



**Edinburgh Tram
Extension Construction
Delivery Plan**
City of Edinburgh Council

Turner & Townsend
Osborne House
1 Osborne House
Osborne Terrace
Edinburgh
EH12 5HG

t: +44(0) 131 347 3400
w: turnerandtowntsend.com



09 June 2015

CEC02087245_0001

Contents

Executive Summary	1
1 Scope of Document	1
2 Overview of Alignment	2
2.1 Route Description	2
2.1.1 Stops	3
2.1.2 Substations and traction power:	3
2.1.3 Overhead Line Equipment:	4
2.1.4 Trackwork:	4
2.1.5 Crossovers:	4
2.1.6 Signalised Traffic Junctions:	5
2.1.7 Tramway Control Systems:	5
3 General Construction Philosophy	7
3.1 Traffic Management	7
3.1.1 Overview	7
3.1.2 Approach	8
3.1.3 York Place to London Road	8
3.1.4 London Road to Foot of Leith Walk	9
3.1.5 Constitution Street from Foot of the Walk to Tower Street	10
3.1.6 Forth Ports area being Constitution Place to Newhaven Stop	13
3.1.7 Notes & Assumptions	15
3.2 Utilities and other below ground Assets:	15
3.2.1 Overview	15
3.2.2 Approach	15
3.2.3 Conflict Schedule	16
3.2.4 Advanced Site Investigation	20
3.3 City Heritage	21
3.3.1 Overview	21
3.3.2 Archaeological Works	21
3.3.3 Listed Buildings	24
3.3.4 Ancient Monuments	31
3.3.5 City Heritage Advanced Works	32
3.4 Civil works	32
3.4.1 Excavation to Formation	33
3.4.2 Drainage	33
3.4.3 Ducting for the tramway control network, the traction power and junction modification	34
3.5 Works to existing structures:	36
3.5.1 Scottish Power tunnel:	36
3.5.2 Leith Walk rail overbridge:	36

Contents

3.5.3	South Leith Parish Church boundary wall with Constitution Street	37
3.5.4	Tower Place Bridge and Victoria Dock Bridge	39
3.5.5	Lindsay Road Retaining Wall	39
3.6	Track works	39
3.7	Stop Construction	42
3.8	Overhead line works and traction power	42
3.9	Tramway control systems	44
3.9.1	Supervisory Control and Data Acquisition (SCADA)	44
3.9.2	Operational Radio System	44
3.9.3	Tram positioning and detection subsystem	45
3.9.4	Passenger information system:	45
3.9.5	Telephone network	45
3.9.6	Passenger help/Passenger emergency help points	45
3.9.7	Closed Circuit Television System (CCTV)	45
3.9.8	Operation data network	45
3.9.9	Software	46
3.10	Traffic junction upgrades	46
3.11	Temporary works	46
3.12	Third party interfaces	46
3.13	Tie in to the existing tramway	47
4	Section by Section Overview	55
4.1	York Place to McDonald Road	59
4.2	York Place to the Foot of the Walk	60
4.3	York Place to Ocean Terminal	61
5	Programme	62
5.1	Overview	62
5.2	Assumed sequencing	62
5.3	Programme durations	64
6	Contract Management	65
6.1	Management teams	65
6.1.1	Client Team	65
6.1.2	Main Contractor	65
7	Recommendations/ Next Steps	67
	Appendix A	70
	A1 - Construction Code of Practice	71
	A2 - Design close out report	72
	A3 - Cost Plan assumptions	73
	Appendix B	74

Contents

B1 - Overhead Line Equipment Building fixing schedule	75
B2 - Trackform schedule	76
Appendix C	77
C1 - Conflict Schedule	78
C2 - Leith Walk Programme site investigation	79
C3 - Leith Walk archaeological findings report	80
C4 - Advanced site investigation plan	81
C5 - Scottish Power tunnel condition survey	82
C6 - Overhead line works at York Place and Picardy Place	83
C7 - Construction Programme	84
C8 - Constitution Street Wall Works	85
C9 - Forth Ports Sewers	86
C10 - Proposed Site Compound	87

Rev	Originator	Approved	Date
0	Steven Jackson	Andy Scott	22/05/2015
1	Steven Jackson	Andy Scott	09/06/2015
<p>© Turner & Townsend Project Management. All rights reserved June 15. This document is expressly provided to and solely for the use of City of Edinburgh Council and must not be quoted from, referred to, used by or distributed to any other party without the prior consent of Turner & Townsend Project Management who accept no liability of whatsoever nature for any use by any other party.</p>			
<p>F:\EDI\INFRA\1. LIVE JOBS\INF12005 - EDINBURGH TRAM BUSINESS CASE\CONSTRUCTION DELIVERY STRATEGY\FINAL\CONSTRUCTION DELIVERY STRATEGY V10 FINAL.DOCX</p>			

Executive Summary

Context

The Construction Delivery Plan (CDP) has been drafted to support the Outline Business Case (OBC) being prepared by The City of Edinburgh Council (CEC) with regards to extending the current Edinburgh tram route from York Place to Newhaven.

A technical working group (TWG) was established with representatives from the organisations who delivered the tramway in May 2014. Those represented were:

- The City of Edinburgh Council
- Turner & Townsend
- Infracore

Design Development

The working group determined that the issued for construction design already submitted, was to sufficient detail to generally be adopted for the business case. There were areas of the design noted which would require further input at the next stage of the project. These are, in the main, minor elements and include, but not limited to:

- Tram alignment from York place to Picardy Place
- Picardy Place junction upgrade
- Track slab over the Scottish Power tunnel on Leith Walk
- London Road/Leith Walk road junction
- Track slab over the Network Rail overbridge on Leith Walk
- Track slab over both Tower Place and Victoria Dock bridges
- General review of the building fixing locations to support the overhead line.
- Redesign of Ocean Terminal Stop as the elements of the trackwork have been de-scoped in this study

The most significant element of design work, which is currently at a preliminary stage, is the alignment design from York Place to the top of Leith Walk including the redesigned junction at Picardy Place. The works to construct both the tramway and junction are not unique however they are complicated by the location at a major traffic junction, and by the expected redevelopment of the St James Shopping Centre, referred to as Edinburgh St James. Once the design is agreed with all parties, successful construction relates to good traffic management and thorough work planning and coordination with the relevant parties, rather than complicated construction techniques.

Construction Plan

The plan has explored the works required to establish the tie in to the existing line at York Place. There is a significant amount of work required to ensure this is performed safely and with as little disruption as possible. It is recommended that further analysis is performed and supported by Edinburgh Trams, recognising that restricting access to the contractor, to maintain the existing service, introduces inefficiencies which may not be the most cost effective option when compared to running a curtailed service for a short time while the works are completed.

Through the lessons learned from the construction of the first phase of tram (York Place to Edinburgh Airport) the following two general principles have been assumed in developing this construction delivery plan:

1. Establish traffic management which opens up large sections of the work site
2. Adopt a continuous approach to construction whereby the diversion of utilities and the installation of the tramway are combined avoiding the need to excavate twice thus minimising disruption, minimising cost and speeding up the construction process.

It is proposed that a Main Contractor is procured to complete all works, including utility diversions. It is assumed equipment similar to that used in the first phase is required (i.e. same trackform, track drainage boxes etc.); however, this may vary depending on the procurement strategy adopted by CEC and the successful Contractor.

The plan has reviewed the construction of the route as a whole (York Place to Newhaven) and discussed the changes should it be decided to construct the extension in smaller elements. The significant changes that piecemeal construction introduces are amendments to the termination points. The significant changes are:

- York Place to McDonald Road: The introduction of a scissors crossover to the west of the McDonald Road Stop.
- York Place to Foot of the Walk: Relocation of the Foot of Walk Stop from the top of Constitution Street to the bottom of Leith Walk to prevent disruption to the Duke Street/Great Street
- York Place to Ocean Terminal: The introduction of a scissors crossover to the south of the Stop.

The CDP has benefited from a number of elements of works carried out under the first phase including a significant number of utility diversions, modification to a number of structures in preparation for the tramway and lessons learned with respect to planning and executing the works. It should however be noted that due to the design development currently underway at Picardy Place there will be the need to perform further utility diversions as the tramway has been realigned since the original design was produced. Further to this following an interrogation of the records from the previous utility diversion contract there is expected to be further works with respect to utility diversions when the route is extended.

Programme

An outline programme has been produced which indicates overall project durations as follows:

- York Place to Newhaven – 70 months
- York Place to McDonald Road – 64 months
- York Place to Foot of the Walk – 68 months
- York Place to Ocean Terminal – 70 months

The programme has been developed assuming traffic management opportunities are realised. It has been assumed the works will be carried out in four traffic management areas, noting that no two adjacent sections can be worked on at any one time:

- York Place Terminus to London Road
- London Road to Foot of Leith Walk
- Constitution Street from Foot of the Walk to Tower Street
- Forth Ports area being Tower Street to Newhaven Stop

Recommendations

To improve scope certainty prior to procurement the following advance works are recommended:

- **Traffic Management Modelling** – Following discussions with the TWG and agreement with the Project Board around the traffic management approach detailed above it is proposed that the plans are further developed and a level of traffic modelling is carried out to ensure a workable solution is available. During this exercise it is also proposed that a scoping exercise is undertaken to establish the level of works required to the diversionary routes to accommodate any increase in traffic due to the diversions.
- **Advanced Utility Site Investigation** – As part of this study a utility conflict schedule has been developed based on a desktop study. Within the next stage of the project it is advised that a series of advanced site investigation works are carried out in key areas identified by the utility conflict schedule. These areas are as follows:
 - Location 1 – Picardy Place in front of Cathedral
 - Location 2 – Picardy Place at Crossing of Scottish Power Tunnel
 - Location 3 – London Road Junction
 - Location 4 – Elm Row at Scottish Power Tunnel
 - Location 5 – Leith Walk Railway Bridge
 - Location 6 – Balfour Street Tramstop (275Kv)
 - Location 7 – Jane Street Junction
 - Location 8 – Foot of the Walk Tramstop area
 - Location 9 – Queen Charlotte Street Junction
 - Location 10 – Bernard Street/Baltic Street Junction
 - Location 11 – Lindsay Road Sewer

This advanced site investigation should be carried out ahead of the procurement and tender production to improve certainty on scope and allow assessment on the appropriate level of risk transfer.

- **Advanced Archaeological Site Investigation** - As part of this study various discussions have been held with the City Archaeologist to understand the likelihood of finding items of archaeological interest during the project. As a result it is recommended that a series of advanced site investigation works are carried out in the following key areas:
 - Location 12 – 1817 Dock structure at Ocean Terminal
 - Location 13 – Queen Charlotte Street to Baltic Street Archaeological Findings

This advanced site investigation should be carried out ahead of the procurement and tender production to improve scope certainty and allow assessment on the appropriate level of risk transfer.

- **Constitution Street Wall Advanced Works** – Due to the level of risk around the historic cemetery wall at Constitution Street and the impact on the programme if these works were to be carried out in conjunction with the main works it is advised that a separate advanced works contract should be procured to carry out the following:
 - Advanced Consultation with church & family members affected by works
 - Careful dismantling, removal and labelling of existing wall parts
 - Removal/Archaeological dig of around 200nr bodies under wall
 - Construction of foundations as shown on attached drawing

- Restoration of wall
 - Reinstatement of wall
- **Market Testing Survey** – Due to current market conditions and the competitive nature of the construction market it is advised that CEC should carry out rigorous of market testing. This analysis will determine the overall appetite within the market for the project, level of risk transfer available to the Contractor and appetite for a single design and build construction model.
- **Edinburgh St James Agreement Conclusion** – Within the early stages of the next phase of the project it is advised that scope definition, in relation to the agreement with the Edinburgh St James Development, is ratified. This will ensure scope is sufficiently well defined ahead of market testing and the Tender production phase.
- **3rd Party Engagement** – Throughout this phase of the OBC development most 3rd parties involved in the project have been engaged with. Within the next phase of the project it is advised that agreement is reached on the mechanism to resolve outstanding issues and determine final governance arrangements for the project. It is also advised a detailed review is carried out of existing 3rd party agreements to ensure all existing obligations are understood and can be considered during the procurement phase.
- **Current Detailed Design** – The TWG considered the current design was at an advanced stage but a thorough review of the current design is recommended to inform the Tender Documentation for the main works particularly with regards to:
 - the tie in works to support single line running to Picardy Place
 - the trackslab over/adjacent to the Scottish Power tunnel
 - the York Place to Picard Place tram alignment
 - the new Picardy Place road junction
 - Leith Walk following the Leith Programme works
 - London Road/Leith Walk junction redesign
 - the trackslab spanning the Network Rail overbridge
 - finalisation of Tower Place bridge and Victoria Dock bridge to accommodate the tramway i.e. OLE corbels, ducting, bridge expansion joints and trackform
 - the redesign of Ocean Terminal Stop due to de-scoping
 - review of the OLE design particularly the proposed building fixings
- **Design Value Engineering** – During this phase of the OBC development a number of sections of the design were identified that could be improved or value engineered. It is advised that CEC appoint a team to review the current design in detail and consider any elements for value engineering. .
- **Operator Input** – The extension of the system is for the main part, isolated from Edinburgh Trams, however it is recommended discussions commence with them on the following key elements:
 - The sequencing, scheduling and physical nature of the tie in at York Place
 - The requirements with regards to software upgrades and how these are managed.
- **Impact if a sectional approach** – The TWG noted that should the route be extended in sections the following changes would be required to the current scheme:
 - Macdonald Road Termination:
 - The provision of a scissors crossover at the MacDonald Road Stop
 - Reconfiguration of the OLE design

- Foot of the Walk Termination:
 - New tram stop at the foot of the walk
 - Reconfiguration of the OLE design
 - Road realignment to accommodate the stop
- Ocean Terminal Termination:
 - Reconfiguration of the OLE design
 - Introduction of a scissors crossover in front of the stop

The above items should be considered when performing the scoping of any future extension.

The above recommendations have been made to inform the procurement of works required to extend the tramway and to highlight the key issues relating to the successful delivery of the extension.

1 Scope of Document

This CDP is a supporting document to the OBC being drafted by (CEC).

This document will discuss the route from York Place to Newhaven and then provide an overarching construction delivery plan and has been developed through a technical working group (TWG) established with representatives from the organisations who delivered the tramway in May 2014. Those represented were:

- The City of Edinburgh Council
- Turner & Townsend
- Infraco

The document is not being written to support an application to the Scottish Parliament for permission to construct the route. This has already been granted, via the Edinburgh Tram (Line One) Act 2006 (the Act). Under this act a number of requirements were imposed on the promoter of the route. The requirement relevant to this document is the need to adhere to the Code of Construction Practice (CoCP). The CoCP is included in Appendix A.

Under the scope of the Infraco Contract Settlement Agreement (developed post mediation and signed September 2011) the construction works from York Place to Newhaven were excluded by the decision taken by CEC to suspend this element of the route.

The completion of the design from York Place to Newhaven was suspended and reported on in the closure report dated 15th June 2012 and attached in Appendix A. The majority of the works had been designed to "Issued for Construction" (IFC) status and certain elements of the works had been constructed, which will be explored further in this document. As this is the case, the TWG established by CEC to support the drafting of the OBC, agreed the IFC design should be adopted where this is in place and only challenged in those areas where there has been a change to the receiving environment since the design was completed. This document will note where the IFC design has been challenged or where gaps in the IFC design remain.

The OBC is being developed in such a way as to allow CEC to make an informed decision as to whether it is appropriate to construct the entire extension to Newhaven or to build out in sections, over time, from the current terminus at York Place. The OBC will be presenting four options for consideration, these are:

- York Place to Newhaven (full route)
- York Place to Ocean Terminal
- York Place to the Foot of the Walk
- York Place to McDonald Road

This plan has been drafted for the full route, the other delivery options are discussed in more detail in section 5.

The cost plan has been developed taking account of the construction requirements noted in this document. The underpinning assumptions for the cost plan can be found in Appendix A.

2 Overview of Alignment

The full route starts at the current York Place temporary Stop and runs for 4.7km to a planned new terminus Stop at Newhaven as shown schematically on figure 1 below.

