Custom House Quay

Initial Construction Method Statement

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1.0 Introduction

Arch Henderson (AH) are undertaking the design of a new quay wall along the north bank of the River Clyde, between Glasgow Bridge and Victoria Bridge. As part of these works, an application for a Marine Scotland License is required, section 5 (i) of the Marine Scotland License application states there is a requirement for a method statement. This document should be used as the method statement for the application. Whilst this method statement has been prepared using knowledge of the site, design and available construction techniques, it is subject to modification by the appointed contractor.

2.0 Method Statement

The below method statement provides a high-level approach to the quay wall construction of Custom House Quay.

- Mobilisation.
- Establish Site/ Compound.
- Remove vegetation, fenders and loose fixings from the existing quay wall.
- Remove cantilevered section of existing quayside
- Install sheet piles (sequential working)
- Partial infill of material between existing quay wall and new wall
- Install of waling beam and ground anchors (sequential working)
- Remainder of fill up to the underside of cope beam
- Cope beam construction
- Fixing of quay furniture including safety ladders and anodes
- Construction of the bridging structure piles (at the SPT tunnel interface)
- Construction of the bridging structure superstructure.

2.1 Piling Works – Plant

Piling operations for the quay wall will be carried out sequentially in sections of approximately 20 to 30 metres in length. The installation will proceed in a controlled and phased manner to ensure structural continuity and minimise disruption to marine operations. A range of specialist marine and land-based plant will be utilised to support the sheet piling and associated construction activities. A summary of the primary plant and equipment required for the works is provided below:

- Crawler Crane – Utilised for handling and driving sheet piles from the landward side, including operation of vibro-hammer or impact hammer as required.
- Crane Barge – Provides marine-based lifting capacity for pile handling, positioning of temporary works, and placement of structural elements.

- Supply Barges – Used to transport steel sheet piles, temporary works components, and general construction materials to the installation site.
- Fill Barge – Facilitates the delivery and controlled placement of granular backfill or infill material behind the quay wall structure.
- Jack-Up Barge – Provides a stable working platform in the marine environment, enabling safe crane operations, piling works, and access to areas not reachable from the landward side.

