NORTH LEWISHAM HEAT NETWORK

ELEMENT A - ROUTE OPTIMISATION STUDY

CONFIDENTIAL

WSP | PARSONS BRINCKERHOFF

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ELEMENT A - ROUTE OPTIMISATION STUDY

London Borough of Lewisham

Final
Confidential

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FIGURES

APPENDICES

ABBREVIATIONS

°C	degrees celsius
ADE	Association of Decentralised Energy
CHP	Combined Heat and Power (engine)
COP	UK Heat Networks Code of Practice
DHW	Domestic Hot Water
DH	District Heating
DN	Nominal diameter
EfW	Energy from Waste
EHV	Extra High Voltage
GPR	Ground Penetrating Radar
GW	Gigawatt
GWh	Gigawatt-hour
HIU	Heat Interface Unit
HV	High Voltage
IP	Intermediate Pressure
kW	Kilowatt
kWh	Kilowatt-hour
kWth	Kilowatt of thermal energy
LBL	London Borough of Lewisham
LP	Low Pressure
LV	Low Voltage
m	metres
m^2	Square metre
m/s	metres per second
mm	millimetres
MW	Megawatts
MWh	Megawatt-hour
NJUG	National Joint Utilities Group
NLHN	North Lewisham Heat Network
NRSWA	New Road and Street Works Act
SCR	Surrey Canal Road
SELCHP	South East London Combined Heat and Power
SROH	Specification for the Reinstatement of Highway
p/kWh	pence per Kilowatt-hour
SH	Space Heating
SL	Street Lighting
SINC	Site of Nature Conservation
SSA	Strategic Site Allocation
TfL	Transport for London
TRA	Tenants and Residents Association
UKPN	UK Power Networks
UXO	Unexploded Ordnance
WRC	Waste Reception Centre
WSP | PB	WSP | Parsons Brinckerhoff

1 EXECUTIVE SUMMARY

Introduction

WSP | Parsons Brinckerhoff have been appointed by LB Lewisham to undertake a feasibility assessment for a heat network connecting the SELCHP energy from waste facility to a number of new developments in the north Lewisham area. This study is preceded by a WSP | Parsons Brinckerhoff feasibility assessment for a New Cross Heat Network linking the SELCHP energy from waste facility on Landmann Way with Goldsmiths University on New Cross Road.

The previous study concluded that a heat network linking only SELCHP with Goldsmiths and a small number of adjacent loads would not be economically attractive; however it also identified the potential for an expanded network that serves the large number of new developments in the north Lewisham area. A preliminary economic analysis concluded that this larger scheme would deliver a good return on investment. The purpose of this study is therefore to undertake the necessary technical analysis and to produce a more detailed economic analysis for this north Lewisham section.

The feasibility study is comprised of three elements. Element A – this study – is a route optimisation study comprised of several separate reports:

- Overall route optimisation report (this report)
- Preliminary ecological appraisal report
- Contaminated land report
- Archaeological constraints report
- Transport infrastructure impact assessment

This study continues from the point of interface with the previous study, which is the junction of Surrey Canal Road and Grinstead Road. The pipework running between SELCHP and this interface point (i.e. down Surrey Canal Road) was assessed in the previous feasibility study and the sizing included an allowance for the loads included in this North Lewisham extension study.

Methodology

The starting point for the study was an initial preferred route provided by LB Lewisham. The route runs down Canal Approach and along Evelyn Street between Convoys Wharf and the Marine Wharf and Cannon Wharf developments. We liaised with LBL planning officers to identify all of the ongoing or proposed developments in the area that should be considered for connection. Many of these developments are obligated under their planning conditions or Section 106 agreements to make provision for future connection of their heating systems to a district heating network. The estates identified through this process are as follows.

Development loads
Convoys Wharf
Cannon Wharf
Marine Wharf East
Marine Wharf West
Yeoman Street
The Wharves Deptford
Arklow Road
Neptune Wharf
Deptford Green school site

We interrogated the planning documentation for each of the development sites to identify the proposed energy centre location. Where development has already commenced, we contacted the developers to confirm the latest design information. The energy centre location within each development is assumed to be the point of interface with the district heat network. We then used these points of interface to identify the most direct route for the heat network.

Additional loads were also identified through consultation with Lewisham Homes and the *Element B* report from the previous New Cross Heat Network study, which proposed expansion options for the SELCHP to Goldsmiths system. Three schools and one social housing block were identified through this process. They are:

Additional loads
Sir Francis Drake primary
Deptford Park primary
Grinling Gibbons primary
Sayes Court

Full existing utilities mapping was procured in order to assess the extent and location of services throughout the area. We interrogated this mapping with particular focus on the roads identified for the most direct route between SELCHP and the development points of interface. The process highlighted sections of the network with high numbers of existing utilities or high risk services such as HV or EHV (extra high voltage) electricity and intermediate pressure gas mains.

Following a review of the utilities mapping, a site survey was undertaken. This included photographing key areas of the study area and noting the affected businesses along the most direct route and potential alternative routes. An LBL land ownership map was also sourced.

Based on the collated information, we reviewed the routing and proposed alternative options where necessary. We reviewed the findings of the other studies (contaminated land, ecology, archaeological heritage, transport impact) and factored these findings into our analysis and recommendations. We identified areas of engineering difficulty, which will be the subject of more detailed analysis in the Element B (design) study. We reviewed LBL land ownership mapping and identified points along the route options that would require wayleaves and we proposed a schedule of site investigations that would help to reduce the construction risk in areas of engineering difficulty or with a high volume of existing services. Finally, a preferred route was identified based on the outcomes.

Results

Although the initial preferred route utilises Canal Approach, we identified several difficulties in using it to install DH pipework. Firstly, it is a private road and would therefore require a wayleave,

although we have been unable to establish who owns the road through consultation with LBL departmental officers. Secondly, Canal Approach was once part of the Grand Surrey Canal. The contaminated land assessment identified the former canal as carrying a risk to health due to its use as historic landfill. The infill material used is a mix of inert, household and commercial waste and this poses a risk to operatives if large sections of it are excavated. Given these issues, and the potential for a soft dig route through Deptford Park, Canal Approach does not form part of the proposed route for the heat network.

In reviewing existing utilities mapping review, Evelyn Street was identified as being of particular concern due to the high number of services. This reflects its position as the main route running east-west through the area, making it something of a service corridor. Despite this, we have concluded that it would not be possible to completely avoid Evelyn Street; however certain route options do minimise its use:

1) Installing pipework through Deptford Park

2) Installing pipework through Marine Wharf West linear park

The use of Deptford Park would minimise the requirement to install in both Grinstead Road and Evelyn Street. This delivers the dual benefit of avoiding existing services in those carriageways and reducing the installation cost as the park would be soft dig excavation. We discussed this option with LBL parks officers, who commented that it may be possible to install through the park as it contributes to the Borough's strategic goals. They noted, however, that formal proposals would need to be discussed and local interest groups such as *Deptfolke* consulted. Key issues are likely to be: reinstatement quality, pipe routing within the park, avoidance of existing trees and whether the scheme could contribute towards improvement works elsewhere in the park.

The recently developed linear park within the Marine Wharf West development would further reduce the requirement for installation in Evelyn Street if pipework could be installed through it. This option was initially identified as the Marine Wharf West planning documents stated the intention to include ducting through the linear park to allow DH pipework to be brought onto the site; however we have confirmed with the developer that the ducts were not installed. As such, it would be necessary to re-excavate in order to install the pipework. An alternative route has been identified; however it is approximately 200m longer and requires installation through more of Evelyn Street. We would therefore maintain that the preferred option should be to utilise the linear park; however a wayleave would be required.

Several additional areas of engineering difficulty were identified, perhaps the most challenging of which is Blackhorse Bridge on Evelyn Street. It is a former bridge over the Grand Surrey Canal and the land either side is privately owned. Several options were identified for getting pipework across the bridge, such as burying the pipework in the carriageway if the bridge construction is deep enough, or slinging the pipe over the side of the bridge; however further investigation is required in order to determine the preferred solution. This will be investigated in more detail in the Element B report.

In conclusion, the north Lewisham extension is largely more straightforward than the pipework route between SELCHP and Goldsmiths for the following reasons:

- Apart from at the junction of Grinstead Road and Trundleys Road, there are no intermediate or high pressure gas mains in the area.

- There are no TfL red routes in the road network.
- There is not as much interface with the rail network as in the network connection SELCHP and Goldsmiths. The only point of interface is at the junction of Surrey Canal Road and Grinstead Road.
- There are no sites of ecological significance – statutory or non-statutory (i.e. SINCs).
- There is a large green space area – Deptford Park – that can potentially reduce the cost of installation significantly.

Despite this, there are still some complicating factors; specifically:

- Evelyn Street is heavily congested with services and is the only road that runs between sites to the north and south of the area (i.e. Arklow Road to Cannon Wharf).
- Evelyn Street is also heavily trafficked and would require diversions, including for several bus routes, if it must be closed during installation. This could be avoided through one lane control; however this would lead to congestion through the area.
- Closure of the Surrey Canal Road rail bridge, if required, would cause massive disruption to the high volume of trains running between London Bridge, Deptford and New Cross. This is considered unlikely, however, as Network Rail would be unlikely to permit such a closure. Also, the installation should not affect the bridge construction and could be done with Network Rail supervision and monitoring.
- A means of crossing Blackhorse Bridge must be found.

Several areas for site investigations were identified. These investigations will not be undertaken as part of this feasibility study process, but would help reduce construction risk in several key areas of the proposed route. They are:

Site	Proposed site investigation	Purpose
Evelyn Street carriageway	Full GPR (radar truck) and possible intermittent trial holes	Assess the extent and location of buried services in the carriageway along this key street
Blackhorse Bridge	Trial holes	Assess the depth of the road structure in the carriageway.
Junction of Grinstead Rd and Trundleys Rd	GPR to identify mains and trial hole to accurately locate the IP gas main	Determine the location of 600mm IP gas main as it crosses Grinstead Road
Hicks St & Alloa Rd	GPR and possible trial hole	Determine location and extent of existing services.
Junction of Grove St and Dragoon Rd	GPR and possible trial hole	Determine position of existing services through congested junction.

Preferred route

Based on the analysis undertaken in this assessment, the preferred route for the north Lewisham extension to the New Cross Heat Network utilises Deptford Park as much as possible to maximise the extent of soft dig installation; and avoids Evelyn Street as much as possible by utilising Hicks Street and Alloa Road as well as the Marine Wharf West linear park.

It is noted that installation in Hicks Street and Alloa Road would require extensive parking suspensions and should be confirmed with site investigations. The route through the linear park would also require a wayleave.

The length of the preferred route is 4,100m (trench length).

2 INTRODUCTION

2.1 PROJECT BACKGROUND

This report forms part of the Element A route optimisation study for a North Lewisham Heat Network (NLHN). The Element A route optimisation study is the first of a three part feasibility assessment produced by WSP | PB for LB Lewisham. The full list of documentation produced in the delivery of this assessment is as follows:

- Element A – Route optimisation study:
    - Overall route optimisation report (this report)
    - Preliminary ecological appraisal report
    - Contaminated land report
    - Archaeological constraints report
    - Transport infrastructure impact assessment
- Element B – Design study
- Element C – Delivery study

This study is preceded by a WSP | PB feasibility assessment for a New Cross Heat Network linking the SELCHP energy from waste facility on Landmann Way with the Goldsmiths University, London site on New Cross Road. The previous study concluded that a heat network linking only SELCHP with Goldsmiths and a small number of adjacent loads would not be economically attractive; however it also identified the potential for an expanded network that serves the large number of new developments in the north Lewisham area. A preliminary economic analysis concluded that this larger scheme would deliver a good return on investment. The purpose of this study is therefore to undertake the necessary technical analysis and to produce a more detailed economic analysis for this north Lewisham section.

2.2 LOADS

The scope of this feasibility assessment is therefore to build upon the analysis undertaken in the New Cross Heat Network feasibility assessment to include the following development sites.

- The Wharves, Deptford
- Cannon Wharf
- Marine Wharf East
- Marine Wharf West

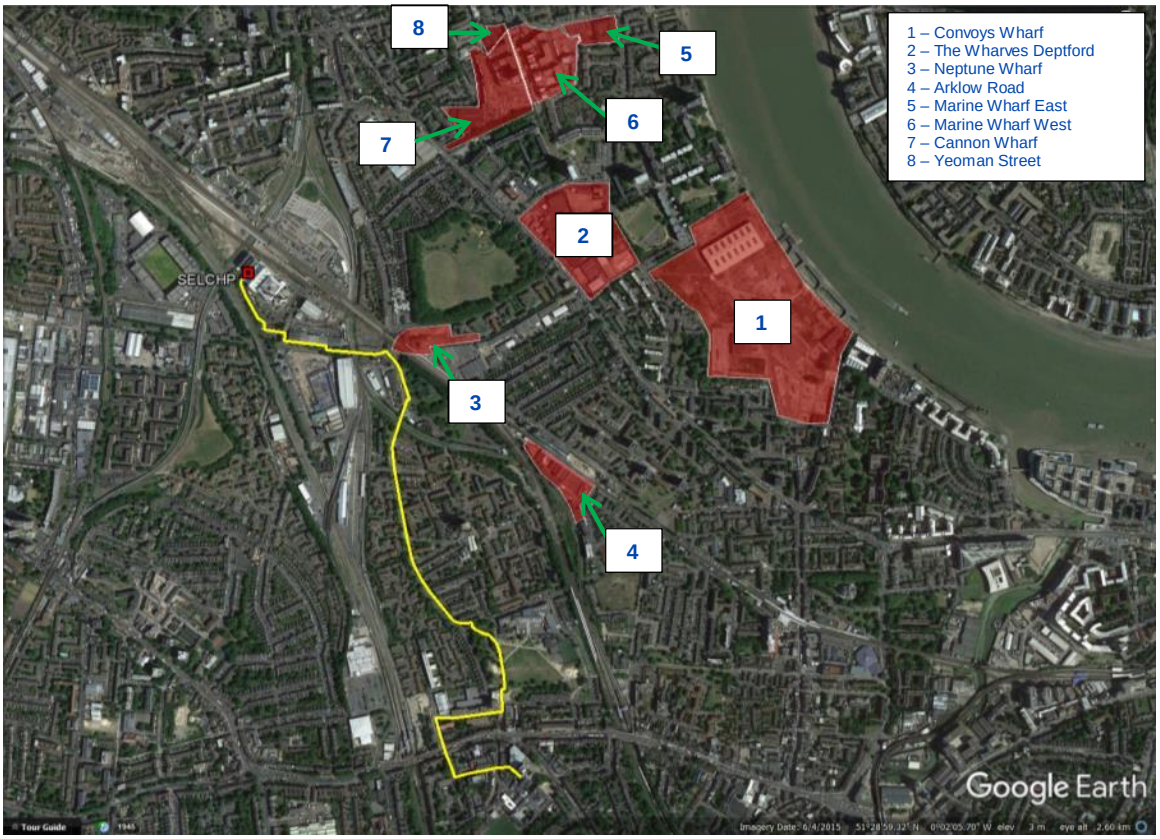
- Yeoman Street
- Neptune Wharf
- Convoys Wharf
- Arklow Road

LBL planning officers and local housing associations will also be consulted to determine whether there are additional sites that should be considered for connection.

This study continues from the point of interface with the previous study, which is the junction of Surrey Canal Road and Grinstead Road. The pipework running between SELCHP and this interface point (i.e. down Surrey Canal Road) was assessed in the previous feasibility study and the sizing included an allowance for the loads included in this North Lewisham extension study.

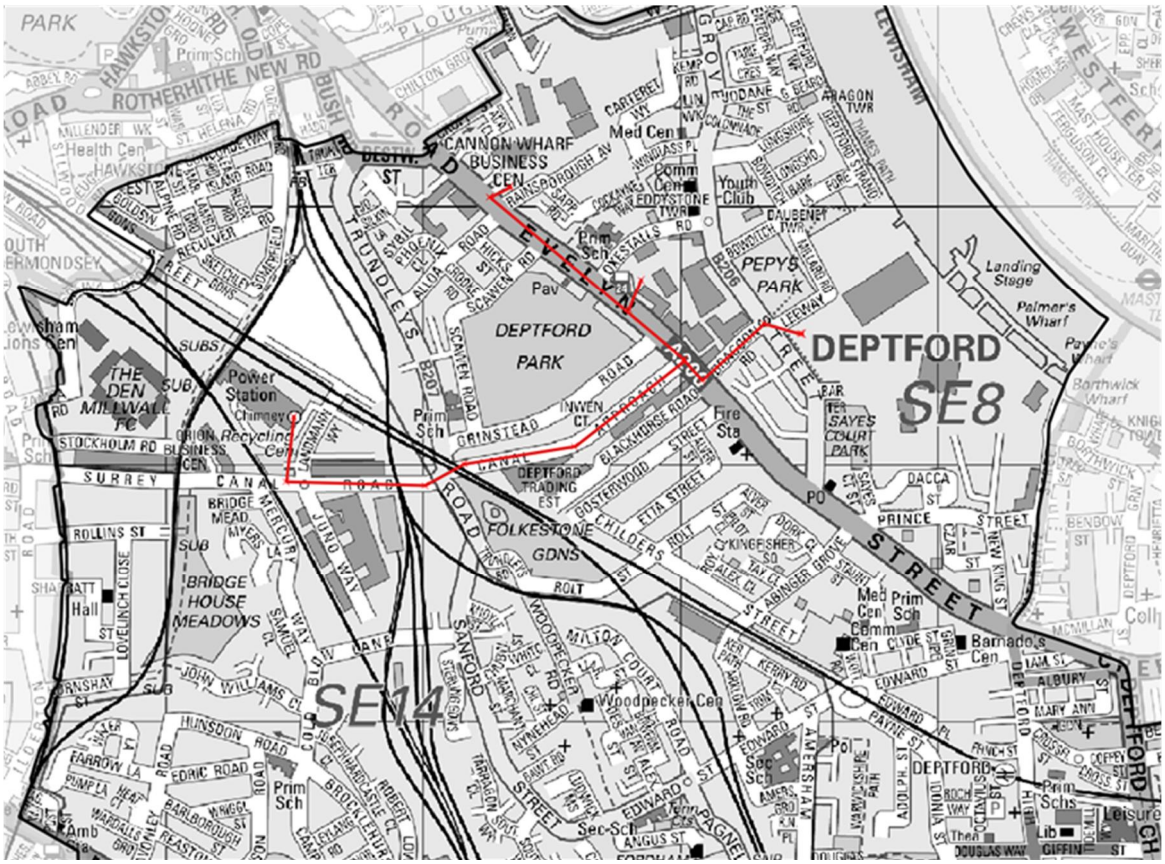
Note that the use of two different heat network names across the two studies gives the impression that there would be two separate heat networks – the New Cross and the North Lewisham heat networks. These two names are used to define two separate studies, focusing on two areas of what would be the same heat network if all loads connected. The preferred route identified for the New Cross Heat Network is shown in Figure 2-1. The location of the North Lewisham development sites is also shown.

Figure 2-1: New Cross Heat Network preferred route (yellow line) and North Lewisham development sites (red polygons)



LBL have developed an initial preferred route for the North Lewisham expansion, which is presented in Figure 2-2 and will form the starting point for this study.

Figure 2-2: Initial preferred route - proposed by LBL



3 DISTRICT HEATING DESIGN AND INSTALLATION PRINCIPLES

3.1 TYPICAL PIPE INSTALLATION CONDITIONS

Most DH pipe is comprised of polyurethane foam insulation bonded to a steel 'carrier' pipe. The outer casing is high-density polyethylene. It is available in single pipe, where two separate pre-insulated pipes are used for the flow and return, or twin pipe, where the flow and return carrier pipes are within a single polyethylene casing.

Single pipe is easier to work with in an urban setting because twin-pipe is harder to manipulate in congested areas due to its larger size and difficulties in bending the pipe in the vertical plane, as the two carrier pipes within the single outer casing are stacked vertically. Twin pipe is also only available in sizes up to 200mm internal diameter, making it less suited to large heat networks.

