# Part 3-6 Link High-Level Construction Methodology

## Queen Street Wastewater Diversion – Part 3-6

| | | | |
|---|---|---|---|
| Contract Manager: | Andre van Wonderen | Date: | 15 November 2025 |
| Project Manager: | Dominic Wakeland | Document No: | |
| | | Revision: | 04 |
| | | Status: | For Consent |

## Document History and Status

| Revision | Date | Author | Reviewed by | Approved by | Status |
|---|---|---|---|---|---|
| 00 | 24/09/24 | T Connell | D Wakeland | | Draft |
| 01 | 26/09/24 | T Connell | D Wakeland | | For Consent |
| 02 | 27/09/24 | T Connell | D Wakeland | D Wakeland | For Consent |
| 03 | 21/10/24 | D Wakeland | | D Wakeland | For Consent |
| 04 | 15/11/24 | D Wakeland | | D Wakeland | For Consent |

## Revision Details

| Revision | Details |
|---|---|
| 00 | Draft methodology |
| 01 | Added post and panel shaft option |
| 02 | Minor Amendments |
| 03 | Amended as per WSP comments |
| 04 | Updated to include network utility relocations |

## Document Details

| | |
|---|---|
| **Document Name:** | Part 3 – 6 High-Level Construction Methodology |
| **Status:** | Final |
| **Document No:** | |
| **Author:** | T Connell |

# Contents

# 1. Introduction

The purpose of this high-level methodology is to inform the planning and consent teams of how Fulton Hogan (FH) intends to construct the Part 3-6 link that forms part of Watercare's Queen Street Wastewater Diversion Programme.

These works comprise of a tunnelled section from the Part 3 Mayoral Drive shaft across the Mayoral Drive Queen Street intersection to a receival shaft for future connections at the Queen Street and Marmion St intersection. This methodology has been created with the plan that the works will be completed prior to the Mayoral Drive shaft being reinstated. The intention is to remove the requirement to reopen the Part 3 Mayoral Drive Shaft in the future, reducing the negative impact on the City Centre, its businesses, residents, and other stakeholders.

This methodology is high-level, and no site investigation has taken place. Due to this, broad assumptions have been made and the methodology will be reviewed as more information becomes available.

# 2. Construction Methodology

## 2.1. Site setup

The Construction Support Area (CSA) at 34-38 Greys Avenue established for the Part 3 main works will be utilised for the storage of pipes and equipment. This CSA will also contain worker welfare facilities and offices.

Traffic management will be set up in advance, and the design will be coordinated with Auckland Transport and subject to an agreed Traffic Management Plan (TMP).

A 45m long by 11m wide compound will be set up around the shaft area at Marmion St to allow for the construction of the shaft and the tunnelling operations. The compound will make use of temporary concrete or steel barriers with hoardings around the perimeter of each, with access gates on one or both ends.

Figure 1 below shows the shaft envelope for consenting the possible shaft location (red box). The compound, defined by the pink lines for the hoarding and traffic barrier, will move with the shaft as drawn below.