Figure 1 – Typical Crane Barge

Figure 2 – Typical Supply Barge

Figure 3 – Typical Barge

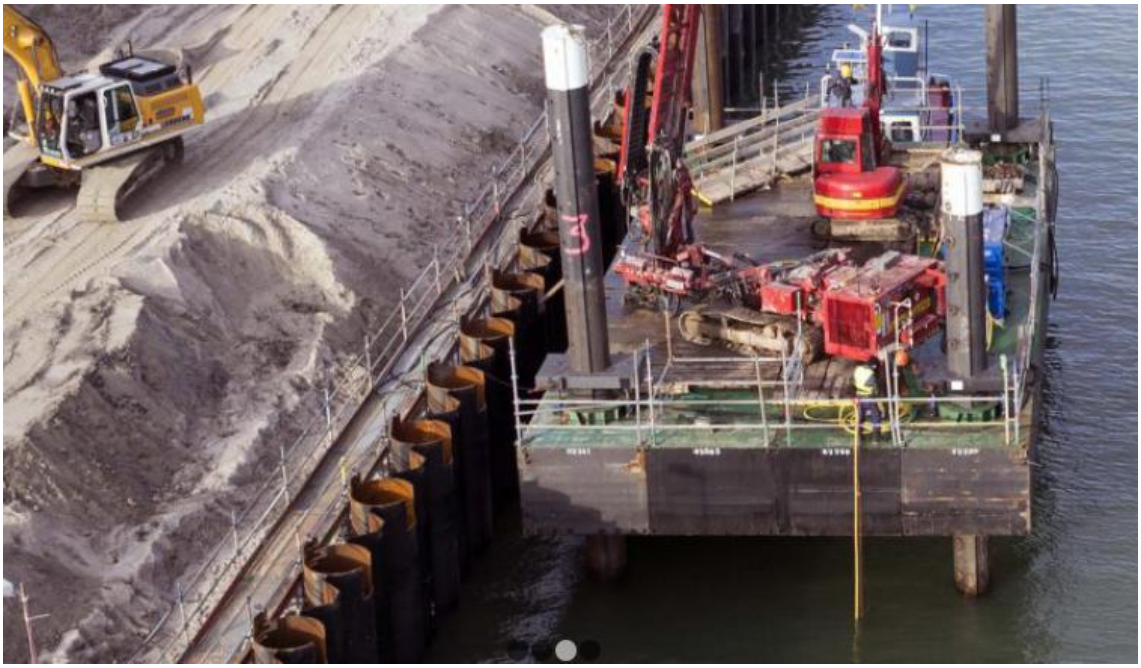

Figure 4 – Typical Jack-Up Barge

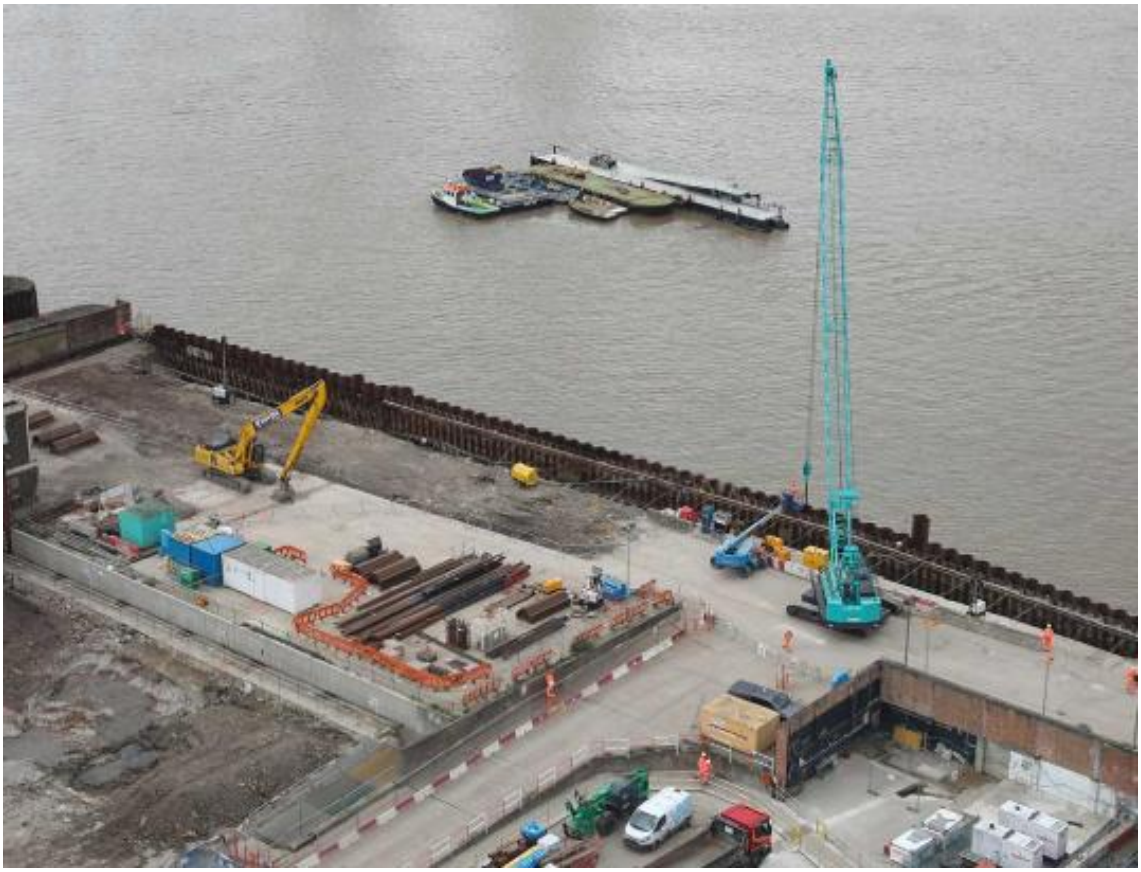

Figure 5 – Typical Crawler Crane

2.2 Demolition of existing cantilever quay wall

- The area will be isolated from public access and marine traffic. If necessary, floating plant or a jack-up barge will be positioned to provide access to the water-facing edge of the structure.
- The concrete cantilever will be removed in a controlled manner using mechanical breakers or wire saws, working from land or a barge as appropriate. Where reinforcement is exposed, it will be cut and removed progressively to prevent instability or unplanned collapse.
- All demolition debris will be lifted out using an excavator, crane or barge-mounted plant and disposed of in accordance with the project waste management plan. Measures will be taken to prevent concrete or rebar from entering the watercourse.

2.3 Piling Works – Piling Gate

The piling gate is a temporary structure that is used to guide and secure sheet piles during installation to ensure accurate alignment. The methodology for installing the temporary piling gate is as follows:

- The first permanent steel sheet pile will be installed at the designated starting location, in accordance with the approved design drawings. Installation will be carried out using either a vibro-hammer or an impact hammer, operated via a crawler crane or a crane mounted on the crane barge, depending on site access and positioning requirements.
