Watercare Services Limited

QUEEN STREET WASTEWATER DIVERSION PROGRAMME: MAYORAL DRIVE ALIGNMENT PROJECT

SITE MANAGEMENT PLAN

23 JUNE 2025

CONFIDENTIAL

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SITE MANAGEMENT PLAN

Watercare Services Limited

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REV	DATE	DETAILS
A	23/06/2025	Issue to Client

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ABBREVIATIONS AND DEFINITIONS

AC	Auckland Council
AUP	Auckland Unitary Plan (Operative in Part)
DSI	Detailed Site Investigation
m bgl	Metres below ground level
MfE	Ministry for the Environment
NESCS	National Environmental Standard
PAH	Polycyclic Aromatic Hydrocarbons
PSI	Preliminary Site Investigation
SMP	Site Management Plan
SVR	Site Verification Report
TPH	Total Petroleum Hydrocarbons
The alignment	The new wastewater pipeline between the P4MH3 shaft within 329 Queen Street and the P1MH1 shaft within Vincent Street
Watercare	Watercare Services Limited
WSP	WSP New Zealand Limited

1 INTRODUCTION

1.1 OVERVIEW

WSP New Zealand Limited (WSP) has been engaged by Watercare Services Limited (Watercare) to develop a Site Management Plan (SMP) for the proposed Mayoral Drive Alignment portion of the Queen Street Programme, herein referred to as 'the alignment'.

Watercare is proposing to upgrade the existing wastewater network of the upper (southern) catchment of the Auckland city centre. The current network has insufficient capacity to meet future needs based on increased development in the area. The wider programme of works has been split into separate parts for the purpose of design, consenting and construction; the consenting and construction packages of the Queen Street programme are shown in Figure 1-1. A detailed overview of the Mayoral Alignment is provided in Figure 1 of Appendix A.

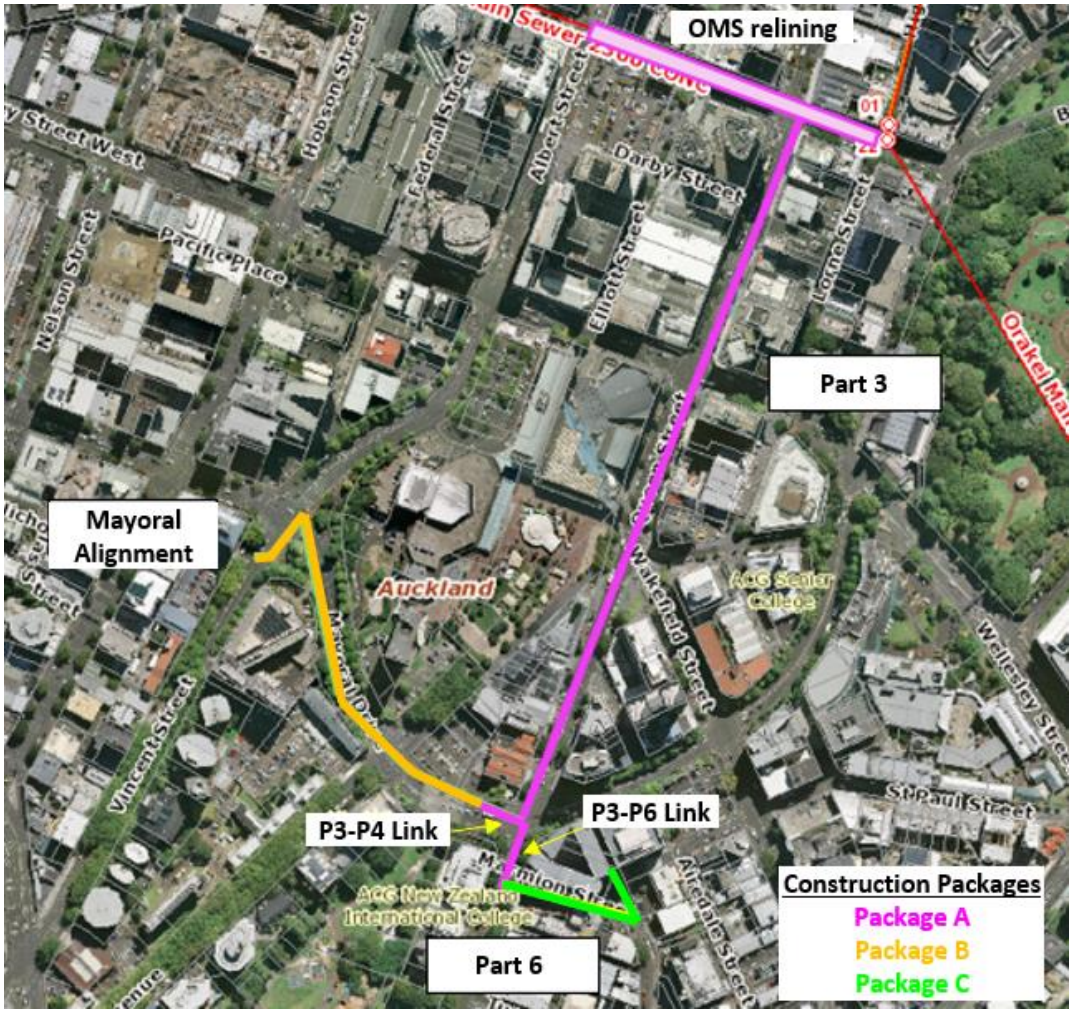

Figure 1-1: Queen Street Wastewater Diversion Programme

The alignment involves a new wastewater pipe within or adjacent to the road reserve of Mayoral Drive. The works proposed include a 375mm – 700mm diameter wastewater pipeline between the P4MH3 shaft within 329 Queen Street and the P1MH1 shaft within Vincent Street, along with connections to 'engineered overflow points' (EOPs) and manholes.

1.2 OBJECTIVE

This SMP has been prepared to ensure soils disturbed, removed, and/or remaining in the alignment during the works meet the requirements of the following:

- *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NESCS).
- *Auckland Unitary Plan – Operative in Part 2016* (AUP), (updated June 2025)
- *Technical Guidelines for Disposal to Land* (WasteMINZ, 2023)
- *New Zealand Guidelines for Assessing and Managing Asbestos in Soil* (NZGAMAS) (BRANZ, 2024)

This SMP has been developed in accordance with the Ministry for the Environment (MfE) *Contaminated land management guidelines No. 1: Reporting on contaminated sites in New Zealand* (CLMG, No. 1) (MfE, 2021a) and is a live document, to be updated throughout the project when necessary.

1.3 PROPER USE OF THIS DOCUMENT

WSP has prepared this SMP to outline site management procedures associated with contaminated soil that will be required to be disturbed during the proposed works.

These controls must be complied with when undertaking ground disturbance activities along the alignment and include the prevention of uncontrolled release of soil contaminants (including dust emissions, soil erosion and sediment discharges), health and safety precautions for site contractors, disposal procedures for soil (where required), additional sampling and recording requirements.

The principles outlined in this SMP will be used by the contractor to detail actual practices and methodologies for site specific work areas. This plan remains a working document throughout the duration of the site works and may be updated under the technical verification of a Suitably Qualified and Experienced Practitioner (SQEP).

1.4 RESPONSIBILITIES FOR IMPLEMENTATION

The main contractor is responsible for implementing this SMP. A copy of this report shall be kept on site for the duration of the project works and shall be updated throughout the duration of the project when required (e.g., procurement of additional information or change in scope).

Project personnel shall be briefed on the contents of this SMP and be encouraged to read it, particularly those personnel likely to be exposed to contaminated soil.

1.5 PROPOSED WORKS

Watercare plan to upgrade the existing wastewater network which involves a new wastewater pipe within or adjacent to the road reserve of Mayoral Drive. The development works will include soil disturbance, and re-use or disposal of excess spoil. The current soil disturbance estimates for

the works are summarised below. The current construction design for the alignment is attached in Appendix B.

Open cut construction works:

- Open cut construction is proposed for two short sections of the proposed pipeline between the shafts for P4MH3 and the P3-P4 Connector Tunnel within 329 Queen Street, and between P1MH2 and the end connection EX MH - 4845768 within Vincent Street.
- Open cut construction is also proposed for network tie-ins and connections to existing EOPs.

Trenchless tunnelling works:

- It is proposed to construct the tunnelled sections between manholes P4MH3 (within Greys Avenue carpark) and P1MH2 (within Vincent Street, opposite the intersection with Mayoral Drive) of the wastewater pipeline using a trenchless pilot-guided boring methodology. Minimal soil disposal is expected.

Temporary construction shafts:

- Six construction shafts are proposed along the Mayoral Drive alignment.
- Total earthworks volume for the shafts is approximately 1,898 m^3 (see Table 1-1 below for a breakdown).
- Additional earthworks volume due to temporary works is approximately 170 m^3, making the **total earthworks volume for the proposed works 2,068 m^3**.

Table 1-1: Summary of shaft earthworks

Manhole ID	Width (m)	Length (m)	Depth (m)	Earthworks Volume (m^3)
P4MH3	5	5	6.5	162.5
P4MH2	5	7.5	9	337.5
P4MH1	5.5	12	9	594
P5MH2	5	6.5	8.5	276
P5MH1	5	9.5	7	332.5
P1MH2	5	6	6.5	195

1.6 PREVIOUS INVESTIGATIONS

WSP has previously undertaken a Preliminary and Detailed Site Investigation (PSI & DSI) (WSP, 2025) and two Hazardous Activities and Industries List (HAIL) Assessments along the Mayoral Drive alignment. One HAIL assessment was for the northern section of the alignment (WSP, 2022a) and the other HAIL assessment was the southern section of the alignment (WSP, 2022b). A summary of the PSI & DSI report is provided in Section 1.6.1.

Following the completion of the PSI & DSI report, GWE Consulting Engineers (GWE) produced an SMP and Site Validation Report (SVR) for specific construction works within the Greys Avenue carpark. The findings of the SVR are detailed in Section 1.6.2.

1.6.1 WSP (2025) - PRELIMINARY & DETAILED SITE INVESTIGATION

WSP conducted a PSI and DSI for the alignment, completing the intrusive investigation portion in 2023. The report has since been updated to reflect the latest design change (Appendix F of the Application).

The PSI identified the HAIL category G3 (*Landfill sites*) within the vicinity of the proposed works, relating to the Greys Avenue carpark at the southern end of the alignment. This was identified based on previous investigations, which recorded construction and demolition (C&D) material underlying the asphalt surfacing, reported to include concrete slabs, timber, bricks, and refuse.

Based on the above, a DSI was proposed targeting the C&D material at Greys Avenue carpark and for soil disposal purposes along the alignment.

The scope of the DSI comprised:

- Collection of 35 soil samples from nine locations across the alignment.
- Analysis of representative soil samples for potential contaminants of concern, including:
    - Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc).
    - Total petroleum hydrocarbons (TPH).
    - Polycyclic aromatic hydrocarbons (PAH).
    - Asbestos.

All investigated locations comprised fill material underlying asphalt to depths up to approximately 1.4 metres below ground level (m bgl). The fill material was primarily sandy gravels with minor building refuse, consisting of brick, metals, and ceramics, observed within the fill in all locations. The fill was underlain by silty clays. An overview of the sampling locations is provided in the attached Figure 2, Appendix A.

Soil results were reported exceeding the Auckland Region Background Concentrations – Volcanic (ARC, 2001) at five of the nine sampling locations (BH23/02, BH23/03, BH23/05, BH23/06, and BH23/07). Asbestos was recorded exceeding the NZGAMAS soil guideline values (SGV) for commercial/industrial land use criteria at two locations (BH23/05 and BH23/07). Additionally, a bonded asbestos-containing concrete sheet was reported at BH23/03_0.7.

Based on the reported soil concentrations exceeding background concentrations, the NESCS was considered to apply to much of the alignment. The proposed works are expected to exceed permitted soil disturbance volumes under regulation 8 (3) and therefore a controlled activity consent is required. However, at locations where asbestos SGV was exceeded (BH23/03, BH23/05 and BH23/07), a restricted discretionary consent is required.

