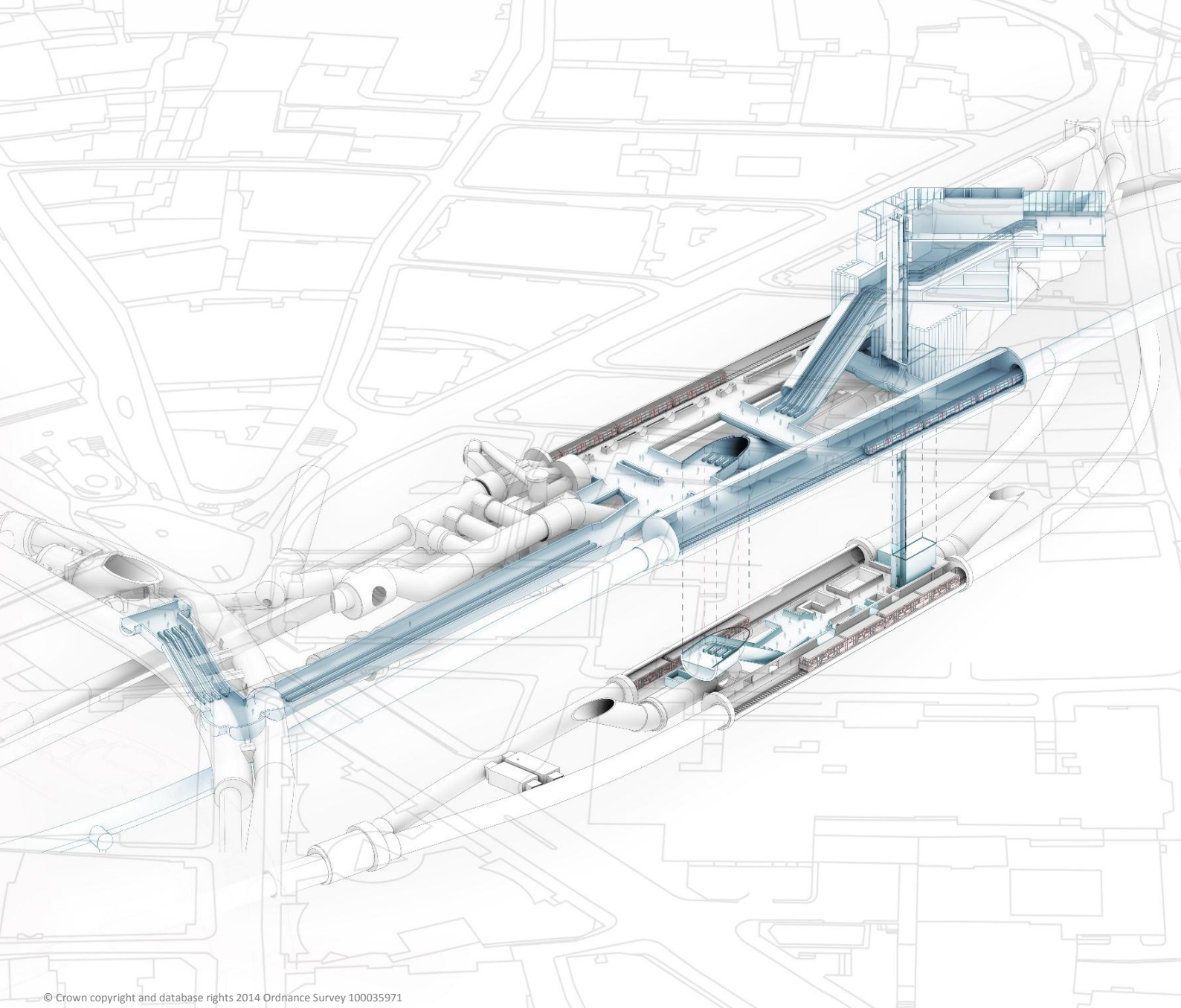


A4.1 – Draft Code of Construction Practice



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Transport and Works Act 1992
London Underground (Bank Station Capacity Upgrade) Order

Draft Code of Construction Practice

September 2014

MAYOR OF LONDON



**TRANSPORT
FOR LONDON**
EVERY JOURNEY MATTERS

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Transport and Works Act 1992

London Underground (Bank Station Capacity Upgrade) Order

Draft Code of Construction Practice

September 2014

Bank Station Capacity Upgrade Project
5th Floor
10 King William Street
London EC4N 7TW

LUL Document Reference:
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List of Abbreviations

Abbreviation	Definition
AURN	Automatic Urban and Rural Network
BPM	Best Practicable Means
BS	British Standard
BSCU	Bank Station Capacity Upgrade
BSI	British Standard Institute
CEEQUAL	Civil Engineering Environmental Quality Assessment and Award Scheme
CL:AIRE	Contaminated Land: Applications In Real Environments
CLP	Construction Logistics Plan
CoCP	Code of Construction Practice
CoP	Code of Practice for Deconstruction and Construction Sites
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EOD	Explosive Ordnance Disposal
ES	Environmental Statement
FORS	Fleet Operator Recognition Scheme
HGV	Heavy Goods Vehicle
LED	Light Emitting Diode
LUL	London Underground Limited
m	Metres
m ³	Metres cubed
NRMM	Non-Road Mobile Machinery
OSD	Over Site Development
PC	Personal Computer
PM _{2.5}	Fine Particulate Matter with a mean aerodynamic diameter of 2.5 microns or less
PM ₁₀	Particulate Matter with a mean aerodynamic diameter of 10 microns or less
SCL	Sprayed Concrete Lining
SWMP	Site Waste Management Plan
TMP	Traffic Management Plan
TWAO	Transport and Works Act Order
UXO	Unexploded Ordnance

1 Introduction

1.1.1 This document is the draft Code of Construction Practice (CoCP) for the Bank Station Capacity Upgrade (BSCU) Project. In summary this CoCP describes:

- an overview of the construction of the BSCU, including details of the work site locations and layouts, contractor, working methods and timescales (further details are provided within the Outline Construction Logistics Plan (CLP), Appendix A8.2 of the Environmental Statement (ES));
- the approach to communication with people living and working nearby; and
- the principles of environmental management, including measures to avoid or reduce impacts (known as 'mitigation' measures) and monitoring, that will be applied by the contractor for each of the following areas:
 - noise and vibration;
 - air quality, including dust;
 - land contamination;
 - waste and materials handling and storage;
 - water resources and flood risk;
 - sustainability and preservation;
 - climate change and sustainability;
 - archaeology and built heritage;
 - trees and wildlife;
 - townscape and visual amenity; and
 - highways and access.

1.1.2 The *Code of Practice for Deconstruction and Construction Sites Seventh Edition* (City of London Corporation, May 2013), details the standards to which the City of London Corporation expects sites to be maintained and operated. For brevity that document is referred to hereafter as the City of London Corporation *CoP*. The City of London Corporation *CoP* is necessarily generic and its requirements have been incorporated into this project-specific CoCP (fulfilling the City of London Corporation requirement for a Scheme of Protective Works document). Use of the term 'construction' herein implicitly includes demolition unless specified otherwise. Where relevant, other policies, standards and guidance documents have also been used to prepare this CoCP, including legislation, policy documents published by London Underground Limited (LUL) and the Mayor of London, and British Standards. Reference has also been made to other recent codes of construction practice produced by LUL.

- 1.1.3 This CoCP is presented alongside the Environmental Statement which accompanies the Transport and Works Act (TWAO) application for the BSCU. This CoCP is expected to be updated during or following the determination of the TWAO in consultation with the City of London Corporation and potentially other stakeholders and neighbours as required, and/or to incorporate any undertakings or assurances which arise through the TWAO application process. The final CoCP will be implemented by the Contractor to minimise and manage the environmental impacts of the project's construction phase, including taking account of any relevant changes to legislation, policy, standards and guidance since the time this CoCP was written (September 2014).
- 1.1.4 Note: The City of London Corporation *CoP* suggests prior approval of the CoCP / Scheme of Protective Works. Since this BSCU CoCP has been prepared with reference to the City of London Corporation *CoP* and works are not scheduled to commence until 2016, it is assumed that this 'approval' will be via the TWAO application / determination process and likely by the City of London pursuant to a planning condition associated with the TWAO. Nonetheless, the City of London Corporation (Pollution Control Team) have been consulted on the draft CoCP, and a response received.

2 Site and Works Overview

2.1 Proposed Works

2.1.1 In summary the proposed BSCU demolition and construction activities are as follows:

- demolition of a number of existing structures occupying the proposed site of the new station entrance off Cannon Street (excluding 20 Abchurch Lane) – it should be noted that this demolition is also provisioned for within a separate Planning Application for the 10 King William Street Over Site Development (OSD);
- preparatory works and shaft construction at two worksites (known as the 'Whole Block Site' and the 'Arthur Street Work Site');
- excavation and construction of new Northern Line Southbound Tunnel;
- excavation and construction of a new platform, various cross passages and escalator tunnels; and
- construction of a new Station Entrance on Cannon Street.

2.1.2 Indicative drawings illustrating the location of these sites, the below ground works, and the likely site arrangements; as well as an outline of the programme are provided below.

2.2 Site Contact Information

2.2.1 The City of London Corporation *CoP* requests that a 'Site Information Sheet' within a prescribed template is provided prior to works commencing. The information sheet template includes for details of the likely areas of adverse environmental effects, together with proposed mitigation/control measures. This information is contained within this CoCP, as well as the BSCU Environmental Statement. The Site Information Sheet also includes for contact details for the works. Prior to the works commencing, such details will be provided to the City of London by the Contractor, and will include:

- a named contact for the works;
- site contact Direct Dial number and email address;
- site 24hr contact number;
- the company address of the contractor; and
- the contractor's company email address and phone number.

2.3 Site Plans

- 2.3.1 A development location plan is provided in Figure 2.1 overleaf. A series of plans of the work sites are provided in Figures 2.2 and 2.3.

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Figure 2.1: Indicative Locations of the Working Areas

