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Table of contents

1 Introduction
   1.1 Purpose and scope
   1.2 Background

2 Description of activities
   2.1 Overview of proposed works
   2.2 Plant and equipment set-up
   2.3 Princes Wharf section

3 Proposed hazardous substances
   3.1 Quantities of hazardous substances
   3.2 Health and Safety at Work (Hazardous Substances) regulations

4 Industrial and Trade Activities and risk evaluation

5 Discharges to air

6 Environmental setting

7 Management controls
   7.1 Introduction
   7.2 Site establishment
   7.3 Asphalt bund
   7.4 Water management
   7.5 Stormwater catch pits
   7.6 Jet grout spillage control
   7.7 Cement silo management
   7.8 Dust management
   7.9 Spoil management
   7.10 Environmental management and spill response plans

8 Resource consent requirements
   8.1 Hazardous substances resource consent requirements
   8.2 Industrial and Trade Activities
   8.3 Discharges to air

9 Assessment of effects
   9.1 Hazardous substances assessment
   9.2 Industrial and Trade Activities assessment
   9.3 Discharges to air

10 Conclusions

11 Applicability

Appendix A : Figures
Appendix B : Cement Safety Data Sheet
Appendix C : Hazardous Substances Standard Assessment
Appendix D : Industrial and Trade Activity Standards Assessment
Appendix E : Hazardous substances risk assessment
1 Introduction

1.1 Purpose and scope

This Report has been prepared in support of a resource consent application for the Princes Wharf section of the Quay Street seawall upgrade project (Seawall Project). The resource consent application for the Princes Wharf section seeks authorisation for two possible construction methodologies, a palisade wall or jet grout columns. This Report relates to the jet grout column option.

The Report addresses the following chapters of the Auckland Unitary Plan Operative in Part (AUP) chapters and provides an assessment of the actual and potential environmental effects of the actual and potential environmental effects of the proposed jet grout column design and methodology:

- E31 Hazardous Substances;
- E33 Industrial and trade activities; and
- E14 Air quality.

1.2 Background

The Quay Street seawall extends from the western side of Lower Hobson Street to the Western side of Marsden Wharf at the Downtown Ferry Terminal in Central Auckland. The seawall forms the harbour edge of a historical reclamation, which supports Quay Street and the services contained within the road corridor.

The Quay Street seawall upgrade is required in order for the seawall to meet current seismic performance design standards, to repair damage and ensure resilience to future climate and changing use patterns. While the upgrade is part of the overall plan for Downtown Auckland, it is also now an important enabler of the wider Downtown Infrastructure Development Programme (Downtown Programme) to ready the precinct for the America’s Cup (AC36) and Asia-Pacific Economic Cooperation (APEC) events in 2021.

In May 2018, Auckland Transport (AT) lodged three separate applications for resource consent for the upgrade of the Quay Street seawall (the Seawall Project). The Seawall Project has been divided into four sections for the purpose of resource consent applications and construction and, to date, applications have been lodged for three of these four sections. The Ferry Building section is still in the design phase and the resource consent application for this section will be lodged at a later date.

For two of the lodged applications, relating to the Princes Wharf section and the Ferry Basin section, AT would like to include in the application for resource consent an alternative seawall upgrade design and construction methodology. This is in addition to the methodology described in the application documentation already submitted to Auckland Council. This is a result of the Early Contractor Involvement (ECI) phase of the Seawall Project, where alternative seawall upgrade options have been considered.

The alternative seawall methodology (referred to as the jet grout column option) proposed is for the installation of jet grout columns in the Quay Street road reserve, landward of the existing seawall.

The proposal is now to seek resource consent for both the original methodology (as submitted) and the jet grout column option for the Princes Wharf and Ferry Basin sections, so that AT has the option to implement either (but not both) of the options for each section (depending on the final methodology chosen by the appointed contractor).
In summary, resource consents are currently being sought to authorise the following seawall upgrade options:

<table>
<thead>
<tr>
<th>Seawall Section</th>
<th>Application Lodged May 2018</th>
<th>Addendum to Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princes Wharf</td>
<td>Palisade wall</td>
<td>Jet grout columns</td>
</tr>
<tr>
<td>Ferry Basin</td>
<td>Post and panel wall</td>
<td>Jet grout columns</td>
</tr>
<tr>
<td>Queens Wharf to Marsden Wharf</td>
<td>Palisade wall</td>
<td>N/A</td>
</tr>
</tbody>
</table>

A separate resource consent application is being made for each of the sections, and each section will be constructed as a standalone project once consented. The sections may therefore be constructed sequentially, or there may be some overlap in the construction programme.

This Report is based on the following documents:

- Construction Methodology Report, prepared by Downer / Soletanche Bachy dated October 2018;
- Resource consent drawings, prepared by Tonkin + Taylor, dated October 2018; and
2 Description of activities

2.1 Overview of proposed works

Jet grout columns are proposed to be installed landward of the existing seawall on the northern side of Quay Street, within the road reserve, for a length of approximately 105 m. The proposed jet grout column alignment will be south of the Auckland Harbour Board (AHB) Fence lighting pylons, and within the row of existing street trees. The proposed alignment of the jet grout columns will allow for Tree 18 to be retained.

The concept design proposes up to five rows of 1.4 m diameter columns spaced at 1.2 m centres north-south, so that there is 200 mm overlap between the columns in that direction. In the east-west direction the columns are proposed to be spaced at 3.0 m centres. While the alignment of the columns, number of rows, diameter of the columns and spacing may change with the final design, the overall extent of ground treated with jet grout columns is unlikely to be larger than as shown on the proposed drawings.

The jet grout columns will be installed by jet grouting, which is a construction process that involves breaking up the soil with a high-pressure jet in a pre-drilled borehole and mixing the loosened soil with a self-hardening grout to form columns (refer to Figure 2.1.). Excess material will be bought up to the surface as spoil and disposed of.

A gravity grouting operation called “pre-drilling” is required for jet grout columns located in the vicinity of the existing seawall, where there is the presence of basalt gravels and boulders. The gravity grouting process involves pre-drilling through the basalt layers and backfilling the predrilled hole with a thick grout (non-hazardous bentonite (<5%) mix with cement and water) to fill any voids within the basalt boulders. The predrilling diameter shall be sufficient for the further jetting operation (approximately 200 mm diameter is proposed). The final jet grout column is to be adapted based on the actual layer of basalt as per Figure 2.2.

No works within the coastal marine area (CMA) are proposed in the Princes Wharf section of the Seawall Project.

Refer to the Construction Methodology, prepared by Downer / Soletanche Bachy dated September 2018 for further information regarding the proposed works.
Figure 2.1: Jet grouting of columns using twin jets, image provided by Downer

Figure 2.2: Example of gravity grout pre-drilled location with basalt boulders for jet grout columns

The grout mix comprises of cement (delivered by truck tanker and stored in silos) which is mixed on site by a mixing plant and is then delivered by pipe to the head of the rig.

In order to maintain a clean work area, the spoil arising from the head of the holes shall be directed into a spoil collection box as shown in Figure 7.1 and Figure 7.2 (refer to Section 7.9). Spoil will be pumped from the box and discharged to a dedicated spoil pit or container. Once the spoil starts to set, it is tested and removed to an appropriate landfill.
2.2 Plant and equipment set-up

The jet grouting plant (one per jet grout rig) is comprised of the following equipment:

- A high pressure pump (type Soilmec 7T450 or similar) (Figure 2.3 and Figure 2.4);
- A mixing plant (Type TWM30 or similar) (Figure 2.3 and Figure 2.4);
- A horizontal or vertical cement silo (Figure 2.3 and Figure 2.4); and
- A generator or a transformer to supply the electricity.