Overall, resource consent is required under the NESCS as a restricted discretionary activity.

With respect to the AUP, five samples (BH23/02_0.5, BH23/04_0.5A, BH23/05_0.45, BH23/06_1.0, BH23/06_2.0) reported exceedances for heavy metals above the AUP Permitted Activity Criteria. Therefore, the AUP is considered likely to apply to land at and adjacent to these locations. The total soil disturbance in areas where the AUP applies is expected to exceed the permitted activity volume for the project of 200 m^3. Therefore, a controlled activity consent is required. Under Chapter E30.6.2.1, a Site Management Plan (SMP) is required in this case.

The PSI/DSI recommended that an SMP is produced for the proposed soil disturbance works to provide guidance on the framework of Health, Safety and Environmental risk control measures during the works with an Unexpected Discovery Protocol (UDP) outlining the course of action if evidence of contaminated soils and groundwater or hazardous materials are encountered during earthworks.

1.6.2 GWE (2024-2025) – SMP AND SITE VALIDATION REPORT

Since WSP completed the initial DSI investigation in 2023, GWE have completed a Site Management Plan (SMP) (GWE, 2024) specifically for a temporary shaft at the eastern end of Greys Avenue carpark associated with the P3-P4 Connector, and a platform for a separation plant in the central area of Greys Avenue carpark. GWE subsequently produced a Site Validation Report (SVR) (GWE, 2025) for the completed excavation works associated with the separation plant platform construction.

Earthworks for the separation plant platform were undertaken from January to February of 2025, supervised by GWE and reported within the SVR. GWE reported significant building rubble in the area of the proposed platform, likely sourced from the former building demolished in-situ prior to the car park construction. The C&D material comprised timber, concrete, plaster mouldings and brickwork. Asbestos-containing material (ACM) consisting of non-friable cement board fragments was observed in the C&D material, not exceeding a total of 0.5 m^2 of fragments.

As the C&D material was deemed geotechnically unsuitable, 202.6 m^3 of material was cut and approximately 300 m^3 of imported fill material was brought onto site.

2 REGULATORY ENVIRONMENT

2.1 HEALTH AND SAFETY AT WORK ACT 2015

The *Health and Safety at Work Act 2015* (HSWA) places a duty on a person conducting a business or undertaking (PCBU) to eliminate all health and safety risks associated with the use of the site as a workplace, as part of the design process. As contamination represents a health and safety risk, the PCBU has an obligation to eliminate exposure to contamination where possible and to minimise the risk of exposure as far as reasonably practicable where elimination is not possible.

2.2 HEALTH AND SAFETY AT WORK (ASBESTOS) REGULATION 2016

Specific regulations have also been developed under the HSWA which relate to the management of asbestos in the workplace and also cover the regulation of asbestos in soil. The *Health and Safety at Work (Asbestos) Regulations 2016* (HSWA-A) sets out duties and controls for any work involving asbestos or ACM and should be read in conjunction with the NZGAMAS, which details specific controls with regard to working with asbestos in soil.

2.3 NESCS 2011

The policy objective of the NESCS is to ensure land affected by contaminants in soil is appropriately identified and assessed when soil disturbance and/or land development activities take place. The NESCS enables the safe use of affected land by:

- Establishing regulations for five land use scenarios that ensure district planning controls relevant to assessing and managing public health risks from contaminants in soil are appropriate and nationally consistent.
- Establishing soil contaminant standards protective of human health and requiring their use when decisions are made under the NESCS; and
- Ensuring best practice and consistent reporting on land affected or potentially affected by contaminants is applied that enables efficient information gathering and consistent decision-making.

3 ALIGNMENT DETAILS

The alignment is located within Auckland city centre, on a section of Mayoral Drive between Queen Street and Vincent Street/Cook Street, along with a short extension within Vincent Street. In addition, the project works will also occur within Greys Avenue carpark on Greys Avenue. An overview of the proposed alignment is provided in the attached Figure 1, Appendix A.

A summary of the alignment details is provided in Table 3-1 below.

Table 3-1: Summary of alignment details

DESCRIPTION	SITE INFORMATION
Alignment address	Alignment is between 329 Queen Street to 67-101 Vincent Street along Mayoral Drive
Approximate alignment area	16,003 m^2
Approximate total earthworks volume	2,068 m^3
Legal description	N/A
Territorial Authority	Auckland Council (AC)
Current site use	Road
Proposed site use	Road
Adjacent sites use	Commercial

4 SITE MANAGEMENT PROCEDURES

4.1 GENERAL

The purpose of this SMP is to provide procedures for earthworks within the identified areas to ensure soil disturbance is conducted in a manner that appropriately manages the potential impacts of the soil contamination relating to human health and the environment.

Contamination is one of several hazards that may need to be managed during the works. Details of how hazards are to be managed on site will be provided by the main Contractor in the overall project health, safety, and environment plan (HSEP) and the construction environmental management plan (CEMP). The HSEP will include a full list of site and activity-related hazards and prescribed controls, and the CEMP will detail general management controls at the site (for example, hours of operation) and construction-related controls such as the specifics of sediment and erosion control devices.

This SMP has been developed to outline the appropriate control measures when conducting soil disturbance along the alignment to effectively:

- Minimise worker and public contact with contaminated soil.
- Ensure that waste soil is appropriately managed.
- Manage the quality of any imported fill materials to ensure that contaminated materials are not imported to the site. This includes any recycled granular materials brought to site.
- Minimise risk to local sensitive environmental receptors.

This section details the procedures for the management of contaminated soil during the earthworks and redevelopment. It includes control measures for reducing human exposure to contaminated soils while minimising contaminated discharges to air and land. These measures must be established prior to commencing works and be maintained throughout the project.

Based on the findings of the previous investigations, contaminants of concern were found to exceed Auckland Regional Background Concentrations for Volcanic Soils and risk to human health criteria for commercial/industrial land use. The primary contaminants are heavy metals and asbestos.

Asbestos was reported in soil samples recovered from four of the nine locations of the DSI; BH23/03, BH23/05, BH23/06 and BH23/07. Concentrations were below the commercial/industrial SGV for fibrous asbestos (FA) and asbestos fibres (AF) at BH23/03 and BH23/06 and exceeded the SGV in three samples from BH23/05 and one from BH23/07. Specific controls for the areas of asbestos-contaminated soils are detailed in Section 4.6. Note that asbestos-contaminated soils are not deemed suitable for re-use on-site.

No other contaminants were reported exceeding commercial / industrial soil SGV; therefore, soils at all other locations where asbestos was not identified are suitable for re-use on-site.

4.2 CONTAMINATED SOIL DEFINITION

For the purposes of this plan, contaminated soil is any soil which contains concentrations of contaminants above the adopted background concentrations, or the AUP permitted activity criteria. The definition of cleanfill is provided in Section 4.9.

4.3 ROLE AND RESPONSIBILITIES

The allocated roles for the implementation of this SMP are provided in Table 4-1 below.

Table 4-1: Role and responsibilities

ROLE	RESPONSIBILIITES	RESPONSIBLE PARTY	CONTACT DETAILS
Project Owner	Overall authority of the site and proposed works	Watercare Services Limited	TBC
Main contractor	Responsible for the completion of the proposed works in accordance with contract documents, construction drawings, this SMP, UDP and any applicable resource consents. Responsible for ensuring all site staff are inducted into the requirements of this SMP and all required tools and equipment are available during works.	Fulton Hogan	TBC
Engineers Representative	Responsible for the oversight of the proposed works in accordance with contract documents, construction drawings, this SMP, UDP and any applicable resource consents.	TBC	TBC
Contaminated Land Specialist	Responsible for the preparation of this SMP in accordance with the CLMG, No.1. Responsible for completion of any further sampling and reporting (as required) and to be available throughout the works in the case of an unexpected discovery of additional contamination.	WSP	Laurence Shotliff Environmental Scientist Laurence.Shotliff@wsp.com
Regulatory Authority	Overall authority over site works in accordance with district and regional planning rules.	Auckland Council	TBC

4.4 PRE-WORKS

The following procedures shall be implemented by the contractor prior to any ground disturbance works commencing.

AC shall be notified according to requirements of the consent. Prior to works commencing, the Contractor shall ensure that the following are in place to aid in the management of site safety and environmental compliance.

- Signage, including works information and health and safety requirements.
- Fencing, where appropriate, to exclude entry by the general public.
- Silt and sediment controls measures.

It is recommended that the person(s) responsible for undertaking the ground disturbance activity (generally the contractor) prepare and implement a health and safety plan/Job Safety and Environment Analysis (JSEA) in compliance with the *Health and Safety at Work Act 2015* and associated regulations, legislation, codes, and guidelines.

The health and safety plan should cover hazards associated with the work (e.g., equipment used) and working practises/activities.

- All workers shall be inducted prior to carrying out works at the site. The induction shall include the likelihood of contaminated soil, training relating to indicators of contamination, protocols for unexpected discovery of contamination, and personal protective equipment (PPE) requirements.
- Eating, drinking, and smoking should only be permitted in specified areas of the site, and after thorough hand washing has occurred.
- Hand to mouth and hand to face contact should be avoided on site.

4.5 SITE MANAGEMENT DURING SOIL DISTURBANCE

This section outlines the site-specific controls and management processes to be followed during soil disturbance along the alignment.

4.5.1 PERSONAL PROTECTIVE EQUIPMENT

Based on the DSI the following PPE will be mandatory for all personnel involved in ground disturbance activities where the potential for direct contact (including accidental) with contaminated materials exists:

- Wrist to ankle cover.
- Wipeable safety footwear.
- Nitrile gloves (if soil is handled directly).
- P2, or higher, grade dust masks (if there is the potential for the generation of contaminated dust).
- Safety glasses.
- Hard hat.

- Hi-vis.

The above list should be reviewed prior to site works to ensure the appropriate level of PPE based on the works to be undertaken.

Additional PPE may be required for disturbance of asbestos contaminated soils, refer to Section 4.6 for further information.

4.5.2 DECONTAMINATION

For the areas of the alignment requiring asbestos controls, a decontamination process will need to be followed when undertaking soil disturbance. The areas requiring asbestos controls are detailed in Section 4.6.

The purpose of decontamination is to reduce potential exposure and further prevent the spread of contamination outside the work area.

All workers are required to be appropriately trained in decontamination procedures at the initial site induction. Typical decontamination steps for those in direct contact with contaminated soils include the following:

Note that these steps will be reviewed prior to works commencing on site and be adapted according to the type of works to be completed.

1. Take all equipment to the designated decontamination area, which is protected by a polythene ground sheet.
2. Spray around worker with clean misting spray to drop any airborne fibres out of suspension, and to dampen down any fibres present on the workers PPE.
3. Wipe all equipment down with wet wipes (excavation equipment can be washed down on site with water), disposing of wipes into a 200 micron clearly labelled waste disposal bag.
4. Remove coveralls carefully by peeling back the hood and following the coveralls inside out, gloves and boot covers can be rolled into the coveralls. Dispose all into the waste bag.
5. Wipe down hands, boots, and respirator with wet wipes, dispose of wipes in waste bag.
6. Wipe down ground sheet and dispose of ground sheet in waste bag.
7. Move to an open area, hold breath and remove remaining PPE, wipe face around mask seal and the mask itself, dispose of wipes in waste bag.
8. Double bag and dispose of waste appropriately.

4.6 REMOVAL OF ASBESTOS-IMPACTED MATERIAL

Based on the soil data collected during the WSP DSI (WSP, 2025) and information reported by GWE (GWE, 2025), asbestos controls are recommended for the following areas of construction during soil disturbance:

- P4MH3: Soil disturbance should be supervised by an asbestos competent person. If C&D material and/or ACM is identified, trace asbestos contamination controls should be put in place, escalating to higher controls if deemed necessary.

- P4MH2: Soil disturbance should be supervised by an asbestos competent person with trace asbestos contamination controls in place, escalating to higher controls if deemed necessary.
- P4MH1B/P4MH1A: From surface to 0.5 m bgl trace asbestos controls should be in place, from 0.5 to 3 m bgl works low level asbestos controls should be in place, with no controls required then onwards.
- P5MH2: From surface to 3 m bgl trace asbestos controls should be in place.