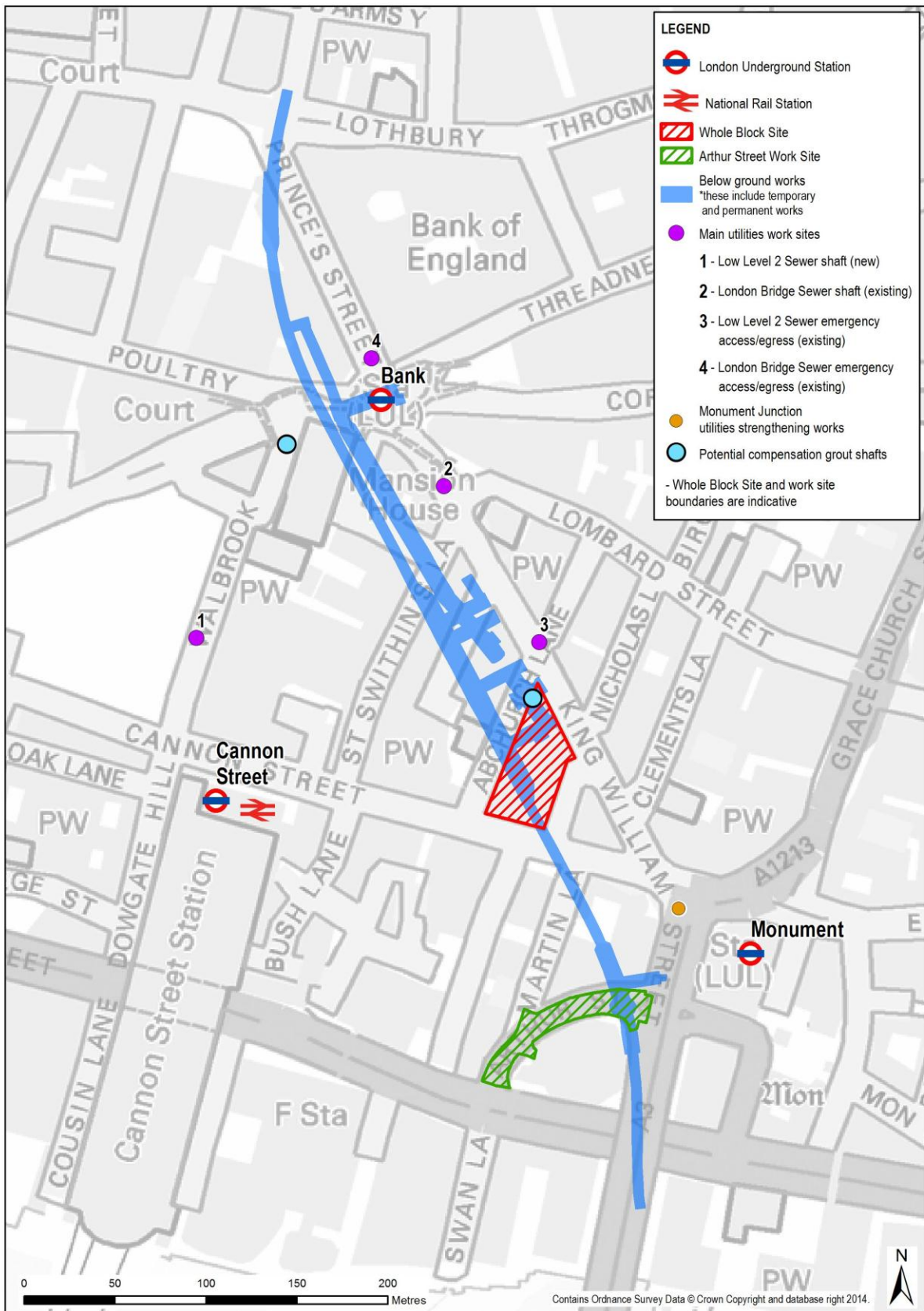


Figure 2.2: The Whole Block Work Site - *Indicative Only*

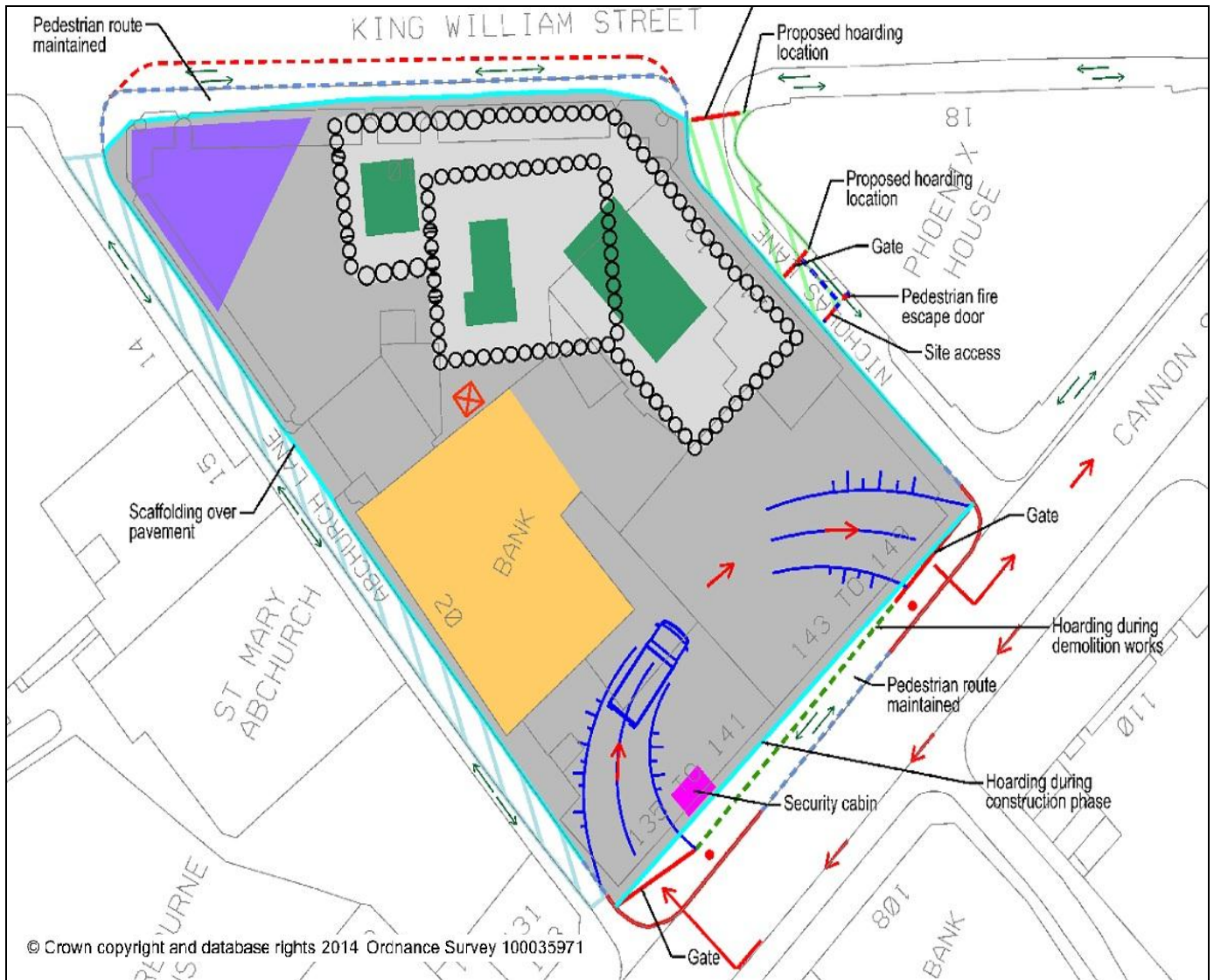
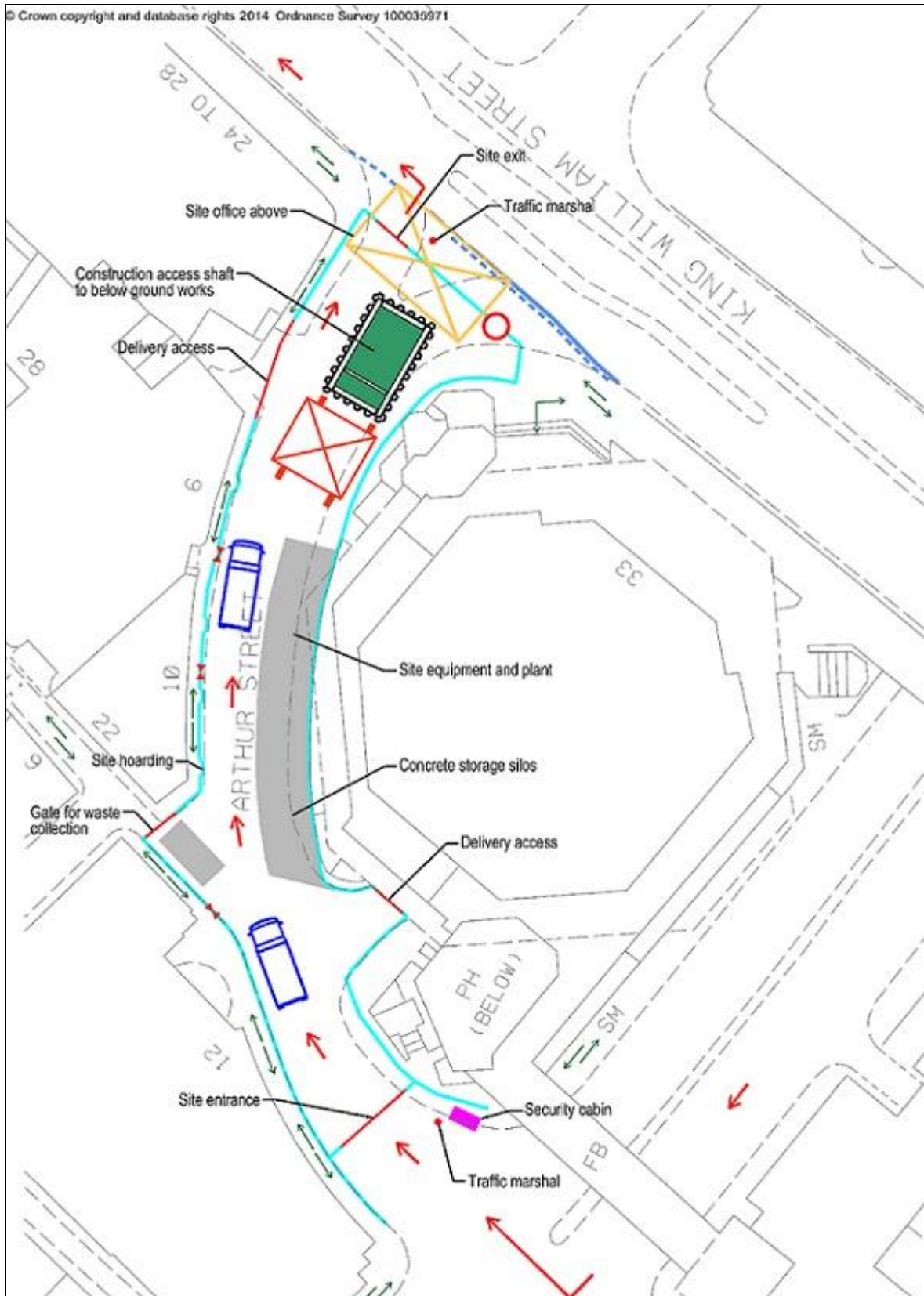


Figure 2.3: The Arthur Street Work Site (surface) - *Indicative Only*



2.4 Indicative Programme of Proposed Works

2.4.1 The construction programme is anticipated to span approximately five and a half years.

- Enabling Works would be undertaken at commencement of construction (2016) for a duration likely to be between nine and fourteen months;

Whole Block Site

- Demolition of the buildings on the Whole Block Site are expected to commence in Year 1 for a duration of approximately nine months;
- Escalator box piling is expected to commence in Year 1 for a duration of approximately four months;
- Escalator box excavation and structure is expected to commence in Year 2 for a duration of approximately 13 months;
- Station Works from the Whole Block Site are expected to commence in Year 3 for a duration of approximately 24 months;
- Construction of a new station entrance is expected to commence in Year 5 for a duration of approximately 12 months;

Arthur Street Work Site

- Arthur Street Site setup and construction of the Arthur Street Shaft is expected to commence in Year 1 for a duration of approximately eight months;
- Tunnelling works from Arthur Street are expected to commence in Year 1 for a duration of approximately 43 months;
- The Blockade is expected to commence in Year 5 for a duration of approximately four months;
- Key below ground interchanges are expected to be brought in to use in Year 5;
- Completion of all works is expected in Year 6 (2021).

3 General Principles of Construction Environmental Management

3.1 Environmental Management

3.1.1 The Contractor will implement an Environmental Management System (EMS) (certified to the ISO 14001 standard) for this project.

3.1.2 The EMS (and its associated documentation) will remain 'live' throughout the construction period, and associated documentation will be reviewed every six months as a minimum to reflect the changing focus of the construction activities and the potential environmental aspects associated with these (as well as relevant developments in legislation, policy, construction working methods, and identified opportunities for improvement). The EMS will draw upon the information contained within this CoCP, and include documentation that details specific mitigation and actions to address the project's key potential environmental risks.

3.2 Considerate Contractor Scheme

3.2.1 The Contractor will register with the Considerate Contractors Scheme administered by the City of London Corporation, and through the implementation of this CoCP, seek to comply with the associated code of practice.

3.2.2 The Contractor will also apply for the Considerate Contractors Scheme's Environmental Award.

3.2.3 The project is participating in the CEEQUAL scheme.

3.3 Site Management and Responsibilities

Environment Manager

3.3.1 The Contractor's Environment Manager's key responsibilities will, amongst others, include:

- implementation of the CoCP (this document);
- implement and maintain the Environmental Management System;
- development and provision of environmental training for site workers to include induction for all personnel, tool box talks and specific training for personnel with specific environmental responsibilities;
- management of all environmental personnel including all environmental specialists;

- approval of the environmental parts of the Contractor's and Sub-Contractors' method statements;
- co-ordination with other contractors at other work sites in the vicinity (generally taken to be up to 200m distant) regarding cumulative impacts;
- ensuring compliance with environmental legal and contractual requirements;
- provision of advice and instruction to construction teams to deal rapidly and effectively with environmental incidents and complaints;
- analysing individual environmental incidents and complaints to identify root causes, corrective and preventive actions needed, and to identify any trends and strategic actions; and
- management of environmental monitoring as required by this CoCP including analysis and interpretation of monitoring results and actions.

Environmental Field Engineer

3.3.2 An Environmental Field Engineer may be appointed to support the Environment Manager, for example by undertaking site-based environmental monitoring and inspection/auditing.

Other Environmental Staff

3.3.3 It is anticipated that the following environmental staff may be required to provide specialist advice and services:

- Noise and Vibration Specialist;
- Air Quality Specialist;
- Land Contamination Specialist;
- Waste Manager; and
- Archaeology and Built Heritage Specialist.

Construction Staff

3.3.4 The Construction Manager / Engineering Manager will, amongst other duties, be responsible for assisting the Environment Manager in efforts to ensure that engineering and construction works proceed with the minimum environmental impact.

3.3.5 The Construction Manager, or appropriate delegate, will regularly undertake a 'pedestrian journey check' to check that roads, pedestrian footpaths and routes used by pedestrians around the construction site perimeter are suitably protected, well maintained, unobstructed and properly signed.

- 3.3.6 Site Agents will be responsible for ensuring that environmental issues are covered adequately in method statements and for co-operating with requests by environmental staff for access to site.
- 3.3.7 Site Foremen will be responsible for assisting environmental staff with any site investigations, for reporting discovery of items of environmental interest, and if necessary complying with instructions to stop work or change method of working.
- 3.3.8 All employees will be responsible for the implementation of the relevant requirements of the CoCP including being familiar with and demonstrating commitment to the implementation of the Contractor's Environmental Policy and CoCP, monitoring their workplace for potential environmental risks and alerting their immediate line manager if any are observed, and assisting the Contractor in its pursuit of continual improvement in environmental performance.
- ### 3.4 Training
- 3.4.1 Specific environmental training shall also be provided to construction staff. A training programme will be developed, delivered and maintained by the Environment Manager prior to and during the construction period. This will include induction for all personnel, tool box talks and specific training for personnel with particular environmental responsibilities. Training will be continued as necessary throughout construction.
- ### 3.5 Emergency Preparedness and Response
- 3.5.1 Information will be displayed in a prominent place at the BSCU Work Sites in order to assist workers in preparing for and dealing with environmental incidents, should they occur. The information will include:
- plans showing the environmental features of each site and its surroundings;
 - emergency access routes;
 - emergency instructions in the event of a leak or spillage on site, including contact details;
 - hydrants, fire points, location of spill kits;
 - location of bunded storage areas, tanks, chemical and gas storage locations; and
 - locations of waste and materials store.
- 3.5.2 All environmental incidents will be reported immediately by employees to their supervisor who will deal with the incident as immediately as practicable, and notify the Site Agent. As necessary, advice will be sought from the

- Environment Manager on incident response, and the Environment Manager will, in any respect, be informed of the incident as soon as practicable. In turn, the Environment Manager will inform the LUL Project Manager. Following this, the incident will be investigated and the necessary preventative / corrective actions developed and instigated.
- 3.5.3 The Environment Manager will commence investigation of all environmental incidents within one working day, to determine the cause of the incident; ensure environmental harm is remediated wherever practicable; and to introduce improved preventative measures wherever practicable. The size of the investigation will be proportional to the environmental incident in question, and should be a practical tool to improve operations on site for the better. The incident report will be submitted to the LUL Project Manager.
- 3.5.4 If a spill reaches a surface water body (or a drain leading unimpeded to one) or soaks away in open ground, the Environment Manager will contact the Environment Agency as soon as is practicable on the 24hr helpline.
- 3.5.5 If a spill enters a foul drain, the drain asset owner, (either Thames Water or City of London Corporation) will be notified as soon as practicable through the Environment Manager.
- 3.5.6 If incidents do not fall into any precise category, and if there is any doubt, the Environment Agency will be contacted through the Environment Manager.
- 3.5.7 Records of environmental incidents will be made available to the City of London Corporation.

4 Liaison and Consultation Strategy

4.1 Liaison with Neighbours

Identification of Neighbours Who May Be Affected

- 4.1.1 It is recognised that the work sites are located within a highly urban environment with a number of nearby business premises, places of worship, historic buildings and (although relatively few) residential properties.
- 4.1.2 A Consultation and Engagement Strategy has been developed for the BSCU Project and its implementation is already underway.
- 4.1.3 Prior to the construction phase of the BSCU commencing, project information will be provided to the neighbours including Ward Member(s), local community groups, businesses and other individuals identified.