There will be a maximum of two jet grout rigs and one gravity grout rig in operation at any one time.

Figure 2.3: Example of Jet grouting plant set-up on CRL1 (Auckland)

Figure 2.4: 3D drawing of jet grouting equipment per rig (Spoil pits will be located within the working area)
The jet grouting rig is a Comacchio MC12 or similar, rotary drilling machine equipped with a long mast extension and is specially fitted for jet grouting. The rig is equipped with an on-board computer (Jean Lutz or similar) to control jet grouting parameters and good execution of the column.

Other equipment used in the jet grouting process include:

- Drilling rig for the pre-drilling;
- Spoil pit;
- Water treatment plant or de-sanding unit (to re-use the water of the pre-drilling and pre-jet);
- Excavator and trucks for spoil removal;
- Peristaltic pump (spoil pump) for the spoil transfer between the rig and the spoil pit;
- Water tank for storage (Figure 2.4); and
- Telehandler.

The final location of the jet grouting plant will be determined following detailed design, however it will be located within the construction zone of Princes Wharf section as indicated in Figure 2.5 and Figure 2.6 below. There may be two jet grout rigs installed, one per site, in the event that construction timeframes overlap. If the jet grouting plant is located on ground to be improved with jet grout columns, it will be relocated once during the jet grouting operation for work to proceed on the original location.

Existing drains within the immediate location of the plant will be covered or sealed to avoid potential for contamination. A perimeter bund will be constructed around the plant to prevent clean stormwater from entering the area, and to contain any potentially contaminated stormwater within the area in the event of a spillage (such as from grout or drilling fluid) from works areas into public areas (discussed further in Section 7).

The layouts for each section are described in further detail in Section 2.3 below. The design concepts are yet to be finalised, while the alignment of the columns, number of rows, diameter of the columns and spacing may change in each case with the final design, the overall extent of ground treated with jet grout columns is unlikely to be larger than as shown on the proposed drawings.

The full site drawings can be found in Appendix A.

2.3 Princes Wharf section

Jet grout columns are proposed to be installed landward of the existing seawall on the northern side of Quay Street, within the road reserve, for a length of approximately 105 m. The spoil pits, water treatment, cement storage and mixing plant are indicatively shown to be located at the eastern end of the site.

Jet grout column construction in this site will be executed in two phases to maintain vehicle access to Princes Wharf on the western end shown in Figure 2.4 and Figure 2.6. Once phase 1 is completed, the working area will be adapted as per Figure 2.6 and a hose bridge is to be installed on the road in order to protect the lines connected between the jet grout plant and the jet grouting rig during completion of phase 2.

On the western side, where basalt boulders may be encountered, works will be undertaken following both the gravity and jet grouting method, as described in Section 2.1 and 2.2. However, where columns are about 36m landward of the existing seawall, the gravity grouting operation may not be required depending on the location of basalt boulders, and works will be undertaken as described above in Section 2.2 without pre-drilling.
Figure 2.5: Princes Wharf site layout phase 1 showing spoil pits, water treatment and cement storage at the eastern end and drill rig in action at the western end.

Figure 2.6: Princes Wharf site layout phase 2 showing spoil pits, water treatment and cement storage at the eastern end and drill rig in action at the western end.

Full site drawings can be found in Appendix A.
3 Proposed hazardous substances

3.1 Quantities of hazardous substances

The jet grouting plants will use and store cement within either a single 60 tonne silo or two 30 tonne silos. If required due to timeframes, there may be two jet grouting column construction projects in operation at once, doubling the cement storage quantity with a maximum separation of approximately 100 m. The total volume and hazard classification of cement (from SDS supplied by Downer attached Appendix B) is outlined in Table 3.1.

Table 3.1: Summary of substances, volumes and hazard classifications

<table>
<thead>
<tr>
<th>Substance</th>
<th>Hazard Classification</th>
<th>State</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement HSR002544</td>
<td>6.3A, 6.9B, 8.3A</td>
<td>Solid (powder)</td>
<td>Up to 120 tonnes (60 tonnes per location)</td>
</tr>
</tbody>
</table>

In addition to the storage of cement, small quantities of other additives will be used as part of the plant but these are in small quantities (no more than 20 L) and therefore, are well below any of the trigger levels in the AUP and have not been considered further.

3.2 Health and Safety at Work (Hazardous Substances) regulations

In addition to the requirements under the AUP for hazardous substances the use and storage of Cement will trigger requirements under the Health and Safety at Work (Hazardous Substances) regulations (HSW-HS). The relevant requirements under the HSW-HS for the proposed volumes of cement are outlined in Table 3.2 below.

Table 3.2: Summary of HSW-HS requirements

<table>
<thead>
<tr>
<th>Substance</th>
<th>State</th>
<th>Vol</th>
<th>Identified requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement HSR002544</td>
<td>Solid (powder)</td>
<td>Up to 120 tonnes</td>
<td>Signage (&gt;1,000 L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Emergency response plan (&gt;1,000 L)</td>
</tr>
</tbody>
</table>
4 Industrial and Trade Activities and risk evaluation

Table 4.1 identifies the Industrial and Trade Activities (ITAs) that will be undertaken along with the pollution risks and contaminants associated with each of the activities. The relevant physical (structural) and procedural controls that will be implemented to minimise adverse environment effects are outlined in Section 7 Management controls.

Table 4.1: Risks and contaminants of the Industrial and Trade Activity

<table>
<thead>
<tr>
<th>Sub Activity</th>
<th>Risk identification and contaminants of concern</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ITA Pollution Risks</td>
</tr>
<tr>
<td>Cement storage including loading and unloading</td>
<td>Cement discharged to stormwater</td>
</tr>
<tr>
<td></td>
<td>Contaminants</td>
</tr>
<tr>
<td></td>
<td>Elevated pH, suspended solids</td>
</tr>
<tr>
<td>Jet grout plant and injection</td>
<td>Grout spillage discharged to water (either via stormwater or direct runoff to the harbour)</td>
</tr>
<tr>
<td></td>
<td>Elevated pH, suspended solids</td>
</tr>
<tr>
<td>Spoil handling and storage</td>
<td>Spillage of spoil</td>
</tr>
<tr>
<td></td>
<td>Elevated pH, suspended solids</td>
</tr>
</tbody>
</table>
5 Discharges to air

The proposed jet grout plant will store and handle cement which will be mixed with water within the mixing plant. The cement will be delivered via cement tanker and unloaded pneumatically. The cement silos will be fitted with fabric filters, to collect the dust at the top of the silo as air is displaced during filling. The process does not involve any storage or handling of aggregate or sand. The cement will be fed into the mixing plant via an enclosed system.

Therefore, the main potential for discharges to air is cement dust from the fabric filter during unloading.
6 Environmental setting

The jet grout column construction works are planned to take place on the road reserve of Quay Street which runs between the AUP Business City Centre zoned buildings to the north and south, and the General Coastal Marine zone on the northern side.

Quay Street provides east-west connections across the city for general transport, public transport including ferries, buses, trains and a bi-directional cycleway, and supports access to local businesses. The relatively high density of commercial activity and vehicular and pedestrian traffic in this area means that the area has a high sensitivity to cement dust and hazardous substances.

The proposed works on the existing seawall are also adjacent to the coastal marine area of the Waitematā Harbour. The Waitematā harbour environment is highly modified to facilitate high volumes of marine traffic. The existing stormwater catch pits along Quay Street discharge directly to the harbour. The Ferry Basin Marine Ecological Effects Addendum Report, prepared by Tonkin + Taylor, notes that the benthic species within the ferry basin area are predominantly exotic or invasive and the seafloor is subject to continuous disturbance from ferry movements. Despite being of low ecological value the area is very exposed and of aesthetic value to waterfront patrons.