The requirement of an asbestos competent person at P4MH3 and P4MH2 is based on the recorded C&D material beneath the Greys Avenue Carpark, which may be variable in asbestos content and require dynamic risk control.

P5MH2 has two sampling locations in its vicinity (BH23/06 and BH23/08B), trace asbestos was recorded at BH23/06 and no asbestos was recorded at BH23/08B. WSP consider following the controls for BH23/06 to be prudent, as there is considered to be a high potential to encounter asbestos containing material given the area of excavation for the shaft (5 m x 6.5 m).

The controls for P4MH1B/P4MH1A are based on the asbestos levels recorded at sampling location BH23/05.

The asbestos control levels noted above are detailed in Table 6 (*Primary mitigation control requirements for work involving asbestos*) and Table 7 (*Vehicle decontamination* requirements) of the NZGAMAS, reproduced here for reference in Figures 4-1 and 4-2, respectively.

The PPE and respiratory protective equipment (RPE) requirements for trace asbestos contamination are as follows:

- No air monitoring has been undertaken, and therefore the asbestos-specific PPE detailed in Figure 4-1 will be required.
- It is considered unlikely for trace levels of asbestos during air monitoring to be exceeded, therefore, no asbestos-specific RPE is required.

Where low-level asbestos controls are required (detailed above), the recorded level of asbestos exceeds the commercial/industrial SGV, and so soil/fill material will require off-site disposal. Re-use of asbestos contaminated soils not exceeding the SGV is acceptable within the alignment as all areas will be covered by a hardstand layer; however, it is not recommended as it will necessitate the need for asbestos controls throughout the project and in cases of future soil disturbance in the contaminated areas.

Scenario	PPE	Respiratory protective equipment (RPE)*	Dust/asbestos fibre suppression	Decontamination facilities
Class A Contamination >0.01 f/ML (Air) >1% FA/AF (Soil)	Disposable coveralls rated type 5, category 3, nitrile gloves, steel toe capped gumboots or safety footwear with disposable overshoes.	Full-face P3 respirator with particulate filter. Consider increasing to power-assisted if required.	Water and asbestos-encapsulating polymer emulsion product applied before starting work and during as required. Consider adding a surfactant to water for amphibole fibres (brown and blue).	Basic disposable wet decontamination tent or trailer. Consider powered and plumbed decontamination unit if project scale warrants.
Class B Contamination >0.01 f/ML (Air) >0.01% FA/AF (Soil) >1% ACM (Soil)		Half-face P3 respirator with particulate filter. Consider increasing to full-face if friable ACM present.		Basic disposable decontamination tent and foot wash.
Low Level Asbestos Contamination ≤0/01 f/ML (Air) >0.001% FA/AF (Soil) >0.01% ACM (Soil)		Disposable P2 dust mask.	Water via localised points. Addition of surfactants and polymers where the location is sensitive (such as adjacent to busy centres, schools). Temporary cover of contaminated area awaiting remediation.	
Trace Asbestos Contamination ≤0.01 f/ML (Air) <0.001% FA/AF (Soil) <0.01% ACM (Soil)	No asbestos-specific PPE if air monitoring confirms asbestos below 0.01 f/ml.	No asbestos-specific RPE if SQEP confirms unlikely to exceed trace levels in air monitoring (0.01 f/ml) and/or if air monitoring confirms asbestos below 0.01 f/ml.		Foot wash and used PPE collection area.

*Refer to Part C section 14 of the ACOP and AS/NZS 1715:2009 for more information on RPE selection.

Table 6. Primary mitigation control requirements for work involving asbestos.

Figure 4-1 Control requirements for work involving asbestos (sourced from BRANZ, 2024)

Scenario	Vehicle assessment before demobilisation from site	Vehicle assessment completed by	Vehicle (truck) protection	Truck/excavator air conditioning
Class A Contamination >0.01 f/ML (Air) >1% FA/AF (Soil)	Visual plus swab samples, air sampling should be undertaken inside the cab.	Independent assessor or independent competent person.*	200 µm heavy-gauge polythene wrapped soil/lined trays and truck covered.	HEPA filter system fitted for all occupied vehicles, filter replaced or clean down with HEPA vacuum cleaner post work.
Class B Contamination >0.01 f/ML (Air) >0.01% FA/AF (Soil) >1% ACM (Soil)	Visual (plus swab samples if friable ACM is elsewhere on site – lagging, insulation, etc).	Independent assessor or independent competent person.*		HEPA filter system fitted for all occupied vehicles where friable ACM on site (lagging, insulation, etc).
Low Level Asbestos Contamination ≤0/01 f/ML (Air) >0.001% FA/AF (Soil) >0.01% ACM (Soil)	Visual assessment.	Competent person or SQEP.	Truck lining/soil wrapping depends on the receiving landfill. All trucks should be covered.	Standard air conditioning.
Trace Asbestos Contamination ≤0.01 f/ML (Air) <0.001% FA/AF (Soil) <0.01% ACM (Soil)				

*An independent competent person must meet the requirements of regulation 41(3) under the Asbestos Regulations.

Table 7. Vehicle decontamination requirements.

Figure 4-2 – Vehicle decontamination requirements (sourced from BRANZ, 2024)

4.7 EXCAVATION AND DISTURBANCE OF CONTAMINATED SOIL

Soils classified as exceeding Class 5 criteria (i.e., above site background concentrations) shall have the following procedures applied when handling and disposing of excavated materials and/or spoil derived from the site. Note that Class 4 and Class 3, as defined in the *Technical Guidelines for Disposal to Land* (WasteMINZ, 2023) are classed as having higher concentrations of contaminants present than Class 5, and herein represent contaminated soil.

The soil re-use and disposal options are tabulated below based on the specific areas of construction. Spoil generated from sections of trenchless construction is expected to be at sufficient depth that it will be within natural strata and so should be suitable for disposal as Class 5.

Table 4-2: Soil Reuse / Disposal Options

Construction Location	Depth (m bgl)	Accepted Criteria	Contaminants
P4MH3[1]	0 – 0.5	Class 3	Heavy metals and trace asbestos
	>0.5	Class 5[2]	-
P4MH2[1]	0 – 0.5	Class 3	Heavy metals and trace asbestos
	>0.5	Class 5	-
P4MH1B/P4MH1A	0 – 0.5	Redvale Landfill (as exceeds Class 3)	Heavy metals and trace asbestos
	0.5 – 3	Class 3	Heavy metals and low-level asbestos
	>3	Class 5	-
P5MH2	0-0.5	Redvale Landfill (as exceeds Class 3)	Heavy metals and trace asbestos
	0.5-3	Class 4	
	>3	Class 5	-
Works from P5MH1 westwards	-	Class 5	-

1. P4MH2 and P4MH3 are within or adjacent to Greys Avenue Carpark, which is recorded to be underlain in areas by buried C&D material containing asbestos. Therefore, where C&D material is encountered during excavation of P4MH2 or P4MH3, material should be disposed of as Class 3 with trace asbestos (<0.001 % w/w) based on the available site data.
2. Note that Class 5 (Cleanfill) criteria is site dependent and acceptance of material at a cleanfill facility should be confirmed prior to works commencing.

Should unusually coloured or odorous soil/fill be identified during the site works, the contractor shall contact Watercare's project manager (who will seek SQEP input if necessary). Following notification, a visual inspection of the material should be completed, and additional advice regarding its safe handling and disposal and the requirement of the collection of any validation samples of excavated material is to be provided. Further detail of this process is outlined in the UDP in Section 5.4 of this SMP.

4.7.1 STOCKPILE MANAGEMENT

In the event that the excavated material is stockpiled onsite prior to offsite disposal, stockpiled material will be managed by the contractor as follows:

- The receiving ground should be covered in plastic sheeting, such as a high-density polyethylene liner, to prevent material runoff.
- A bund will be constructed around the stockpile to minimise stormwater run-on and run-off.
- Stockpiles will be wetted and maintained damp (but not wet) and/or kept covered with plastic sheeting when material is not being added or removed to prevent erosion and dust generation.
- Stockpiles will not exceed 2m in height.
- Stockpiling should not be undertaken for extended periods of time (>1 month).

- Stockpiling of buried demolition waste should be avoided where possible.

4.7.2 EROSION, SEDIMENT AND DUST CONTROL

Erosion and sediment controls shall be put in place to ensure that the generation of potentially contaminated stormwater or groundwater is minimised and managed. Sediment controls will be undertaken in accordance with industry best practice, and in place of local erosion control guidelines. This will include (but is not limited to) the AC *Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region, 2016* (AC, 2016).

An Erosion and Sediment Control Plan (ESCP) must be prepared by the contractor prior to commencement of earthworks. The ESCP must ensure that erosion and sediment controls are adequate to ensure that contaminated soil does not travel off-site. Daily inspections of erosion and sediment controls and the adjacent stormwater system will be conducted.

Additional inspections will also be conducted following high rainfall.

Dust generated for the excavation of material has the potential to contain contaminants, and during windy conditions, could migrate off-site. Dust must be managed during the excavation works to ensure that it generally complies with the *Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions* (MfE, 2001). To control the generation of dust, the contractor will ensure that:

- Working in windy conditions is avoided.
- All areas subject to soil disturbance activities are wetted and remain damp (but not saturated) at all times during soil works. When utilising water to control dust, the contractor will ensure that:
    - The volume of water used does not exceed soil field capacity causing run-off that could discharge off-site.
    - The application of water does not induce soil erosion and/or pugging.
    - Stockpiled material is covered.
    - Plant access onto the works area is limited where possible.
    - A dust and odour complaints log will be maintained by the site contractor.

If complaints regarding dust are received, the following information will be recorded:

- Time and date of the complaint.
- Name and location of the complaint.
- Weather conditions, description of site activities, and location of site activities.
- Nature of the complaint.
- Mitigation measures undertaken and evaluation of effectiveness.

4.7.3 MONITORING AND CONTROL

Monitoring requirements for general earthworks and erosion and sediment control shall be specified in the CEMP and ESCP.

Contamination-specific monitoring shall be as follows:

- Daily, the contractor shall check covers on stockpiles of contaminated material (if any) and ensure appropriate diversion bunds are in place.
- Throughout ground disturbance works, the contractor shall be vigilant for the presence of unexpected contamination.
- If weather or other site conditions change, the contractor shall review the controls in place on site to determine if any changes are required to suit the new condition.
- An asbestos competent person shall supervise soil disturbance within Greys Avenue carpark as detailed in Section 4.6.

4.7.4 STORMWATER MANAGEMENT

All practical steps must be taken to separate 'clean' and 'dirty' stormwater/surface runoff. Separation and diversion of clean stormwater away from areas of ground disturbance is standard practice for any earthworks activity, but becomes more important where contaminants are present. To minimise the potential for clean stormwater to encounter contaminated soil, the stormwater and sediment controls detailed in the ESCP for the works shall be implemented. At a minimum these controls shall include:

- Diverting 'clean' stormwater away from excavated areas using onsite topography and/or sediment socks.
- Allowing stormwater falling within the site to infiltrate land.
- Monitoring before and after any rainfall or weather event sufficient to generate runoff. Any corrective actions to be completed within 24hrs or prior to any forecast weather event. Key monitoring points are identified as stormwater sump protection, clean/dirty water diversion systems and stockpile management.
- Where soil saturation is too great for accumulated stormwater to discharge to ground and removing via dewatering is required, a sucker truck may be the most effective option for removal of potentially contaminated surface water; and
- Contaminated surface water shall not be discharged to the stormwater system without appropriate resource consents and sampling completed by a CLS to determine the concentrations of contaminants in stormwater.
    - Where required, stormwater sampling shall be analysed for dissolved heavy metals and any additional analytes recommended by the CLS with the samples submitted to an International Accreditation New Zealand accredited laboratory for analysis.
    - The CLS shall compare the results to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018). Table 3.4.1 'Trigger values for toxicants for freshwater (where available) at the level of protection of 80 per cent of species and any other guidelines as required by the applicable resource consent.