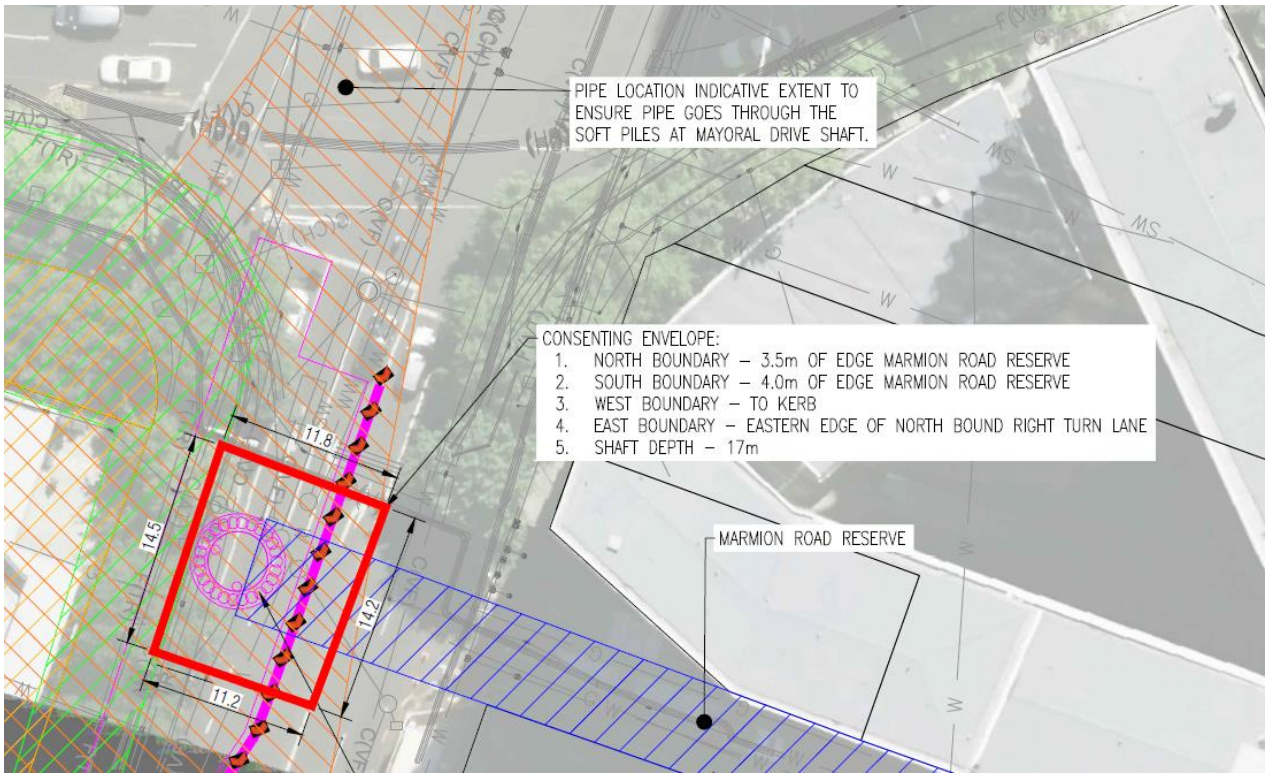


**Figure 1: Shaft footprint consented envelope (red box)**

### 2.1.1. Mayoral Drive

The shaft at Mayoral Drive used for Part 3 Main Works will act as the launch pit for the trenchless installation of the DN450-700 pipeline. The backfilling and construction of the Mayoral Drive manhole works will be paused while the Part 3-6 link is constructed. Once backfilled to the correct height for the pilot bore rig, a platform will be installed over the manhole to create a level working platform for the pilot bore rig to work from.

### 2.1.2. Marmion Street Shaft Construction

The Marmion Street shaft will be used as a reception pit for the Pilot Guided Boring Machine. The shafts outside diameter will be up to 6.4m constructed using 600-900mm piles, 200mm in-situ shotcrete lining, 4m internal diameter and 17m deep. The shaft construction will be required to go through a temporary works design process that will consider the ground condition and site requirements.

The basic steps required to construct secant shafts are outlined below:

1. A concrete guide wall is excavated and formed at ground level to guide the drill rig
2. Soft piles are drilled in a hit-and-miss fashion to avoid damaging the adjacent pile while they are curing.
3. The missed soft piles are then constructed.
4. Hard piles are then drilled through the soft piles creating a continuous retaining wall
5. Steps 2 to 4 are repeated until all piles are constructed and there is a continuous retaining wall.

The piles will be continuous flight auger (CFA) piles drilled using an SR-45 or SR-65. Once all piles are completed the shaft excavation will commence. The spoil material will be drilled out using an SR-45 or SR-65 and loaded using a 20T excavator into 6-8-wheeler trucks to be carted offsite over a period of 1-2 weeks.

Once the shaft has been excavated to approximately 1m below the invert, a 300-500mm thick concrete plug will be poured to form the base. This plug creates a level working platform while also

retaining the groundwater from below. Once the plug has been constructed the dewatering requirements will significantly reduce or stop.

The shaft will be lined using shotcrete in 2m lifts to the depth of the shaft, although this may happen later when the final manhole is to be constructed. This will be constructed with multiple lifts. Once the internal works and tie-ins for the shaft are complete, a precast lid with 1-2No. 600mm manhole openings will be installed for future entry and the road will be reinstated. The shaft lining and secant piles will remain in place and form part of the permanent works.