The nearest council water quality monitoring stations are located at Judges Bay and St Marys Bay, 2 km east and 1.5 km west of the works respectively. Both bays are rated high risk to human health and have no-swim warnings issued by Safeswim due to above-guideline results for Faecal Indicator Bacteria. Coastal pollution in this region is primarily due to the age of combined stormwater and wastewater networks in the area and the propensity for these networks to be overwhelmed during heavy rains, displacing diluted wastewater from engineered overflow points into local waterways or directly to the coast.

There are also other construction operations in the area, including Commercial Bay development and the City Rail Link works (trench excavation works on Lower Queen Street 450 m south of site and the Customs Street/Albert Street intersection tunnel excavation currently underway 350 m south of site). The sections of the seawall may be constructed in overlapping timeframes, with two of the four sections proposed to use jet grout column methodology. Other cement storage and use activities in the vicinity include Firth Industries’ Hamer Street site which is 900 m northwest on Wynyard Quarter and Holcim Ltd 1 km to the east on Plumer Street.
7 Management controls

7.1 Introduction

The proposed management controls are outlined in the Environmental Management Response Plan (EMRP), prepared by Downer and Soletanche Bachy, dated October 2018. The key controls within the EMRP include:

- Site establishment;
- Bunding of the works areas;
- Water treatment and disposal;
- Stormwater management;
- Cement silo management;
- Dust management; and
- Spoil management.

Downer’s Construction Methodology provides an outline of the jet grout spoil management controls that are reproduced in this section. Cement silo management controls provided are industry standards, and the environmental management plan and spill response plan are a required controls for industrial and trade activities. All of these controls are described in more detail below.

7.2 Site establishment

Site establishment works to be undertaken on Quay Street include traffic management, establishment of the site compound and 2.4 m high timber hoarding, construction access and laydown areas, relocation of utility services (as required), removal of existing pavers and installation of clean metaled areas for plant operation and installation of sediment controls.

7.3 Asphalt bund

An asphalt bund will be installed around the site to prevent clean stormwater from entering the site and mixing with disturbed ground from the construction site and to contain any potentially contaminated stormwater within the area in the event of a spillage (such as from grout or drilling fluid) from works areas into public areas. This bund will most likely be laid along the base of the site hoardings to ensure the required heights are achieved to prevent overtopping in a large storm event.

7.4 Water management

Dewatering of spoil may be required at times during construction. A trade waste discharge consent may be applied for which would enable potentially contaminated water to be discharged to sewer once sediment had been settled out. In the event that this trade waste consent is not issued, all dewatered material will be captured on site and removed via tanker for appropriate disposal.

Depending on the volumes of water requiring dewatering, a lamella clarifier maybe installed onsite to ensure the settling of sediment particles within the water prior to discharge.

The source of the water in use for the formulation of the grout will be from the mains, and a de-sanding unit may be used to re-use water from the pre-drilling and pre-jet activities.
7.5 Stormwater catch pits

Stormwater catch pits within the construction site will be managed through the installation of an Enviropod insert (or similar) to capture sediment prior to discharge. The Enviropods will be inspected and maintained on a weekly basis with any accumulated sediment being deposited into the spoil pit for off-site discharge.

Existing drains within the immediate location of the jet grout plant will be covered or sealed to avoid potential for contamination.

Only stormwater that does not come into contact with exposed areas will be directed to the stormwater catchpits; all exposed material in the project area are considered contaminated unless proven otherwise. Stormwater outfalls or discharge points into the harbour immediately downstream of the site will be monitored daily for visible plumes and unexpected sediment discharge.

7.6 Jet grout spillage control

Several measures are proposed to be implemented at site in order to control grout spillage:

- Washing of tools at each rod removal will occur on top of spoil collection box with the mix of water and grout being directly pumped to the pit via the peristaltic pump;
- Installation of a permanent bunded wall around the jet grouting plant slab and installation of sump pit equipped with a submersible pump within the bunded walls;
- Regular inspection of grouting lines;
- Fuse hose is to be installed on the grout line in order to control any leaks in case of increase of pressure (hose burst). A fuse hose is a section of sacrificial hose which controls the location of a hose burst;
- Pre-drilling and monitoring of the prejet is to be used as a check control for potential grout spillage into the sea. As the system works in a close loop any loss of water will be quickly identified and investigated to confirm any spillage into the sea or other location;
- In the event of a grout spill, the material will be contained using provisions of the spill kits, including silt socks or other physical barriers such as plywood or sandbags. Once contained, it will be scraped up and disposed of to the spoil pit where it will be mixed with the jet grout spoil for discharge off site; and
- A Spill Response Plan will be in place with trained staff to deal with the unlikely event of a grout spill.

7.7 Cement silo management

The cement silo will be fitted with a cement silo filter. All filling of the silos will be undertaken under the supervision of operators trained in the procedures for standard operation and emergency response. In addition, the following controls apply:

- The silos will be filled from the base by blowing the cement into the silo from the tanker. The silo is equipped with sensors and high level alarms to prevent over filling or over pressurisation;
- The truck-to-silo connection fittings will not allow the pneumatic pump to operate unless the connection is correct;
- Once the refill is complete, additional air is blasted through the connection to clear cement from the line and ensure no material is lost when disconnecting the fittings; and
- The silo filter will be maintained and cleaned regularly to ensure operational effectiveness.
Weekly inspections of the cement silo and systems will be carried out and recorded to meet the ITA requirement that environmentally hazardous substances are stored and/or contained appropriately.

### 7.8 Dust management

Due to the nature of jet grouting, dust during construction is not anticipated to be an issue. Nevertheless, regular visual inspections will be undertaken by the Site Superintendent during high risk weather e.g. extended dry periods or high winds.

In the event that visible discharges are identified from the site, surface dampening with water will occur.

### 7.9 Spoil management

Waste material from the process, which is a mix of soil, water and grout, will be recovered at the surface and pumped to the spoil pit before being taken away for disposal (using vacuum trucks for liquid or regular trucks for solid material). This process is illustrated further below.

In order to maintain a clean work area, the spoil arising from the head of the jet grout columns will be directed into a spoil collection box as shown in Figure 7.1. Based on the deepest column proposed, the maximum production of spoil per column will be up to 50 m³.

![Figure 7.1: Spoil collection box set up with the rig](image-url)
Figure 7.2: Spoil collection box in operation

Spoil will be pumped from the box (shown in action, refer Figure 7.2) and discharged to a dedicated spoil pit or container shown in Figure 7.3 and Figure 7.4.

The hoses which will run between the collection box and the spoil pit will be inspected daily at their joins and along their length checking for any splits or holes where spoil material could unintentionally be discharged from.
Spoil enters the pit closest to the camera, dewatered in the second section and prepared for offsite disposal in the third pit section. Spoil pits will be sized with contingency for possible rainwater collection and managed to an appropriate level. It is proposed that the pits be uncovered during
operation hours to assist in drying out the spoil mixture, and covered by tarpaulins overnight and during rainfall. Each site will have 3 to 8 bunded pits depending on construction requirements.

7.10 Environmental management and spill response plans

The Environmental Management Response Plan (ERMP) has been prepared for the site to meet the ITA requirements for an environmental management plan specified in Table E33.9.2 (Appendix D). It includes a spill response plan to address the ITA requirements specified in Table E33.9.1 (Appendix D).
8 Resource consent requirements

8.1 Hazardous substances resource consent requirements

The hazardous substances requirements under the AUP are provided in Chapter E31. The activity table in Section E31.4.3 sets out the permitted activity and restricted discretionary activity volumes for hazardous facilities for different land use zones.

