update of requirements	Joseph Metti	Jacob Bayley

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Scope

This Network Standard details the design requirements for oil containment within major substations. It also includes provisions to minimise the spread of fire.

This Standard applies to the oil containment systems used for new major substations with primary voltages of 132, 66 and 33 kV. It also applies to existing major substations with these primary voltages where it is reasonably practicable to do so.

This Standard does not include provisions for pole top transformers and capacitors, distribution and customer substations, kiosks, regulators, tap changer auto transformer substations, reclosers or oil filled cables and their associated pressure vessels.

This Network Standard deals with the two main types of oil-water separation systems currently used by Ausgrid:

- 1) Parallel Plate Separator (PPS) - a closed drainage design with bund storage which uses a pumped oil-water separator system.
- 2) Enhanced Gravity Oil and Water Separator (EGOWS) - a gravity drainage system and tank which uses a delayed release principle to separate the oil and water.

Alternative oil-water separation systems can be proposed for use, subject to suitable performance testing and verification of compliance.

References in this Network Standard to a particular type of oil-water separator shall, where appropriate, also be applicable to an approved alternative system of comparable design.

Oil containment systems shall be designed to meet the requirements of this Network Standard and the relevant parts of AS 2067 and AS 1940. Where a conflict occurs, the requirements of this Network Standard shall prevail.

Reference Documents

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards.

Ausgrid Documents

- NS001 Glossary of Terms
- Electricity Network Safety Management System Manual
- NS171 Firestopping in Substations.
- NS187 Passive Fire Mitigation Design of Substations.
- NS190 Oil Containment Operational Requirements for Major Substations
- EG 100: Oil Handling
- EGN 101: Oil spill containment and clean up guide
- EMS 350: Environmental Management Strategy 350, Oil Filled Equipment.

Other Standards and Documents

- Australian Rainfall and Runoff; The Institution of Engineers, Australia.
- AS 1170 Loading Code.
- AS 1657 Fixed platforms, walkways, stairways and ladders - Design construction and Installation.
- AS 1940 The Storage and handling of flammable and combustible liquids.
- AS 2067 Substations and high voltage installations exceeding 1kV a.c.
- AS 2865 Confined Spaces
- AS 3000 Electrical installations (known as Australian/New Zealand Wiring Rules)

- AS 3500 National plumbing and drainage code – Stormwater drainage.
- Fire Safety Study Guideline, Hazardous Industry Planning Advisory Paper No. 2, Department of Planning NSW Fire Brigades.

Acts and Regulations

- Electricity Supply (General) Regulation 2014 (NSW)
- Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)
- National Construction Code (NCC)
- Protection of the Environment Operations Act 1997
- Work Health and Safety Act 2011 (NSW)
- Work Health and Safety Regulation 2017 (NSW)

Clause Standard Requirements

1 Design Requirements

- 1.1 The purpose of an oil containment system is to manage the risks associated with the uncontained spread of oil or fire following equipment failure, and to minimise oil pollution during normal operation of the equipment.
- 1.2 The provision of oil containment at major substations shall be based on the following design requirements:
- The oil containment system design criteria shall be as follows;
 - Only one transformer will rupture at any one time releasing its entire contents;
 - A major rain event does not occur simultaneously with an emergency situation;
 - The residual oil in storage is less than 10% the volume of the largest transformer;
 - The oil containment system design is for short term emergency oil retention only;
 - The oil containment system shall operate automatically, or shall be a passive system; and
 - A secondary containment area or emergency response process shall be used to manage the flow of excess water and/or foam when firefighting;
 - For all sites except CBD substations, a minimum of 20 minutes firefighting medium containment shall be provided in accordance with AS 1940. The flow rates shall be a minimum of 4 L/s (using foam) and the overall volume shall be rounded up to 5,000 litres, or the volume needed to provide a 100mm firefighting foam layer, whichever is the greater. Refer also to Section 8;
 - CBD sites shall have 90 minutes of firefighting water containment at the flow rate of the high velocity water spray system. Refer also to Section 8; and
 - Controlled overflow or surcharge into other bunds, or into secondary containment areas on the site, is permitted under the application of firefighting medium. Refer to Section 8 and Annexure E.

2 Oil Containment Design

2.1 General

- 2.1.1 For new substation sites, all oil filled equipment shall be banded unless indicated otherwise by this Network Standard.
- 2.1.2 For existing substations, all areas with oil filled equipment containing more than 1000 litres of oil shall have oil containment facilities, except where exempted by a site-specific risk assessment undertaken by Ausgrid. Oil containment is not required where an item of equipment has less than 1000 litres of oil.
- 2.1.3 Where oil containment is not provided under Clause 2.1.2, the equipment shall be located such that it is not in a drainage path to a waterway, or such that any oil lost will not create a hazardous situation to the public, neighbouring buildings or equipment in accordance with AS 1940.
- 2.1.4 High voltage capacitors that are outdoors do not require oil containment because they are sealed units that contain minimal free oil. Refer to Section 9.

2.2 Catastrophic Failure Scenario

- 2.2.1 Banded PPS oil containment systems shall adopt the following design requirements to address a catastrophic failure risk:
- contain the oil within banded areas;
 - design the PPS to shut down upon neat oil flow through the separator;
 - design the bunds to have capacity for the full transformer oil contents, plus at least 5000 litres of firefighting medium or a 100mm foam layer, whichever is the greater; and

- direct overflows from bunded areas to a secondary containment area where practicable, or otherwise manage by the emergency response process.

2.2.2 Gravity drainage oil containment systems shall adopt the following design requirements to address a catastrophic failure risk:

- contain oil spillage within bunded areas and provide a quick draining route for oil;
- design the bunds and pipes for the flow rate of the firefighting water to facilitate rapid removal of oil from the bund;
- design the bunds to be drained via a flame trap to minimise the potential for fire to reach the oil containment tank;
- design the bunds to hold 100% of the oil volume to provide adequate drainage time in the event the pipes are partially blocked;
- design the oil containment tank to retain 110% volume of oil from one transformer;
- design EGOWS systems with a manual or automatic shut-off valve at the outlet of the tank to prevent discharge of the firefighting medium; and
- direct overflows from the oil containment system to a secondary containment area where practicable, or otherwise manage by the emergency response process.

2.2.3 Gravity drainage of bunded areas may assist in reducing the fire risk following a major oil spill. However, gravity drainage shall not be relied upon as the primary control measure in minimising the spread of fire.

2.3 Normal Operation Scenario

2.3.1 Bunded PPS oil containment systems shall have a stormwater discharge less than 10ppm of oils and greases, including during all storm events. The water level inside the bunds is permitted to rise during storm events while treated discharge from the PPS continues at a constant rate.

2.3.2 Gravity drainage oil containment systems shall have a stormwater discharge less than 10ppm of oils and greases. For higher intensity rainfall events, increased oil / water discharges are permitted (refer to Clause 6.2).

2.4 Existing or Temporary Major Substations

2.4.1 Alternative oil containment designs may be required for existing or temporary major substations, due to site constraints and other factors preventing the use of conventional systems.

2.4.2 The minimum requirement for these sites shall be a bund around each transformer. The bunds shall be designed for 100% of the oil volume plus secondary containment as described in Clause 5.6.

2.4.3 Allowance shall be made for the containment of overflows during a significant rainfall event. The retained water may be contaminated and may require disposal off-site.

3 Regulatory Requirements

3.1 Sewer

3.1.1 For oil containment discharge to sewer:

- A Trade Waste Agreement (TWA) is required with specific monitoring and discharge requirements as determined by the relevant authorities; and
- The minimum discharge requirement shall be less than 10ppm for oils and greases.