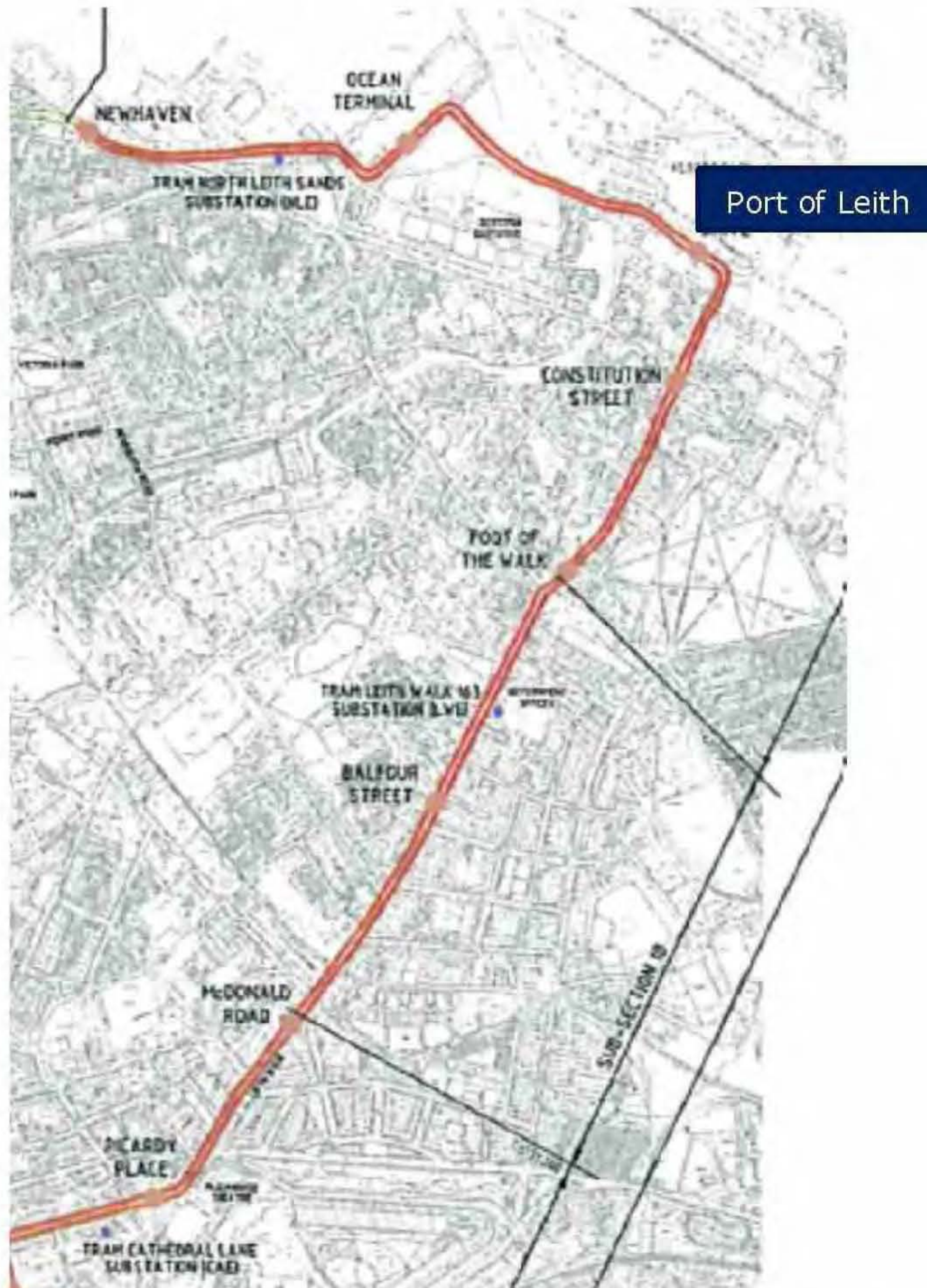


Figure 1: Schematic showing the proposed route from the York Place temporary Stop to Newhaven Stop.

2.1 Route Description

The extension commences at York Place and crosses Broughton Street Junction to an island Stop adjacent to the existing Picardy Place Roundabout. The alignment from York Place through Picardy Place has been determined through discussions between CEC and the Edinburgh St James developer. It is understood the resulting enlarged roundabout site is earmarked for future development.

From Picardy Place the line heads north east passing over London Road Junction which will be reconfigured to a fully signalised junction from what is currently a roundabout. The line then continues along Leith Walk in dedicated public transport lanes (inbound and outbound) with a

central reserve accommodating the overhead line poles. There are Stops at McDonald Road and Balfour Street, both with island platforms.

The line then passes over Great Junction Street to a side platform Stop at the Foot of the Walk in Constitution Street. The next Stop is located at Bernard Street before the line swings west at the Casino to the Port of Leith Stop on Ocean Drive which has side platforms.

The line then runs along Ocean Drive in a shared running corridor over Tower Place Bridge and Victoria Dock Entrance Bridge before turning south to an island platform Stop at Ocean Terminal. From Ocean Terminal the alignment stays on Ocean Drive until it reaches North Leith Sands where it rises to meet Lindsay Road. It then runs in a tram only corridor adjacent to Lindsay Road until reaching Newhaven Stop (side platform) located just before Sandpiper Drive.

2.1.1 Stops

There are seven Stops to be located at:

- Picardy Place – Island Platform
- McDonald Road – Island Platform
- Balfour Street – Island Platform
- Foot of the Walk – Side Platform (Bespoke Arrangement)
- Bernard Street – Island Platform
- Port of Leith – Island Platform
- Ocean Terminal – Island Platform
- Newhaven – Side Platform

2.1.2 Substations and traction power:

Two new traction power substations are required, one on Leith Walk in the old tram depot and the other at North Leith Sands just before the point where the tram climbs to run along Lindsay Road. Both these substations require an 11kVa supply from Scottish Power.

The substations will feed the overhead line via a ducting network installed from the substations to the alignment and then along the route of the tramway as indicated in figure 2.

There will be provision made to collect stray current and return it into the system as is currently used.

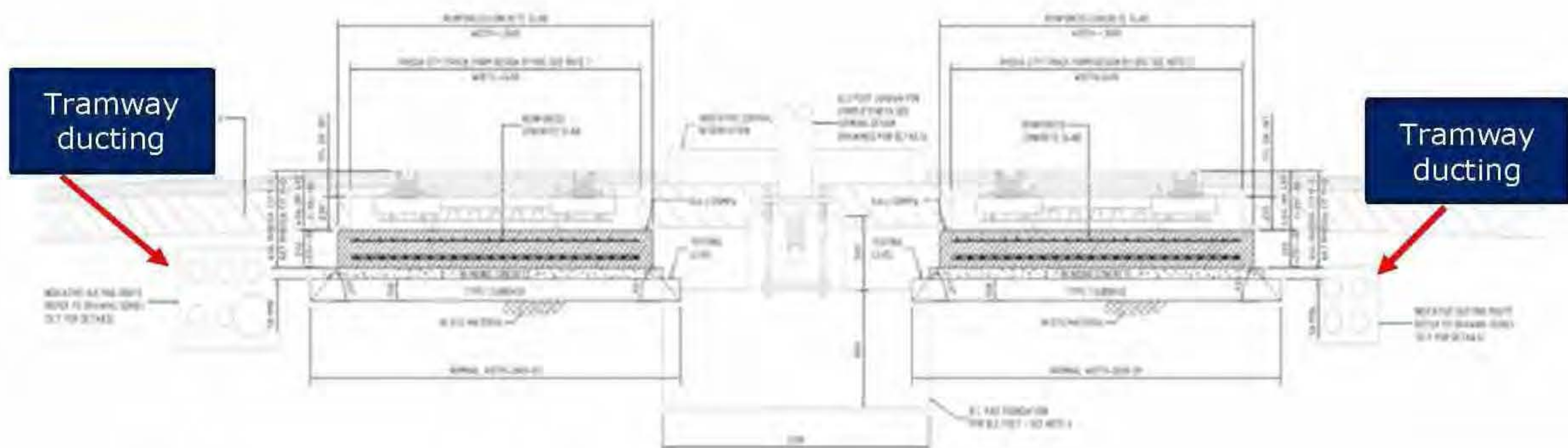


Figure 2: Typical cross section through the track bed including ducting, but excluding drainage extracted from drawing number ULE90130-SW-DRG-000682 rev 6.

2.1.3 Overhead Line Equipment:

The overhead line equipment (OLE) will be a continuation of the arrangement currently installed. It will be supported either on poles positioned centrally between the tracks, on building fixings or in certain locations on side poles. A standard reinforced concrete pad foundations will be used to support the poles where possible. Where there are space constraints a bored reinforced concrete pile or a bespoke reinforced concrete pad will be selected as the foundation.

A number of the building fixings have already been installed between York Place and Newhaven, but their suitability should be reassessed. Where appropriate these will be retained and used. Others have been designed but not installed due to access issues or the requirement for a special building fixing to be adopted. The requirement to install these fixings should be assessed at the next stage of the project. A schedule of all the fixing, installed or otherwise, is included in Appendix B.

2.1.4 Trackwork:

Currently it is proposed to use the same track construction used for the first phase of tram; a typical cross section of track construction is shown in figure 2. The constituent parts are:

- A type 1 compacted sub-base layer – depth dependent on the existing ground conditions
- A 50mm deep concrete blinding layer
- A 250mm deep reinforced concrete slab
- The track slab, rails and concrete upstands with an overall depth of approximate 410mm – this incorporates the concrete sleepers, the rails and the rail fixings

Due to environmental constraints imposed by the Act there is a requirement in certain locations to reduce the potential groundborne noise and vibration impacts caused by the introduction of the tramway. There are two ways this will be done:

- By using a floating track slab arrangement which offers the maximum potential to reduce the impacts by creating a cushioned “bath” for the track slab to sit in
- By using a “Rheda City Soft” arrangement which offers reduced attenuation compared with the normal track slab but not to the extent of the floating track slab. This is a simpler method of construction than the floating track slab

The types of trackform and any special treatment proposed are listed in Appendix B.

2.1.5 Crossovers:

To provide for operational flexibility a number of crossovers are being provided. These are located:

- At York Place – This turnout is currently in operation to support the tramway and will not be changed.
- To the south west of the Foot of the Walk road junction on Leith Walk – This will be a turnout arrangement similar to that already in use at York Place.
- To the east of the Newhaven Stop – This will be a full scissors crossover to allow for operational flexibility.

2.1.6 Signalised Traffic Junctions:

There are existing road junctions which will be impacted by the tramway. 21 of these will be signalised and are located as follows:

- Picardy Place/Leith Place/Broughton Street
- Picardy Place/Leith Walk
- London Road/Leith Walk
- Annandale Street/Montgomery Street/Leith Walk
- Brunswick Road/McDonald Road/Leith Walk
- Pilrig Street/Iona Street/Leith Walk
- Dalmeny Street/Leith Walk
- Jameson Place/Balfour Street/Leith Walk
- Smiths Place/Springfield Street/Leith Walk
- Manderson Street/Leith Walk
- Great Junction Street/Duke Street/Leith Walk – commonly referred to as the Foot of the Walk.
- Queen Charlotte Street/Constitution Street
- Bernard Street/Constitution Street
- Tower Street/Constitution Street
- Ocean Drive/ Constitution Street
- Ocean Drive/Ocean Terminal North Junction
- Ocean Drive/Ocean Terminal South Junction
- Ocean Drive/Ocean Terminal exit Junction
- Ocean Drive/North Leith Sands
- Ocean Drive/Forth Ports
- Lindsay Road/Ocean Drive West

Further to this and in order to provide a safe means of access to the Stops a number of signalised pedestrian crossing are required. These are located as follows:

- McDonald Road Stop
- Port of Leith Stop
- Lindsay Road Stop

2.1.7 Tramway Control Systems:

The extended alignment will be equipped with the same level of supervisory control and communication systems as are currently in use on the existing tramway namely:

- Supervisory Control and Data Acquisition (SCADA)
- Operational Radio System
- Tram positioning and detection subsystem
- Passenger information system
- Telephone network
- Passenger help/Passenger emergency help points
- Closed Circuit Television System (CCTV)
- Operation data network
- Software

The control systems will be extended via the ducting network, shown in figure 2, parallel to the new alignment and will link back to the Operational Control Centre (OCC) at the Gogar Depot. Minor cabling works will be required in the OCC. There will be the need to perform upgrades to the existing software so that it recognises the extended alignment and new equipment. This

report will however note the management of any physical works and matters which could impact on operation of the existing line.

3 General Construction Philosophy

There are number of constituent parts which when combine create the tramway. These are as follows:

- Traffic Management
- Utility diversions
- City heritage
- Civil works
- Works to existing structures
- Track works
- Stop works
- Overhead line works and traction power
- Tramway control systems
- Traffic junction upgrades
- Temporary works
- Third party interfaces

Through the lessons learned from the construction of the first phase of tram the following two general principles have been assumed in developing this CDP:

1. Establish traffic management which opens up large sections of the work site
2. Adopt a continuous approach to construction whereby the diversion of utilities and the installation of the tramway are combined avoiding the need to excavate twice thus minimising disruption and speeding up the construction process.

It is proposed that a Main Contractor will then complete all the tram infrastructure works. It is assumed equipment to be installed is similar to that adopted on the first phase (i.e. same trackform, track drainage boxes etc.); however, this may vary depending on the procurement strategy adopted by CEC and the successful Contractor.

The extension will be constructed following these two principles and in line with the descriptions below which detail the works required to construct the base line alignment from York Place to Newhaven.

3.1 Traffic Management

3.1.1 Overview

To facilitate all the works there is a need to provide significant traffic management. The current proposals are to deliver the project in substantial sections with wider city traffic management required to facilitate the required closures. From a Traffic Management perspective the route can be split into the following sections:

- York Place Terminus to London Road
- London Road to Foot of Leith Walk
- Constitution Street from Foot of the Walk to Tower Street
- Forth Ports area being Tower Street to Newhaven Stop

The TWG, felt the pros and cons evidenced in the table 1 below substantiated the decision to adopt this traffic management approach:

Pros	Cons
Programme saving using the knowledge of timescales from previous works	Extended commercial/community disruption
Savings (cost and programme) to be made from full utility diversions	Impact on diversion routes including road conditions
Savings on TM costs (less moves)	Cost of reconfiguring junctions
Consistency in Communications with the City e.g. Bus schedules	Loading to businesses - Logistic Service costs
Flexibility to solve site issues as they arise	Bus services - Elderly/Disabled people using further away stops
More efficient track laying/ducts/drainage	General pessimistic feeling from the public due to previous works
Efficient testing point to point	
Robust business continuity coupled with support and logistic crews	
Road Laying - quicker, permanent roads better quality with less transverse joints	
One running lane with crossings where possible (e.g. Leith Walk)	
Public get used to diversions which leads to natural traffic flow adjustments	

Table 1: Pros and Cons of adopting large sections of traffic management

3.1.2 Approach

Based on the above overview and generalised approach detailed, the methodology for each section varies slightly and can be detailed further below.

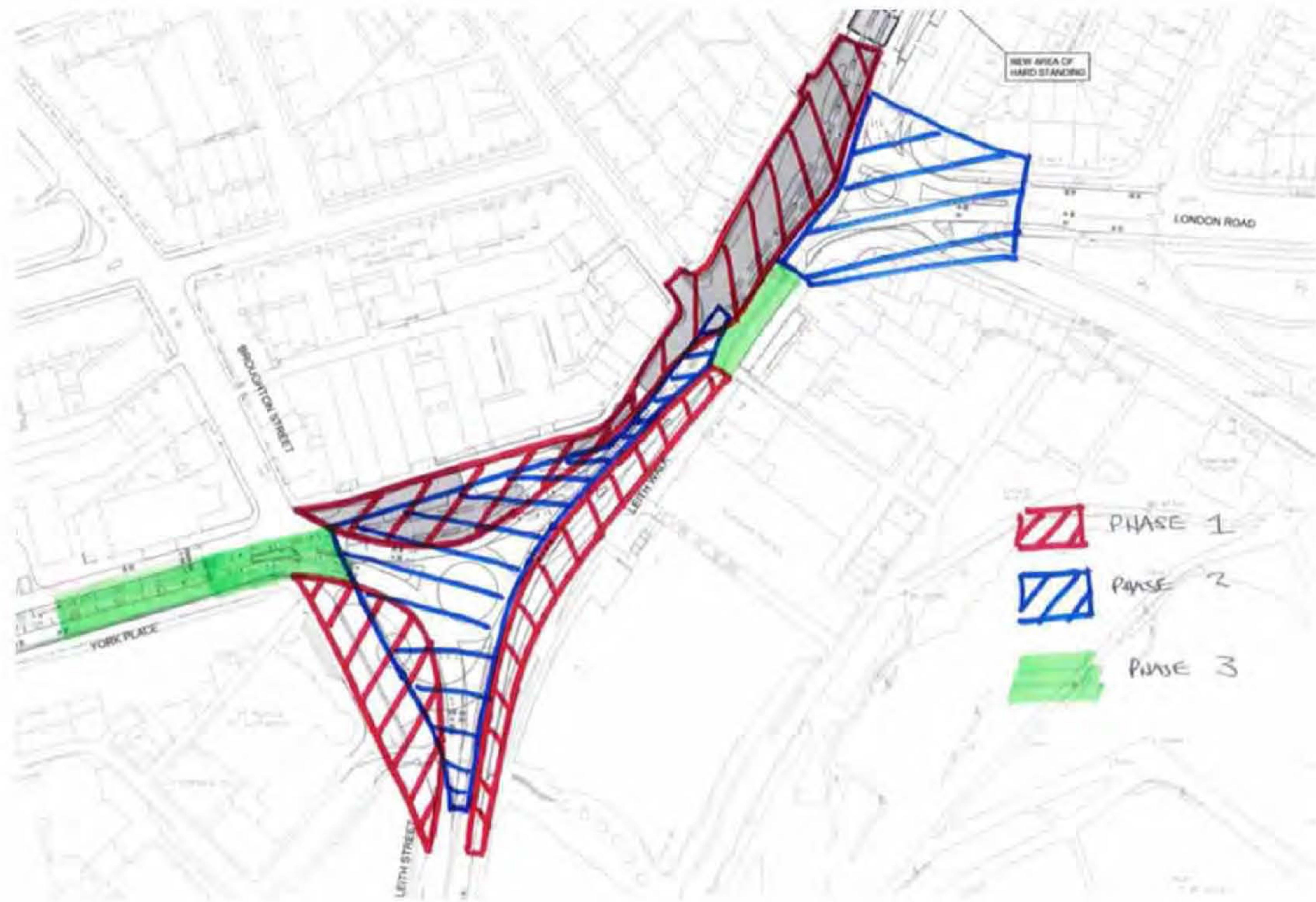
3.1.3 York Place to London Road

This section of the route is a heavily trafficked section of Edinburgh’s road network and strategic in terms of access in and out of the city centre from the north and east. On this basis it was felt that a traffic management approach to be undertaken here should ensure through traffic would be able to access and leave the city centre through the site accordingly. On this basis a three phased approach has been developed as follows:

