1. Queen Street – Part 3 to 4 Connector Design and Construction Statement

1.1. Introduction

This additional methodology should be read in conjunction with the Part 3 construction methodology. It provides details of how an early section of the Part 4 works will be constructed to enable the Part 3 tunnelling works, referred to as the 'Part 3-Part 4' connector.

These works will consist of constructing a 36m length of the Part 4 tunnel and one temporary shaft, which will in turn allow the Part 3 mTBM temporary services to be more easily routed between the Greys Ave Construction Support Area ('CSA') and the Part 3 launch shaft at the intersection of Mayoral Drive and Queen St. This service tunnel route will also cause less disruption to the local pedestrian / roading network.

Construction of this tunnel section and shaft will be used initially as temporary works for the Part 3 construction and will then revert to be used as permanent works for Part 4.

1.2. Shaft Construction for P3 – P4 Connector in Greys Ave Carpark

The basic steps required to construct a temporary post and panel shaft is outlined below and in Figures 1, 2 and 3:

- An auger attachment on a 20-36t excavator or small piling rig (GEAX EK-60) will be used to drill 550mm dia holes and steel H beams will be set into each with sand and concrete backfill. A hydrovac will be required to expose existing services before the piles are installed.
- The shaft will be excavated from the top using an excavator at surface level to a depth of approximately 1m below pipe invert (5m deep shaft). Six-wheeler trucks will be used to remove spoil off site. Approx shaft spoil volume will be 50m^3 (10 return truck trips).
- Steel road plates or timber lagging will be installed between H beams as the excavation advances.
- The shaft base will be lined out with 300-500mm of aggregate and blinding concrete to provide a solid and level working platform.
- If dewatering is required, a submersible pump will be used to remove water from excavation. The water will be pumped into clarifying tank for treatment, if sediment laden, before discharging to stormwater. The pumps will run continuously while the trench is open and will be powered by a diesel generator or grid power from the CSA.
- Once the shaft has been used for tunnelling (refer Section 1.3 below), a trench will be dug to install more of the pipeline, up to P4MH3 (under a separate consent), the shaft will then be reinstated. For manhole construction and shaft reinstatement please refer to the Part 3 methodology.

Plant List for Shaft Works

Activity	Plant List
Drilling and installing steel posts	10 – 36t excavator/GEAX EK-60 & Hydrovac
Excavating shaft	20-36t excavator
Spoil removal	6-wheeler or artic trucks
Concrete base	Concrete truck, pump truck