3.1.2 Discharge of treated water to sewers shall only be undertaken when a connection to stormwater is not practical, and provided that no stormwater inflow is collected for discharge.

3.2 Stormwater

For oil containment discharge to stormwater:

- The minimum discharge requirement shall be less than 10ppm for oils and greases;

- Connection to stormwater shall be in accordance with the current environmental management strategy, EMS 350; and
- Approvals shall be sought for new connections to Local Council, Sydney Water or Hunter Water Corporation Stormwater Systems.

3.3 Local Council Requirements

Local council stormwater codes of practice and guidelines shall be reviewed and adopted where practicable.

4 Oil Containment Layout for New Substations

4.1 CBD Major Substation with High Velocity Water Spray

- 4.1.1 Each transformer shall have a bund which is drained to a storage tank or designated overflow area. The tank shall be designed to take a minimum of 90 minutes of high velocity water spray from one of the transformer bays and 110% of the oil volume of the largest transformer.
- 4.1.2 The storage tank is permitted overflow into the cable basement or other area in the event of high velocity water spray operation greater than a minimum of 90 minutes. The overflow shall be taken from the bottom of the tank.
- 4.1.3 Where stormwater can enter the system, the contents of the tank shall be connected to a PPS (or approved alternative) prior to discharge to stormwater or sewer.
- 4.1.4 During emergency situations in CBD substations with PPS systems, the PPS shall be shut down by the operation of the transformer protection system and activation of the high velocity water spray system. Refer to Annexure C for a description of PPS shut down modes under emergency operation.
- 4.1.5 CBD capacitor bays containing capacitors with oil shall have bunds and may be fitted with sprinklers. Where sprinklers are fitted, the bunded areas shall be connected to an independent storage tank designed for 90 minutes of sprinkler discharge.
- 4.1.6 The contents of the storage tank for capacitor bays shall not be connected to a PPS. Any waste collected shall be disposed of off-site. A tank pump-out point shall be provided for tanker access.
- 4.1.7 A schematic layout of the oil containment system in CBD major substations using high velocity water sprays for fire protection is provided in Annexure B.

4.2 Suburban Major Substation

4.2.1 Bunded PPS System

- 4.2.1.1 The transformers shall be individually bunded and any discharge points shall be kept normally closed. Automatically operated pumps shall be provided within the bunds together with suitable bund sumps and above ground pipes constructed to the requirements of Clause 7.1.1.
- 4.2.1.2 All liquids shall be pumped to a PPS oil/water separator, or approved alternative, and treated prior to discharge to stormwater. Further details of the PPS system are provided in Annexure C.
- 4.2.1.3 The bund storage shall be sized to retain all oil spills, with a suitable margin for rainwater and/or fire-fighting medium. Any overflow from the bund area shall be directed to a secondary containment storage area where practicable, or otherwise managed by the emergency response process.
- 4.2.1.4 Secondary containment storage areas shall be designed to the requirements of Section 5.6.

4.2.2 Gravity Drainage System

4.2.2.1 The transformers shall be individually banded and drained to an Enhanced Gravity Oil Water Separator (EGOWS) or approved alternative. The treated stormwater shall be discharged to stormwater.

4.2.2.2 The EGOWS shall be manually or automatically closed by a butterfly valve at the tank outlet upon application of firefighting water. The overflow from the oil containment tank shall be directed to a secondary containment area where practicable, or otherwise managed by the emergency response process.

4.2.2.3 Where secondary containment areas are installed, they shall be designed to the requirements of Section 5.6.

4.2.3 Schematic Layouts

Schematic layouts of the oil containment systems in suburban major substations, for both banded PPS and gravity drainage systems, are provided in Annexure B.

5 Oil Containment Bunding

5.1 General

Oil containment banded areas shall be designed to minimise the entry of clean stormwater. All sub-soil drainage, yard run-off and roof drainage shall be excluded from the banded areas. All bunds shall be designed to AS 1940.

5.2 Transformer Bunding

The extent and layout of bunds for new substations shall be such that burning fuel cannot propagate the fire to adjoining transformers, structures and adjacent premises and shall meet the requirements of AS 1940.

5.3 Spray Screens

5.3.1 Bunding shall be designed to capture a 1:2 (Horizontal : Vertical) spray discharge to AS 1940 requirements. Where the bund cannot be placed to meet the spray discharge, spray screens shall be installed.

5.3.2 Where the transformer radiators are positioned in close proximity to the bund wall, spray screens shall only be placed to a maximum height of 1.5 m above the bund wall.

5.3.3 Spray screens near the transformer radiators shall be louvered to allow sufficient air flow around the radiators. These spray screens shall be removable if regular access is required for maintenance.

5.4 Transformer Roadways

5.4.1 For new sites, transformer roadways shall be banded using speed humps where required. The drainage shall be to stormwater via an easily accessible and identifiable butterfly valve. This valve shall remain open except when oil filled equipment is parked on the roadway, or when operations are underway that involve the transferring of oil.

5.4.2 At existing sites, the requirements of Clause 5.4.1 shall apply where it is practicable without the need for laying of new drainage pipes or the rebuilding of existing pits.

5.4.3 For existing sites with restricted space, alternative arrangements shall be assessed using smaller transformer bay areas together with a risk assessment for drainage of the transformer roadway within the 1:2 spray zone.

5.5 Bunding Design Requirements

5.5.1 All banded areas shall have a 1% floor slope. Where drainage from the bund is required for gravity drainage systems it shall be via a flame trap.

5.5.2 All banded areas shall be finished with a non-slip surface.

5.5.3 Permanent bunds shall be constructed from reinforced concrete. For instances where the bunds will be temporary, earthen bunds are permitted.

- 5.5.4 All bunds shall be designed to sustain loading from a spray screen, allowing flexibility for larger transformers in bunds while maintaining AS 1940 compliance.
- 5.5.5 For new substations, and where reasonably practicable for existing substations, the following requirements shall apply:
- All openings in the bund floor for power cables shall be raised above the bund floor, or otherwise the floor sloped away from the opening to avoid ponding. Refer to drawing A4-190509 for design details.
 - Where secondary cables pass through a bund floor opening, the opening shall be raised using internal bunding to a minimum 50 mm above the bund wall height. Refer to drawing A3-225716 for design details.
- 5.5.6 Personnel access into the bund up to a maximum 400mm step over is permitted, provided the bund height is appropriately highlighted. A platform at bund height is not required. All other means of access into the bund shall meet the requirements of AS 1657.
- 5.6 **Secondary Containment**
- 5.6.1 **Containment Area Requirements**
- 5.6.1.1 The design of secondary containment for major substations will vary depending on the site location and site constraints.
- 5.6.1.2 Permeable or unpaved secondary containment areas shall not be used in locations with a high water table, or with sandy soils, or close to waterways or sensitive environments.
- 5.6.1.3 All secondary containment areas shall be provided with immediate localised remediation after use.
- 5.6.2 **Oil Spill Kits**
- An oil spill kit shall be made available at every major substation to assist with the provision of secondary containment.
- 5.6.3 **Secondary Containment Options**
- Secondary containment options and the requirements for major substations are provided in Annexure E.
- 6 Oil-Water Separators**
- 6.1 **Parallel Plate Separator (PPS)**
- 6.1.1 Parallel Plate Separators (PPS), or an approved alternative, shall be used with oil containment systems that rely on bund storage. A PPS can also be used in cases when it is not possible to drain entirely by gravity, where a high velocity water spray system is installed (e.g. CBD substations), and for retrofitting into existing major substations.
- 6.1.2 PPS systems shall be designed to provide stormwater discharges of less than 10ppm of oil in water during all storm events.
- 6.1.3 The PPS control panel, and the motor-pump arrangement that supplies the PPS, shall be installed above the bund high water level in order to prevent the equipment flooding in the event of bund filling. The control panel shall be installed in a location accessible from outside the bund.
- 6.1.4 The PPS shall be fitted with waste oil tank that triggers the pump to stop when full.
- 6.1.5 Refer to Annexure C for the design requirements associated with PPS system shutdown, alarms, and neat oil flow.
- 6.2 **Enhanced Gravity Oil Water Separator (EGOWS)**
- 6.2.1 EGOWS systems, or an approved alternative, shall be installed in accordance with a site-specific design to be provided by Ausgrid for each substation.
- 6.2.2 EGOWS shall be designed to provide stormwater discharges of less than 10ppm of oil in water during normal storm events. During higher intensity storm events the EGOWS may discharge oil/water of up to 100ppm or greater.
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- 6.2.3 The oil containment tank shall be sized such that oil globule sizes of 33 microns or larger are contained within the tank for the following rainfall events:
- 1 in 1 year ARI storms of 1 hour, 12 hour, 24 hour, 48 hour and 72 hour duration; and
 - 1 in 20 year ARI storm of 5 minute duration.
- 6.2.4 In environmentally sensitive areas the EGOWS tank shall be increased in size where it is deemed necessary to achieve the required discharge limits for higher intensity storm events.
- 6.2.5 Alternatively, where the site layout permits, a non-overflow tank design can be installed that complies under all storm events. This design maintains a constant discharge and allows the inflow to surcharge into the bund areas. The EGOWS tank design will require access covers that are raised to bund height.
- 6.2.6 Refer to Annexure C for the design requirements associated with EGOWS system emergency operation and access to oil containment tanks.