4.7.5 ODOUR MANAGEMENT

The following controls shall be implemented during excavation and soil disturbance activities:

- Erosion and sediment controls shall be implemented in accordance with the ESCP.
- Material requiring off-site disposal shall be placed directly into trucks or lined bins for off-site disposal.

- Material suitable for re-use on-site can be stockpiled in accordance with the controls detailed in Section 4.7.1 prior to re-use on-site. Stockpiling of demolition fill from Greys Avenue carpark should be avoided.
- Spillages of contaminated soil during placement in trucks shall be cleaned up as soon as practicable. Spillages shall not be left unattended as contaminated soil could be trafficked by trucks and transported off-site.
- If unexpected contamination is encountered during works, the works shall cease in the immediate vicinity and the procedures documented in Section 5.4 shall be followed.

4.8 OFF-SITE SOIL DISPOSAL

Refer to Table 4-2 for soil re-use and disposal options for each section of the alignment. As noted in Section 4.6, soils are suitable for reuse on-site where asbestos is not present.

Shafts P4MH2 and P4MH3 are in the vicinity of Greys Avenue carpark, which is recorded to be underlain in areas by buried C&D material containing asbestos. Therefore, where C&D material is encountered during excavation of P4MH2 or P4MH3, material should be disposed of as Class 3 with trace asbestos (<0.001 % w/w) based on the available site data.

Prior to removal off-site, confirmation of material acceptance shall be sought from the receiving facility, and an approved transport provider confirmed. Material acceptance by the receiving landfill may require additional testing.

In the case of additional testing, this SMP shall be updated to reflect the appropriately licensed disposal location.

4.8.1 VEHICLE MOVEMENTS

In all cases:

- Trucks transporting soil for off-site disposal shall be covered.
- Have the necessary permits from the disposal facility to confirm that the facility can receive the materials prior to off-site transportation.
- Weighbridge dockets and/or a summary sheet shall be retained.

The following measures shall be implemented to prevent soil from being dispersed onto roads or transported to another site (excluding transport to a disposal facility) as well as to minimise the generation of dust:

- Trucks shall stick to dedicated haul routes and avoid tracking over un-stabilised areas.
- Any excess soil on vehicle tyres or machinery shall be removed before vehicles leave the work area.
- All trucks transporting excavated soil to the selected disposal facility shall be appropriately covered.

4.9 IMPORTED MATERIAL REQUIREMENTS

If importation of soil is required, these shall originate from:

- A site which has been determined by a CLS to have had no known history of potentially contaminating activities, as detailed on the HAIL, or
- A site which has been adequately investigated by a suitably qualified contaminated land professional, in accordance with MfE's *Contaminated Land Management Guideline No. 5: Site investigation and analysis of soils* (CLMG No. 5) (MfE, 2021b) to meet the 'cleanfill material' definition.

In accordance with the *Technical Guidelines for Disposal to Land* (WasteMINZ, 2023), cleanfill is characterised as:

> *"Virgin excavated natural material such as clay, soil and rock that are free of combustible, putrescible, degradable or leachable components. When discharged to the environment, clean fill material will not have a detectable effect relative to the background, and the fill site will be able to be utilised for an unrestricted purpose on closure. Future excavation into the filled materials. "*

Engineering materials may be used, including clean quarry materials and recycled crushed concrete aggregate that is site won or sourced from a quarry or supplier. The supplier of these materials is to provide documentation to confirm suitability for use.

For crushed concrete aggregate, the additional information is required:

- Sourced from the site: address of the source site, copies of pre-demolition asbestos surveys, copies of asbestos clearance certificates prepared prior to demolition and asbestos testing at a rate of 1 in 500 m^3; and
- Sourced from a supplier: confirmation of processing procedures and asbestos testing at a rate of 1 in 500 m^3 of product is to be provided by the supplier. The CLS shall review the supplied information prior to acceptance, or the material stockpiled on site until available.

5 HEALTH AND SAFETY

5.1 IDENTIFICATION OF HAZARDS

The WSP, 2025 DSI indicated contamination within on-site soil above local background concentrations.

Potential exposure routes for the identified contaminants include:

- Inhalation of dust (potentially contaminated and uncontaminated).
- Ingestion of potentially contaminated soil or dust.
- Dermal absorption of potentially contaminated soil or dust.
- Skin and eye contact with potentially contaminated soil or dust.

Recommended procedures to mitigate the risk associated with these hazards are provided in Section 5.3.

5.2 IDENTIFICATION OF NEW HAZARDS

There is the potential for additional hazards to be identified and encountered during the works. The Site Manager (or equivalent health and safety representative) is responsible for reviewing any new work element and assessing whether there are any new associated hazards and associated elimination, isolation, and minimisation measures.

The Site Manager (or equivalent) shall seek review by a CLS, if necessary. The Site Manager (or equivalent) shall then instruct all personnel on the health and safety procedures associated with the new hazard and ensure an updated version of this SMP is maintained on-site.

5.3 CONTROL MEASURES

When considering hazard and risk controls, the hierarchy listed below should be followed, in preference from one to five. Example questions are provided to illustrate each step (refer to Figure 5-1).

ELIMINATION – does the task that creates the hazard need to be performed?

SUBSTITUTION – can a different tool be used?

ENGINEERING – can the hazard be guarded to protect people?

ADMINISTRATION – are there warning signs and a procedure to address the hazard? Administrative controls include procedures to reduce the risks associated with identified hazards. These controls include:

- Job Safety Analysis (JSA) or Task Analysis.
- Work plans.
- Training.
- Warning signs.

- Communication with the Fulton Hogan Site Manager.

PERSONAL PROTECTIVE EQUIPMENT – is the appropriate PPE being used? The following is noted:

- PPE is considered the lowest level of protection against a hazard.
- No single combination of protective equipment and clothing can provide protection against all hazards; PPE should be used in conjunction with other protective methods.
- The types of PPE will depend on the specific task undertaken. However, certain PPE is required in all work areas.

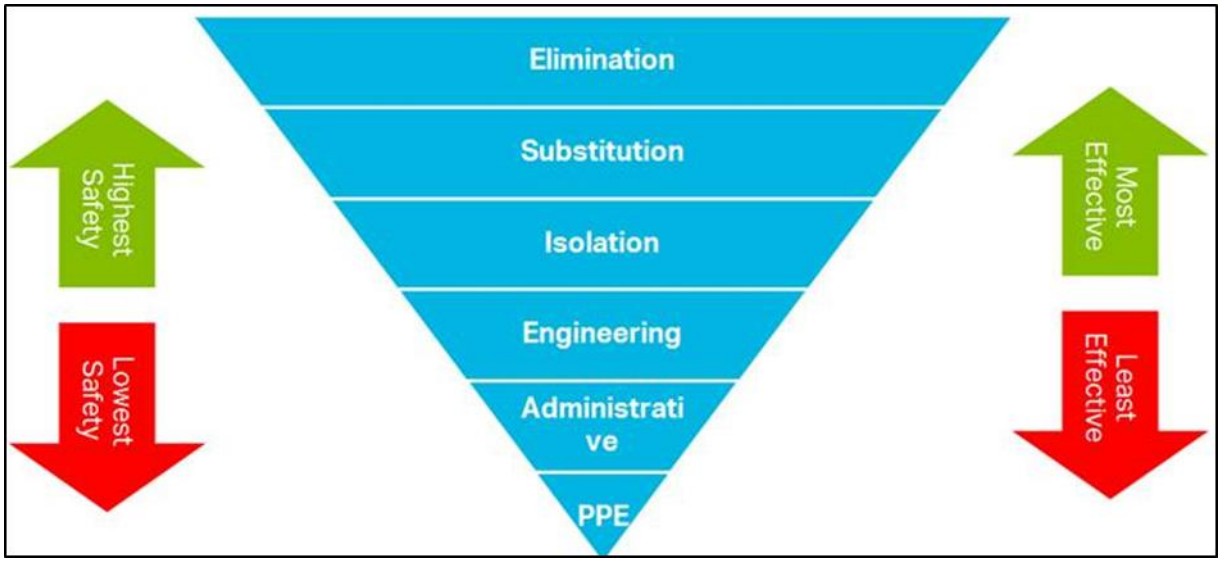

Figure 5-1 Hazard Hierarchy

5.4 UNEXPECTED DISCOVERY OF CONTAMINATION

If, during earthworks, additional contaminated soils or hazardous materials are encountered beyond those already identified, cease all work in the affected area until the CLS has assessed and identified the material.

Evidence of additional contamination likely to trigger a stop work procedure may include:

- Visual (buried refuse, metal objects, building material, soil or water staining/bleaching or discolouration).
- Chemical odours (fuel, sulphurous, rotting vegetation or sewage).
- Separate phase liquids or 'rainbow effect' films on groundwater.
- Auditory (gas leaks, flowing or dripping liquid); and
- Fibrous cement-based board materials that may contain asbestos.

If any such indicator is observed during earthworks, the following steps should be taken:

- Cease all work within a 5 m radius and make the work area safe and restrict access to all workers until instructed by the CLS or approved delegate.
- Shut off all ignition sources and, if possible, contain any contaminant discharge and close/divert any water flow.

- Advise the WSP Contaminated Land Specialist and the client (Watercare).
- Work shall not resume until the 'all clear' is given by the CLS.
- The CLS (in consultation with the Site Manager) shall assess the site. If the assessment concludes that confirmation of contamination is required, the following actions shall be implemented:
    - Control the site: install temporary fencing, temporary cover, silt traps and bunding as required around the area of potential additional contamination.
    - Small volumes of excavated soil shall be contained in covered skips to minimise contaminated discharges from rainfall runoff and dust.
    - If this is not possible, larger volumes shall be covered and bunded to manage dust and stormwater runoff.
    - Potentially contaminated water shall be collected and disposed of to an appropriately licensed treatment facility. It must not be discharged to the construction stormwater system.
    - Samples of the suspect material shall be collected (by the CLS) for laboratory analyses using appropriate procedures (if required).
- The results of the laboratory analysis shall be assessed against the relevant human health and environmental discharge regulatory standards/acceptance criteria as appropriate.
- This SMP shall be updated with any additionally required controls measures based on the contaminant of concern.
- Any soils or material requiring offsite disposal must be disposed of at facilities consented to accept the material; and
- A register shall be maintained including a description of additional contaminated material discovered, including location, type, quantity, and disposal record (disposal receipts).