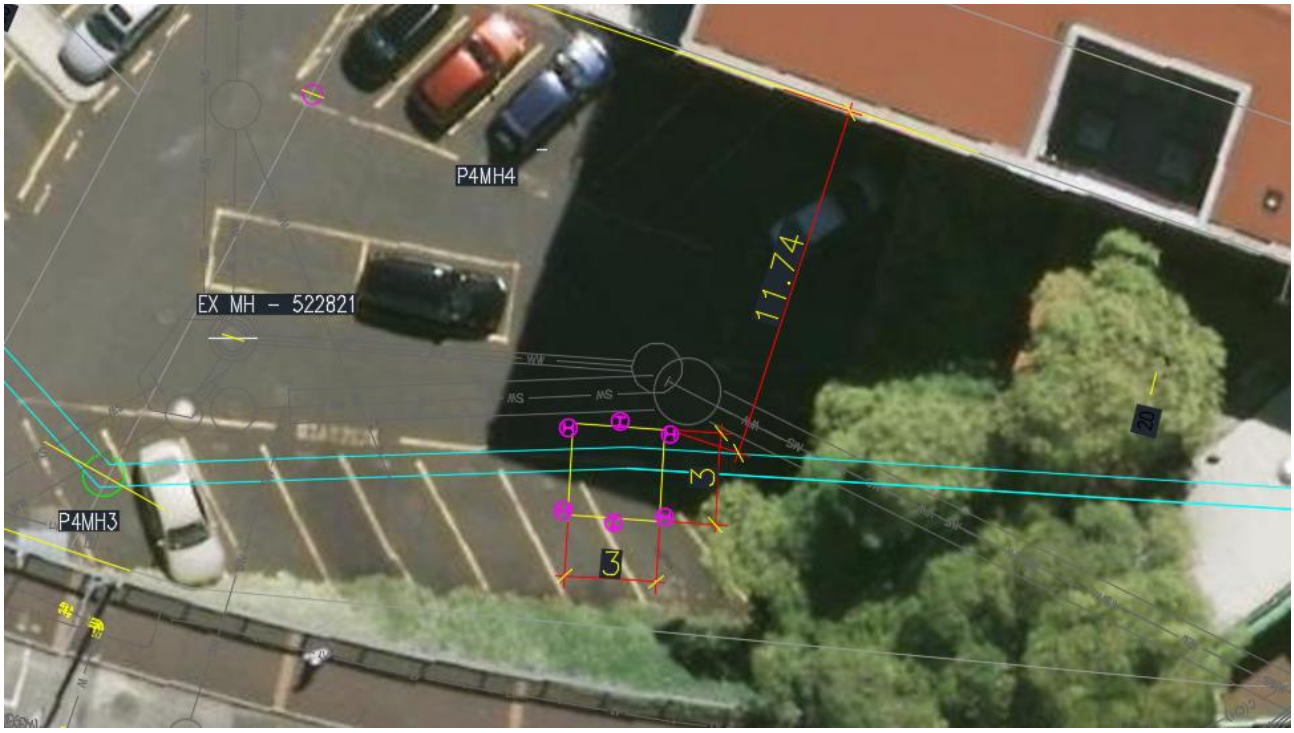

Figure 1 – Temporary shaft location - plan view

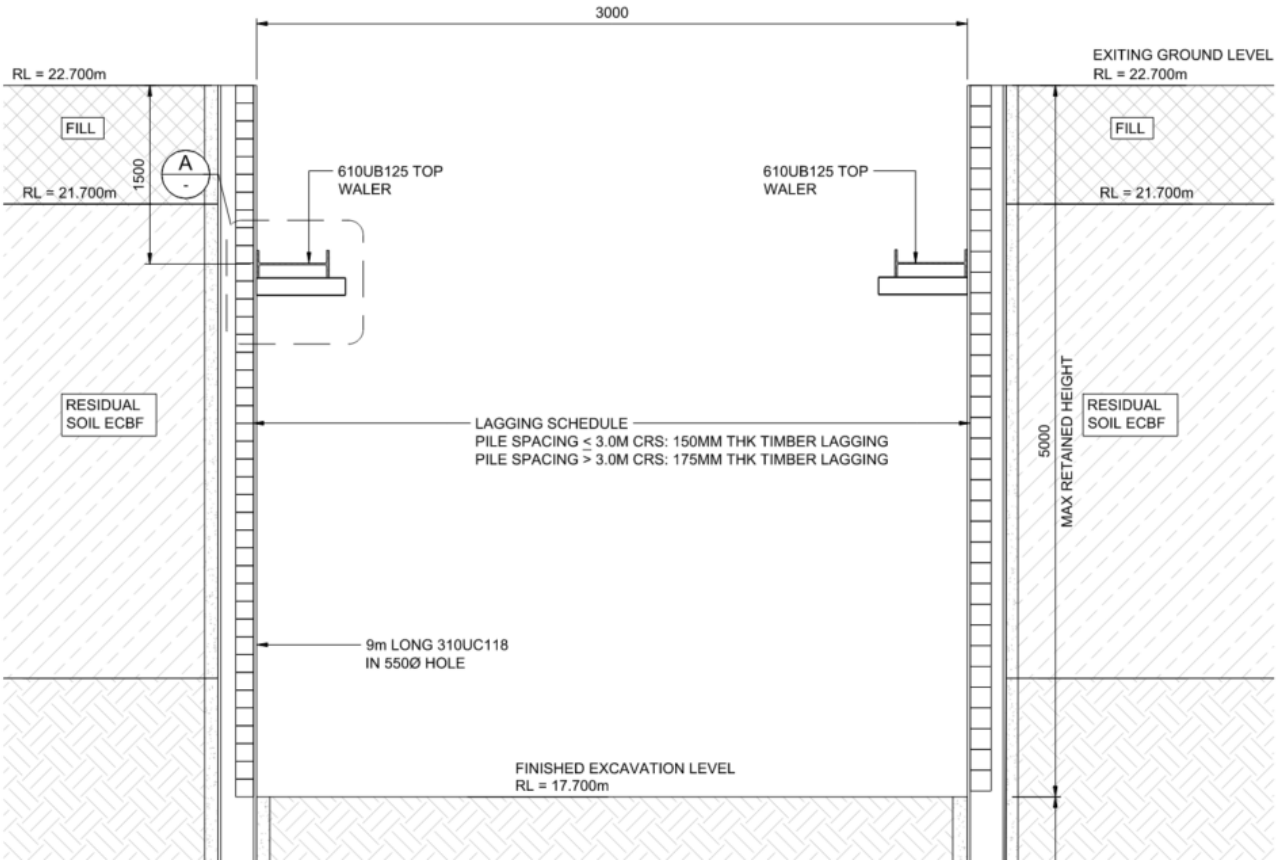

Figure 2 – Temporary shaft design - section view

1.3. Trenchless bore CONSTRUCTION

The basic construction steps required to tunnel between the Greys Ave Car Park temporary shaft and the Part 3 Mayoral Dr/Queen St shaft are outlined below.

Trenchless laser guided bore construction will be used:

- Setup power pack, pump and water tank on surface adjacent to launch pit
- Lift boring 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 excavator or vacuum truck will be used to remove spoil from the drive, and it will be disposed offsite using 6 wheelers or sucker trucks. Approx wet tunnel spoil volume will be 20m^3 (8 return truck trips).
- Simultaneously jack GRP pipes between pits
- Clean up and flush drill slurry out of pipe by jetting and vacuum truck
- CCTV inspect and low-pressure air test on completion

Plant List for Tunnelling Works

Activity	Plant List
Tunnelling – Launch Shaft (Greys Ave)	Crane truck
	Power pack container
	Pipe jack
	Sucker truck or 6-wheeler
	Tool truck
Tunnelling – Reception Shaft (Queen St)	Crane truck
	Power pack container
	Pipe jack
	Tool truck

Figure 3, 4 and 5 below demonstrate the proposed boring operation (note that exact methods vary between different machines).