7 Drainage and Associated Facilities

7.1 Pipework

7.1.1 Bunded PPS System

- 7.1.1.1 Where site conditions allow, the pipework between pumps and PPS shall be located above ground and within the bund storage area.
- 7.1.1.2 The pipework shall be constructed using the following materials and designed to the appropriate criteria:
- Outdoor locations outside the bund area – stainless steel pipes;
 - Outdoor locations inside the bund area – PVC pipes or other suitable material;
 - Indoor locations where damaged pipework would discharge into stormwater – stainless steel pipes;
 - Indoor locations elsewhere – PVC pipes or other suitable material;
 - Temporary locations – PVC pipes or other suitable material.

7.1.2 Gravity Drainage with Oil Containment Tank

- 7.1.2.1 All pipes draining to an oil containment tank shall be designed to resist at least 100°C and be oil resistant. In addition, any exposed pipes laid in open trenches shall be fire resistant.
- 7.1.2.2 The pipe drainage system shall be constructed using the following materials and designed to the appropriate criteria:
- Galvanised steel rolled groove system (Victaulic or approved equivalent); or
 - Stainless steel rolled groove system (Victaulic or approved equivalent); or
 - Cast iron pipes.
- 7.1.2.3 Pipe joints with rubber seals shall use Nitrile rubber or other oil resistant material. Where a higher temperature resistance is required, Viton rubber shall be used.
- 7.1.2.4 A minimum of 0.5% fall shall be maintained for all drainage channels and pipework draining to an oil containment tank.
- 7.1.2.5 Oil containment pipes for gravity drainage shall be 150mm in diameter for new substations, except for CBD substations where larger diameter pipes may be necessary to cater for the high velocity water spray system.
- 7.1.2.6 Where site conditions allow, pipes shall be laid above ground on supports or in trenches with removable covers (similar to secondary cable trenches). Pipe trenches shall be drained to the stormwater system.
- 7.1.3 **Pipework Design Requirements**
- Refer to Annexure D for the design requirements associated with oil containment pipework.

7.2 Other Drainage Facilities

Refer to Annexure D for the design requirements associated with pits, flame traps, valves, pumps and other facilities.

8 Fire Fighting Water Containment Capacity

- 8.1 For CBD and other major indoor substations using fixed firefighting systems, provision shall be made for up to 90 minutes of expelled firefighting water to be stored in accordance with Fire Safety Study Guideline, Hazardous Industry Planning Advisory Paper No. 2, Department of Planning, NSW Fire Brigades.
- 8.2 For both non-rural and rural sites, the minimum containment storage time for non-fixed system firefighting is 20 minutes. The assumed firefighting method shall be one hose with foam at 4 L/s.
- 8.3 For both non-rural and rural sites, the required minimum containment storage can be inclusive of the volume available within the bunded areas, plus any secondary containment or overflow areas available on site. Refer also to Annexure E.
- 8.4 Where a full bund oil fire may occur, a suitable volume allowance shall be made based on a nominal burn down rate of 100mm per hour applied across the surface area of the bund. Actual burn down rates may vary based on conditions and the use of higher values shall be subject to approval by Ausgrid.

9 Capacitors

9.1 General

High voltage capacitors contain either Jarylec or Faradol fluid for the purpose of insulation. With a specific gravity of 1.006 and 1.001 respectively, these fluids are slightly heavier than water and therefore standard gravity separation is impractical. Stormwater run-off from capacitor bank areas shall not pass into the standard oil containment catchments or oil containment tanks.

9.2 Outdoor Capacitor Banks

- 9.2.1 Capacitors are sealed units containing minimal oil with low risk of leakage. For this reason, capacitors in outdoor yards shall not be bunded.
- 9.2.2 Where there is a significant risk of leaking capacitors, a risk assessment shall be undertaken to determine whether the use of a concrete perimeter bund is required.

9.3 Capacitor Banks and Fire Sprinklers

- 9.3.1 Where the capacitor banks are located within a building and the room is fire protected with fire protection sprinklers, the room shall be drained to a dedicated containment tank. The containment tank shall have the capacity to take a minimum 90 minutes of the firefighting water.
- 9.3.2 The room containing the capacitor banks and fire sprinklers shall be bunded.

10 Decommissioning of Oil Containment Tanks

- 10.1 An underground oil containment tank that has been taken out of service shall be either:
- removed; or
 - drained, steam cleaned and completely filled with an inert solid material (e.g. sand, backfill mortar).
- 10.2 All pipework shall be disconnected and removed from the tank, drained and the open ends sealed off.
- 10.3 When oil containment tanks are decommissioned and/or removed, the potential for contamination of the surrounding soil and groundwater shall be investigated.
- 10.4 Ausgrid's Environmental Services shall be contacted for more information regarding the management of contaminated land.