Construction Phase Communication

- 4.1.4 The Contractor will undertake regular communication with neighbours and interested parties, by newsletter / information flyer and / or information boards, and direct contact where necessary, in order to keep neighbours informed about current progress and planned works. This information will include that stated below, where applicable, together with details of the City of London Corporation Pollution Team contact:
- the location of the planned works;
 - the type of planned works which are anticipated to give rise to effects on adjacent residents;
 - the duration of the planned works and the periods within which works will be undertaken;
 - the anticipated effects of the planned works;
 - the measures to be implemented in line with this CoCP to mitigate the impact of the planned works;
 - contact details for enquiries; and
 - complaints procedure.
- 4.1.5 Information will be displayed outside the BSCU Work Sites, which as a minimum shall identify key personnel, contact addresses, website and telephone numbers, including complaint contact numbers. Additional information will include details of the scheme and its progress.
- 4.1.6 The Contractor will liaise with LUL and adhere to the project-wide communications strategy, specifically providing timely information regarding

planned activities – and significant changes to planned activities – so that, as necessary, these can be incorporated into websites, email alerts and on-board announcements on trains travelling into affected stations to alert local residents and station users of any upcoming changes.

Other Communication

- 4.1.7 The Contractor will appoint a responsible person to liaise with the City of London Corporation, neighbours and interested parties in order to keep them informed of matters likely to affect them. The City of London Corporation Pollution Team will be supplied with a current 24-hour call out number that will be answered in the case of an emergency.
 - 4.1.8 Good relations will be fostered by keeping neighbours informed of progress and by responding to complaints quickly and fairly.
 - 4.1.9 The Site Hours Variation Request procedure (see Appendix A) will be followed for any works outside the 'standard hours' or within the 'quiet hours' where these works are not already consented.
 - 4.1.10 Arrangements will be put in place for notifying or alerting neighbours in advance (preferably at least four days) of forthcoming noisy works, where applicable.
- ### **4.2 Complaints Procedures**
- 4.2.1 Contact numbers, email and postal addresses for the enquiries and complaints system will be displayed on signs around the construction site and will be published on a website and in newsletters.
 - 4.2.2 Where complaints are made, the Contractor will try to resolve the complaint within three working days. Where an issue cannot be resolved immediately, the complainant will be notified within three working days and the Contractor will take action to resolve the problem, endeavouring to respond and take action within ten working days. If the Contractor is unable to resolve the complaint within ten working days an update will be sent within that timeframe to keep the complainant notified of progress.
 - 4.2.3 The City of London Corporation will be notified within one working day of any complaints received, together with the steps taken (if possible) to resolve the issue. If it is not possible to provide details of remedial actions during the initial notification, these will be provided to the City of London within three working days of the complaint being received.

4.2.4 The Contractor will maintain a complaints / incidents logbook or repository including but not limited to:

- the nature of the complaint;
- the cause of the complaint; and
- where appropriate, the remedial action taken.

4.2.5 The complaints / incidents records will be made available to the City of London Corporation on request.

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5 Site Operations and Working Hours

5.1 Working Hours

5.1.1 Dependent on the phase of works, the construction will take place during standard working hours only, extended hours, or 24 hour working.

Standard Working Hours

5.1.2 The City of London Corporation define 'standard' working hours as follows:

- 08:00 - 18:00 hours (Monday to Friday)
- 08:00 - 13:00 hours (Saturday)

5.1.3 The City of London Corporation's *CoP* also states that no noisy working is permitted on Sundays, Bank or Public Holidays.

5.1.4 It is proposed that certain activities will be undertaken outside of the standard working hours during the mobilisation / demobilisation hours – i.e. the periods up to one hour before and one hour after 'standard hours'. Mobilisation / demobilisation activities will comprise arrival and departure of workforce and staff at site and movement of plant and equipment to and from its place of work (if parked up, engines to be turned off, staff to remain considerate of neighbours, no loud music or raised voices); general refuelling; site inspections and safety checks; site meetings (briefings and quiet inspections / walkovers); site clean-up (site housekeeping that does not require use of plant); site maintenance; and low key maintenance and safety checking of plant and machinery (provided this does not require or cause hammering, banging, etc.). Mobilisation/ demobilisation does not include lorry movements into and out of the site.

5.1.5 Maintenance activities may be undertaken during the 'maintenance' hours which comprise 13:00 to 17:00 hours Saturdays and 10:00 to 16:00 hours Sundays. The activities allowed in the maintenance period are limited to those that do not cause significant noise, vibration or disturbance. Maintenance activities will comprise general mechanical maintenance to construction machinery and plant. Only essential maintenance works will be undertaken on Sundays.

Extended Hours and 24 Hour Working

5.1.6 It is the intention of the BSCU to undertake certain elements of construction work on a 24 hours, seven days a week basis, for reasons of safety and engineering practicability. These works will generally be limited to:

- below ground works associated with excavation and tunnelling;
- surface operations undertaken in support of below ground works; and

- some utilities works (particularly those requiring works within the highway to shorten the period of road closure or where there would be an unacceptable traffic congestion impact from undertaking those works within the daytime).
- 5.1.7 For other works which are unlikely to result in disturbance to neighbouring residents and commercial activities, 24 hour, seven day working may be undertaken, which could also include working on Sundays and Bank / public holidays. 24hr, seven day working or extended hours working will also be necessary in some circumstances for safety reasons, or where activities require completion as a continuous process that cannot be completed within the duration of a standard working day.
- 5.1.8 Examples of works which may need to be undertaken out of hours include:
- utilities works (utilising lower night time sewer flows, and to minimise the disruption on users);
 - deliveries, including those of oversized loads - to minimise the impact on other road users;
 - large volume concrete pours; and
 - works in support of below ground activities where those works are constrained to London Underground engineering hours (i.e. works on the live railway).

Quiet Hours

- 5.1.9 The Contractor may place time restrictions on 'noisy' works to reduce noise disturbance to businesses. The City of London Corporation *CoP* does not define the term 'noisy' - however it is proposed that it be interpreted as explained in the following paragraphs. The *CoP* presents 'quiet hours' as being:
- 10:00 - 12:00 (Monday to Friday); and
 - 14:00 - 16:00 (Monday to Friday).
- 5.1.10 The following activities will not usually be permitted during 'quiet hours' where there exists a potential for causing a nuisance to receptors:
- cutting using power tools;
 - breaking out using power tools;
 - the use of impact fasteners; and
 - other noisy activities, depending on the specific location of site and neighbours, to be ascertained by the Environment Manager.

- 5.1.11 Exceptions, including lorry arrivals and departures, will be discussed between the Environment Manager and the City of London Corporation, and will only be made where there is an overriding justification provided in terms of safety or engineering practicality (for example below ground works, or activities in support of them), or where it can be adequately demonstrated that the likelihood of causing a noise nuisance from those works is low. In these instances the Contractor will seek the approval of the City of London Corporation, which could be (where consent for the intended working hours is not already held) through the submission, at least four days prior to the intended activities, of a Site Hours Variation Request Sheet (see Appendix A). Neighbours will be provided with an information flyer at least four days in advance of the proposed work taking place.

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5.2 Schedule of Plant and Equipment

5.2.1 Consideration has been given to the types of plant and equipment that are likely to be used during the works. An indication of typical types of plant and equipment associated with the construction phases are identified below (note that this list is non-exhaustive).

Utilities Works

- excavators;
- excavated material removal trucks;
- delivery trucks; and
- Rollers.

Piling

- piling rig;
- steel delivery trucks;
- concrete delivery trucks; and
- excavated material removal trucks.

Excavation - Reinforced Concrete

- concrete delivery trucks;
- concrete pump; and
- mini crane.

Tunnelling

- dry mix concrete plant;
- ready mix concrete silo and pump;
- tunnel concrete trucks;
- excavated material removal trucks;
- 20 tonne excavator;
- ventilation fan;
- tunnel loader; and
- spraying robot.

Arthur Street Work Site

- ventilation fan;
- 32 tonne gantry crane;

- excavator;
- skips;
- 10 tonne forklift;
- steel delivery trucks;
- concrete delivery trucks;
- excavated material removal trucks;
- 500 kVA generator (emergency);
- transformer; and
- compressor.

Whole Block Work Site

- piling rig;
- tower crane;
- 13 tonne excavator;
- 20 tonne excavator;
- ventilation fan;
- 10 tonne forklift;
- concrete delivery trucks;
- skips;
- excavated material removal trucks;
- 40m boom pump;
- 500 kVA generator (emergency);
- transformer;
- in-tunnel dewatering station; and
- compressor.

Other (tunnel reinforced concrete; MEP, track etc.)

- tunnel transport trucks;
- mini crane;
- excavator with breaker;
- compressor; and
- Manitou or similar.

6 Noise and Vibration

6.1 Introduction

6.1.1 The Contractor will, as far as reasonably practicable, seek to monitor, control and limit noise and vibration levels so that affected properties and other sensitive receptors are protected from excessive or prolonged noise and vibration associated with construction activities at both work sites. Best Practicable Means (BPM) is defined under Section 72 of the Control of Pollution Act 1974 as those measures which are 'reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications'. The Contractor will apply BPM to all activities to minimise the effects of noise and vibration and comply with the requirements of this CoCP.

6.2 Working Hours

6.2.1 A key mechanism for managing the impact of noise will be through adherence to site working hours. These are discussed in detail in Section 5 of this CoCP.

6.3 Protective Works

6.3.1 Mitigation will be considered in the following order:

- a) noise and vibration minimisation at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, and the use of less intrusive alarms; and
- b) screening and positioning: for example local screening of equipment or perimeter hoarding; as well as the location of equipment on site.

Tunnelling

6.3.2 The construction of the new tunnels and adits will be carried out using the technique of sprayed concrete lining. This method involves the sequential excavation of the ground using an excavator and the subsequent provision of support to the excavations by spraying the excavation face with steel fibre reinforced concrete. The sequential excavation means that the tunnels are progressed between one metre and three metres per day with the excavation face supported with concrete each shift. The excavations are continued by removing the concrete from the excavation face before excavating further.

6.3.3 This method requires that the temporary support of the excavation face is broken out each day. The methods to be employed consist of using the excavator to remove the concrete that constitutes the temporary support. Where support is required for periods of more than 24 hours such as planned

stops for extended breaks, to work around existing building foundations, or for when a change in direction is required, the concrete to be broken out will be harder and thicker and it will not be possible using an excavator. In these circumstances, percussive breakers may be used, together with other techniques as appropriate. There may also be a requirement to use percussive breakers to excavate foamed concrete used to temporarily support some below ground structures.

- 6.3.4 To ensure that potential disturbance in terms of groundborne noise and vibration is kept to a minimum, BPM will be employed to reduce the time and location where percussive breakers are required to be used to a minimum. In addition, the groundborne noise and vibration effects of the works will be reviewed on a regular basis (see Section 6.4 Monitoring Regimes) to keep disturbance to a minimum.

Other Works: Minimisation at Source

- 6.3.5 Off-site preparation of pre-fabricated components, where practicable, will be standard practice.

- 6.3.6 Where appropriate and practicable, the following measures to minimise noise and vibration levels will be adopted:

- employing only modern, quiet and well-maintained equipment (all equipment must comply with *EC Directive 2000/14/EC*, *UK Statutory Instrument 2001/1701* and *British Standard 5228:2009*; any plant, equipment, or items fitted with noise control equipment found to be defective will not be operated until repaired;
- careful planning of the sequence of work in order to minimise the transfer of noise/vibration to neighbours;
- using silenced modern piling rigs with careful operation of the rigs;
- where reasonably practicable, fixed items of construction plant will be electrically powered from the mains supply in preference to being diesel or petrol driven;
- use of screws and drills rather than nails for fixing hoardings, etc.;
- careful handling of materials and waste such as lowering rather than dropping items;
- loading / unloading material into vehicles within designated areas only;
- taking care when erecting or striking scaffolds to avoid impact noise from banging steel;

- avoidance of unnecessary noise (such as engines idling between operations, shouting, loud radios or excessive revving of engines) by effective site management;
- vehicles and mechanical plant utilised on the work sites for any activity associated with the construction works will be fitted with effective exhaust silencers and shall be maintained in good working order and operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable; and
- furthermore, the Contractor will adopt the recommendations set out in Section 8 of *BS 5228-1: 2009* and Section 8 of *BS 5228 2: 2009* with regard to noise and vibration mitigation options respectively.

Reversing Alarms / Moving Plant Safety Alarms

6.3.7 The Contractor will, as far as reasonably practicable, ensure that the noise from reversing / warning alarms is controlled and limited. This will be managed through the following hierarchy of techniques:

- the layout of the work sites have been designed to limit and where reasonably practicable, avoid the need for the reversing of vehicles (e.g. there is a separate site entrance and exit). The Contractor will ensure that drivers are familiar with the layouts of the work sites;
- alarms incorporating one or more of the features listed below or any other comparable system will be used where reasonably practicable:
 - use of broadband (non-tonal) signals;
 - self-adjusting output sounders;
 - flashing warning lights; and
- alarms will be set to the minimum output noise level required for safety compliance, but at a level where the intended effect of the alarm will be achieved.

Other Works: Screening and Positioning

6.3.8 Where control at source is not practicable or adequate, the distance between noise / vibration sources and sensitive neighbours will be maximised and the transmission path interrupted as practicable. This can be achieved through:

- intelligent siting of stationary plant and loading / unloading areas;
- erecting impervious hoardings (up to 3.6m in height);
- the positioning of temporary structures; and
- erection of acoustic screens or enclosures around static equipment.

- 6.3.9 All tunnel ventilation plant with connections to the atmosphere in any noise-sensitive location will be subject to mitigation measures appropriate to its local environment – including orientating away from sensitive receptors, and the use of locally erected screens where necessary.
- 6.3.10 Areas of temporary works away from the main working areas shall be surrounded by temporary fencing, generally equipped with acoustically insulating panels where practicable.

6.4 Monitoring Regimes

- 6.4.1 Noise and vibration monitoring will be undertaken prior to and during the construction works.
- 6.4.2 All noise and vibration monitoring data will be made available to the City of London Corporation. The data shall be presented in a format which shall be agreed with the City of London Corporation and easily interpreted by non-technical third parties.