- 2 No. temporary steel sheet piles will be driven into the seabed approximately 20–30 metres adjacent to the initial permanent pile. These will be installed using the same equipment and method as the initial pile. Their function is to provide support for the gate structure and maintain spatial tolerances during setup.
- A lateral stiffener (horizontal beam) will be lowered into position between the two temporary sheet piles using one of the cranes. Once in place, the stiffener will be either welded or bolted to the temporary piles to form a stable frame.
- The lower gate members will be lifted into position between the lateral stiffener and the first installed sheet pile. These members will be secured at each end using bolted or welded connections to ensure rigidity and dimensional control during piling.
- Following installation of the lower members, the upper gate members will be positioned and fixed in the same manner. These elements ensure vertical guidance and restraint during pile placement and driving.
- Where access platforms or walkways are incorporated into the gate system, guardrails will be installed for safe working access. These will be lifted into position and fixed by bolting to the designated connection points on the walkway structure.
- The completed piling gate shall be surveyed and verified for plumb and alignment prior to commencing full sheet pile installation.

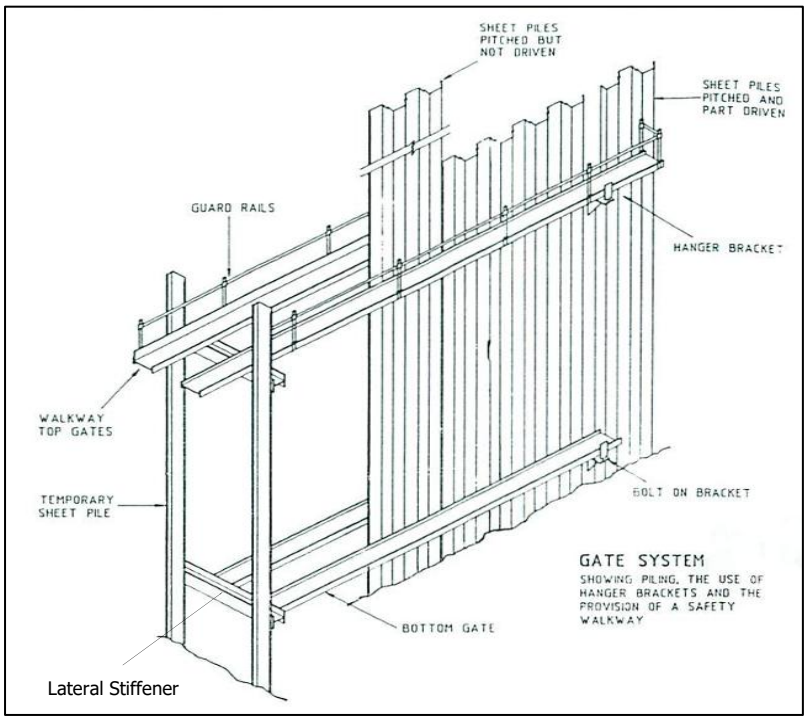

Figure 6 – Pling Gate Structure

2.4 Piling Works – Sequential Sheet Piles

The following methodology is for the installation of the sheet piles only.