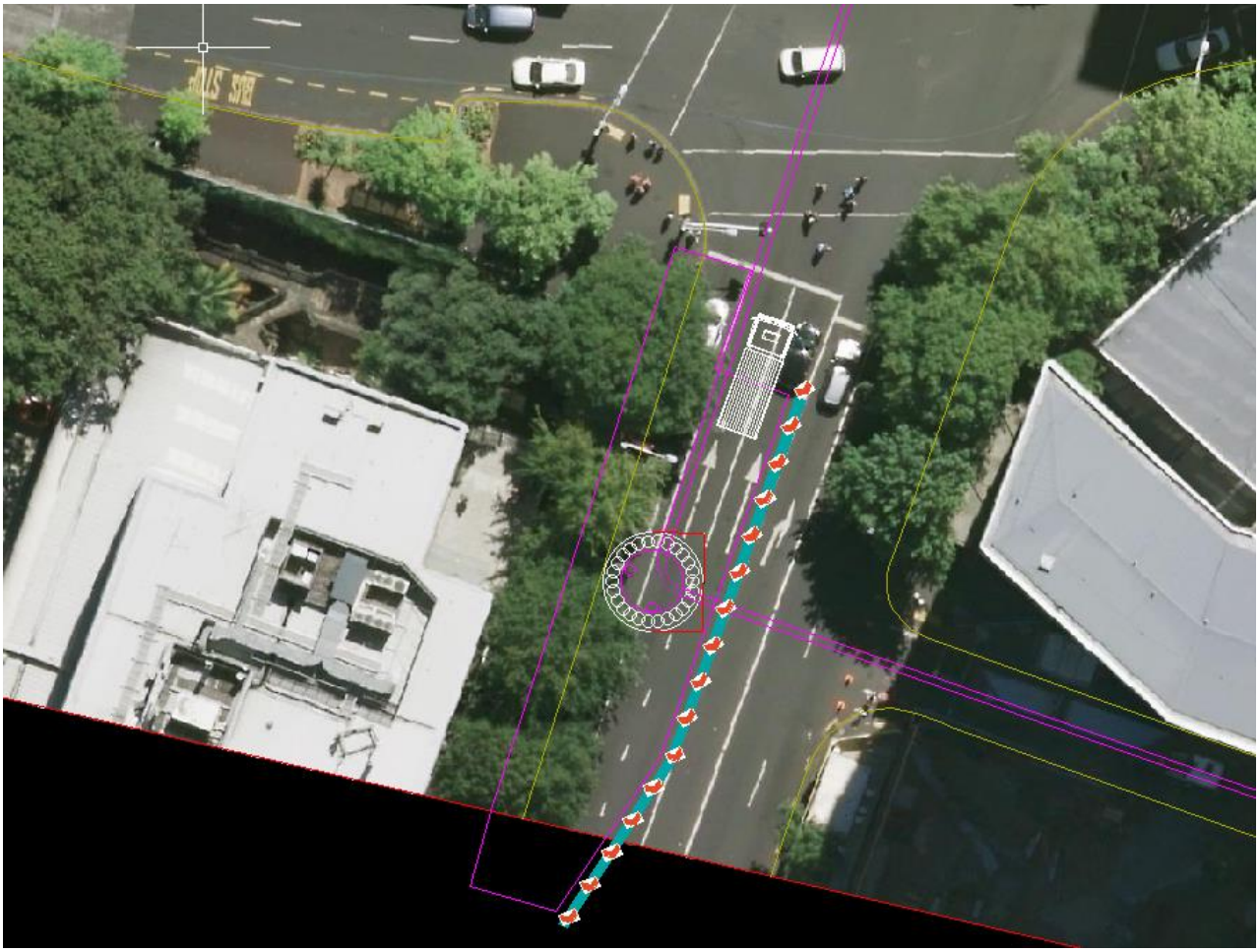

**Figure 2: Secant piled shaft layout**

## 2.2. Trenchless construction

A DN450-700 pipe will be installed using a pilot guided boring machine. This method drills a smaller diameter pilot bore from the launch pit to the reception pit, a reamer is then connected in reception pit and guided back to the launch pit. A soft pile window will be constructed on the pipe alignment at each shaft to allow the boring machine to breakthrough. The basic operation for this trenchless method is as follows:

**Pilot Bore:**

1. Set up the Guidance System in the Launch Pit
2. Place drill rig in launching pit and align rack
3. Place Drill Head on Drill Rack
4. Connect all supporting items including vacuum to carry the slurry
5. Commence pilot bore

**Reamer and Pipe Installation:**

1. Install pusher unit at reception pit
2. Attach the reamer to the pilot
3. Place pipe on pusher and install vacuum system through the pipe
4. Start the reamer and push pipe into bore
5. Place next pipe disconnect vacuum system and install through second pipe
6. Repeat steps 3-5 until all the pipes have reached the launch pit

## 2.3. Network Utility Relocations

The existing underground network utilities within both the footpath and carriageway of Queen Street will need to be relocated to enable the construction of the Marmion Shaft. The utilities to be relocated away from the shaft footprint will likely include potable water, electricity, wastewater, stormwater and communications. However, as potholing has not been undertaken, there may be further relocations required. Hence a flexible ‘shaft envelope’ (red box) is being sought to demonstrate the possible shaft location as mentioned in Section 2.1.