The storage and use of hazardous substances for this construction project will be within the road reserve which is not listed in Table E31.4.3. Therefore, the storage and use of cement is a discretionary activity under Rule E31.4.1 (A7) as it is not otherwise provided for. No hazardous substance storage will occur within the coastal marine area.

An initial assessment against the permitted standards has been undertaken in Appendix C.

8.2 Industrial and Trade Activities

The rules applying to ITAs are determined based on Table E33.4.3 which includes a list of ITAs and classifies the risk of an ITA based on the industrial and trade activity area (ITA area).

The ITA area is the total of all areas used for outdoor storage, handling or processing of materials or products that may contribute to the quality or quantity of hazardous substances, and the area at risk from failure of the largest unbunded container.

The activity of preparing and using the grout for column formation has been considered as “Cement, lime, plaster and concrete products” in Table E33.4.3, which would categorise an ITA area of less than 1,000 m² as moderate risk, and an activity area of greater than 1,000 m² as high risk.

The following activities are considered part of the overall ITA area:

- The jet grout plant including the drill rig, high pressure pump and mixing plant;
- Storage of raw materials for use with the jet grout plant including the cement silos; and
- The spoil handling and storage areas.

The total area exceeds 1,000 m² and therefore is a high risk activity.

The activity status is listed as a controlled activity under Rule A8 in Table E33.4.1 for the use of land.

An initial assessment against the permitted standards has been undertaken in Appendix D.

8.3 Discharges to air

The provisions in Chapter E14 of the AUP relate to the management of air quality. The consent status of an activity is determined in Table E14.4.1 by the type of activity and the sensitivity of the surrounding air environment.

The works proposed will be within a high air quality – dust and odour area.

The activity falls under Rule A77 for cement storage, handling, redistribution or packaging, which when located in a high air quality area has a discretionary activity status.
9 Assessment of effects

9.1 Hazardous substances assessment

A hazardous substance risk assessment has been undertaken for the storage and handling of cement (see Appendix E).

The main hazards that have been identified which could result in off-site effects include accidental release associated with a leakage or rupture of the mixing plant equipment through plant or connection failure or through release during operation and recharging of the cement silo.

Cement will be completely contained within the silos and mixing plant and will have specific controls, through design, examination, testing and certification for pneumatic equipment under the HSW-HS regulations. Standard operating procedures and emergency response procedures will be in place to include recharging operations and plant operation.

The risk assessment has assessed the risks to be low. While the sensitivity of the receiving environment has been identified as being high, due to the assessed risk as being low and considering the design and operational procedures the effects associated with the use and storage of cement is less than minor.

Due to the use of main transport routes, the close proximity of the cement supply (located less than one kilometre away along Quay Street) and the use of industry standard secure delivery tankers, the risks associated with the transport of cement to the site are considered low.

9.2 Industrial and Trade Activities assessment

The objective of the ITA rules is to minimise adverse effects on land or water from the use of hazardous substances and discharge of contaminants. The main hazards of the jet grout plant and associated activities include those covered above in Section 9.1, as well as container leak or rupture during unloading of cement at the site, grout entering stormwater or directly discharged overland to the harbour.

As outlined in Section 7, the jet grout plant will be bunded with all stormwater drains either sealed or covered. In addition, the works areas where jet grouting is being undertaken will be bunded to contain any spills or leaks in addition to containing the runoff from the spoil which is conveyed from the rig’s spoil collection box to spoil tanks prior to removal off-site.

The risk of overflow from the spoil tanks will be controlled though procedures for management of the tank levels and disposal, cover of drains in the immediate area, bunding of the site and spill response plans.

All waste from the process will be collected, stored and disposed of at an appropriate landfill. With these controls in place the potential effects to the surrounding environment posed by the jet grout plant are less than minor.

9.3 Discharges to air

The only discharge to air is dust associated with the storage and handling of cement. As outlined in Section 5 above, the cement will be completely contained within the silos and mixing plant, and delivery of cement will be conveyed through sealed connections and pneumatic pumps, resulting in no avenue for loss of cement dust to the air. The silos will also be fitted with fabric filters to minimise any discharges to air from the cement silos during filling.
Dust generation during construction of the jet grout columns is anticipated to be negligible due to the slurry nature of the grout and spoil. Conditions will be monitored by the Site Superintendent during high risk conditions (e.g. high winds, extended dry periods), and surface dampening measures will be deployed where dust discharges are identified.

Taking into consideration the controls listed above, the potential effects associated with discharges to air from the jet grout plant are less than minor.
10 Conclusions

The hazardous substances risk assessment has identified that the risks associated with the storage and handling of the cement at each site are low due to the use of closed systems and equipment controlled by design, examination, testing and certification, and the use of standard operating procedures and with the contingency of emergency response procedures.

Potential effects associated with transporting hazardous substances to the site are minimised by the close proximity of cement supply along an appropriate transport route and use of secure delivery tankers and have been assessed as less than minor.

The risk of adverse off-site effects from the ITA will be mitigated through the site design including proposed spill containment measures (bunded storage, sealed surfaces, stormwater shut-off valve and diversion) and operational procedures (spill response plan, unloading and safe handling procedures and site ITA Environmental Management Plan). With these control measures in place the effects on people and the environment have been assessed as low.

The risks of reduced air quality from cement dust has been assessed as negligible due the use of sealed and closed systems and procedural controls for the handling and storage of cement.
11 Applicability

This report has been prepared for the exclusive use of our client Auckland Transport, with respect to the particular brief given to us, and in accordance with our Letter of Engagement dated 31 August 2018. It may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that Auckland Transport will submit this report to Auckland Council in support of an application for resource consent for the development described herein and that Auckland Council will rely on this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Report prepared by: Authorised for Tonkin & Taylor Ltd by:

Rose Turnwald Richard Reinen-Hamill
Environmental Engineer Project Director
Figure 11.1: Princes Wharf Stage One, featuring indicative jet grout construction equipment
Figure 11.2: Princes Wharf Phase Two, featuring indicative jet grout construction equipment
Ultracem Cement
General Purpose Portland Cement (Type GP)

Classified as: Hazardous according to the Hazardous Substances (Minimum Degrees of Hazard) Regulations 2011.

SUPPLIER DETAILS
Holcim (NZ) Ltd
1/1 Show Place
Addington
Christchurch 8024

Business Telephone: 03 339 7500

Emergency Contact 24 hrs: 0800 CHEMCALL 0800 243 622

Section 1: IDENTIFICATION OF THE MATERIAL

Product Name: Ultracem Cement - General Purpose Portland Cement (Type GP)
CAS No: 65997-15-1

Other names:
Ordinary Portland Cement,
High-Early-Strength Portland Cement,
Moderate-Heat Portland Cement,
Low-Heat Portland Cement,

Recommended use: Used as the basic material for concrete, mortar and paste

Section 2: HAZARDS IDENTIFICATION

Ultracem Cement is not classified as a Dangerous Good for Transport.

Ultracem Cement is classified as hazardous according to criteria in the Hazardous Substances (Minimum Degrees of Hazards) Regulations 2001.