6 REFERENCES

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7 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Watercare Services Limited ('Client') in relation to the management of contaminated land for the Mayoral Drive Alignment Project of the Queen Street Wastewater Diversion Programme ('Purpose') and in accordance with the TO-WSP-65 Dated 23 December 2025 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the 2025 WSP PSI & DSI report. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

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APPENDIX A - FIGURES

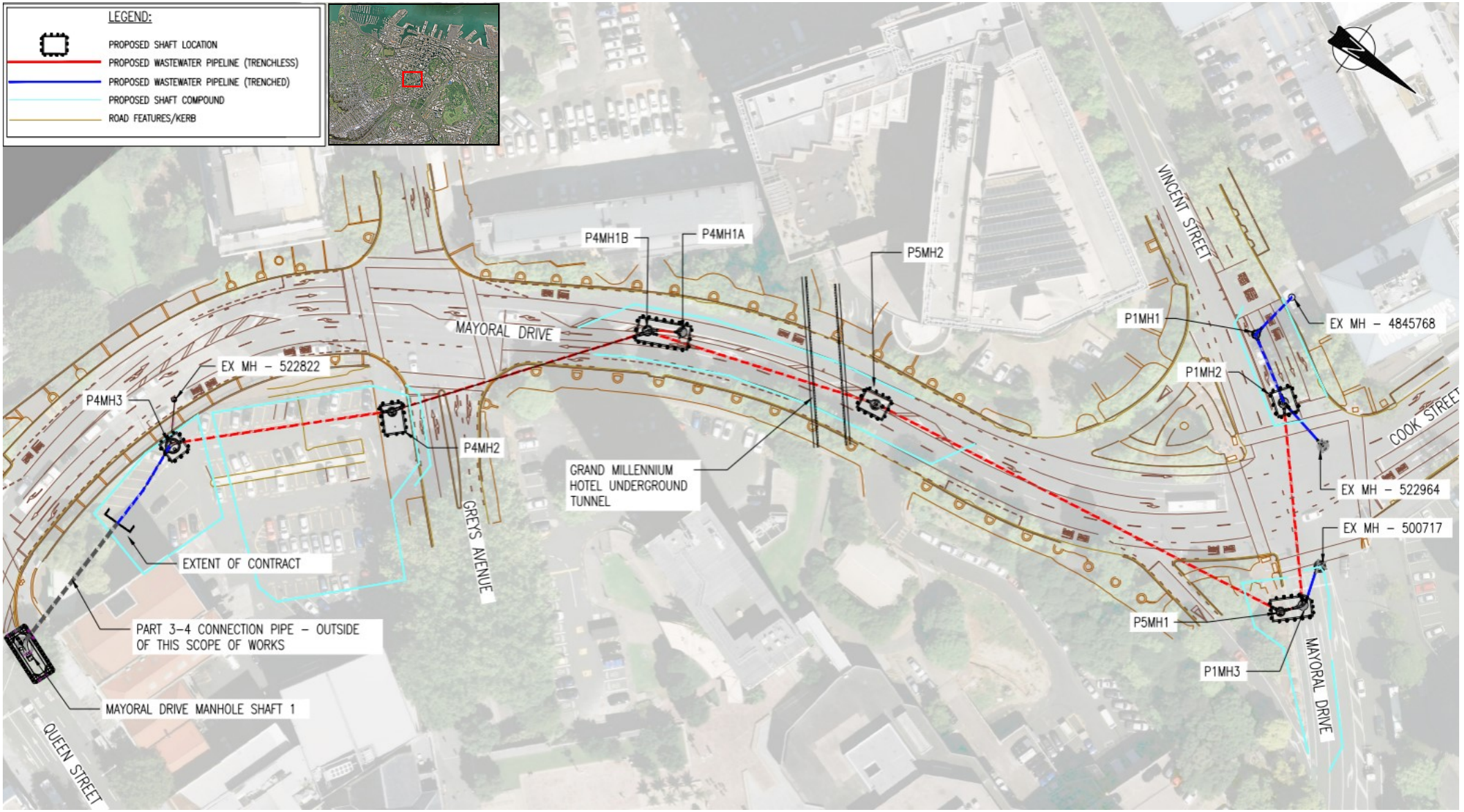

Figure 1 - Mayoral Drive Alignment Location Plan

Queen Street Wastewater Diversion Programme

Vincent Street, Mayoral Drive and Queen Street, Auckland CBD

Project Number:	Author:	Client:
W-SL001.04	L.S	Watercare
Date:	**Approved by:**	
18/06/2025	G.C	

Level 3, 100 Beaumont St, Auckland 1010 | Tel (09) 355 9500

Source: Watercare Drawing No. 2014250.XXX, dated 25/03/2025

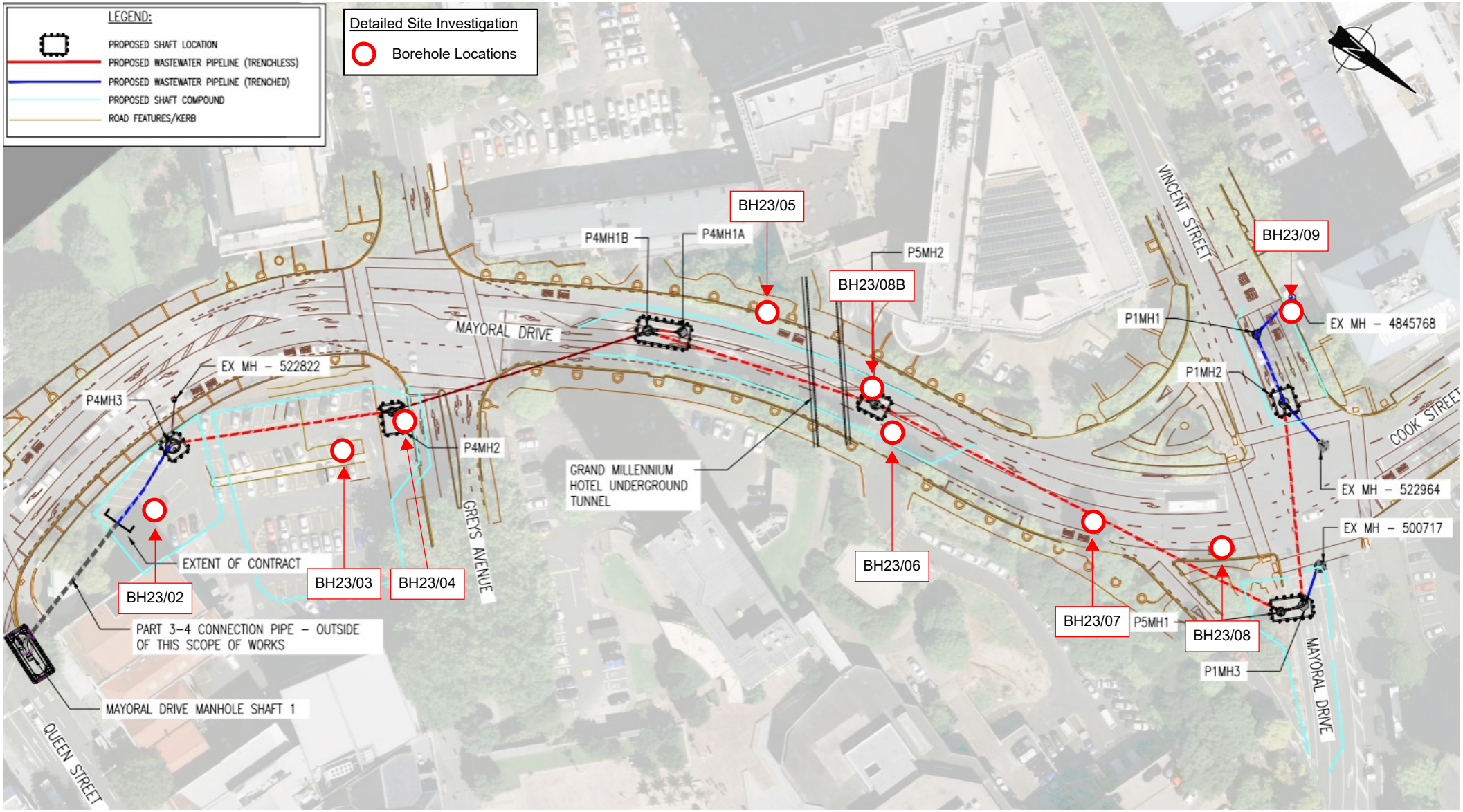

Figure 2 - WSP 2025 DSI Location Plan

Queen Street Wastewater Diversion Programme

Vincent Street, Mayoral Drive and Queen Street, Auckland CBD

Project Number:	Author:	Client:
W-SL001.04	L.S	Watercare
Date:	**Approved by:**	
18/06/2025	G.C	

Level 3, 100 Beaumont St, Auckland 1010 | Tel (09) 355 9500

Source: Watercare Drawing No. 2014250.XXX, dated 25/03/2025

APPENDIX B – CONSTRUCTION METHODOLOGY

Construction Methodology

Queen Street Wastewater Diversion – Package B

Contract No: CT7754

Project Manager:	Dominic Wakeland	Date:	28 November 2024
		Document No:	QSSD-CS-XXXX
		Revision:	04
		Status:	For Consenting

Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
00	08/09/23	J Gordon	D Wakeland		Draft
01	22/09/23	J Gordon	D Wakeland		For Consenting
02	15/10/24	D Wakeland	WSP Planning Team	D Wakeland	For Consenting – Updated Alignment
03	15/11/24	D Wakeland	WSP Planning Team	D Wakeland	For Consenting
04	28/11/24	C Miles (WSP)	D Wakeland	D Wakeland	For Consenting
05	15/02/25	M Gerecke	D Wakeland	D Wakeland	For Consenting

Revision Details

Revision	Details
00	Draft methodology
01	Updated as per WSP comments
02	Updated to reflect change to alignment
03	Updated to clarify items as requested by WSP Planning Team
04	Shaft sizes updated by WSP post WSL Operations/WSL/WSP/FH Mayoral Drive Workshop
05	Shaft and compound sizes updated to reflect current Package B alignment

Document Details

Document Name:	Construction Methodology
Status:	For Consenting
Document No:	QSSD-CS-XXXX
Author:	D Wakeland

Contents

1. Introduction

The purpose of this high-level construction methodology statement is to provide an understanding of how the Project (Mayoral Drive section of the Queen Street Wastewater Diversion Project) will be implemented by Fulton Hogan (FH) for consent purposes under the Resource Management Act 1991.

The Project works generally comprise the construction of a new wastewater pipe to collect flows from the north end of Vincent Street and convey them to southern of Part 3 of the project, adjacent to the intersection of Mayoral Drive and Queen Street.

The Mayoral Drive Alignment is made up of 3 sections (Part 1, Part 4 and Part 5) as shown in Figure 1 below. The scheme also includes making connections to and taking wastewater flows from several existing Engineered Overflow Points (EOPs)along the alignment.

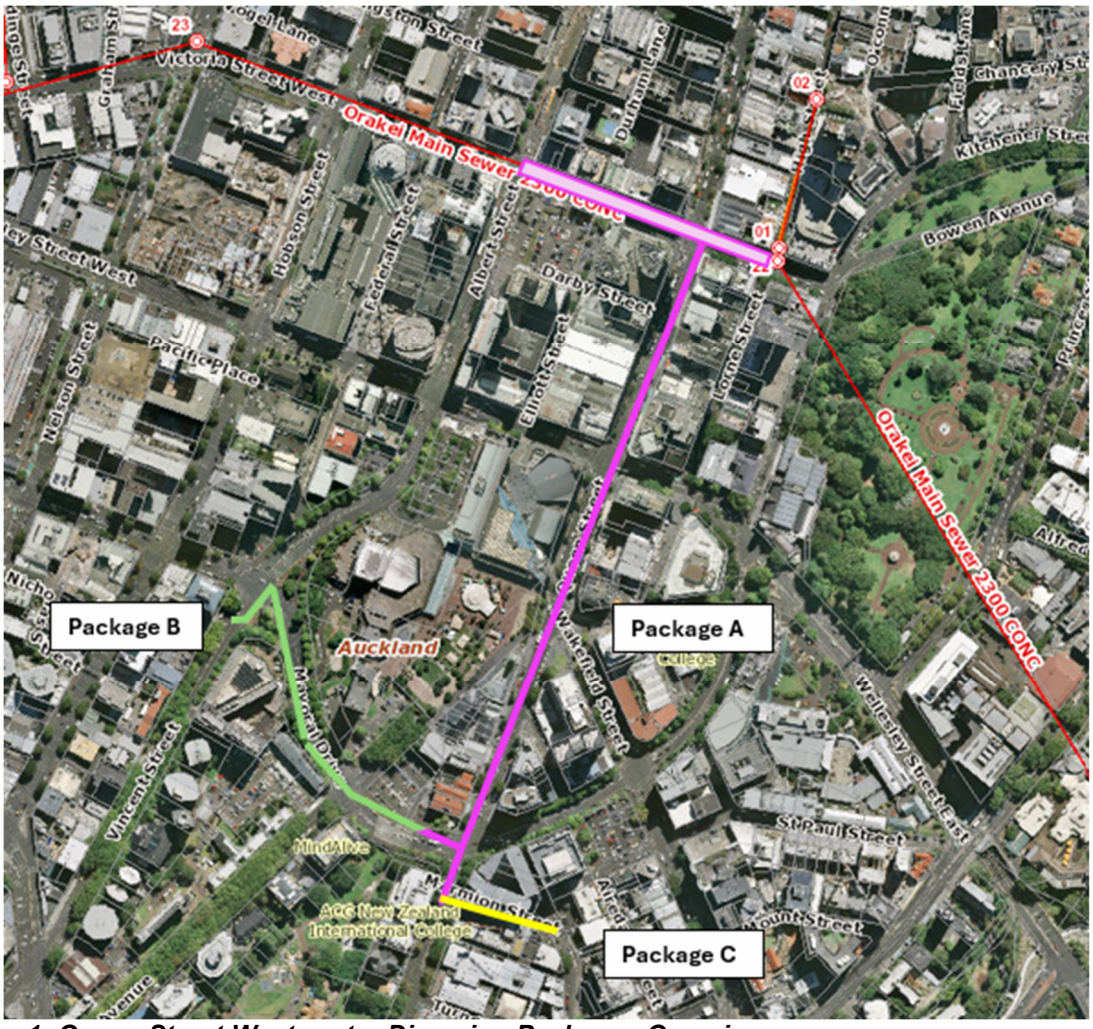

Figure 1: Queen Street Wastewater Diversion Packages Overview

This document has been created prior to issue of GFR, GIR, GBR or detailed design. Likewise, various stakeholder impacts will need to be assessed, and their constraints accommodated including assets, street trees, traffic needs, services, etc. As such, broad assumptions have been made and this methodology is subject to change as a result of new information becoming available.