Open-cut progressive trenching will be utilised to relocate any utilities that are required to be relocated. The trenches are expected to typically be between 0.4m and 2m in width and between 0.3m and 3m deep, depending on the location of the utility, and will be constructed in 3 to 10 m-long sections per day (depending on depth of trench). Once the new ducts and pipes are installed, the trenches shall be backfilled with the footpath and/or road reinstated.

Where trench works are required within the road corridor, this will involve a combination of reduced traffic lanes and full closure of traffic lanes to enable utility relocation works to be completed.

The following high-level methodology will apply to network utility relocations:

**Table 1: High-level network utility relocation methodology**

| Stage | Construction Activities |
|---|---|
| Site set out | Set up traffic management and fencing. Identify and mark-out position of trenches along the affected roadway and footpath areas. |

| | |
|---|---|
| Pavement removal | Saw cut and remove existing pavement. |
| Trench construction | Expose, identify, and support existing utilities up to a 1.5m – 3m depth.<br>Trenches will be constructed to a width of approximately 1m. All spoil will be loaded onto trucks and disposed of off-site. |
| Utilities installation | Once trench is at required depth, bedding will be placed in the trench, with the new utility assets installed. |
| Reinstatement | Once installed, the trench will be backfilled and compacted in layers as specified. Surface is then reinstated with asphalt. Backfill material will be imported. Fill will be a mixture of cut to fill aggregate from site and imported fill.<br>Backfill may be stockpiled on site for a short period. |

The network utilities within the Marmion Shaft's consenting envelope which may need to be relocated or protected are outlined in Table 2 below.

**Table 2: Summary of potentially affected network utilities**

| Asset ID | Type | Owner | Action |
|---|---|---|---|
| **N/A** | Electricity – 11 kV | Vector | Relocate |
| **N/A** | Electricity - HV | Vector | Avoid |
| **Cable ID HOB-PEN-A-CBL** | Electricity – LV | Transpower | Relocate |
| **Manholes – IDs 2000465764, 2000308548, 2000017189** | Stormwater | Healthy Waters | Protect |
| **Pipes – IDs 2000110404, 2000937040, 2000486432** | Stormwater | Healthy Waters | Protect |
| **Pipes – IDs 2000277930, 2000679895** | Stormwater | Healthy Waters | Relocate |
| **Pipe ID 852334** | Wastewater | Watercare | Relocate |
| **Manhole ID 522814** | Wastewater | Watercare | Protect |
| **Pipe ID 1650257** | Potable Water | Watercare | Relocate |
| **N/A** | Communications | Vector | Relocate |
| **N/A** | Communications | One NZ | Relocate |
| **N/A** | Communications | City Link | Relocate |

Due to the proximity of these services to each other, a wider trench may be necessary to divert the services in a common service trench which would be either benched or shored. If a wider trench is required, then this could cause earthwork estimates to increase by 2-3 times.

## 2.4. Plant and Equipment

The following equipment is required to construct the Project:

| Secant Shaft Construction | Trenchless construction | Network utility relocations |
|---|---|---|
| CFA piling - SR-45 or SR-65 | 35-90T All Terrain/Mobile Crane | Trucks (regular, concrete trucks and 4 – 8 wheeled) |

| | | |
|---|---|---|
| 3-35T excavators | HIAB truck | Concrete saw / handheld concrete breaker |
| 6-8-wheeler trucks | Power pack container (may be truck-mounted) | 8T excavator |
| 400kg plate compactor | Tool truck | Hydro vac |
| Concrete pump | Vacuum truck | Trench shield |
| Concrete trucks | Axis/Pilot bore micro tunnelling machine | Air actuated compaction equipment |
| Silenced Generator | Bentonite mixing system (if required) | Asphalt paver |
| 7T vibrating drum construction roller | | Double drum roller |
| | | Mobile generator |

## 2.5. Earthworks (Estimate)

| **Activity** | **Area** | **Volume** |
|---|---|---|
| Crane & piling platform | 216m$^2$ | 152m$^3$ |
| Shaft construction | 32m$^2$ | 544m$^3$ |
| Trenchless (pilot bore) | 46m$^2$ | 25m$^3$ |
| NU Relocations | 260m$^2$ | 507.5m$^3$ |
| Total | **554m$^2$** | **1,228.5m$^3$** |

## 2.6. Programme Durations

The expected start date of this scope of work is September 2025.

- Compound/traffic management set up – 13 days
- Network utility relocations – 3 – 6 months
- Shaft construction – 50 days, of which dewatering is required for 20 days
- Tunnel construction – 15 days
- Manhole construction – 30 days (may be completed at a later date).
- Road reinstatement – 10 days