- Phase 1 – Outer site areas including construction of new Picardy Place gyratory and kerblines
- Phase 2 – Island Site and Tramway with traffic using new gyratory

- Phase 3 – York Place Extension

This can be illustrated in the diagram below:

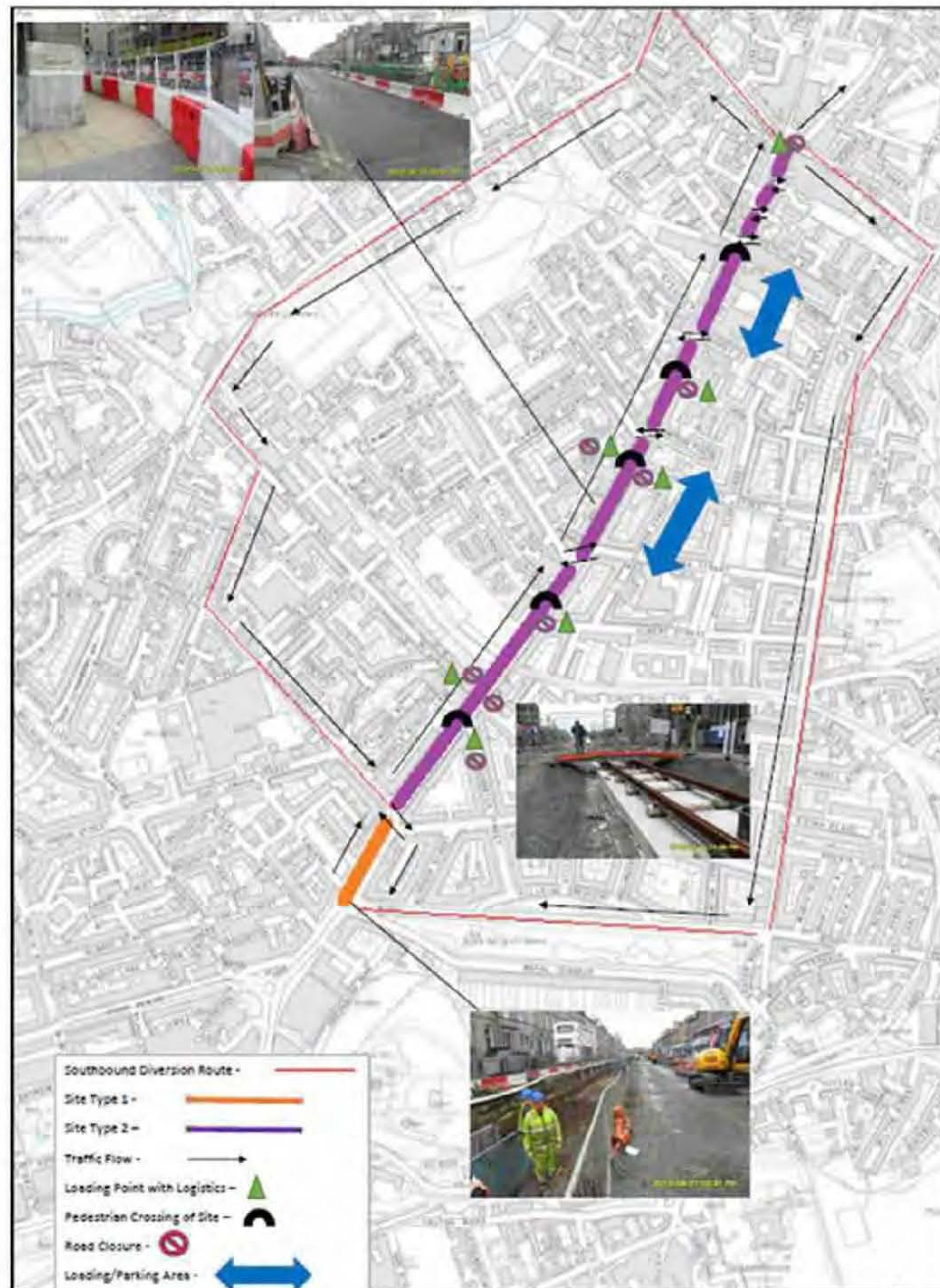


3.1.4 London Road to Foot of Leith Walk

This section of the route is also heavily trafficked and used by many bus routes in and out of the city centre towards the north and east. Although this is noted it is also evident that there is sufficient capacity within the wider city roads to implement an improved traffic management strategy on Leith Walk. The key enabler for Leith Walk is to allow a single lane of traffic either flowing Northbound or Southbound whilst the rest of the street is closed to allow construction to take place. This together with 2nr proposed loading areas, allows works between London Road and Foot of the Walk to be carried out in the following three phases:

- Phase 1 - 1 Lane Northbound/Southbound and Southbound carriageway, kerbing, central reservation and full tram construction with 2nr sections for loading/parking.
- Phase 2 - Southbound carriageway, kerbing, central reservation and full tram construction at 2nr previous loading/parking areas
- Phase 3 - Northbound carriageway reconstruction and kerbing works

The above approach will be based on the below diagram:

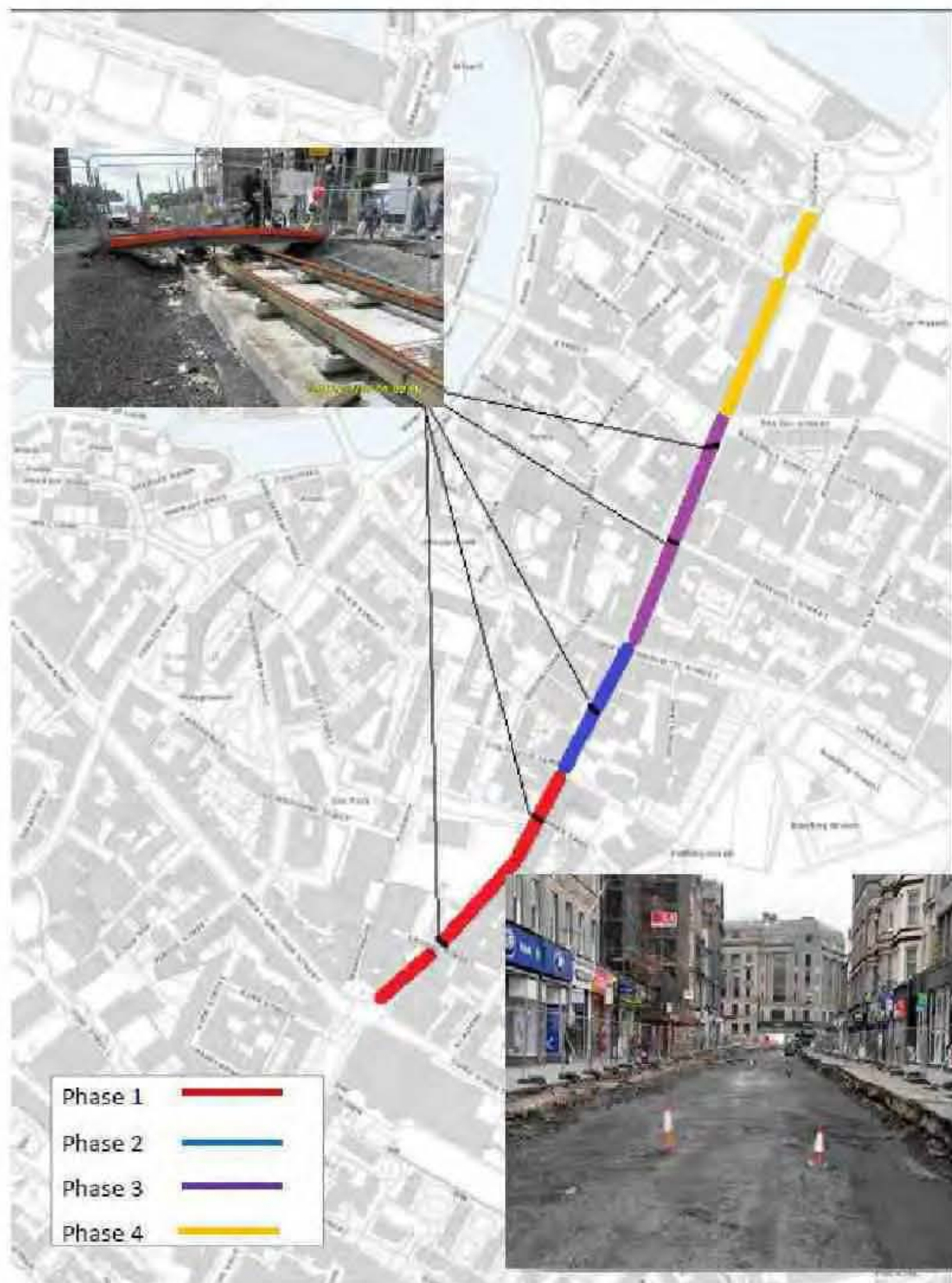


3.1.5 Constitution Street from Foot of the Walk to Tower Street

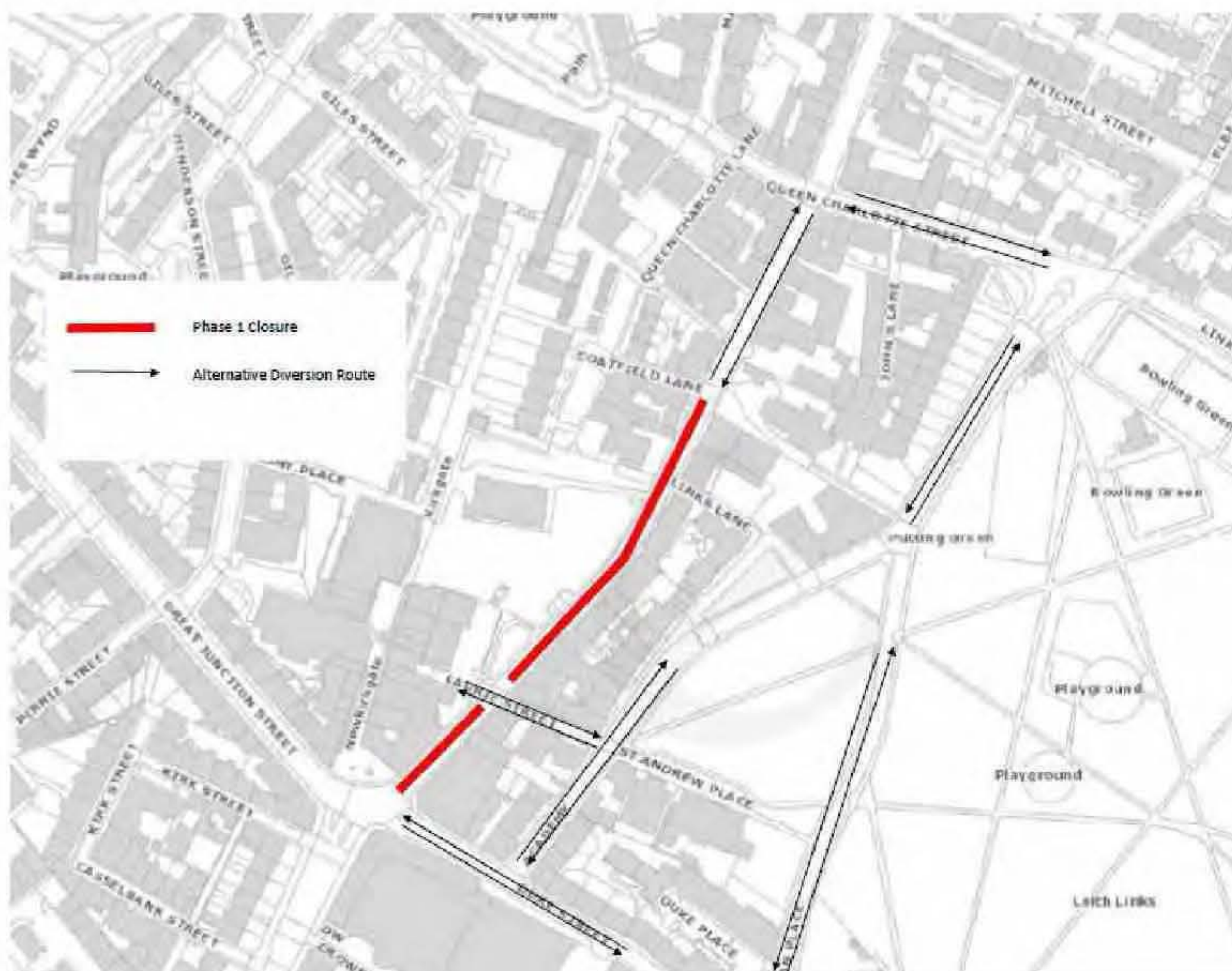
This section of the route differs from those previously discussed, primarily due to the constraints in relation to availability of space and road width. From this point the route changes to a single lane shared car, bus and tram arrangement with no further traffic lane. In this regard, and due to the availability of wider city diversionary routes the overall strategy for this section of Constitution Street is to close the full width of the road in sections to allow all works to take place, prior to reopening. On this basis the key stages of traffic management for this section are as follows:

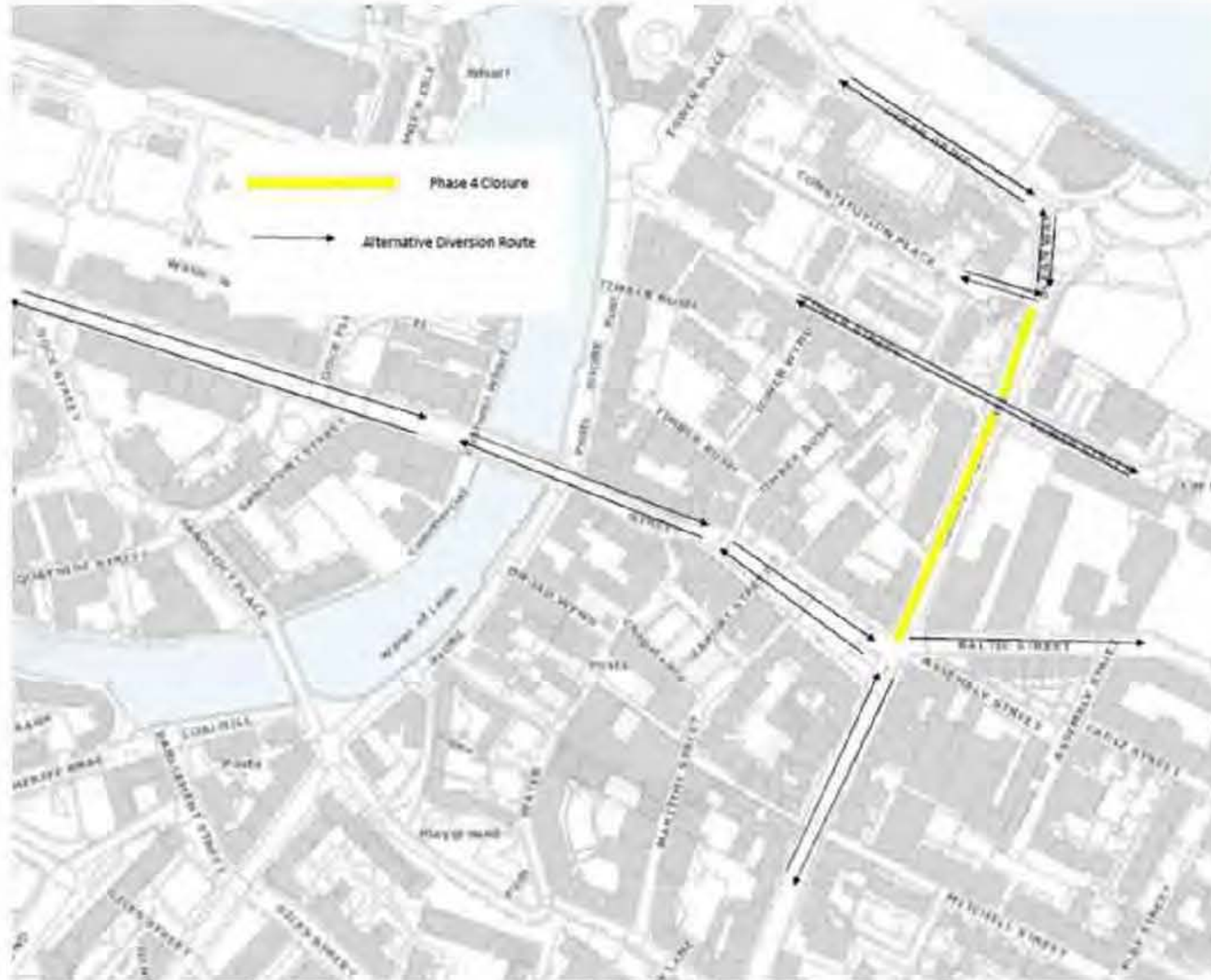
- Phase 1 - Foot of the Walk to Coatfield Lane (Full Closure - All Works)
- Phase 2 - Coatfield Lane to Queen Charlotte Street (Full Closure - All Works)
- Phase 3 - Queen Charlotte Street to Baltic/Bernard Street (Full Closure - All Works)
- Phase 4 - Baltic/Bernard Street to Constitution Place (Full Closure - All Works)