This document covers the general sequencing and methodology for the construction of temporary shafts, pipelines, connections, manholes and associated works. It should be reviewed in conjunction with the FH high level construction programme (refer **Appendix A**).

2. Site Set Up and Enabling works

A construction support area (CSA) will be located within the Greys Avenue Carpark and will utilise the space previously established during the Part 3 (package A) works. Some office/cabin reconfiguration may be required (refer Figure 2 below).

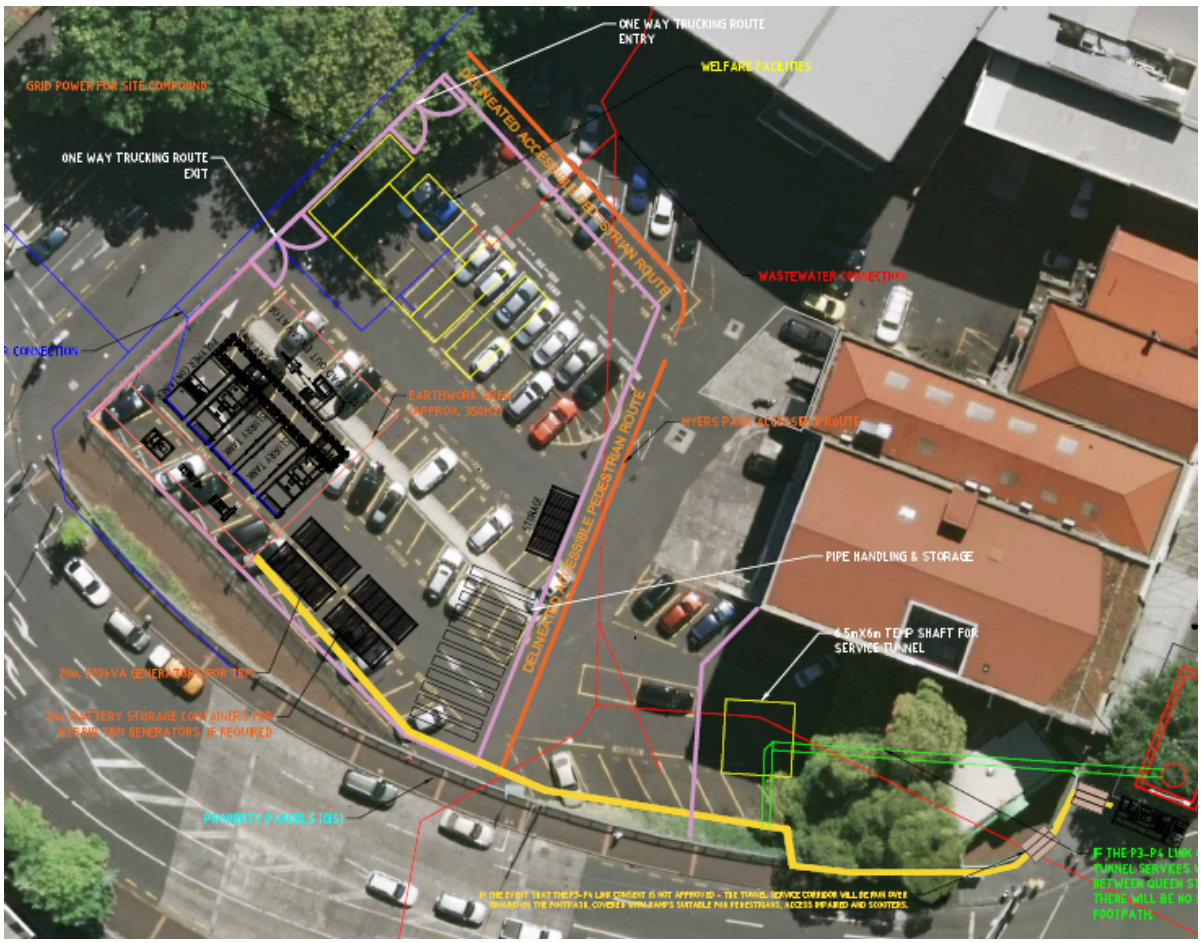

Figure 2: Layout for Construction Support Area

Limited site laydown/materials storage will be accommodated within the CSA. Most excavated materials and construction materials (pipes, aggregates, etc.) will be removed/delivered to the site on a “just-in-time” basis.

Traffic management will be setup in advance of compound construction ensuring all agreed vehicle, pedestrian and property access requirements are adhered to.

Four long-term site compounds (6 to 8 months) will be established within Mayoral Drive and Vincent St traffic lanes to allow construction of temporary shafts and tunnelling works. For these compounds, temporary steel barriers and temporary fencing/hoarding will be constructed around the perimeter of each, with access gates one or both ends. Indicative site compound layout plans are provided below and are subject to final design, traffic impact assessments and TMP’s. The traffic restrictions required to accommodate these compounds are also indicatively shown in Figures 3 and 4 below. The compound widths have been driven by the shaft temporary works requirements and the barrier protections required for these deep shafts (refer Figure 5).

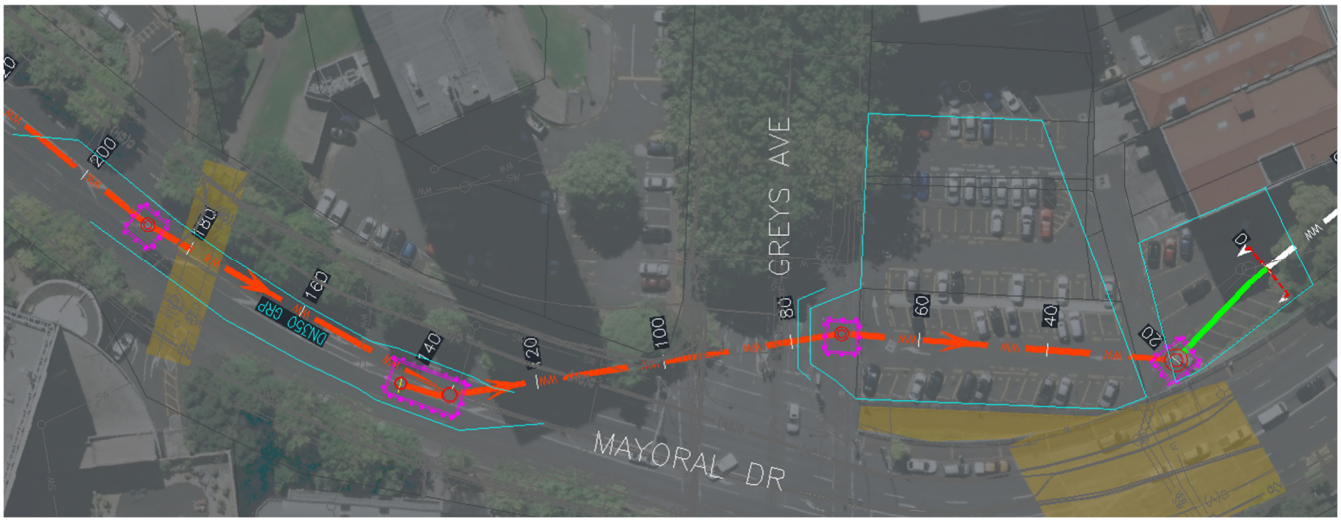

Figure 3: Two long-term compounds on Mayoral Drive/Greys Avenue (compound extents shown with blue line)

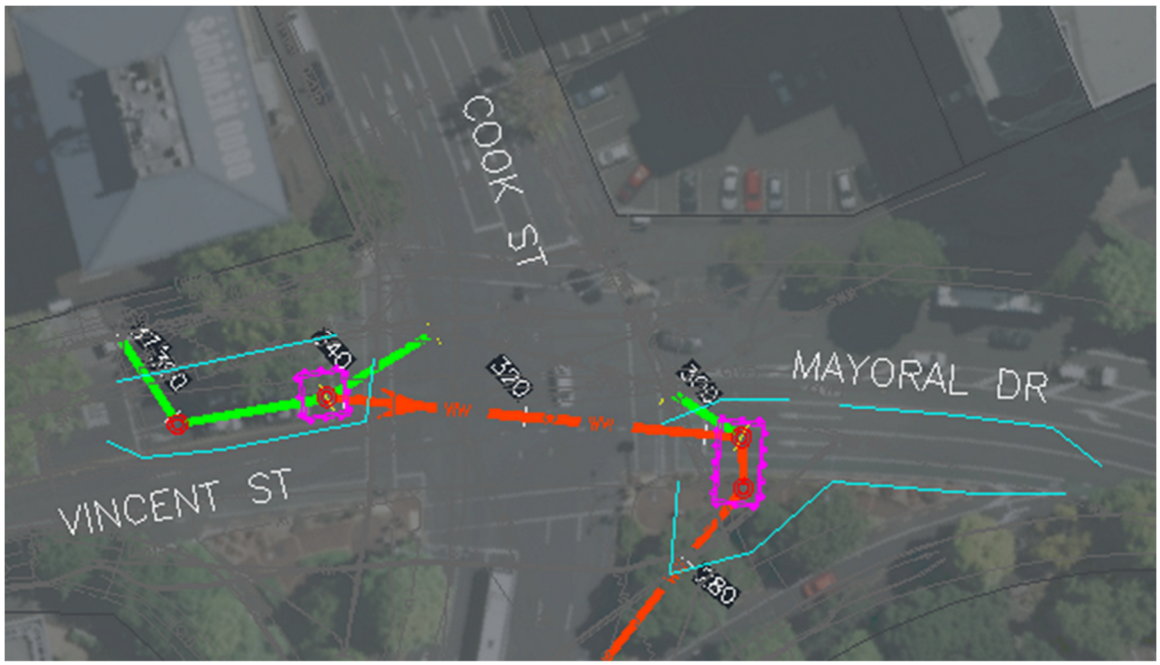

Figure 4: Two long-term compounds at Cook St/Mayoral Drive/Vincent St intersection (compound extents shown with blue lines)

General site working hours will be Monday-Saturday 7 am-6 pm. Sunday and night work will only be carried out if required by traffic management or WSL operational restrictions such as for tie-ins/connections to existing pipe work.

Heavy vehicle movements between the compounds and Greys Avenue CSA will be 40 movements per day at peak.

2.1. Utility Diversions

There will be a need for utility diversions to enable shaft construction ahead of main works start. NUOs have been engaged early in the design to assist with the diversion planning process. The depth and geotech conditions of the existing and proposed underground service diversions will guide the need for any trench shoring. Based on the diversions required, some

trenches will need to remain open longer than 10 days. Service locations will be marked out for any existing services prior to any intrusive works, and then the trench will be opened up for diversion works to begin. A hydro or air vac will be used to safely uncover all underground utilities within the trench. Dewatering may be required within the trench. Necessary utilities will be diverted, the trench will be backfilled, and area returned to its original condition.