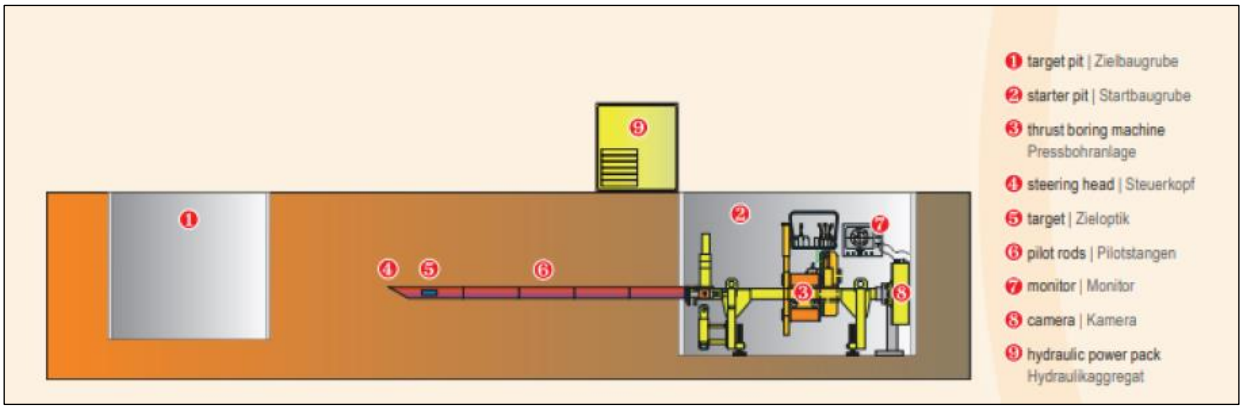

Figure 3 – Typical trenchless bore – pilot process

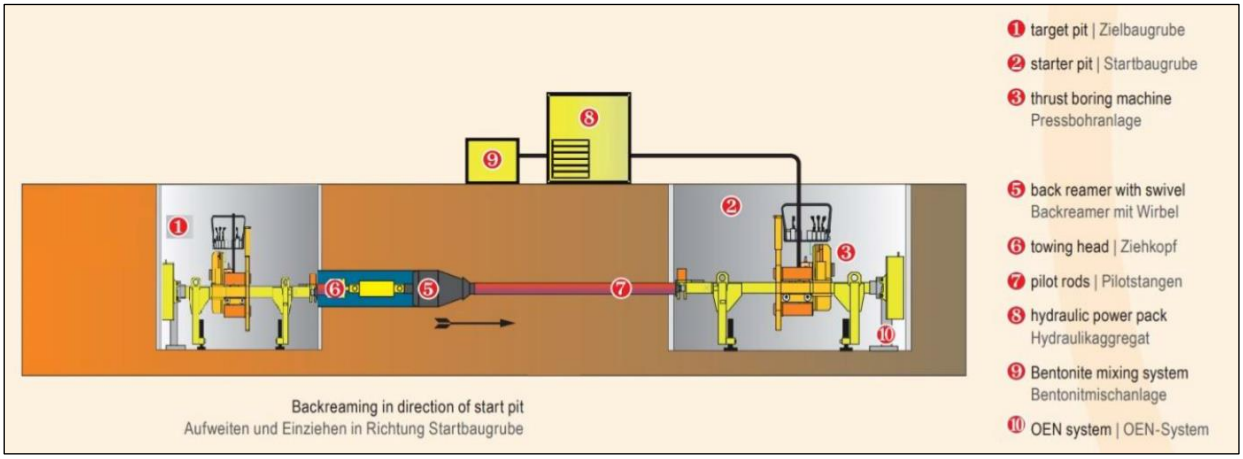

Figure 4 – Typical trenchless bore – cutting back

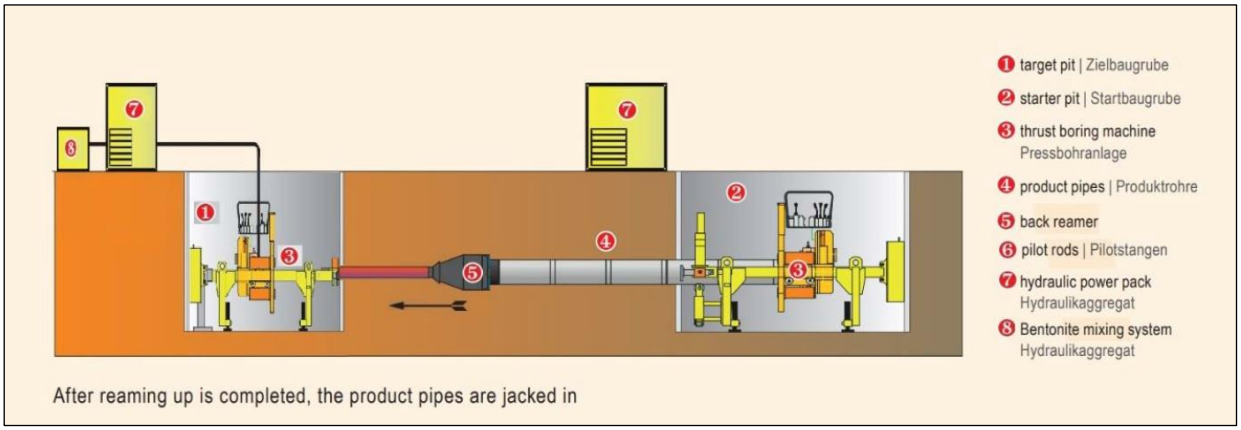

Figure 5 – Typical trenchless bore – jacking pipes in

2. Sequence of work & Programme Durations

- Shaft construction – 10 days (dewatering required for 1-2 days for this activity).
- Allow groundwater to recharge as required, monitoring to take place.
- Tunnel construction – 7 days (dewatering required for this activity).
- Allow groundwater to recharge as required, monitoring to take place.
- Manhole construction – 0 days – to be constructed under the Mayoral Drive Alignment Consent.

3. Revision History

Rev.	Date	Author	Description
0	03/08/2023	Jeremy Gordon	Issued for WSL & WSP review
1	04/08/2023	Jeremy Gordon	Issued for specialist review (WSP Planning Team)
2	07/09/2023	Jeremy Gordon	Final
3	26/01/2024	Dominic Wakeland	Update to reflect location changes for shafts due to Eke Panuku feedback.
4	19/04/2024	Dominic Wakeland	Updated temporary shaft design and positioning to satisfy s92 request.

5	23/04/2024	Dominic Wakeland	Updated Section 2 to reflect groundwater detail.