Noise Monitoring

- 6.4.3 A number of semi-permanent noise monitors will be installed prior to the main construction activities commencing. The proposed locations for these shall be subject to discussion and agreement with City of London Corporation – to ensure that their number and location enables a representative understanding of the construction noise output from both worksites.
- 6.4.4 To ensure its continued accurate operation, the Contractor will:
- ensure all acoustic measurements are made with industry recognised and suitably calibrated equipment (standard practice is to calibrate sound level meters every two years under laboratory conditions), using sound level meters which comply with *BS EN 61672-1:2003*;
 - check all sound level meters with a sound level calibrator conforming to *BS EN 60942:2003* before and after installation and at agreed intervals where longer term monitoring is proposed, at least every three months. The results of these checks are to be recorded and held by the Contractor; and
 - employ trained and competent personnel to undertake monitoring.
- 6.4.5 All monitoring will be undertaken using type 1 noise monitors.
- 6.4.6 Data will be downloaded a minimum of once a week to monitor performance and to assist the investigation of any complaints received.
- 6.4.7 Trigger levels will be agreed at suitable stages of the construction works with the City of London Corporation. Semi-permanent noise monitors employed during the construction period will enable real-time monitoring against trigger

levels. Noise monitors that detect an elevated noise reading (averaged over the appropriate timescale) will be set up to send a text message to the Environment Manager so that they can take appropriate investigative action and if necessary corrective action at the work sites. Additionally, audio recordings can be made when trigger levels are breached to aid investigation.

6.4.8 The Contractor, where necessary, will also undertake spot-measurements of construction noise levels using a hand-held meter to investigate issues that may arise. For the occupied dwellings and offices nearest to the predominant source(s) of construction noise the values should be measured or calculated one metre in front of exposed windows.

6.4.9 The Contractor will report on noise data to the City of London Corporation on a weekly basis.

Vibration Monitoring

6.4.10 Semi-permanent vibration monitors will be installed at a number of locations when works with the potential to give rise to vibration are to be undertaken. Trigger levels will be determined in due course. Where practicable, vibration monitors that detect an elevated vibration reading (averaged over the appropriate timescale) will be set up to send a text message to the Environment Manager so that they can take appropriate investigative action and if necessary corrective action at the work site(s).

6.4.11 Trigger levels will be based on criteria and/or procedures for vibration control which are specified and assessed for three purposes:

- to protect the occupants and users of buildings from disturbance, for which vibration dose values are assessed (vibration dose values are defined and their application to occupants of buildings is discussed in *BS 6472-1:2008*);
- to protect buildings from risk of physical damage, for which peak component particle velocities are assessed in accordance with *BS 7385-2:1993*; and
- to protect particularly vibration-sensitive equipment and processes from damage or disruption, for which peak component acceleration, velocity or displacement are assessed as appropriate to each process or item of equipment.

6.5 Section 61 Consents

- 6.5.1 The project will seek agreement from the City of London Corporation under *Section 61 of the Control of Pollution Act 1974* for works which are deemed by the project as having the potential to give rise to disturbance to nearby receptors. Applications for consent will include a description of the works to which they pertain (including an outline programme), details of the BPM to be applied (including any monitoring and associated reporting), and noise predictions associated with the works. Where appropriate, and to reflect unforeseen changes to the working methodology or additions to the scope of works, consent will be sought from the City of London Corporation to vary existing *Section 61* consents. New *Section 61* consents will generally be sought to reflect each new materially different phase of works on the worksites.

7 Air Quality

7.1 Introduction

7.1.1 The Contractor will, as far as reasonably practicable, seek to monitor, control and limit emissions to the atmosphere in terms of gaseous and particulate pollutants from vehicles and plant used on the two work sites, and dust from construction activities, through employment of BPM. The Contractor will identify potential sources and apply appropriate control techniques.

7.2 Specification and Use of Vehicles and Equipment to Minimise Emissions

7.2.1 The Contractor will ensure that the adverse effects of vehicle and plant emissions are controlled. This will be achieved where practicable through adherence to emission criteria for on-road and off-road vehicles and plant as well as additional plant and vehicle controls as follows.

On-Road Vehicles

7.2.2 All commercial on-road vehicles used in construction will meet European certified CO₂ limits (Table 7.1) and the European Emission Standards pursuant to the *EC Directive 98/69/EC* (commonly known as Euro Standards), for that year in which it is introduced into the fleet (Table 7.2). This will also be in compliance with the London Low Emissions Zone. The Contractor will also ensure all on-road vehicles used in the construction fall below or meet the following CO₂ limits and Euro Standards as follows:

- cars - maximum certified CO₂ emissions of 105 g/km and a minimum of Euro 5 emission standards;
- vans equal to or less than 1205 kg kerb weight - maximum certified CO₂ emissions of 115g/km CO₂ and a minimum of Euro 5 emission standards;
- vans between 1205 and 1660kg kerb weight - maximum certified CO₂ emissions of 155g/km CO₂ and a minimum of Euro 5 emission standards;
- vans greater than 1660kg kerb weight - maximum certified CO₂ emissions of 215g/km CO₂ and a minimum of Euro 5 emission standards; and
- heavy duty vehicles greater than 3500kg kerb weight - Euro V emission standards.

Table 7.1: Certified CO₂ Limits (g/km)

Vehicle	Certified CO ₂ Limits (g/km)					
	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Cars	95	90	85	80	75	70
Vans ≤ 1205 kg kerb weight	105	100	95	90	85	80
Vans 1205-1660 kg kerb weight	145	140	135	130	125	120
Vans > 1660 kg kerb weight	205	200	195	190	185	180

Table 7.2: European Emission Standards for Road Vehicles

Vehicle	European Emission Standards for Road Vehicles					
	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Cars	Euro 5	Euro 6	Euro 6	Euro 6	Euro 6	Euro 6
Vans ≤ 1205 kg kerb weight	Euro 5	Euro 6	Euro 6	Euro 6	Euro 6	Euro 6
Vans 1205-1660 kg kerb weight	Euro 5	Euro 5	Euro 6	Euro 6	Euro 6	Euro 6
Vans > 1660 kg kerb weight	Euro 5	Euro 5	Euro 6	Euro 6	Euro 6	Euro 6
Heavy Duty Vehicles >3500 kg	Euro VI	Euro VI	Euro VI	Euro VI	Euro VI	Euro VI

Off-Road Vehicles and Plant

7.2.3 The Contractor will ensure that they meet or exceed the minimum standard:

- All Non-Road Mobile Machinery (NRMM) should meet at least Stage 3B emission criteria where it is available. If Stage 3B equipment is not available for an otherwise qualifying engine output, NRMM will, where practicable and efficient, be fitted with particle traps and / or catalytic exhaust treatment. An inventory of NRMM alongside proof of emission limits for all equipment will be maintained. All machinery will be regularly serviced and service logs kept for inspection.

7.3 Vehicle Procurement and Replacement

7.3.1 The Contractor will ensure that all vehicles procured or leased, by itself and its sub-contractors, are specified in accordance with the following principles:

- consider as a high priority CO₂, air quality, noise impacts as part of the decision making process when procuring and leasing vehicles; and
- adopt a technology-neutral approach in the procurement and leasing of vehicles, e.g. do not automatically favour diesel over petrol.

7.3.2 In line with Mayoral environmental strategies and commitments to reduce CO₂ emissions, the Contractor will consider the inclusion of zero or ultra-low carbon vehicles in their fleet such as electric, plug-in hybrid or biomethane vehicles where practicable and offers a demonstrable overall environmental benefit. If any on-road or off-road vehicle or plant become due for replacement during the period of the BSCU Works, the Contractor will ensure that the replacement vehicle/engine meets the requirements set out in paragraphs 7.2.2 and 7.2.3. If vehicles that meet the requirements are not available by the specified deadline, then the Contractor will consider an alternative standard until such time as those vehicles become available.

7.4 Additional Plant and Vehicle Controls

7.4.1 Measures to be considered for limiting emissions and avoiding nuisance will include the following as appropriate and as far as reasonably practicable:

- ensuring that the engines of all vehicles and plant on the work sites are not left running unnecessarily;
- using low emission vehicles;
- using ultra low sulphur fuels in plant and vehicles;
- use of diesel particulate filters where appropriate, beneficial and practicable;
- should any emissions of dark smoke occur (except during start up) then the relevant machinery should be stopped and any problem rectified before being used;
- requiring that plant will be well maintained, with routine servicing of plant and vehicles to be completed in accordance with the manufacturer's recommendations and records maintained for the work undertaken;
- siting fixed plant away from potential sensitive receptors;
- minimising the use of diesel or petrol powered generators and instead using mains electricity or battery powered equipment; and
- maximising energy efficiency (this may include maximising vehicle utilisation by ensuring full loading and efficient routing).

7.5 Protective Works – Dust

Schedule of Potentially Dusty Works

7.5.1 The following works will potentially generate dust, which could result in adverse impact if left unmitigated:

- earthworks associated with the construction of the station infrastructure and tunnelling works;
- on-site processing of earthworks and tunnelling spoil material;
- stockpiling / storage of construction materials and / or earthworks and tunnelling spoil;
- particulate emissions from non-road mobile machinery and generators (although every effort will be made to utilise mains electricity where practicable);
- movement of construction vehicles (heavy duty vehicles and non-road mobile machinery) on unsurfaced and surfaced ground;
- the ‘trackout’ of dust onto the public road network from heavy duty vehicles accessing and leaving the site;
- dust caused by the Sprayed Concrete Lining (SCL) process below ground (and transferred to surface via the ventilation systems);
- on-site concrete batching (particularly deliveries of dry materials); and
- grinding and cutting of materials.

Main Principles of Protective Works

7.5.2 The Contractor will comply where practicable with the guidance set out in the Greater London Authority Best Practice Guidance document (Greater London Authority and London Councils, 2006) or subsequent versions of that document that might be published. The project is considered as a high risk site under that guidance. This will follow the hierarchy below:

- prevention – The works methodology and the two work site setups will be planned to eliminate as far as possible the dust raising potential of the BSCU;
- suppression – Where prevention measures cannot eliminate the potential for dust then methods of suppression will be used;
- containment – In the event that prevention and suppression methods have been taken and a potential for dust remains then, where possible, methods of containment will be used.

7.5.3 The dust control procedures on the work sites will include, as appropriate, the following:

Site Planning

- erect solid barriers around the entire site boundary;
- ensure no burning of waste materials takes place on site;
- plan the site layout – materials with the potential to produce dust, as well as machinery and dust causing activities, should be located away from sensitive receptors where reasonably practicable;
- provide hard surfaced site haul routes, which should be regularly inspected for integrity and repaired if required;
- provide easily cleaned hardstanding surfaces for vehicles;
- ensure an adequate water supply on the site;
- as required, provide filtration systems within the tunnel ventilation system;
- put in place real-time dust monitors across site; and
- additionally, a trained and responsible manager will be on site during working times to maintain a log book and carry out site inspections; and all staff will have basic training and awareness training delivered through their induction and toolbox talks. The site Dust Log Book will be provided by the Environmental Manager.

Site Maintenance

- ensure disposal of run-off water from dust suppression activities is in accordance with the appropriate legal requirements (where possible this should be re-used);
- maintain all dust control equipment in good condition and record maintenance activities;
- keep site fencing, barriers and scaffolding clean;
- ensure regular cleaning of hardstandings;
- do not allow dry sweeping of large areas;
- carry out site inspections regularly to monitor compliance with dust control procedures set out above and record the results of the inspections, including nil returns, in a site log book;
- increase the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and

- record any exceptional incidents causing dust episodes on or off the site and the action taken to resolve the situation in the site log book.

Construction Traffic

- effective vehicle cleaning and specific wheel washing will be implemented for vehicles leaving site, wherever there is a potential for carrying dust or mud off the site;
- haul routes will be dampened down / swept when necessary;
- no site runoff of water or mud;
- hard surfacing and effective cleaning of haul routes and appropriate speed limit around site;
- routinely clean the public highway using wet sweeping methods during periods of dry weather;
- all loads entering and leaving site to be covered;
- minimise movement of construction traffic around site; and
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

Above-Ground Site Activities

General:

- minimise dust generating activities;
- use water as dust suppressant where applicable;
- re-surface earthworks and exposed areas at the earliest opportunity;
- ensure vehicles working on site have exhausts positioned such that the risk of re-suspension of ground dust is minimised (exhausts should preferably point upwards), where reasonably practicable; and
- careful consideration should be given to the location and temperature control of tar and asphalt burners.

Material storage and handling:

- ensure slopes on stockpiles are no steeper than the natural angle of repose of the material and maintain smooth profile;
- cover, seed, seal, damp down or fence stockpiles to prevent wind whipping;
- ensure sand and other aggregates are stored in shielded areas and are not allowed to dry out;

- minimise the amount of excavated material held on site;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- avoid double handling of material wherever reasonably practicable.

Concrete:

- mix large quantities of cement, bentonite, grouts and other similar materials in designated areas which will be enclosed or shielded;
- silos to be provided with dust arrestment (bag or cartridge filters); and
- concrete crushers and/or concrete batchers should have a permit to operate.

Chutes and skips:

- where practicable use enclosed rubble chutes and conveyors, but preference is to be given to other, safer options;
- use water to suppress dust emissions from such equipment, where practicable; and
- sheet or otherwise enclose loaded bins and skips.

Cutting, grinding and sawing will be undertaken off site or below ground where practicable. Where work does take place on site, the following techniques will be used:

- all equipment should be fitted with a water suppressant system (where available);
- dust extraction should be used (or water damping) wherever dust may be generated; for example with stone cutting disc equipment;
- areas used to undertake cutting and grinding should be screened; and
- shears and guillotines or burners should be used in preference to disc cutters on activities such as re-bar cutting and decking.