Annexure A: Selection Criteria for Oil Containment Systems

- A1 For Greenfield sites the following site criteria can be used to determine the preferred oil containment system;
- 1) Sites preferred for bunded PPS systems include:
 - Urban locations in the vicinity of Ausgrid's Aqueous Waste Services depots where response and travel times are low and operation and maintenance costs are reduced.
 - Locations where effective gravity drainage is difficult or costly to achieve.
 - Congested sites where a gravity system either cannot be readily accommodated or would constrain an efficient site layout for plant and equipment.
 - Sites where the EGOWS tank cannot be located adjacent to, or in close proximity (10m to 15m) of, the transformer bunds.
 - Sites where the EGOWS tank requires extra strengthening to support mobile crane outrigger loadings (e.g. in the vicinity of TX bays).
 - Locations where difficult site conditions such as rock, low soil strength, high water table, restricted access etc. adds significant costs to the civil works.
 - Locations where early civil works for gravity systems are an expected critical path item and a significant project benefit can be realised through reduced program duration and site costs.
 - Environmentally sensitive areas where strict discharge limits cannot be satisfied by gravity systems under all conditions (e.g. high flowrates).
 - 2) Sites preferred for gravity drainage systems include:
 - Rural locations where response and travel times are high and O&M costs are increased for PPS systems.
 - Sites where sufficient space is available to locate the gravity system without significant impact on the efficient site layout of plant and equipment.
 - Sites where the EGOWS tank can be optimally located, namely:
 - a) adjacent to, or nearby (10m to 15m), the transformer bunds, and
 - b) with minimal gravity drainage pipework, and
 - c) without additional strengthening of the tank to support mobile crane outrigger loadings.
 - Locations with suitable geotechnical conditions and good site access that enable low cost civil construction.
 - Locations where the civil works for gravity systems will have minimal impact on the program duration.
 - High hazard locations where the continuous removal of fuel by gravity drainage may assist in providing a reduced fire risk following a major oil spill. Gravity drainage shall not be relied upon as the primary control measure in minimising the spread of fire.
 - CBD and other locations which require a high velocity water spray system for the transformer area.
 - Sites where significant benefits can be realised by combining the functions of an EGOWS with required On-Site Stormwater Detention (OSD) into one tank unit.
- A2 For a generic Greenfield site, a bunded PPS system can be comparable, on a LCC basis, with a gravity drainage system using an EGOWS tank. Selection of the preferred oil containment system can therefore be determined by the site-specific criteria indicated above, together with a LCC analysis.
- A3 For existing Brownfield retrofit sites, the preferred oil containment system is commonly a bunded PPS system. The alternative gravity drainage system is less favourable and can incur significant
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additional costs and construction risk due to existing underground services, together with increased site disturbance and site works duration.

A4 For all oil containment systems, the design shall be optimised for each site. This will require:

- Early incorporation into the substation site layout design to optimise all aspects of the substation design and associated works.
- A system design that is as compact as site conditions allow.
- Innovation in design to take advantage of any multi-use functions (e.g. combined EGOWS and OSD where possible).

Annexure B: Oil Containment Layout for New Substations

B1 CBD Major Substation with High Velocity Water Spray

B1.1 A CBD major substation:

- is fully contained within a building;
- will have nil or limited stormwater entry during day-to-day operations; and
- will have transformers protected by a high velocity water spray fire protection system.

B1.2 A schematic layout of the oil containment system in CBD major substations using high velocity water sprays is provided in Figure 1.

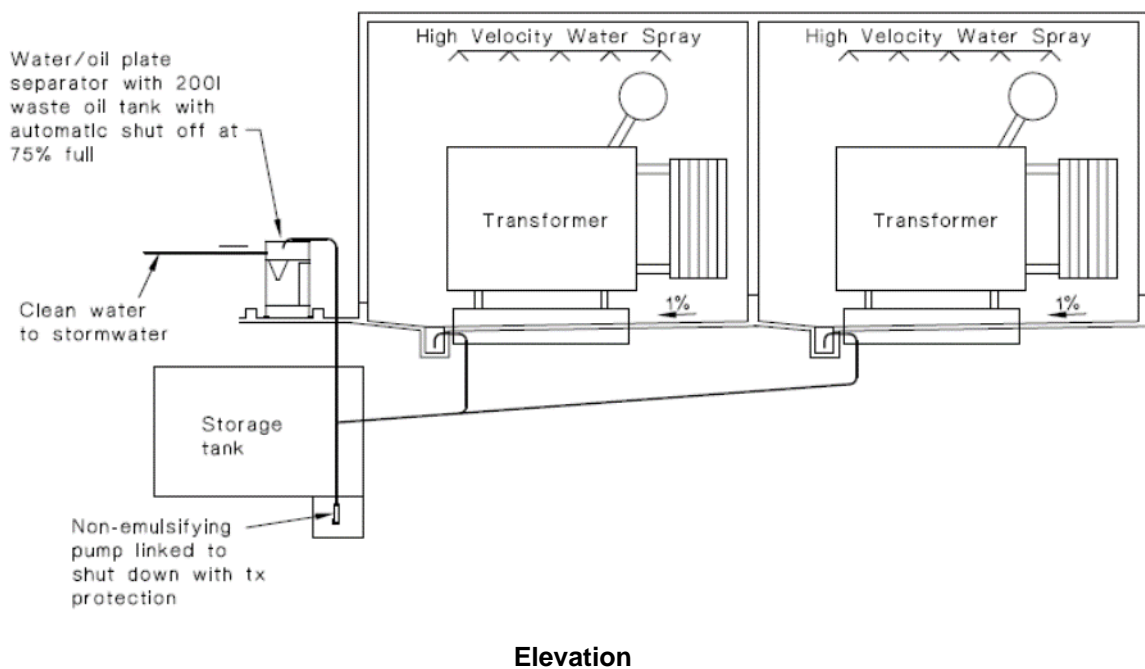


Figure 1 – Schematic of CBD substation with high velocity water spray

B2 Suburban Major Substation

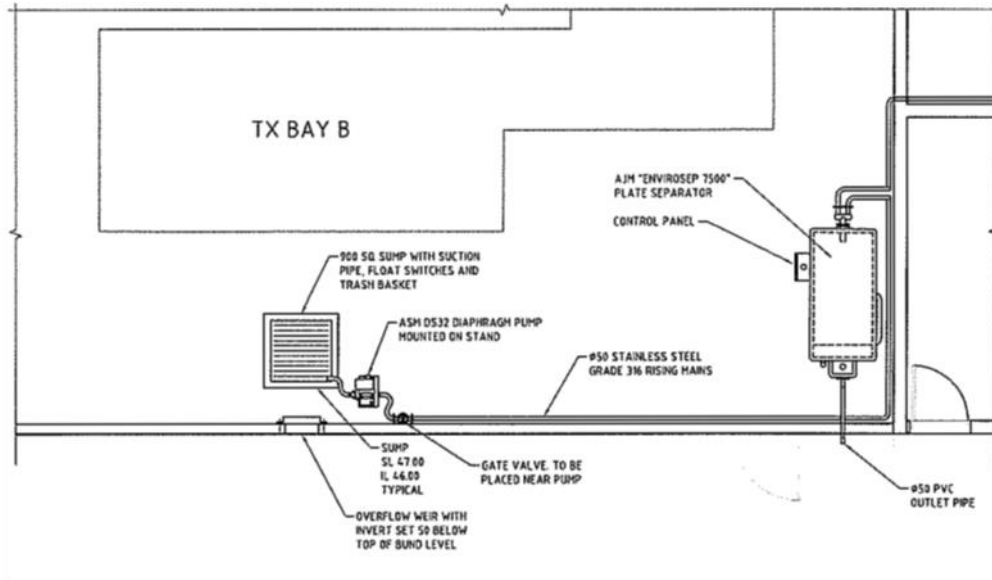
B2.1 General

A suburban major substation:

- consists of switching equipment (indoor or outdoor), outdoor transformers and a control building; and
- will have high volumes of stormwater run-off from the site.

B2.2 Bunded PPS System

A schematic layout of the bunded PPS oil containment system is provided in Figure 2.