A general overview of these sections is as follows:



To identify the wider area diversionary routes for each section the below diagrams are referenced:





Phase 4 Wider City Diversionary Routes:

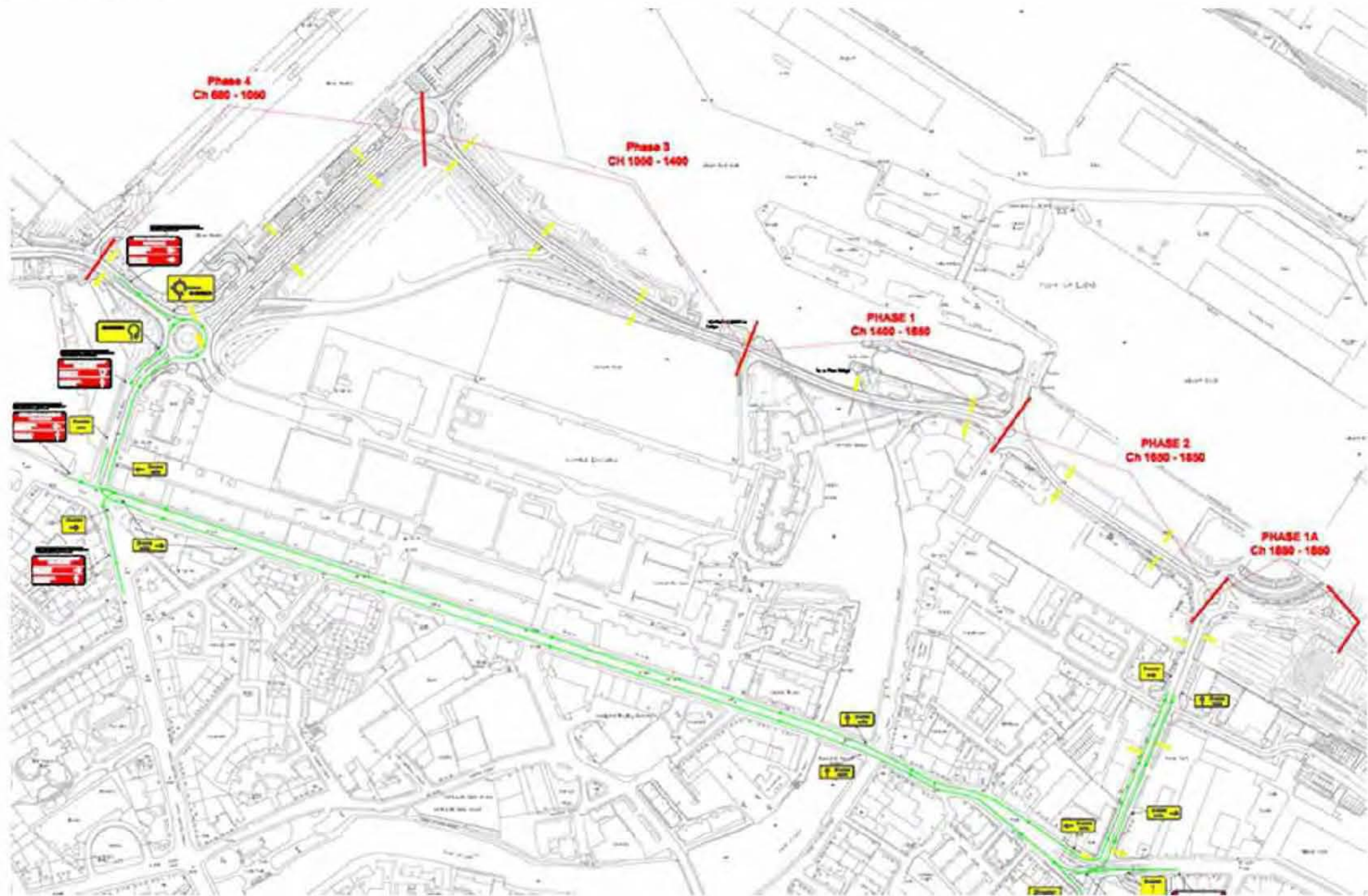
3.1.6 Forth Ports area being Constitution Place to Newhaven Stop

Within this final section of traffic management between Constitution Place and Newhaven Stop the route predominantly follows through Forth Ports land in the docks. As this is the case and due to the 3rd Party Agreement with Forth Ports which details access requirements during construction, the following nine phased approach has been adopted:

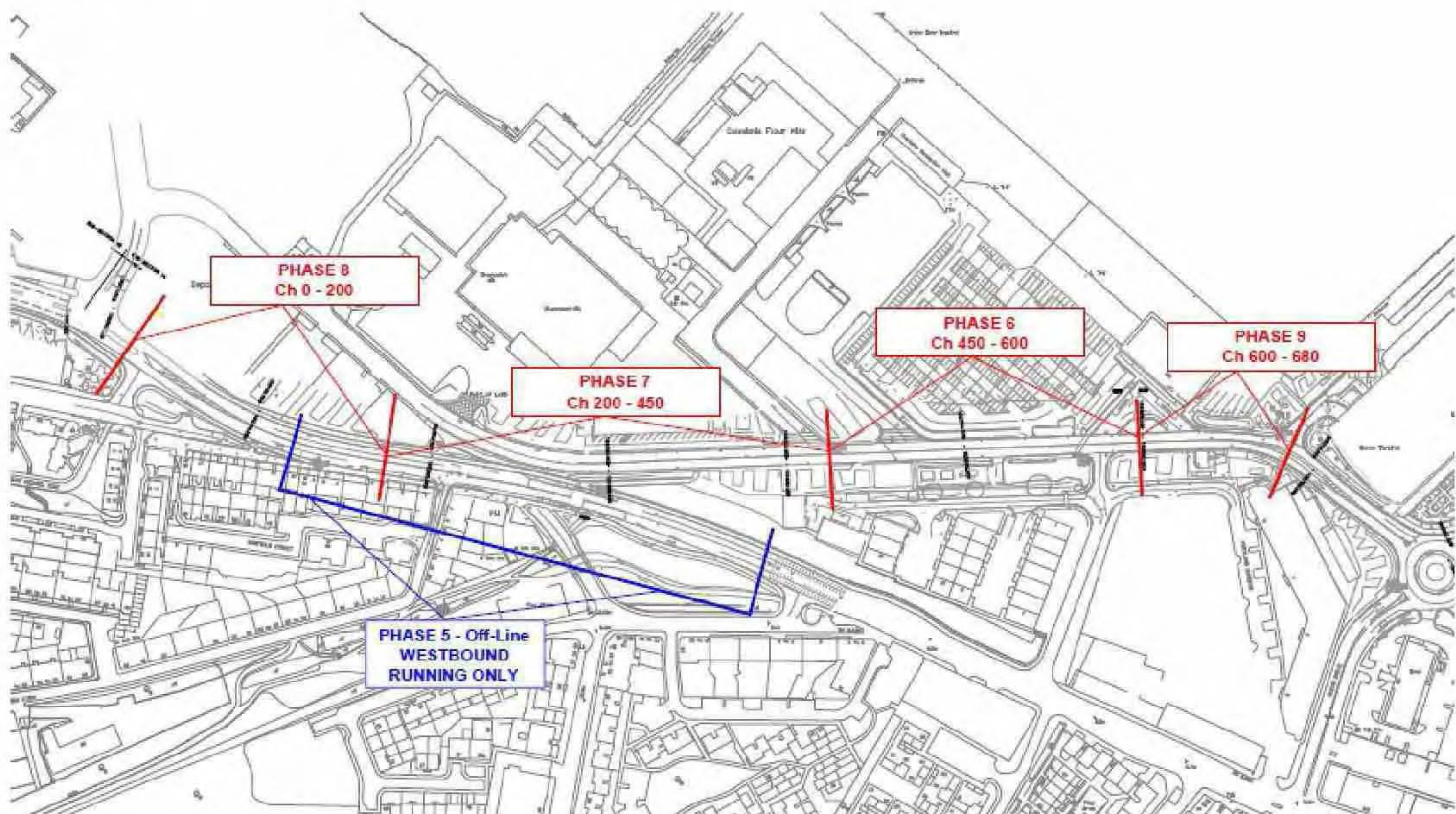
- Phase 1 - Victoria Dock Bridge to Tower Place (Full Closure - Full Works)
- Phase 2 - Tower Place to Casino (Full Closure - Full Works)
- Phase 3 - Victoria Dock bridge to Ocean Terminal North Roundabout (Full Closure - Full Works)
- Phase 4 - Ocean Terminal North Roundabout to Ocean Terminal South Car Park Exit (Full Closure - Full Works)
- Phase 5 - Lindsay Road Carriageway
- Phase 6 - North Leith Sands 1 (Full Closure - Full Works)
- Phase 7 - Lindsay Road Retaining Wall (Full Closure - Full Works)
- Phase 8 - Newhaven Terminus
- Phase 9 - North Leith Sands 2 (Full Closure - Full Works)

These sections can be illustrated in the following drawing extract:

Phase 1 -4



Phase 5 - 9



3.1.7 Notes & Assumptions

The following are the key notes and assumptions that were made in the development of the above traffic management sequencing:

- The traffic management phases shown above should be developed further in the next stage of this project, in line with the delivery programme. It is noted that further testing and modelling in particular is required to validate the phasing shown.
- It should be noted that sections of the works areas can be run concurrently i.e. Leith Walk and Forth Ports.
- The traffic management plans shown in 3.1.6 have been approved by Forth Ports.
- The Traffic Management strategy has assumed there will no alterations due to the Edinburgh St James construction.
- It is assumed that adequate pedestrian crossing points will be agreed with stakeholders and CEC during final development.
- There may be specific traffic management required within each of the sections for road crossings etc., and the CDP has assumed these will be developed further by the Contractor and approval by CEC without significant impact to the overall scheme.
- The Leith Walk single lane can either be Northbound or Southbound dependant on preferred solution by CEC, for illustrative purposes we have shown a northbound lane.
- It is assumed minimal works are required to the wider traffic management diversionary routes to accommodate the required closures.

3.2 Utilities and other below ground Assets:

3.2.1 Overview

A major part of the works involved in introducing a tram between York Place and Newhaven is the clearing of obstructions from the tram construction path including all required utility diversions. It is understood that the majority of utility diversions have been carried out by previous contractors', however it is known residual issues remain to be resolved.

As well as the works required to remove any conflicts such as utility apparatus there is a requirement to have liaison with and obtain approvals from the utility companies. The details of how these will be dealt with are found below.

3.2.2 Approach

It is assumed that the utility diversions that are required will be designed and performed by the Main Contractor when the site constraints are further defined following the initial excavation works.

As well as this it is assumed that the utility companies will provide a dedicated resource to fast track the design approval process and agreement on details of final construction methodology including shutdowns/power outages.

It is proposed that a utility team will be put in place with representatives from the key utility companies along with Main Contractor representation and a client utility coordinator to oversee the utility works and issues. In addition it is recommended that weekly co-ordination meetings are held to ensure design and construction matters are aligned.

3.2.3 Conflict Schedule

3.2.3.1 Summary

As part of the development of the OBC for the tram extension to Newhaven a desktop utility assessment has been carried out which has developed a conflict schedule detailing likely utility conflicts along the route whilst excavation works are ongoing. The schedule covers all conflicts identified during a desktop exercise which reviewed the route in detail identifying utilities, legacy issues, CEC assets, basements, archaeological works, monuments, obstructions and underground structures that have the capacity to delay the project. A conflict schedule was then prepared which details the action required to mitigate the issue and this can be found in Appendix C. The following are the key areas of significance within the conflicts schedule:

- Bernard Street /Baltic Street Incomplete MUDFA Works
- Scottish Power Tunnel (Picardy Place to Leith Walk)
- Scottish Power 275Kv at Albert Street
- Constitution Street Sewer
- Scottish Water Legacy Issues
- Jane Street BT Works
- Jane Street Gas Main Works
- Picardy Place Road Realignment
- Forth Ports Sewers
- Incomplete MUDFA Sewer/Manhole Diversions

The desktop exercise has identified a total of 1214 conflicts along the route with 60% of these being between York Place and Foot of the Walk, 35% between Foot of the Walk and Ocean Terminal and the remaining 5% from Ocean Terminal to Newhaven. It should be noted that there are likely to be further conflicts that are currently unknown and will only become apparent when the excavation works occur.

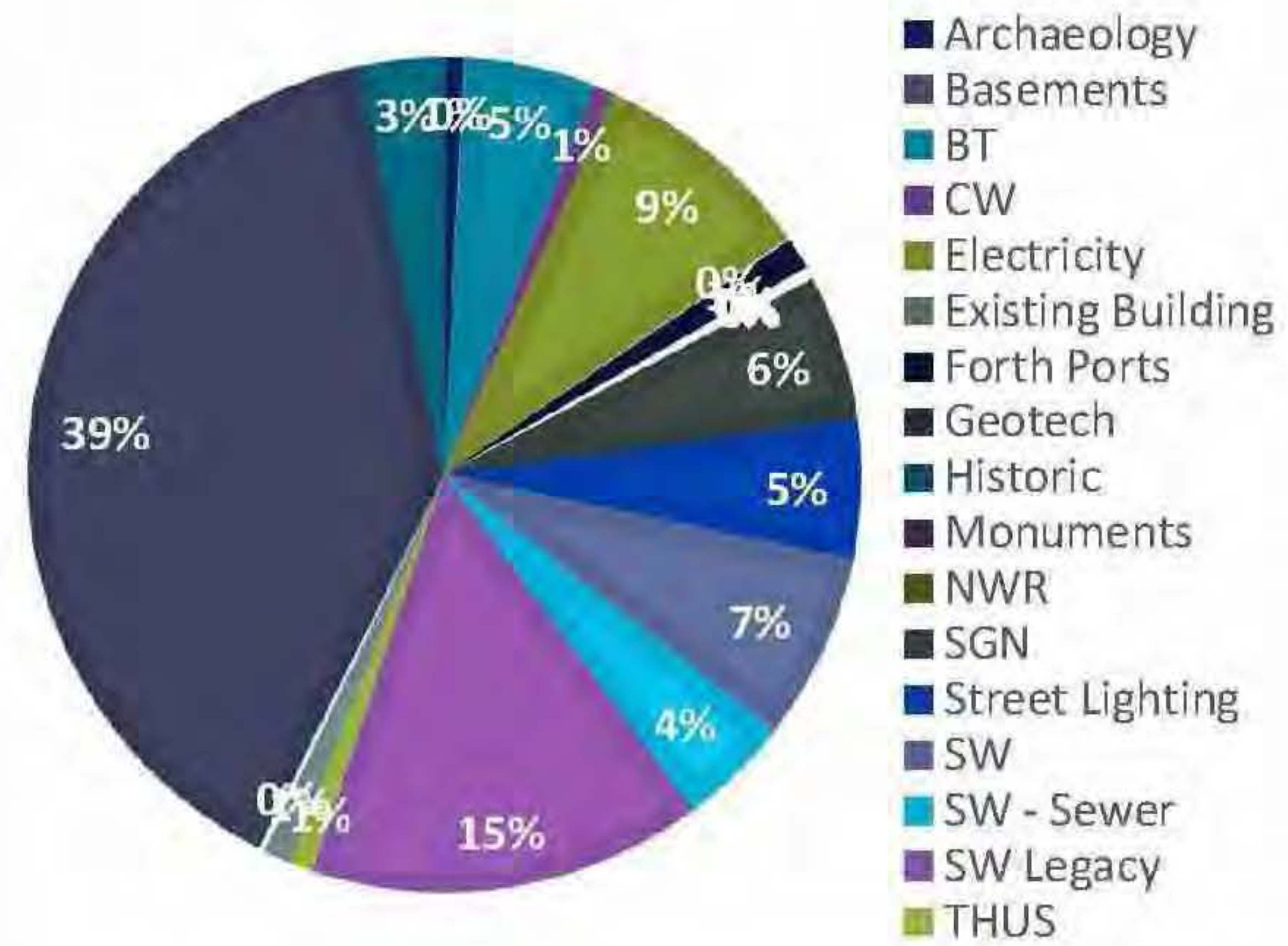
The conflict schedule has been developed through the use of existing CEC as built information (Carillion As Builts, Farrans As Builts, Clancy Docwra As Builts, L&M Surveys Information) along with meetings with key representatives from the utility companies, CEC Archaeology and CEC Transport to ensure a robust schedule is produced.