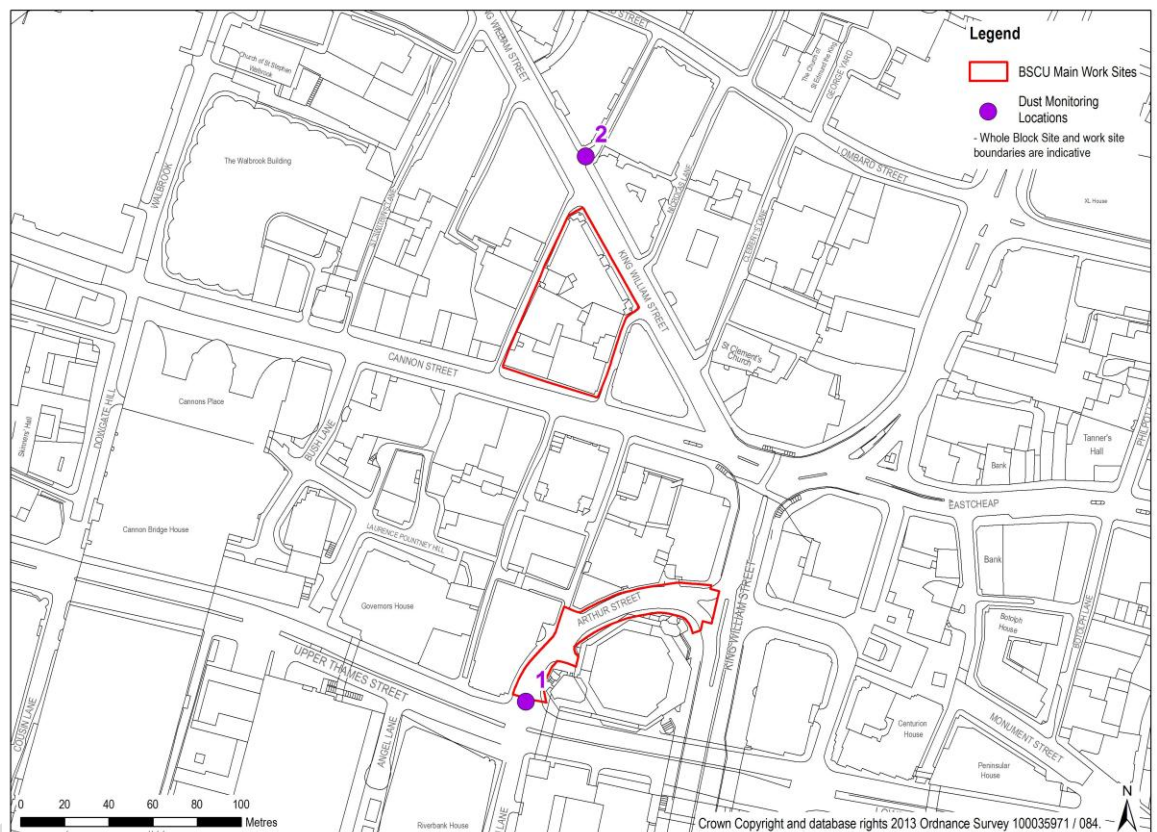
7.6 Monitoring Regimes – Dust

Dust Monitoring Regime

- 7.6.1 The Contractor will ensure that dust monitoring is carried out during construction, by trained and competent personnel.
- 7.6.2 Transect monitoring is proposed as the main method, however additional monitoring at a number of sensitive receptors may also be utilised if necessary.

A transect will be set up across the two sites according to the direction of the prevailing wind. Two automatic particulate monitors will measure PM₁₀ levels at either end of the transect. These instruments will provide data that can be downloaded in real-time. The proposed indicative transect monitoring locations are as shown in Figure 7.1.

Figure 7.1: Indicative Dust Monitoring Locations



1. Southern side of Arthur Street (upwind site); and
2. Junction of King William Street and Abchurch Lane (downwind site).

- 7.6.3 During 'high risk' construction events, it may be necessary to supplement the automated monitoring with hand-held monitors, particularly focusing on any sensitive locations.
- 7.6.4 As well as this, the Contractor will carry out visual dust deposition and soiling rate assessments within 100m of the boundaries of each of the work sites. These visual assessments will be subjective, with significance of soiling and need or not for corrective action determined by the opinion of the assessor and conditions present at that time / place.

Dust Management Regime

7.6.5 The Contractor will establish a dust management regime for both work sites, as well as other working areas as appropriate, to include:

- identifying a responsible person on-site for dust monitoring who can access real-time PM₁₀ data from automatic monitors;
- ensuring that adequate quality assurance/quality control is in place and that any identified causes that are not being undertaken in line with dust control procedures will be rectified where practicable;
- recording visual inspection of site activities, dust controls and site conditions in a daily dust log;
- dust monitoring data will be reported to the City of London Corporation on request, together with any complaints received and actions taken to deal with complaints; and
- to ensure plans are co-ordinated and dust and particulate matter emissions are minimised, liaison with site managers and / or environment managers of other major high risk construction sites within 500m both downwind and upwind of the site boundary will occur.

Procedures in the Event of Dust Limit Exceedance

7.6.6 The automated survey instruments used will operate an alert (PC based or mobile phone) should a predetermined site action level(s) be reached. The site action level(s) will be determined with the agreement of the City of London Corporation. If the alert is triggered the following actions will be taken:

- the nominated person or someone delegated by the nominated person will as quickly as reasonably practicable investigate activities on the site to ascertain if any visible dust is emanating from the site or activities are occurring that are not in line with dust control procedures;
- if activities are occurring that are not in line with dust control procedures this will be rectified where practicable;
- any identified causes will be rectified where practicable. Actions will be recorded in the site log book and the City of London Corporation notified of the incident and actions as soon as practicable, but within seven days (unless otherwise agreed);
- if no source of the incident is identified by the Contractor, the City of London Corporation and/or Automatic Urban and Rural Network (AURN) monitoring sites will be interrogated to establish if there is a wider area increase in particulate concentrations; and
- if the cause of the alert is not related to site operations the outcome of any investigation will be recorded in the site log book and reported to the City of London Corporation at the time of the regular dust reporting.

8 Land Contamination

8.1 Introduction

8.1.1 As the areas in which works will take place have long been developed, primarily for commercial purposes (office uses), the likelihood of significant contamination in soils and groundwater beneath the site is considered to be low. The most likely source of contamination arises from Made Ground in shallow soils.

8.1.2 The BSCU could therefore disturb existing land contamination and spread / cause further contamination if not managed appropriately. Contamination could potentially affect groundwater, surface water and human health and safety.

8.2 Protective Works

8.2.1 If any contamination or ground gas is identified or suspected (e.g. unusual appearance, smell etc.) during the course of the BSCU, the Contractor will implement a response plan and undertake further specific investigations. Where ground contamination is identified, the City of London Corporation Pollution Team will be notified. Where ground-water contamination is suspected, Environment Agency and City of London Corporation Pollution Team will be contacted and the next steps agreed.

8.2.2 To enable classification of the waste for disposal purposes, analysis of the waste material will be arranged and appropriate disposal undertaken in conjunction with the Waste Manager. If material is found to be contaminated, its appropriate storage before removal from site will ensure no cross contamination with non-contaminated materials.

8.3 Unexploded Ordnance

8.3.1 MACC International Ltd produced an Unexploded Ordnance (UXO) Desk Study in October 2011. The desk study identified a credible UXO threat to intrusive engineering works. The current risk level is considered to be Medium to High, in the risk depth 0–8m; therefore a robust UXO mitigation strategy will be implemented by the Contractor to permit the work to proceed in the safest 'acceptable' manner.

8.3.2 Mitigation will be applied to intrusive engineering works which represent a UXO risk pathway in order to reduce the level of UXO risk to an acceptable level. The following general mitigation measures will be carried out prior to any work taking place on the two work sites:

- risk communication: stakeholders will be made aware that the risk of encounter is considered high and the possible impact it may have on the project;
- risk planning: production of a UXO site safety and emergency procedures plan; and
- safety training: UXO Safety Induction Training will be provided to everyone working at the site on an activity, e.g. ground works, where there is an identified UXO risk. The training will be provided by a qualified Explosive Ordnance Disposal (EOD) Engineer and delivered as a separate module of the Site Safety Induction Course.

8.3.3 The Contractor will ensure that UXO safety monitoring is undertaken wherever a risk of UXO is identified; this will be conducted by a qualified EOD Engineer using a specialist magnetometer. The technique will vary depending on the type of intrusive engineering work. Specific activity mitigation measures will be reviewed prior to starting work.

8.3.4 Any suspect devices encountered must be notified to the City of London Corporation Police and/or Metropolitan Police. All site work must be stopped and the site evacuated until such time as the matter has been appropriately dealt with and the site declared safe.

9 Waste and Materials Handling and Storage

9.1 Introduction

9.1.1 The Contractor will manage construction and excavation waste at the work sites in accordance with the waste hierarchy. The principal objectives of sustainable resource and waste management are to use material resources more efficiently, reduce waste at source and, through recycling and other means, reduce the quantity of waste that requires final disposal. These are translated to the BSCU as: the application of designing-out waste principles to minimise construction waste; the segregation of construction and excavation materials; and the use of a suitable waste contractor to maximise diversion from landfill via re-use, recycling and recovery.

9.1.2 Waste from the construction of the works will be dominated by excavated material. Waste management measures will be prepared that facilitate the reuse of excavated material and diversion of waste from landfill in line with the waste hierarchy. Excavated material that is either uncontaminated or which can be remediated to a suitable standard and can be used for site engineering and restoration purposes will be managed in accordance with the controls specified by the *CL:AIRE Definition of Waste: Development Industry Code of Practice* (Contaminated Land: Applications In Real Environments (CL:AIRE), 2011). This will help to maximise opportunities for re-use of excavated material.

9.2 Site Waste Management Plan

9.2.1 A Site Waste Management Plan (SWMP) will be developed and will be utilised as an internal waste management and monitoring tool during the course of the project. The purpose of a SWMP is to assist in forecasting and managing waste materials efficiently, ensuring the legal disposal of waste, and that material recycling, reuse and recovery is maximised in accordance with the waste hierarchy.

9.3 Measures to Reduce Potential Impacts from Waste

9.3.1 Alongside minimising material use and waste generation during the project, the Contractor will also ensure the potential impacts from the waste it does produce is minimised by implementing best practice in the classification, storage, transfer and disposal of waste. The Contractor will ensure staff are suitably trained to undertake these duties, which will include, but will not be limited to, waste management handling, inspection and reporting.

Identification and Classification of Waste

9.3.2 Where generated, waste will be classified in accordance with the statutory controls governing the management of inert, non-hazardous and hazardous wastes. These will be identified in the SWMP along with the quantities of each waste type likely to arise during the project. This will ensure compliance with legislation and ensure waste is handled and disposed of correctly.

Segregation and Storage of Waste

9.3.3 The Contractor will take the following steps to ensure the safe and secure storage of different waste streams:

- skips and storage receptacles will be sheeted, or otherwise remain lidded or closed, during times when waste is not being deposited into them. They will also be covered to prevent the escape of waste whilst in transit and loaded (but not overloaded) for maximum payload efficiency;
- skips and storage receptacles will be inspected on arrival to ensure they are fit for purpose. Skips and storage receptacles that are not fit for purpose will be taken out of use immediately with appropriate signage used to signify that they should not be used;
- mixing of inert, hazardous and non-hazardous wastes, either whilst stored on-site or upon collection, will be avoided;
- liquid wastes will be stored on hard-surfaced areas using secondary containment systems to prevent spillages. For fuels this should be in compliance with the *Control of Pollution (Oil Storage) Regulations 2001*;
- non contained waste will not be stored within 10m of any surface water drainage system or foul water drainage system; and
- the storage and segregation of waste will comply with any air quality management measures outlined above that are necessary to prevent harm to human health, amenity and the environment through nuisances such as dust, odour or pests.

9.3.4 If space permits at the work sites, skips and other storage receptacles used for the containment of waste will be colour-coded / signed to facilitate separation of waste for re-use and recycling. However it is more likely, given the very limited space available at both work sites, that waste will be sent off site for segregation and recycling. Off-site segregation would not affect the percentage recycled.

9.4 Duty of Care Requirements and Authorisations

- 9.4.1 The Contractor will maintain a duty of care at all times to ensure that waste generated is handled in accordance with the relevant legislation governing its storage, transfer, treatment and disposal.
- 9.4.2 Provision will be made for a suitable environmental specialist to identify any hazardous wastes, so that they can be suitably managed and disposed of during the BSCU.
- 9.4.3 The Contractor will put in place all relevant authorisations prior to the removal of any waste from site and maintain a register of this information. This will be in relation to the transfer of waste (waste carriers); any off-site waste management facilities (permitted or exempt sites) to which waste is taken to and any requirements for hazardous waste premises notification. The Contractor will also ensure that an environmental permit or registered exemption is in place prior to any on-site treatment of BSCU waste being undertaken.
- 9.4.4 Any waste leaving the work sites will be accompanied by appropriate duty of care documentation in line with the relevant statutory requirements for waste transfer and hazardous wastes (as appropriate). Duty of care documentation will be retained for two years. A sample Waste Transfer Note is provided in Appendix B. However it is worth noting that the national electronic duty of care (edoc) programme commenced in January 2014. edoc is a four year programme to develop a national, internet-based system to monitor the collection, transportation and disposal of waste materials across the UK. It will offer an alternative that will transform the existing paper-based system of waste transfer notes, modernising the way that waste data is collected in the UK. It is anticipated that by 2016 the project may be utilising electronic Waste Transfer Notes rather than the paper example being referred to.
- 9.4.5 The Contractor will maintain a register of all waste loads leaving the work sites to provide a suitable audit trail and to facilitate monitoring and reporting of waste types, quantities and management methods.

10 Water Resources and Flood Risk

10.1 Introduction

10.1.1 The project will implement working methods to protect surface and groundwater from pollution and other adverse impacts including change to flow volume, water levels and quality. Thus the Contractor will manage surface water and groundwater to protect drains/sewerage and groundwater resources, together with employing appropriate monitoring systems and emergency procedures.

10.2 Protective Works

Groundwater

10.2.1 The BSCU construction involves excavations through the shallow aquifer. This includes the Arthur Street Shaft that will be 40m deep with piled walls. Therefore it is deemed that the shallow aquifer and any supported receptors could be impacted by the BSCU.

10.2.2 The construction does not involve excavations into the deep aquifer or dewatering of the deep aquifer. Therefore the works will not impact the deep aquifer and supported receptors, such as licensed groundwater abstractions. The BSCU are not expected to increase contamination risks to Controlled Waters as works will not extend beneath the London Clay Formation.