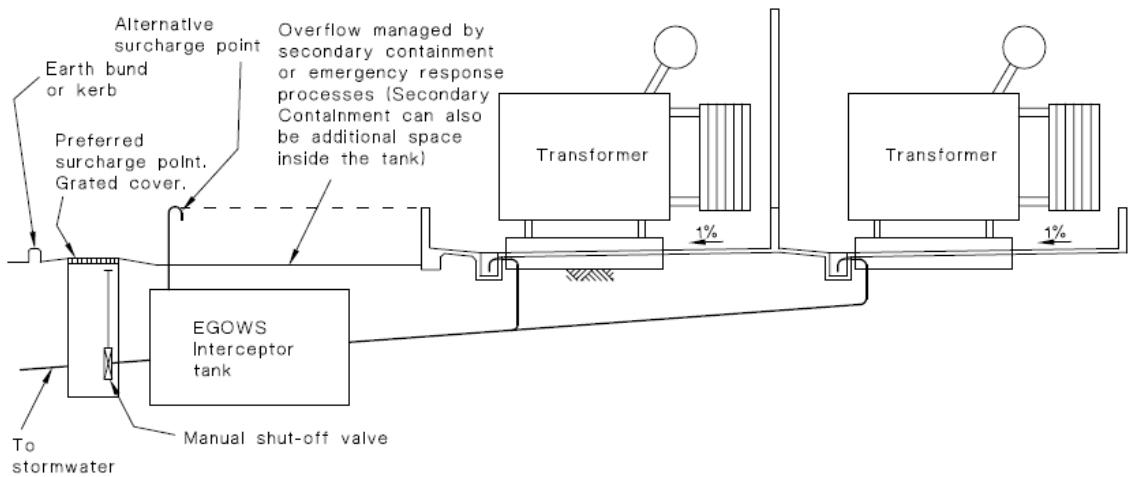


Plan

Figure 2 - Schematic of Suburban Major Substation - Bunded PPS System (Typical)

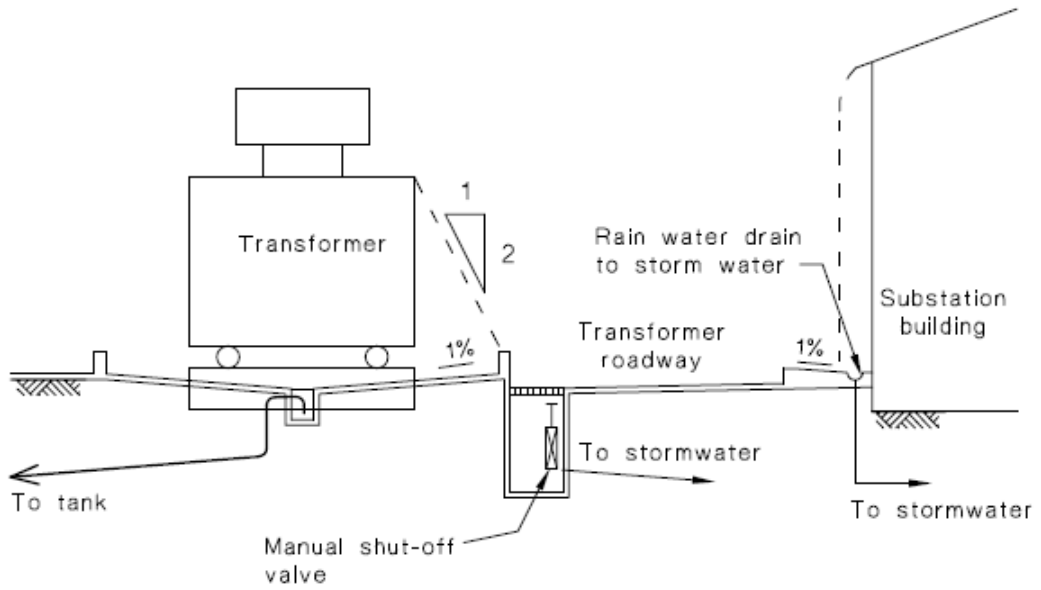
B2.3 Gravity Drainage System

A schematic layout of the gravity drainage oil containment system is provided in Figure 3 and Figure 4.



Elevation

Figure 3 - Schematic of suburban major substation - Gravity drainage system



Elevation

Figure 4 - Schematic cross-section for Figure 3

Annexure C: Oil-Water Separators and Oil Containment Tanks

C1 Parallel Plate Separator (PPS)

C1.1 Design and Installation

Annexure F provides details of the main design features and installation requirements for the current PPS system being installed at major substations.

Testing and maintenance specifications shall be supplied and verified by the manufacturer.

C1.2 PPS System Shutdown

The PPS system shall be able to operate independently of the substation protection system. This means the system shall independently shut down after an incident to avoid discharging oil off site.

The PPS power supply shall be dedicated and fitted with a Residual Current Device (RCD) unit at the point of supply.

C1.3 PPS System Alarms

A communications system shall be installed using the Network Fibre Optic System where available. This will enable local and remote monitoring and control of the PPS for the purposes of improved efficiency and maintenance.

The PPS system shall provide alarm signals to the PPS control panel for the following conditions as a minimum:

- 1) Waste oil tank high level;
- 2) Pump failure; and
- 3) High bund level.

For Item 3) the high level float switch shall be located in the sump just clear of the grate. The alarm signal to SCADA shall be delayed by four hours.

Where any of the alarms activate, a flashing light mounted on top of the control panel shall activate. In addition, suitable signals shall be sent via the communications network notifying of the fault and any further data as required.

Only one alarm signal shall be sent to the control room via SCADA.

C1.4 Neat Oil Flow

The PPS unit shall accept neat oil being pumped through the unit in the case of a bulk oil loss from a catastrophic transformer failure. Under this condition the PPS unit shall:

- shut down when the waste oil tank high level is activated; and
- not discharge oil from the separator unit.

C2 Enhanced Gravity Oil Water Separator (EGOWS)

C2.1 Design and Installation

EGOWS are an oil-water separation system used with gravity drainage systems. Developed by the University of New South Wales, they provide stormwater discharges of less than 10ppm of oil in water during normal storm events.

C2.2 Emergency Operation of EGOWS

A butterfly valve shall be located at the outlet of an oil containment tank in an easily accessible and identifiable location. A butterfly valve may also be required at the secondary containment outlet. Both valves shall be shut off with the application of firefighting medium in order to close off the gravity drainage system.

Closure of the outlet valves shall allow the oil containment system to surcharge and for the overflow to be directed to a secondary containment area, whilst retaining bulk oil in the oil containment tank. Alternatively, the flow can be surcharged into the transformer bund areas which will provide a large secondary containment volume.

Where secondary containment is not viable, an emergency plan response process shall be prepared to manage the surcharge overflow.

C3 Access to Oil Containment Tanks

C3.1 General

All tanks shall be fitted with three 900 x 900 access covers to the appropriate class (Class B or D). The covers shall be located one each on the inlet, middle and outlet chambers. Where the design allows for surcharging, the tanks shall use bolt-down, gas tight covers in accordance with Clause C3.2.

All tanks shall have 1.8m internal head clearance and shall contain internal vertical ladders or step irons.

Enclosed tanks are confined spaces and shall require signage and confined space entry procedures in accordance with AS 2865 and WHS Regulation.

All tanks shall be labelled with confined space signage located just inside the access covers on the side edge of the roof slab.

Tanks shall be provided with adequate clearance around the access points of the tank to allow for the erection of fall arrest equipment.

All tanks shall be suitably located to allow for removal of hatches and to enable ready access by maintenance crews and cleanout tankers.

C3.2 Bolt-Down Covers for Hydraulic Pressure

Bolt-down, gas tight covers shall be used where the design allows for surcharge of the system. The use of bolt-down, gas tight covers will be site specific and dependent on the operation of the oil containment system and hydraulic conditions.

C4 Inspection and Hold Points

Annexure G provides details of the main inspection and hold points associated with the installation of oil-water separators. Annexure G outlines the timing, responsibility and key inspection items necessary to ensure that oil-water separation systems are properly installed and fully functional at each site.

Annexure D: Drainage and Associated Facilities

D1 Pipework

D1.1 General

A risk assessment shall be undertaken whenever direct buried pipework is adopted, to determine the risk of soil contamination. The risk assessment shall consider issues such as site conditions, sensitive environments, design life and ease of replacement.