Classified under the group standard Construction Products (Subsidiary Hazard) Group Standard 2006

HSNO APPROVAL NUMBER: HSR002544

HSNO CLASSIFICATIONS:
6.3A Skin irritant
6.9B Harmful to human target organs or systems (respiratory)
8.3A Eye corrosive
H315 Causes skin irritation.
H318 Causes serious eye damage
H371 May cause damage to organs (respiratory)
H373 May cause damage to organs (respiratory) through prolonged or repeated exposure

GHS Classification:  
Skin corrosion/irritation Category 2  
Eye damage/irritation Category 1  
Specific target organ toxicity (single exposure) Category 2 (respiratory system)  
Specific target organ toxicity (repeated exposure) Category 2 (respiratory system)

GHS Pictograms:

DANGER

PREVENTION STATEMENTS:  
P260 Do not breathe dust.  
P264 Wash hands and other areas of exposed skin thoroughly after handling.  
P270 Do not eat, drink or smoke when using this product.  
P280 Wear protective gloves/protective clothing/eye protection/face protection.

RESPONSE STATEMENTS  
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.  
P332 + P313 If skin irritation occurs: Get medical advice/attention.  
P362 Take off contaminated clothing and wash before re-use.  
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.  
P310 Immediately call a POISON CENTER or doctor/physician.  
P309 + P311 IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.

STORAGE  
P405 Store locked up.

DISPOSAL  
P501 In accordance with the Hazardous Substances (Disposal) Regulations 2001. Refer to Section 13 of this SDS.
Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Main Component</th>
<th>Material Name</th>
<th>CAS Number</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Cement consisting of</td>
<td>Calcium Silicates</td>
<td>65997-15-1</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>Clinker</td>
<td>Calcium Silicates</td>
<td>12168-85-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calcium Aluminate</td>
<td>12042-78-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calcium Aluminoferrite</td>
<td>12068-35-8</td>
<td></td>
</tr>
<tr>
<td>Gypsum</td>
<td>Calcium Sulfate</td>
<td>7778-18-9</td>
<td></td>
</tr>
<tr>
<td>Calcium Oxide</td>
<td></td>
<td>1305-78-8</td>
<td>≤2%</td>
</tr>
<tr>
<td>Crystalline Silica</td>
<td></td>
<td>14808-60-7</td>
<td>&lt;0.1%</td>
</tr>
</tbody>
</table>

NOTE: Composition is dependent upon product origin.

Section 4: FIRST AID MEASURES

Workplace Facilities Required: Eye wash and safety shower facilities are recommended.

If Inhaled: Remove to fresh air, away from dust. If coughing and other symptoms persist, seek medical attention.

In Contact with Eye: Hold eyes open, flush with water for at least 15 minutes. If irritation or redness persists, seek medical attention. Continue rinsing. Note: If wet cement is splashed in the eye treat as above and seek immediate medical attention.

In Contact with Skin: Immediately wash skin with plenty of soap and water, while removing contaminated clothing and shoes. Wash contaminated clothing before re-use. Seek medical advice if irritation persists.

If Swallowed: DO NOT INDUCE VOMITING. Rinse mouth. Give large quantities of water. Never give anything by mouth to an unconscious person. Seek medical attention if symptoms persist. If vomiting occurs, keep head below hips to prevent aspiration to lungs.

Personal Protective Equipment: It is recommended that the first aid responder wear gloves and eye protection to prevent exposure to wet cement.

Advice to Doctor: Treat symptomatically. Wet cement is corrosive and exposure to skin or eye may cause caustic type burns. Ophthalmological opinion should be sought for burns to eyes.
Section 5: FIRE FIGHTING MEASURES

Fire/Explosion Hazard: Ultracem Cement is not flammable or combustible.

Suitable Extinguishing Media: Use extinguishing media appropriate to the surrounding environment.

Precautions in Connection with Fire: None required

Section 6: ACCIDENTAL RELEASE MEASURES

An emergency response plan is required under the Hazardous Substances (Emergency Management) Regulations 2001 when held in quantities greater than 10,000kg.

Precautions: Clear area of all unprotected personnel. Keep unnecessary and unprotected personnel from entering area. Avoid release to the environment.

Suitable Protective Equipment: Emergency responders must use personal protective equipment, including gloves, safety goggles and overalls and dust masks.

Spill or Leak Procedures: Contain and recover product where possible. Sweep or vacuum up dry substance and collect in an appropriate container. Avoid contact with water as this will cause the cement to set. Do not flush to sewer. After the majority of the dry cement has been cleaned up, the water may be used to clean up residual material, ensuring that the cleaning water is recovered and neutralised before disposal.

Water Spill: If a spill occurs into a waterway, notify the Regional Council.

Waste Disposal Methods: Dispose of as per Section 13.

Emergency preparation: Ensure there is appropriate and adequate personal protective equipment, trained personnel and clean up materials for management of accidental release.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Do not breathe dust. Wear protective clothing, including gloves, eye protection, dust mask.

Safe Handling: Ensure correct manual handling procedures are observed when handling bags. Avoid skin and eye contact. Do not eat drink or smoke when using this product. Keep away from food, foodstuffs, drinks or clothing. After use wash exposed skin thoroughly. As this product is alkaline, avoid contact with acidic products.

Approved handler: An approved handler is not required for this substance.
Storage: Storage areas need to offer suitable protection from moisture to prevent the cement from setting. Ensure packages are sealed and protected from physical damage. Ensure all labelling on packaging remains intact and legible. Storage areas should be locked when not in use.

Site Storage Requirements: Site Signage will be required when quantities exceed 1000kg.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

It is an offence to exceed the HSNO exposure standard, including the workplace exposure standards, unless provided as a guidance only under section 77B.

Workplace Exposure Standards: Portland Cement: 10mg/m3 TWA as inspirable dust.

Engineering Controls: Dust minimisation measures must be taken to reduce exposure. Use local mechanical ventilation or extraction in areas where dust generation is unavoidable. When handling large amounts, a dust collection system should be considered. Clean work areas regularly.

Personal Protective Equipment: Avoid contact with the skin, eyes and avoid breathing dust.

Avoid extended contact of skin with wet cement and never kneel in wet cement. Wear personal protective equipment such as overalls, impervious footwear, and gloves such as PVC. Refer to Australian and New Zealand Standards AS/NZS 4501 for occupational protective clothing and AS/NZS 2161 for protective gloves.

Remove any contaminated clothing to avoid prolonged contact with the skin. Wash work clothes regularly.

Use safety glasses with side shields or safety goggles to protect eyes. When handling large quantities consider using a face shield. Refer to AS/NZS 1336 for suitable eye and face protection.

Where dust exposure is unable to be fully controlled by engineering controls, wear a suitable P1 or P2 dust mask. When handling large quantities where a lot of dust is generated a half face or full face particulate respirator should be considered. Ensure all personnel using dust masks or respirators have been trained on their proper use and maintenance. Refer to AS/NZS 1715 and AS/NZS 1716 for suitable respiratory protection.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Description: Ash grey powder

Odour: Odourless

Melting Point (°C): Approx 1350°C

Vapour Pressure: Not applicable

Solubility: Very low solubility in water. Reacts to form an alkaline solution.
Section 10: STABILITY AND REACTIVITY

Stability: Reacts with water and becomes a stable solid. Wet cement is caustic prior to setting. When stored correctly is sealed packages, away from moisture, product is stable.

Conditions to Avoid: Unintended contact with water.

Incompatibility: Avoid contact with acidic products as exothermic reactions may occur.

Section 11: TOXICOLOGICAL INFORMATION

Acute Exposure

Acute Toxicity: Ultracem Cement is not an acutely toxic substance via oral, skin, or inhalation exposure routes.

Inhalation: Inhalation of dust is irritating to the nose, throat and respiratory tract causing sneezing and coughing. Inhalation of dust may aggravate pre-existing conditions such as asthma.