The conflict schedule identifies a total conflict resolution cost of £13.072M which will be included within the overall cost plan (note this excludes any utility company or others direct costs). Of this £5.5M is allocated to Scottish Water conflict issues including £2.9M of Legacy Works from previous contract works.

3.2.3.2 Conflicts

Based on the desktop exercise carried out, the following is a breakdown of the 1214 known conflicts by type/utility company:

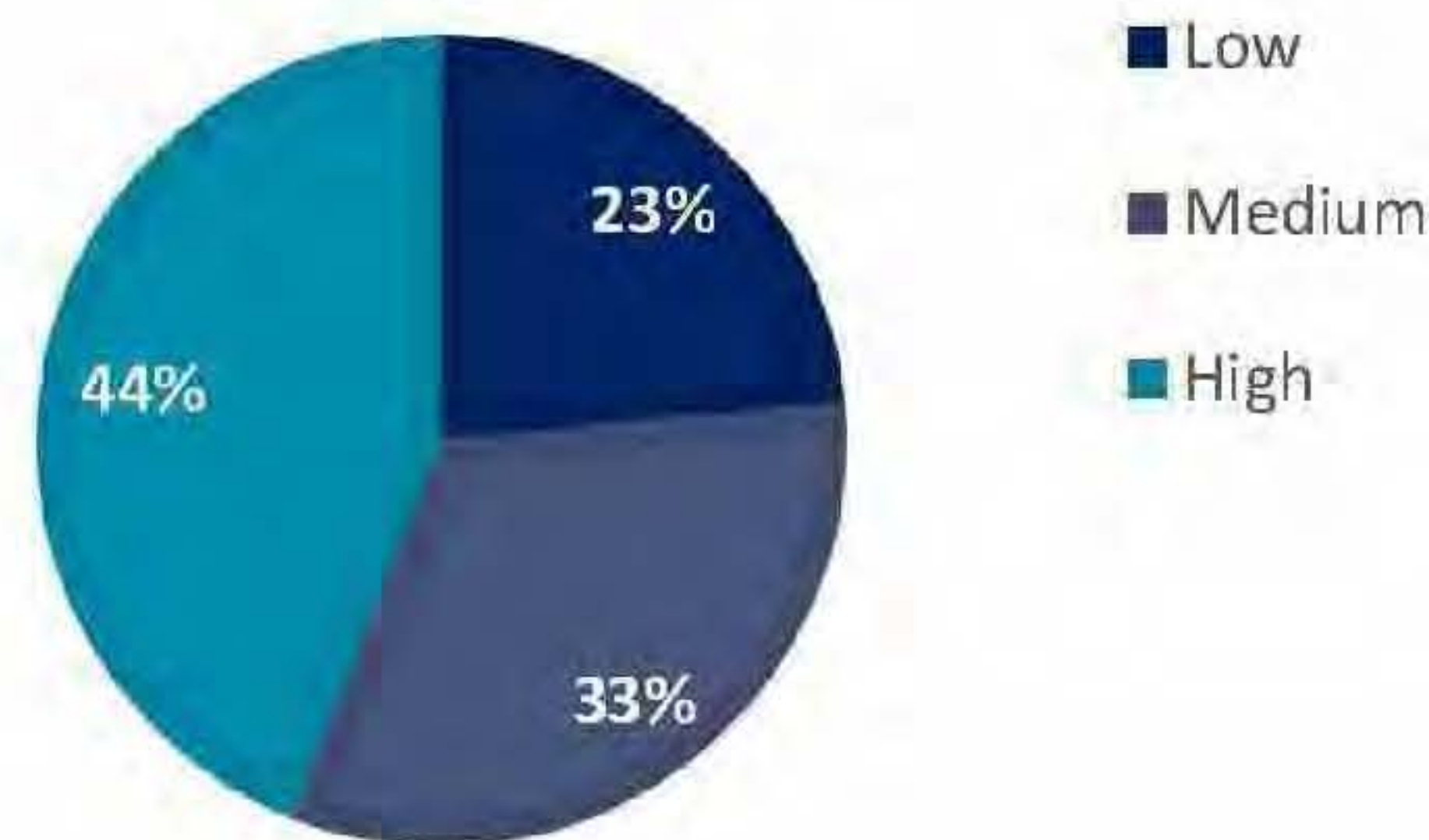
Type	Number
1 Archaeology	9
2 Basements	1
3 BT	61
4 CW	10
5 Electricity	106
6 Existing Building	1
7 Forth Ports	15
8 Geotech	1
9 Historic	1
10 Monuments	3
11 NWR	1
12 SGN	69
13 Street Lighting	65
14 SW	88
15 SW - Sewer	53
16 SW Legacy	185
17 THUS	11
18 Traffic Signals	13
19 Underground Structure	3
20 Unknown Utility	478
21 Virgin Media	40



Based on the above statistics, the following are deemed to be the 'top' conflict issues along the route:

Ref	Section	Specific Location	Utility/Type	Details	Likelihood	Comments	Cost Plan
1	YP to McDonald Road	Picardy Place Junction West (Cathedral Monoblock area)	SW	0.6m diameter water main with several service connections	Medium	Associated with level changes at Picardy Roundabout	£ 150,000
2	YP to McDonald Road	Picardy Place Junction North Side (Holiday Inn)	Electricity	SP Tunnel	High	Crossing of SP Tunnel under footprint of tramway. 1.6m cover to existing road levels	£ 50,000
3	YP to McDonald Road	Gayfield Square to Annandale Street	Electricity	SP Tunnel	High		£ 550,000
4	YP to McDonald Road	McDonald Road Tramstop/Terminus	SW Legacy	MUD 156 - Inadequate separation of watermain	High		£ 75,000
5	McDonald Road to FoW	Balfour Street Tramstop Area	Electricity	275kV Scottish Power cables at variable depths from 600mm both longitudinal and crossing	High	Requires alternative solution or diversion	£ 75,000
6	McDonald Road to FoW	McDonald Road to Shrub Place Lane	NWR	Network Rail - Leith Walk Railway Bridge	Medium		£ 125,000
7	FoW to OT	FoW to Baltic Street	SW - Sewer	Brick Arch sewer running along centre of Constitution Street is <1.2m below FRL	Medium		£ 275,000
8	FoW to OT	Laurie Street to Coatfield Lane	Historic	Historic Constitution Street Leith Parish Church Wall required to be carefully taken down restores and rebuilt to suit OLE foundations - Stability of wall is poor	High		£ 1,000,000
9	FoW to OT	FoW Tramstop	Basements	Basements between 161 Constitution St and 174 Constitution Street	High		£ 150,000
10	McDonald Road to FoW	FoW Junction	Archaeology	Leith Walk - Town Fortifications	High		£ 75,000
11	FoW to OT	FoW to Baltic Street	Archaeology	Leith Medieval Town Boundary Walls, Buildings & Roads	High		£ 1,010,000
12	McDonald Road to FoW	Jane Street Junction	SGN	500mm MP Gas Main (strategic to SGN) with maximum cover of 750mm due to existing culvert/sewer	High	SGN Meeting confirmed protection or diversion works required	£ 75,000
13	FoW to OT	Bernard Street/Baltic Street Junction	SGN	20"/24" gas main diversion/lowering to be carried out - crossing junction of bernard/baltic/constitution street	High	Incomplete Section of Utility Diversion Works at Bernard/Baltic Street	£ 75,000
14	FoW to OT	Bernard Street/Baltic Street Junction	SGN	9" Cast Iron/12.5mm PE gas main diversion/lowering to be carried out - crossing of junction bernard/baltic/constitution street	High	Incomplete Section of Utility Diversion Works at Bernard/Baltic Street	£ 75,000
15	FoW to OT	Baltic Street Junction	SW	12" CI Watermain crossing (Never diverted by MUDFA)	High		£ 30,000
16	FoW to OT	Baltic Street Junction	SW	6" CI Watermain crossing (Never diverted by MUDFA)	High		£ 30,000
17	FoW to OT	Baltic Street to Tower Place	SW	6" CI Watermain longitudinal (Never diverted by MUDFA)	High		£ 30,000
18	FoW to OT	Baltic Street to Tower Place	SW	4" CI Watermain longitudinal (Never diverted by MUDFA)	High		£ 30,000

The desktop assessment has also carried out an assessment on the likelihood of the conflict being an issue to the construction of the tram extension. This can be demonstrated in the visuals below:

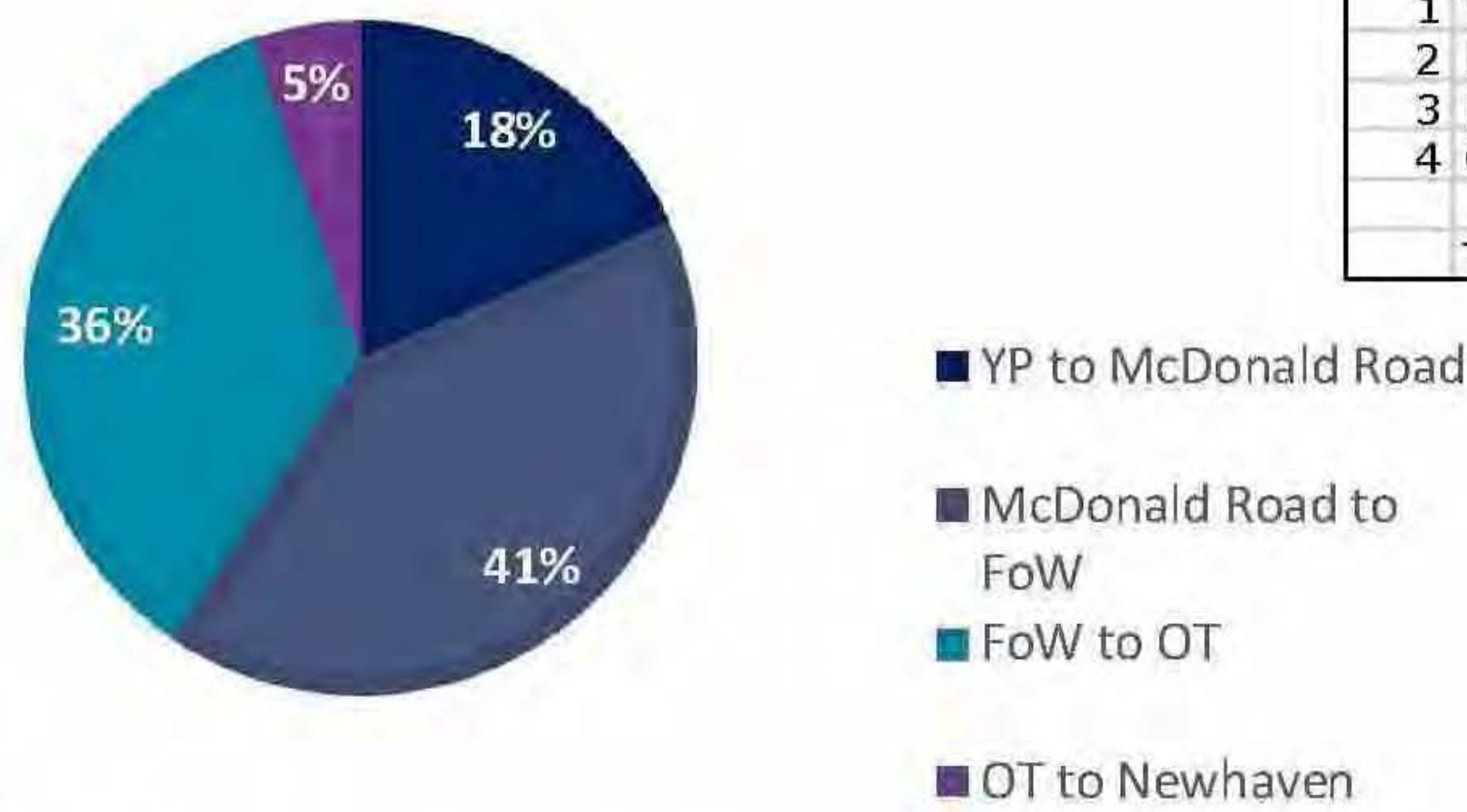


Likelihood	Number
1 Low	285
2 Medium	395
3 High	534

The overall conflict schedule has been divided into the following 4 potential sections of tram extension:

- York Place to McDonald Road
- McDonald Road to Foot of the Walk
- Foot of the Walk to Ocean terminal
- Ocean Terminal to Newhaven

The visuals below identify the geographical split of utility conflicts per section:



Section	Number
1 YP to McDonald Road	223
2 McDonald Road to FoW	499
3 FoW to OT	430
4 OT to Newhaven	62
Total	1214

3.2.3.3 Statutory Utility Companies

As discussed under 3.2.2 the proposal is to establish a utility team with each of the statutory companies recognising that each individual arrangement differs based on the scope and complexity of works required. The following section details the specific requirement for each individual organisation.

3.2.3.3.1 Scottish Water

Through discussion with Scottish Water during the business case production phase, it was agreed that the equivalent of 7nr Full Time Equivalents (FTE) would be required during the delivery phase. This level of resource is required to carry out the following duties:

- Construction Supervision

- Design Review & Authorisation
- Authority to Work (DOMS)
- Technical Query Review & Response
- Handovers
- Drainage Connection Reviews
- Health & Safety
- Project Management of SW resource etc.

Scottish Water has confirmed that a new standard specification was being prepared and would be applicable to the tram extension works and that this specified the requirement to carry out pre and post CCTV surveys of all sewer routes affected by the tram construction works. The cost of this survey work has been included in the capital cost plan.

3.2.3.3.2 Scottish Gas Networks

Following discussions with Scotia Gas Networks (SGN), a review of the diversions identified in the utility conflict schedule and the experience from the first phase it was agreed that 2nr FTE SGN design/supervisors would be required. This level of resource has been allowed for in the cost plan.

3.2.3.3.3 Scottish Power

Following discussions with Scottish Power (SP), a review of the diversions identified in the utility conflict schedule and the experience from the first phase, it was agreed that 2nr FTE SP supervisors would be required. This level of resource has been allowed for in the cost plan.

3.2.3.3.4 British Telecom

Following discussions with British Telecom (BT), a review of the diversions identified in the utility conflict schedule and the experience from the first phase, it was agreed that 2nr FTE supervisors would be required. This level of resource has been allowed for in the cost plan.

It should be noted that any diversionary works will require a level of direct input by BT particularly to carry out the cabling and jointing works. These works will in most cases require to be carried out ahead of the final decommissioning and removal of the existing apparatus and will therefore require BT to agree to the construction programme, and provision of resources required to carry out the works.

3.2.3.3.5 Virgin Media

Following discussions with Virgin Media (VM), a review of the diversions identified in the utility conflict schedule and the experience from the first phase, it was agreed that 2nr FTE supervisors would be required. This level of resource has been allowed for in the cost plan.

It should be noted that should any VM diversionary works will require a level of direct input by VM particularly to carry out cabling and jointing works. These works will in most cases require to be carried out ahead of the final decommissioning and removal of the existing apparatus in place and will therefore require VM to agree to the construction programme, and provision of resources required to carry out the works.

3.2.3.3.6 THUS & Other Comms

Smaller communications companies with minor diversion or protection works will be managed on a conflict by conflict basis with no requirement to provide a full time dedicated resource to the project.

It is proposed that initial contact is made with the companies to inform them of how the project plans to address any conflict issues, in relation to their apparatus.

3.2.4 Advanced Site Investigation

Following the desktop utility assessment the TWG agreed that an advanced site investigation contract should be carried out during the main works pre contract period to confirm the results of the utility conflict schedule.

3.2.4.1 Leith Programme Utility Information

Whilst considering the areas requiring further site investigation and to verify the results of the desktop utility conflict schedule the TWG reviewed information provided by the Leith Programme team. This information was gathered during the construction works and identified utility apparatus and its approximate location.

Based on the information provided by the Leith Programme we have assumed no further Site Investigation is required in these areas.



Further details of the Leith Walk Programme Site Investigation information can be found in Appendix C.

3.2.4.2 Advanced Site Investigation Package

An assessment, based on the outputs of the desktop exercise has identified the following key areas that should be investigated further through site investigation in the pre-contract stage of the project:

- Location 1 – Picardy Place in front of Cathedral
- Location 2 – Picardy Place at Crossing of Scottish Power Tunnel
- Location 3 – London Road Junction
- Location 4 – Elm Row at Scottish Power Tunnel
- Location 5 – Leith Walk Railway Bridge
- Location 6 – Balfour Street Tramstop (275Kv)

- Location 7 – Jane Street Junction
- Location 8 – Foot of the Walk Tramstop area
- Location 9 – Queen Charlotte Street Junction
- Location 10 – Bernard Street/Baltic Street Junction
- Location 11 – Lindsay Road Sewer

The above areas can be identified on a plan identified in Appendix C.

3.3 City Heritage

3.3.1 Overview

As part of the construction works associated with the extension of the tram to Newhaven, there are a number of heritage items that need to be considered when developing the CDP. These are as follows:

- Archaeological Areas of Interest
- Listed Buildings
- Ancient Monument relocation

Each of the above has been considered within the development of the CDP and further specific details are found below.