Installation of district heating pipework is generally versatile. It is typically installed below ground in a friction restrained system, wherein the backfill material applies a friction force to the pipe, limiting the expansion through application of axial stress. The extent of the expansion and axial stresses are a product of several factors, including:

- Pipe size
- Installation depth
- Insulation thickness (series)
- System temperatures

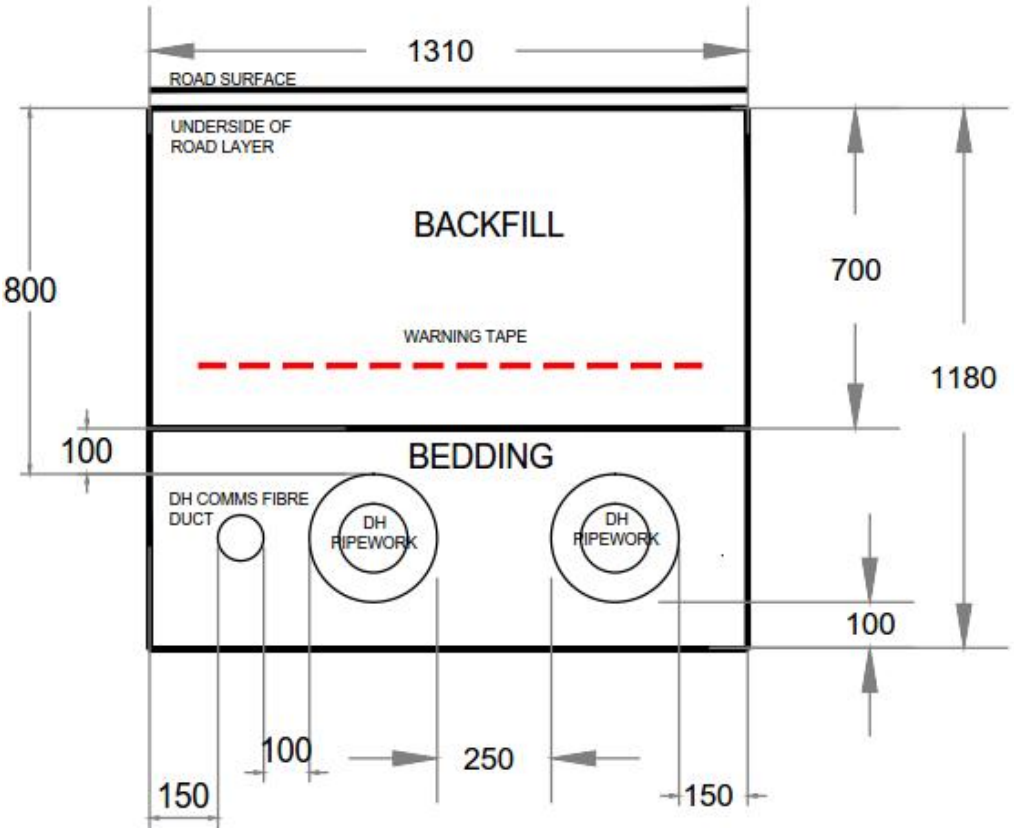
Manufacturer guidelines specify that DH pipework should typically be buried within a depth range of 500mm to 1500mm (depending on the manufacturer). In reality, installation depth varies significantly according to site conditions such as the extent of existing services and it is often necessary to install at depths outside of the 'typical' range.

As long as the axial stress in the pipe can be regulated with reduction measures such as expansion loops, the 'hard limits' for pipe depth are usually dictated by the vertical loading on the pipework. For example, if a pipe is installed at shallow depth underneath a main road, it is at risk from excessive vertical loading from the traffic above. In these instances, steel plates or concrete rafts can be used to protect the pipework from excessive vertical loading. Conversely, when installation is too deep, the weight of the soil above compromises the integrity of the bond between the foam insulation and the steel carrier pipe.

Pipework can be buried in hard dig or soft dig ground and it is generally preferable to install in soft dig areas due to the reduced cost of civil engineering works associated with the installation. It should be installed, as much as possible, in areas where it can be accessed readily in the event of a leak.

A typical trench section for installed DH single pipe with a controls cabling duct is shown in Figure 3-1.

Figure 3-1: Typical buried DH single pipe trench section – 150mm internal diameter pipe



DH pipes are typically welded in situ before outer casing joint closures are fitted, which means space is required within the trench for installers to work around the pipe. In addition to the trench width, additional space will be required for a working area.

Civils contractors need space to excavate the trench and move spoil away from the area and DH installers need to be able to position pipe alongside the trench, for example using a HIAB, and then to lift it into the trench for installation. As such, although the trench may be around 1 to 1.5 metres in width, the required working area would be much greater during key stages in the installation period. Examples of DH pipe installations are presented in Figure 3-2 and Figure 3-3.

Figure 3-2: DH trench example

Figure 3-3: DH trench spoil area

3.2 PIPE SIZING

Pipe sizing is important in route selection as the diameter of the pipework affects interfaces with other features such as existing utilities. The pipe size also plays a role in the static design of the system – for example by requiring the use of stress reduction measures such as expansion loops, which may also affect the route selection.

Pipe sizing is primarily a product of the network load and operating temperatures. These things will be investigated in more detail in Elements B and C; however it is possible at this stage to offer an assessment of other factors that will impact on the selection.

In the New Cross Heat Network study, we learned several things about the availability of heat supply from SELCHP through liaison with Veolia, who operate the facility, as detailed below.

Table 3-1: SELCHP heat supply information

Item	Value
Maximum DH supply temperature	105°C
Preferred DH return temperature	70°C
Current heat supply capacity	30MW
Potential future heat supply capacity	40MW
Current DH load	17MW
Maximum heat available to Lewisham	23MW

At present, the maximum available heat supply from SELCHP is 23MW, assuming they opt to upgrade their heat exchange capacity from 30MW to 40MW. At the maximum available supply temperature (105°C) and the preferred return temperature (70°C) it is possible to calculate an upper limit for the pipe size leaving the SELCHP facility.

Using the typical velocity recommendations in the CIBSE *UK Heat Networks Code of Practice*[1] (COP), a **300mm** pipe would be smallest pipe capable of carrying a load of 23MW. A 300mm pipe could supply up to 28MW within these design limitations, as shown in Table 3-2.

Table 3-2: Pipe capacity at COP recommended velocities and 105/70°C system temperatures

Nominal pipe diameter (mm)	Typical velocity from Code of Practice (m/s)	Capcity at 105/70°C (MW)
200	1.9	9.5
250	2.2	17.4
300	2.5	27.9

The loads to the south that were assessed for the original New Cross Heat Network study (i.e. Goldsmiths University, Batavia Road etc) had a combined peak of approximately 4.4MW. With base load only connections, the maximum demand is approximately 1.1MW, which leaves between 18.5MW and 22MW available for loads in the north Lewisham expansion area. Under both scenarios, a 300mm pipe would be required to deliver heat on to the north Lewisham extension area.

It is important to highlight at this stage that the current maximum supply from SELCHP could change significantly if back-up boilers were installed within the District Heating Hall at the facility. In previous discussion with Veolia, they have not ruled out this possibility. In this event, back-up boiler plant and system pipework could be sized to meet the peak heat demand for the north Lewisham expansion area. This will be investigated in more detail in Elements B and C, but we would certainly expect it to be higher than 23MW.

It is also important to note that the capacity of a given pipe diameter can be significantly enhanced by increasing the temperature differential between the flow and return. Given the number of new developments that are proposed for connection, it would be possible for the designers of these secondary systems to achieve return temperatures of 40°C on the space

[1] CIBSE / ADE CP1 – *UK Heat Networks Code of Practice*

heating and 25°C on the hot water, as promoted by CIBSE[2]. It is therefore not unreasonable to assume that mixed primary return temperatures of around 50°C or lower would be readily achievable from these new developments if the secondary system designers were engaged early enough and, ideally, required to design to these requirements.

A comparison of the capacity of different pipe diameters at different system temperatures is presented in Table 3-3 by way of illustration.

Table 3-3: Capacity of different pipe sizes at different system temperatures (velocity 2.5m/s)

Nominal pipe diameter (mm)	Typical velocity from Code of Practice (m/s)	Capcity at 105/70°C (MW)	Capcity at 105/50°C (MW)
200	1.9	9.5	15.1
250	2.2	17.4	27.5
300	2.5	27.9	44.2

The requisite pipe sizing for the north Lewisham expansion of a New Cross Heat Network is therefore very dependent on whether the new development secondary system contractors can be required to deliver the lowest possible return temperatures. The Element B report will investigate the intended secondary system designs for the various developments.

[2] CIBSE/ ADE CP1 – *UK Heat Networks Code of Practice*; and CIBSE AM12 (2013) – *Combined Heat and Power for Buildings*

4 ROUTE SITE SURVEY

4.1 POINTS OF INTERFACE

In order to determine the pipe route, we have identified, where possible, the most likely position for the heat network interface at each of the proposed development sites. This has been done through direct consultation with the developers, or using information within the planning documentation, which is publicly available on the Lewisham planning portal.

4.1.1 Convoys Wharf

The Convoys Wharf development is not yet under construction, but the site is being prepared. They are obligated under Section 106 to investigate connecting to an area heat network and to use all Reasonable Endeavours to secure a connection. The S106 Agreement states:

'*The Owner…shall use all Reasonable Endeavours to enter into legally binding arrangements to secure the connection of the Development to SELCHP and thereafter shall construct the Development so as to be able to connect to SELCHP.*

If despite using all Reasonable Endeavours…the Owner has not been able to…secure connection of the Development to SELCHP by:

a) *the date upon which it submits the Reserved Matters Application or planning application for the last Energy Centre that is to be provided in the Development; and*

b) *the date of Occupation of 1700 Dwellings*

(whichever is the later) then the Owner shall be released from any further obligation to secure connection…to SELCHP '

It is noted that these obligations are helpful in protecting the longer-term strategic development of the network as they require developers to start from a position of seeking to connect and providing a heating system that is suitable for connection to a heat network.

We consulted with the Convoys Wharf developer – Hutchison Property Group Ltd – to discuss the most likely point of interface with the heat network. They advised that it would be near the northerly entrance to the site - around Grove Street/Leeway. The proposed location is shown on Figure 4-1.

Figure 4-1: Convoys Wharf proposed DH interface location

4.1.2 The Wharves, Deptford

The Wharves Deptford is located between Dragoon Road and Oxestalls Road, adjacent to Evelyn Street. Demolition and site clearance is underway on the first plot (of six) with construction work to commence in spring 2017. Planning permission required the provision of infrastructure to facilitate a connection to an area heat network; however they are not obligated to connect.

A position for a DH interface substation for The Wharves, Deptford is proposed in the 2009 Energy Strategy produced by Max Fordham and updated in the 2015 Lend Lease Energy Assessment, both of which are accessible via the Lewisham planning portal.

The proposed energy centre location is shown in the 2015 Energy Assessment at the centre of the site. The drawing, which was produced by AECOM, is presented in Figure 4-2.

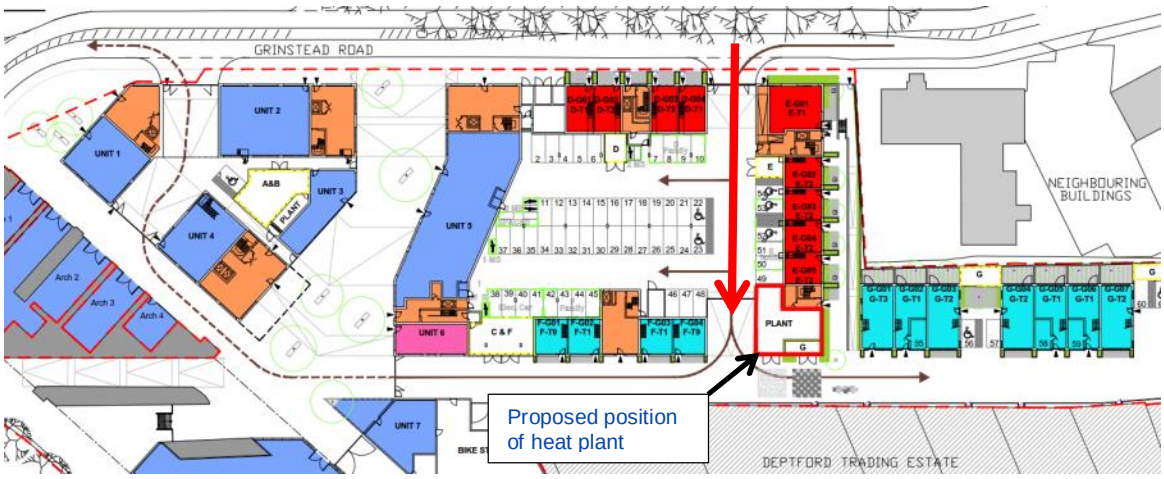
Figure 4-2: The Wharves Deptford proposed EC location (red box) and DH pipework route

4.1.3 Neptune Wharf

Neptune Wharf is comprised of approximately 200 residential units and 2,000m^2 of non-residential space. Planning permission has been granted and, according to LBL planners, an 18 to 24 month build out is expected at the end of a 6 to 12 month remediation process, which is expected to start next year. Connection to the DH network is not obligated under planning, however the developer is required to submit details of pipe/conduit routes onto the site.

A position for heat plant at the Neptune Wharf development is indicated on a key site plan produced by Galliard Homes, which is accessible via the Lewisham planning portal. The proposed location is shown in Figure 4-3.

Figure 4-3: Neptune Wharf key site plan showing plant room position and route onto site (red arrow)

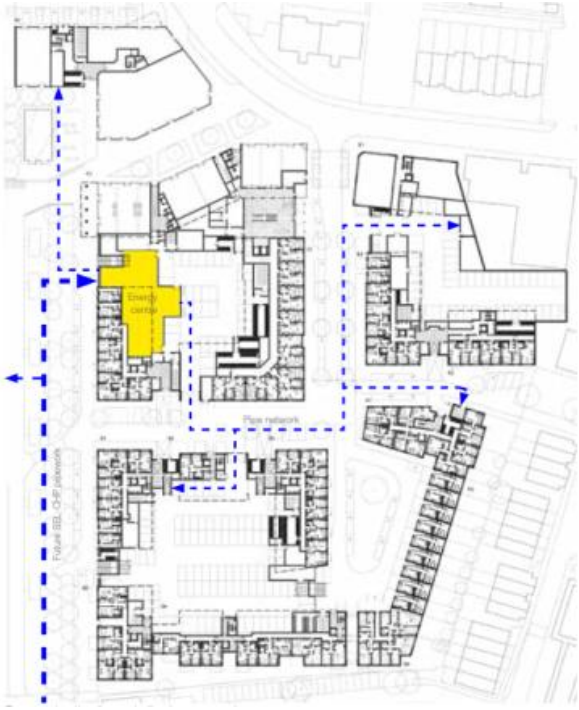


4.1.4 Marine Wharf West

Marine Wharf West sits in between Marine Wharf East and Cannon Wharf. The projected completion of the scheme is April 2017. Some sections are already completed and occupied. Planning permission required the provision of infrastructure to facilitate a connection to an area heat network; however they are not obligated to connect.

A position for energy centre at Marine Wharf West is indicated in the design access statement produced by Meinhardt, which is accessible via the Lewisham planning portal. The plan also shows the proposed routing of pipework onto (thick blue line) and around (thin blue lines) the site Figure 4-4.

Figure 4-4: Marine Wharf West proposed energy centre location and pipework route onto and around site (blue arrows)



We contacted the developer – Berkeley Homes – who provided the most recent design information for the site. As-installed drawings have not yet been completed but, given the extent of progress on site, it is assumed these drawings are up-to-date.

The developer preferred that design information was excluded from the report; however we can confirm that the pipe system layout is broadly the same as the information provided in the Design Access statement and the energy centre is in the same position.

The design access statement also proposes the use of pipe ducts to provide access to the Marine Wharf and Cannon Wharf sites:

> '*It is proposed that the linear park will have the potential for the ducts to be installed along its length, which can then provide future connections to both Marine Wharf and Cannon Wharf.*'

In discussion with Berkeley Homes, however, they confirmed that the ducts have not been installed through the linear park.

4.1.5 Marine Wharf East

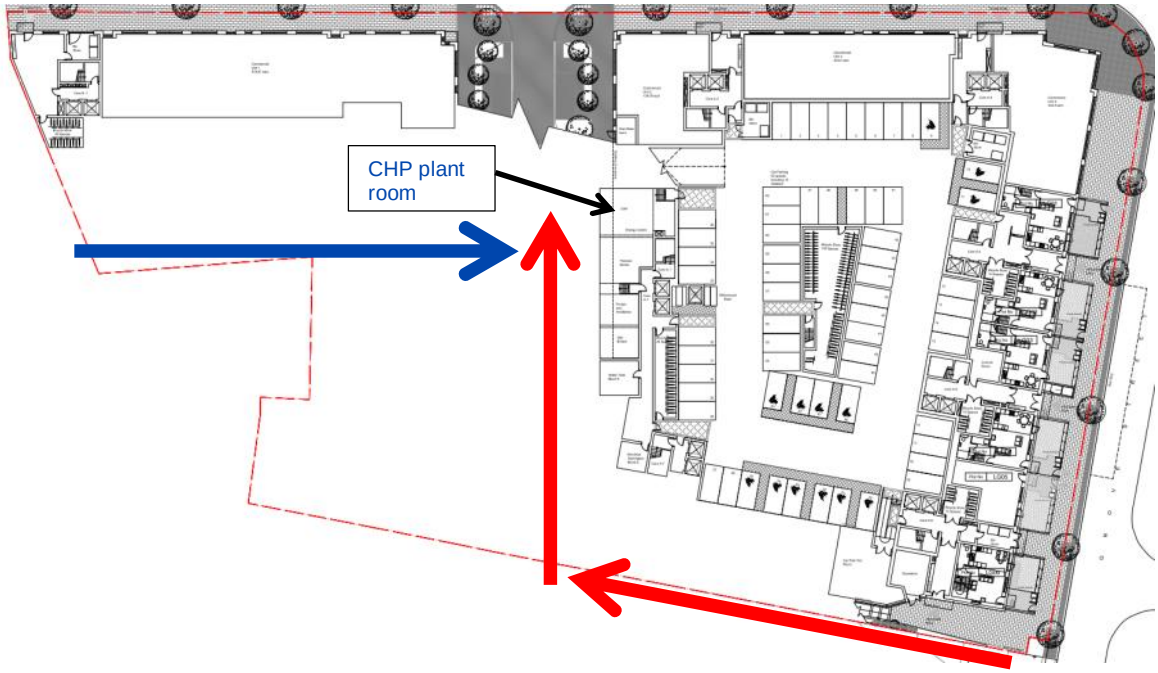
Marine Wharf East is located directly east of Marine Wharf West. Demolition and site clearance is now complete in preparation for development to commence. Planning condition number 9 for the development is for Future Connection to a District Combined Cooling, Heat and Power or Combined Heat and Power Scheme, with a requirement to provide:

> *A written feasibility, commitment and timeframe for connecting to a District Combined Cooling, Heat and Power (CCHP) or Combined Heat and Power Scheme (CHP) Scheme and Network*

As such, the development appears to be obligated to connect to an area heat network if available.

The energy centre position within the Marine Wharf East site is shown on the lower ground floor in a BUJ Architects site layout drawing, which is available on the Lewisham planning portal. It is presented in Figure 4-5.

Figure 4-5: Marine Wharf East CHP plant room location and proposed site access (red arrow) and potential route for DH pipe from Marine Wharf West (blue arrow)



It is noted that the Marine Wharf West design access statement proposes to use ducting to route pipe from Marine Wharf West across to Marine Wharf East. This would provide a more direct route from the heat network mains to the west onto the Marine Wharf East site.

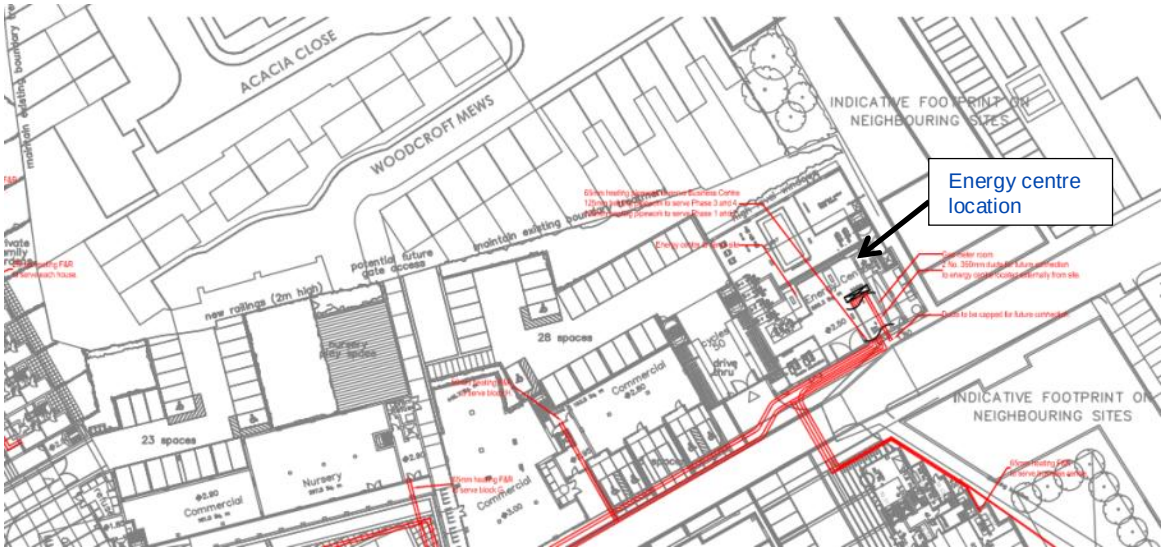
The alternative would require the DH mains to enter the site from the east which, based on the existing road layout, would entail significant additional pipework and, therefore, cost.