10.2.3 The Contractor will comply with *BS 6031 Code of Practice for Earthworks* regarding the general control of site drainage including all washings, dewatering, abstractions and surface water run-off, unless otherwise agreed.

10.2.4 Tunnelling undertaken as part of the BSCU will be carried out by excavation and with the use of sprayed concrete lining.

10.2.5 Any groundwater seepage into the below ground works will be diverted and managed appropriately.

Surface Water

10.2.6 Waste water generated from site activities including water from dewatering excavations, site run off slurry and bentonite are classified as trade effluent. The Contractor will manage and dispose of foul water effluents from the work sites as follows:

- by preference, connection to the local foul water sewer (to be agreed with Thames Water and in a manner adhering to the conditions of the permit obtained); and/or
- containment by temporary foul drainage facilities and disposal off-site by a licensed contractor.

- 10.2.7 Contact will be made with the City of London Corporation Drainage Services Group and Thames Water before any work is undertaken on connections to sewers or drains running under the public highway. Any work will be in accordance with the requirements of the City of London Corporation *CoP*, including sealing off redundant sewers, surveying and testing retained sewers, and provision of new sewers to the required standards. Where piling or excavation is potentially within three metres of a public sewer, the contractor will make an application to Thames Water in accordance with *Buildings Regulations 2010, part H4*.
- 10.2.8 Silty water arising from the washing of plant, equipment and surfaces will be re-used if appropriate or be appropriately disposed of.
- 10.2.9 In relation to storage of any oil-based materials including petrol, diesel, waste and above ground fuel and oil storage tanks (where over 200 litres), the Contractor will comply with the *Control of Pollution (Oil Storage) (England) Regulations 2001*, as amended, and the Environment Agency publication, *Pollution Prevention Guidelines 2: Above Ground Oil Storage Tanks (PPG 2)*. The following is based upon PPG 2:
- positioning – place away from open drains and loose fitting manhole covers or in places where split oil could soak into the ground;
 - specification – containers should be made of a material that is suitable for the type of oil stored; of sufficient strength and structural integrity to ensure that it will not burst or leak in ordinary use; has a way of preventing drain down by gravity e.g. top off-take and / or isolating check valves;
 - secondary containment – will be a minimum of 110 per cent of the volume of oil the inner container is designed for (or the largest container within the bunded area as appropriate) where 200 litres or more is stored; and
 - ancillary equipment – will be positioned within the secondary containment.
- 10.2.10 The Contractor will comply with the Environment Agency publication, *Pollution Prevention Guidelines 26: Drums and Intermediate Bulk Containers in relation to chemical storage, handling and use*, as summarised in Figure 10.1.

Figure 10.1: Chemical Storage, Handling and Use

<i>Know what you have in store</i>	<ul style="list-style-type: none"> • Label all storage with what's stored in it and any hazard it poses • Keep an up to date inventory of the materials on site and what volume
<i>Safe storage</i>	<ul style="list-style-type: none"> • Ensure primary containers are fit to do the job • Use an impermeable secondary containment system (SCS) , ensuring the location, capacity, design and construction of your SCS is suitable • Take care if storing hazardous substances, flammable liquids - special precautions may be required
<i>Delivery and handling of containers</i>	<ul style="list-style-type: none"> • Label materials delivery and handling areas • Isolate these areas from surface water and groundwater • Supervise all deliveries and material transfers
<i>Primary and secondary container maintenance</i>	<ul style="list-style-type: none"> • Inspect weekly to make sure that they: are not leaking, corroded or damaged in any way; all hazard signs are undamaged; the bund or drip tray is clean and clear; and the containers are safely stored. • Defects should be repaired promptly or the container should be taken out of use immediately.
<i>Disposal</i>	<ul style="list-style-type: none"> • Duty of Care to ensure it's disposed of correctly • Register as a hazardous waste producer (if $\geq 500\text{kg}$ of hazardous waste is produced in any 12 months) • Illegal to dilute or mix different categories of wastes and you must store them separately.

10.2.11 Stationary plant will be provided with measures such as drip trays or absorbent 'plant nappies' to retain any minor leakage of oil or fuel, which will be checked, and if necessary, emptied at regular intervals to prevent overflow.

10.2.12 Spillage kits will be stored at key locations on the work sites. Spillage kits will also be kept with mobile fuel bowsers. Staff will be trained in their use.

10.2.13 Concrete wash waters typically have a high pH (11-12), high suspended solids, and other trace materials (some originating from cement, others from additives or from the mixing equipment). The Contractor will minimise the amount of wash water produced and, where possible and practicable, reuse it on site. Wash waters that cannot be reused on site will be treated via a 'siltbuster' type plant or similar where necessary, before being discharged to foul sewer in accordance with the Thames Water trade effluent consent.

10.2.14 Any water supply pipes accidentally damaged during construction will be repaired or replaced as quickly as reasonably practicable by the statutory undertaker.

10.2.15 The contractor will design the worksite to minimise the likelihood of runoff from site causing a nuisance to users of adjacent roads and footways.

10.3 Monitoring Regimes

10.3.1 Groundwater monitoring plans and corrective actions will as necessary be developed and implemented to enable the effectiveness of mitigation measures to limit pollution risk to be monitored and any pollution incidents to be identified.

10.3.2 Periodic monitoring of discharges will occur to ensure compliance with the discharge consent / licence.

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11 Sustainability and Preservation

11.1 Climate Change and Sustainability

11.1.1 The Contractor will implement working methods that reduce energy consumption and aim to continually improve energy efficiency on the working areas

11.1.2 This will include where practicable but not be limited to:

- avoiding unnecessary day and night time site, accommodation and office lighting;
- installing energy efficient security and task lighting, e.g. Light Emitting Diodes (LEDs);
- providing well insulated site accommodation; and
- metering, data collection, communication and reporting.

11.1.3 The following table provides a range of key energy saving measures to be implemented during the works where practicable:

Table 11.1: Potential Energy Saving Measures

Potential Measures: Construction Energy	Feasibility	Potential for Energy /CO ₂ Savings	Note
Minimising the use of diesel or petrol powered generators and instead using mains electricity or battery powered equipment	High	Medium	A high capacity grid connection secured early within the project stage. The electricity substation currently below 20 Abchurch Lane to be retained for temporary power during the construction.
Power-down equipment/plant when not in use	Medium	Medium	Where not detrimental to the running or lifecycle of plant, switch off all engines/power when not in use.
Recommended vehicle and plant servicing	High	Low	Ensure all vehicles and machinery is serviced at recommended intervals to guarantee optimum engine efficiencies and reduce waste energy.
Select energy efficient plant	High	Medium	Fuel-efficient plant, machinery and vehicles used wherever possible.

Potential Measures: Construction Energy	Feasibility	Potential for Energy /CO ₂ Savings	Note
Maximise vehicle utilisation	Medium	Medium	All vehicles and plant are to be fully loaded before starting a cycle or trip where practicable to ensure minimum run-time and efficient use of capacity.
Keep spent fuel record	Medium	Low	Maintain records of all fuel used by site plant, machinery and vehicles to determine usage characteristics.
Use low carbon fuelling options	High	Medium	Biodiesel or ultra-low sulphur diesel alternatives used wherever possible.
Set energy targets	High	Low	Set SMART targets for site energy consumptions and make them clearly visible to the entire workforce.
Metering of energy usage	Medium	Low	Collect metered data on all non-plant related energy usage and monitor usage characteristics.
Specify smart controls for offices and welfare spaces	Medium	Low	Install smart controls for lighting and heating of non-plant related energy usage including timers and motion sensors.
Correctly size generators	High	Medium	Deploy correctly sized generators for electrical provision on-site, where applicable.
Efficient lighting and small power	High	Medium	Use low-energy equivalents of common equipment, e.g. low-energy lighting and efficient air heaters.
Provide well insulated site accommodation.	Medium	Low	Provide appropriate levels of thermal insulation to the relevant areas of site accommodation to reduce energy consumption associated with heating.

11.2 Archaeology and Built Heritage

- 11.2.1 During construction, lorry movements will be concentrated on Cannon Street and to the east, away from the majority of heritage assets which are concentrated to the west of the work sites. Site hoardings erected to all the boundaries of the work sites will be of high quality.
- 11.2.2 Any appropriate archaeological investigation or mitigation measures will be undertaken in accordance with an Archaeological Project Design and Written Scheme of Investigation prepared and approved in advance with the City of London Corporation's Historic Environment Advisor. This may include general or targeted watching briefs, trial trench evaluation and / or detailed excavation.
- 11.2.3 The Contractor will carry out the works in such a way as to ensure that disturbance to potential archaeological sites and deposits will be managed in accordance with the aforementioned.
- 11.2.4 The Contractor will carry out the works in such a way as to minimise the risk of damage to listed buildings and scheduled monuments.
- 11.2.5 The Contractor will design and carry out construction of the project in a manner that will minimise the impact on buildings and third party infrastructure as a result of ground movement. The Contractor will reduce, control and limit ground movement.
- 11.2.6 The Contractor will design and install instrumentation and monitoring to confirm that ground movements and construction impacts are as predicted and acceptable and to provide advance warnings where significant deviation from predicted movement occurs. Monitoring will be carried out in a number of locations prior to commencement of construction work to enable baseline values to be established and will continue until settlement due to the works, as shown by the monitoring, has effectively ceased.
- 11.2.7 Further information is provided on Settlement (and Monitoring) within section 14 of this document.

11.3 Trees and Wildlife

- 11.3.1 Site inspections were made by experienced ecologists to the work sites in 2011 and again in August 2013. The surface areas of the two sites are almost entirely covered by buildings or hard surfacing. There is one tree and a small amount of vegetation adjacent to the Arthur Street Work Site. However the investigations indicate that nothing of ecological or nature conservation interest will be affected by the works.
- 11.3.2 Where any unexpected species (e.g. nesting birds) are identified by any personnel on site, all works within that area that have the potential to impact

upon the species shall cease immediately. Site management will be immediately informed and they will contact an ecologist. No further work may take place within that specific area until permission has been given by an ecologist and site management.

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12 Townscape and Visual Amenity

12.1 Work Sites External Perimeters

- 12.1.1 To reduce visual effects due to the presence of construction traffic, plant and equipment, as well as the removal of old and introduction of new built fabric, the work sites will be surrounded by hoarding to create an orderly appearance and reduce as far as possible any negative effect on townscape and visual amenity.
- 12.1.2 The hoarding will be used to display publicity material about the development including the telephone contacts for the developer's / Contractor's site representatives and other key personnel of use for information or reporting purposes. Furthermore, the hoarding will have strategically placed observation windows to allow the public to view progress on site.
- 12.1.3 When there is any extended period of no working at either site then a notice will be placed on the hoarding to advise the public as to why there is no working at that time.
- 12.1.4 The hoarding will be maintained in good condition throughout the length of construction works; with any graffiti and fly-posting removed promptly.
- 12.1.5 Hoardings around the main working areas shall generally be 3.6 metres high and in all cases shall be a minimum of 2.4 metres high. Where material benefit can be demonstrated and it is practicable, the contractor will consider utilising hoarding materials which offer enhanced acoustic performance in comparison to plywood/timber. In addition, consideration will be given to the provision of clear perspex sections where advantageous (e.g, to provide natural light to otherwise largely enclosed sections of footway). Areas of temporary works away from the main working areas shall be surrounded by temporary fencing, generally equipped with acoustically insulating panels where practicable.
- 12.1.6 The strict control of access is paramount for safety and security on site. Manned security points will control both operative and personnel access at both work sites.
- 12.1.7 The public will be protected from works along all footways through the use of hoarding and, at certain stages of the works, gantries.
- 12.1.8 The roads providing access to the work sites will be maintained free of excessive dust and mud as far as is reasonably practicable, as described below. The surrounding roads and pavements will be maintained to a reasonable standard.
- 12.1.9 To help keep areas outside the work sites tidy, the Contractor will work to maintain the sites outside perimeters free of litter. This will be checked weekly.

12.2 Work Site Interiors

- 12.2.1 Surrounding buildings will provide view points over the work sites and as such the internal image of the sites will need to be maintained. As far as is reasonable given the nature of the works, the work sites will be organised, clean and tidy, and maintained by good housekeeping. This will include regularly clearing litter across the sites.
- 12.2.2 Arrangements will be implemented to provide effective preventative pest control and prompt treatment of any pest infestation.

12.3 Lighting / Light Pollution

- 12.3.1 The Contractor will have regard to the impact site lighting could have on surrounding receptors and ensure it is located and aligned so as to minimise intrusion into residential properties or constitute a road hazard.
- 12.3.2 The Contractor will also provide lighting to site boundaries, with illumination sufficient to ensure the safety of the passing public, including disabled people. In particular, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas.

13 Highways and Access

13.1 Introduction

13.1.1 The Contractor will ensure that works affecting highways are appropriately consented and will undertake the works in such a way as to maintain, as far as reasonably practicable, existing public access routes and rights of way during construction. The Contractor will limit undue inconvenience to the public as far as reasonably practicable whilst carrying out the BSCU. Any advance works required prior to the passing of the TWAO, or works outside of the TWAO Limits within the highway, will be consented through the usual City of London Corporation and Transport for London procedures.

13.2 Traffic Management Plan

13.2.1 A Traffic Management Plan (TMP) (or equivalent) will be produced, co-ordinated and implemented. It is assumed that the TMP(s) will require approval by condition of the TWAO consent by the City of London. The TMP will include:

- details of how traffic will be managed during key phases of construction;
- type of construction vehicles needed, and when;
- access and parking arrangements for service and delivery vehicles;
- pedestrian, cyclist, bus and general traffic considerations; and
- appropriate plans to confirm details of proposed highway closures, diversion routes and traffic routes for works traffic and abnormal loads.

13.2.2 The TMP will be used to plan and co-ordinate activities so as to cause as little disruption, inconvenience and delay to highway users as practicable, without compromising safety. It will consider the safe and effective movement of pedestrians, cyclists and vehicles, both at the work sites and on the wider highway network where they are likely to be impacted by the BSCU to demonstrate how any additional interference with normal transport movements will be minimised.

13.2.3 A risk identification and assessment process will be undertaken as an integral part of the TMP to identify issues and determine control measures to manage the interface between the work sites activities and users of the public highway. Where specific hazards cannot be avoided, the risks they present will be minimised and controlled.