Table 2.2.1 – Diversion Plant Summary

Activity	Plant List
Excavating trench	8-15t excavator with breaker attachment
	6-wheeler truck
	Hydro or Air Vacuum Truck
Dewatering	Submersible pump & lamella clarifier tank
	Silenced Generator 60kVA
Backfilling	6-wheeler truck
	8-15t excavator
	Plate compactor
Reinstatement	Asphalt truck, concrete truck and pump

3. Main Construction Works Overview

Construction methodologies are outlined in Figure 5 below and details for each are provided within the subsections below.

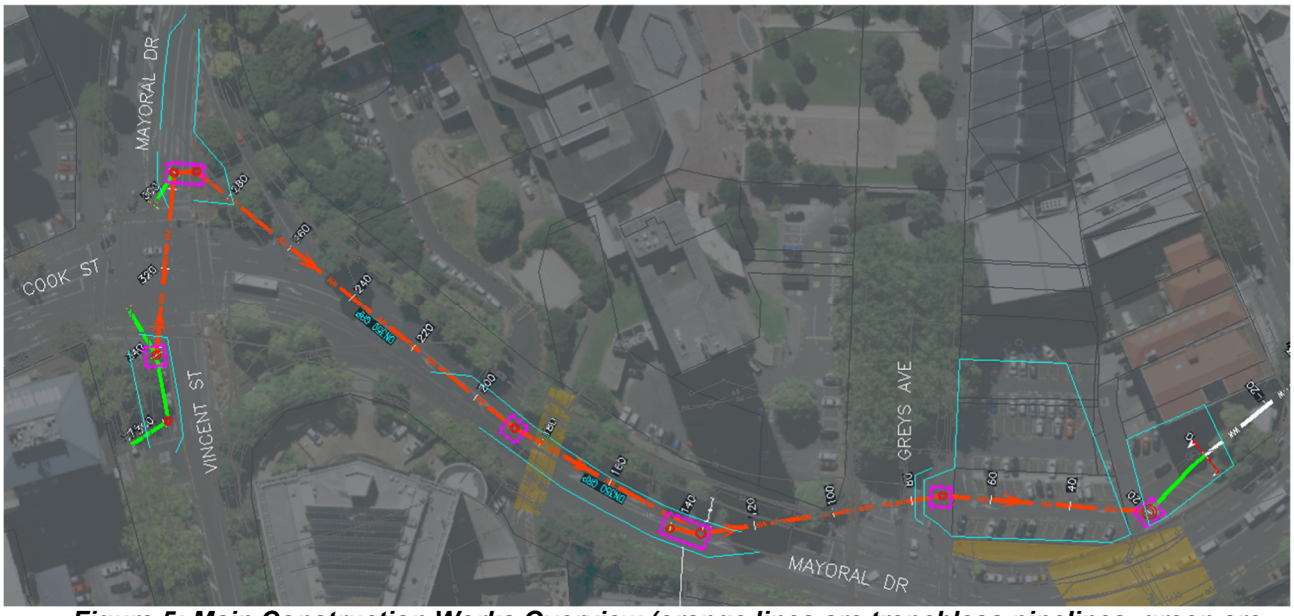

Figure 5: Main Construction Works Overview (orange lines are trenchless pipelines, green are trenched pipelines)

3.1. Shaft Construction

Most manhole locations on this alignment will be used as launch/reception pits for the trenchless construction method (axis/pilot bore). The trenchless method requires shafts with minimum internal dimensions of 4.5m x 4.5m; however, some shafts will contain two manholes and / or existing EOP infrastructure and will need to be oversized. The shoring technique required to support these shafts will be subject to geotechnical conditions and shaft temporary works design but will most likely be a post and panel-type construction method. The shaft sizes for each location are shown in Table 3.1.2 below. The basic steps required to construct temporary post and panel shafts are outlined below and in Figure 6.

- An auger attachment on a 10 – 35t excavator or small piling rig (GEAX EK60) will be used to drill 600mm dia holes. Piles will typically be drilled 4m below pipe inverts. Steel H-columns will be set into each with sand or concrete backfill. A mobile crane will likely be required to pitch and install the steel columns, depending on pile depth
- The shaft will be excavated from the top using an excavator at surface level to a depth of approximately 1m below pipe invert. Six-wheeled trucks will be used to remove spoil off site. Shaft excavations are expected to occur over 1 – 2 weeks, depending on the size and depth of the shafts.
- Steel road plates or timber lagging will be cut and installed between H-columns as the excavation advances.
- Forced air ventilation may be required using a fan at surface level with ventilation ducting into each shaft during work hours.
- The shaft base will be lined out with 300 to 500mm of aggregate and/or 100mm of blinding concrete to provide a solid and level working platform.
- If dewatering is required, a submersible pump will be used to remove water from the excavation. The water will be pumped into a clarifying tank for treatment before discharging to stormwater. The pumps will run continuously while the shaft is open (6-8 months) and will be powered by a silenced diesel generator.
- Once the shaft has been used for tunnelling, a manhole will be constructed, and the shaft reinstated.

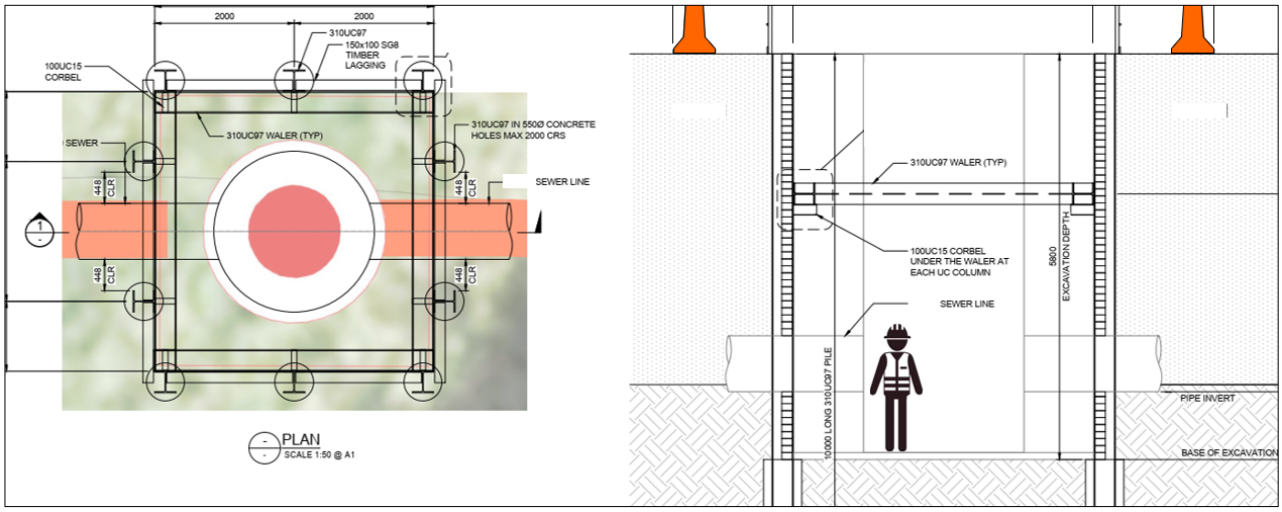

Figure 6 – Typical temporary works detail for shafts (A. O'Sullivan & Associates)

Table 3.1.1 - Shaft Plant Summary

Activity	Plant List
Drilling and installing steel posts	10 – 35t excavator/GEAX EK60, 30-35T mobile crane
Excavating shaft	20 – 35t excavator
Spoil removal	6-wheeler or artic trucks
Concrete base	Concrete truck/concrete pump truck
Dewatering	Submersible pump & lamella clarifier tank
Dewatering	Silenced Generator 60kVA
Ventilation	Fan

Table 3.1.2 - Shaft Earthworks Summary

	Shaft Details (internal dimensions)				
Manhole ID	**Width (m)**	**Length (m)**	**Depth (m)**	**Volume (m3)**	**Duration Shaft Open**
P4MH3	7	14.5	6	609	6 to 8 months
P4MH2	4.5	4.5	8.4	170	6 to 8 months
P4MH1A and B	6.5	11.2	8.3	605	6 to 8 months
P5MH2	4.5	4.5	8.1	165	6 to 8 months
P5MH1 and P1MH3	4.5	8.6	6.5	252	6 to 8 months
P1MH2	4.5	4.5	6	122	6 to 8 months

3.2. Trenchless Construction – Pilot Guided Auger Bore

Due to the pipe depths and shallow grades for this alignment, the most appropriate pipe laying methodology will be a trenchless pilot guided auger (or vacuum) bore rig. It has been assumed that this methodology will be used for the five pipe runs between P4MH3 and P1MH2.

The basic steps for this trenchless methodology are outlined below:

- Setup power pack, pump, vacuum truck, and water tank on surface adjacent to launch pit.
- Lift pilot bore rig into pit and survey into position.
- Drill pilot hole to reception pit using laser guided steering head.
- Install cutting reamer and pull back to launch pit.
- An auger (or vacuum) with sucker truck will be used to remove spoil from the drive and it will be disposed of offsite using 6-wheelers or sucker trucks. Approx wet tunnel spoil volume will be 0.3 m^3/m of DN450 pipe (0.6 m^3/m for DN700 pipe). For a DN450 pipe between P4MH4 and P1MH2, this equates to 95 m^3 (15 to 25 return six-wheeler truck trips).
- Simultaneously jack glass reinforced plastic (GRP) pipes between shafts.
- Clean up and flush drill slurry out of pipe by jetting and vacuum truck.
- CCTV inspection and low-pressure air test on completion.

It has not been decided which exact pilot bore rig will be used, therefore it should be assumed that any of the six shafts could be used as either a launch or reception shaft (or both).

Refer to Figures 7, 8 and 9 below of a typical pilot bore operation (note that exact methods vary between different machines).