Pipework within cable basements shall be subject to specific approval and will most often only be acceptable in CBD major substations. Stainless steel or cast iron shall be used for all internal pipework in basements.

D1.2 Design

The oil containment pipes shall have sufficient capacity for the firefighting medium flowrates in Clause 1.1, and for CBD substations, the transformer high velocity water spray system flowrates.

At suburban locations the pipework can be designed to allow the transformer bund area to surcharge during firefighting flows. At these locations, a butterfly valve shall be provided to shut off the oil containment tank discharge to stormwater before firefighting commences (refer to Clause D3.2).

For gravity drainage systems that adopt the use of pits at junctions (refer to Clause D2.1), the pipework shall be designed to ensure any downstream pits do not surcharge if all the oil from one transformer is lost instantaneously within one bunded area. During such events it shall be assumed there will be no additional flow due to a storm event or activation of fire hoses.

D1.3 Pre-commissioning Tests and Inspection

All existing underground or above ground drainage pipes that are used as part of the oil containment system shall have full hydraulic testing undertaken in accordance with the AS 3500.3.

D2 Pits and Drainage Channels

D2.1 Encasement and Finish

For continuous metal pipework laid in open trenches for gravity drainage systems, there shall be no pits on the inlet drainage line.

For gravity drainage systems that use buried pipework with pits at junctions (e.g. to retrofit existing sites), the associated pits shall be cast in-situ and an oil resistant water-stop seal placed around the pipe and cast into the pit. Oil resistant water-stop seals shall also be used on any concrete joints in the pit construction.

The finish on the inside of pits and drainage channels shall be watertight. Where a watertight structure has not been achieved, a suitable concrete sealant shall be applied to achieve a seal. The sealant used shall be resistant to transformer oil and remain effective for the life of the pit or drainage channel.

Pipe trenches that are used to protect oil containment pipelines are not considered to be drainage channels, and the above requirements for watertightness do not apply.

D2.2 Flame Traps

Flame traps shall consist of a down turned pipe with a 300 mm (minimum) downturn and a 150 mm clearance from the pit floor. The pits are typically 900 mm x 900 mm. The flame traps shall remain full of water or oil forming a seal.

Flame traps shall be provided for gravity drainage systems and shall be located as close to the transformer as possible to:

- facilitate the fast removal of oil/water;
- reduce oil drainage paths across the bunded area; and
- reduce flame front size.

Flame traps shall be cast in-situ with an oil resistant water-stop seal around the pipe. Concrete joints shall be minimised in flame traps, but where required, oil resistant water-stop seals shall be used.

D3 Valves

D3.1 Bunded PPS Systems

PPS systems shall use a ball valve to facilitate maintenance and removal of the pump, where more than one pump is provided to a PPS unit. The ball valve material shall be suitable for connection to the adjoining pipework.

D3.2 Gravity Drainage Systems

A butterfly valve shall be used to shut off an oil containment tank or to direct flow as required. The valve shall be located in a pit that is readily accessible and identifiable and shall be operable with a spindle extension so entry to the valve pit is not required. The pit shall have a hinged grate cover.

For new substations, and where reasonably practicable for existing substations, the butterfly valve shall be located such that it can be safely operated manually during a fire. A suitable separation distance or a fire resistant barrier shall be provided to reduce the radiant heat exposure to an acceptable level (refer to NS187). Where adequate fire segregation cannot be provided for the butterfly valve location, a risk assessment shall be undertaken for the site.

The position of the valve within a tank outlet area depends on the secondary containment method. If the tank is to be used as secondary containment, the valve is positioned on the inlet to the valve pit. If the secondary containment is a separate area, the valve needs to be positioned appropriately to direct flow.

The valves shall be capable of withstanding the conditions expected on site including potential water/oil temperatures during a fire and shall be corrosion resistant.

Valves shall be low maintenance, simple to operate, and all automatic shut off valves shall have a manual override.

The use of non–return valves shall be avoided, except where the system is likely to be affected by:

- a 1:100 year flood; or
- surcharge of the pipework.

All non-return valves shall be of stainless steel construction.

The “Hume-King Flood Gate”, or approved equivalent, is a suitable design for use as a non-return valve.

D4 Pumps

D4.1 General

Where site conditions allow, the oil containment system shall be designed to ensure that dirty water is low lift, by suitable positioning of the discharge point relative to the influent source.

All pumps used on low lift oil containment systems shall be diaphragm pumps.

Where high lift is required, a non-emulsifying screw pump shall be used, noting that these pumps are prone to seizing from debris and do not tolerate no flow conditions.

D4.2 Pumps for Parallel Plate Separators

All pumps used on the PPS system shall be ASM diaphragm pumps, or approved equivalent.

D5 Ventilation Pipework

Ventilation pipes associated with oil containment tanks shall be spatially separated from any lightning masts in accordance with the earthing design for the site.

The minimum horizontal separation distance between the vent pipe exhaust point and the mast shall be 1.5m. Where site conditions allow, the horizontal separation distance shall be increased to 3m.

D6 **Infiltration Trenches**

The use of infiltration trenches shall be avoided within major substations and will be subject to the written approval of Ausgrid.

Annexure E: Secondary Containment Options

E1 Greenfield and Brownfield Sites with PPS Systems

Where the site has no tank and uses a bunded PPS system, or approved alternative, the following options in order of preference shall be assessed.

Options	Containment method	Detailing requirements	Additional containment available	Disadvantages
1	Allow for the burn down rate due to a full bund oil fire	Adopt a burn down rate of 100mm/hr over the full bund surface area	Dependant on bund surface area and time. (e.g. 12,000 litres for a 60m ² bund after 2 hours)	Available volume is time dependent
2	Raise bund height	Raise bunds to a height to meet risk assessment containment volumes.	Minimum 5000 litres or 100mm above oil volume (whichever is greater) - maximum depends on maximum allowable bund height.	Higher bunds mean greater heights for persons to traverse into the bund. This may create a WHS risk. Higher bunds may not be feasible where existing equipment doors or gauges need to be accessed.
3	Provide controlled overflow into neighbouring bunds	Needs connection to neighbouring bunds via pipework valves or underflow weirs.	Available volume has to be calculated for each site but will be approximately 40,000 litres.	<p>Some residual fire risk to neighbouring assets if the overflow control is normally "open".</p> <p>Flame may be transferred. However, fire brigade will be on site to manage any fire that propagates to adjoining bund.</p> <p>Foam is corrosive. Some damage may occur to the neighbouring assets.</p> <p>Would require a clean-up after an incident.</p> <p>Extensive pipework may be required where bunds are not adjacent to one another.</p> <p>Preferred only where FSWs are in place.</p>
4	Provide an overflow area	Requires drainage paths to direct flow to the containment area. Requires installation of appropriate signage and warnings.	Limited only by site constraints. (topography and site use).	<p>Suitable containment area shall be available at the site.</p> <p>Difficult to achieve at brownfield sites due to topography and space.</p> <p>Requires a clean-up of the area following an incident.</p>
5	Direct overflow to the cable basement	Requires the basement to be made watertight or keep a zone 300 mm from the floor penetration free. Requires appropriate shut off valves and	Depends on the basement size. In excess of 30,000 litres.	<p>Some residual fire risk to cable basement if the overflow control is normally "open".</p> <p>Corrosive foam could cause damage to the assets in the basement.</p>

Options	Containment method	Detailing requirements	Additional containment available	Disadvantages
		<p>additional drainage lines.</p> <p>Requires appropriate warning alarms to evacuate the basement.</p>		<p>Requires extensive pipework.</p> <p>Many sites do not have suitable cable basements.</p> <p>Requires a clean-up of the area following an incident.</p>

E2 Greenfield Sites with Tanks (EGOWS)

Where the site has a tank that the bunded areas can drain to by gravity, the following options in order of preference shall be assessed.

