

# AM 2757: Specification for Covers for Underground Structures

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## Document History

Version No.	Date	Author	Version Description
1.0	<i>Feb 2018</i>	<i>R. Jagger</i>	<i>First Revision</i>
2.0		<i>R. Jagger</i>	<i>Miller product ref update</i>
3.0	<i>Oct 2021</i>	<i>R. Jagger</i>	<i>Section 1.5 and section 2 added</i>

# 1. INTRODUCTION

## 1.1. Purpose of Specification

The purpose of this specification is to document the requirements of covers for underground structures.

Through adoption of this documented standard, SEW is looking to optimise the following:

- Cost of construction
- Prevention of falls (to workers and members of the public)
- Ergonomics of people accessing items of equipment in underground structures
- Visual considerations
- Traffic considerations
- Structural considerations
- Odour considerations
- Life expectancy considerations (ie: UV, chemical resistance etc)
- Whole of life condition assessment and asset management

## 1.2. Scope of Specification

This specification is to apply to all water and sewerage underground structures which contain mechanical and / or electrical items at or near atmospheric temperature. It is relevant to underground structures which require regular access, whether the structures be located under a building or outdoors.

It is to be applied to all new underground structures and any underground structures which are being upgraded.

It is **not** appropriate for:

- Rarely (less often than once every 2 years) opened structures such as Sewage Maintenance Holes.  
Covers for these structures are covered by MRWA-S-313
- Openings which are not horizontal
- Very large openings (ie: openings > 20m<sup>2</sup>)
- Openings over high temperature, high / low pressure or very corrosive gases
- Openings which are not at ground level (eg: elevated covers or tank side access covers).

Where prefabricated structures come with their own proprietary cover system, approval will be required from SEW to use the proprietary cover system unless it meets the requirements of this specification.

This specification does not include detailed designs. Each situation is unique, and each cover system needs to be designed specifically for each site.

Registered Engineers using this standard are responsible under the Professional Engineering Act to determine if this is a prescriptive standard. SEW guidance is that some engineering judgement is required to use this standard and that this standard is unlikely to fulfill the requirements of a prescriptive standard.

### 1.3. Key References

The following key references provide further information relevant to this specification:

- MRWA Products Portal (SEW products listing)
- AM2884- Pit Standard
- AM2035- Lifting of Sewer Maintenance Covers Procedure
- AM2773- Sewage Air Valve Standard
- AM2760- Stainless Steel Specification
- AM2035- Lifting of Sewer Maintenance Structure Covers Procedure
- AS 1657- Fixed Platforms, Walkways, Stairways and Ladders
- SEW Sewage Pump Station Standards

Any cover requirements stipulated in standards specific to particular asset classes (eg: Air Valve, Pit or Sewage Pump Station standards) shall take precedence over the requirements stated in this standard.

### 1.4. Cover Types and Selection

South East Water has four design options for underground chamber covers, which includes:

- 1) Fabricated metal covers
- 2) Multi-part ductile iron covers, and
- 3) Turret top covers
- 4) FRP covers (these are not typically used except in treatment plants)

The following process shall be adopted in selecting the optimum cover system:

- A. The designer shall determine the approximate location, approximate size and a concept design for the underground chamber and cover system
- B. The designer shall complete the Appendix A selection matrix and submit a copy of this and the concept design plan(s) to SEW's design team for review
- C. The final location of the underground chamber and the Appendix A selection matrix is finalised and the outcome agreed to by SEW's design team

For Design and Construction projects, this work shall be completed during the tender or costing phase so to ensure that the correct cover systems is allowed for.

The main issues to consider when deciding on the optimum cover system include:

- whether the covers are required to be trafficable
- life cycle cost and required asset life
- maintenance and community risks associated with the structure
- the risk of fugitive emissions from the structure
- the location of the structure relative to features in the neighbouring environment

## 1.5. Features Summary

Cover system requirements are summarised in Table 1 below:

Feature	Fabricated Metal Covers	Multi-part Ductile Iron Covers	Turret Top Covers
Trafficable areas		✓	
Non-trafficable areas	✓		✓
Permanent guard rails	✓		
Temporary guard rails		✓	
Ground level standing area within guard rail enclosed area	✓	✓	
Fall protection davit arm insertion sleeve(s)	✓	✓	✓
Under cover fall arrest grating with removable sections to access items		✓	
Post & winch capability for covers > 20 kg	✓		✓
Lifting chains for covers <=20 kg	✓		
Lifting handles for covers	✓		✓
Above ground operation of chamber enclosed critical isolation valves	✓	✓	✓
Covers labelled with content below	✓	✓	✓
Restrained while open	✓		
Hardstand area around the opening	✓	✓	✓
Lockable with standard SEW lock	✓		✓
Cover seals	✓		✓
Low odour risk	✓		

## 2. GENERAL REQUIREMENTS

### 2.1. Opening and Cover System Footprint

To facilitate SEW's consideration of the optimum cover system, the designer shall provide SEW with an initial plan of the equipment and chamber / pit outline with preferred dimensions of the opening's footprint that will need to be covered.

The opening and cover system footprint shall:

- Enable high maintenance equipment in the underground structure to be replaced by raising the equipment vertically from its installed position, with a minimum clearance between the equipment's outline and the opening's perimeter of 100mm.
- Enable the required worker access into the structure. As per AS 1657, a 750 x 750 working space is required from the front edge of any ladder at the top and bottom of the ladder. Should worker access to the chamber be via a craned workbox, the opening shall be sufficiently large to facilitate a workbox of appropriate size being lowered into position. A minimum clearance between the craned workbox outline and the opening's perimeter of 200mm shall be provided in such cases.
- Provide the above clearances while other fixtures and fittings (eg: pump chains, junction boxes, instruments) are located in their normal operating position.

### 2.2. Above Ground Operation of Below Ground Items

Where practical, below ground covered items which require frequent or critical manual operation shall be operable from ground level when the cover(s) are either open or closed. Underground chamber located items that require this include but are not limited to:

- Air Valve isolation valves
- Main in line isolation valves
- SPS non-return valve pit isolation valves
- Education point isolation valves
- Bypass valves (eg: around PRVs, flow meters, large divide valves etc)
- Penstocks and knifegate valves

This typically means that such valve spindles for these items shall:

- Be extended to just below cover level (< 100 from bottom of cover level)
- Be designed so that the valve has adequate lock out – tag out capability, eg: locking tabs
- Extend to this level using permanent spindle extension(s) which are designed and fabricated in accordance with standard drawings SEWL-STD-003 and 004.
- Where the top of the pit **includes both a fixed ceiling and cover(s)**, the spindle shall typically be brought through the ceiling to within a winding box which is cast into the ceiling/cover slab as per standard drawing SEWL-STD-004 and 006. This applies whether a turret top, fabricated metal or ductile iron cover system is used in conjunction with a ceiling.
- Where vertical spindle extensions **are located within an opening**, they shall be mounted such that they are 100 to 200 from the edge of an opening. This may require one or more 90 degree spindle gearboxes to enable. In this way, the valve shall be operable from ground level while cover(s) are open, with the operator able to stand outside the fall protection system, place a valve key or hand

wheel on the spindle and rotate the spindle without the valve key or handle interfering or clashing with any above ground assets (fall protection assets in particular).

- For fabricated metal and multi-part ductile iron covers where vertical spindle extensions **are located within an opening**, they shall be operable from ground level while the cover system is closed.
- Fabricated metal covers without ceilings will require a small (~100 x ~100) opening located centrally above the extension spindle with a separate hinged cover for this opening. This small hinged cover shall be constructed of metal plate and utilise a 3mm SS316 piano hinge with a recessed SS round finger edge pull insert adjacent to the edge opposite the hinge.

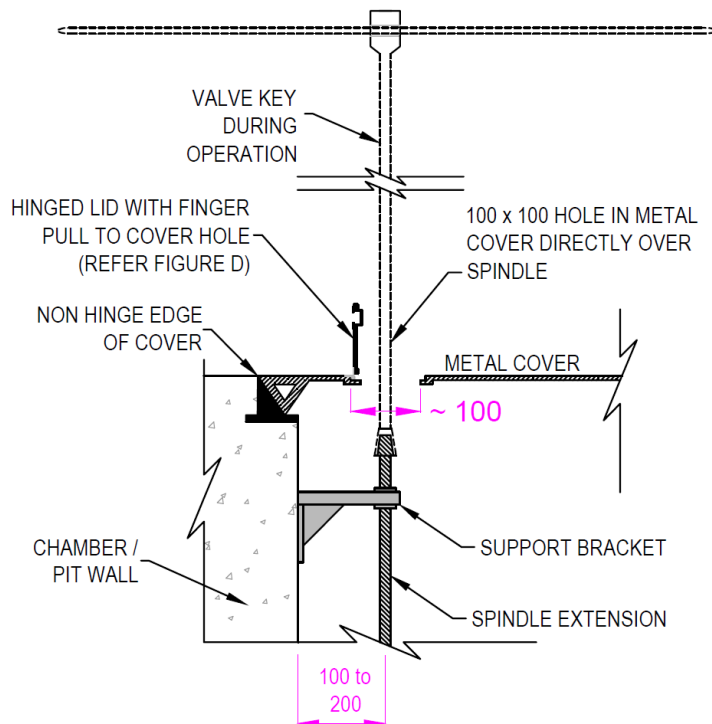


Figure 1: Spindle Extension to Fabricated Metal Cover Opening

- Turret Top covers without ceilings will require a handwheel with attached short spindle extension which could be placed on the permanent spindle extension (which will extend to just under bottom of cover level) for valve operation. This handwheel and short spindle extension shall be restrained to the spindle so it is accessible while standing at ground level and not able to fall. Stainless Steel crimps shall be used in lieu of copper crimps on any braided stainless steel restraint cable.

While not in operation, any handwheel with attached short spindle extension should be stored in such a way that it is secure, would not fall and would not interfere with the removal of frequently maintained items (such as submersible pumps). Typically, the best storage location is at the corner of the turret top where there is greater clearance from items during their removal. Alternatively locate the handwheel with attached short spindle extension in a nearby cabinet.

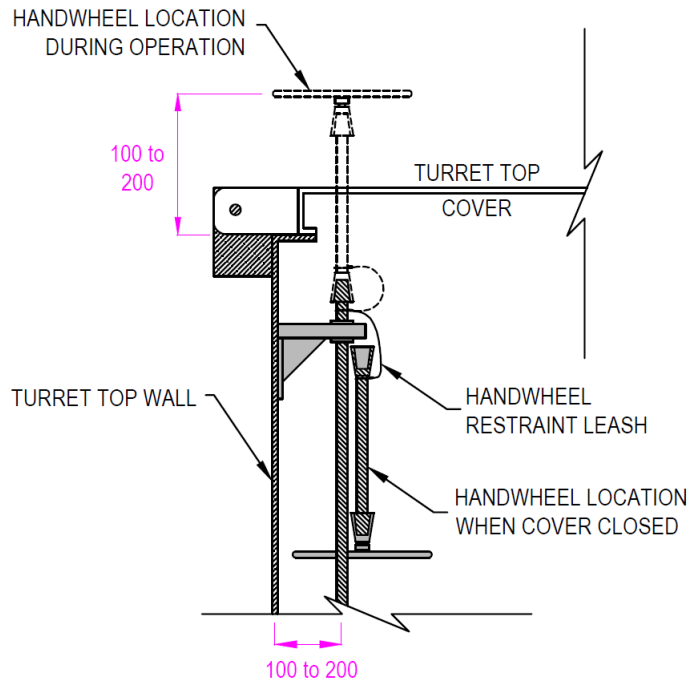


Figure 2: Spindle Extension to Turret Top Opening

- Multi-part Ductile Iron covers without ceilings will require a small (ie: ~50 diameter) circular opening to be cored through the cover which is to be fitted with a removable plug. Contact the cover supplier for advice on the proper location and size of holes to be cored. Typically, holes shall be cored in the “pocket” of the cover which is the space clear of structural strengthening ribs. Spacing between ribs varies, but is typically 50 (for 900 long covers) or 80 (for 450 and 600 long covers). Care should be taken to ensure support beams and cover ribs are not directly over the spindle, but that a cover’s “pocket” is directly above the spindle. Fall protection systems shall not impede or interfere with spindle operation when covers are either open or closed.