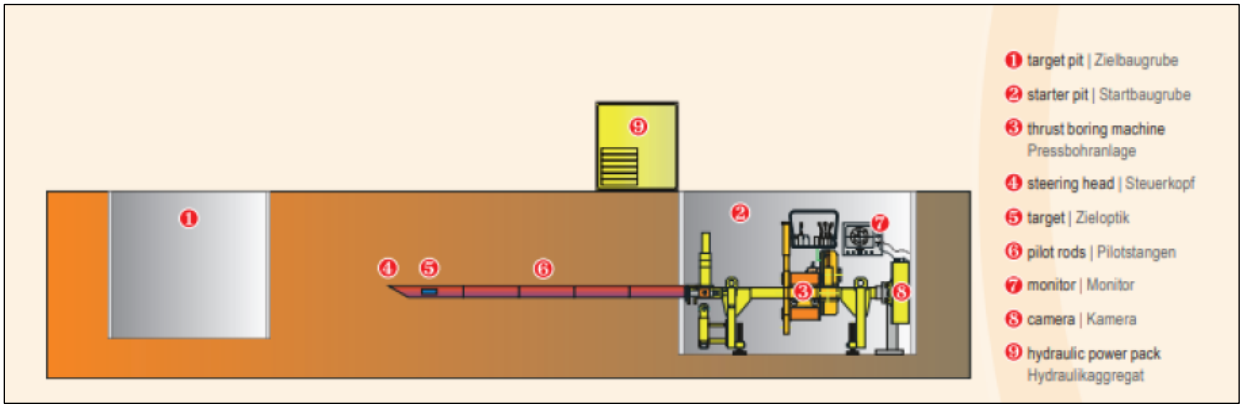

Figure 7 – Typical pilot bore – pilot process

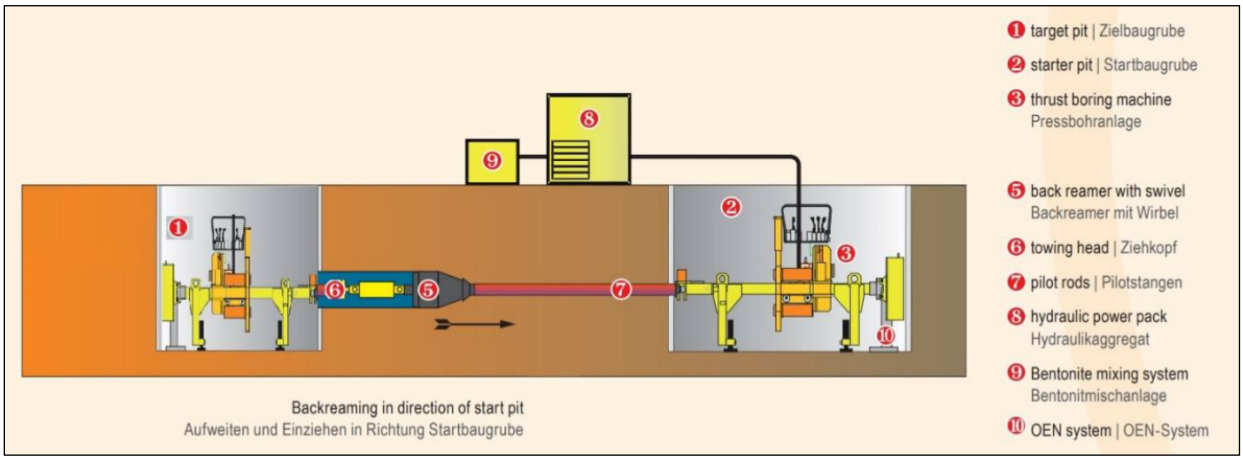

Figure 8 – Typical pilot bore – cutting back

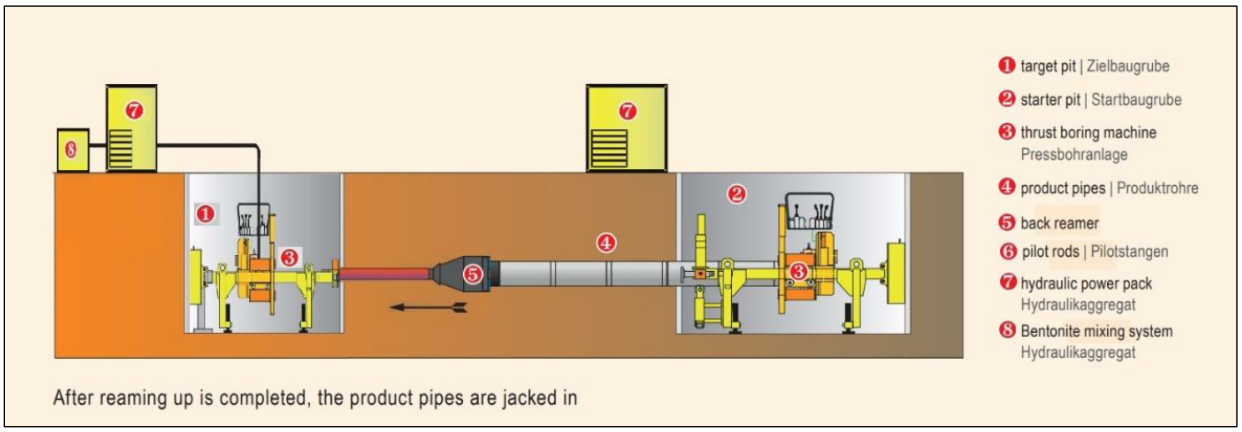

Figure 9 – Typical pilot bore – jacking pipes in

Table 3.2.1 - Tunnelling Plant Summary

Activity	**Plant List**
Pilot Boring – Launch Shafts	Crane HIAB truck
	10 – 20t excavator
	Power pack container
	Pilot boring machine
	6-wheeler or artic trucks truck (or vacuum truck)

	Tool truck
Pilot Boring – Reception Shafts	Crane HIAB truck
	10 – 20t excavator
	Power pack container
	Pilot boring machine
	Tool truck

4. Open Cut Pipe Laying & EOP Connections

For shallow or short pipe runs for existing/EOP connections, an open-cut pipe laying methodology will be used. The steps for this method are listed below:

- For any sections of pipeline outside of the temporary compounds, short-term traffic management will be setup in accordance with approved TMPs, which will likely be staged to allow only short sections of pipeline to be constructed at one time.
- Trench shields and manhole boxes will be used for all trenching over 1.5m depth, which will be most pipeline and connections (refer Figure 11 below). Approximately 10 to 25m of trench will be open at any one time for up to 4 weeks at a time. **NOTE:** *Where existing services cross the trench, the shoring method will change to a driven steel H-pile support method with vertical timbers to accommodate existing services.*
- Expected total trench volumes are:
  - $90m^3$ (P1MH2 to EX MH 522964)
  - $62m^3$ (P5MH1 to EX MH500717)
  - $71m^3$ (P1MH2 – P1MH1)
  - $38m^3$ (P1MH1 – EX MH4845867)
- The total estimated earthworks volume for open-cut trenching is $261m^3$.
- Pipe lengths and precast manholes will be delivered to site on flatbed trucks and unloaded within the site using HIAB trucks or excavators.
- A leading excavator will be used to trench to the required depths and install trench shields as the excavation advances. Wider trench boxes will be provided at manhole locations.
- Excavated materials will be cut to waste as clean, managed or contaminated fill (dependent on contamination testing results).
- If dewatering is required (to be determined by ground investigations), a submersible pump will be used to remove water from excavations. The water will be pumped into a clarifying tank for treatment before discharging to stormwater. The pumps will run continuously while the shaft is open and will be powered by a silenced diesel generator. Noise mitigation will be used such as barrier screens for overnight dewatering if required.
- Pipe bedding material will be carted to the worksite directly from source in 6 or 8-wheeled trucks, spread into the trench using an excavator and compacted using 300 to 800kg plate compactors in specified layers.
- Excavators will be used to lift pipe lengths into the trench.
- Side haunching, overlay bedding and hard fill to pavement level will be constructed as per pipe bedding material (refer to item above).

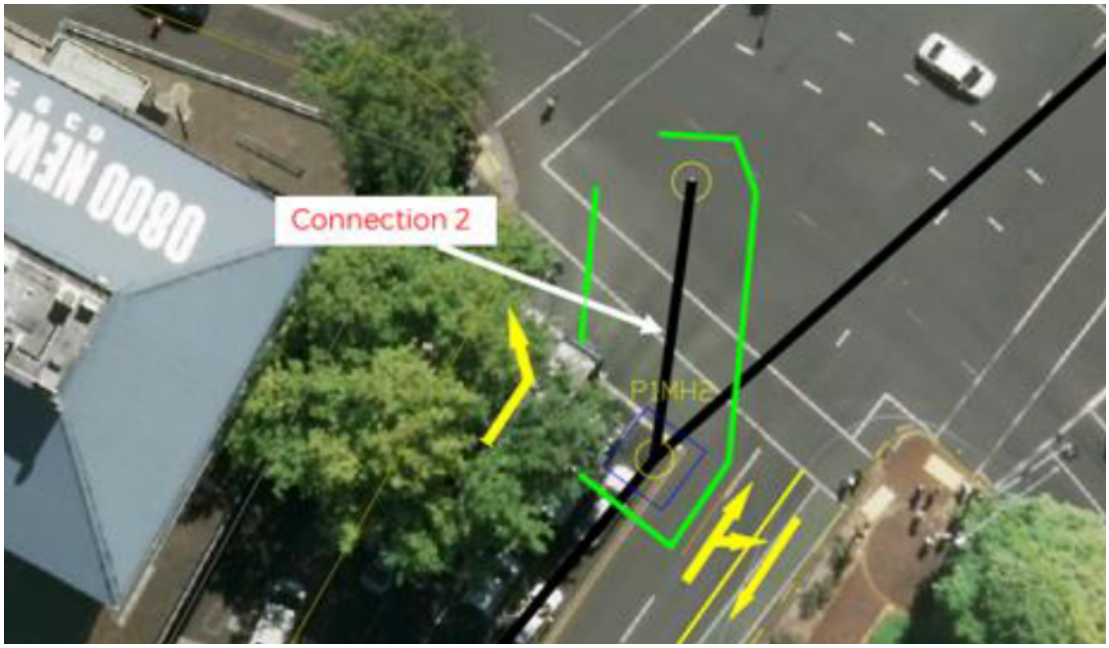

Figure 10 – Plan view of short-term TM for an EOP connection using opencut method

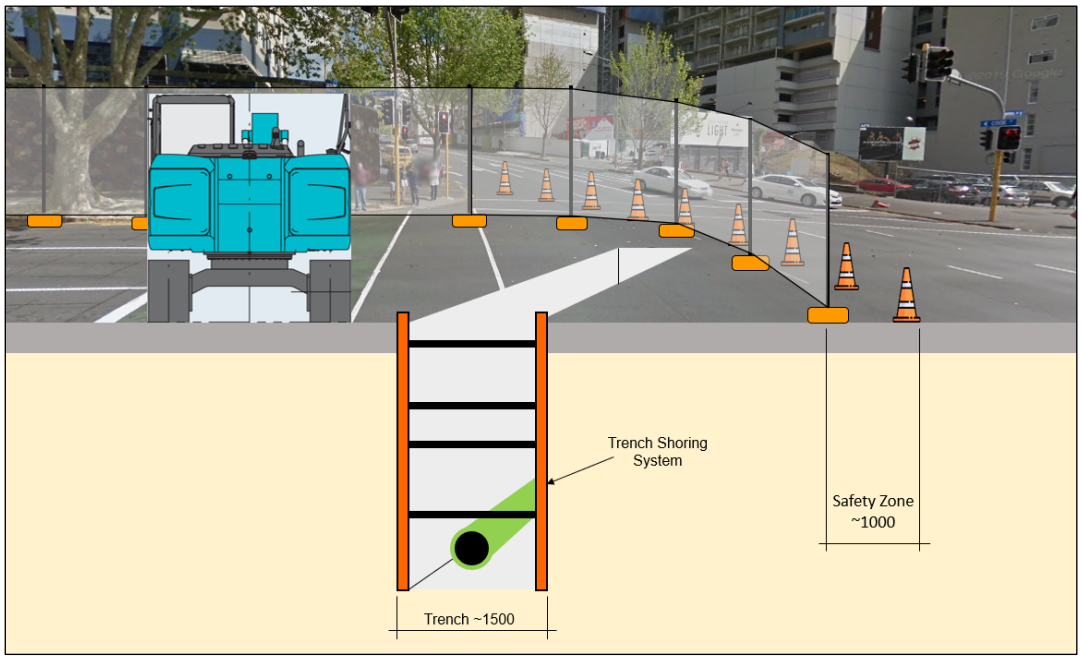

Figure 11 – Trench shoring system for EOP connection using the opencut method

Open Cut Pipe Laying Plant Summary Table

Activity	Plant List
Open cut pipe work / manholes	14 – 35t excavator
	Excavator Movax/Vibro
	Trench shoring/H-Piles
	Six-wheelers or artic trucks
	Hydro excavator
	Concrete truck
	Plate compactor

5. Manhole Construction (at shafts) and Road Pavement Reinstatement

The basic construction steps for manhole construction are detailed below.

- Form and pour concrete manhole base using concrete pump truck or excavator located adjacent to shaft. Alternatively, install a flanged precast manhole base and riser with the excavator.
- Lift in precast manhole riser sections using HIAB or excavator.
- Form and pour connection corbels on outside of precast riser using concrete pump truck or excavator located adjacent to shaft.
- Form and pour manhole benching using concrete pump truck or excavator located adjacent to shaft.
- Lift in and fix any pipe droppers within manholes.
- Backfill void between shaft and manhole with plate compacted aggregates or low strength concrete.
- Cut and abandon shaft temporary works 1.5m below road level as backfill progresses.
- Construct road pavements layers using excavator, plate compactor and vibratory roller.

Manhole and Pavement Plant Summary Table

Activity	Plant List
Manholes	14 – 35t excavator
	Trench shoring/H-Piles
	Excavator Movax/Vibro
	Six-wheeler trucks
	HIAB crane
	Concrete truck
	Concrete pump truck
Road Pavement Reinstatement	14 – 35t excavator
	Plate compactor
	Vibratory roller
	Pilot boring machine
	Tool truck

6. Sequence of work & Programme Durations

Refer Appendix 1 for high level construction programme.