Options	Containment method	Detailing requirements	Additional containment available	Disadvantages
1	Utilise the freeboard in the tank	<p>Needs the tank outlet shut off valve to be fitted. The valve is to be shut prior to application of fire-fighting medium.</p> <p>Needs the drainage system from the bunds to the tank to be watertight to prevent oil loss.</p> <p>All pit lids shall be raised to bund height. Where this is not feasible, pit lids shall be bolt down and gas tight.</p>	<p>Approximately 5000 litres.</p> <p>Actual volume depends on the tank size.</p>	<p>It may not be practical to raise pit lids to bund height.</p> <p>Needs bolt down covers which are a minor inconvenience for maintenance, Covers may not be installed correctly after they are opened.</p> <p>Gas tight covers are not specifically designed for uplift and some residual loss of oil though the lids may occur.</p>
2	Provide controlled overflow into neighbouring bunds	<p>Needs connection to neighbouring bunds via pipework, valves or underflow weirs.</p> <p>Needs a shut off to the tank inlet.</p> <p>Needs a watertight drainage system between bunds and the tank, to prevent oil loss.</p> <p>All pit lids shall be raised to bund height. Where this is not feasible, pit lids shall be bolt down and gas tight.</p>	<p>Available volume has to be calculated for each site but will be approximately 40,000 litres.</p>	<p>Some residual fire risk to neighbouring assets if the overflow control is normally "open".</p> <p>Flame may be transferred. However, fire brigade will be on site to manage any fire that propagates to adjoining bund.</p> <p>Foam is corrosive. Some damage may occur to the neighbouring assets.</p> <p>Would require a clean-up after an incident.</p> <p>Extensive pipework may be required where bunds are not adjacent to one another.</p> <p>Preferred only where FSWs are in place.</p>
3	Utilise the freeboard in the tank and raise bunds	<p>Same as option 1, except for the addition of raised bunds.</p>	<p>Limited by bund height restrictions on site</p>	<p>Same as option 1, except the increased WHS risk of raising bunds shall be considered.</p>

Options	Containment method	Detailing requirements	Additional containment available	Disadvantages
4	Provide an overflow area	Requires tank outlet pit outlet shut-off valve. This will direct flow to another area. Alternatively, the tank can overflow to the secondary containment area and the outlet from that area is provided with a shut off valve.	Limited only by site constraints (topography and site use).	Suitable containment area shall be available at the site. Would require clean-up after an incident.
5	Direct overflow to the cable basement	Requires the basement to be made watertight - or keep a zone 300 mm from the floor penetration free. Requires appropriate shut off valves and additional drainage lines. Requires appropriate warning alarms to evacuate the basement.	Depends on the basement size. In excess of 30,000 litres.	Some residual fire risk to cable basement if the overflow control is normally "open". Corrosive foam could cause damage to the assets in the basement. Requires extensive pipework. Some sites do not have suitable cable basements. Would require a clean-up after an incident.

E3 Brownfield Sites with Tanks (Single Stage, Three Stage or Other)

Where the site has an existing tank that will be re-used when upgraded, the following options in order of preference shall be assessed.

Options	Containment method	Detailing requirements	Additional containment available	Disadvantages
1	Utilise the freeboard in the tank	Needs a tank outlet shut off valve to be fitted. The valve is to be shut prior to application of fire-fighting medium. Needs a watertight drainage system.	Approximately 5000 litres. Actual volume depends on the tank size.	Potentially expensive. Existing drainage lines may not be watertight in most, if not all, cases. Pit lids would need to be raised, or be bolt down and gas tight
2	Provide controlled overflow into neighbouring bunds	Needs connection to neighbouring bunds via pipework, valves or underflow weirs. Needs a shut off to the tank inlet. Needs a watertight drainage system between bunds and the tank, to prevent oil loss. All pits shall be raised or have bolt down and gas tight lids.	Available volume has to be calculated for each site but will be approximately 40,000 litres.	Some residual fire risk to neighbouring assets if the overflow control is normally "open". Flame may be transferred. However, fire brigade will be on site to manage any fire that propagates to adjoining bund. Foam is corrosive. Some damage may occur to the neighbouring assets Potentially expensive. Existing drainage lines may not be watertight in most, if not all, cases.

Options	Containment method	Detailing requirements	Additional containment available	Disadvantages
				<p>Would require a clean-up after an incident.</p> <p>Extensive pipework may be required where bunds are not adjacent to one another.</p> <p>Preferred only where FSWs are in place.</p>
3	Utilise the freeboard in the tank and raise bunds	Same as option 1, except for the addition of raised bunds.	Limited by bund height restrictions on site.	Same as option 1, except the increased WHS risk of raising bunds shall be considered.
4	Provide an overflow area	<p>Requires tank outlet pit outlet shut-off valve. This will direct flow to another area.</p> <p>Alternatively, the tank can overflow to the secondary containment area and the outlet from that area is provided with a shut off valve.</p>	Limited only by the site constraints.	<p>Suitable containment area shall be available at the site.</p> <p>Containment areas will require maintenance and monitoring.</p> <p>Would require a clean-up after an incident.</p>
5	Direct overflow to the cable basement	<p>Requires the basement to be made watertight.</p> <p>Requires appropriate shut off valves and additional drainage lines to divert flow to the basement.</p> <p>Requires appropriate warning alarms to evacuate the basement.</p>	<p>Depends on the basement size.</p> <p>In excess of 30,000 litres.</p>	<p>Some residual fire risk to cable basement if the overflow control is normally "open".</p> <p>Corrosive foam could enter and cause damage to the assets in the basement.</p> <p>Requires extensive pipework.</p> <p>Many sites do not have suitable cable basements.</p> <p>Would require a clean-up after an incident.</p>

Annexure F: PPS Oil Separator Design and Installation Requirements

F1 General

- F1.1 The PPS unit installed in major substations for Ausgrid is the Tasman Water EnviroSEP OS 7500 Oil Separator, or approved equivalent. Reduced capacity Tasman Water separators are acceptable for smaller treatment areas.
- F1.2 The PPS system shall be correctly installed and fully commissioned on site with a minimum 12 months defects liability period to ensure effective long term operation of the system.
- F1.3 The design principles are consistent across all substations with variations to the final placement of some components due to local equipment and conditions.

F2 Parallel Plate Separator Design and Installation

- F2.1 The EnviroSEP OS 7500 Oil Separator Unit is made of 304 Grade Stainless Steel and designed to operate at a maximum flowrate of 5000L/hr. Welding uses mild steel rods as standard, with stainless steel available on request.
- F2.2 The EnviroSEP OS 7500 Unit is 2.1m x 1.86m x 1.175 m high and weighs 550kg empty and 2400kg when full.
- F2.3 The PPS oil separator can be used with inlets from up to four bund pumps. Each pump is set at an equal proportional flowrate so as not to exceed the maximum 5000L/hr at the PPS inlet. Hence, the Total System Capacity of 5000L/hr = F (proportional single flowrate) x N (Number of sump pumps).
- F2.4 The required flowrate for various combinations of pumps is indicated below. All pumps shall have the required flowrate indicated on the Pump ID label, located near the pump.

Table F1 – Flowrates for the EnviroSEP OS 7500

Description	Required Flowrate L/hour	Allowable Range L/hour
1. Single Pump Sites		
One pump operating	2,500	2,400 – 2,500
2. Multi-Pump Sites		
All pumps operating	5,000	4,900 – 5,000
One of two pumps operating	2,500	2,400 – 2,500
One of three pumps operating	1,700	1,600 – 1,700
One of four pumps operating	1,250	1,150 – 1,250

- F2.5 Where site conditions allow, all pipes carrying water shall be installed inside the bund area to enable leaks to be contained.
- F2.6 All conduits and termination boxes for electrical cables shall be in accordance with AS 3000.
- F2.7 Each pump is to be supplied by a dust-tight, immersion-proof (rated IP67 or above) 10A 240v Switched Outlet accessible from outside the bund.
- F2.8 The PPS shall have a dedicated 240vAC 20Amp supply from a 20A Combination Circuit Breaker and RCD (Safety Switch) on the Substation main AC Board and be labelled at both ends to identify the circuit. When commissioned, a single Alarm shall be operational to the System Control Room, with the contact phone number marked on the Control Panel. The Alarm shall have the provision inside the Control Panel of being made “Non-Auto” during servicing.
- F2.9 The PPS oil separator tank shall be located in a bunded area and mounted on four 50mm x 15mm threaded mounting studs so as to provide a height adjustment nut below the support bracket and a locknut above.

- F2.10 The Control Panel shall be mounted to be accessible from outside the bund area. The Control Panel door shall be lockable with a lock type that enables fitting of a suitable Abloy lock.
- F2.11 The PPS shall have all outflow 50mm Kamlock fittings located for the easy connection of tanker hoses from the front. Where the PPS is located in confined areas, the use of a detachable 900 elbow with Kamlock fittings is acceptable.
- F2.12 Each bund pump shall have a flexible hose approximately 500mm long (end fittings excluded) to suit the site constraints and located on the outlet side only. Each pump outlet shall have a ball valve between the flexible hose and rigid pipe. Each pump shall have a stainless steel weatherproof cover that can be easily removed for servicing and is fitted with ventilation louvres on three sides adjacent to the motor vents. The pump cover is to be hinged on the opposite side to the pump pulleys.
- F2.13 Where cables are installed in metal pipes or covers, the ends shall be bushed to prevent cable damage.
- F2.14 The discharge of the PPS shall be directed to the transformer roadway or other well drained areas and shall allow sufficient space for future sampling. The discharge shall not be connected directly to stormwater pipes or pits. Site drainage shall be arranged so as to avoid long term ponding directly in front of the Control Panel.
- F2.15 The Control Panel shall have an Auto/Off Selector Switch for the PPS Alarm circuit. A Control Panel Operations Manual and PLC logic diagrams shall be available to enable the interrogation and calibration of the Control Panel PLC. An electrical circuit diagram for the Control Panel shall also be available in order to facilitate connection of sensors etc by qualified persons.

F3 PPS Manufacturer Installation Requirements

F3.1 General

- Installation Electricals shall comply with AS 3000. The installing electrical Contractor shall provide to the Project Manager a Certificate of Completion - Electrical Works (CCEW) to confirm compliance with AS 3000.
- Pump installation A flexible hose of approximately 500mm in length (end fittings excluded) and correct diameter on the discharge side only of the pump.
- Level Floats Pump start and stop settings are to be to Ausgrid standard detail. The high level float shall operate at the maximum height in the sump just below the grate level.

F3.2 Electrical Requirements

Table F2 - Electrical Requirements for PPS Systems

Item	Description	Rating	Minimum Requirements
Supply	20A RCD Unit on Sub AC Board to Control Panel	240vAC 20A	1 x 3 core cable
SCADA	Sub SCADA to Control Panel	110vDC	1 x 2 core cable
	Sub SCADA to Control Panel		1 x 4 core fibre cable
Floats	Junction Box to each Float	24vAC	1 x 2 core cable per float
	Junction Box to Control Panel	24vAC	1 x 6 core cable
Pumps	Control Panel to each Pump Motor Supply Outlet	240vAC 10A	1 x 3 core cable per pump

F3.3 Pump Installation

ASM diaphragm pumps shall be used on all sites to reduce the requirement for spares. Other pump sizes can be used where specific site conditions dictate.

The pump motor shall be covered to the details shown on the project drawings.

F3.4 **Pipe Installation**

Pipes shall be as specified on the project drawings. The pipe size shall match the manufacturer's recommendations.

Annexure G: Oil Separator Inspection Requirements and Hold Points

Table G1 - Oil Separator Inspection Requirements and Hold Points

Type	Inspection	When Inspection is required	Relevant details	Inspection items	Inspected by
1. EGOWS Oil Containment Tanks					
Civil	Survey of the pipe penetrations	When pipes are in forms and prior to pouring concrete	Project Design Drawings	Tank inlet and tank outlet pipes are set at the correct invert level.	Contractor
	Placement of oil resistant water-stop seals	Prior to concrete pour all shutters being placed to allow for the viewing of the seal.	Project Design Drawings	Check the placement of water-stop seal on all joints and pipe penetrations as required on the drawings.	Engineering - Civil & Building
	External tank inspection	Prior to backfilling	Project Design Drawings	Check to make sure there are no damp spots when the tank is filled to the outlet invert. Check for no cracks above the outlet invert level.	Engineering - Civil & Building
	Final Survey	On completion	Project Design Drawings	Survey the installed; - Outlet pipe IL if fitted - Orifice IL - Outlet pipe IL - Tank base RL at the ends and the middle	Engineering - Survey
2. Parallel Plate Separators					
Civil	Bund Sumps	To be inspected after pouring the sump base and portion of wall in one pour and oil resistant water-stop seal in place.	Project Design Drawings	1. Joint is at correct height 2. Reinforcement is correct 3. Oil resistant water-stop seal is correctly placed	Engineering - Civil & Building or External Design Engineer (See Notes 1 and 2)
	Bund Floor and Wall Reinforcement	To be Inspected once reinforcement and the oil resistant water-stop seals have been placed	Project Design Drawings	1. Reinforcement is correct 2. Falls are correct 3. Oil resistant water-stop in place	
	Anti-Climb devices and Electrical Safety Clearances	During installation of anti-climb devices and on completion of the works.	Project Design Drawings	1. Location and design of anti-climb device. 2. Check safety clearances to all nearby exposed HV.	
Mechanical	Pipes and Pumps	On delivery to site and before installation	Pump and pipe size table on Project Design Drawings	1. Check drawings and flowrate 2. Arrange Work Order No. for site from SAP	Project Manager

Type	Inspection	When Inspection is required	Relevant details	Inspection items	Inspected by
	Installation	During installation	Project Design Drawings	1. Monitor installation of oil containment system	
Electrical	AS3000	Following wiring installation by Licenced Electrician	AS3000 and Project Design Drawings	1. Check position of Control Panel, Junction Boxes, etc 2. Check Pumps / Float switches have plugs & sockets 3. Obtain Certificate of Completion - Elec Works (CCEW)	Project Manager
Testing	Separator Test and Settings	Whilst manufacturer is field checking and setting	O&M Manuals	1. Check unit bolts and levels (side to side / front to back). 2. Adjust settings (Weir, Thimble etc), 3. Check High Oil Alarm and Shut-Off function	Aqueous Waste Services & PPS Manufacturer
Commissioning	Final Checks and Acceptance	On Practical Completion	Project Design Drawings	1. Check labels are correct and in place, 2. Check Pipes, Pumps and Valves operate without leaks, 3. Float switches are not obstructed, 4. All defects and Alarms OK.	Aqueous Waste Services
	Data Entry into SAP	On Practical Completion	Final Inspection Report	1. SAP entry as completed.	Project Manager

¹ Where the structural design is undertaken by an external consultant, the commissioning inspections shall also be undertaken by that consultant.

² Inspections of Anti-Climb devices and Electrical Safety Clearances shall be undertaken by Engineering - Substation Design.