4.1.6 Cannon Wharf

Cannon Wharf is located immediately to the west of Marine Wharf West. It is in the latter stages of development, with six out of nine blocks now completed. The development is required to provide the infrastructure to enable connection to an area heat network, although they are not obligated to connect.

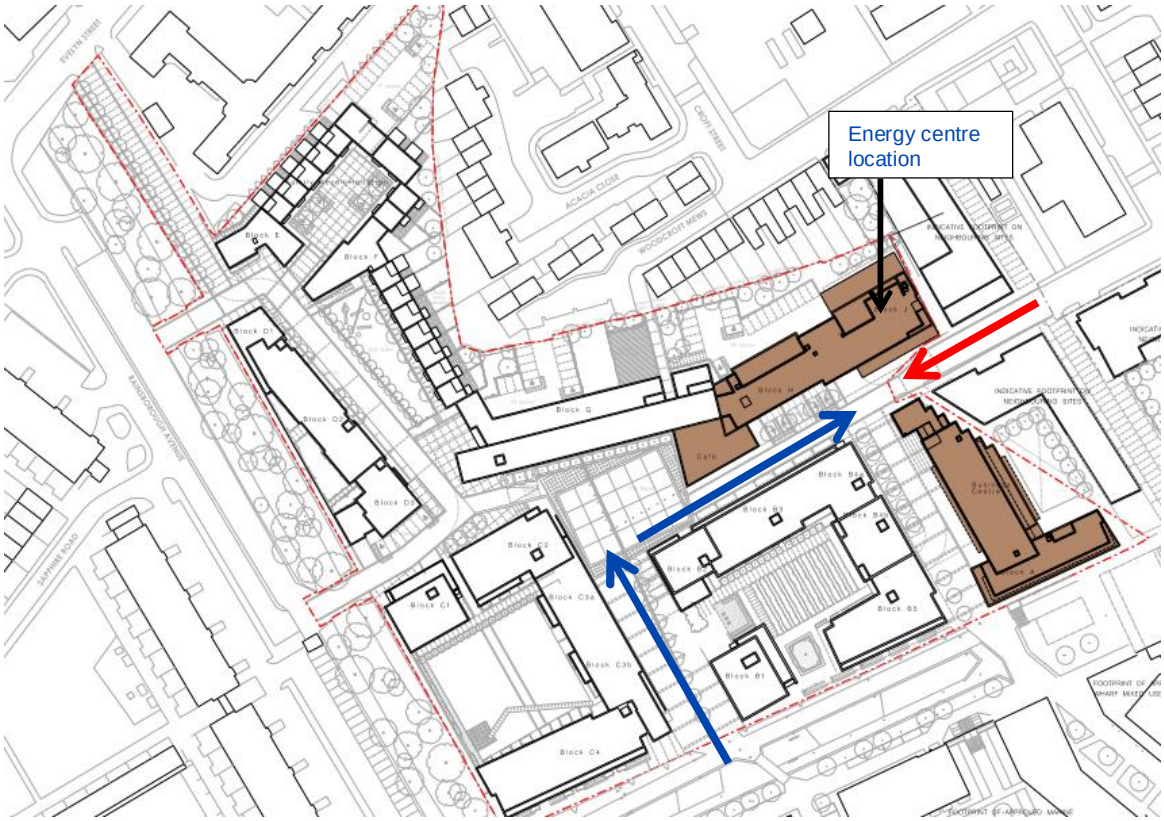
The energy centre position within the Cannon Wharf site is shown in a Whitecode Design Associates services plan, which is available on the Lewisham planning portal. It is presented in Figure 4-6.

Figure 4-6: Cannon Wharf energy centre location from site services plan



The energy centre position within the wider site context is shown in Figure 4-7. We have also included the site access route from the planning information as well as the potential route for pipework from the Marine Wharf West site.

Figure 4-7: Cannon Wharf energy centre position, site access (red arrow) or pipework route from Marine Wharf West (blue arrows)

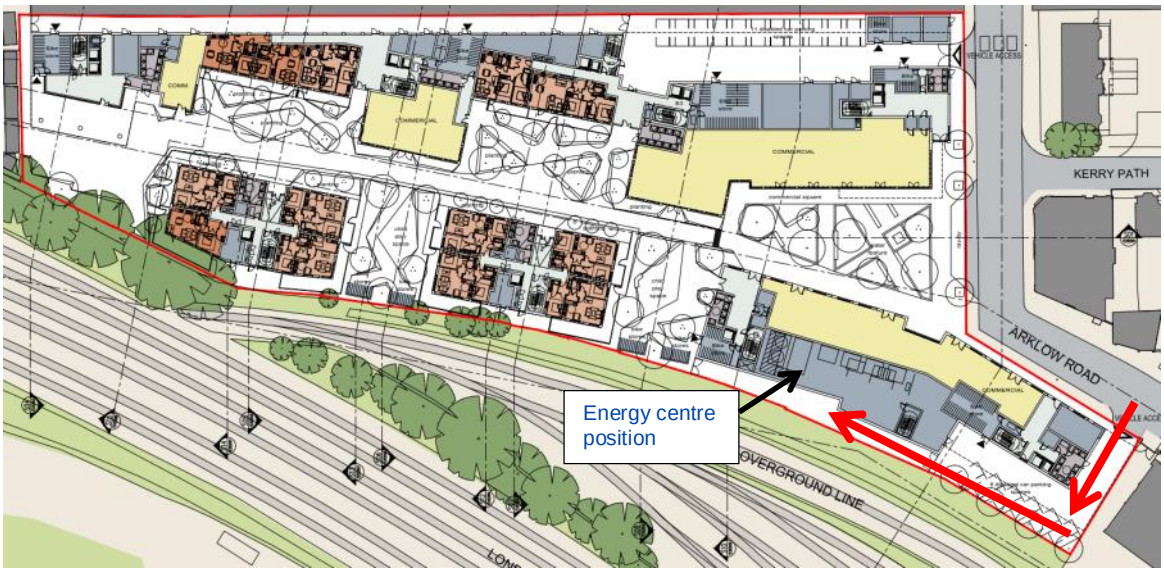


4.1.7 Arklow Road

The Arklow Road development (also called Deptford Foundry) was granted planning permission in September 2016. The expected build-out of the scheme is between late 2016 and 2018. The development is required to provide the infrastructure to enable connection to an area heat network, although they are not obligated to connect.

The proposed position of the energy centre in the Arklow Road site is shown in a Rolfe Judd Architects site layout drawing available on the Lewisham planning portal. The proposed location is indicated in Figure 4-8. We have also included the likely site access route for DH pipework, based on the available routes onto site from the planning information. Note that the position of the energy centre is supported by an August 2016 Energy Compliance document produced by Ridge and Partners.

Figure 4-8: Arklow Road energy centre position and proposed site access (red arrow)

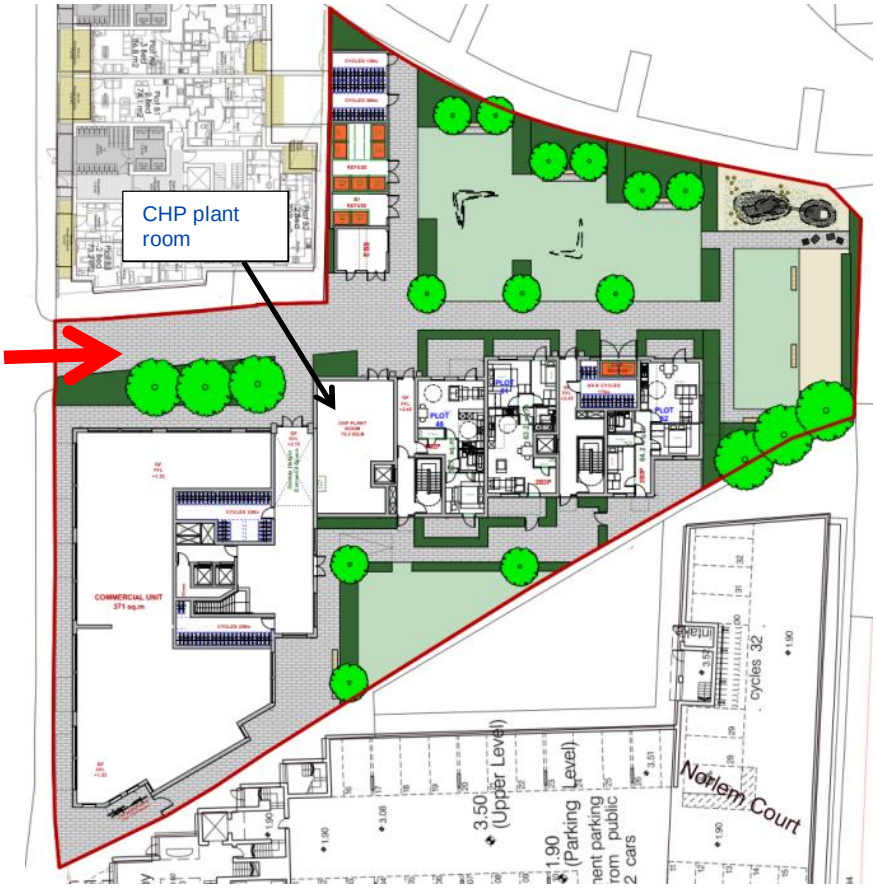


4.1.8 Yeoman Street

The Yeoman Street site sits immediately north of Cannon Wharf. A planning application has been submitted and has space allocated for on-site CHP. As the application is still being considered the planning conditions and Section 106 obligations are yet to be determined. LBL planners were unable to comment on a likely timeframe for a decision.

The proposed position of the energy centre in the Yeoman Street site is shown in a Metropolis PD architects site layout drawing, which is available on the Lewisham planning portal. The proposed location of the plant room is indicated in Figure 4-9. We have also included the likely site access route for DH pipework, based on the available routes onto site from the planning information.

Figure 4-9: Yeoman Street CHP plant room position and proposed site access (red arrow)



4.1.9 Site of former Deptford Green school

LBL planning officers also highlighted a potential development on the site of the former Deptford Green school on Amersham Grove. The proposed development has not yet received planning approval, but is comprised of residential blocks ranging from one to five storeys – totalling 120 units across the whole development.

The position of the proposed energy centre within the site is not explicitly stated within the planning documentation so we have assumed a position, as shown in Figure 4-10.

Figure 4-10: Assumed point of heat interface at Former Deptford Green school development site

4.1.10 Summary of energy centre positions

Based on the information available on the Lewisham planning portal or conversations with the developers, we have identified the energy centre / plant room location at each of the proposed development connections.

Figure 4-11: Position of energy centres / heat interfaces at proposed development connections

4.2 MOST DIRECT ROUTE BASED ON INTERFACE LOCATIONS

Using the locations of the points of interface described in Section 4.1, we have developed a network layout based on the most direct route between the interfaces. This is presented in Figure 4-12 and will be the subject of continued analysis in the following sections.

Note that this route is contingent upon several things:

1) Being able to install in Deptford Park, in soft dig land. If this is not possible, the route could continue down Grinstead Road.

2) Being able to route the main spine of pipework between the Marine Wharf East, Marine Wharf West and Cannon Wharf sites internally. Given that there has been no provision for the installation of future pipework (see Section 4.1.4), a wayleave would be required to re-excavate and install the pipework.

Figure 4-12: Most direct route based on interface locations

The map shows how the Convoys Wharf interface point is at the north west of the development site. This is good, as it is closer to the rest of the development sites, with the exception of Arklow Road and the former Deptford Green School site, which are both further south. The viability of connecting these two loads will be assessed in the Element C report.

5 OTHER POTENTIAL CONNECTIONS

5.1 DEVELOPMENT SITES

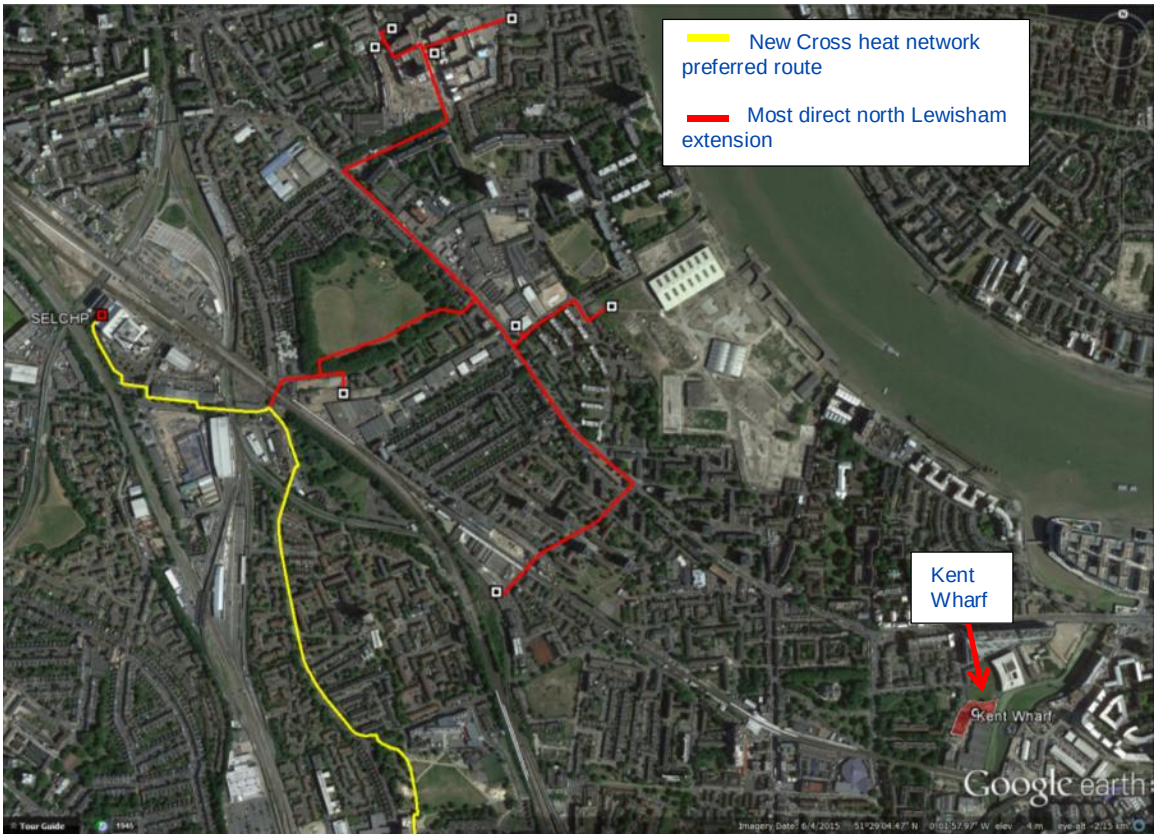
In consultation with LBL planning officers, they identified two additional development sites in the vicinity of the proposed heat network. They are:

- Kent Wharf
- The Deptford Project

5.1.1 Kent Wharf

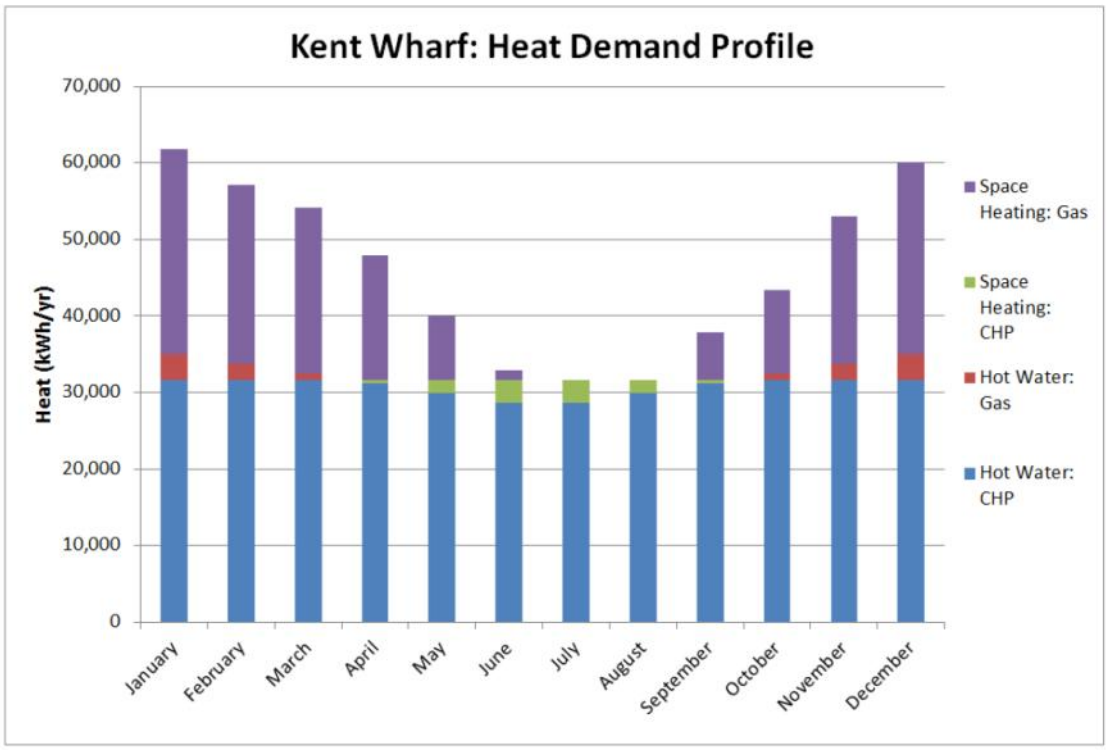
Kent Wharf is a small development located on Creekside, to the east of the proposed heat network. Development as already commenced, with completion expected in 2018. It is comprised of 143 residential units and 1,375m^2 of commercial space and the developer is obligated under planning to make provision for connection to an area heat network; however it is not obligated to connect, either via the condition or under Section 106. The site location is shown Figure 5-1.

Figure 5-1: Location of Kent Wharf development in relation to heat network (red arrow)



The heat load at Kent Wharf is presented in a 2014 Energy Strategy produced by Hodkinson and available on the Lewisham planning portal. The exact kWh figure is not given; however the following chart shows an annual heat demand of approximately **520MWh**.

Figure 5-2: Kent Wharf heat demand profile from Hodkinson Energy Strategy (2014)



According to information provided by LBL planning officers, the development is due for completion in early 2018. In the absence of a heat network connection, heat will be supplied by a CHP of approximately 80kWth, as detailed in the planning documentation.

In order to connect Kent Wharf to the north Lewisham network extension, the pipework would need to extend a considerable distance along Evelyn Street, as shown in Figure 5-3.

Figure 5-3: Network extension to connect Kent Wharf (dashed line)

The length of the proposed extension is approximately 1km. Based on an annual heat load of 520MWh and an assumed load factor of 15 percent[3], the peak demand at Kent Wharf is calculated to be approximately 400kW. With an assumed primary supply temperature of 105°C and a return temperature of 55°C[4], a DN65 pipe would therefore be sufficient to supply peak heat to the network.

Based on recent supplier quotations and build project experience, we have used a series 3 insulation installed cost of £930/metre for a DN65 pipe. The total network extension cost for connecting Kent Wharf is therefore estimated to be in the region of £930k.

If we assume an operating margin (i.e. net of operating costs) of 3p/kWh on heat sales to Kent Wharf, the simple payback on the connection would be approximately 60 years. This simple assessment demonstrates that an extension to Kent Wharf is highly unlikely to be economic, given the scale of the heat demand and its location in relation to the rest of the north Lewisham extension area.

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[3] Load factor defines the relationship between peak and annual heat load and is calculated as: *annual load / (peak load x 8760)*. 15 percent is considered appropriate for a new build, primarily residential development.

[4] A Watkins *Energy Centre Report* available on the Lewisham planning portal states secondary system supply temperatures of 70°C in winter and 65°C in summer. We have therefore assumed a secondary return temperature of 50°C and a 5°C heat loss across the heat interface with the DH.

5.1.2 The Deptford Project

The Deptford Project is a small mixed use development located on Deptford High Street, to the east of the proposed heat network and to the south west of Kent Wharf. It is comprised of a new building containing 121 residential units and commercial space; and the expansion of the existing St Paul's House to contain 8 apartments and a restaurant, with three new town houses at the rear.

The developer is obligated under planning to make provision for connection to an area heat network; however it is not obligated to connect, either via the condition or under Section 106. The site location is shown Figure 5-4.

Figure 5-4: The Deptford Project site location

The Deptford Project annual boiler gas demand has been derived from a 2011 Energy Strategy produced by URS Scott Wilson and available on the Lewisham planning portal. The gas consumption total is approximately 480MWh. At an assumed boiler efficiency of 86 percent, this equates to an annual heating demand of approximately **415MWh**.

In order to connect the Deptford Project development to the north Lewisham network extension, the pipework would need to extend east along Evelyn Street and south down Deptford High Street, as shown in Figure 5-5.

Figure 5-5: Network extension to the Deptford Project

The length of the proposed extension is approximately 775m. Based on an annual heat load of 415MWh and an assumed load factor of 15 percent, the peak demand is calculated to be approximately 315kW. With an assumed primary supply temperature of 105°C and a return temperature of 55°C, a DN50 pipe would therefore be sufficient to supply peak heat to the network.