13.2.4 The Contractor will consult with all relevant stakeholders, including local residents and businesses, regarding the proposed traffic management arrangements required to facilitate the construction of the project. This will

allow alternative arrangements (if necessary) to be agreed and implemented in a timely manner.

- 13.2.5 The Contractor has identified the main access / egress points for the work sites as well as local routes to be used by lorries; details of these are provided in the sections below. Details of these will also be included in the TMP.

13.3 Key Details

- 13.3.1 To limit the construction traffic impacts from the work sites on local residents and businesses, wherever practicable:
- loading and unloading of deliveries will take place within the site boundary;
 - the Arthur Street work site will be used to regulate vehicle movements to the Whole Block site;
 - all vehicles will be booked in using a delivery management tool and deliveries will be timed to reduce the likelihood that vehicles have to park-up / wait outside of the site boundary; and
 - site workers will be encouraged to use public transport to get the site.

13.4 Strategic Routes

- 13.4.1 The strategic routes for construction traffic have been developed to ensure disruption to the road network in the City of London Corporation jurisdiction and surrounding areas is kept to a minimum. The figures overleaf show proposed access routes to the centre of London (Figure 13.1) and the strategic routes for inbound and outbound traffic to both work sites (Figure 13.2).
- 13.4.2 The Contractor will ensure that its heavy goods vehicle (HGV) drivers, as well as those of all sub-contractors, are fully advised of the approved routes (and relevant restrictions) prior to attending either work site. This information will be included in sub-contractors' contracts and re-iterated in site inductions. The Contractor will take a pro-active approach to ensuring drivers adhere to the agreed routes at all times during the construction of the development.

13.5 Site Access / Egress

Whole Block Work Site

- 13.5.1 The access / egress will generally be from Cannon Street. Separate traffic marshal-attended access and egress points will be provided to ensure HGVs can safely enter and leave the site without reversing.
- 13.5.2 A pedestrian entrance generally situated on Abchurch Lane will be provided for access to the site offices and worksite itself.

- 13.5.3 Pedestrian routes around site access and egress points will be provided and be clearly signed, thereby maintaining distinction between areas for pedestrians and areas for moving vehicles. Pedestrian access along Abchurch Lane will be maintained aside from several weekend closures. Nicholas Lane will have periods of temporary closure on part of its length during certain phases of the works, although pedestrian access to buildings off Nicholas Lane will be maintained.

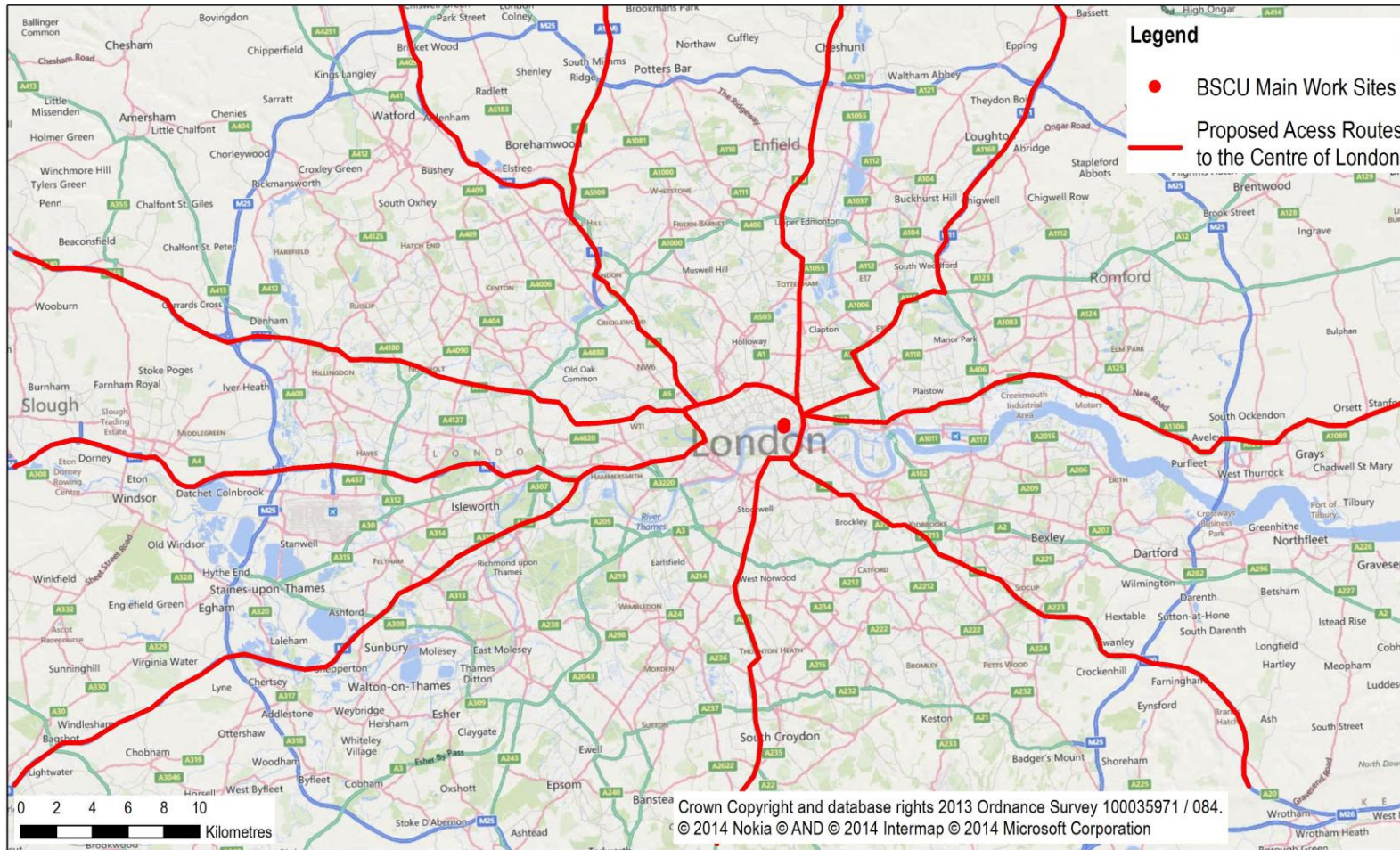
Arthur Street Work Site

- 13.5.4 All construction vehicles will use the Arthur Street Work Site, before as necessary, moving on to the Whole Block Site.
- 13.5.5 Access will be from Upper Thames Street then into Arthur Street. The main access point will be set back sufficiently to allow most construction vehicles to wait clear of Upper Thames Street before entry. It will also be manned by a traffic marshal.
- 13.5.6 The egress point will be on King William Street and be marshalled to ensure the safety of pedestrian and other road users when vehicles are leaving the site.
- 13.5.7 Again, these measures will ensure HGVs can safely enter and leave the site without reversing.

Traffic Diversions

- 13.5.8 The Arthur Street Work Site will prohibit (public) vehicular access on Arthur Street, and the traffic and bus diversions shown on Figure 13.3 will be put in place.
- 13.5.9 In addition, Arthur Street is used by the London Bus Route 15 (Heritage) if the bus gate at Great Tower Street / Lower Thames Street fails. Arrangements with London Buses have been made for a revised alternative route for this service.
- 13.5.10 Pedestrian access through Arthur Street and to building entrances along Arthur Street will be maintained. Furthermore, passage around the site along key pedestrian routes has been agreed with the City of London Corporation Highways Department during the planning of the BSCU.
- 13.5.11 The Contractor will work to support the servicing requirements for its affected neighbours along Arthur Street.

Figure 13.1: Proposed Access Routes to the Centre of London



Note that all access into the City of London is from the East. Vehicles entering Greater London will travel around to the East on the main orbital routes around and then travel in on the following local access routes.

Figure 13.2: Strategic Routes to and from Work Sites

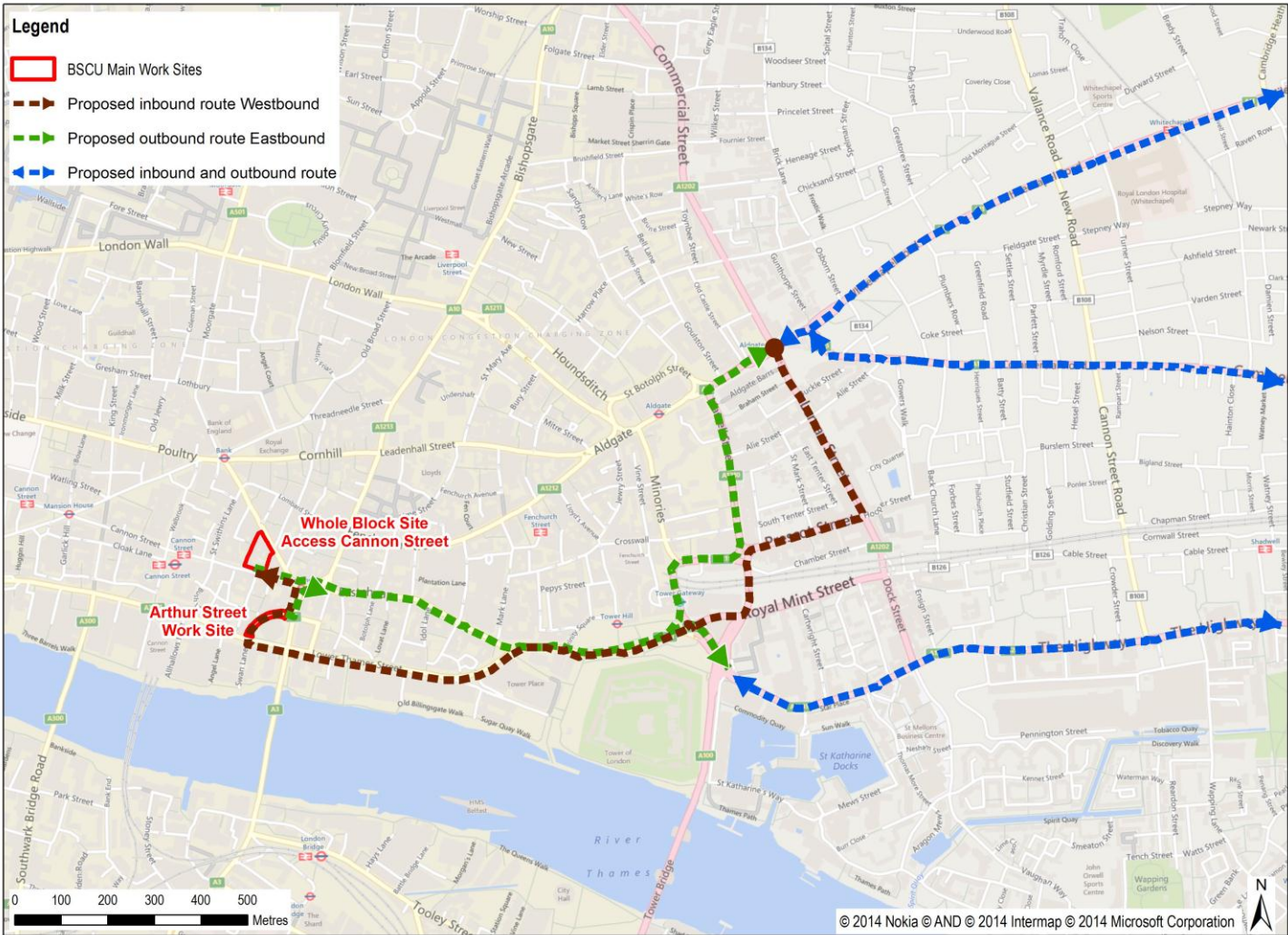
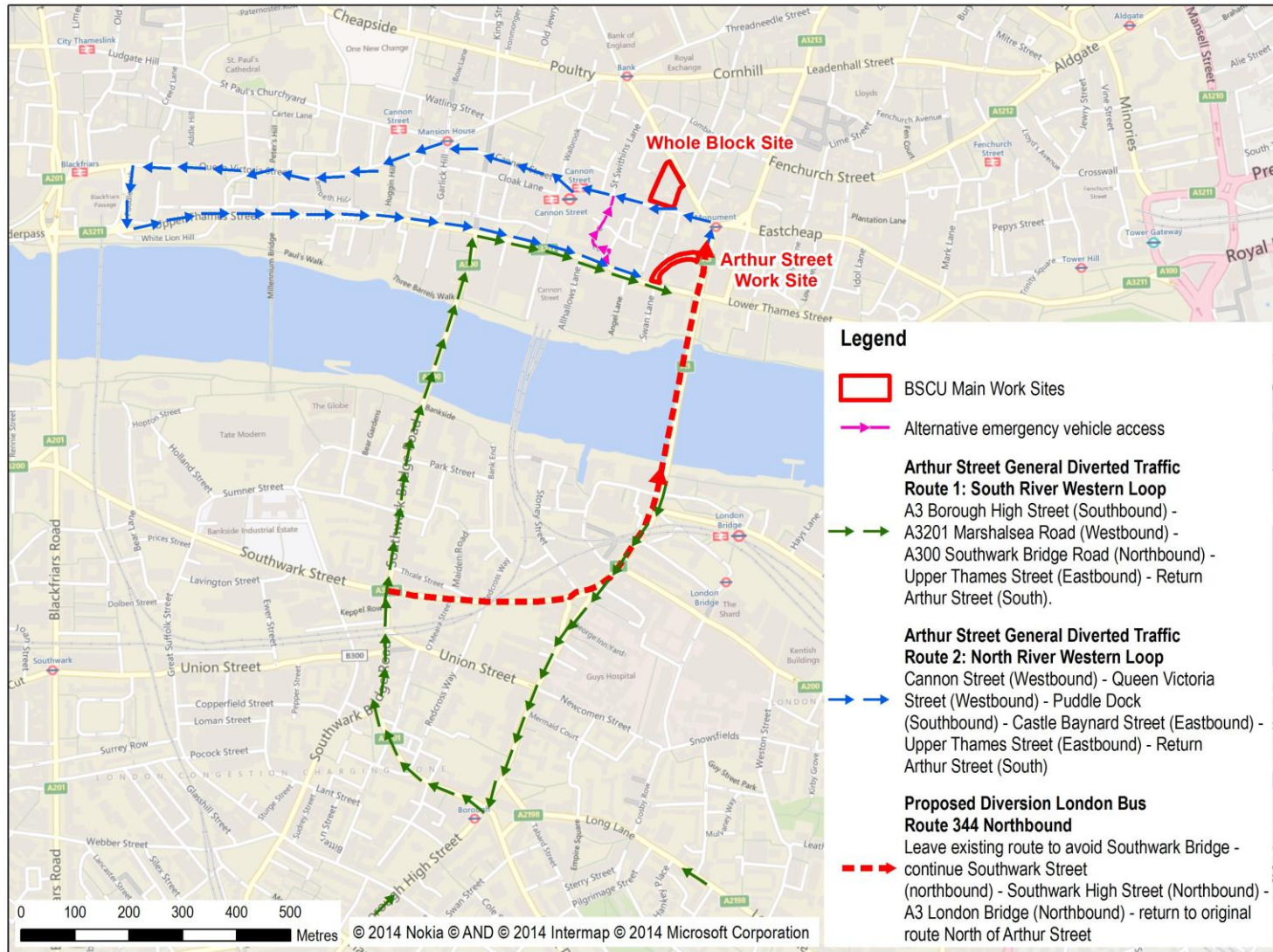


Figure 13.3: Traffic Diversions



Access for Persons with Restricted Mobility during Construction

13.5.12 The Contractor will, where reasonably practicable, work to provide persons with restricted mobility and those with other forms of disability, as specified in the *Disability Discrimination Act 2005*, continued access to services and buildings during the construction works. Where the normal means of access has to be diverted or blocked off, alternative safe routes for persons with restricted mobility will be sought, taking into account existing hazards and obstructions such as pavement kerbs and street lighting standards (lamp posts). Any alternative routes will be well signed, i.e. clear and easy to read by visually-impaired persons. Where particular difficulties are identified, arrangements will be made on a site by site basis.