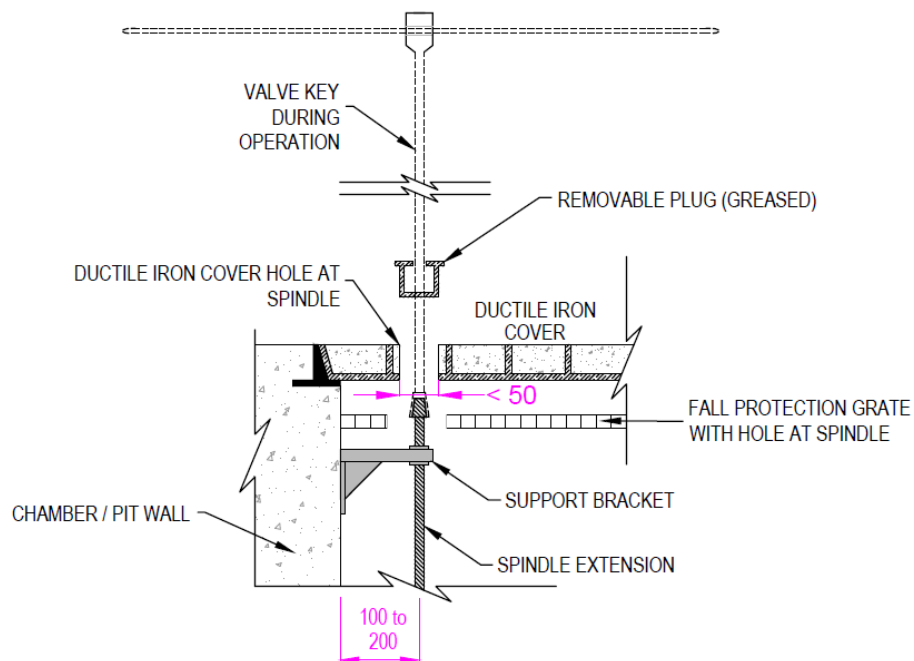


Figure 3: Spindle Extension to Ductile Iron Covered Opening



## 2.3. Cover Labelling

All multi-part covers shall be labelled with the chamber / pit contents below that cover. Equipment naming shall be consistent with the equipment naming convention described in AM2775- WaterShed Data Collection Details and Appendix A of AM2714- Electrical Standards. Engraved labels with text > 10mm high are preferred to printed labels.

## 2.4. Cover Level

All covers shall be set at a level that is 150 above the 1 in 5 year flood level. The covered area shall clearly drain away from the covers. Where practical, this shall be undertaken by grading the finished surface down from the covers on all sides at a grade steeper than 1 in 60. No ponding of water over the covered area is acceptable.

## 2.5. Winch Requirements

All fabricated metal and turret top covers > 20kg in weight shall be provided with the capability to be winched open and closed with a winch system that has the following features:

- Is constructed of stainless steel (at least the structural and mechanical elements)
- Consists of a pole mounted winch where the pole can be inserted into below ground sleeves.
- Sleeves may need to be inserted into core drilled holes within the a cover's existing concrete slab and shall be below ground. Sufficient clear cover of the sleeve hole and opening shall be provided.
- Sleeves shall consist of hot dipped galvanised or stainless steel sleeve, 5mm wall thickness, cast or epoxied in place, with a plastic soil exclusion cap.
- Provides a single sleeve directly behind every cover that is > 20kg on weight.
- Sleeve must be of the appropriate internal diameter for the pole mounted winch and crane provided.
- Mobile pole mounted winch and crane shall be kept on site in a cabinet where practical. Where another cabinet exists in site, it is preferred that this be extended to accommodate the winch crane.



Figure 4: Example of winch set up for fabricated metal covers > 20kg in weight. An in-ground sleeve located behind each cover is with a single mobile post and winch is acceptable in lieu of multiple fixed winches

### 3. FABRICATED METAL COVERS

Fabricated metal covers are a relatively economic option in non-trafficable, low odour situations. They do not provide for ergonomic access to below ground mechanical and electrical equipment from a standing position as turret top covers do. Refer to Attachment B (sheet 1) for the attributes of this cover system. The materials and characteristics of fabricated metal covers are typically as follows:

- 1) Aluminium.
  - a. High strength and stiffness to weight ratios.
  - b. Less durable than alternatives but typically adequately durable unless the covers are regularly opened or subject to mechanical impacts.
  - c. Good corrosion resistance.
- 2) Galvanised plain carbon steel.
  - a. Lowest cost alternative, depending on coating system employed.
  - b. Lower strength and stiffness to weight ratio than aluminium and will often require mechanical assistance to lift.
  - c. Durable and impact resistant.

- d. Poor corrosion resistance and reliant on high quality coating systems. Refer to WSA 201 for selection and application of protective coatings. Required to be galvanised and epoxy coated.
  - e. Not to be used in situations where covers are exposed to sewage, corrosive gases or sea spray.
- 3) Stainless Steel.
- a. Similar mechanical properties to plain steel covers.
  - b. Highest corrosion resistance (depending on grade- refer AM2760).
  - c. Highest cost alternative.

Aluminium covers are typically preferred unless covers are small (and weight not an issue even for other cover materials) or mechanical lifting assistance is required, even if aluminium covers were selected.

### 3.1. Requirements

Fabricated metal covers shall be:

- Used only where there is a **low risk of odour** impacts. Fabricated metal covers may warp during fabrication, warp during their operational life and the rubber seals tend to compress over time, creating gaps in the cover joins from which odours can escape. This makes fabricated metal covers **inappropriate** for structures which contain odour that may negatively affect customers.
- **Non-trafficable**. They shall only be used inside a building or within an area protected from traffic.
- Usually the **best option within buildings**, unless odour gases leaking from the underground chamber into the building may be a risk.
- Located at, or slightly above **ground level**
- Used in conjunction with **permanent guardrails**.
- Wherever possible be hinged and lightweight such that **one person can lift** the cover (ie: < 20 kg each cover). Where cover weight exceeds 20 kg, winch capability shall be provided for each cover to enable the safe operation of the cover (refer section 2.5).
- Designed to ensure that they will in **no way clash or obstruct nearby structures** or items when the covers are opened and closed. This can often be a problem if fabricated metal covers are located adjacent to a turret top cover system.
- **Locked** (as per the SEW's Facility Security requirements) with a standard SEW shank lock when located outside to prevent unauthorised access.
- Designed to ensure that there is no more than a **5mm deflection** when a 1 kN (100 kg) is placed anywhere on any cover.
- All **handles and locks should be recessed** below cover level so they do not sit proud and create a potential tripping hazard.
- Covers shall not be openable **beyond nominal 120 degrees** to avoid the cover becoming a tripping hazard when open or taking up more space than necessary. Normally, permanent guardrails limit the degree to which covers can open.
- **Restrained in the open position** using a quick catch / release mechanism (eg: SS wire and carabineer or galvanised steel welded link chain) which enables covers to be easily attached to the permanent guardrails. This mechanism shall be sufficiently sturdy that strong winds and large horizontal forces on the cover will not cause the restraint to fail.
- Provided with **lifting chains**, constructed of minimum 2mm thick galvanised or stainless steel welded link chain, fixed to the outer edge of the cover and tied off on the permanent guardrail opposite.

- Lifting chains and cover restraints shall **consider ergonomics**.
- Designed to enable items within chambers/pits to be operated as described in section 2.2.
- Inclusive of fall-from-heights protection as described below.

### 3.2. Fall Protection

Fall protection associated with fabricated metal covers shall:

- Be provided when the underground structure is deep (ie: > 1.5m).
- Comply with the requirements indicated in Figure 5.
- Include the provision of **permanent guardrails** which shall:
  1. comply with AS 1657 (fixed platforms, walkways, stairways and ladders) where practical.
  2. constructed of galvanised steel to AS/NZS 4680 and AS 2309 or grade 316 stainless steel.
  3. Include  $\geq 100$ mm high kick plates at ground level.
  4. Have a latched hinged gate to provide access through the guardrail to any internal ladder within the structure. This gate shall swing outwards and be spring loaded to automatically return to the closed position after use. Gates shall be between 600 and 750mm wide.
  5. Have posts securely fastened to the cover slab, each with a minimum 4 fasteners which comply as a minimum to MRWA sewerage standard figures 314-F or 314-G.
- Provide sleeve(s) for davit arm insertion which shall be:
  1. Miller Flush Mount Floor Sleeve, model DH-20SS (for insertion into the top of new concrete slabs).
  2. Miller Floor Mount Sleeve, model DH-7SS (for attachment to the top surface of existing concrete slabs). Where these are used, they shall be carefully positioned to avoid becoming a tripping hazard.
  3.  $\geq 100$ mm clearance from the side of a ladder (out of the way of the ladder)
  4. As close as possible to the opening but also with at least 75mm edge distance between the sleeve and the opening to maintain adequate structural concrete around the sleeve.
- Temporary guardrail arrangements and under cover grating (refer section on ductile iron covers) may be acceptable where permanent guardrails will adversely impact on the functionality of the site. The use of an under cover grating fall protection system used in conjunction with fabricated metal covers requires South East Water approval.
- Provide a means to attach / restrain open fabricated metal covers to the guardrail system.

### 3.3. Cover Seals

Cover seals shall be provided for covers over chambers which may contain sewage.

Cover seals shall:

- Be attached to covers (not the main structure).
- Provide a gas tight seal between covers &/or opening edges. The gas seal shall be sufficient that when a piece of tissue paper is held near the seal during any normal operation of the site on a windless day, it will not noticeably flutter.
- Be non-perishable and proven to be resistant to a high hydrogen sulphide environment ie: constructed from EPDM or Neoprene.

- Be resilient and continue to provide an effective compressed seal under continual closure for at least 10 years.
- Have seals that neatly match the entire surface to which they mate.