- A supply barge, crane barge, and crawler crane are mobilised to the site. All equipment is positioned and anchored if required, ensuring safe working access and stability during pile handling and installation.
- Steel sheet piles are loaded onto the supply barge at the fabrication yard or storage location. Upon arrival at the installation site, the sheet piles are lifted individually or in pre-assembled pairs using a crane equipped with suitable lifting accessories (e.g., sheet clamps or beam spreaders).
- The steel sheet piles are carefully guided and inserted into the pile gate to ensure proper alignment and interlock engagement. The pile gate is pre-installed and set to maintain verticality and correct line and level of the wall alignment.
- Once positioned, the sheet piles are driven into the seabed using either a vibratory hammer or an impact hammer, depending on ground conditions and project specifications. The choice of hammer will be made based on geotechnical requirements, noise/vibration limitations, and pile penetration resistance. Driving continues until the required toe level or set criteria is achieved.
- The above process is repeated sequentially for each section of wall, typically progressing in 20–30 metre lengths, or as dictated by the project phasing and equipment reach. Continuous interlocking of sheet piles is maintained throughout to ensure structural continuity.
- At the location of the existing subway tunnel, sheet pile installation will be omitted as ground conditions and proximity to the tunnel make this unsuitable in this area. To mitigate this, a reinforced concrete deck supported on a series of structural piles will be constructed above the tunnel alignment. This piled deck will serve as a structural continuation of the quay wall while avoiding any risk to the underlying tunnel. Sheet piling works will therefore proceed on either side of the tunnel exclusion zone, terminating at pre-defined interface points. Alignment and connection detailing at these interfaces will ensure continuity of structural performance between the sheet piled quay wall and the piled deck section.
- At the location of South Portland Street Suspension Bridge, a specialist piling methodology will be employed to enable the installation of steel sheet piles beneath the structure, where vertical clearance is limited. To achieve the required embedment depth within the restricted headroom, sheet piles are expected to be spliced and driven in two stages using modified equipment. Lateral support in this area will be provided by a substantial waling beam, with restraint achieved through the use of ground anchors or tie rods, as specified in the design. This approach ensures structural stability while accommodating the spatial limitations imposed by the existing footbridge.