13.6 Work Related Road Risk

13.6.1 The Contractor will ensure compliance to the Transport for London *Standard for Construction Logistics: Managing Work Related Road Risk* (2013).

13.6.2 The Contractor will become a Bronze member of the Fleet Operator Recognition Scheme (FORS), which is an accredited membership scheme for businesses operating van and lorry fleets. FORS offers impartial, independent advice and guidance to motivate members to improve their compliance with relevant laws and their environmental, social and economic performance. The Contractor will also ensure that any of its subcontractors or suppliers who operate freight vehicles comply with the FORS requirements.

13.6.3 The Contractor's vehicles will have appropriate safety features fitted including, as necessary, prominent signage on the rear of the vehicle to warn cyclists of the dangers of passing the vehicle on the inside; side guards; a close proximity warning system; and a Class VI mirror.

13.6.4 The Contractor will also ensure that its drivers are appropriately licensed and trained.

13.7 Green Travel

13.7.1 The Contractor will develop a green travel strategy and produce an associated Construction Worker Travel Plan prior to the start of construction. This will be an internal guidance document, the focus of which will be to encourage construction workers to use public transport to get to both work sites. Sub-contractors will be required to adhere to the strategy.

13.8 Works Affecting Highways and Public Rights of Way

13.8.1 The Contractor will comply with any relevant requirements before commencing works that will involve interference with the highway. Reinstatement works

shall be undertaken to standards suitable for highway adoption. (NOTE: 'Highway' includes all land vested in the relevant local authority or TfL for highway purposes including footways).

13.8.2 When undertaking highway works the Contractor will:

- limit temporary closures of highways and public rights of way to as short a time as reasonably practicable;
- maintain pedestrian access to premises (including for pedestrians with restricted mobility);
- provide diversion routes prior to the commencement of the works, which will be maintained to a comparable standard of those that they replace, or as far as is reasonably practicable;
- provide suitable signage and barriers for diversion works; and
- inform local residents and businesses in advance of the dates and durations of closures and, with the exception of emergency works, will be provided with details of diversion routes a minimum of two weeks in advance (or when final details are available).

13.8.3 The Contractor will co-operate with the City of London Corporation and Transport for London, as well as other development contractors, to maintain capacity of the network when there may be cumulative impacts from construction projects in the area.

13.8.4 Care will be taken to minimise the perceived or actual personal safety effects of hoardings and 'channelised' pedestrian routes around the perimeter of working areas. As appropriate, this will be achieved through measures including the selected use of clear/transparent panels within site hoarding, the provision of artificial lighting, and the use of CCTV.

13.9 Road Cleanliness

13.9.1 Reasonably practicable measures will be put in place to limit the deposition of mud and other debris on the highway. These measures will have regard to the nature and the use of the work sites and will likely include:

- hardstandings at the access and egress point which will be cleaned at appropriate intervals;
- vehicle wash down point to clean vehicle wheels at the exit point on to the highway, as necessary;
- the correct loading of vehicles and sheeting of loads where necessary to avoid spillage during their journeys; and

- the use of mechanical road sweepers combined with water sprays for the suppression of dust to clean site hardstandings and roads in the vicinity of the site exits.

13.9.2 After completion of any works affecting a highway, and on demobilisation from that area, all surplus materials arising from the works will be cleared from the highway, leaving it in a clean and tidy condition in accordance with the reasonable requirements of the highway authority.

13.10 Highway Reinstatement

13.10.1 Where temporary alterations to the highway are required, the highway will be restored to the reasonable satisfaction of the relevant highway authority. Surveys will be used to establish the condition of the highway prior to the commencement and after the completion of the works.

13.10.2 It is acknowledged that the Contractor will be held responsible for any damage caused to the highway by site activities and will be required to carry out the temporary or permanent reinstatement of roads, kerbs, footpaths and street furniture to the satisfaction of the City of London Corporation / Transport for London.

14 Settlement

14.1.1 Settlement is a term given to the way the ground moves in response to a change in its balance, for example where a tunnel is excavated. Construction of tunnels, shafts and basements causes movements in the ground.

14.1.2 The technique largely employed for the below ground construction works on the project - SCL has been selected as being a technique which minimises settlement. Settlement will further be controlled through careful planning and execution of the below ground works.

14.2 Assessment process

14.2.1 In order to understand the risk of damage to third party buildings and utilities, infrastructure within the zone potentially affected by ground movements have been assessed. This is an established part of the design process and involves using well established methods to assess the need for any mitigation works.

14.2.2 Assessments are carried out in accordance with industry best practice and London Underground Limited's established standards. Each assessment uses a staged process, summarised below.

- **Stage 1: Scoping**

Calculations are undertaken to identify the extent of the area where movement may occur due to the works. The results are presented as plan drawings setting out the 1mm surface movement contour with contours of worst case surface ground movement overlaid on the existing infrastructure. This assessment represents the worst case because the effect of buildings on the pattern of ground movement is ignored and conservative parameters are chosen which tend to overestimate ground movements.

- **Stage 2: Initial assessment**

Buildings and other infrastructure within the area identified as being within the 1mm contour in Stage 1 are analysed using simple engineering models to determine the degree of damage that could reasonably be anticipated. This assessment is based on consideration of the strains likely to be induced within the structure. Listed buildings are also assessed for their structural and heritage sensitivity.

- **Stage 3: Detailed assessment**

Detailed analysis of specific buildings or other infrastructure identified as being at risk of moderate damage or worse in Stage 2.

14.2.3 Initial assessment of the buildings and utilities in the vicinity of the BSCU has identified that the predicted settlement is unlikely to have a major detrimental

effect. There may however be minor effects in some buildings, which could include surface cracking or door sticking, which will require repair and redecoration at the project's cost.

14.3 Mitigation measures

14.3.1 In areas where significant damage risk is predicted, appropriate measures are identified and taken to limit the effects.

14.3.2 Depending on the findings of the assessment process the following types of mitigation may be undertaken during construction to protect buildings from the effects of ground movement:

- **Minimisation of ground movement at source**

A range of measures will be used during tunnelling and excavation works to reduce the magnitude of ground movements generated. The detail of the measures will depend on the type of construction involved. These include all actions taken from within the tunnel, shaft or box construction to reduce the ground movements generated at source. It is accepted industry practice that all reasonable measures are employed as a matter of course when undertaking works in an urban environment. This is the case on the BSCU project. Measures that will be variously applied by the contractor to minimise settlement include:

- fast ring closure,
- excavating in small steps,
- face support/ dowelling; and
- excavating in small face areas if necessary.

- **Ground treatment measures**

These comprise methods of reducing or modifying the ground movements generated by tunnelling, or excavation, by improving or changing the engineering response of the ground during works.

Categories of ground treatment include: compensation grouting (injecting grout into the ground above the tunnel to counteract the settlement), maintaining the building position; permeation or jet grouting (involving modification of the actual ground, creating a stiffer ground to reduce movement).

- **Structural measures**

Structural measures require modification or strengthening of the building to better resist or accommodate ground movements. It is not expected that structural mitigation measures will be necessary on BSCU except in certain isolated cases. At these locations, tunnelling will intersect deep

foundations to buildings known as 'piles' necessitating structural modification.

14.4 Provisions in relation to Listed buildings

14.4.1 Specific consideration will be given to buildings which are listed as being of special architectural or historic interest in order to protect the building and any sensitive heritage features contained within.

14.4.2 The specific mitigation measures to be used for each building will be determined during the detailed design and construction phases, and will be tailored to the particular needs of a building and the risks presented to it.

14.5 Pre-construction defect surveys

14.5.1 Condition surveys are undertaken prior to any work taking place so that any effects to buildings can be monitored and addressed as appropriate. A condition survey is only undertaken with the building owners consent. A defect survey would usually be undertaken on any property predicted to experience 10mm or more of settlement prior to tunnelling works commencing. Further, it is likely that all properties anticipated to experience 1mm or more of settlement would be surveyed. This is a written and photographic record of the existing condition of finishes and structures and is carried out by an appropriately qualified engineer or surveyor working jointly for the promoter of the works and the owner of the building. Owners of properties where defect surveys are required are contacted in advance to arrange access, however the survey is not undertaken until shortly before the start of construction activities that could affect the building.

14.6 Monitoring

14.6.1 The Contractor will establish a monitoring scheme across the area affected by the works to verify that construction effects fall within predicted parameters. The need for specific building monitoring will be determined on a case-by-case basis as part of the assessment process.

14.6.2 Typical instrumentation on roads and pavements will include extensometers, inclinometers, piezometers and precise levelling studs. Typical instrumentation on structures will include precise levelling sockets, automated total stations, prisms, electrolevels, tell tales, crackmeters, tape extensometers, water settlement systems and tiltmeters. In some cases additional monitoring may be required to monitor sensitive features of a structure.

- 14.6.3 All instruments will be strategically placed to:
- minimise disruption on Stakeholders;
 - ensure that the instruments are readily accessible for monitoring and maintenance; and
 - obtain optimum results for the control of settlement on the project.
- 14.6.4 All building owners will be provided with a copy of the risk assessment and method statement for the installation prior to it commencing.
- 14.6.5 Monitoring will begin prior to the start of the works and continue until movement attributable to the works has ceased to be measurable.

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- United Kingdom Statutory Instrument (SI) 2001/1701. *The Noise Emission in the Environment by Equipment for use Outdoors Regulations 2001 (as amended).*

Appendix A: Site Hours Variation Request Sheet



Department of Markets and Consumer Protection

Port Health and Public Protection – Pollution Team
 City of London, PO Box 270, Guildhall, London EC2P 2EJ
 Normal and Out of Hours Contact No: 020 7606 3030
publicprotection@cityoflondon.gov.uk

SITE HOURS VARIATION REQUEST SHEET

This form must be completed and returned to the Pollution Team at least 5 days before the activities are to take place. The site hours requested can only be worked if approval is given and this form is countersigned by relevant Environmental Health Officer(s).

Date:				
Company:				
Company Contact:				
Company Contact for Operation:				
Site Name and Address:				
Direct Number:				
e-mail address:				
Operation(s) including location on site:				
Date of operation(s)				
Proposed Working hours:				
Company contact(s) for operation(s):				
Details of operation(s):				
Reasons for the operation(s):				
Plant and/or tools used:				
Predicted noise levels at sensitive location¹	Location	High	Medium	Low
Mitigation measures to minimise high and medium levels of noise:				

Appendix B: Sample Waste Transfer Note

Duty of care: waste transfer note Keep this page and copy it for future use. Please write as clearly as possible.

Section A – Description of waste

A1 Description of the waste being transferred

List of Waste Regulations code(s)

A2 How is the waste contained?

Loose Sacks Skip Drum

Other _____

A3 How much waste? For example, number of sacks, weight

Section B – Current holder of the waste – Transferor

By signing in Section D below I confirm that I have fulfilled my duty to apply the waste hierarchy as required by Regulation 12 of the Waste (England and Wales) Regulations 2011 Yes

B1 Full name

Company name and address

Postcode _____ SIC code (2007) _____

B2 Name of your unitary authority or council

B3 Are you:

The producer of the waste?

The importer of the waste?

The local authority?

The holder of an environmental permit?

Permit number _____

Issued by _____

Registered waste exemption?

Details, including registration number

A registered waste carrier, broker or dealer?

Registration number _____

Details (are you a carrier, broker or dealer?)

Section C – Person collecting the waste – Transferee

C1 Full name

Company name and address

Postcode _____

C2 Are you:

The local authority?

C3 Are you:

The holder of an environmental permit?

Permit number _____

Issued by _____

Registered waste exemption?

Details, including registration number

A registered waste carrier, broker or dealer?

Registration number _____

Details (are you a carrier, broker or dealer?)

Section D – The transfer

D1 Address of transfer or collection point

Postcode _____

Date of transfer (DD/MM/YYYY) _____

D2 Broker or dealer who arranged this transfer (if applicable)

Postcode _____

Registration number _____

Time(s) _____

Transferor's signature _____

Name _____

Representing _____

Transferee's signature _____

Name _____

Representing _____

Appendix C: Schedule of Known Residential Properties

The below table lists residential properties that have been identified within proximity of the main above ground working areas (the Arthur Street and Whole Block worksites).

Nearest Main Worksite	Residential Properties
Arthur Street	6 Martin Lane (apartment above public house)
	28 Martin Lane (3x apartments above office buildings overlooking Arthur Street)
	Fishmongers Hall (residential on 2 nd and 3rd floor - Clerks and Stewards Flats, London Bridge)
	5 Laurence Pountney Lane
	7a Laurence Pountney Lane
Whole Block Site	1 Abchurch Yard (apartments)
	St Swithin's Lane (serviced apartments)
	83/86 Cannon Street (apartments above retail premises)