### 3.4. Fabricated Metal Cover Examples

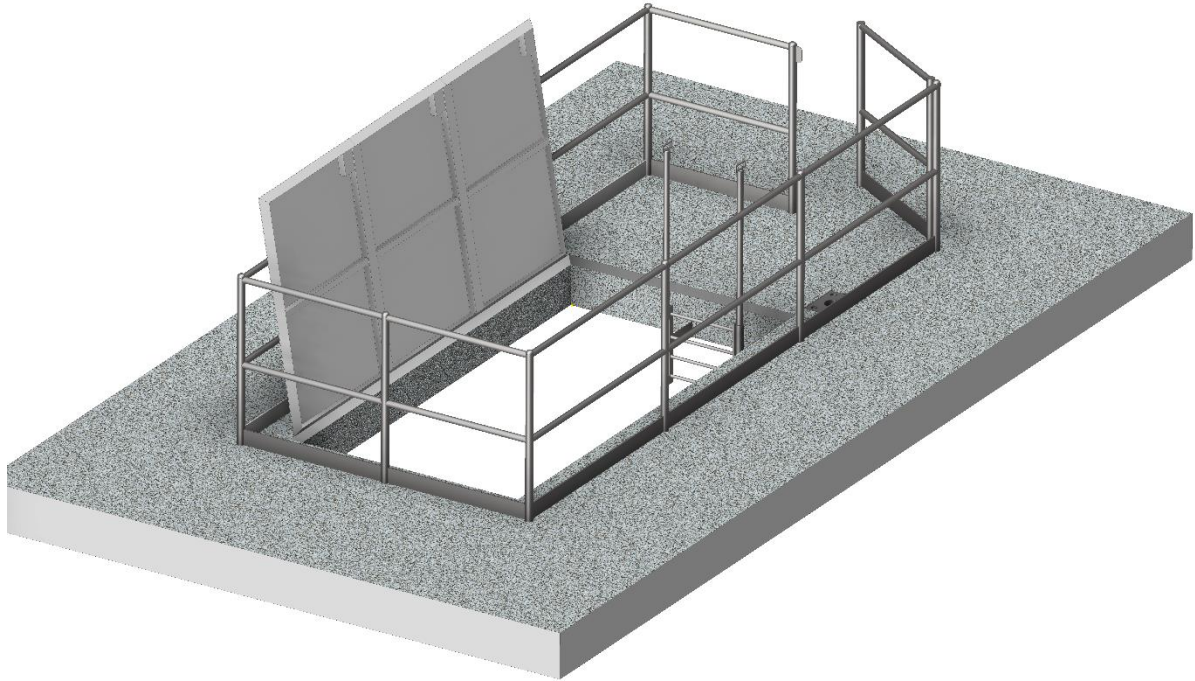


Figure 5: Set up of Fabricated Metal Covers with Fall Protection (refer Appendix B for details)



Figure 6: Example of aluminium covers with permanent guard rails inside a building. (Note: a ground level standing area in front of the ladder inside the guardrail area has not been provided in this example but shall be provided if practical. Refer Figure 1)



Figure 7: Example of external aluminium covers with permanent guard rails  
(Note: a ground level standing area in front of the ladder inside the guardrail area has not been provided in this example but shall be provided if practical. Swing gates to enable worker entry inside the guard rail area is also required. Refer Figure 1)

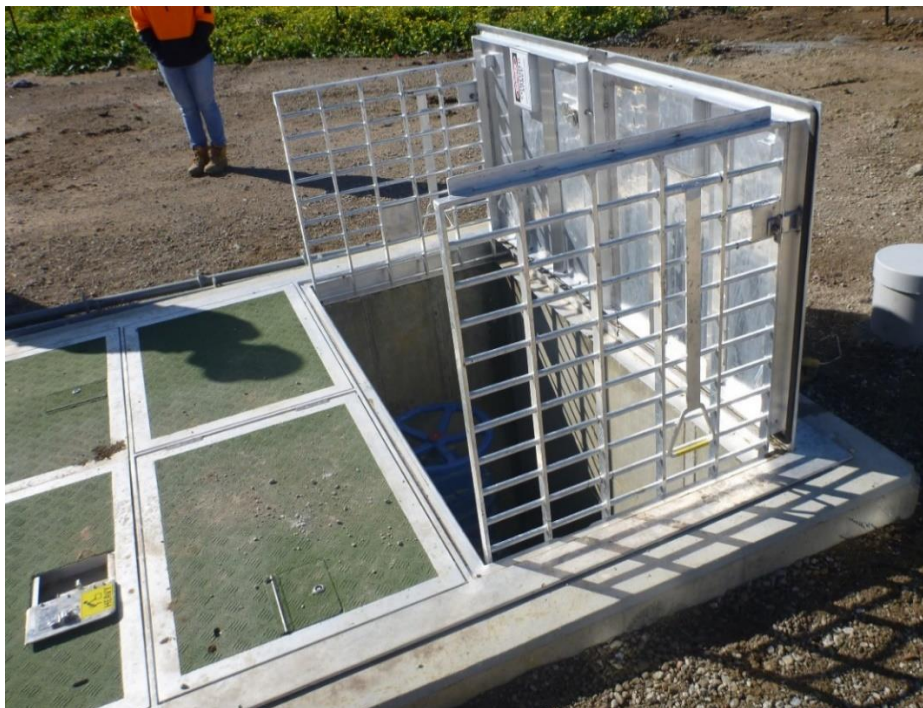


Figure 8: Example of **unacceptable** external aluminium covers with fold up guards.  
(Note: This arrangement would not be acceptable because fabricated metal covers require permanent guardrails)

## 4. MULTI-PART DUCTILE IRON COVERS

For single ductile iron covers, refer to MRWA-S-313 and 313B.

South East Water preferences are as follows:

- 1) Non-trafficable turret top and fabricated metal cover systems be adopted. The designer shall document and submit a compelling justification as to why any underground chamber or pit cannot practically be located in a non-trafficable location. This justification shall include a cost and risk assessment of the alternative options.
- 2) Single row multi-part ductile iron cover systems shall be utilised rather than multiple row system which require undercover support beams. Multiple row ductile iron cover systems are not typically permitted and require South East Water approval.

### 4.1. Requirements

Ductile iron cover systems have the following features:

- Provide **trafficable** covers.
- Secure from unauthorised access. Covers shall **require a specific lifting tool** to remove (ie: “gatic” lifters).
- Relatively heavy and so difficult for young children to move. (it is acknowledged that this also increases the manual handling risk to workers removing or reinstalling covers).
- Economic in appropriate situations.
- Provide a **gas proof seals** which is effective in preventing fugitive emissions.
- **Reliant on mechanical lifting aids** to lift the cover support beams when multiple row covers are used. For this reason, only single row multi-part cover systems are preferred.
- Multi-row cover systems with **cover support beams have a limited length**. Typically, class B cover support beams are limited to approximately 7m and class D cover support beams are limited to approximately 5m. In both cases, the cover support beam would be approximately 250mm deep.
- **Awkward to manage when there are many covers**. When they are removed, covers need to be stacked or moved to the side in order to maintain access to the structure. They can present a tripping hazard when not stored out of the way.
- **Unable to provide ergonomic access to below ground** mechanical and electrical equipment, ie: you must bend down to ground level to handle items under the covers.
- Not particularly resistant to **hydrogen sulphide attack** in extreme hydrogen sulphide environments.

Ductile iron covers shall be:

- Located at ground level.
- SEW approved products
- Conform to MRWA sewerage Table 313-E.
- Covers shall be no longer than 900.
- Tightly nested and greased to eliminate gaps through which odours can escape. Ductile iron covers are appropriate in situations where there is a significant odour risk.
- Installed such that there is **no** vertical displacement > 2mm which may create a tripping hazard.
- Inclusive of fall-from-heights protection as described below.

- Designed to enable items within chambers/pits to be operated as described in section 2.2

## 4.2. Hardstand Area

Multi-part ductile iron cover systems shall have a hardstand area around the opening which:

- Consists of hard pavement (eg: concrete or bitumen) for covers to be rolled to when removed
- Have a plan area equivalent to 1.5 x the opening footprint area
- Enable all covers to be removed and relocated without interfering with worker access to below ground items such as ladders, junction boxes, instruments, pump cables or raised spindles.

## 4.3. Fall Protection

Fall protection associated with ductile iron covers shall:

- Be provided when the underground structure is deep (ie: > 1.5m).
- Comply with the requirements indicated in Appendix B (sheet 2).
- Include the provision of three (3) items:
  1. Sleeve inserted into the cover slab for davit arm insertion, and
  2. Sleeves inserted into the cover slab for the insertion of temporary guardrail posts
  3. Under cover hinged grating
- Sleeves for davit arm insertion shall be:
  1. Miller Flush Mount Floor Sleeve, model DH-20SS (for insertion into the top of new concrete slabs). Model DH-7SS which is attached to the top surface concrete slabs and so is not suitable in trafficable situations.
  2. >100mm clearance from the side of a ladder (out of the way of the ladder)
  3. As close as possible to the opening but also with at least 75mm edge distance between the sleeve and the opening to maintain adequate structural concrete around the sleeve.
- A temporary guardrail system shall be provided for each opening which shall be:
  1. readily available off the shelf
  2. lightweight, with each element easily liftable by one person (ie: < 10 kg)
  3. compliant to AS 1657 (fixed platforms, walkways, stairways and ladders)
  4. Include >100mm high kick plates at ground level.
  5. structurally stiff and strong enough to withstand at least two people falling against the guardrail at the same time.
  6. stored within a powder coated aluminium cabinet which meets SEW's electrical cabinet requirements (refer AM2714). This cabinet shall be located within in a nearby non-trafficable area.
  7. Contain a ground level standing area >1m wide in front of the ladder which is inside the guardrail area (for workers connected to the davit arm fall protection system) to enter/exit the ladder.
  8. Have adequate clearance from switchboards in accordance with AS 3000.
- Sleeves for temporary guardrail insertion shall:
  1. Be located within 300mm of the opening but also with at least 75mm edge distance between the sleeve and the opening to maintain adequate structural concrete around the sleeve.
  2. Be constructed of 316 Stainless Steel



3. Be fitted with removable caps, set just below the top surface level
  4. Have an internal diameter compatible with the selected temporary guardrail posts.
  5. Have a depth > 200mm while still enabling the erected guardrail structure to achieve minimum height.
- Undercover hinged grating shall:
    1. Be hinged along the outer edge so that the grating can hinge upwards and out of the way of human entering the structure.
    2. Normally rest in the horizontal closed position against a load bearing positive stop.
    3. Rest in the open position against the cover slab or temporary guardrail, with a 316 stainless steel quick catch / release mechanism (eg: SS wire and carabiner) which enables the grating to be easily restrained in the open position.
    4. Consist of stainless steel (refer SEW stainless steel specification) mesh with bars (flat or round) at 100mm separation in both dimensions.
    5. Be designed to ensure that there is no more than a 5mm deflection when a 1 kN (100 kg) is placed anywhere on the grating.
    6. Not contain any openings / gaps wider than 200mm.
    7. Contain separate non-entry smaller openings above items (eg: junction boxes, raised spindles) that require regular access. A small hinged grate shall be provided to cover this opening, which shall be large enough to easily work on the below item but not large enough for humans to fall through (eg: < 300 diameter).

#### 4.4. Multi-part Ductile Iron Cover Examples

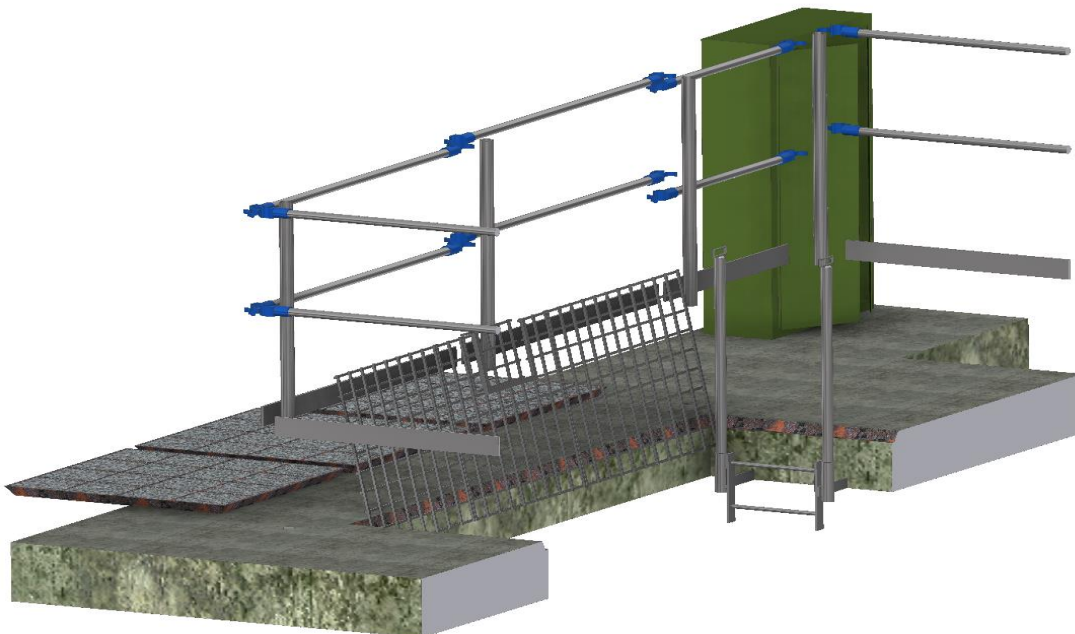


Figure 9: Ductile Iron Cover and Fall Protection Arrangements.  
Exploded isometric section view showing guardrail system suspended above the installed position.  
Refer to Appendix B for details



Figure 10: Example of Multipart trafficable concrete infill ductile iron covers  
(Guard rail system not yet installed)

## 5. TURRET TOP COVERS.

Turret top covers are the most common type of cover over pump wells. They provide safe, rapid and easy operations and maintenance access to equipment. They are typically used for larger pumps, or situations where odour risks are significant and the pumps are located in a non-trafficable area. Refer to Appendix B (sheet 3) for details.

Turret top covers are:

- A bespoke metal fabrication that mounts the covers at a handrail height above an underground structure cover slab.
- Able to provide solid **protection against accidental fall-from-heights** and confined space entry risks, even when the covers are fully open.
- Able to **prevent fugitive emissions** when the rubber seals are maintained and under compression.
- Able to provide **ergonomic access** to mechanical plant and electrical/instrumentation equipment, which shall be mounted at waist height where practical.
- **Expensive** relative to fabricated metal or ductile iron covers.
- **Possibly obstructive** to driver / rider / pedestrian visibility when located near roads.
- **Possibly detrimental** to the **visual aesthetics** of highly public neighbourhoods.

### 5.1. Turret Top Examples



Figure 11: Example of turret top close up (note: missing rubber door stoppers)



Figure 12: Example of turret top opened-up (next to aluminium covers opened-up)  
(Note that fabricated metal covers shown are not compliant)

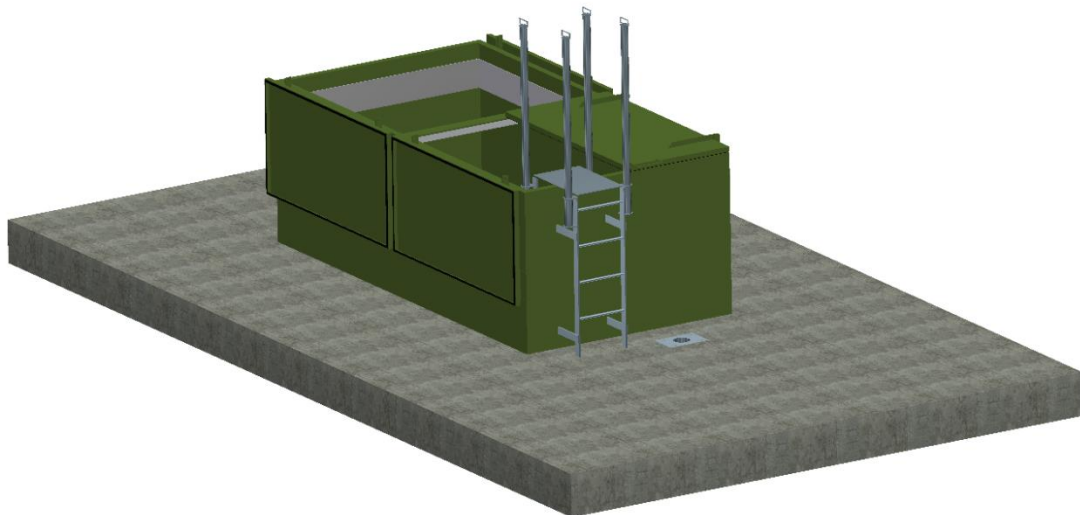


Figure 13: Turret Top Arrangements (isometric view)  
(refer to Appendix B for details)

## 5.2. Turret Top Risks and Controls

While turret tops effectively minimise work time, control fall-from-heights, control unintentional Confined Space Entry and various ergonomic and manual handling risks, other risks that need consideration include:

1) **Traffic Risks.**

When turret tops are located near roadways, they can hinder the visibility of drivers, riders and pedestrians. Such locations can also increase the need to protect the turret top from collisions with impact rated bollards or barriers, reducing access to the structure. These risks increase as the proximity and volume of traffic increases. The site layout design can reduce these risks, though in some cases trafficable covers may be preferable. Fences, gates and bollards can be used to reduce the risk of collision.

- 2) **Local aesthetic and community acceptance issues.**  
Turret tops may create aesthetic issues when located in or near high profile public land. Stakeholder consultation may be required to determine if there are any special requirements. In sensitive areas, the site layout design may be able to address such issues or the turret top may need to be painted in a particular way. Failing that, ground level covers may need to be utilized.
- 3) **Overhead cables.**  
As a crane is required to lift heavy items, such as pumps, over the turret top wall, clearance to overhead cables can be problematic. The designer needs to measure heights to overhead cables, consider electrical no go zones and crane boom heights and then calculate whether items can be safely removed with a turret top in place. If items cannot be safely lifted, ground level covers may be a viable alternative.
- 4) **Reduction in work space during opening of the covers.**  
Turret top covers need to be able to rotate through almost 270 degrees whilst still providing adequate space for workers to stand nearby as this occurs.

### 5.3. General Requirements

Turret tops shall be designed and manufactured:

- To prevent unintentional or unauthorised access to underground structures.
- To enable easy access to all mechanical and electrical items in the underground structure for maintenance activities.
- In a factory environment as much as practical.
- Such that all visible sheet metal / plate surfaces are powder coated 300 micron thick to Colourbond Rivergum gloss G62.
- Such that all coatings are applied in a factory environment where practical. Coating damage which occurs during transport or installation shall be checked as part of the ITP (Inspection and Test Plan) and reported to SEW once detected. Only minor coating damage (ie: < 5cm<sup>2</sup>) may be repaired on site.
- With folded seams / joins as much as practical. Remaining seams / joins shall be welded where practical unless the item needs to be removable, in which case fasteners may be used.
- Such that externally accessible fasteners are tamper proof.
- Such that stainless steel components comply with AM 2760 Stainless Steel Specification.

### 5.4. Floor Mounting Requirements

Turret top floor mountings shall:

- Closely matches the opening of the top slab (0 to +20mm larger than the opening in either dimension).
- Mount entirely on the top surface slab of the underground structure.
- Have a contact surface between the turret top and top slab which is 40 to 75mm wide.

- Be fastened to the top slab with removable min M10 stainless steel fasteners spaced at less than or equal to 600mm centres. Fasteners shall be removable from directly above (i.e: not located within a recess).
- Include a min 5mm thick and  $\geq 40$ mm wide butyl mastic seal applied around the entire interface between the turret top and top slab (with no gaps to provide a gas seal).
- Be constructed from min 3mm thick stainless steel sheet.
- Be welded to or folded from the turret top wall.

## 5.5. Wall Requirements

Turret top walls shall:

- Be between 1000mm and 1100mm high, noting that the height of the wall needs to be sufficient to enable the covers to hang nearly vertical in the open position.
- Be constructed from min 3mm thick stainless steel sheet.
- Be stiff enough to ensure that a horizontal 1 kN point load applied anywhere on the wall causes less than a 5mm deflection.
- Be stiff enough to ensure that where ladders are fixed to walls, a 100kg person climbing anywhere on any ladder will cause less than a 5mm deflection anywhere on the wall.
- Support all guiderails and be stiff enough to ensure that the positioning of both pumps anywhere along the guiderails will cause less than a 5mm deflection anywhere on the wall.

## 5.6. Cover Requirements

Turret top covers shall:

- Be able to be easily opened by hand (without a mechanical lifting aid) while standing on the ground slab.
- Have sufficient open space around the covers such that the covers can be fully opened without interfering with workers standing adjacent to the covers. Workers should be provided with a minimum of 1000mm paved standing room between an opening cover and any nearby obstruction.
- Be constructed from minimum 3mm thick marine grade (grade 5052, 5083 or 6064-T4) aluminium sheet.
- Wherever possible, covers shall be hinged and lightweight such that one person can lift the cover (ie: < 20 kg each cover). Where cover weight exceeds 20 kg, a winch shall be provided for each cover to enable the safe operation of the cover (refer section 2.5).
- Where cover openings are large and cover weights are not suitable for winch removal, roll on – roll off covers may be a more suitable alternative. Lifting bars may also be fitted to swing covers to reduce the effort required to move them.
- Be stiff enough to ensure that a vertical 1 kN point (100 kg) load applied anywhere on a cover causes less than a 5mm deflection (relative to the perimeter of the cover, ie: excluding seal compression. Test would involve placing a 100kg weight anywhere on the cover, holding a straight edge across the cover and measuring the max deflection).
- When fully open, rest against rubber stops fitted to the turret top walls. To avoid metal or coating damage, open covers shall not contact the coated sheet metal wall surface.

- When open, swing covers shall hang in a near vertical alignment (i.e. nearly parallel to the turret walls, approximately 270 degree swing) to enable workers to reach over the covers to access items inside the turret top.
- Each be fitted with at least one lifting handle near each cover's edge which is easily accessible while standing on the underground structure's cover slab.
- Have a closing mechanism which has a lever action that ensures adequate compression of the seal. Closing mechanisms fitted to covers should be lightweight to reduce the overall weight of covers.
- Have a closing mechanism which can be secured with padlocks, shielded to prevent bolt cutter removal. Padlocks shall be keyed to SEW's standard and be provided by SEW as per SEW's lock standards.
- Have heavy duty stainless steel hinges with hinge pinion > 6mm in diameter.
- Have hinges with a maximum 1000mm separation.

## 5.7. Cover Seals

Cover seals shall be provided for covers over chambers which may contain sewage.

Cover seals shall:

- Be attached to covers (not the main structure).
- Provide a gas tight seal between covers &/or opening edges. The gas seal shall be sufficient that when a piece of tissue paper is held near the seal during any normal operation of the site on a windless day, it will not noticeably flutter.
- Be non-perishable and proven to be resistant to a high hydrogen sulphide environment ie: constructed from EPDM or Neoprene.
- Be resilient and continue to provide an effective compressed seal under continual closure for at least 10 years.
- Have seals that neatly match the entire surface to which they mate.

## 5.8. Confined Space Access Requirements

- All ladders and associated stanchions, brackets and fasteners shall be constructed of stainless steel.
- Ladders (stanchions excepted) shall comply where possible with the requirements of standard drawing SEWL-STD-005 in SEW Supplementary Manual to WSA04 Sewage Pumping Station Code.
- External ladders shall be fixed entirely to the turret top wall with at least 4 points of contact.
- External ladders shall be located to rest on and be supported by the ground slab.
- All ground surface within 1000mm of the external ladder shall be included in the footprint of the cover slab of the underground structure.
- All ladders shall have extendable stanchions to minimum 1.1m above the top rung of the ladder.
- Stanchions shall be able to be raised safely from ground level.
- Inner ladders shall be located to enable safe unimpeded access to the floor of the underground structure in a single vertical pitch.
- A minimum 5mm thick marine grade aluminium or stainless steel swing-away platform shall be provided for traversing between the inner and outer ladders. This platform shall

be as long as the gap between the two ladders and as wide as the internal width of the internal and external ladders. This platform shall be connected to the internal ladder and rotate away from the external ladder (to enable the cover to close). This platform shall drain, i.e. not fill or hold with water in any position.

- Provide sleeve(s) for davit arm insertion which shall be:
  - Miller Flush Mount Floor Sleeve, model DH-20SS (for insertion into the top of new concrete slabs).
  - Miller Floor Mount Sleeve, model DH-7SS (for attachment to the top surface of existing concrete slabs). Where these are used, they shall be carefully positioned to avoid becoming a tripping hazard.

## 5.9. Internal Fitout Requirements

- Pump and mixer guiderails shall be extended to within 100mm of the top of the turret top wall.
- For smaller pumps and mixers (ie: < 20 kW), guiderails may be attached to and supported by the top wall. Larger pump and mixer guide rails shall be attached to and supported by the ground slab.
- Where internal bracing or beams are required (to stiffen the structure &/or provide support for covers), pumps shall be able to be removed without removing any cross beams.
- Internal bracing or beams shall be easily removed when required to enable general maintenance.
- Flat bar / sheet shall be fitted internally just under the opening's perimeter on all four sides for hanging of junction boxes, pump chains, cable socks and mounting pump guiderail brackets.
- This flat bar / sheet shall be minimum 3mm thick, 70mm wide, fabricated from stainless steel with the top of the flat bar / sheet located at 100mm to 200mm from the top of the turret wall.
- Sufficient cable shall be fitted to all hanging equipment to enable the equipment to be removed and relocated to ground level (for maintenance) without disconnecting the cable.
- Where below ground spindles are extended to just below cover level, a handwheel with attached short spindle extension shall be provided in accordance with section 2.2.

## 5.10. Turret Top Ventilation

When there is mechanical ventilation of the chamber below the turret top or when well level is changing rapidly (ie: during pumping), the sides and covers of turret tops can pull in noticeably and can vibrate. The design of the turret top needs to take this into account so that appreciable negative pressure or vibration impacts are not significant.

## 5.11. Turret Top Approved Suppliers

Turret tops may be purchased from one of the following suppliers:

- Bell environmental [www.bellenvironmental.com.au/](http://www.bellenvironmental.com.au/)
- TankWeld [www.tankweld.com.au/](http://www.tankweld.com.au/)
- Aquatec [www.aquatecenviro.com](http://www.aquatecenviro.com)



These suppliers have constructed a number of these structures and are aware of SEW's requirements. Standard drawings are not available for turret tops due to the need for local and site specific variations.

## 6. ASSET INFORMATION AND REGISTRATION

Installed covers must have clearly marked identification labels with South East Water registered asset identification numbers and descriptions. The contractor shall provide the below listed information to enable covers to be registered in South East Water's asset register. Attributes shall include at least:

- Location (plant area)
- Size (L x W)
- Material (Aluminium, Stainless Steel, Ductile Iron, Fibre Reinforced Polymer)
- Estimated weight of covers
- Structure being covered (eg: wet well, valve pit)
- Recommended Means of Lifting (eg: crane lift, 1 person lift, 2 person lift)
- Photographic documentation of the installed covers

## 7. Fibre Reinforced Polymer Cover Additional Requirements

The following additional requirements shall be provided for Fibre Reinforced Polymer (FRP) covers:

- material data information which include but not limited to chemical resistance, physical, mechanical properties and design life
- standard documentation as set out in WIMES 8.05 Appendix G – FRP/GRP Cover Specification
- mechanical property information (provided in their commercial standard product sheet, engineering data and/or laboratory test data)
- Flexural strength (MPa) of the cover
- Flexural strength (MPa) of the FRP composite material
- If the FRP cover consist of a finished gel or flow coat, provide the flexural strength (MPa) of the gel, flow coat or external moulded skin
- The contractor shall supply to SEW an additional spare cover from each manufacturing batch to be held in permanent and safe storage for subsequent testing (including post-contract and long term periods) and comparative investigations. The spares shall be wrapped in plastic bags preventing exposure to sunlight while under storage.
- Sawing or cutting of any manufactured unit or module is not preferred. However in exceptional circumstances if cutting is absolutely necessary, cutting must be done with angle grinders in compliance with the manufacturer's requirements. Appropriate gelcoat treatment shall be applied to the exposed surfaces resulting from the cut and shall meet the requirements of the manufacturer.

## 8.APPENDIX A : COVER TYPE SELECTION MATRIX

This selection matrix is available in Excel format on request.

**Underground Chamber Covers- Cost & Risk Assessment**

<b>PROCESS</b>										
Scoring System: 0 - Not feasible. Unsatisfactory. 1 - Poor outcome but not a "show stopper" 2 - Neither good nor bad outcome 3 - Good outcome. Negligible Risk in this case. 4 - Excellent outcome. Virtually no risk in this case.										
1) Score all options the same if the cost / risk issue is not relevant to the project. Score each risk / cost using score 0 to 4 as per scoring system above. Some scores are provided but they may be changed.										
2) Score each cost / risk (in pale yellow cells) and choose the highest overall rating option shown at bottom of table, unless:										
3) The highest rating option has scored a 0 somewhere and is not feasible, in which case select the next highest feasible option.										

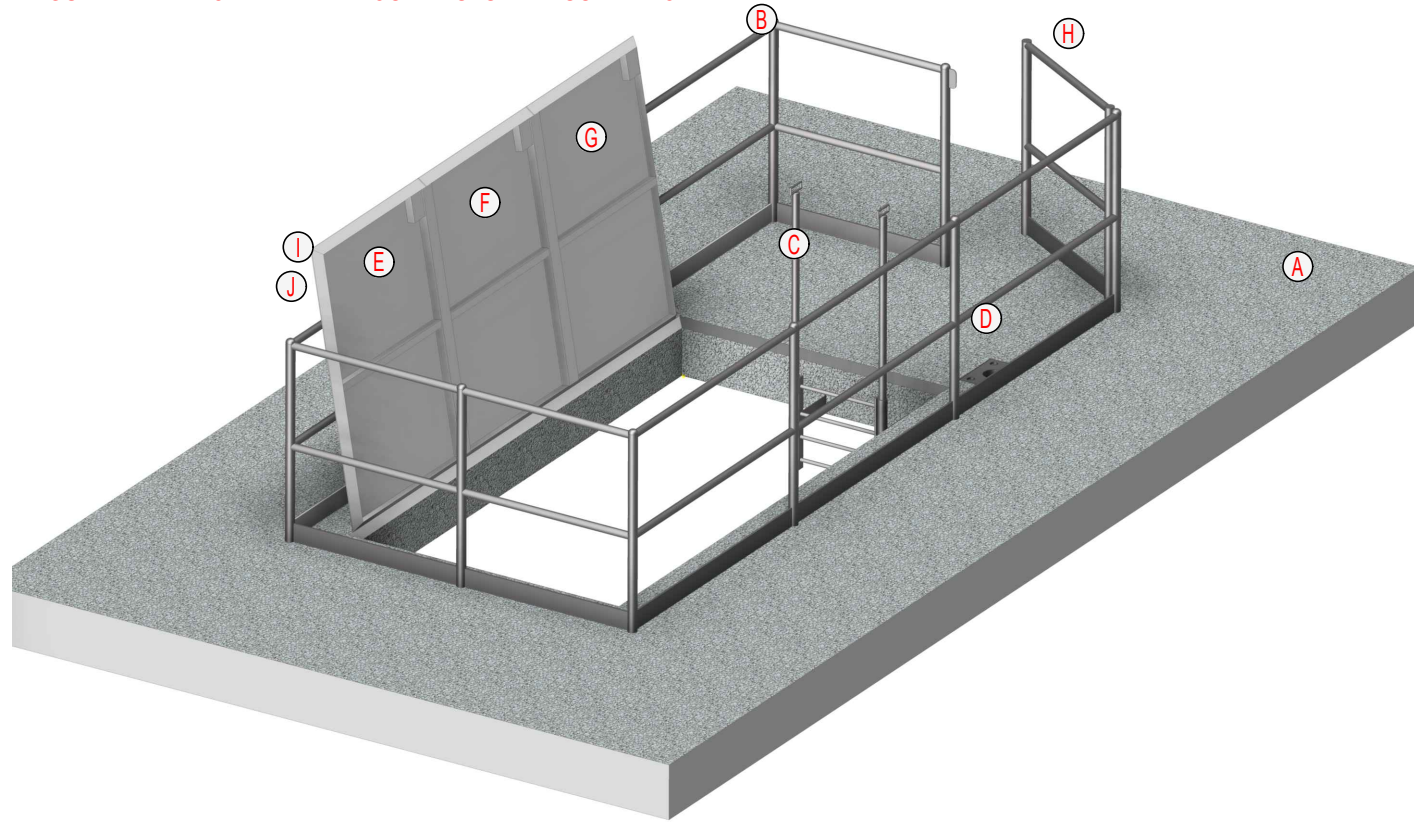
Cost	Cost Factors	Cost Impact	Weighting	Possible Cost Controls / Issues	Fabricated Metal Covers with fixed handrails	Score	Ductile Iron Covers with sub level grates & temporary handrails	Score	Turret Top	Score
Capital Cost	Cost of design and construction	Very High	15	Simple off the shelf products less costly	Typically \$5 to \$15k per Underground Chamber	2	Typically \$5 to \$10k per Underground Chamber	3	Typically \$25 to \$50k per Underground Chamber (5x the cost)	1
Reduced asset life	Corrosion	Moderate	5	Low corrosion risk materials. H2S levels in Underground Chamber	Aluminium has a 25 yr life.	2	Ductile iron covers have 25 yr life	2	SS (if used) is the most corrosion resistant of material options, although covers are still aluminium	2
Reduced asset life	Vandalism	Low	3	Location of Underground Chamber and the site's security (refer to security spec).	Covers not easily damaged by vandals, but handrails are more susceptible	3	Not easily damaged by vandals.	4	Can be subject to being painted or tagged, but physical damage is unlikely (depending on the location).	
Reduced asset life	Vehicle Strike	Moderate	5	Proximity to and level of traffic in adjacent road. Prevention of Vehicle strike / driving over covers using bollards / fencing / building. Use of trafficable covers.	Cannot withstand vehicle weight. Typically only used in fenced areas or buildings where unauthorised traffic access to the covers is prevented.		Can support vehicle weight without damage.	4	Above ground structure prone to vehicle strikes, especially when near trafficable areas and the turret top is unfenced / unprotected.	
Reduced asset life	Wear & Tear	Low	3	Simple design. Hard wearing materials. Low loadings on mechanical components (low weight).	Requires hinges and locks	2	Low wear of surfaces. Covers can be easily replaced.	4	Requires hinges and locks	2
Time & Cost of Maintenance	Access to M&E items. Ease of inspection. Time to set up safety equipment. More time on site also means more time exposed to OHS risks and some increase in likelihood. Frequency and duration of maintenance.	High	10	Permanent fall protection (so does not need to be set up and pulled down each time). Light and easy to open covers (one person lift if possible). Locate maintenance items in easy to access locations.	Lightweight and can be operated by one person. Good set up time, but poor access to M&E items below ground level.	1	Covers present a tripping hazard when removed and take time to remove them from the working area.	1	Ideal as far as minimising maintenance time and inconvenience	4

Risk Description	Risk Factors	Uncontrolled Risk Level	Weighting	Possible Risk Controls / Issues	Fabricated Metal Covers with fixed handrails	Score	Ductile Iron Covers with sub level grates & temporary handrails	Score	Turret Top	Score
Odour complaints	Only relevant to sewage containing structures. Gas tightness of Underground Chamber. H2S level of sewage. Location - distance to people & number of people exposed.	High	10	Forced ventilation (-ve pressure & air treatment). Chemical dosing of Underground Chamber or inflows. Gas tight covers. Negative pressure in wet well. Water seals on gravity pipes into Underground Chamber. Avoid Underground Chambers in built up areas (esp if high H2S).	Very difficult to make gas tight. Perhaps suitable where public access to site is low, there is a significant buffer to nearby people or the structure is located under a building / enclosure.		Reliable Gas Seal	3	Reliable Gas Seal	3
Visual Aesthetics	Locality of Underground Chamber. Prominence of location.	Moderate	5	Avoid locating asset in highly visible areas. Minimise size and prominence of above ground structures.	Usually moderate impact on aesthetics due to permanent guardrails that are typically used in conjunction with AI covers.		Has virtually no effect on aesthetics	4	Highly visible structure. Likely not a feasible solution in areas where the turret top is highly visible.	
Road Safety	Will the cover system obstruct the view of drivers and pedestrians? Will the cover system need to be trafficable?	High	10	Locate covers away from roadway. Use ground level covers.	Not suitable in trafficable areas or in areas where it is difficult to prevent vehicle access.		Gatic covers pose no significant traffic risk and are the likley choice in areas where covers must be trafficable		Highly visible structure. Likely not a feasible solution in areas where turret top would impede driver / pedestrian visibility in the road reserve.	
Falling from Heights	Trip hazards both when open & closed. Quality and dependability of fall protection measures (grates / barricades). Duration of fall protection removal (for pump removal).	High	10	Temporary Barricades. Sub surface grates. Permanent Barricades (turret / handrails) Removal of Trip Hazards. Reduce exposure to the opening (reduce maintenance or elevate opening)	Effective fall prevention measures can be deployed. May have to be removed during equipment removal from the well. Covers do not present a tripping hazard when open as lie against and secured to guard rails	3	Effective fall prevention measures can be deployed. Even though should locate covers away from opening when removed, they present a tripping hazard when open	2	Very unlikely, provided workers intentionally entering the space are connected to a davit arm.	4
Public Access when Open (pedestrian or vehicle)	Location - number & proximity of people nearby.	Moderate	5	Fencing. Signage. Bollards - barricades. Avoid Underground Chambers in built up areas. Reduce exposure to the opening (reduce maintenance or elevate opening).	Very unlikely unless signage and barricades not deployed	2	Very unlikely unless signage and barricades not deployed	2	Unintentional entry into the well is highly unlikely	4
Site security. Unauthorised Entry.	History of crime / security breaches in the area.	Moderate	5	Fencing. Locked gates. Lighting. Alarms & CCTV. Bollards - barricades. Durable (thick & strong materials) design. Avoid Underground Chambers in built up areas. Avoid Underground Chambers in high crime / security problem areas.	Can be padlocked. Fasteners requiring specialist tools can be used. Seams may be welded.	3	Weight only. Covers not secured. Gatic lifter required (relatively easy to procure)	2	Can be padlocked. Use fasteners requiring specialist tools to remove or weld seams.	3
Manual Handling to open / close covers	Movement of heavy covers. Awkwardness of cover removal (reaching up, down or across, twisting)	Moderate	5	Smaller covers. Lighter weight materials. Crane lift. Locate covers close to waist height.	Provided cover size is not excessive, moderate risk, especially as covers can be manually lifted with chains from a good working height.	3	Some risk of back strain during operation. Need to drag covers some distance from the opening. Cross members are heavy and require removal with a mechanical aid.	1	Provided cover size is not excessive, moderate risk as covers are lifted from a good working height.	3
Manual Handling of underground items	Location of commonly accessed items. Weight of items being handled.	Moderate	5	Locate items at waist height. Locate items close to person. Enable removal of items without need to twist or swivel. Reduce weight / stiffness of items (eg: pump cables).	M&E equipment located below ground. Awkward posture required to reach items.	1	M&E equipment located below ground. Awkward posture required to reach items. Can access items through holes in grating	2	Commonly accessed items located at convenient height. Limited bending down required. Some leaning over required.	4
Covers form an obstruction when open	Proximity of other above ground structures. Resting position when open.	High	10	Ensure sufficient space around covers	Not a significant concern where covers can lean against permanent guardrails	3	Covers can usually be placed somewhere out of the way once removed.	1	Covers require sufficient space around them to open to the vertical downwards resting position.	4
Confined Space Entry	CSE competence of personnel. Ventilation of Space. H2S levels of sewage.	High	10	Prevent access to the space other than to trained and approved personnel.ie: CSE permit process + site security + H2S monitoring of wet well. Ventilation of wet well- enforced or forced.	Covers have limited effect on CSE risk other than through preventing unauthorised access and falling from heights (covered else where)					

<b>WEIGHTED AVERAGE TOTAL</b>						11.3		14.9		16.7
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## 9.APPENDIX B : COVER DESIGN ILLUSTRATIONS

**FIGURE A: FABRICATED METAL COVER SYSTEM- ISOMETRIC VIEW**

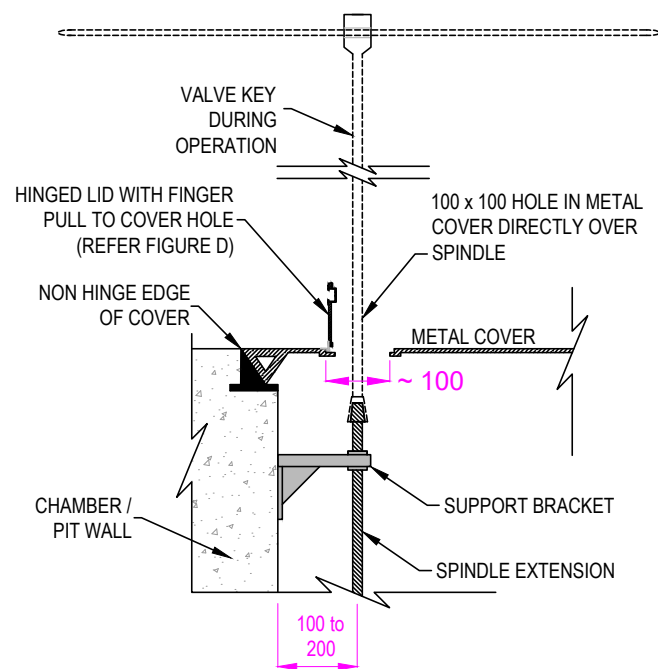


**TABLE A: COMPONENTS**

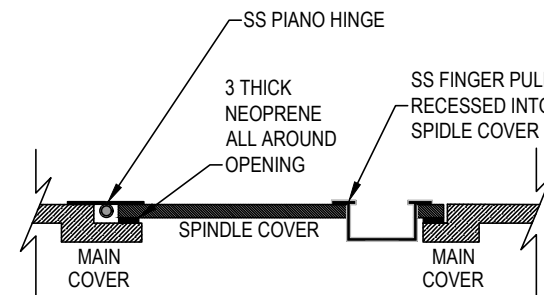
ITEM	DESCRIPTION	MATERIAL	NOTES
A	COVER SLAB	REINFORCED CONCRETE	OPENING SIZED TO SUIT UNDERGROUND PLANT
B	PERMANENT GUARDRAILS	GALVANIZED STEEL OR SS	TO INCLUDE KICK PLATES. TO AS 1657
C	LADDER	SS316L	TO SEW DRAWING SEWL-STD-005
D	DAVIT ARM MOUNTING	SS304	MILLER FLUSH MOUNT SLEEVE MODEL DH-20SS
E	METAL COVER, 1ST OPEN	GRADE 5052, 5083 or 6064-T6	EACH COVER TO HAVE RECESSED HANDLE SO HANDLES DO NOT PRESENT TRIPPING HAZARD. 1ST COVER OPEN IS TO LATCH TO COVER SLAB AND LOCK WITH STANDARD SEW LOCK. 2ND COVER TO BE HELD DOWN BY 1ST COVER, 3RD COVER BY 2ND COVER etc SO ONLY ONE LOCK REQUIRED
F	METAL COVER, 2ND OPEN	MARINE GRADE ALUMINIUM	
G	METAL COVER, 3RD OPEN		
H	SWING GATE	AS ITEM B	AUTO CLOSING WITH LATCH
I	LIFTING CHAINS	GALVANISED WELDED LINK CHAIN WITH LINKS ≥2mm THICK. CARABINEER TO CLIP THROUGH LINKS	FASTENED TO LIFTING END OF COVER AND TIED OFF AT TOP OF VERTICAL POST OF GUARDRAIL ON THE OPPOSITE SIDE. ENABLES COVERS TO BE LIFTED FROM A STANDING POSITION
J	COVER RESTRAINTS	CARABINEER WITH SHORT SS316 LEASH TO TOP OF VERTICAL GUARDRAIL POST	TO RESTRAIN EACH COVER TO THE GUARDRAIL WHEN OPEN, CLIP CARABINEER THROUGH A LIFTING CHAIN LINK

**Notes Regarding Fabricated Metal Covers:**

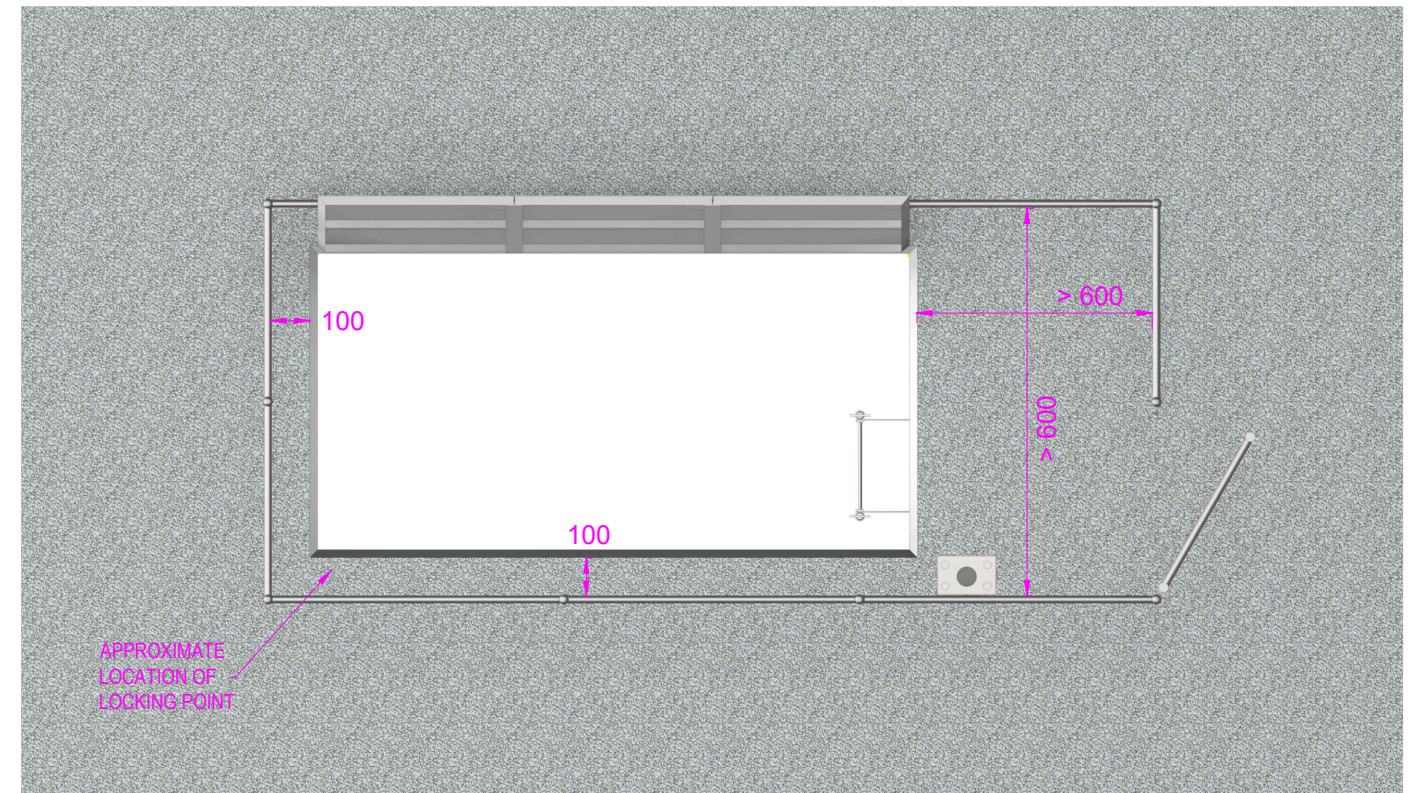
1. This drawing is indicative only, and does not represent a fabrication or construction issue drawing.
2. Each cover system needs to be individually designed so that it integrates well with the other assets on site and enables safe and efficient operations and maintenance activities to be performed.
3. These covers are non-trafficable and shall only be used in conjunction with appropriate measures to prevent vehicle traffic on the covers.
4. These covers shall only be used in conjunction with permanent guardrails.
5. These covers shall only be used where odour emissions are unlikely to be problematic.
6. All dimensions in mm.



**FIGURE C: SPINDLE EXTENSION TO DUCTILE IRON COVERED OPENING**



**FIGURE D: SPINDLE OPENING COVER (IN CLOSED POSITION)**



**FIGURE B: FABRICATED METAL COVER SYSTEM- PLAN VIEW**

**SCHEMATIC ONLY**  
NOT TO BE USED FOR CONSTRUCTION

REV	ZONE	DESCRIPTION	DATE	DESIGNED	DRAWN	DES. CHK.	DRAFT CHK.
B		SPINDLE EXTENSION DETAIL ADDED	08/2021	R. JAGGER	R. JAGGER	J. STREET	J. STREET
A		1ST REVISION	07/2018	R. JAGGER	R. JAGGER	M. MAXWELL	M. MAXWELL

**South East Water Corporation**  
WatersEdge 101 Wells Street  
Frankston VIC 3199  
T 61 3 9552 3000 F 61 3 9552 3001  
E info@sew.com.au www.sew.com.au

**South East Water**

MELWAY REF: SHEET SIZE: **A3** (FULL SIZE PLOT) APPROVED: COLIN PAXMAN

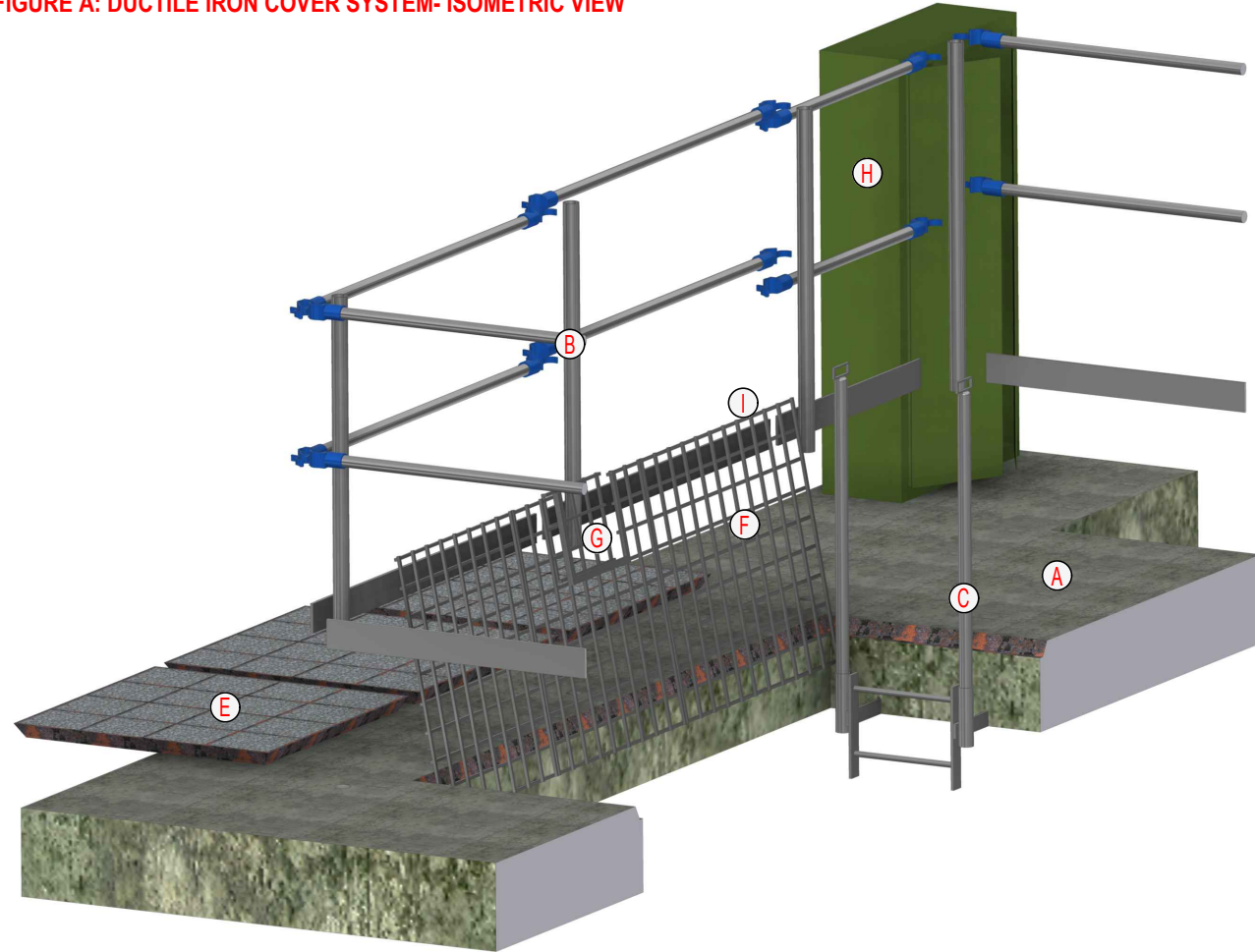
**SOUTH EAST WATER CORPORATION**  
**UNDERGROUND STRUCTURE COVERS SPECIFICATION**  
**FABRICATED METAL COVERS**  
Sheet 1 of 3

PLAN TYPE:  
SCALE: NA

DRAWING NUMBER  
**AM2757- SHEET 1**

NUMERAL REV

**FIGURE A: DUCTILE IRON COVER SYSTEM- ISOMETRIC VIEW**

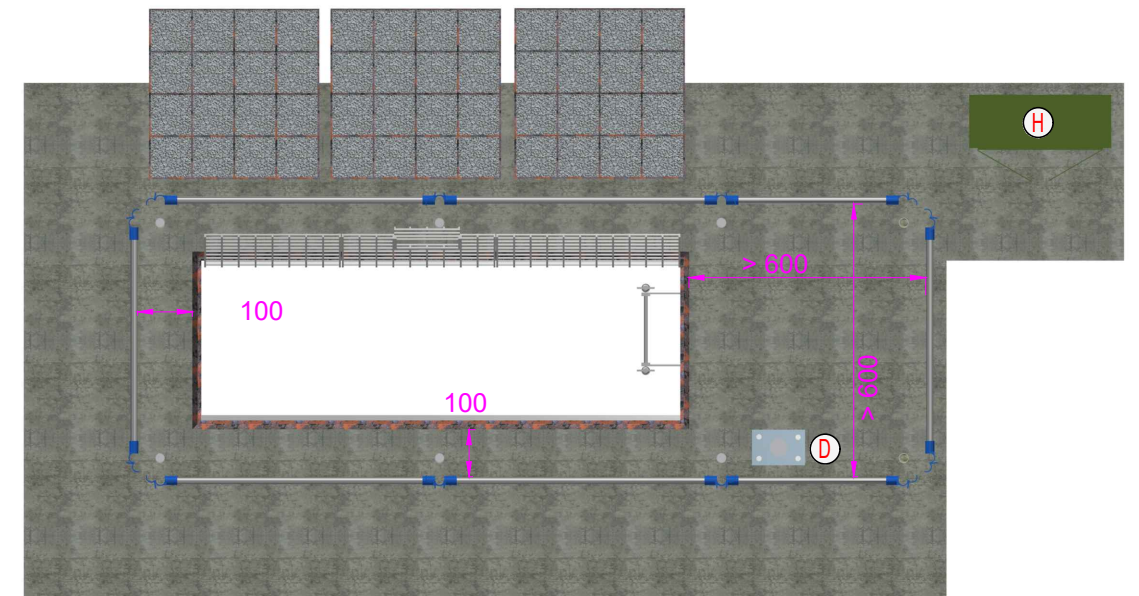


**TABLE A: COMPONENTS**

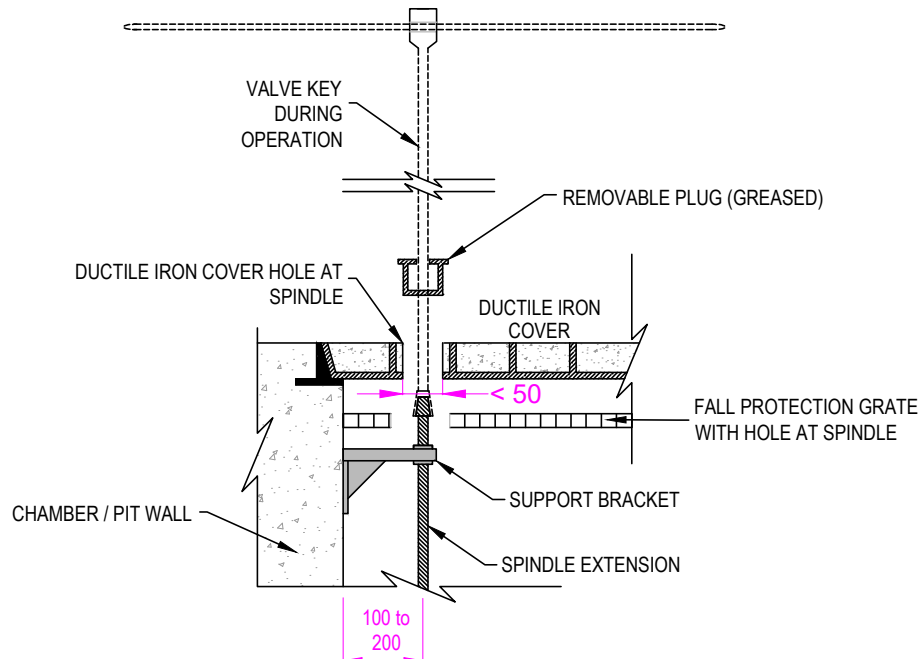
ITEM	DESCRIPTION	MATERIAL	NOTES
A	COVER SLAB	REINFORCED CONCRETE	OPENING SIZED TO SUIT UNDERGROUND PLANT
B	REMOVABLE GUARDRAILS	GALVANIZED STEEL OR SS	TO INCLUDE KICK PLATES. TO AS 1657
C	LADDER	SS316L	TO SEW DRAWING SEWL-STD-005
D	DAVIT ARM MOUNTING	SS304	MILLER FLUSH MOUNT SLEEVE MODEL DH-20SS
E	DUCTILE IRON COVER	APPROVED DI COVER	NO MORE THAN ONE ROW OF COVERS PERMITTED
F	FALL PROTECTION MESH	SS316	NO OPENING GREATER THAN 200 WIDE PERMITTED. HINGED. EACH GRATE < 15 kg
G	HATCH OVER SMALL OPENING	SS316	TO PROVIDE EASY ACCESS TO JUNCTION BOX & INSTRUMENTS. HINGED
H	STORAGE CUBICLE	AS ITEM B	TO STORE REMOVABLE GUARDRAIL SYSTEM. LOCKED WITH SEW LOCK
I	COVER RESTRAINTS	CARABINEER & SS CABLE LEASH	TO RESTRAIN EACH MESH TO THE GUARDRAIL WHEN OPEN. FIX LEASH TO MESH, FIX CARABINEER AROUND GUARDRAIL

**Notes Regarding Ductile Iron Covers:**

1. This drawing is indicative only, and does not represent a fabrication or construction issue drawing.
2. Each cover system needs to be individually designed so that it integrates well with the other assets on site and enables safe and efficient operations and maintenance activities to be performed.
3. These covers are for structures in trafficable areas.
4. These covers shall only be used in conjunction with temporary mobile guardrails.
5. All dimensions in mm.



**FIGURE B: DUCTILE IRON COVER SYSTEM- PLAN VIEW**



**FIGURE C: SPINDLE EXTENSION TO DUCTILE IRON COVERED OPENING**

**SCHEMATIC ONLY**  
NOT TO BE USED FOR CONSTRUCTION

REV	ZONE	DESCRIPTION	DATE	DESIGNED	DRAWN	DES. CHK.	DRAFT CHK.
B		SPINDLE EXTENSION DETAIL ADDED	08/ 2021	R. JAGGER	R. JAGGER	J. STREET	J. STREET
A		1ST REVISION	07/ 2018	R. JAGGER	R. JAGGER	M. MAXWELL	M. MAXWELL

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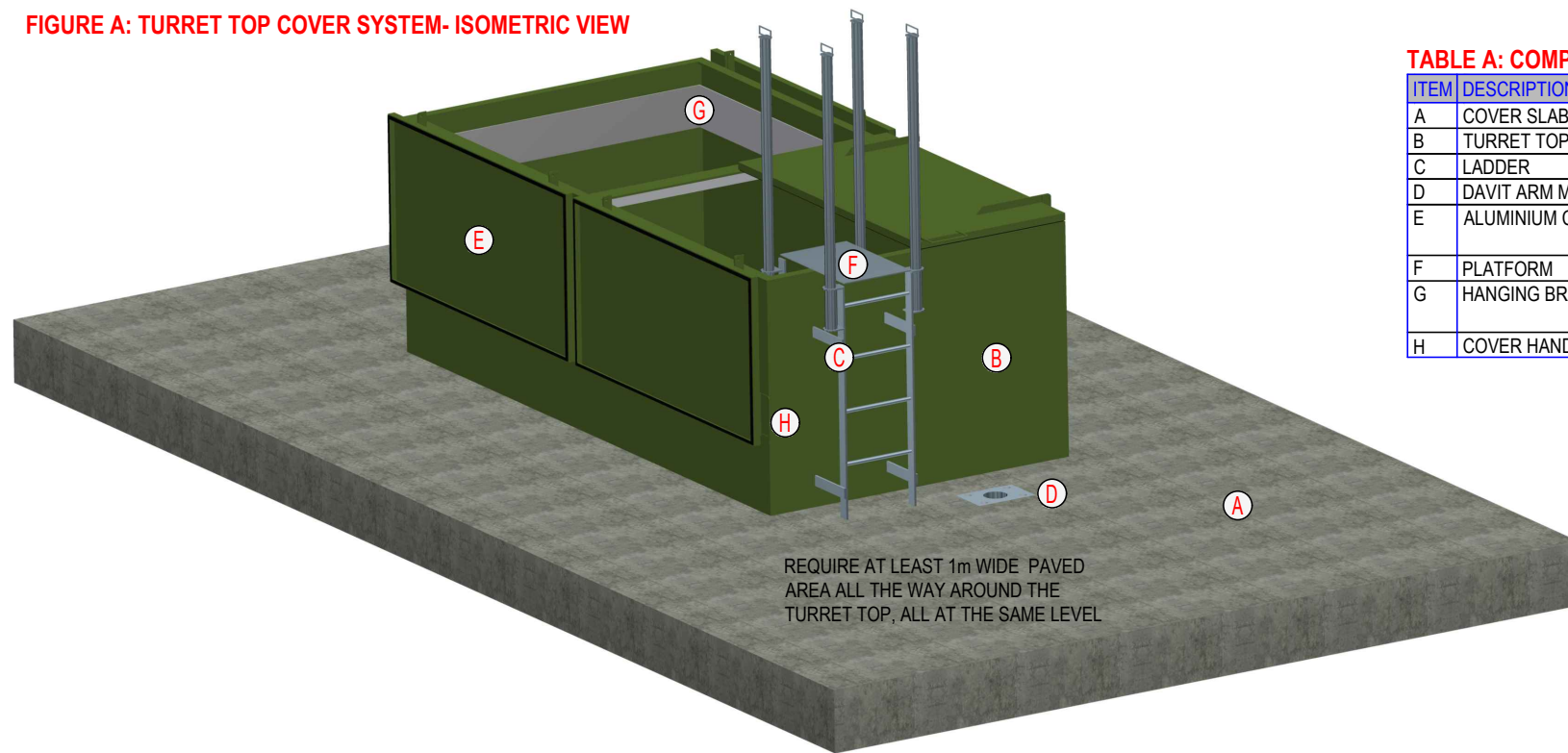
**South East Water**

MELWAY REF: SHEET SIZE: **A3** (FULL SIZE PLOT) APPROVED: COLIN PAXMAN

**SOUTH EAST WATER CORPORATION**  
**UNDERGROUND STRUCTURE COVERS SPECIFICATION**  
**DUCTILE IRON COVERS**  
Sheet 2 of 3

PLAN TYPE:	
SCALE:	NA
DRAWING NUMBER	
AM2757- SHEET 2	
NUMERAL	REV

**FIGURE A: TURRET TOP COVER SYSTEM- ISOMETRIC VIEW**

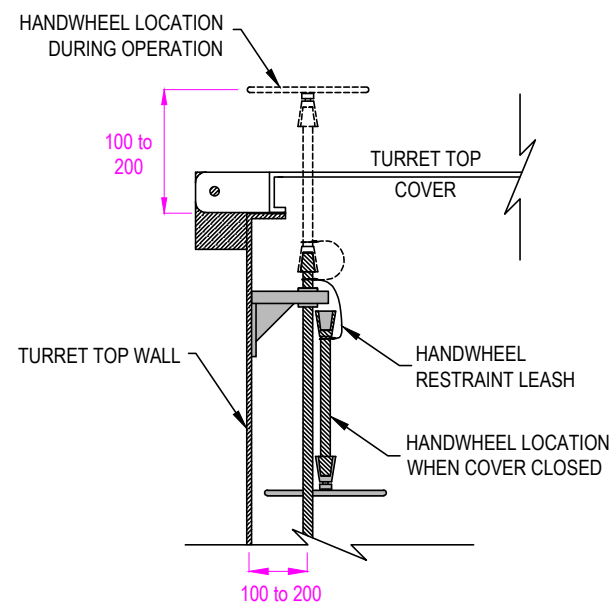


**TABLE A: COMPONENTS**

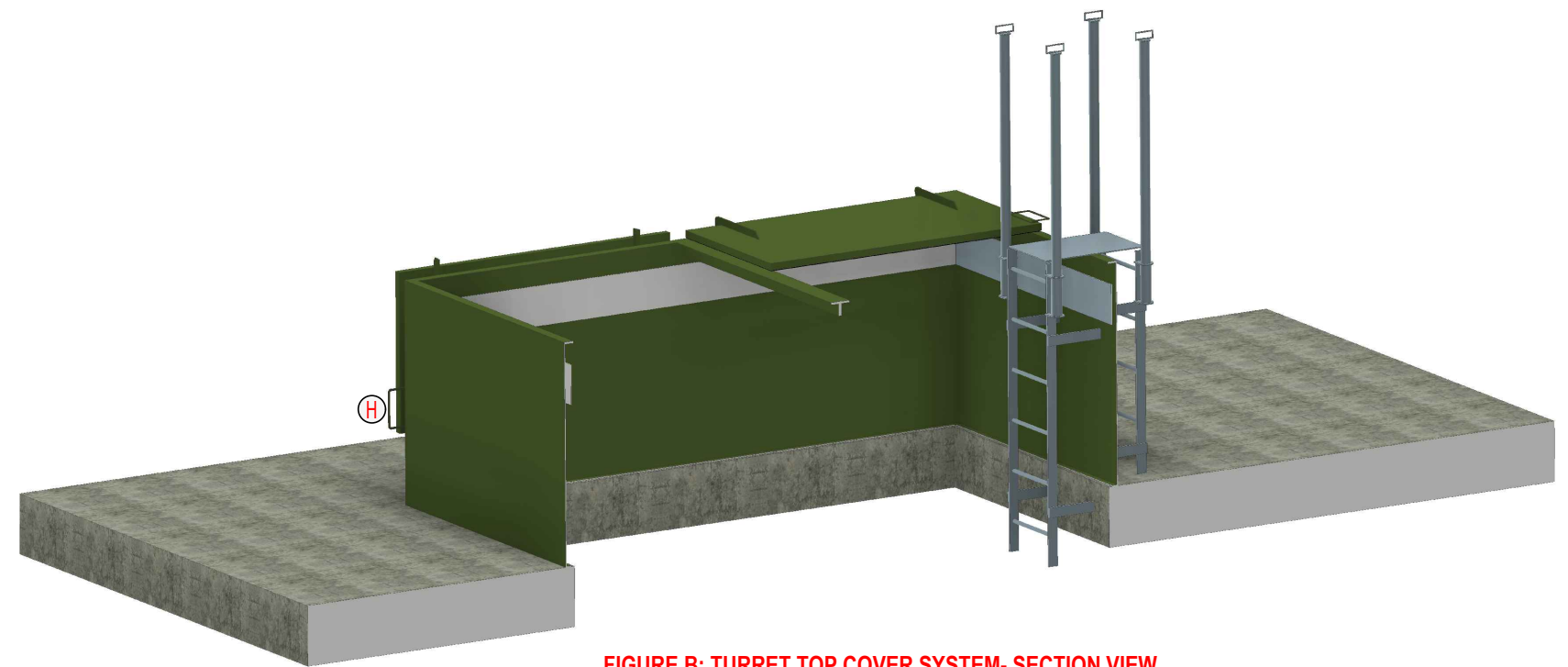
ITEM	DESCRIPTION	MATERIAL	NOTES
A	COVER SLAB	REINFORCED CONCRETE	OPENING SIZED TO SUIT UNDERGROUND PLANT
B	TURRET TOP WALLS	≥3MM THICK STAINLESS STEEL	
C	LADDER	SS316L	TOSEW DRAWING SEWL-STD-005
D	DAVIT ARM MOUNTING	SS304	MILLER FLUSH MOUNT SLEEVE MODEL DH-20SS
E	ALUMINIUM COVER	GRADE 5052, 5083 or 6064-T6 MARINE GRADE ALUMINIUM	ROLL ON - ROLL OFF COVERS ARE AN ALTERNATIVE TO SWING COVERS WHERE COVER WEIGHTS ARE EXCESSIVE
F	PLATFORM	SS316	
G	HANGING BRACKET	SS316	PROVIDES EDGE OVER WHICH TO HANG CHAINS, INSTRUMENT LINES, JUNCTION BOXES etc
H	COVER HANDLE	SS316	

**Notes Regarding Turret Top Covers:**

1. This drawing is indicative only, and does not represent a fabrication or construction issue drawing.
2. Each cover system needs to be individually designed so that it integrates well with the other assets on site and enables safe and efficient operations and maintenance activities to be performed.



**FIGURE C: SPINDLE EXTENSION TO TURRET TOP OPENING**



**FIGURE B: TURRET TOP COVER SYSTEM- SECTION VIEW**

**SCHEMATIC ONLY**  
NOT TO BE USED FOR CONSTRUCTION

REV	ZONE	DESCRIPTION	DATE	DESIGNED	DRAWN	DES. CHK.	DRAFT CHK.
B		HAND WHEEL DETAIL ADDED	08/ 2021	R. JAGGER	R. JAGGER	J. STREET	J. STREET
A		1ST REVISION	07/ 2018	R. JAGGER	R. JAGGER	M. MAXWELL	M. MAXWELL

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**SOUTH EAST WATER CORPORATION**  
UNDERGROUND STRUCTURE COVERS SPECIFICATION  
TURRET TOP COVER SYSTEM  
Sheet 3 of 3

PLAN TYPE:	
SCALE:	NA
DRAWING NUMBER	
COVER - T.T	
NUMERAL	REV