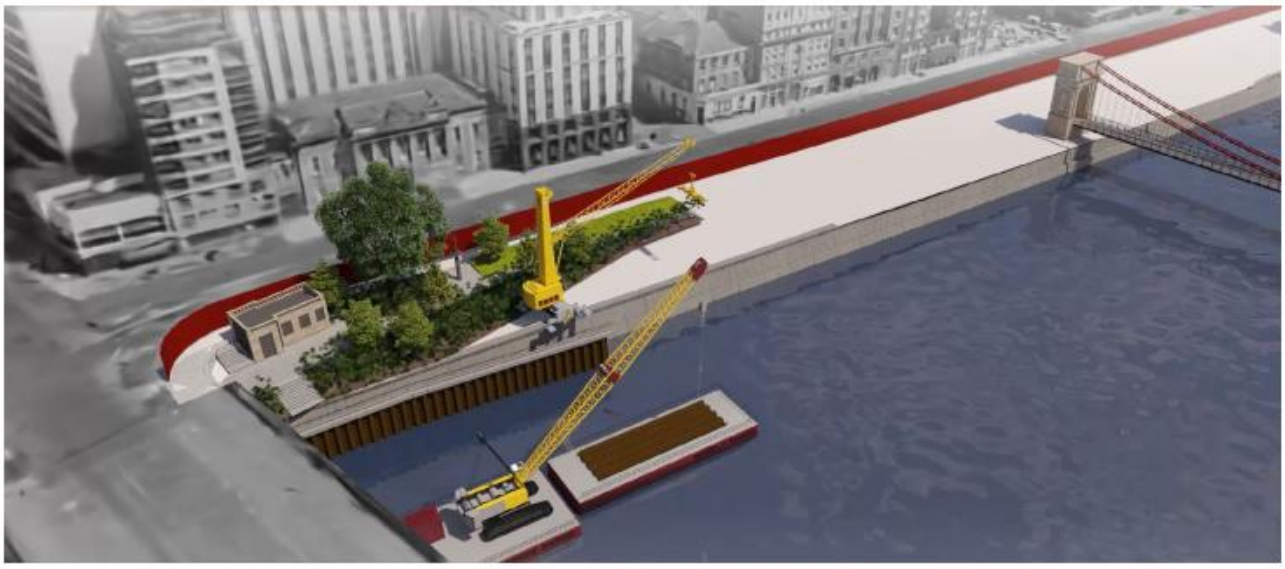

Figure 7 – 3D model of sheet pile installation

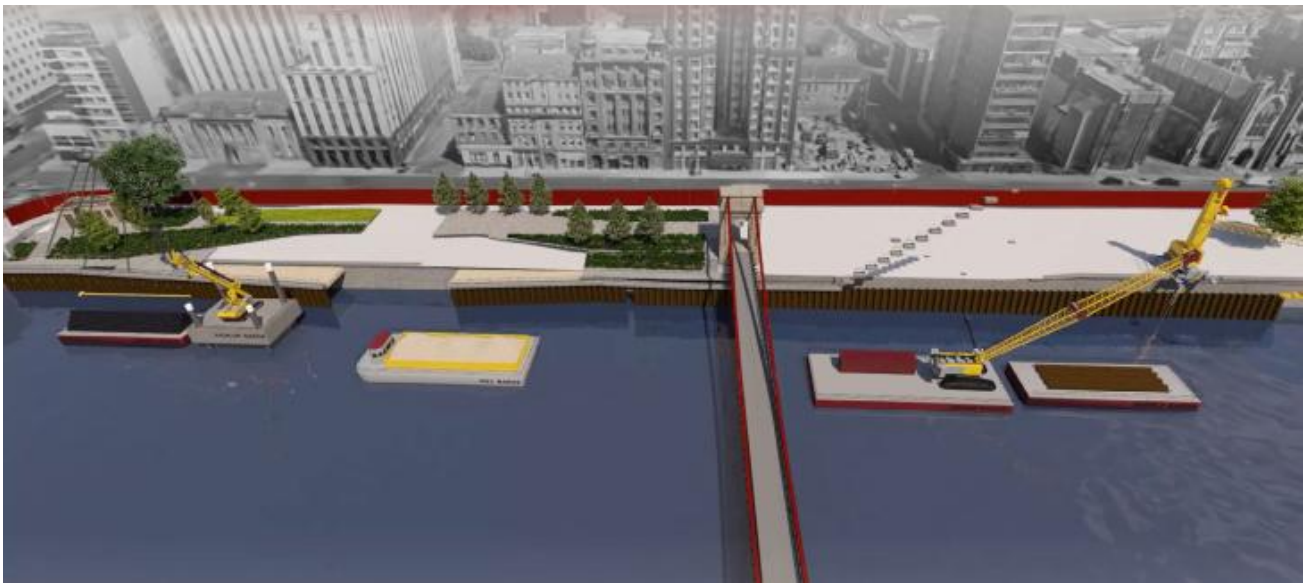

Figure 8 – 3D model of sheet pile installation

2.5 Piling Works – Ground Anchor Installation

The following methodology is for the installation of the ground anchors.