3.3.2 Archaeological Works

Members of the TWG met with John Lawson, the city archaeologist who explained what the requirements were with respect to dealing with an archaeological find along the tram extension route. As with the Traffic Management, how Archaeology will be dealt with as part of the project varies, dependent upon section. The differing sections of Archaeological Investigation works are as follows:

- York Place to Foot of the Walk
- Constitution Street from Foot of the Walk to Constitution Place
- Forth Ports Area

Based on the above sections further detail for each can be found below:

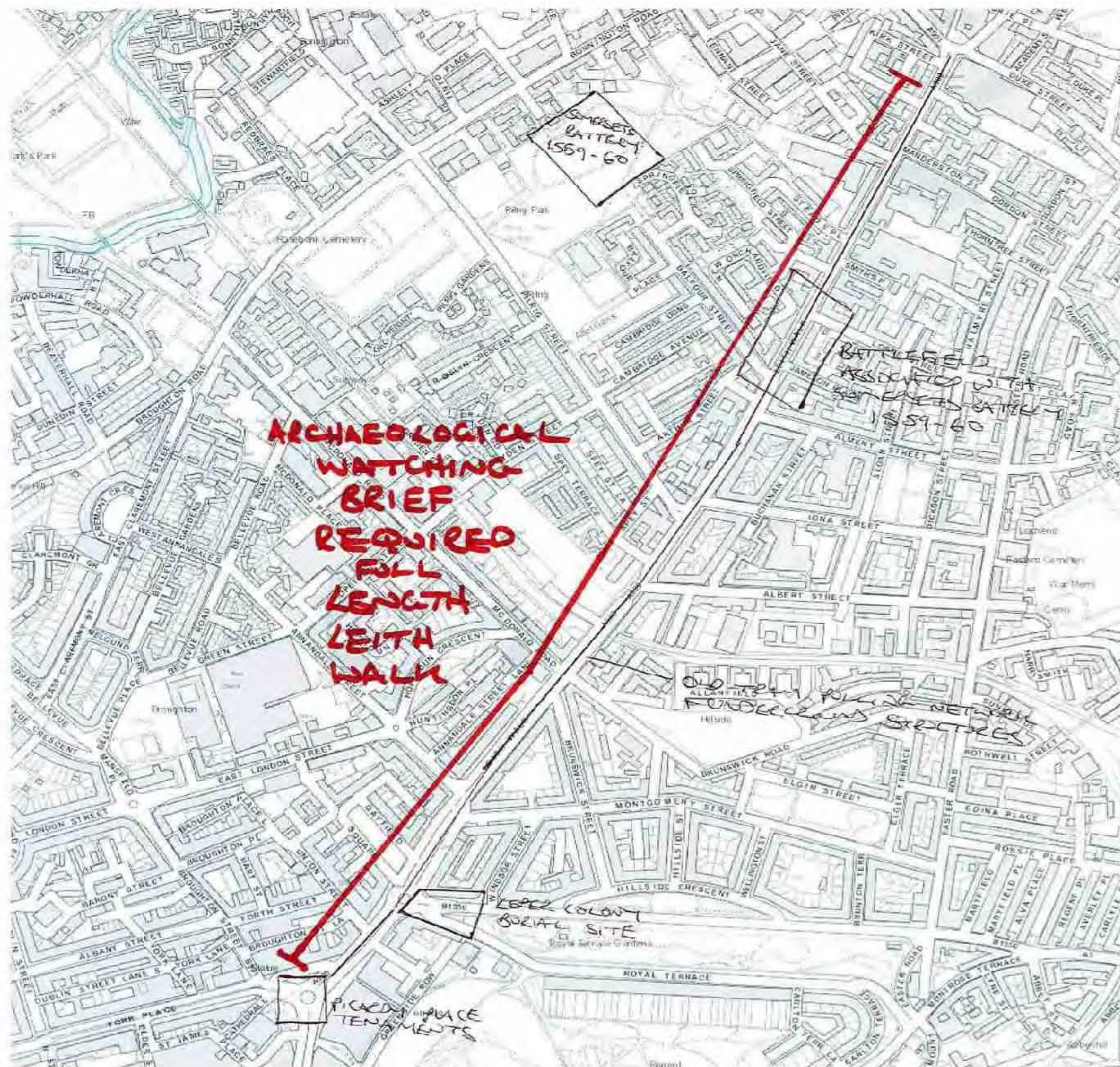
3.3.2.1 York Place to Foot of the Walk

This section of the route has varying areas of archaeological interest, however based on previous works it is believed that the approach taken in this section of the route is to ensure an Archaeological watching brief is available during the main excavation works to record any features of archaeological interest should they arise.

It is assumed that the following are likely items of archaeological interest within this section:

- Tram winding tunnels and shafts along full length
- Picardy Place tenements
- Pilrig Street to Jane Street potential trenches from around 1559/60 associated with the Somerset's Battery
- London Road burial site (likely to be out with tram path)
- 16th & 17th century town defences and medieval entrance to Leith. (Foot of the Walk)

These can be seen on the following plan



3.3.2.2 Constitution Street from Foot of the Walk to Constitution Place

This section of the route has a significant level of archaeological interest and will require some programme allowance for dealing with archaeological issues.

On this basis an archaeological excavation period has been allowed within the construction programme for any investigation works to take place. The allowances made for archaeological investigation works can be identified in table 2 below:

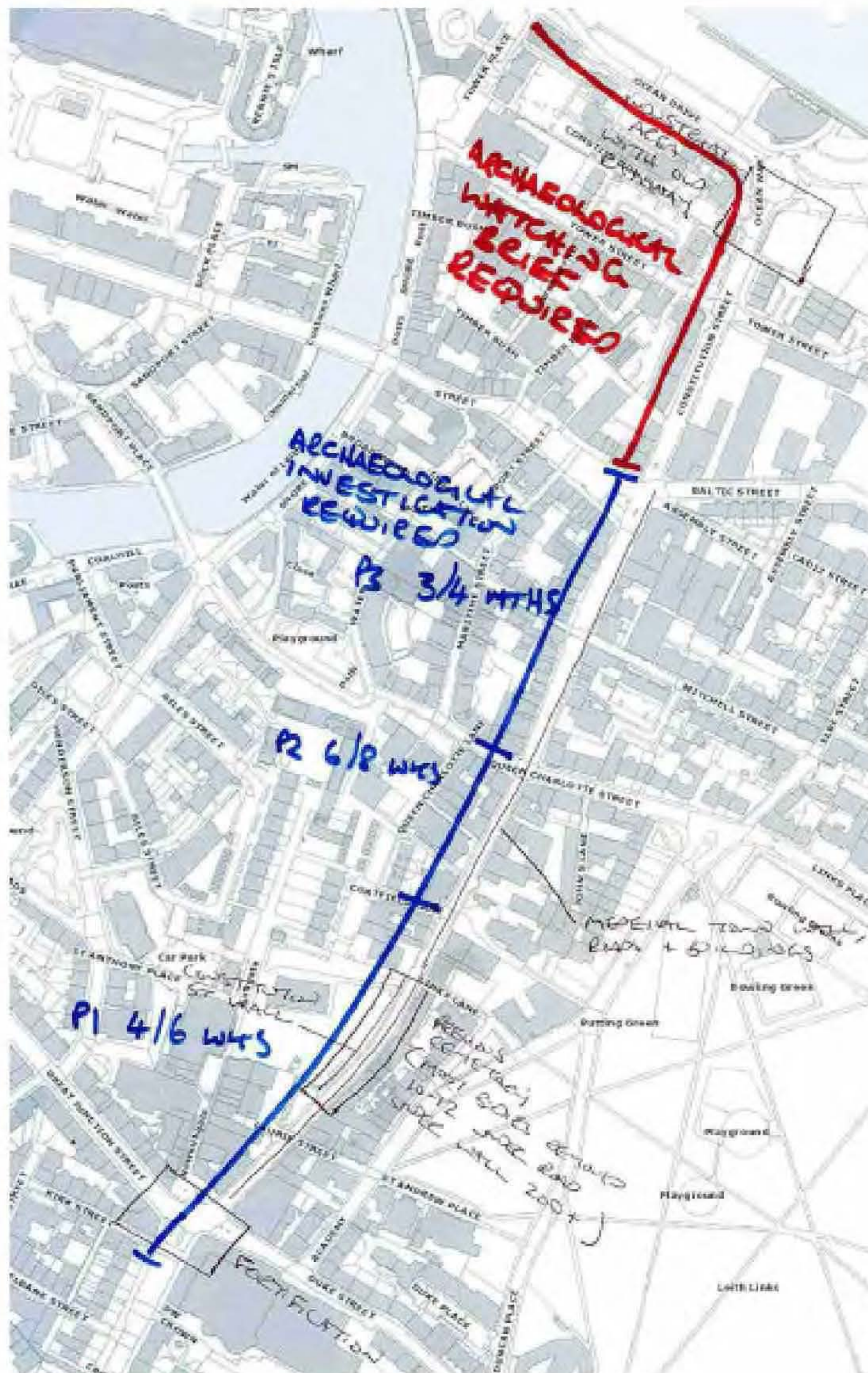
Ref	TM Section	Archaeological Duration
1	Foot of the Walk to Coatfield Lane	3 weeks
2	Coatfield Lane to Queen Charlotte Street	4 weeks
3	Queen Charlotte Street to Baltic Street	8 weeks
4	Baltic Street to Constitution Place	2 weeks

Table 2: Expected archaeological durations

It is assumed that the following are likely items of archaeological interest within this section:

- 16th/17th Century Town Defences
- Constitution Street Wall and 14th-18th Century Graveyard
- Urban Medieval Town – 12th -19th Century
- Maritime deposits and remains on foreshore

These are shown on the following plan:



3.3.2.3 Forth Ports Area

This section of the route has varying sections of archaeological interest, predominantly around the old Leith Docks area, however based on previous works in the area it is believed that the approach taken in this section of the route is to ensure an Archaeological watching brief is available during the main excavation works to record any features of archaeological interest

should they arise. No allowance has been made in the construction programme for investigation works in this section of the works.

It is assumed that the following are likely items of archaeological interest within this section:

- 19th/20th Century Dock Infrastructure, Quays, Shipyard and associated buildings
- Made ground at Ocean Way
- Old Railway Lines/Tramway
- 1817 docks at the roundabout junction to Victoria Quay / Ocean Terminal

These can be shown on the following plan:



3.3.3 Listed Buildings

Throughout the route there are a number of listed buildings and structures and have been considered as part of the CDP. These have been categorised as follows:

- Improvement Works Required
- Protection Works Required
- No Works Required

Schedule 1 below provides a details of the listed building and structures which have had to be considered as part of this review:

Building/Structure Reference	Location	Category
4 BROUGHTON STREET, ST JAMES PLACE AND CHAPEL LANE, ST MARY'S (ROMAN CATHOLIC) CATHEDRAL, WITH ST ANDREW'S HALL, TERRACE, STEPS AND RAILINGS	York Place to McDonald Road	Protection Works Required
PICARDY PLACE 2-22 (EVEN NOS) AND 16,17 UNION PLACE AND 19, 19A BROUGHTON STREET WITH MEWS TO BROUGHTON STREET LANE	York Place to McDonald Road	No Works
20-25 (INCLUSIVE NOS) UNION PLACE AND 2 UNION STREET	York Place to McDonald Road	No Works
18 AND 19 UNION PLACE	York Place to McDonald Road	No Works
63-67 (ODD NOS) YORK PLACE, INCLUDING RAILINGS	York Place to McDonald Road	No Works
GREENSIDE PLACE, LADY GLENORCHY'S CHURCH	York Place to McDonald Road	No Works
18-22 (EVEN NOS) GREENSIDE PLACE, THE PLAYHOUSE THEATRE	York Place to McDonald Road	No Works
23-27 (INCLUSIVE NOS) GREENSIDE PLACE	York Place to McDonald Road	No Works
1-8 (INCLUSIVE NOS) BAXTER'S PLACE INCLUDING RAILINGS	York Place to McDonald Road	No Works
1-5 (INCLUSIVE NOS) BLENHEIM PLACE INCLUDING RAILINGS	York Place to McDonald Road	No Works
1-6 (INCLUSIVE NOS) ANTIGUA STREET AND 1-3 (ODD NUMBERS) UNION STREET INCLUDING RAILINGS AND GARDEN WALL	York Place to McDonald Road	No Works
7-10 (INCLUSIVE NOS) ANTIGUA STREET	York Place to McDonald Road	No Works
1-23 (INCLUSIVE NOS) ELM ROW AND 2 MONTGOMERY STREET	York Place to McDonald Road	No Works
1-5 (INCLUSIVE NOS) GAYFIELD PLACE AND 33-33A GAYFIELD SQUARE INCLUDING RAILINGS	York Place to McDonald Road	No Works

Building/Structure Reference	Location	Category
1-8 (INCLUSIVE NOS) HADDINGTON PLACE INCLUDING RAILINGS	York Place to McDonald Road	No Works
25-29 (INCLUSIVE NOS) ELM ROW AND 1-5 (ODD NOS) MONTGOMERY STREET	York Place to McDonald Road	No Works
40-44 (INCLUSIVE NOS) ELM ROW, GATEWAY THEATRE	York Place to McDonald Road	No Works
17A-27A (INCLUSIVE NOS) HADDINGTON PLACE WITH 26 AND 28 ANNANDALE STREET LANE	York Place to McDonald Road	No Works
28-32A (INCLUSIVE NOS) HADDINGTON PLACE WITH 30 AND 32 ANNANDALE STREET LANE	York Place to McDonald Road	No Works
2 MCDONALD ROAD LIBRARY INCLUDING NELSON HALL	York Place to McDonald Road	No Works
372-376 (EVEN NOS) LEITH WALK (FORMERLY 1-3 GEORGE PLACE), INCLUDING BOUNDARY WALLS	McDonald Road to Foot of the Walk	No Works
LEITH WALK AND PILRIG STREET, PILRIG DALMENY CHURCH AND HALLS (C OF S)	McDonald Road to Foot of the Walk	No Works
1 PILRIG PLACE AND 2-6 (EVEN NOS) PILRIG STREET	McDonald Road to Foot of the Walk	No Works
334, 336C-340 AND 346A LEITH WALK WITH RAILINGS AND LAMP STANDARDS	McDonald Road to Foot of the Walk	No Works
328 LEITH WALK	McDonald Road to Foot of the Walk	No Works
324 AND 326 LEITH WALK WITH BOUNDARY WALL	McDonald Road to Foot of the Walk	No Works
318, 320 AND 322 LEITH WALK WITH BOUNDARY WALL	McDonald Road to Foot of the Walk	No Works
314 AND 316 LEITH WALK	McDonald Road to Foot of the Walk	No Works

Building/Structure Reference	Location	Category
308 AND 312 LEITH WALK	McDonald Road to Foot of the Walk	No Works
306 LEITH WALK WITH BOUNDARY WALL	McDonald Road to Foot of the Walk	No Works
302 LEITH WALK	McDonald Road to Foot of the Walk	No Works
296 LEITH WALK	McDonald Road to Foot of the Walk	No Works
280-284 (EVEN NOS) LEITH WALK	McDonald Road to Foot of the Walk	No Works
276, 278 LEITH WALK AND 1, 3 BALFOUR STREET	McDonald Road to Foot of the Walk	No Works
244-252 (EVEN NOS) LEITH WALK	McDonald Road to Foot of the Walk	No Works
234-242 (EVEN NOS) LEITH WALK, FORMER VICTORIA INDIA RUBBER MILLS BUILDINGS	McDonald Road to Foot of the Walk	No Works
214 LEITH WALK WITH RAILINGS	McDonald Road to Foot of the Walk	No Works
185-193 (ODD NOS) LEITH WALK	McDonald Road to Foot of the Walk	No Works
169-177 (ODD NOS) LEITH WALK AND 1 SMITH'S PLACE	McDonald Road to Foot of the Walk	No Works
172 LEITH WALK, CRAIG AND ROSE PLC	McDonald Road to Foot of the Walk	No Works
165 LEITH WALK, COMMUNITY CENTRE	McDonald Road to Foot of the Walk	No Works
80-90 (EVEN NOS) LEITH WALK	McDonald Road to Foot of the Walk	No Works
68-76 (EVEN NOS) LEITH WALK	McDonald Road to Foot of the Walk	No Works
55-59 LEITH WALK, TSB AND 61 LEITH WALK AND CROWN STREET, BANK OF SCOTLAND	McDonald Road to Foot of the Walk	No Works