Ingestion: This product may be slightly abrasive and corrosive to the mouth and throat if swallowed although this route of exposure is unlikely under normal industrial handling.

Skin Contact: Causes irritation. Dust irritates and dries the skin. Wet cement is strongly alkaline and may cause serious skin burns without obvious pain at the time of exposure.

Eye Contact: May cause caustic burns to the eyes. Dust is also a mechanical irritant.

Chronic Exposure:

Mutagen/Carcinogen/Reproductive Toxicant: There is no data to indicate that Ultracem Cement is mutagenic, carcinogenic or a reproductive toxicant.

Specific Target Organ Systemic Toxicity: Ultracem Cement contains a small percentage of Calcium Oxide (up to 2%) which is classified as having a toxic effect on the respiratory system through single exposure and repeated exposure. Therefore, Ultracem Cement may be harmful to the human respiratory system with an increased risk of bronchitis or pneumonia.

Other Chronic Health Effects: Ultracem Cement contains trace amounts of Chromium which may cause allergic dermatitis in individuals who are allergic to Chromium.
Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: There is no information to indicate that Ultracem Cement is toxic to the environment. The product forms an alkaline slurry when mixed with water which may affect the pH of aquatic systems if exposed to large quantities. For this reason, the product should be kept clear of waterways.

Persistence/degradability: Product is persistent and has low degradability.

Bio-accumulation: Unknown.

Mobility: Product is not expected to be mobile in a landfill situation.

Section 13: DISPOSAL CONSIDERATIONS

Disposal: Ultracem Cement can be taken to a landfill site for disposal. Avoid dust generation during disposal. Keep out of drains and waterways. Cleaning water from spills can be disposed of via a licenced waste disposal contractor. The cleaning water may need to be neutralised prior to disposal.

Disposal of Packaging: Packaging can be taken to a landfill site for disposal.

Section 14: TRANSPORT INFORMATION

Ultracem Cement is not classified as a Dangerous Good for transport in accordance with NZS5433:2012.

UN Number: None allocated
Proper Shipping Name: None allocated
Class and Subsidiary Risk: None allocated
Packing Group: None allocated
Hazchem Code: None allocated

Transport with a method that does not cause dust. Ensure transportation methods prevent torn bags, leakage from packages and collapsing loads. Take precautions to prevent moisture contamination.

In case of emergency call 0800 CHEMCALL (0800 243 622).

Section 15: REGULATORY INFORMATION

HSNO Approval Code: HSR002554
HSNO Classifications: 6.3A - Skin irritant
6.9B - Harmful to target organs or systems (respiratory)
8.3A - Eye corrosive

This substance does not trigger Location Test Certificate, Approved Handler or Tracking requirements.

Section 16: OTHER INFORMATION

The information provided in this Safety Data Sheet relates only to the specific material designated herein. This Safety Data Sheet summarises our best knowledge of the health and safety hazard information of the product and how to safely handle the product in the workplace. Each user should read this SDS and consider the information in the context of how the product will be handled and used in the workplace including its use in conjunction with other products.

This substance is approved under HSNO for use as a construction product. All reasonable care has been taken to ensure that the information and advice contained herein are from sources believed to be reliable and to represent the most up-to-date knowledge available at the date given in Section 16. Holcim (NZ) Ltd assumes no liability for any damages related to the use or misuse of this substance.

All chemical materials may present unknown hazards as people have varying degrees of sensitivity to chemicals. Therefore, this product should be used with caution. The information herein is given in good faith, but no warranty, express or implied is made.

SDS Created: 25/09/2015
Revised: 27 July 2016
Revised: 26 October 2016

Reason for Revision 27 July 2016: Holcim logo added, product name change.
Reason for Revision 26 October 2016: Crystalline Silica added to Section 3 table.

References:

EPA NZ Chemical Classification and Information Database
Supplier SDS: Mitsubishi Materials Corporation, Portland Cement, January 2015.

END OF SAFETY DATA SHEET
Appendix C: Hazardous Substances Standard Assessment
**Table 1.1: Assessment against permitted activity standards E31.6**

<table>
<thead>
<tr>
<th>E31.6 Standards</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E31.6.1. Hazardous facilities site design</strong></td>
<td><strong>Comment</strong></td>
</tr>
<tr>
<td>(1) Any part of a hazardous facility involved in the manufacture, mixing,</td>
<td><strong>Not applicable</strong></td>
</tr>
<tr>
<td>packaging, storage, loading, transfer, usage or handling of hazardous substances</td>
<td></td>
</tr>
<tr>
<td>must be located designed, constructed and operated to ensure that:</td>
<td></td>
</tr>
<tr>
<td>(a) on-site facilities are set back from the more sensitive uses and watercourses</td>
<td>Any unintended spill material will be contained on site by virtue of multiple bunding controls. Spill response plans will be in place to facilitate swift clean-up of any spill material. There will be no accumulation outside of the site area.</td>
</tr>
<tr>
<td>to comply with the distances specified in the activity tables above; and</td>
<td></td>
</tr>
<tr>
<td>(b) hazardous substances are stored to:</td>
<td></td>
</tr>
<tr>
<td>(i) ensure that in the event of an unintended spill or release substances are</td>
<td>Site drainage systems will be operated to avoid contaminants discharging from the site, systems include: bunding of equipment containing hazardous substances, bunding of the site perimeter, coverage of onsite drainage, and installation of enviropods at controlled drain sites.</td>
</tr>
<tr>
<td>contained within the intended areas of the site; and</td>
<td></td>
</tr>
<tr>
<td>(ii) prevent the accumulation of any solid, liquid, gas or vapour outside of</td>
<td>No discharge of hazardous substances, unless a tradewaste agreement can be obtained from Watercare, in which case only treated wastewater will be discharged within the parameters of the agreement.</td>
</tr>
<tr>
<td>the site area.</td>
<td></td>
</tr>
<tr>
<td>(2) The site drainage systems (including for washwater) must be designed,</td>
<td></td>
</tr>
<tr>
<td>constructed and operated to prevent the entry or discharge of hazardous</td>
<td></td>
</tr>
<tr>
<td>substances into:</td>
<td></td>
</tr>
<tr>
<td>(a) the stormwater or sewerage systems unless authorised by the relevant</td>
<td></td>
</tr>
<tr>
<td>network utility operator; and</td>
<td></td>
</tr>
<tr>
<td>(b) air, land or water, including groundwater and potable water supplies,</td>
<td></td>
</tr>
<tr>
<td>unless authorised by a resource consent or another rule in the Plan.</td>
<td></td>
</tr>
<tr>
<td><strong>Note 11</strong></td>
<td>Compliance can be achieved using precautionary methods, including clearly identified stormwater grates and access holes, roofing, sloped pavements, interceptor drains, containment and diversion valves, oil-water separators, sumps and similar systems.</td>
</tr>
<tr>
<td><strong>E31.6.3. Hazardous facilities spill containment system</strong></td>
<td>All bunding and containment will be constructed of impervious materials resistant to cement or grout.</td>
</tr>
<tr>
<td>(1) Any part of the hazardous facility site where a hazardous substance spill</td>
<td>No liquid hazardous substances are proposed.</td>
</tr>
<tr>
<td>may occur must be serviced by a suitable spill containment system that is:</td>
<td></td>
</tr>
<tr>
<td>(a) constructed from impervious materials resistant to all hazardous substances</td>
<td></td>
</tr>
<tr>
<td>on-site; and</td>
<td></td>
</tr>
<tr>
<td>(b) for liquid hazardous substances:</td>
<td></td>
</tr>
<tr>
<td>(i) able to contain the maximum volume of the largest tank present plus an</td>
<td></td>
</tr>
<tr>
<td>allowance for stormwater or fire water;</td>
<td></td>
</tr>
</tbody>
</table>
(ii) for drums or other smaller containers, able to contain half of the maximum volume of substances stored, plus an allowance for stormwater or fire water;  
Any small volumes of hazardous substances will have secondary containment that meets this requirement

(iii) able to prevent any spill or other unintentional release of hazardous substances, and any stormwater and/or fire water that has become contaminated, from entering the stormwater drainage system, unless authorised by the relevant network utility; and  
Stormwater drainage systems will be covered and managed to avoid discharge of contaminants

(iv) able to prevent any spill or other unintentional release of hazardous substances, and any stormwater and/or fire water that has become contaminated, from discharging into air, land or water, including groundwater and potable water supplies, unless authorised by a resource consent or another rule in the Plan.  
Entire site will be bunded at the perimeter to contain all hazardous substances on site.

**E31.6.4. Hazardous facilities waste management**

(1) Any hazardous facility generating waste containing hazardous substances must dispose of these wastes to lawfully operated facilities or be serviced by a Council approved waste disposal contractor  
Waste product ‘spoil’ will be collected in spoil pits, dried and disposed of via an appropriate facility.
Appendix D: Industrial and Trade Activity Standards Assessment
**Table 1.1: Assessment against permitted activity standard E33.6.1.1**

<table>
<thead>
<tr>
<th>Permitted activity standards E33.6.1.1. Use of land for an industrial or trade activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Wastewater and washwater produced by industrial or trade activities must be disposed of on-site via the sanitary sewer, subject to approval from Watercare, or it must be collected, either for recycling or disposal, to a system or facility with all the appropriate authorisations to accept wastewater of that type. For the purposes of this rule, wastewater or washwater also includes: (a) boiler blow down and condensate; (b) all waste liquids generated or collected as part of an industrial or trade activity; (c) cooling tower water excluding vapour; and (d) condensate from air compressors.</td>
<td>A waste mixture of soil, water and grout is generated during construction of jet grout columns and will be collected in spoil tanks and disposed of offsite by contracted waste specialists. A Trade Waste consent may be sought for the discharge of water from the jet grout process. If this is not successful, this water will be removed off-site by vacuum truck for disposal off-site at an approved disposal facility.</td>
</tr>
<tr>
<td>(2) A spill response plan is prepared where any environmentally hazardous substance is handled, used or stored on land at a quantity greater than used for domestic purposes. These plans must meet the requirements of Table E33.9.1 as relevant and be supplied to the Council on request.</td>
<td>A spill response plan will be provided as an appendix to the Environmental Management Response Plan.</td>
</tr>
<tr>
<td>3) For environmentally hazardous substances in quantities covered by Part 4 of the Hazardous Substances (Emergency Management) Regulations 2001, a spill response plan prepared in accordance with those regulations will be considered to comply with Standard E33.6.1.1(2) provided the emergency spill response plan also explicitly addresses matters (vi) to (x) in Table E33.9.1.</td>
<td>N/A - Standard E33.6.1.1(2) will be met.</td>
</tr>
<tr>
<td>(4) For environmentally hazardous substances not covered by Part 4 of the Hazardous Substances (Emergency Management) Regulations 2001, a spill response plan prepared in accordance with Council’s factsheet 'Being Prepared for a Spill' will be considered to comply with Standard E33.6.1.1(2).</td>
<td>A spill response plan will be provided as an appendix to the Environmental Management Response Plan.</td>
</tr>
<tr>
<td>5) When the quantity of environmentally hazardous substances stored above the ground exceeds that used for domestic purposes, it must be stored: (a) in a container and in a manner that prevents the entry of rainwater into the container; and (b) within a secondary containment device or within a containment system that is constructed of impervious materials that are resistant to chemical attack from the substances contained therein.</td>
<td>All environmentally hazardous substances will be stored in closed containment in bunded areas. The only significant volumes of environmentally hazardous substances is cement which is a solid and stored within a sealed cement silo. The waste spoil will be stored in open bunded containment (to aid drying), which will be covered with tarpaulins during rainfall, overnight, or outside of site working hours.</td>
</tr>
<tr>
<td>(6) For environmentally hazardous substances in quantities covered by Part 4 of the Hazardous Substances (Emergency Management) Regulations 2001, storage requirements in accordance with those regulations will be considered to comply with Standard E33.6.1.1(5).</td>
<td>N/A - Standard E33.6.1.1(5) will be met.</td>
</tr>
</tbody>
</table>
For environmentally hazardous substances not covered by Part 4 of the Hazardous Substances (Emergency Management) Regulations 2001, storage requirements in accordance with council’s factsheet ‘Above Ground Storage’ noting the following bund sizing criteria for secondary stage storage, will be considered to comply with Standard E33.6.1.1(5) where:

(a) for tanks the bund has a storage capacity of at least 110 per cent of the capacity of the largest tank taking into account the volume displaced by any equipment and/or materials stored within the bund; and

(b) for drums the bund has an effective storage height of at least 100mm, allowing for any sloping ground, and the bund is set back from the drums by a distance equal to half the height of the stacked or stored drums.

Cement stored in solid powder form in a certified tank does not require a bund. Bunding around jet grout mixing plant will be approximately 150mm in height.

All secondary containment devices must be designed, constructed and managed so that uncontaminated rainwater and stormwater runoff is prevented from flowing into the contained area.

Uncontaminated rainwater and stormwater runoff will be prevented from flowing into contained areas. Roofing over jet grout plant minimises rainwater entering the bunded area.

Weekly inspections must be undertaken and recorded to check that environmentally hazardous substances are stored and/or contained appropriately except as follows:

(a) National Grid - monthly inspections;

(b) electricity substations – annual inspections; and

(c) unmanned depots or facilities - monthly inspections.

Weekly inspections will be undertaken and documented.

A regular reconciliation process must be undertaken for any environmentally hazardous substance stored in an underground storage tank that will identify any leakage or unaccounted losses of material from the tank.

N/A no underground tanks

Any waste compactors and bins must be located and operated in such a manner that prevents leachate or waste leaking from them.

Waste ‘spoil’ from the formation of grout columns will be stored and operated in a manner that prevents leachate or any leaks.

All on-site vehicle re-fuelling areas must be segregated and housed under cover, and/or surrounded by a drain that drains to an appropriately designed and sized stormwater treatment and spill containment device fitted with a shut-off valve.

Refuelling of drill rig and excavator by diesel mini- tanker will occur occasionally on site away from stormwater catch pits. Attended refuelling will ensure no spills or over-filling occurs.

Operations must be undertaken in accordance with an environmental management plan specific to the industrial or trade activity. This plan must be prepared in accordance with Table E33.9.2, and supplied to Council upon request.

The Environmental Management and Response plan has been prepared to meet the requirements of E33.9.2 and will be supplied to the Council.

Where the industrial or trade activity is located within a sewage treatment facility then the wastewater generated on site by that industrial or trade activity may be disposed of within that facility.

N/A – Not a sewage facility
### Table 1.2: Industrial and Trade Activities environmental management plan requirements

<table>
<thead>
<tr>
<th>Table E33.9.2 Environmental management plan requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Specify how the permitted activity controls will be complied with</td>
</tr>
<tr>
<td>ii. Identify the environmentally hazardous substances associated with the industrial or trade activity</td>
</tr>
<tr>
<td>iii. Set out the methods to be used to avoid discharges of environmentally hazardous substances onto or into land or water</td>
</tr>
<tr>
<td>iv. For discharge of contaminants arising from land on which the industrial or trade activity is undertaken, set out the primary treatment or source control methods that may be necessary to avoid, remedy or mitigate more than minor adverse effects on the receiving environment</td>
</tr>
<tr>
<td>v. Specify the methods for the operation and maintenance of any treatment devices on site</td>
</tr>
<tr>
<td>vi. Identifies assessment requirements to report on the performance of the environmental management plan</td>
</tr>
</tbody>
</table>

### Table 1.3: Industrial and Trade Activities spill response plan requirements

<table>
<thead>
<tr>
<th>Table E33.9.1 Spill response plan requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. A protocol/method for identifying and stopping the discharge of environmentally hazardous substances to land or water and avoiding future events of this nature</td>
</tr>
<tr>
<td>ii. Emergency containment and clean-up procedures</td>
</tr>
<tr>
<td>iii. A list of appropriate spill kit contents to enable the containment and/or absorption of spilt material and a plan showing the location of the spill kits</td>
</tr>
<tr>
<td>iv. A requirement for appropriate signage to identify the location of spill kits and the actions to be taken in the event of a spill</td>
</tr>
<tr>
<td>v. Actions to remedy or mitigate any adverse effects on the environment or public health and safety arising from the discharges or spills of environmentally hazardous substances to land or water</td>
</tr>
<tr>
<td>vi. Methods for disposal of spilt environmentally hazardous substances and any other contaminated materials used in the spill clean-up</td>
</tr>
<tr>
<td>vii. A schedule of adequate training for personnel in the use of the emergency spill response plan and in anticipating and preventing the likelihood of spills</td>
</tr>
<tr>
<td>viii. Up-to-date and accurate copies of all drainage plans for the land on which the industrial or trade activity is undertaken showing the location of the final discharge point to the public stormwater system or to land or water</td>
</tr>
<tr>
<td>ix. A procedure for notifying as soon as practicable Council’s 24-hour emergency response service and the relevant stormwater or wastewater network operator in the event of any discharge of environmentally hazardous substances that results in, or is likely to result in, contamination of any stormwater system, or land or water</td>
</tr>
<tr>
<td>x. Methods for disposing of any spills in a secondary containment device. The plan must set out how it will be disposed of in an appropriate and authorised manner</td>
</tr>
</tbody>
</table>
Appendix E: Hazardous substances risk assessment
Introduction

The following sub-sections set out a risk assessment of the storage and handling of hazardous substances at the site for the proposed storage volumes. The approach to hazard analysis and risk assessment is based on Ministry for the Environment Guidance for Hazardous Facilities ME339\(^1\) (2000).

The risk assessment involves consideration of:

- Identification of potential hazards, failure modes and exposure pathways;
- The sensitivity of the surrounding environment;
- The separation distances from neighbouring activities and the number of people potentially at risk from the facility;
- Cumulative risks of hazardous facilities in the area; and
- Transport of hazardous substances on and off the site to ensure safe access and appropriate routes for delivery vehicles on site to minimise risk of spillage.

Hazard analysis

The hazards associated with hazardous substances are generally classified as follows:

- Fire/Explosion Effects: concerned with damage to property, the built environment and safety of people;
- Human Health Effects: concerned with the well-being, health and safety of people; and
- Environmental Effects: concerned with damage to ecosystems and natural resources.

Table 1.1 sets out the hazard analysis for the site, identifying and rating potential hazards.

The hazards identified are considered to be low. No hazards have been identified that cannot be mitigated through the proposed site control measures.

Table 1.1: Hazard Analysis

<table>
<thead>
<tr>
<th>Hazardous Substance</th>
<th>Identification of potential hazard properties (HFSP Hazard level)</th>
<th>Failure Modes</th>
<th>Exposure pathways</th>
<th>Indicative hazard rating</th>
<th>Potential off-site effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>People (respiratory health hazard, skin and eye damage)</td>
<td>Connection failure to mixing plant, Or to jet grouting drill, Entering groundwater during curing</td>
<td>People Environment</td>
<td>Low/moderate health effects, low/moderate hazard to the environment</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Environment (alkaline)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Risk analysis

Method

A qualitative analysis of the identified hazards/failure modes has been undertaken, in accordance with the method described in the MfE (2000) guidance, by applying a qualitative rating to the frequency (likelihood) of the failure occurring, taking into account the controls in place, and an effects rating which considers the severity of the potential effect. The qualitative likelihood and effects ratings are described in Table 1.2 and Table 1.3, respectively.

Table 1.2: Qualitative rating of likelihood

<table>
<thead>
<tr>
<th>Frequency rating</th>
<th>Descriptor</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Almost certain</td>
<td>The event is expected to occur in most circumstances</td>
</tr>
<tr>
<td>B</td>
<td>Likely</td>
<td>The event will probably occur in most circumstances</td>
</tr>
<tr>
<td>C</td>
<td>Moderate</td>
<td>The event should occur at some time</td>
</tr>
<tr>
<td>D</td>
<td>Unlikely</td>
<td>The event could occur at some time</td>
</tr>
<tr>
<td>E</td>
<td>Rare</td>
<td>The event may occur only in exceptional circumstances</td>
</tr>
</tbody>
</table>

Table 1.3: Qualitative rating of effects

<table>
<thead>
<tr>
<th>Effects rating</th>
<th>Descriptor</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Insignificant</td>
<td>No injuries, negligible damage to property</td>
</tr>
<tr>
<td>2</td>
<td>Minor</td>
<td>First aid treatment required, minor damage to property</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>First aid treatment required, moderate damage to on-site property, minor damage to off-site property</td>
</tr>
<tr>
<td>4</td>
<td>Major</td>
<td>Extensive injuries, extensive damage on-site, moderate damage to off-site property</td>
</tr>
<tr>
<td>5</td>
<td>Catastrophic</td>
<td>Fatalities both on and off-site</td>
</tr>
</tbody>
</table>

The likelihood and effects ratings are then combined to qualitatively assess the overall level of risk associated with each hazard. The risk assessment matrix is shown in Table 1.4.

Table 1.4: Risk matrix

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Frequency</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insignificant (1)</td>
<td>Minor (2)</td>
</tr>
<tr>
<td>Almost certain (A)</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>Likely (B)</td>
<td>Moderate</td>
<td>Significant</td>
</tr>
<tr>
<td>Moderate (C)</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Unlikely (D)</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Rare (E)</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

The hazards identified in Table 1.1 for cement are considered to be low/moderate in relation to human and environmental toxicity.
Table 11.5: Risk Assessment

<table>
<thead>
<tr>
<th>Event</th>
<th>Likelihood of event</th>
<th>Effects</th>
<th>Level of risk</th>
<th>Mitigation/Management Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak from connections from silo to mixing plant</td>
<td>Rare - The event could occur at some time</td>
<td>Minor – potential injury to persons on-site</td>
<td>Low, managed through design and site controls.</td>
<td>Appropriate design, testing, certification and maintenance of the silos, mixing plant and connections will minimise the risk of leakage of hazardous substances. Secondary containment for the grout mixing plant will be in place. Emergency response plans will be prepared for the event of accidental release.</td>
</tr>
<tr>
<td>Leak from connections from road tanker to storage silo</td>
<td>Rare – the event could occur at some time</td>
<td>Minor – On site effects only</td>
<td>Low</td>
<td>Offloading procedures, emergency response procedures and training in place. Appropriate design, testing, certification and maintenance of the silos, tankers and connections will minimise the risk of leakage of hazardous substances.</td>
</tr>
</tbody>
</table>