- The jack-up barge will be positioned adjacent to the completed 30 m sheet pile section. The barge will be jacked up to provide a stable working platform and aligned to ensure accurate drilling orientation toward the anchor target zone.
- Anchor locations, inclinations, and entry angles will be set out using survey control in accordance with the anchor layout drawings. Inclination guides or drilling jigs may be installed on the barge deck to ensure consistent alignment.
- Anchor boreholes will be drilled at the specified 45° inclination using a rotary or percussive drilling rig mounted on the jack-up platform. Drilling will proceed to the design embedment depth, which may vary depending on geotechnical conditions (e.g. to reach a competent soil or rock stratum). Drilling fluids or air flush may be used to stabilise the borehole as required.
- Once the borehole is complete and cleaned, the ground anchor system will be installed. This may involve inserting a pre-assembled steel tie rod, strand tendon, or bar system into the borehole.
- For grouted anchors, cementitious grout will be injected into the borehole under pressure to encapsulate the anchor and bond it to the surrounding ground. Grouting will be carried out in accordance with the project specifications and may involve single or multi-stage grouting depending on anchor type.
- The anchor head will be secured to the front face of the sheet pile wall via a waling beam system that will be lowered behind the sheet piled wall using a crawler crane. The wailing beam will be welded to the rear of the sheet piled wall. Anchors will then be stressed using hydraulic jacks to the specified load, monitored via calibrated pressure gauges or load cells, and locked off upon acceptance of the test criteria.
- Upon completion of anchor installation for the current 30 m section, the jack-up barge will be repositioned to the next sheet pile segment, and the above process repeated.

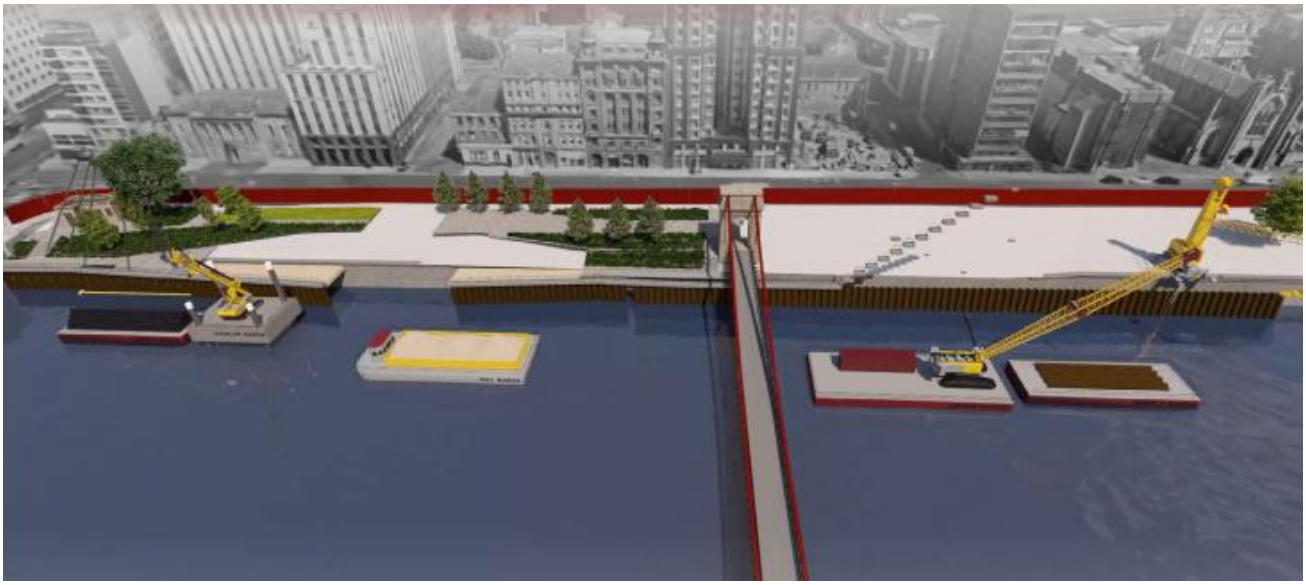

Figure 9 – 3D model of Installation of Ground Anchors

2.6 Subway Tunnel Bridging Structure

The bridging structure shall be installed using similar equipment and plant as the rest of the quay wall. The existing quay wall at the SPT interface shall be stabilised using methods deemed appropriate for the area. A contractor will be required to demonstrate that the construction method proposed for the area will not compromise the structural integrity of the subway tunnel located underneath.

The steel tubular piles supporting the bridging structure shall then be installed and socketed into the bedrock. Pile socketing may be undertaken using a pile top drill or similar as deemed appropriate by the contractor. During pile installation, vibration monitors shall be installed in the subway tunnels and to check vibration levels and within permissible levels.

Once the piles are installed, precast crosshead beams and the perpendicular prestressed bridge beams shall be placed using a crane. To facilitate installation of the precast crosshead beams, some of the existing quay wall shall be take down, this will be localised only and shall be carried out from the quayside.

At this point the sheet piled screen shall be fitted to the front of the piles and finally the in-situ reinforced concrete deck slab shall be poured.

2.7 Drainage Works

The are currently four Scottish Water Combined Sewer Outfalls (CSO's) through the quay wall at Custom House Quay. As part of planned Scottish Water works these shall be consolidated into three new CSO outfalls. During the construction phase the 4 existing CSO's shall be kept online with discharge temporarily extended out past the new quay wall line. The 3 new CSO outfalls are indicatively shown in figure 10 below. The position of the flap valve is still to be determined by Scottish Water. It shall either be positioned on the quay wall as per below or it shall be positioned in a chamber to the rear of the quay wall. Either way a non-return system shall be in place.

The surface water drainage system along Custom House Quay shall be locally collected, treated and discharged through the quay wall at high level through small diameter drainage pipes. The level of the discharge pipes will be sufficiently high with regards to MHWS that no flap valves shall be required.

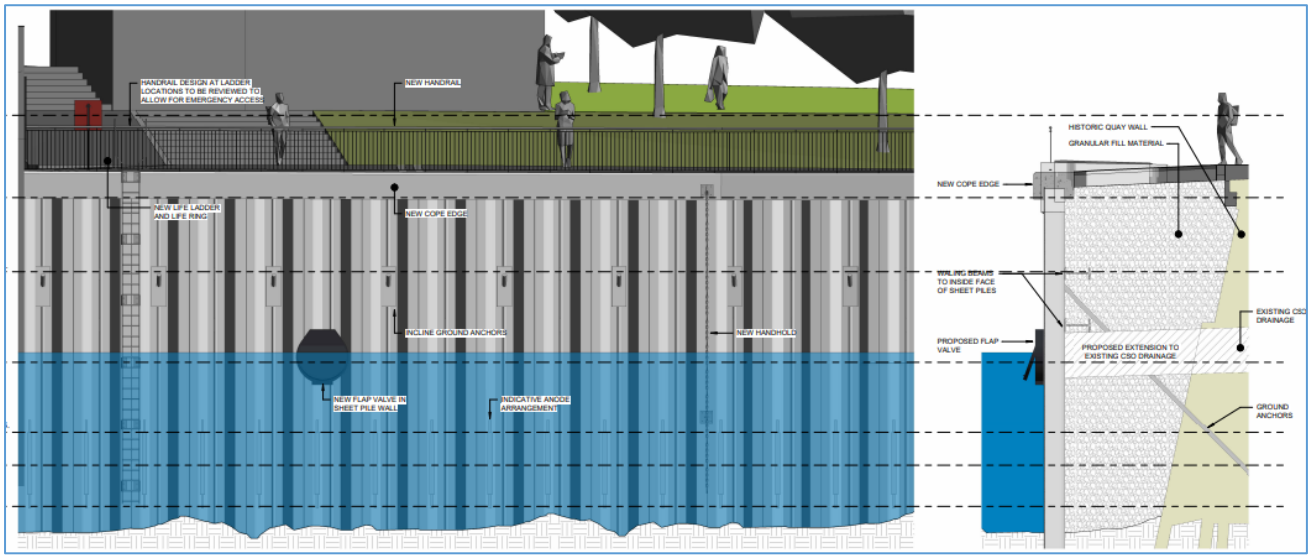

Figure 10 – Typical New CSO Outfall