Building/Structure Reference	Location	Category
60 AND 62 LEITH WALK WITH BOUNDARY WALLS, LAMP STANDARDS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
52 LEITH WALK WITH BOUNDARY WALLS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
42 LEITH WALK WITH BOUNDARY WALLS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
34, 36 AND 38 LEITH WALK WITH BOUNDARY WALLS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
26 LEITH WALK WITH BOUNDARY WALLS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
20 AND 22 LEITH WALK AND 3 CASSEL'S LANE WITH BOUNDARY WALLS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
12 LEITH WALK 3 AND 5 KIRK STREET AND 1 CASSEL'S LANE WITH BOUNDARY WALLS AND RAILINGS	McDonald Road to Foot of the Walk	No Works
1-5 (ODD NOS) GREAT JUNCTION STREET, 2 AND 4 LEITH WALK AND 2, 4 KIRK STREET	McDonald Road to Foot of the Walk	No Works
7-23 (ODD NOS) LEITH WALK AND 2 - 22 (EVEN NOS) DUKE STREET, FORMER LEITH CENTRAL STATION OFFICES, INCLUDING CENTRAL AND NORTHERN BARS	McDonald Road to Foot of the Walk	No Works
173 AND 177-181 CONSTITUTION STREET AND 7, 7B, 9, 9A, 11 AND 13 DUKE STREET, FORMER PALACE CINEMA	Foot of the Walk to Ocean Terminal	No Works
170-174 (EVEN NOS) CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
161 AND 163 CONSTITUTION STREET AND 22 LAURIE STREET	Foot of the Walk to Ocean Terminal	No Works
159 CONSTITUTION STREET AND 23 LAURIE STREET	Foot of the Walk to Ocean Terminal	No Works
149, 149A CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works

Building/Structure Reference	Location	Category
141-147 (ODD NOS) CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
137 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
1 AND 2 KIRKGATE, ST MARY'S (SOUTH LEITH PARISH) CHURCH (C OF S) WITH GRAVEYARD, WALLS, GATES AND RAILINGS	Foot of the Walk to Ocean Terminal	Improvement Works Required
134-138 (EVEN NOS) CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
132 CONSTITUTION STREET WITH BOUNDARY WALLS AND RAILINGS	Foot of the Walk to Ocean Terminal	No Works
121-125 (ODD NOS) CONSTITUTION STREET AND WAREHOUSE	Foot of the Walk to Ocean Terminal	No Works
101-109 (ODD NOS) CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
106 CONSTITUTION STREET, ST MARY STAR OF THE SEA (RC) CHURCH WITH BOUNDARY WALLS, GATEPIERS AND GATES	Foot of the Walk to Ocean Terminal	No Works
96 -104 (EVEN NOS) CONSTITUTION STREET AND 3, 3A QUEEN CHARLOTTE LANE	Foot of the Walk to Ocean Terminal	No Works
28-42 (EVEN NOS) QUEEN CHARLOTTE STREET AND 94 CONSTITUTION STREET AND 1 QUEEN CHARLOTTE LANE	Foot of the Walk to Ocean Terminal	No Works
91 AND 93 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
44 QUEEN CHARLOTTE STREET	Foot of the Walk to Ocean Terminal	No Works
92 CONSTITUTION STREET AND 27 QUEEN CHARLOTTE STREET	Foot of the Walk to Ocean Terminal	No Works
29-41 (ODD NOS) QUEEN CHARLOTTE STREET, LEITH	Foot of the Walk to Ocean Terminal	No Works

Building/Structure Reference	Location	Category
POLICE STATION, FORMER TOWN HALL AND RAILINGS		
84 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
78 AND 80 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
74 AND 76 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
69 AND 71 CONSTITUTION STREET, FORMER ST JOHN'S EAST CHURCH (C OF S)	Foot of the Walk to Ocean Terminal	No Works
59-65 (ODD NOS) CONSTITUTION STREET WITH RAILINGS	Foot of the Walk to Ocean Terminal	No Works
57/57B CONSTITUTION STREET AND 49 AND 51/1 AND 2 MITCHELL STREET, FORMER LEITH POST OFFICE	Foot of the Walk to Ocean Terminal	No Works
68 CONSTITUTION STREET WITH GATEPIERS AND RAILINGS	Foot of the Walk to Ocean Terminal	No Works
60 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
55 CONSTITUTION STREET WITH BOUNDARY WALLS AND RAILINGS	Foot of the Walk to Ocean Terminal	No Works
45-53 (ODD NOS) CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
44, 44A, 46 AND 46A CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
37-43 (ODD NOS) CONSTITUTION STREET AND 49 ASSEMBLY STREET, EXCHANGE BUILDINGS	Foot of the Walk to Ocean Terminal	No Works
36-42 (EVEN NOS) CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
1-13 (ODD NOS) BERNARD STREET, 30-34 (EVEN NOS) CONSTITUTION STREET, WATERLOO BUILDINGS	Foot of the Walk to Ocean Terminal	No Works

Building/Structure Reference	Location	Category
2 BERNARD STREET AND 28 CONSTITUTION STREET	Foot of the Walk to Ocean Terminal	No Works
29-31A (ODD NOS) AND 35 CONSTITUTION STREET AND 9 BALTIC STREET, FORMER CORN EXCHANGE	Foot of the Walk to Ocean Terminal	No Works
LEITH DOCKS, TOWER PLACE, HARBOUR AND DOCK OFFICES	Foot of the Walk to Ocean Terminal	No Works
LEITH DOCKS, ALEXANDRA DRY DOCK	Foot of the Walk to Ocean Terminal	No Works
VICTORIA SWING BRIDGE, LEITH DOCKS	Foot of the Walk to Ocean Terminal	Protection Works
LEITH DOCKS, ALEXANDRA DRY DOCK HYDRAULIC STATION	Foot of the Walk to Ocean Terminal	No Works
LEITH DOCKS, VICTORIA DOCK AND LOCK GATES	Foot of the Walk to Ocean Terminal	No Works
LEITH DOCKS, PAINT SHED AT SHIPBUILDING YARD	Foot of the Walk to Ocean Terminal	No Works

Schedule 1: Listed structures along the route

3.3.4 Ancient Monuments

Throughout the route between York Place and Newhaven there are a number of Ancient Monuments within public realm spaces which conflict with the tram construction path. Each of these monuments will be dealt with on an individual basis and have been assessed in relation to their current location, condition and revised road alignments to develop how each of these monuments will be dealt with by the project. Table 3 below details each of the monuments considered along the route and how they should be dealt with:

Ref	Description	Location	Assessment
1	Paolozzi Monuments	Picardy Place	Permanent Relocation Required
2	Sherlock Holmes Monument	Picardy Place	Permanent Relocation Required
3	Queen Victoria Statue	Foot of The Walk	Protection Measures
4	Robert Burns Statue	Bernard Street	Permanent Relocation Required

Table 3: Monuments along the route and their treatment

3.3.5 City Heritage Advanced Works

Through discussion with various parties with an interest in the city heritage during the construction works phase it has become evident that an element advanced works is required. These are detailed below:

3.3.5.1 Constitution Street Wall Stabilisation Works

The stabilisation of the Constitution Street church wall has been identified as a significant element of work with the potential to impact on the construction programme should this be carried out as part of the main works packages.

The following scope of works, to stabilise the wall, has been assumed for an advanced works contract:

- Advanced Consultation with church & family members affected by works
- Careful dismantling, removal and labelling of existing wall parts
- Removal/Archaeological dig of around 200nr bodies under wall
- Construction of foundations as shown on attached drawing
- Restoration of wall
- Reinstatement of wall

These works are assumed to take place in the pre-contract stages of the project programme.

3.3.5.2 Advanced Archaeological Site Investigation

Through discussions with the City Archaeologist it has become evident that there are a number of areas of particular archaeological interest that may affect the tram extension construction works and that these should be understood in more detail through advanced archaeological site investigation works, carried out in conjunction with the advanced utility site investigation works.

The following locations have been identified as areas requiring advanced site investigation during the pre-contract period:

- Location 12 – 1817 Dock structure at Ocean Terminal
- Location 13 – Queen Charlotte Street to Baltic Street Archaeological Findings

A location Plan showing these sites can be found in Appendix C.

It should also be noted that during the development of this business case and specifically the review of the archaeological requirements, discussions have been ongoing with the Leith Programme team to establish the level of archaeological findings during the construction phase. A report identifying the findings can be found in Appendix C.

3.4 Civil works

The items of work included in the civil work scope is as follows:

- Excavations to formation
- Drainage (track and road)
- Ducting for the tramway control network, the traction power and junction modification
- OLE pole foundation excavation
- Backfilling with type 1 – Discussed under trackwork construction

- Provision of the reinforced concrete slab beneath the track slab - Discussed under trackwork construction
- Road reconstruction both between the rails and adjacent to the tramway - Discussed under trackwork construction
- Junction, road and kerb realignment works

3.4.1 Excavation to Formation

Once the traffic management has been installed, the tram corridor will be excavated taking into account the existence of live utilities.

Over the entire route there is approximately 30,000m³ of material to be excavated. There is a requirement to import a small quantity of material to elevate the tramway from Leith Sands up to Lindsay Road, as it is anticipated the site won material will not be of the required quality. As a result the site won material will be excavated and removed straight from site to tip.

3.4.2 Drainage

3.4.2.1 Drainage – Track:

The drainage required to drain the track is essentially an extension of the existing road drainage system. It is anticipated the drainage along Leith Walk and Constitution Street will be designed to tie in to the existing CEC road drainage system via gully connections wherever possible. Where manholes are required to the Scottish Water system, they will be constructed to the required standards.

Through the Forth Ports land the drainage installed will be to an adoptable standard.

The track groove will use the same drainage system and is as shown in figure 3. The track drainage boxes are installed and connected to the drainage pipe that typically comes up through a cut out in the track slab and track improvement layer. The track drainage boxes are installed before the track slab and concrete shoulders are constructed.

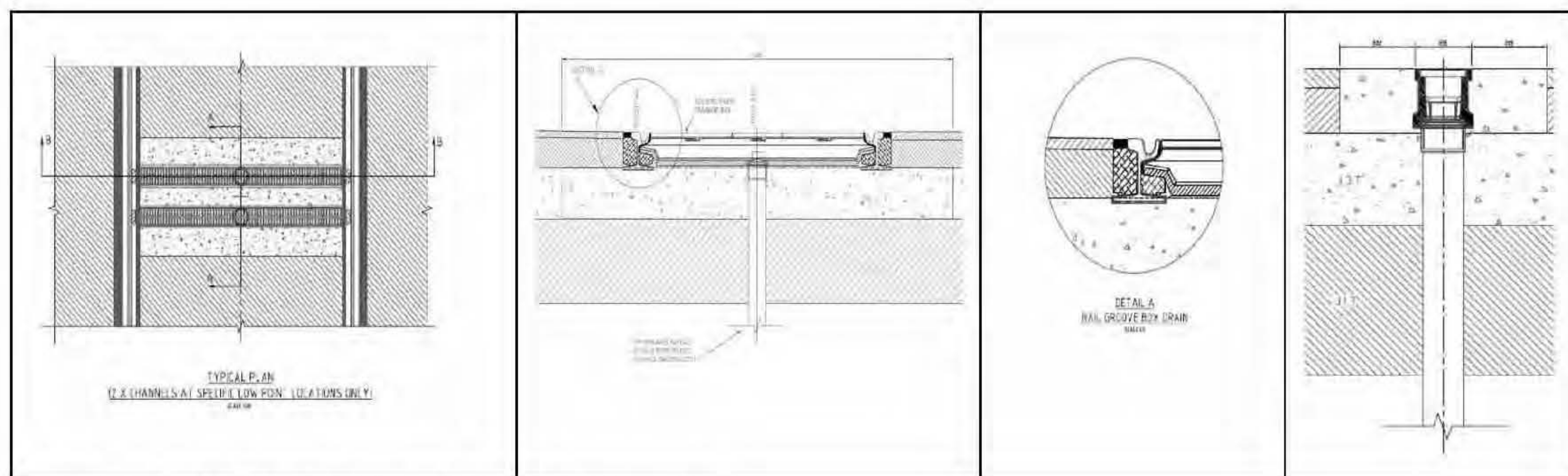


Figure 3: Typical track groove drainage arrangement

3.4.2.2 Drainage – Ancillary Roads:

As there is a requirement to modify a number of road junctions to accommodate the tramway there will be the need to amend some of the existing road drainage. This will be done during the actual junction upgrade works and is not expected to be significant in regards to work scope.

3.4.3 Ducting for the tramway control network, the traction power and junction modification

As shown in figure 2 above a network of ducting is required running parallel to the tramway alignment. Typically the ducting follows the general layout noted in table 4

Location	Quantity	Supplying	Diameter
Parallel to Outbound	6 way	Traction power	300mm
		Signalling	150mm
		Telecom	150mm
		LVD	150mm
		Control	150mm
		Spare	150mm
Parallel to Inbound	4 way	Signalling	150mm
		Telecom	150mm
		LVD	150mm
		Spare	150mm
Cross track – Traffic/Tram signalling – Intervals to suit	4 way	Signalling	150mm
		Telecom	150mm
		LVD	150mm
		Spare	150mm
Cross track – Traction feeder cables – At all feeder poles	Single	Traction power	300mm
IMU Antenna – Intervals to suit	Single	TPDS	50mm
Stops	100mm ducting routed to supply power and comms connections to the Stop equipment		
Dalmeny Street to Arthur Street		Future proofing for the replacement of the 275KV crossing	TBC following agreement with SP


Location	Quantity	Supplying	Diameter
			
Power supply into/out of new substations	9 way and a 6 Way	HV and LV power supply Telecoms	All 150mm

Table 4: Overview of ducting required

The ducting and associated chambers along the main alignment will be installed when formation has been reached.

The tramway, in general, is being positioned down the centre of the existing carriageways. This limits the amount of impact on the existing road network however in certain areas the exiting junctions, carriageways including kerb lines will be require alteration to accommodate the alignment. These areas are as follows:

- The current Picardy Place junction will be upgraded to both accommodate the tram and to provide a potential development site in the centre of the junction.
- London Road/Leith Walk road junction will require upgrading from that proposed to be installed under the Leith Walk Project as this does not accommodate the tram alignment.
- Bernard Street is upgraded to create a public realm area.
- The Foot of the Walk/Duke Street junction will require upgrading from that being installed under the Leith Walk Project as this does not accommodate the tram alignment.
- Minor kerb realignment along the length of Leith Walk will be required.
- Minor kerb realignment along Constitution Street will be required.
- The roundabouts in the Forth Ports area will all be changed to signalised junctions.
- Lindsay Road will be lowered and realigned so the tram alignment can be accommodated on the north side.
- Minor kerb line realignment of Ocean Drive.
- General minor realignment all other junctions to provide for the required signalisation and maintain road safety.

The kerb realignments will be completed using the main traffic management phasing and will on the whole only require the removal of a strip of footway which will be reinstated using existing or matching materials.

Some of the areas are however remote to the tram alignment resulting in separate individual traffic management schemes, to complete the works. These works will be planned in such away so that access is maintained to side roads and properties.

3.5 Works to existing structures:

Due to nature of the alignment there is minimal structural works required. The structures affected are:

- the Scottish Power tunnel which runs from Picardy Place to McDonald Road
- the existing Network Rail Leith Walk rail overbridge at Shrub Place
- the South Leith Parish Church boundary wall with Constitution Street.
- the existing Tower Place bridge
- the existing Victoria Dock bridge
- the existing Lindsay Road Retaining wall

3.5.1 Scottish Power tunnel:

The tunnel runs from Picardy Place to McDonald Road and its condition is described in the survey attached in Appendix C. The exact depth of the tunnel is unknown as previous works did not uncover it. This has led to the assumption there is sufficient depth to allow the track slab to cross. See figure 4 below:

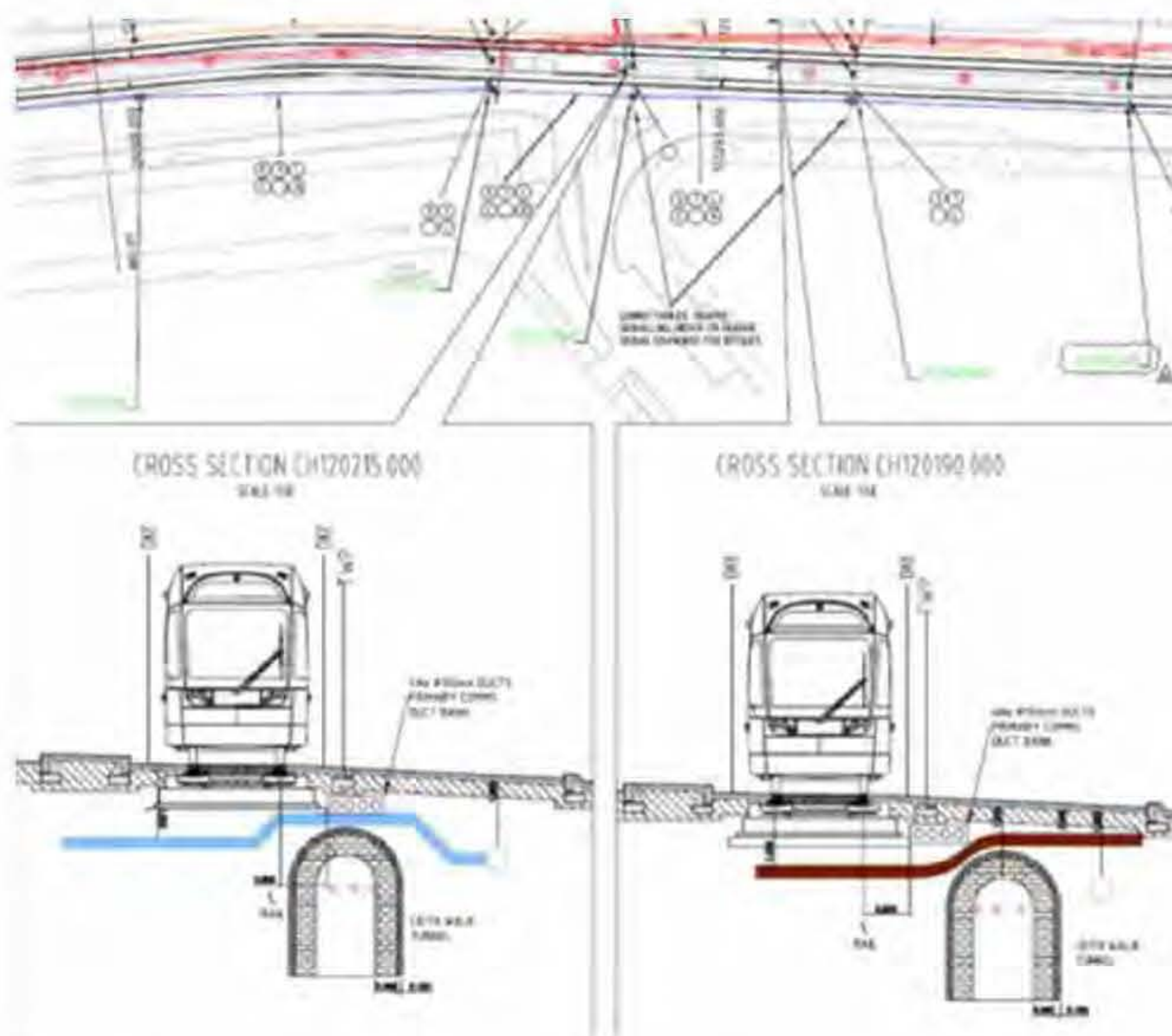


Figure 4: Interface with Scottish Power tunnel

It is recommended that trial holes be dug at discrete locations along the length of the tunnel to determine its actual depth to inform the track slab design prior to any works commencing on site. It is anticipated that reduced depth trackform may be required in some areas. The generic designs used in Phase 1a would need to be adapted if possible for these locations.