Based on recent supplier quotations and build project experience, we have used a series 3 insulation installed cost of £860/metre for a DN50 pipe. The total network extension cost for connecting Kent Wharf is therefore estimated to be in the region of £665k.

If we conservatively assume an operating margin (i.e. net of operating costs) of 3p/kWh on heat sales to the site, the simple payback on the connection would be approximately 55 years. This simple assessment demonstrates that an extension to the Deptford Project is highly unlikely to be economic, given the scale of the heat demand and its location in relation to the rest of the north Lewisham extension area.

5.1.3 Kent Wharf and Deptford Project combined connection

Given then location of the two potential additional connections, some of the pipe connection cost would be split across the two connections if they were both served from the heat network, as shown in Figure 5-6. The total extension length would be 1.4km of pipework (trench length), of which 380m would be DN80, 620m would be DN65 and 40m would be DN50 diameter.

Figure 5-6: Extension to serve Kent Wharf and the Deptford Project developments

Using the annual heat loads and installed pipe costs described previously, this would equate to an additional 935MWh of heat demand at a network extension cost of approximately £1.3m. If, as before, we assume an operating margin of 3p/kWh, the two connections would deliver a simple payback of approximately 46 years.

We would therefore conclude that these connections are not economically attractive on their own. If additional heat load comes forward to the east of the proposed north Lewisham extension, it would be worth reconsidering these connections as they already have the facility to connect to an area heat network; however they will be excluded from further analysis in this study.

5.2 EXISTING BUILDINGS

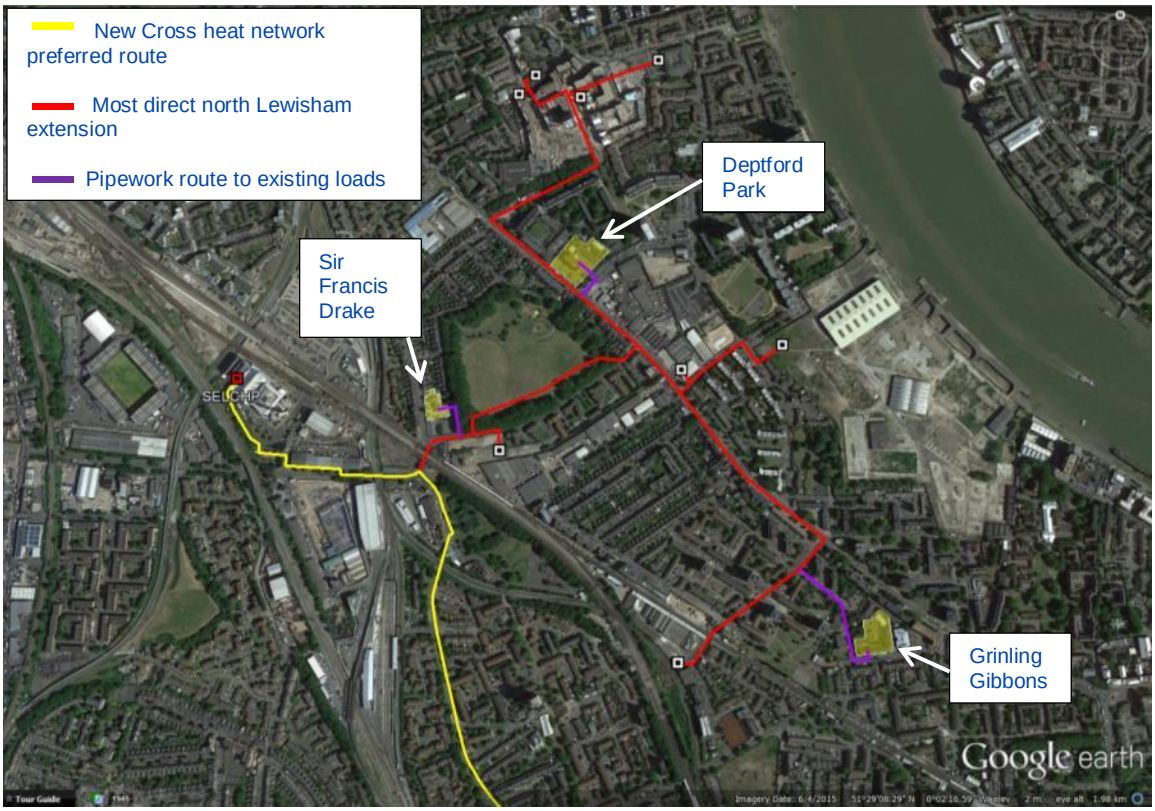
5.2.1 LB Lewisham buildings

The New Cross Heat Network expansion assessment identified several existing loads in the vicinity of the development. The three that were determined to be of interest to the scheme are all primary schools:

- Sir Francis Drake primary on Trundley's Road
- Deptford Park Primary on Evelyn Street/Oxestalls Road
- Grinling Gibbons primary on Clyde Street

The location of the three schools in relation to the developments, along with the most direct route to serve them is presented in Figure 5-7.

Figure 5-7: LBL buildings positions (yellow polygons)



The map shows how Deptford Park and Sir Francis Drake primary schools are both adjacent to the most direct network route. Grinling Gibbons would be most easily connected, via a c. 260m extension down Staunton Street.

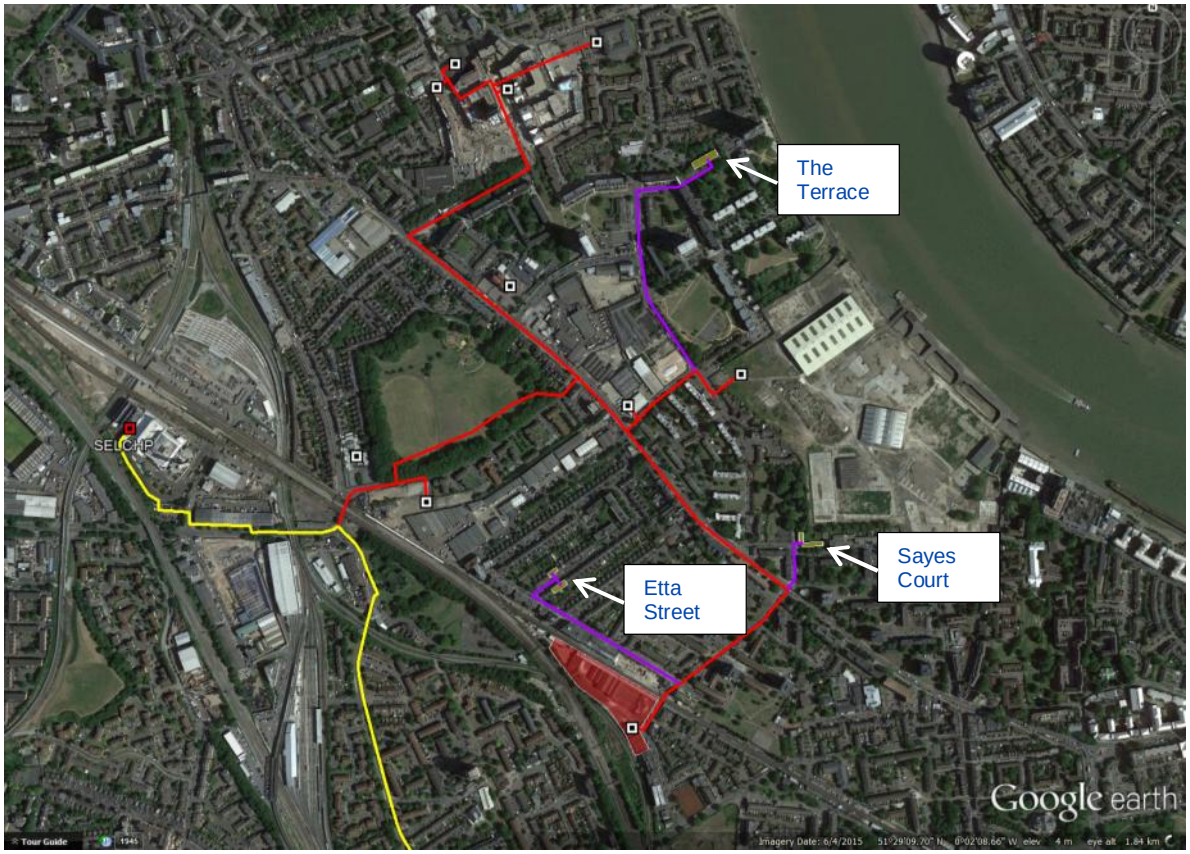
5.2.2 Lewisham Homes dwellings

Lewisham Homes provided information for three of their sites within the area that are communally heated. They information provided is as follows:

- Etta Street – 14 properties served by a Vaillant 658 Boiler
- Sayes Court –14 properties served by x2 Broag remeha Boilers
- The Terrace – 20 properties served by oil fired boilers

The position of the buildings along with the most direct route between them is shown on Figure 5-8.

Figure 5-8: Lewisham Homes buildings positions (yellow polygons)



Of the three sites, Etta Street is actually two very small blocks – one on each side of the street. The approximate length of the connection is 375m and so it is excluded at this point as the load for 14 houses would never be sufficient to justify the cost of connection.

The Terrace is over 500m away and is also excluded from further analysis on the same basis.

Sayes Court is much nearer to the network, just off Evelyn Street. The connection length is approximately 100m which, for 14 dwellings is still unlikely to be economically attractive; however we will include in the analysis that follows in Element C.

6 UTILITIES ASSESSMENT

6.1 UTILITIES MAPPING

Full utilities mapping was procured to assess the extent of existing services within the study area. The primary focus was to assess the most direct route based on interface locations, as presented in Figure 4-12. The following sections present a summary of each of the affected utilities within the context of the most direct route and taking into account any major infrastructure – such as intermediate or high pressure gas mains, HV and EHV electricity, and large sewer or water mains – in the wider area.

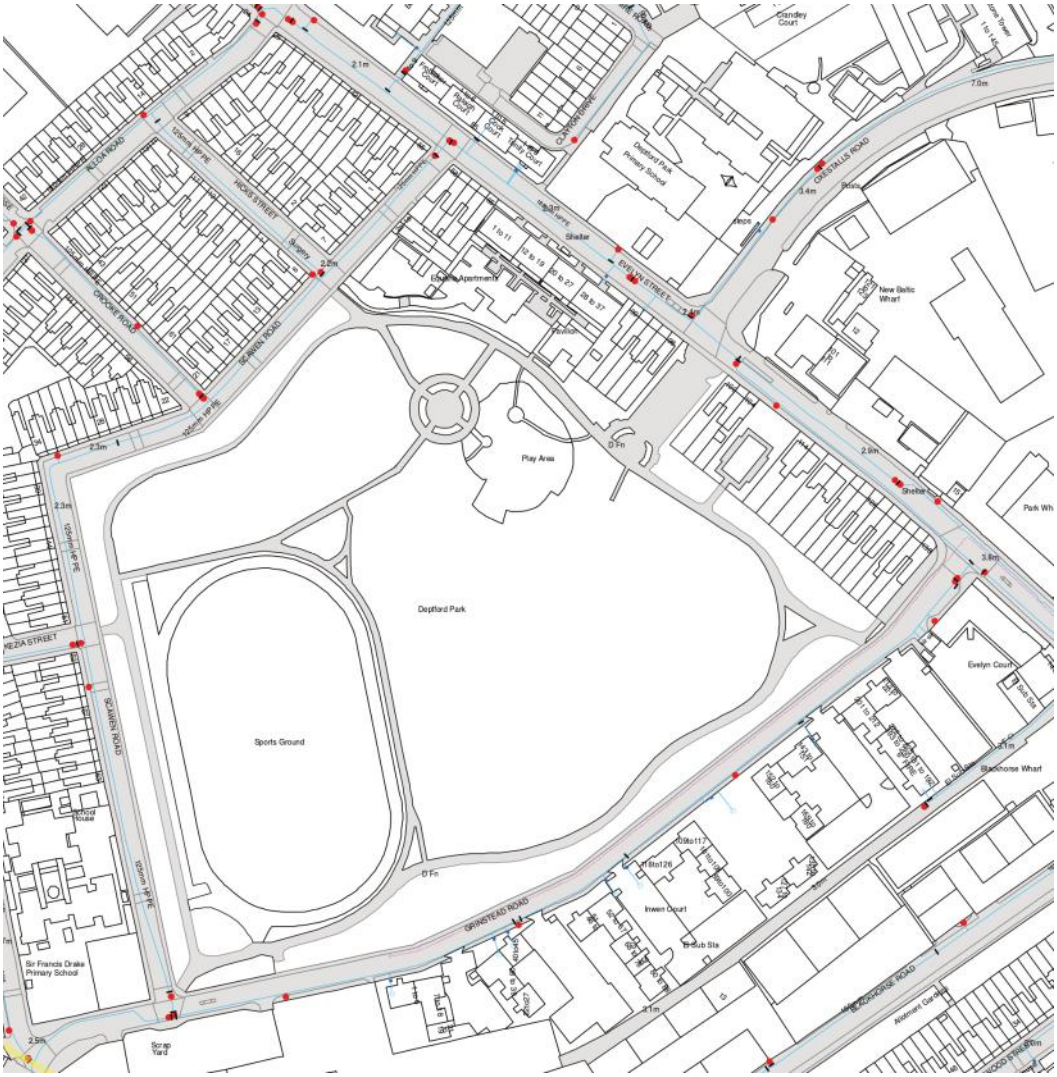
Note that the full set of utilities maps will be supplied to LBL with this report.

6.1.1 Mains water

Thames Water provided full mapping of their water infrastructure for the study area. Figure 6-1 presents a section of the mapping showing the junction of Surrey Canal Road, Trundleys Road and Grinstead Road in the south west corner, Grinstead Road and Evelyn Street (A200). The wider mapping shows the following:

- There is a single distribution main running up Grinstead Road at approximately 2.5m deep (to the invert level). The mapping suggests the main is in the westbound carriageway.
- There is a proposed main shown running through the eastbound carriageway. It terminates outside the Neptune Wharf development, so it is presumed that it is to serve the new development. The depth and diameter of this main is not shown on the drawing. This must be a distribution (rather than a trunk) main as its source is an existing distribution main on Evelyn Street.
- There are two 180mm distribution mains running along Evelyn Street, which converge into a single 180mm main around the junction with Oxestalls Rd. The mains are around 2m deep towards the north end of Evelyn Street (the Cannon Wharf end) and 5m deep at the south end (the Convoys Wharf end).
- The mapping suggests the mains are in to the side of the carriageway or in the footpath in most places.
- There are no trunk mains along the proposed route.

Figure 6-1: Water infrastructure - Grinstead Road and Evelyn Street



A summary of the water mains along the most direct route is presented in Table 6-1.

Table 6-1: Distribution water mains along the most direct network route

Street	No. of mains	Diameter (mm)	Approximate invert level (m)
Grinstead Road	1 existing & 1 proposed	Not stated. Assume 180mm	2.5
Evelyn Street	2	2 x 180mm	2.5m - 5.0m
Rainsborough Avenue	1	125mm	Not stated
Abinger Grove	1	180mm	Not stated
Arklow Road	1	180mm	Not stated
Dragoon Road	1	250mm	Not stated
Grove Street	2	1 x 200mm; 1 x 180mm	1.5m - 2.0m

Thames Water guidance for working near their mains[5] requires that when crossing TW water or sewer infrastructure, there should be sufficient distance between the two services. The document does not specify the separation that must be maintained; however we spoke to Thames Water's development planning team, who advised that they require 300mm of separation. Where this cannot be adhered to, their engineers would review the detail and make a decision on a case by case basis, seeking to avoid diversions if possible, although this could not be guaranteed.

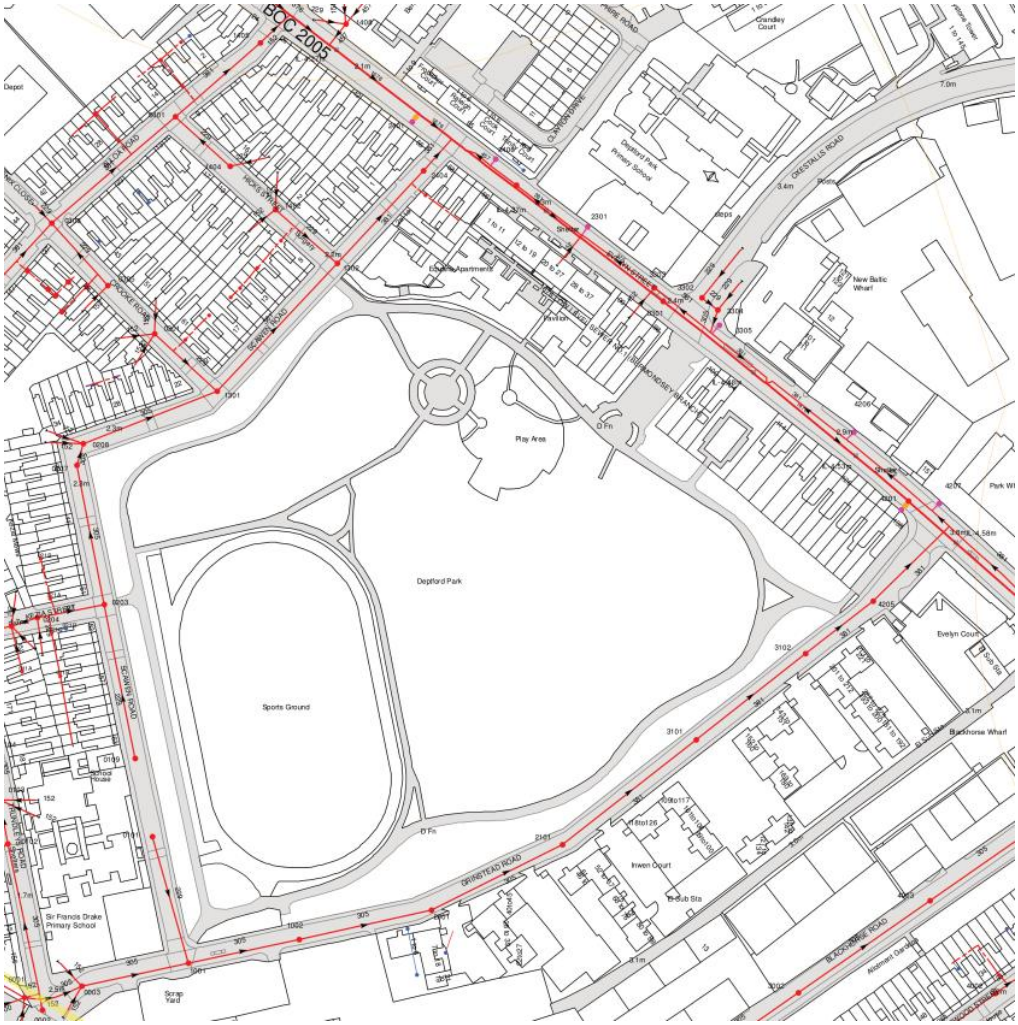
6.1.2 Waste water

Thames Water provided full mapping of their waste water infrastructure for the study area. Figure 6-2 presents a section of the mapping showing the junction of Surrey Canal Road, Trundleys Road and Grinstead Road in the south west corner, Grinstead Road and Evelyn Street (A200). The mapping shows the following:

- The junction of Surrey Canal Road, Trundley's Road and Grinstead Road is particularly congested, with a confluence of combined sewers from all the major roads that share this junction.
- There is a single 305mm combined sewer running up Grinstead Road, becoming a 381mm main towards the junction with Evelyn Street.
- There are two sewers running along Evelyn Street. One trunk combined sewer – Low Level Sewer #1 (Bermondsey Branch), which is approximately 4.5m deep – and a 381mm local combined sewer at approximately 2.9m.

[5] https://www.thameswater.co.uk/developers/18785.htm

Figure 6-2: Waste water infrastructure - Grinstead Road and Evelyn Street



A summary of the waste water mains along the most direct route is presented in Table 6-2.

Table 6-2: Waste water mains along the most direct network route

Street	No. of mains	Diameter (mm)	Approximate invert level (m)
Grinstead Road	1	305 becoming 381	2.5
Evelyn Street	2	1 x 1676 trunk; 1 x 381	1 x 4.5; 1 x 2.9
Rainsborough Avenue	1	305 becoming 457	Not stated
Abinger Grove	1	305	Not stated
Arklow Road	1	305	Not stated
Dragoon Road	1	229 becoming 305	Not stated
Grove Street	1	1100 x 813	1.9

6.1.3 Gas

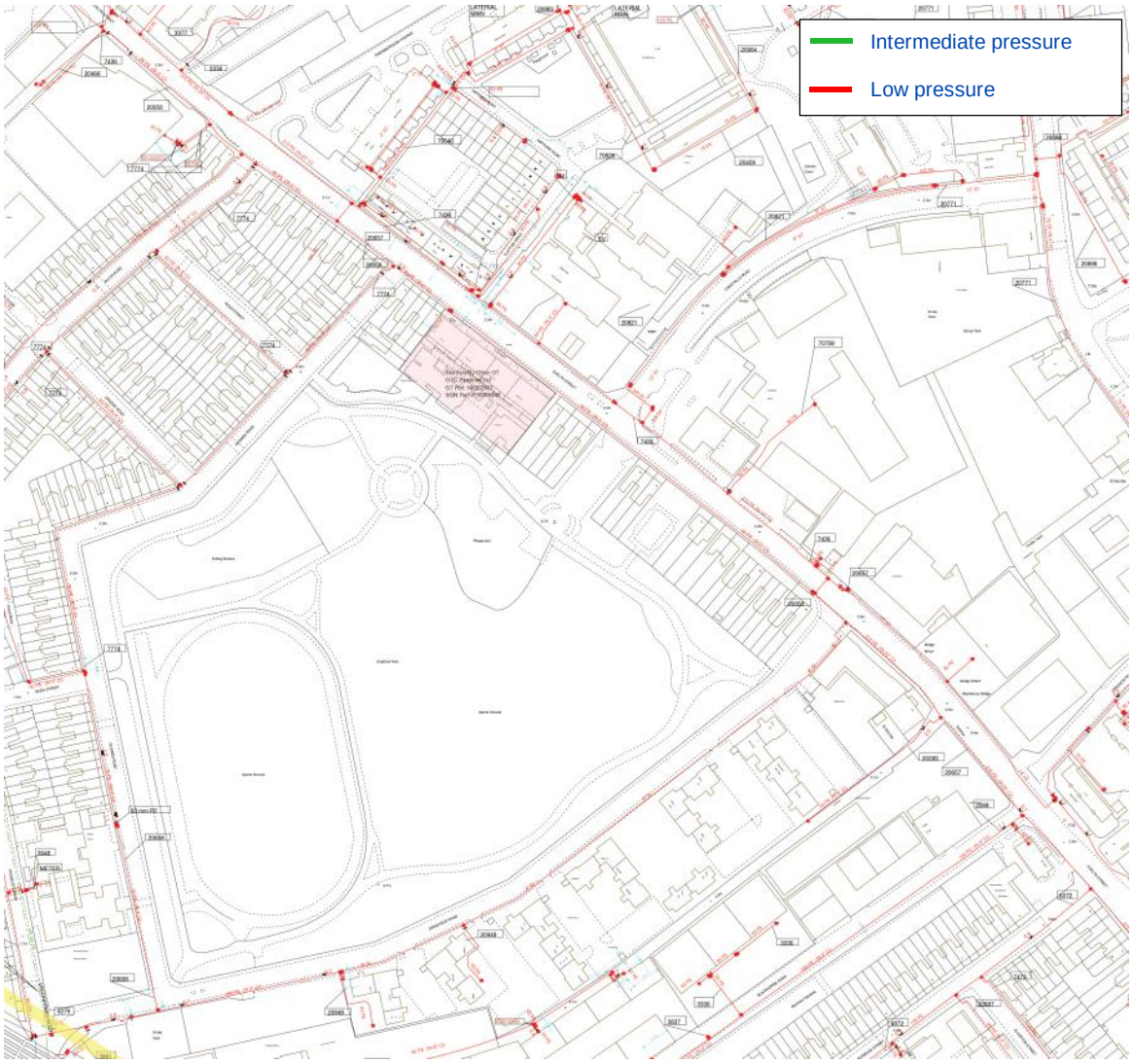
Southern Gas Networks provided full mapping of their infrastructure for the study area. Figure 6-2 presents a section of the mapping showing the junction of Surrey Canal Road, Trundleys Road and Grinstead Road in the south west corner, Grinstead Road and Evelyn Street (A200). The mapping shows the following:

- There is an intermediate pressure (IP) gas main crossing Grinstead Road at the junction with Trundley's Road. This is the only part of the most direct route with IP or high pressure (HP) gas infrastructure.

- There is a 9" (225mm) low pressure (LP) main running up Grinstead Road. The mapping suggests the pipe is in the southern footway.

- There are two mains running along Evelyn Street. There appears, from the mapping, to be on in each footway. The main in the south footway is 315mm PE inside a 20" (500mm) cast iron pipe. The main in the north footway is 14" (350mm) cast iron.

Figure 6-3: Gas infrastructure - Grinstead Road and Evelyn Street



The gas infrastructure around the junction of Grinstead Road, Trundley's Walk and Surrey Canal Road, including the IP mains shown in green, is presented in Figure 6-4. It shows how two IP

mains – one from Surrey Canal Road and one from Trundley's Walk – converge into a single pipe that continues down Trundleys Road. The previous study highlighted the requirement to negotiate this gas infrastructure on Surrey Canal Road and Trundleys Road; however the north Lewisham extension will also need to pass underneath the 24" (600mm) IP main as it crosses Grinstead Road.

Southern Gas Networks guidance[6] requires the following in working close to an IP gas main:

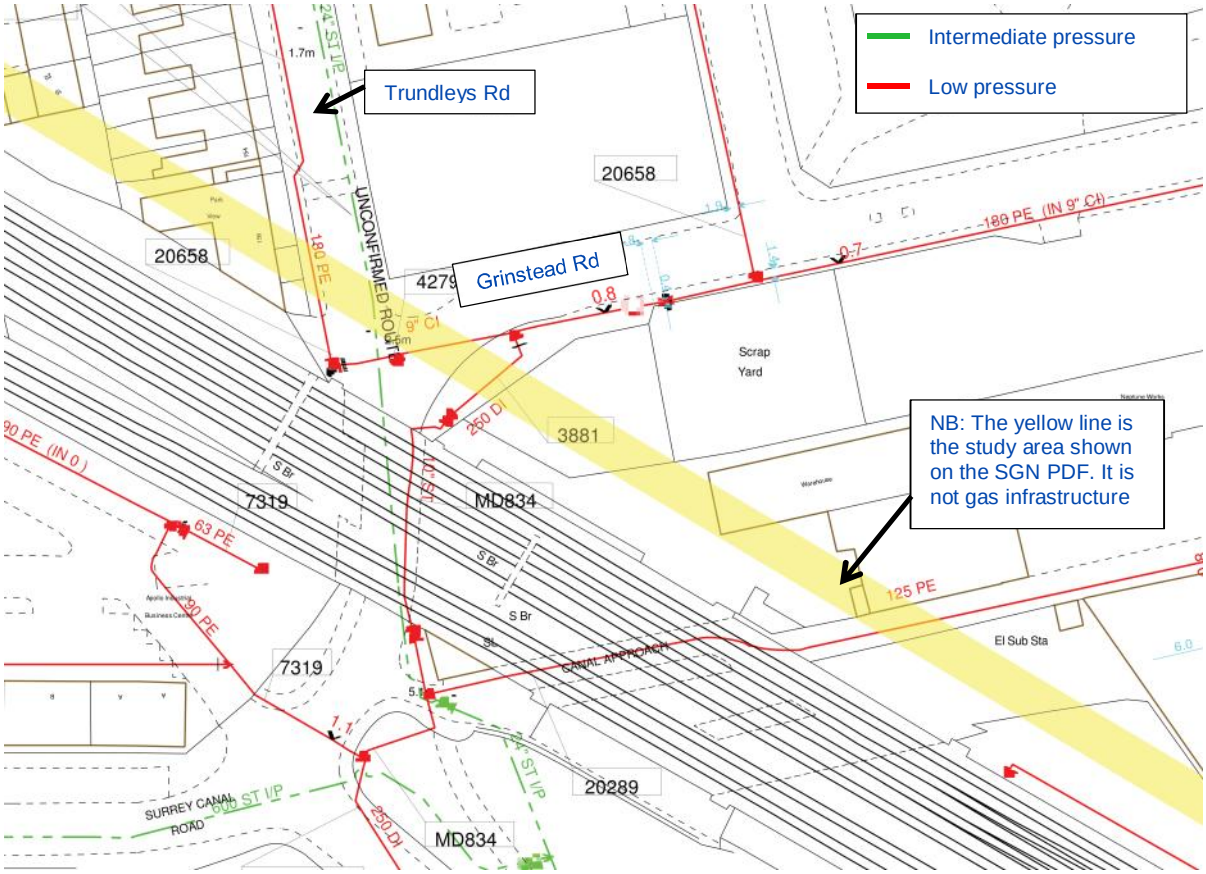
1) There should be no mechanical excavation above or within 3m of the intermediate pressure system.

2) A minimum clearance of 600mm or 1.5 times the external diameter of the gas pipe, whichever is greater, must be maintained. It is noted that, where this minimum separation cannot be achieved, site discussions should be held with SGN operatives to agree a suitable distance.

It is noted that there is no means of avoiding the requirement to cross these IP gas mains and this should be an area for further site investigations in order to further inform the design process. Recommendations for site investigations are presented in Section 12.6.

[6] https://www.sgn.co.uk/Safety/Dig-safely/

Figure 6-4: Gas infrastructure around junction of Surrey Canal Rd, Grinstead Rd & Trundleys Rd



A summary of the gas mains along the most direct route is presented in Table 6-3.

Table 6-3: Gas mains along the most direct network route

Street	No. of mains	Diameter (mm)	Approximate invert level (m)
Grinstead Road	1 x IP crossing; 1 x LP the length of road	600mm IP; 225mm LP cast iron	2.5m IP; 0.8m LP
Evelyn Street	2	500mm in south footway; 350mm in north footway	Around 1m
Rainsborough Avenue	N/A	N/A	N/A
Abinger Grove	2	200mm	Around 1m
Arklow Road	1	125mm	0.7m
Dragoon Road	1	180mm	0.8m
Grove Street	1	100mm	0.6m

6.1.4 Electricity

UK Power Networks (UKPN) provided full mapping of their infrastructure for the study area. We have assessed the mapping to identify areas with high numbers of electrical infrastructure and/or places where extra high voltage (EHV) cables are present.

Consultation of the mapping shows that electrical infrastructure is abundant throughout the whole area; however there are some streets where there is more cable than others and/or EHV cable is present.

Note that UKPN mapping states depths of installation to be '*normally 750mm carriageway and 600mm cover in footway*'. The mapping shows cables as being largely installed in the footway or to the side of the carriageways.

A summary of the electricity infrastructure along the most direct route is presented in Table 6-4. The Deptford Park side of Grinstead Road appears to be clear of electricity cables, presumably as no local distribution is required on that side of the road as it is adjacent to the park.

Table 6-4: Electricity mains along the most direct network route

Street	No. of mains	Type
Grinstead Road	2	HV & LV
Evelyn Street	Multiple	1 x EHV; multiple HV
Rainsborough Avenue	N/A	N/A
Abinger Grove	Multiple	LV, HV & EHV
Arklow Road	Multiple	LV, HV & EHV
Dragoon Road	2	1 x HV; 1 x LV
Grove Street	Multiple	HV & LV

6.1.5 BT comms

BT provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route.

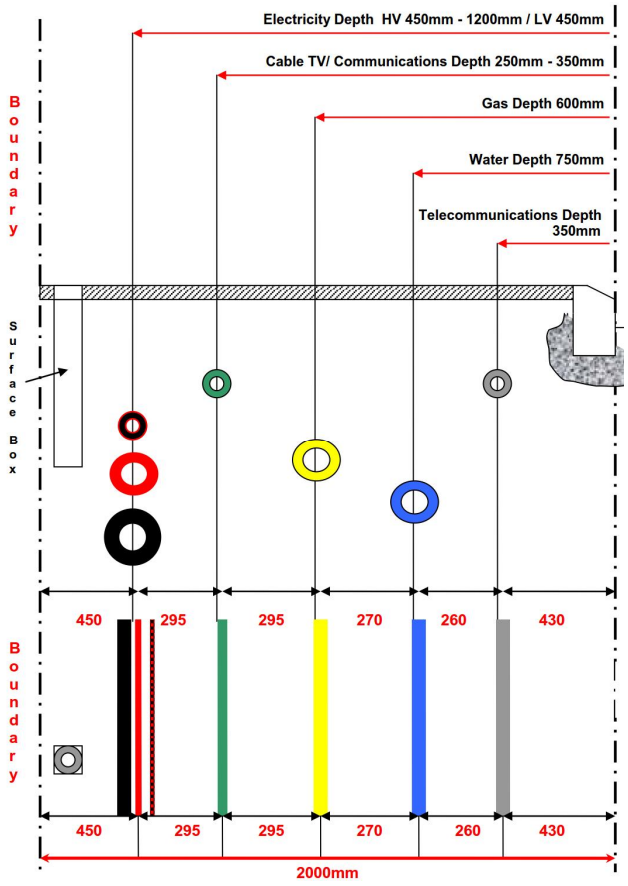
As with electricity cables, the BT infrastructure around London is abundant, with cables in most streets. Cables are largely installed outside of the carriageways – i.e. in the footways.

Rainborough Avenue is the only street along the most direct route with no BT cabling installed. The Deptford Park side of Grinstead Road also appears to be clear of BT cables, presumably as no local distribution is required on that side of the road as it is adjacent to the park.

With regard to minimum separation, there are no specific requirements for installation in proximity to comms cables. NJUG guidelines[7] recommend that comms infrastructure should be installed within the footway at a depth of 250-350mm where possible. The recommended separation is 260mm horizontally from the centre of the comms service to the centre of the next service, as shown in Figure 6-5.

[7] http://www.njug.org.uk/wp-content/uploads/V1-Positioning-Colour-Coding-Issue-8.pdf

Figure 6-5: NJUG recommended depth of installation and separation for services in a 2m footway



In reality, our experience is that the position of services and their proximity to each other varies significantly, depending on the number of other services in the area and the order in which they are installed. It would therefore be unrealistic to assume that the position of services in a London carriageway or footway would be as recommended by NJUG. That is not to say service providers would not seek to follow these guidelines, but in many cases it would not be possible.

As with all other services, it is important to maintain as much separation as possible, to minimise the risk of damaging other services on installation and to minimise the risk of the DH pipework being exposed[8] or damaged during works carried out on an adjacent service.

6.1.6 Virgin comms

Virgin provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route.

[8] There is a risk of buckling if large sections of pipework are exposed, as the soil friction force acting on the pipe is removed.

As with BT, Virgin have cabling installed in every street in the most direct route with the exception of Rainborough Avenue. The mapping also shows the infrastructure predominantly within the footways or to the edge of the carriageway.

An example of the mapping, showing Grinstead Road and Evelyn Street is presented in Figure 6-6.

Figure 6-6: Virgin infrastructure – Grinstead Road and Evelyn Street

6.1.7 Vodafone comms

Vodafone provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route.

The only road affected by Vodafone's infrastructure is Evelyn Street, where a single cable is shown running to the north of the carriageway, as shown in Figure 6-7.

Figure 6-7: Vodafone infrastructure - Evelyn Street

6.1.8 Colt Technology comms

Colt Technology provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route and the only road affected is Evelyn Street.

A single cable/duct is shown running down along Evelyn Street; however the position of the service cannot be determine from the mapping due to the resolution. Due to the number of services in Evelyn Street, we would recommend that site investigations are undertaken here to confirm their position. Recommendations for site investigations are presented in Section 12.6.

6.1.9 Plancast comms

Plancast provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route and the only road affected is Evelyn Street.

A single cable/duct is shown running down along Evelyn Street; however the position of the service cannot be determine from the mapping due to the resolution. Due to the number of services in Evelyn Street, we would recommend that site investigations are undertaken here to confirm their position. Recommendations for site investigations are presented in Section 12.6.

6.1.10 Instalcom comms

Instalcom provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route and the only road affected is Evelyn Street.

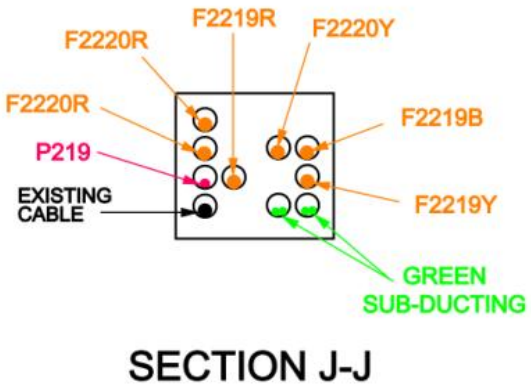
A single cable/duct is shown running down along Evelyn Street; however the position of the service cannot be determine from the mapping due to the resolution. Due to the number of services in Evelyn Street, we would recommend that site investigations are undertaken here to confirm their position. Recommendations for site investigations are presented in Section 12.6.

6.1.11 London Underground cables

London Underground provided full mapping of their infrastructure for the study area. We have assessed the mapping to determine the extent of cabling across the most direct route and the only road affected is Evelyn Street.

The south side of Evelyn Street contains a bank of ten ducted cables (plus spare ducts), as shown in the manhole cross section presented in Figure 6-8. Note that the configuration of the ducts within the manholes varies. The depth of the ducts varies from approximately 1m to approximately 2.5m.

Figure 6-8: London Underground road cabling cross section - Evelyn Street



We are not aware of any specific requirements that apply to the installation of other services in proximity to London Underground ducts; however DH installation practice requires a minimum of 100mm clearance around the pipework.

6.1.12 Utilities mapping summary

We have compiled the information in the preceding sections to show the utilities installed in each of the streets on the most direct route. We have also included services in roads servicing the additional loads identified as being potential connections options in Section 5. The results are presented in Table 6-5.

Table 6-5: Summary of services along most direct route

Street	Gas		Waste water	Mains water distrib.	Electricity			BT comms	Virgin comms	Vodaphone comms	Colt comms	Plancast comms	Instalcom comms	London Underground cables
	LP	IP			LV	HV	EHV							
Grinstead Road	☑	☑	☑	☑	☑	☑		☑						
Evelyn Street	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Rainsborough Avenue			☑	☑										
Abinger Grove	☑		☑	☑	☑	☑	☑	☑						
Arklow Road	☑		☑	☑	☑	☑	☑	☑						
Dragoon Road	☑		☑	☑	☑	☑		☑						
Grove Street	☑		☑	☑	☑	☑		☑						
Staunton Street / Clyde Street	☑		☑	☑	☑	☑		☑						
Scawen Road	☑		☑	☑	☑	☑		☑						
Sayes Court Street	☑		☑	☑	☑	☑		☑						

The table shows how Evelyn Street is heavily congested with every type of service. This reflects its position as the primary route through the area and suggests that it may be difficult to find space to install DH pipework within the street.

Many of the services in Evelyn Street are comms utilities, which are typically installed in the footways. As such, it may still be possible to install pipework within the carriageway.

6.2 CONCLUSIONS

The utilities mapping shows a high level of existing services in most of the study area; however most of it is typical service infrastructure for a large city. Compared to the route between SELCHP and Goldsmiths University, the area is certainly aided by the lack of IP gas mains once the network passes the junction of Trundleys Road and Grinstead Road.

There are also no trunk water mains along the proposed route, which would make diversions easier to execute if required.

Of all the roads being considered for installation, Evelyn Street (A200) is probably the most important as it is the only road that runs east-west, providing a link between the various loads. It is therefore unfortunate, although not surprising, that this is also the road with by far the most existing service infrastructure.

Given the extent of existing services, we would conclude that there is a high risk of them impacting on the design and installation of the proposed heat network, particularly in Evelyn Street, where there is the highest number of services. Site investigations prior to the procurement of a design and build contractor will certainly help to reduce the project risk; however it is our experience that no amount of site investigation can completely de-risk the construction phase with regard to issues arising from the number and/or position of existing services. It is only when full trench excavation has taken place that there is absolute certainty. Trial holes, although certainly useful, are only a cross section at one point on the system; and GPR, although more extensive, is subject to significant margins of error (+/- 20 percent) and missed services.

We would recommend the following steps in dealing with this risk:

1) Undertake site investigations prior to the detailed design and construction phases. This is discussed in detail in Section 12.6.

2) Minimise, as far as possible, the extent of installation within areas of high existing services – particularly Evelyn Street.

3) Ensure the construction tender and contract documentation is absolutely clear on the demarcation of risk associated with issues arising from existing services. Contractual elements that should be considered include:

    a. The depth of excavation required. High numbers of existing services may mean trenches of up to 3m in depth may be required in places.

    b. Unexpected material costs arising from re-designs to avoid existing services. Additional bends may be required to avoid services.

    c. Design iteration costs if required during the construction phase.

    d. Delays to the project completion date arising from the above.

7 SITE SURVEY

7.1 OBSERVATIONS ON SITE

Following the review of utilities mapping, we undertook a site survey to support the findings of the desk based assessment. Several key things were noted, as described in the following sections.

7.1.1 Canal approach

The initial preferred route proposed by LBL utilises Canal Approach to extend east towards Evelyn Street. This route was part of the former Grand Surrey Canal. On visiting the site, we observed that Canal Approach is fenced off at both ends and appears to be used for storage of, among other things, refuse skips. Images are presented in Figure 7-1 and Figure 7-2.

Figure 7-1: Locked entrance to Canal Approach on Surrey Canal Road

Figure 7-2: Canal Approach taken from behind locked gate on Evelyn Street

Furthermore, on consulting the land ownership mapping provided by LBL and presented in Figure 10-1, we can see that Canal Approach is un-adopted highway. In consultation with LBL highways officers, they confirmed that the road is privately owned, although it is not known by whom.

It is also noted that the contaminated land study which accompanies this report has highlighted the sensitivity of excavating along the old canal route due to the inert, household and commercial waste material that was used to infill the canal and its subsequent classification as historic landfill. This raises the risk to health of operatives from exposure to contaminated materials via direct contact (ingestion, dermal contact or inhalation. The contaminated land study concluded that the general risk to human health across the wider study area is low to moderate; however if the route follows the path of the Grand Surrey Canal, it is suggested that this risk would increase due to the concentration of contaminated materials in this area.

Section 8 confirms that Canal Approach is unlikely to be the most economic route towards Evelyn Street. An alternative would be to use the soft dig land in Deptford Park, which would significantly reduce the cost of installation and would also provide a means of avoiding large parts of Evelyn Street, which is congested with existing services, as discussed in Section 6. The option of installing in Deptford Park is discussed in Section 8.1.

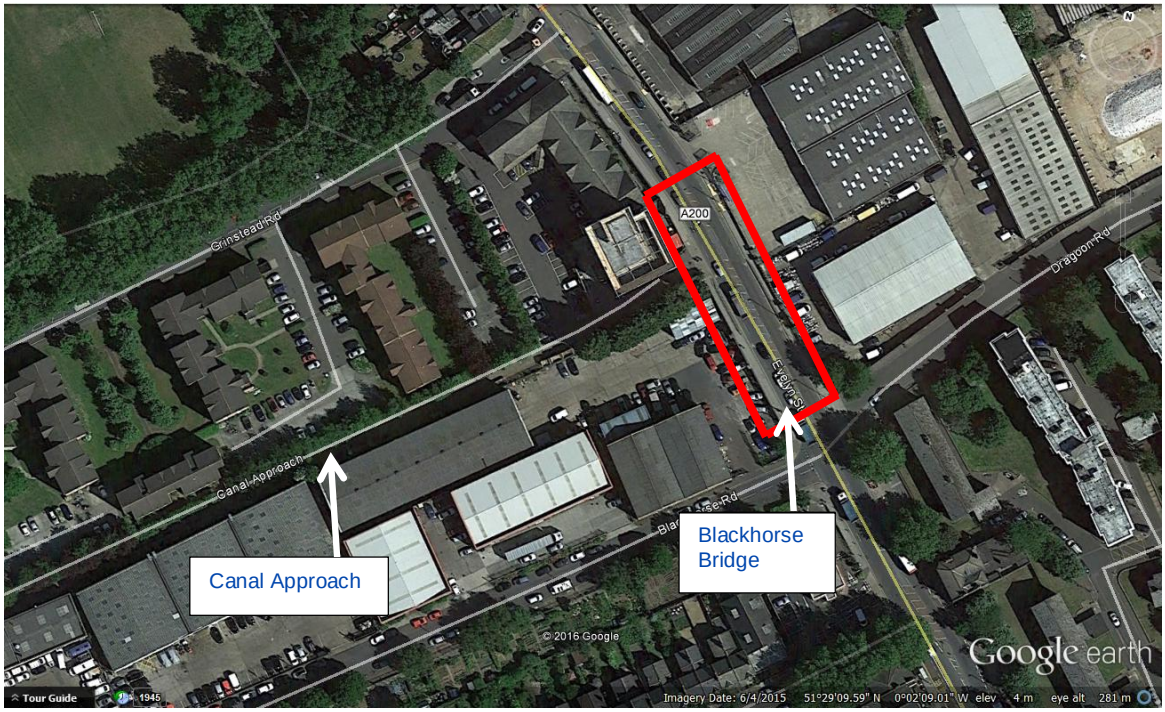
Grinstead Road also appears to offer a viable alternative, as it is wide and there are no large or high risk existing services other than the IP gas main at the junction with Trundleys Road, which cannot be avoided (see Section 6.1.3).

As a result of this, we would conclude that Canal Approach is not the preferred routing option for accessing loads to the east of Surrey Canal Road.

7.1.2 Blackhorse Bridge

On surveying the area, we noted that part of Evelyn Street is a raised bridge that crosses two car parks – one on each side of the road. The bridge is referred to in the Southern Gas Networks mapping as Blackhorse Bridge and crosses over the old Surrey Canal route. As such, Canal Approach ends on Blackhorse Bridge. The location of the bridge is shown in Figure 7-3.

Figure 7-3: Blackhorse Bridge location



On the northbound side of the road, the bridge crosses a car park that appears to belong to *Hi-line Cash and Carry* – a wine wholesaler, although there were works going on in the car park at the time we visited and a security guard was on the gate. See Figure 7-4.

Figure 7-4: Evelyn Street bridge - northbound side, looking into Cash & Carry car park

On the southbound side, the bridge crosses an area at the back of *Safestore Self Storage*. See Figure 7-5.

Figure 7-5: Evelyn Street road bridge southbound side - taken from Selfstore car park

Upon preliminary investigation, the options for navigating this bridge crossing would appear to be:

1) Route the pipe through the Hi Cash and Carry car park, which is at lower level, before coming out onto Blackhorse Road and re-joining Evelyn Street. This would be best

achieved if the mains came up Canal Approach, which is directly adjacent to the car park, however we have highlighted in Section 7.1.1 the issues with installation in Canal Approach. It may still be possible to use a small section of Canal Approach to bring the pipe into the Cash and Carry car park however.

2) Install the pipework within the road construction over the bridge. This would require confirmation of the road construction depth and means the pipework would, in all likelihood, be installed at very shallow depth. This is not in itself an issue, but would require careful design and probably protection over the DH pipe to avoid excess vertical loading, e.g. a steel plate.

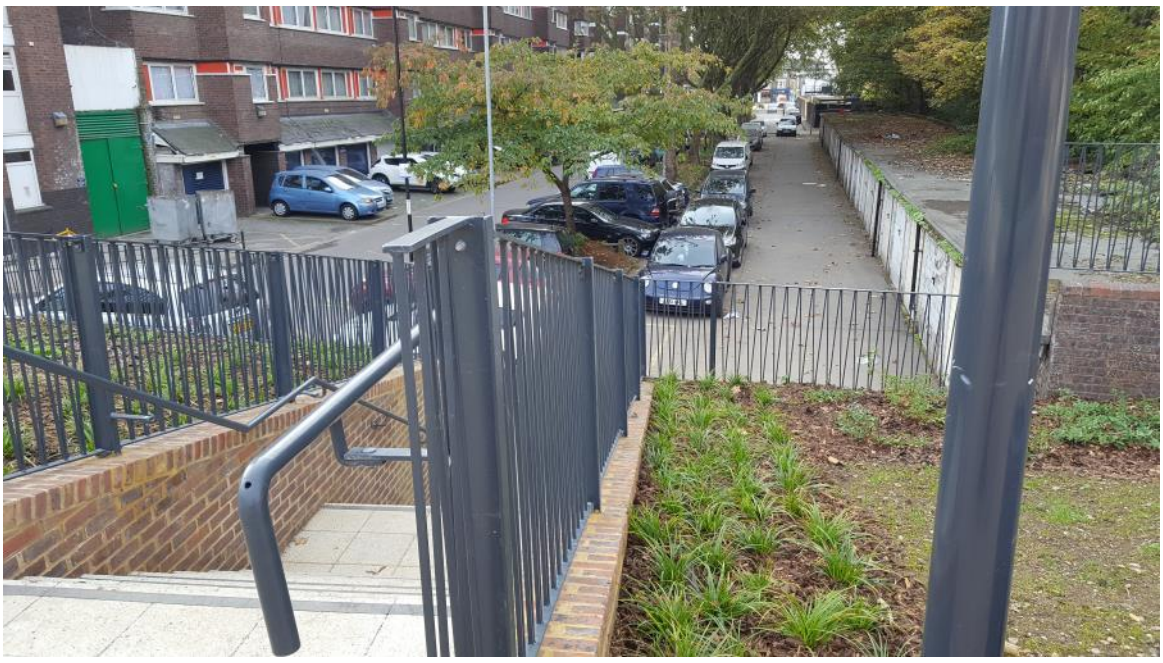
3) Affix the pipe externally to the bridge structure. This would mean the pipework would need to divert out of the Evelyn Street carriageway and out onto the outside or underside of the bridge.

Ultimately, it will be necessary to find a means of crossing the bridge as there is no alternative route that avoids it. Identifying the best solution is likely to require site investigation – probably a trial hole to determine the depth of the road structure – however we will investigate the options further in the Element B study. At this stage, it should be noted as an area of engineering difficulty that must be overcome.

7.1.3 Footpath between Deptford Park school and Marine Wharf West linear park

The most direct route to the four developments in the north of the study area – Cannon Wharf, Marine Wharf West and East, and Yeoman Street – has previously been identified as being via Rainsborough Avenue, which leads up to the linear park running through Marine Wharf West (see and Figure 4-12 and Figure 7-6).

Figure 7-6: Rainsborough Avenue - taken from Marine Wharf West linear park



On surveying the site, however, we identified a potential alternative that would minimise the requirement to install pipework within Evelyn Street, which we have already identified as being congested with existing utilities.

A small footpath runs along the side of Deptford Park school at Oxestalls Road and joins up with the new linear park, as shown in Figure 7-7 and Figure 7-8.

Figure 7-7: Aerial view of footpath (red line) between Oxestalls Rd and Marine Wharf West linear park

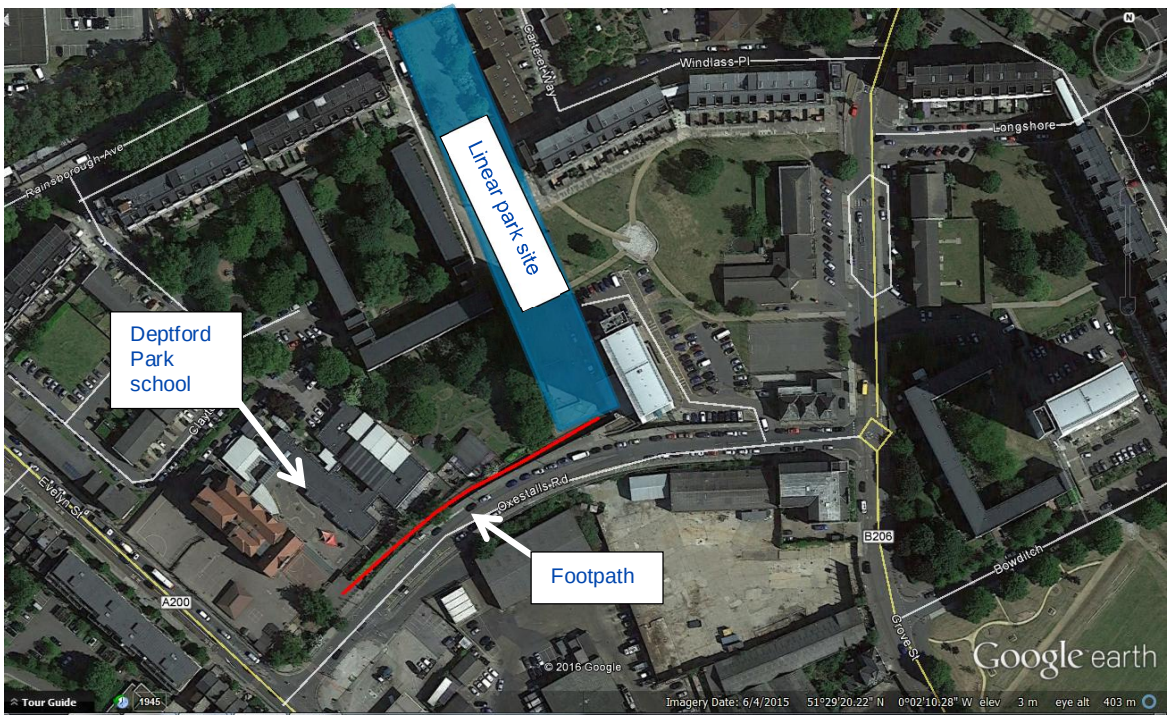


Figure 7-8: Photo of footpath between Oxestalls Rd and Marine Wharf West linear park

The viability of this route is, however, questionable due to the width of the footpath, which limits the space within which the pipe could be installed. There is sufficient width to do so; however if there are other services already installed, it is unlikely that space can be found for the DH pipework.

Furthermore, there are several mature trees in the middle of the footpath (visible in Figure 7-8), towards the linear park end. It would not be possible to install the pipework without removing these trees; and so it is assumed that the route is not possible.

This option could be investigated further if installation within Evelyn Street proves to be particularly problematic.

7.2 GENERAL CONCLUSIONS

Based on the site surveying, we would conclude that the part of the most direct route that offers the most concern is Blackhorse Bridge. There is no means of avoiding it, so a solution must be found and will be investigated further in the Element B report. Site investigations will most likely be required too.

Generally, the roads are wide, which suggests there is a good chance of there being sufficient space to install the DH pipework. There is evidence of existing services, i.e. manhole covers and scarring within the carriageway; however this would be expected in just about every street in any major city. The utilities mapping suggests the area of the route with a very high number of existing services is Evelyn Street.

Canal Approach was part of the initial preferred route; however it is, in all likelihood, more expensive than installing the pipework in Deptford Park (see Section 10.3). It is also noted that the contaminated land assessment highlighted the former Grand Surrey Canal route as a

potentially sensitive area due to the infill material that was used. Grinstead Road, which runs alongside Deptford Park, also offers a seemingly viable alternative to Canal Approach.

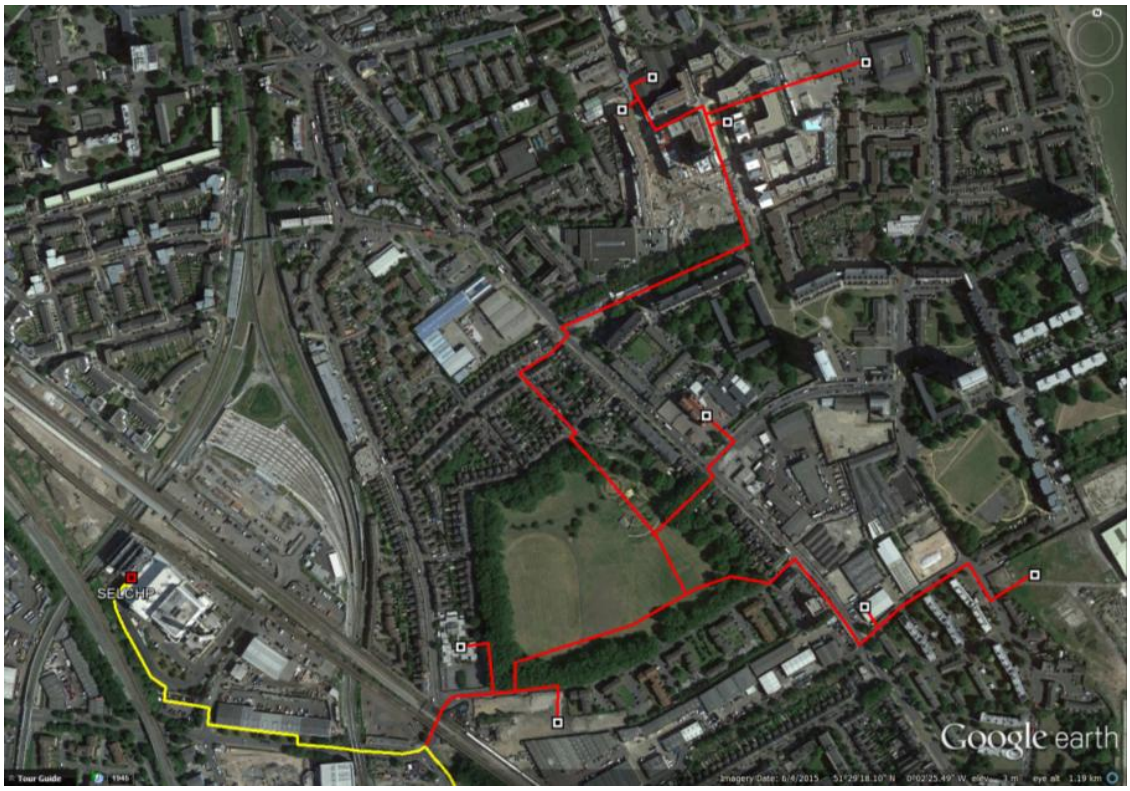
8 ALTERNATIVE ROUTE OPTIONS

8.1 DEPTFORD PARK

Deptford Park is presented in the most direct route between interface points (Figure 4-12) as a means of avoiding installation within Canal Approach and of maximising the extent of soft dig installation.

Given the extent of the services in Evelyn Street, we consider this to be the part of the most direct route that is most likely to be problematic. Although there is no means of avoiding the road altogether, the requirement to install pipework there can be minimised by maximising installation within Deptford Park, as shown in Figure 8-1.

Figure 8-1: Alternative route minimising installation in Evelyn Street



The preliminary ecological appraisal that accompanies this report has concluded that Deptford Park is not considered to pose a constraint to the proposed development as it is subject to standard management regimes and considered to be of low conservation value. That is not to say, however, that LBL departmental officers would permit the installation of pipework within the park. This is discussed further in Section 10.3.

If the installation of pipework within the park can be agreed, this route is also likely to be preferable, from an economic point of view, due to the replacement of hard dig installation on Evelyn Street with soft dig installation in Deptford Park. However the route does rely on the use of Hicks Street and Alloa Road.

Consultation of the utilities mapping shows that there are multiple services in Hicks Street and Alloa Road; specifically:

- Low pressure gas – 100mm
- Mains water – 125mm
- Waste water – 229mm
- LV electricity
- BT comms

Both roads are narrow, so there is not a great deal of room for installation. It would therefore not be possible to definitively confirm the possibility of installation without site investigations.

It is also noted that there is residential parking on either side of Hicks Street and Alloa Road, as shown in Figure 8-2. Works in both streets would therefore not be without disruption and would require parking suspensions.

Figure 8-2: Hicks Street

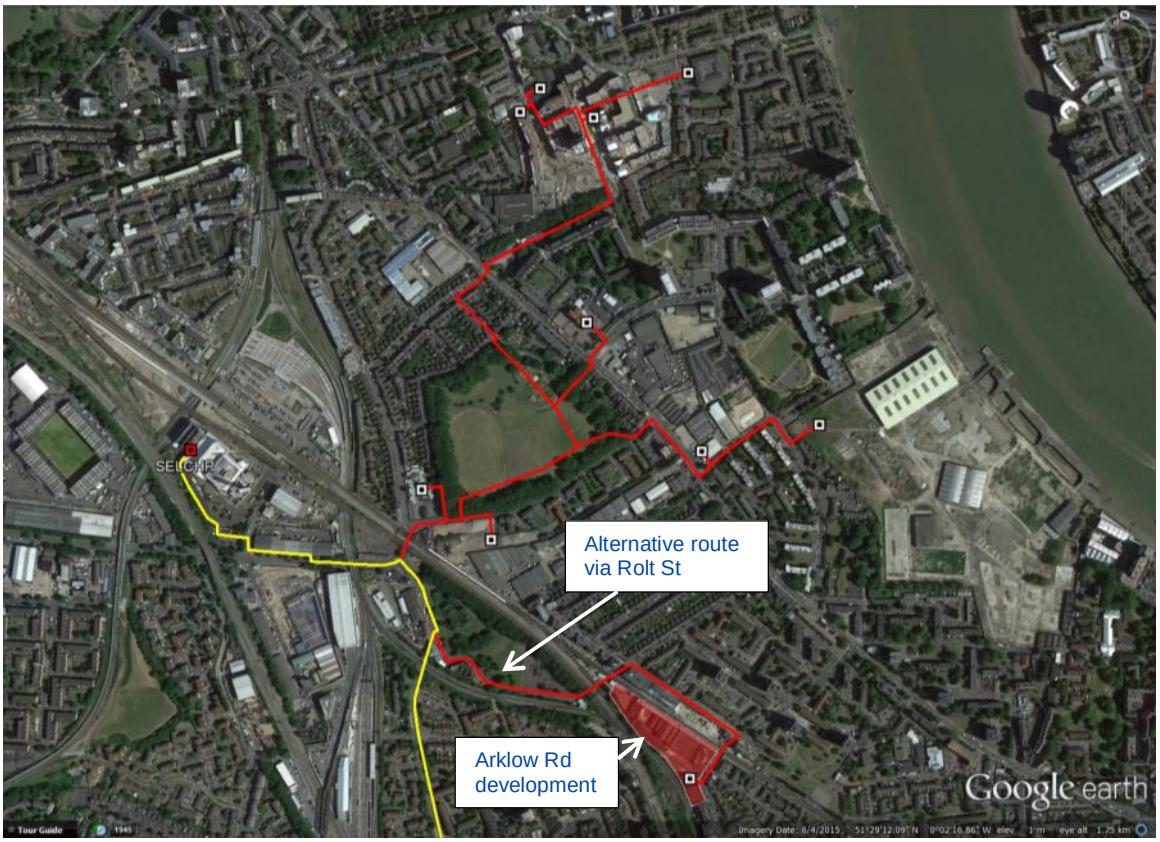
As a result of this uncertainty, we would recommend site investigations on Hicks Street and Alloa Road to confirm the extent of existing services. The location and type of investigations required are discussed in Section 12.6.

8.2 TO ARKLOW ROAD VIA ROLT STREET

An alternative route to the Arklow Road development may be required if it is necessary to minimise installation within Evelyn Street due to the number of existing services, as discussed in Section 8.1.

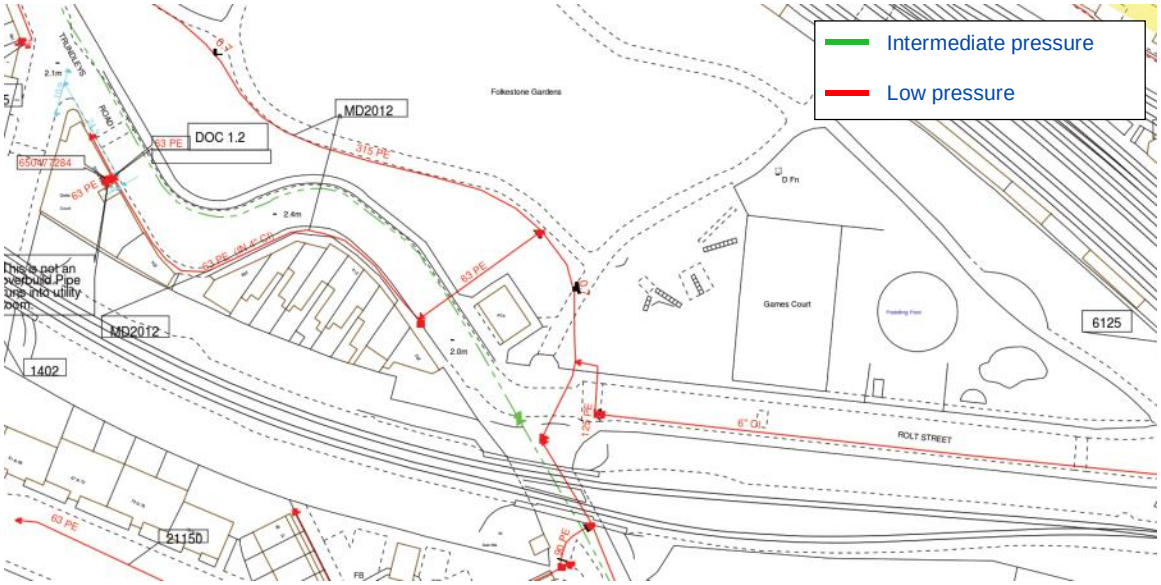
The most obvious alternative is to supply Arklow Road from the preferred New Cross network route identified in the previous study, as shown in Figure 8-3.

Figure 8-3: Alternative route to Arklow Road - avoiding Evelyn Street



Although this route seems to provide a reasonable alternative, it is noted that an IP gas main also follows the same route down Rolt Street, continuing on down Woodpecker Road, as shown in Figure 8-4.

Figure 8-4: Gas infrastructure around Rolt Street and Folkestone Gardens



The IP gas main running down Rolt Street is 600mm in diameter. Based on Southern Gas Networks' minimum separation of 1.5 times the pipe diameter (see Section 6.1.3), there should be at least 900mm separation between the DH mains and the IP gas main, although the wording in the SGN *General Safety Measures* document (see footnote 6) suggests this may be negotiable on a case-by-case basis. Rolt Street is fairly wide so this may be achievable; however there are other services in the road; specifically:

- Waste water
- Mains water
- BT
- Electricity
- Virgin Media

As such, it may be difficult to find space in Rolt Street to install DH mains. An alternative might be to go straight across Folkestone Gardens and under the railway using the footpath between Folkestone Gardens and Childers Street, as shown in Figure 8-5 and Figure 8-6. Folkestone Gardens is a Designated Site of Nature Conservation (SINC), however, and is therefore protected by London and Lewisham planning policy. Our preliminary ecological appraisal for the New Cross heat network recommended that any requirement for vegetation clearance is avoided. If this is not possible, any direct effects on the pond, grassland and any mature trees should be avoided.

We would therefore conclude that, although routing the pipe through Folkestone Gardens may, in theory, be possible, every effort should be made to avoid it.

Figure 8-5: Alternative route to Arklow Road using Folkestone Gardens

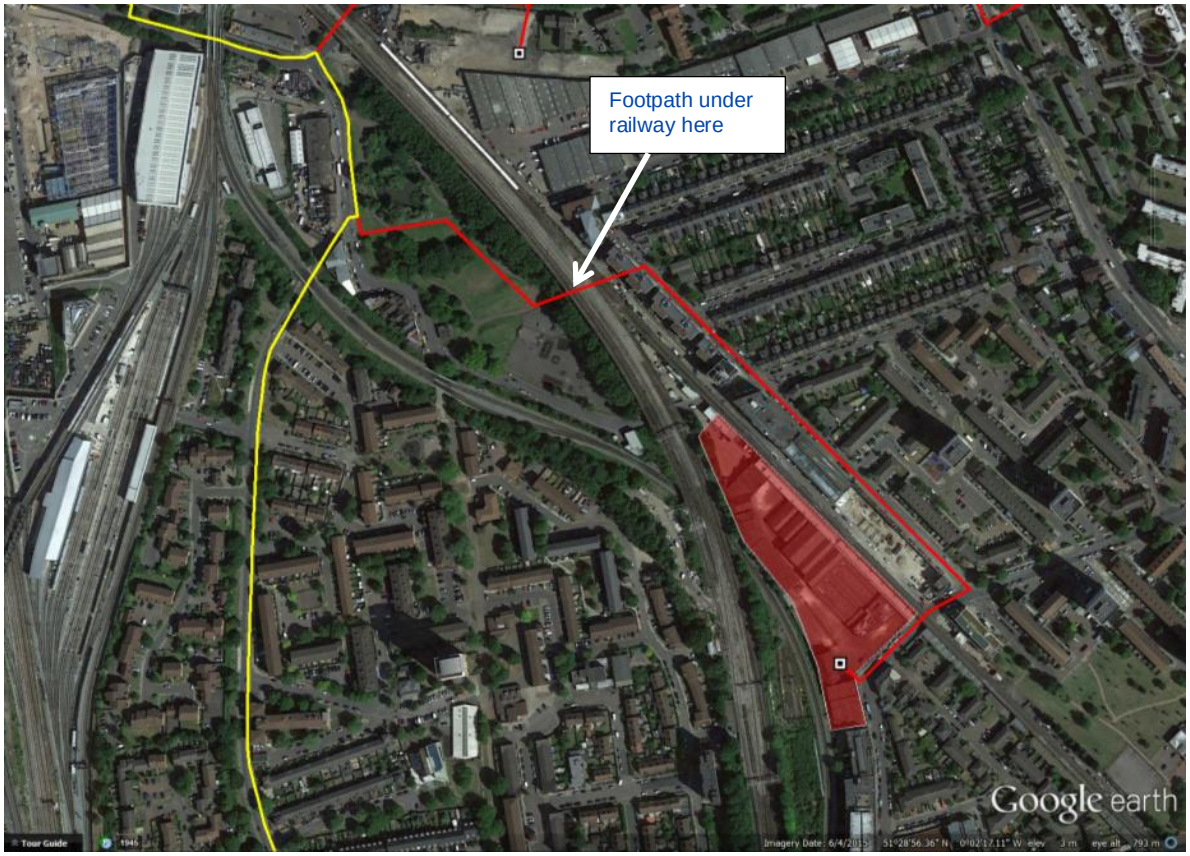


Figure 8-6: Footpath between Folkestone Gardens and Childers Street - from Childers Street

8.3 AVOIDING MARINE WHARF WEST LINEAR PARK

To date, we have been unable to establish whether ducts for future DH connection pipework were installed within the Marine Wharf West linear park (see Section 4.1.4). If not, it is possible that there will be objections to digging up the park, which has just been completed, in order to install new pipework. We have therefore considered alternatives.

The following route, although longer, does avoid the linear park by continuing down Evelyn Street and routing round to Yeoman Street via Croft Street and Chilton Grove.

Figure 8-7: Alternative route avoiding Marine Wharf West linear park

A review of the utilities mapping for this alternative route shows that the existing services through Croft Street, Chilton Grove and Yeoman Street are as follows:

- Low pressure gas – 100mm
- Mains water – 180mm
- Waste water – 305mm
- LV & HV electricity
- BT comms
- Virgin comms (Croft St only)
- Vodafone comms
- Interoute comms (Yeoman St and Chilton Grove only)

It is also noted that there is a Thames Water pumping station – Earl Pumping Station – on Chilton Grove, near the junction with Yeoman Street. It forms part of the Thames Tideway tunnel and is therefore being redeveloped, with main construction in this area set to start in 2017[9]. The Tideway Tunnel site setup is already underway, with tunnelling set to begin in 2017.

Figure 8-8: Earl Pumping Station – Chilton Grove

The redevelopment includes both tunnelling and building works, so depending on timings, there may be a clash with any heat network installation works through the area, although the tunnel will be significantly deeper than the DH works. The Tideway website states there will be average of nine heavy goods vehicle deliveries per day, rising to 34 vehicles over the four month tunnelling period.

[9] https://www.tideway.london/the-tunnel/construction-sites/earl-pumping-station-deptford/

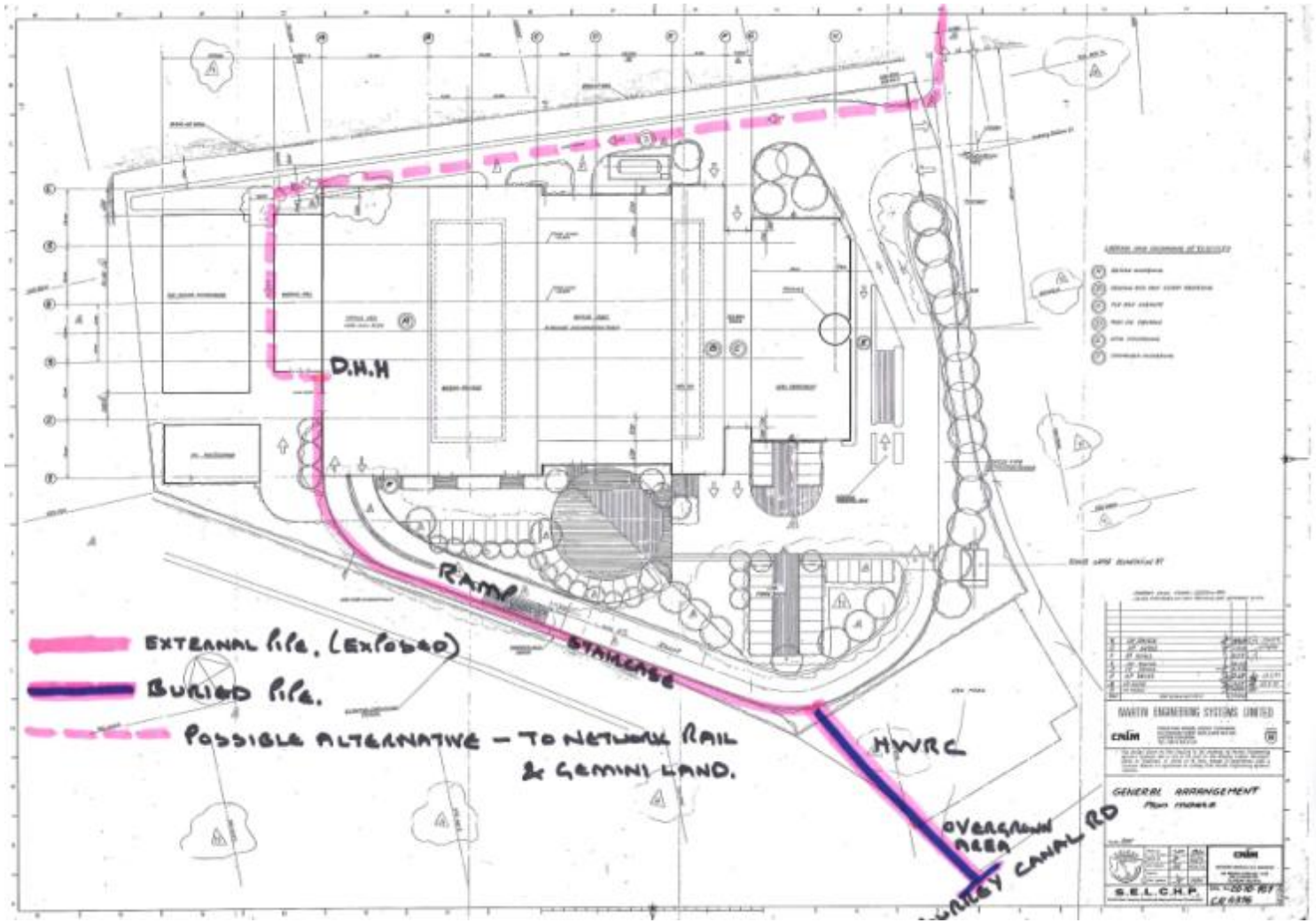
9 ROUTE OFF THE SELCHP SITE

We contacted Veolia to confirm there has been no change to their proposals for pipe route options off their site. They confirmed no change.

Veolia's preferred route exits SELCHP via the LBL-owned Landmann Way Waste Reception Centre (WRC); although we proposed that the route within the WRC is modified so that the pipe exits out onto Landmann Way through the entrance to the WRC, rather than through the fencing at the back of the site.

The route within the SELCHP facility boundary remains as proposed by Veolia and shown in Figure 9-1.

Figure 9-1: Route options off the SELCHP site



The route exits the SELCHP district heating hall at high level and runs along the side of the building to the elevated ramp that waste vehicles use to deliver waste to the facility. The pipes will then be suspended from the side or underside of the access ramp (Figure 9-2), emerging onto the grass verge that runs alongside the ramp (Figure 9-3), where the pipes will be buried before exiting out into the Waste Reception Centre.

Figure 9-2: Underside of ramp within SELCHP - pipes to be suspended from here

Figure 9-3: Grass verge to side of SELCHP access ramp - pipe to emerge from under the ramp here

Figure 9-4: Landmann Way Waste Reception Centre, taken from SELCHP

An alternative route off the site was identified by Veolia, where the pipe exits to the back of the site and onto the Network Rail land behind SELCHP (shown as a dashed line on Figure 9-1).

Having reviewed this option, however, we believe that the extent of the rail infrastructure at the back of SELCHP means the only way the pipe can access loads to the east (i.e. the north Lewisham extension) as well as Goldsmiths University is via Surrey Canal Road. As such, it makes little sense to exit SELCHP at this point unless the preferred route is not achievable.

10 LAND OWNERSHIP AND RESIDENT/BUSINESS INTERFACES

10.1 LAND OWNERSHIP

LBL provided land ownership mapping for the study area, which is presented in Figure 10-1. It shows how nearly all of the roads in the area are adopted highway, including those which have been identified in the network routing; namely:

- Grinstead Road
- Evelyn Street
- Rainsborough Avenue
- Dragoon Road
- Grove Street
- Abinger Grove and Arklow Road

Roads identified in potential alternative routing options are also shown to be adopted highway; namely:

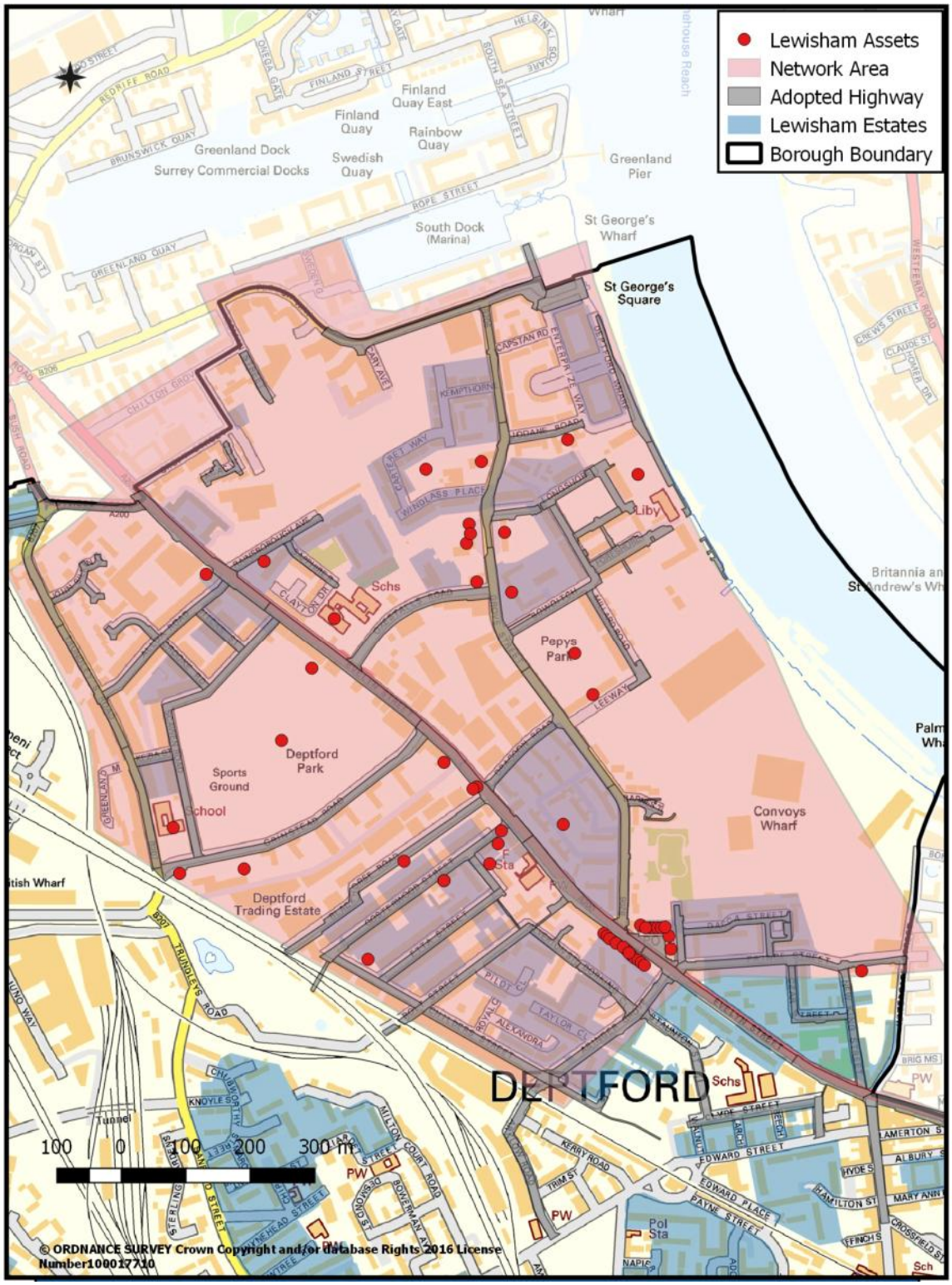
- Rolt Street
- Childers Road

On the basis of this mapping it is concluded that there are two areas where route selection could be affected by land ownership in delivering the network:

1) Marine Wharf West linear park, which provides access to Marine Wharf East, Cannon Wharf and Yeoman Street (see Section 4.1.4).

2) A short section of Canal Approach if it is used to access the Hi line Cash and Carry car park adjacent to Blackhorse Bridge (see Section 7.1.2).

Figure 10-1: LBL land ownership mapping



10.2 INTERFACES WITH LOCAL BUSINESSES

On the site survey, we recorded the businesses that would be affected by the pipe installation along the proposed route. It is noted that there are many small businesses along Evelyn Street

that we felt would not be directly affected by pipe installation within the carriageway as they are small, local shops with no car parking and access via the footpath. See Figure 10-2 for an example.

Figure 10-2: Shops along Evelyn Street

We have recorded the names of all the businesses whose access would be affected by installation within the carriageway along the proposed route. They are presented in Table 10-1.

Table 10-1: Affected businesses

Road	Businesses affected	Type
Grinstead Road	Trundleys Tyres	Tyre merchant
	Access All Areas (AAA)	Environmental services
Evelyn Street	KFC drive through	Fast food outlet
	SG Oto car mechanic	Businesses on Blackhorse Road
	Ascot Cab Company	
	BJK Shop Equipment	
	Deptford MOT and Service	
	Quotax Insurance Services	
	Fastglass Windscreens	
	Deptford Trading Estate	
	Cash and Carry	Wholesalers
	Hi Line Wines Ltd	Wine merchant
	Shell Garage	Petrol station
Dragoon Road	Safestore Self Storage	Storage facility
Abinger Road	Steeldeck	Steel platforms
	Parkside Business Estate	Industrial Estate

10.3 PARKS

In discussion with LBL parks officers, they noted that it would be possible, in theory, to install pipework within Deptford Park if it is part of a scheme that contributes to the Council's strategic goals. Several key considerations were noted.

1) It would be preferable to avoid the north east end of the park, where there has been redevelopment in recent years. As such, options that avoid installation in Grinstead Road (see Section 4.2) are preferable to options that also avoid installation in Evelyn Street (see Section 8.1).

2) It would be necessary to agree the reinstatement – probably to the same standard as is currently the case or better.

3) Pipe installation should not affect tree roots.

4) Consultation would be required with several parties, including local interest group Deptfolke, who may have objections – particularly to installation in the north east corner.

5) If the scheme was able to contribute in some way to the enhancement of the park – for example if it could pay for the improvement of some existing flowerbeds – that may improve public perception.

In summary, the preferred route utilises Deptford Park to minimise the extent of hard dig installation. We can conclude that, subject to further discussion with LBL parks officers and local interest groups, this remains a possibility. The exact routing of the pipework through the park would also require further consultation.

11 LOCAL AUTHORITY REQUIREMENTS

11.1 ROAD WORKING CONSENTS

Installation of DH pipework in the road must be in accordance with the New Road and Street Works Act (NRSWA) and the Specification for the Reinstatement of Highway (SROH).

In order to undertake major works in the road in Lewisham, a minimum of three months' advance notice must be given to LBL. Starts may be granted early upon receipt and agreement of full project details and proper coordination. Advance notice should be given by the Works Promoter. This does not need to be the contractor and may be the project manager within the client team. As such, it is recommended that advance notice is given as soon as the pipe route has been fixed so as to avoid delays to the contractor's programme. Note that a separate permit is required for each road through which works are planned.

As the installation of the pipe will not be undertaken, or directly employed by, a utilities company or the Highway Authority, a Section 50 license will be required for working in the public highway. The Section 50 licence ensures that the Contractor carrying out the works is competent to do so and that there are sufficient funds available during the guarantee period of the works. Copies of Section 50 application documentation are provided in the New Cross Heat Network Feasibility Study Element A Document Package along with this report.

The Contractor may not begin works in the road until the Section 50 license has been granted. The turnaround time for an application, as advised by LBL, is no longer than one month. It is noted that a Section 50 application fee of £390 applies as well as a deposit, refundable after an agreed period, to guarantee the quality of the reinstatement. The level of the deposit is not pre-defined for street works projects of this scale; however LBL Highways confirmed that this would be agreed with the appointed contractor prior to installation.

11.2 PARKING BAY SUSPENSIONS

Parking bay suspensions as required would be arranged via NSL, who manage LBL's parking services. The relevant contact at NSL is Johnson Iroro (Johnson.iroro@nslservices.co.uk).

11.3 TRAFFIC MANAGEMENT AND DIVERSIONS

Traffic management and road diversions and road closures must be arranged with LBL's Network Management team (dave.wheeler@lewisham.gov.uk). All applications must be submitted with full details shown on drawings and maps, which should be submitted along with a completed *Application for Temporary Traffic Management Order*.

11.4 PLANNED ROAD CLOSURES AND EVENTS

At the time of writing, LBL are not aware of any planned road closures or events in the vicinity of the proposed route other than the London marathon, which passes through the area once a year in April. The 2017 route has not been announced at the time of writing; however the 2016 route included the closure of Evelyn Street (A200).

11.5 KEY ROAD ACCESS AND IMPACT ON LOCAL DEVELOPMENTS

Of primary concern in establishing a construction programme for the heat network should be the impact on the local road infrastructure. This is particularly the case given the extent of development works in the north Lewisham area.

The high number of large scale building projects means the roads will be in use by construction traffic for years to come. Convoys Wharf, for example, currently has an estimated completion date of 2025. As such, the installation of the heat network infrastructure will, in all likelihood, have an impact on construction traffic. This should be borne in mind through the design and construction planning of the network, although it would be difficult to time the network delivery in such a way that it minimises the impact on construction traffic; particularly given that:

1) Many of the developments in the area do not yet have detailed timeframes.

2) The construction of the new development sites and the heat network are intrinsically linked; i.e. the pipe infrastructure is required in order to heat the development from the heat network.

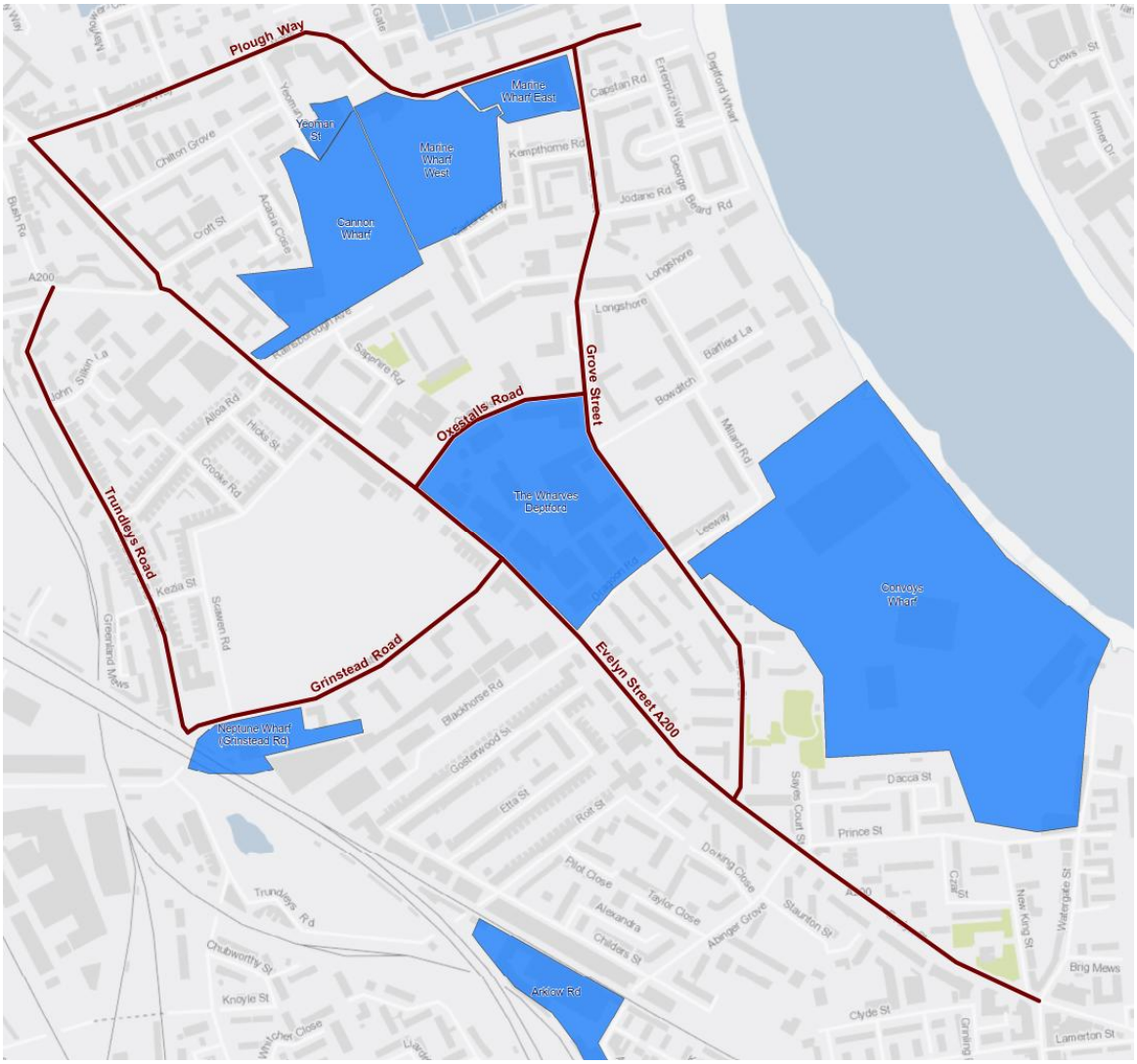
It is also noted that the phasing of development in the area introduces the potential for a phased heat network delivery. It may not be practical or economic to install the whole pipe system up to the boundary of developments that are not due for completion until well into the future. This will be investigated further in the Element C study.

In discussion with LBL's Highways officers, they identified the A200 – Evelyn Street – as the main route through the area. They identified the following roads as key access routes which must be kept open as far as practicable.

- Evelyn Street – A200
- Grove Street
- Plough Way
- Grinstead Road
- Trundleys Road
- Oxestalls Road

A map showing the sensitive routes is presented in Figure 11-1. Of these roads, Evelyn Street, Grinstead Road and a small section of Grove Street are all on the preferred route. It would not really be possible to avoid these roads altogether, so it is recommended that the works are planned and sequenced carefully to minimise disruption to the other development works going on in the area at the time.

Figure 11-1: Sensitive routes, as highlighted by LBL Highways



12 CONCLUSIONS

12.1 SUMMARY OF ADDITIONAL REPORTS

This report forms part of a wider set of reports which comprise Element A of this feasibility study. The accompanying Element A reports are:

- NLHN: Transport Infrastructure Impact Assessment;
- NLHN: Archaeological Constraints Report
- NLHN: Contaminated Land Report
- NLHN: Preliminary Ecological Appraisal

The transport infrastructure assessment concluded that the installation of the proposed pipe system will affect transport access, particularly on the A200 (Evelyn Street). It identified diversions and alternative routes that can be provided for road users and commuters, albeit with some inconvenience. Before any work can be carried out, the relevant authorities should be contacted and applications for permits made. The main application will be submitted through the London Permit Scheme (LoPS), who will then distribute it to both TfL and LB Lewisham. It was also noted that none of the roads are TfL red routes, which makes the permitting process easier.

The preliminary ecological appraisal report concluded that the proposed works would not directly impact any Sites of Nature Conservation (SINCs) or statutory sites (e.g. local nature reserves). It is noted however that one of the potential alternative routes identified in Section 8.1 proposes routing pipework through Folkestone Gardens, which was identified in the previous New Cross heat network feasibility study as a SINC, requiring the minimisation of impacts to ecological features within the site (see Section 8.1). The report also highlighted the potential presence of several protected species and/or notable species within the area. These include amphibians, bats, breeding birds and reptiles. All of these species could place constraints on the proposed development. Ecological tool box talks should be given to contractors prior to the works commencing to make them aware of the legalisation afforded to protected species and the working practices implemented to minimise harm.

The contaminated land assessment concluded that much of the site has a history of industrial activities that could potentially contaminate land. The risk to construction workers and local residents is, nevertheless, determined to be low to moderate due to the limited extent of the anticipated works. Limited ground investigation is recommended at this stage, to support design and site characterisation. This should particularly focus on places where the route coincides with the former route of the Grand Surrey Canal, due to its classification as historic landfill based on the inert, household and commercial waste that was used as infill.

The risk of unexploded ordnance on the site was determined to be medium to high, due to the potential threat from WW11 German HE bombs, with a residual threat from IBS and British AAA projectiles. The proposed risk mitigation strategy is to include Operational UXO Risk Management Plan and Safety & Awareness Briefing for all construction workers. In areas that have not been developed since WWII, an additional control of an EOD Banksman is recommended.

The archaeological constraints report concluded that no below-ground assets were identified in the site that were of national importance and therefore merit preservation *in situ*. Preservation by record is recommended for any remains of the Surrey Canal, within the area of Royal Dockyard, and of the potential early or late medieval road surface of Evelyn Street, if it is observed. It was also recommended that an archaeological watching brief is employed for excavation in these areas.

12.2 INTERFACE MATRIX

Following completion of the desk and site surveys, a route interface matrix has been developed for the various route options, as presented in Table 12-1.

Table 12-1: Route interface matrix

Section ID	Name	Notes	Potential disruption / engineering difficulty
INITIAL PROPOSED ROUTE			
1	Canal Approach	Private road with behind locked access. Appears to be in use for storage of skips.	1: Change in elevation. 2: Junction with Surrey Canal Road is very busy 3: Junction with Surrey Canal Road contains multiple IP gas mains.
2	Evelyn Street	Heavy traffic flow as major route through the area. Footways on both sides. Pipe must pass over Blackhorse Bridge to access loads to the south, i.e. Convoys Wharf and Arklow Road.	1: Installation in road highly disruptive. 2: Must pass over Blackhorse Bridge. 3: High number of existing services. 4: LBL traffic sesnitive road. 5: Includes bus lane. 6: Traffic management required.
3	Dragoon Road	No vehicle access from Evelyn Street. Wide road. Not busy.	1: Change in elevation. 2: Site access to The Wharves Deptfrod from here.
4	Grove Street	Access to both Convoys Wharf and The Wharves, Deptford from here.	Junction of Grove Street and Leeway appears to be congested with existing services. Lots of scarring.
OPTION 1 - SECTIONS FOR MOST DIRECT ROUTE BASED ON INTERFACE LOCATIONS			
5	Grinstead Road	Goes through a largely residential area with some businesses at the Surrey Canal Road end. Deptford Park is adjacent to the eastbound carriageway.	1: Must pass under railway bridge. Requires engagement with Network Rail. 2: IP gas main crosses the road at junction with Trundleys Rd 3: Access to Neptune Wharf development from here. 4: Some new services will go in for Neptunes Wharf.
6	Deptford Park	Large green space to the north of Grinstead Road. Mature trees around the edge. Contains recreational areas .	1: Requirement to avoid installation near trees. 2: Reinstatement would need to be to current standard. 3: Potential opposition from local interest groups.
7	Abinger / Arklow Road	Provides access to Arklow Road developoment. Also the main route to the Evelyn Estate, so a lot of residential access.	Requirement to pass underneath railway arches at junction of Arklow Road and Abinger Road.
8	Rainsborough Avenue	Narrow road running along the back of Cannons Wharf development. Utilities mapping shows very little services through this street.	Change in elevation to get up onto Marine Wharf West linear park.
9	Marine Wharf West linear park	Now complete landscaped area between Marine Wharf West and Cannons Wharf developments.	Unconfirmed as to whether the proposed ducts were installed for bringing DH onto the site as part of the development. If not, re-excavating the park may be unpopular.
OPTION 2 - SECTIONS AVOIDING EVELYN STREET USING DEPTFORD PARK			
10	Hicks Street	Small residential street.	1: Narrow residential street. 2: On street parking must be suspended. 3: Existing services will further limit space for installation.
11	Alloa Road	Small residential street.	1: Narrow residential street. 2: On street parking must be suspended. 3: Existing services will further limit space for installation.
OPTION 3 - SECTIONS AVOIDING EVELYN STREET USING FOOTPATH AT SIDE OF OXESTALLS ROAD			
12	Footpath at side of Oxestalls Rd	Runs along the side of Deptford Park primary and joins up with the linear park leading to Marine Wharf West.	1: Footpath is narrow with some existing utillties already in place. 2: Trees in the middle of the footpath further limiting space. 3: Potential blocking of access to the school.
OPTION 4 - SECTIONS AVOIDING EVELYN STREET USING ROLT STREET			
13	Rolt Street	Avoids requirement to use Evelyn Street to serve Arklow Rd. Proposed alternative uses a branch off the New Cross Heat Network that runs through Folkestone Gardens.	1: 600mm IP gas main runs along Trundleys Road and onto Rolt Street. 2: Must pass under railway bridge on Rolt St. Requires engagement with Network Rail.
OPTION 5 - SECTIONS AVOIDING LINEAR PARK USING CROFT STREET & YEOMAN STREET			
14	Croft Street	Residential street	1: On street parking must be suspended.
15	Chilton Grove	Residential street	1: Earl Pumping Station located on junction with Yeoman St. 2: On street parking must be suspended.
16	Yeoman Street	Residential street	1: Earl Pumping Station located on junction with Yeoman St. 2: On street parking must be suspended. 3: Road bricks must be replaced on reinstatement.
OPTION 6 - SECTIONS AVOIDING EVELYN STREET USING FOLKESTONE GARDENS			
17	Folkestone Gardens	Route avoiding Rolt Street using Folkestone Gardens footpath that passes under the railway bridge onto Chilers Street.	1: Folkestone Gardens is a site of ecological significance containing a pond, mature trees and grassland that should not be disturbed. 2: The park has recently been remodelled so installing pipework through it would be politifcally sensitive. 3: Reinstatement must be to the same standard as before excavation.

12.3 PREFERRED ROUTE

Based on the analysis undertaken in this assessment, the preferred route for the north Lewisham extension to the New Cross Heat Network utilises Deptford Park as much as possible to maximise the extent of soft dig installation; and avoids Evelyn Street as much as possible by utilising Hicks Street and Alloa Road. It is noted that installation in these two roads would require extensive parking suspensions and should be confirmed with site investigations, as proposed in Section 12.6. The route would also require the negotiation of a wayleave to install pipework through the Marine Wharf West linear park.

The preferred route is presented in Appendix A. The other route options considered are presented in Appendix B.

The length of the preferred route is 4,100m (trench length).

12.4 FINANCIAL RISK ANALYSIS

Based on the results of this route optimisation study and the supporting ecology, contaminated land, transport and archaeological heritage studies, we have prepared a financial risk assessment for the network development.

The risk assessment is presented in Appendix C.

12.5 GENERAL CONCLUSIONS

The north Lewisham extension is largely more straightforward than the pipework route between SELCHP and Goldsmiths for the following reasons:

- Apart from at the junction of Grinstead Road and Trundleys Road, there are no intermediate or high pressure gas mains in the area.
- There are no TfL red routes in the road network.
- There is not as much interface with the rail network as in the network connection SELCHP and Goldsmiths. The only point of interface is at the junction of Surrey Canal Road and Grinstead Road.
- There are no sites of ecological significance – statutory or non-statutory (i.e. SINCs).
- There is a large green space area – Deptford Park – that can potentially reduce the cost of installation significantly, although this would require formal agreement with parks officers and local interest groups such as *Deptfolke*, as the scheme moves into detailed design.

Despite this, there are still some complicating factors; specifically:

- Evelyn Street is heavily congested with services and is the only road that runs between sites to the north and south of the area (i.e. Arklow Road to Cannon Wharf).

- Evelyn Street is also heavily trafficked and would require diversions, including for several bus routes, if it must be closed during installation. This could be avoided through one lane control; however this would lead to congestion through the area.

- Closure of the Surrey Canal Road rail bridge, if required, would cause massive disruption to the high volume of trains running between London Bridge, Deptford and New Cross. This is considered unlikely, however, as Network Rail would be unlikely to permit such a closure. Also, the installation should not affect the bridge construction and could be done with Network Rail supervision and monitoring.

- A means of crossing Blackhorse Bridge must be found.

12.6 AREAS FOR FURTHER INVESTIGATION

This route optimisation study has provided a good level detail around the site conditions in the north Lewisham extension area and proposed a preferred route for the DH pipework. It is important to note, however, that utilities mapping and a site survey cannot determine with any degree of accuracy, the below ground conditions through the proposed network route. In order to increase certainty around the space available for pipe installation, further investigative works such as ground penetrating radar (GPR) and trial holing is required.

There is no real limit to the amount preliminary of site investigative work that can be done prior to the installation of district heating infrastructure. Obviously the more that is done, the more confidence can be placed in the detailed pipe system design that precedes construction. The timing and extent of site investigations may be influenced by the availability of funds and the distribution of contract risk. For example, if the construction contract is clear that costs arising from the discovery of services in an unexpected location are to be borne by the design and build contractor, they may wish to spend more time undertaking trial holes and GPR across the whole of the proposed route before they undertake the construction design process[10].

As such, if money were no object, we would recommend that the whole of the proposed route should be subject to a programme of GPR and intermittent trial holing. However the risk of doing so at this stage in a project is significant, given the cost of these investigations and the potential for the project not to go ahead. We have therefore identified several key, sensitive areas where site investigations would add more clarity, as detailed in Table 12-2.

[10] In our experience, issues arising from existing services are one of the major risks and contractual sticking points in a DH installation project. Even when the contract documentation seeks to apportion the responsibility for dealing with service diversions, DH redesigns and associated delays, it is often a source of disagreement between the contractor and the client.

Table 12-2: Proposed site investigations

Site	Proposed site investigation	Purpose
Evelyn Street carriageway	Full GPR (radar truck) and possible intermittent trial holes	Assess the extent and location of buried services in the carriageway along this key street
Blackhorse Bridge	Trial holes	Assess the depth of the road structure in the carriageway.
Junction of Grinstead Rd and Trundleys Rd	GPR to identify mains and trial hole to accurately locate the IP gas main	Determine the location of 600mm IP gas main as it crosses Grinstead Road
Hicks St & Alloa Rd	GPR and possible trial hole	Determine location and extent of existing services.
Junction of Grove St and Dragoon Rd	GPR and possible trial hole	Determine position of existing services through congested junction.

12.7 REPORT LIMITATIONS

There have been several things that, to date, we have been unable to verify and are therefore considered limitations to the report.

We have been unable to confirm the ownership status of Canal Approach, although LBL departmental officers advise that it is a private road. We have also concluded that it does not form part of the preferred route anyway.

We have been unable to source bridge construction information for Blackhorse Bridge. LBL are in the process of trying to locate drawings and these can be reviewed for the Element B study.

Appendix A

PREFERRED ROUTE

Appendix B

ALTERNATIVE ROUTE OPTIONS

Appendix C

FINANCIAL RISK ASSESSMENT