3.5.2 Leith Walk rail overbridge:

The rail overbridge is located as indicated on the plan below, figure 5

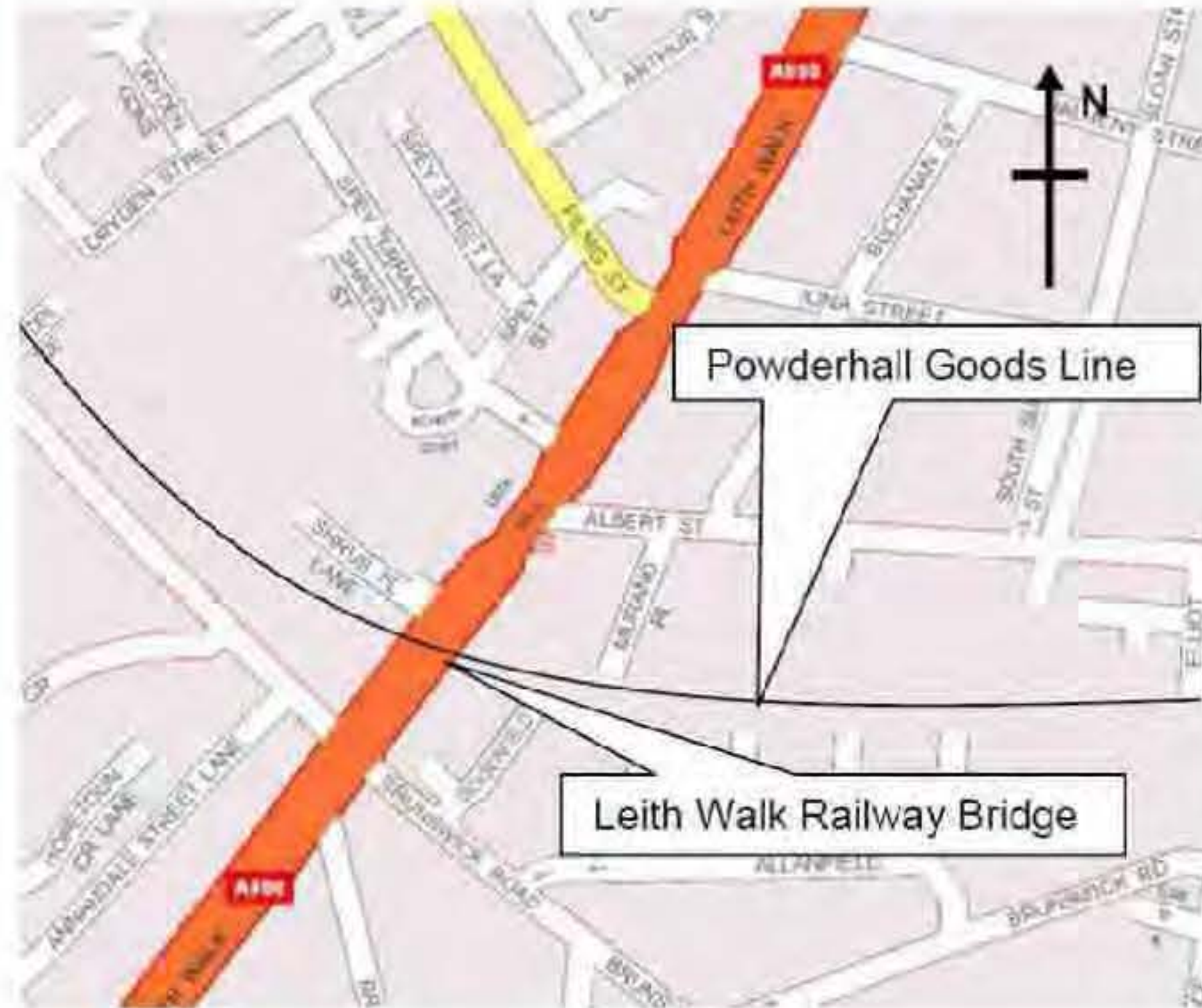


Figure 5: Location of the Leith Walk rail overbridge

Previously the bridge has been surveyed to determine its adequacy to carry the tramway. It was found that no substantial works are required to the substructure of the bridge. Further to this, approval in principle (AIP) documentation has been issued to CEC for approval. It is anticipated that as the AIP submission was at such a stage only minor design work is required to finalise the document. It is assumed the fill over the bridge will be removed and the top of the structure exposed for the width of track alignment. The structure will then be backfilled, and the ducting installed, surrounded by suitable material. A waterproofing membrane will be provided and then the trackslab constructed.

As this structure belongs to Network Rail their agreement will be required prior to commencing the works. This is as described within the Asset Protection Agreement (APA) signed between CEC and Network Rail as part of the initial Tram Project.

3.5.3 South Leith Parish Church boundary wall with Constitution Street

The existing wall running along Constitution Street which forms the boundary with South Leith Parish Church is a listed structure dating back to approximately 1800.

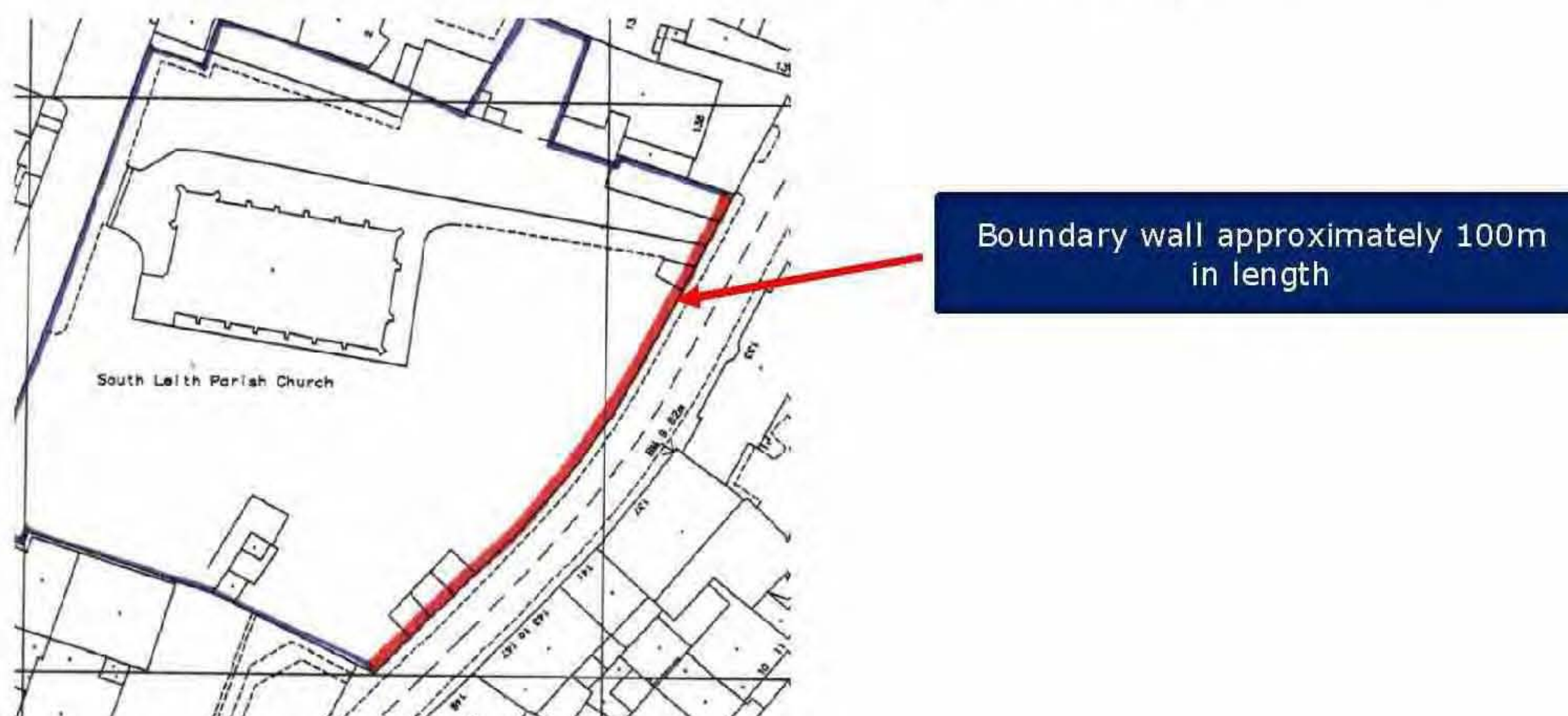


Figure 6: Location of South Leith parish Church boundary wall

During the development of this area of the city the wall has been built on an old burial ground, on top of the bodies buried below it and without an appropriate foundation. Previously in this

area a large number of skeletons were discovered, that required careful removal. The same is expected in this location.

There is a requirement to excavate within 1.0m of the wall when constructing the track slab and the OLE poles and foundations. It is believed the wall is not sufficiently stable, due to the lack of foundation support to withstand these works.

In addition the tram project requires OLE poles at approximately 20m centres a number of which will be adjacent to the wall, requiring a foundation to a minimum depth of 2.0m. There is no reasonable design solution available which allows for the removal or relocation of these poles. The installation of the OLE pole foundations will substantially impact the wall.

Temporary works could be implemented to support the wall; however, this would be more disruptive, costly and would require land out with the Limits of Deviation (LOD). It is anticipated the works to the boundary wall will be undertaken in advance of the main works to minimise disruption.

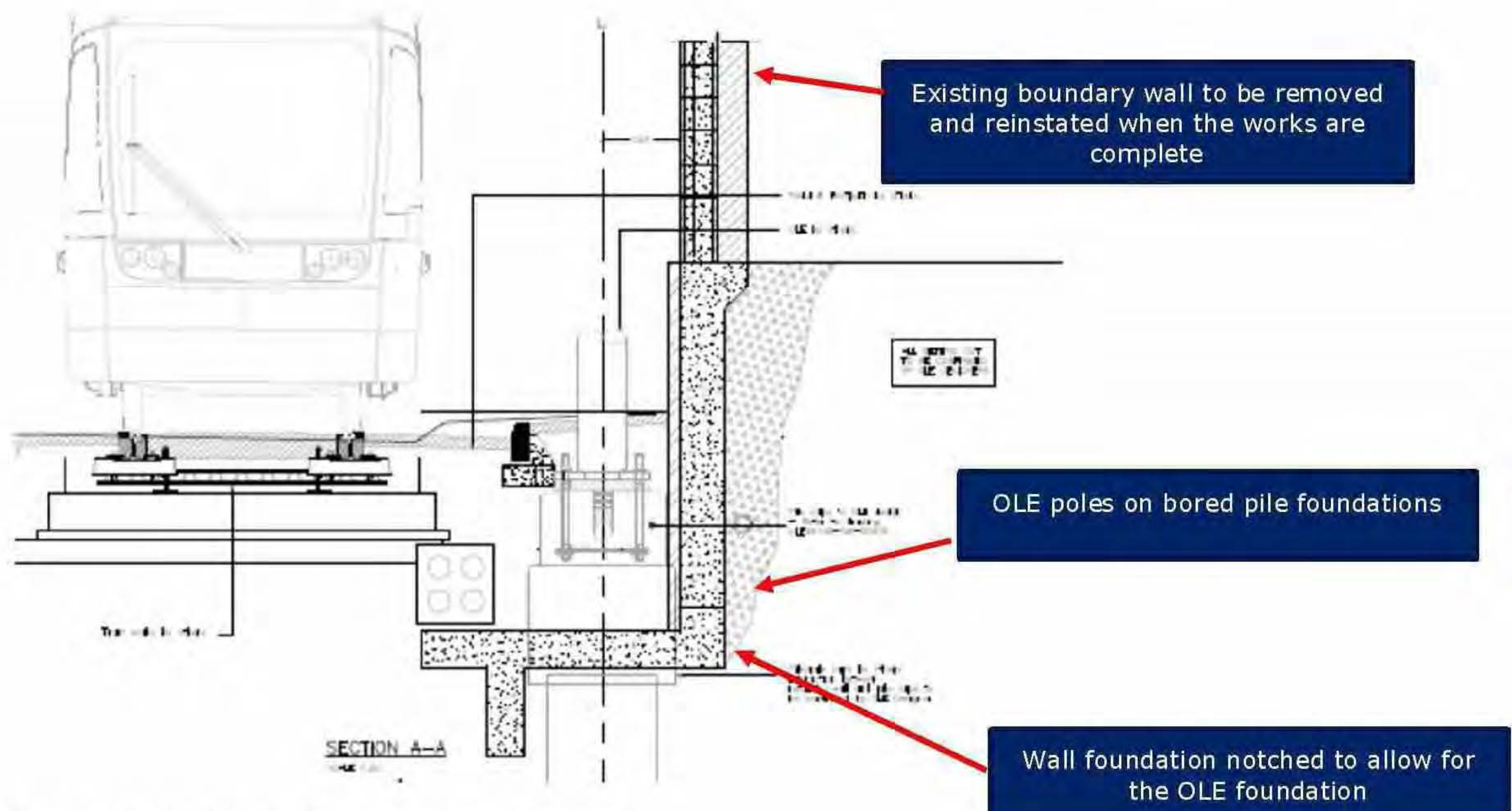


Figure 7: South Leith Parish Church boundary wall

As the structure is listed, the following is required to preserve the structure and allow the tramway works to proceed:

- Careful dismantle, removal and labelling of existing wall parts
- Removal/Archaeological dig of around 200nr bodies under wall
- Construction of foundations as shown on attached drawing
- Restoration of wall
- Reinstatement of wall

3.5.4 Tower Place Bridge and Victoria Dock Bridge

There is minimal structural works required to the existing structures. Under the previous tram contract, the works required to Tower Place Bridge to accommodate the tram (including new footway) were partially completed. There is minor work required to provide corbels for the OLE poles on the structures.

There is an element of design work required to finalise the integration of the track and the structures. This is discussed in the trackwork section below. Due to the shallow depth of the bridges, the standard Rheda trackform solution cannot be accommodated and a shallow depth trackform is required.

Further to this the tram ducting is to be installed within the deck of both bridges.

3.5.5 Lindsay Road Retaining Wall

The Lindsay Road retaining wall was partially constructed during the first phase of the works. There is the requirement to complete the full scope of the wall works including, but not limited to, reinforced concrete wall construction, engineering backfill, parapets and general roadway and tramway construction.

3.6 Track works

The current design is to continue with the use the Rheda City trackform system which has already been installed on the first phase. The benefit of this is it maintains consistency across the network which provides advantages in the maintenance phase. Also under the first phase CEC procured track work components required for the extension which is currently in storage.

At various locations along the alignment there is a requirement to introduce variations to the trackform design. The locations of these are noted in Appendix B and are as follows:

- Floating trackform
- Rheda City Soft
- Shallow trackform

Due to width restrictions along Constitution Street, variations of the floating trackform design not used in the first phase are likely to be required.

The Rheda CITY D standard trackform is shown in figures 7 and 8 below: