Hard Landscape Strategy

Surface Type 01
Permeable Tegula Concrete Sett
Color: 95% Burnt Ochra
5% Charcoal

Surface Type 02
Natural stone paving

Surface Type 03
Reclaimed Brick from site

Surface Type 04
Grasscrete

Surface Type 05
Self binding gravel

Surface Type 06
Natural stone tactile paving

Surface Type 07
Eco Rubber Play chippings
Colour: Green

Surface Type 08
Granite chippings
Size: 20-40mm

Approach to surfaces

The aspiration to develop high quality landscape spaces across the site has led to the selection of a number of materials appropriate for the different spaces within the development. Hard landscape elements selected are to be of a physically robust quality, appropriate to the site's intensive use.

Materials that have been selected are sympathetic to the local context and are appropriate to their location and use.

The materials detailed here form a structured palette that are coordinated to create visual unity and integrity within the existing surrounding landscape.

The materials selected for the palette will provide cohesion to the hard landscape areas within the development. They will convey a unifying character, and consideration has been given to the appropriateness of the materials with regard to place making and their long-term performance, durability and maintenance requirements. Consideration has been given to materials' impact on the environment such as sourcing, cost, and project sustainability.

All surface materials will be UK origin.

EXTERIOR ARCHITECTURE

11.0

RESIDENTIAL QUALITY

11.0 RESIDENTIAL QUALITY

This application proposes 106 new build homes plus 3 refurbished units of a proportionate mix of 1, 2 and 3 bed apartments.

They are therefore designed to achieve or exceed minimum floor areas for each typology, and to include a variety of other spatial criteria.

Meeting the Space Standards is an important part of delivering housing quality, but it is also of great importance that the homes are designed efficiently, and that the internal arrangement is organised well to achieve the most useable and cost-effective space provision. Additionally they will be designed to achieve sustainable living standards through the building's response to daylight and the external environment, through the North-South orientation of the blocks, the facade design, and the internal arrangement of each unit.

Similarly, the quality of shared common spaces within the residential buildings are of importance in creating a pleasant, safe environment for residents to return home to. Each residential building has its own secure entrance, leading to a stair and lift core that serves 9 flats per floor. This is a scale that is considered to engender a shared responsibility for common spaces, and build a secure community in which to live.

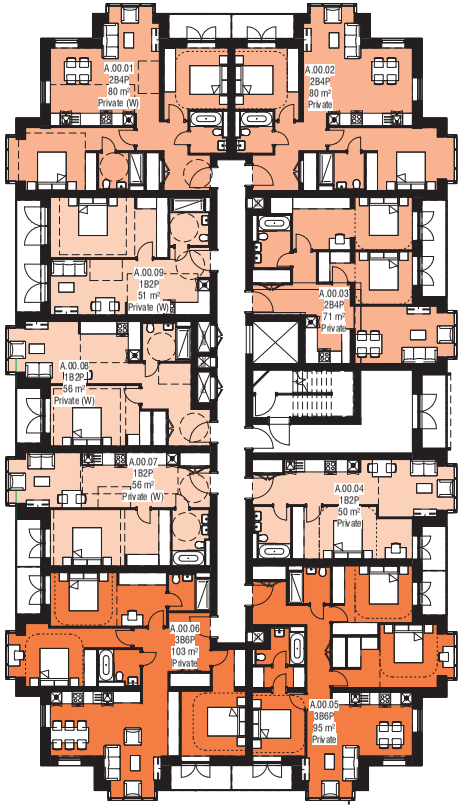
The homes are therefore of high-quality design in terms of organisation of space, appropriateness for use and flexibility for a full range of life circumstances.

On the following pages, typical examples of each home are provided, with commentary as to the key quality signifiers embedded within the designs.

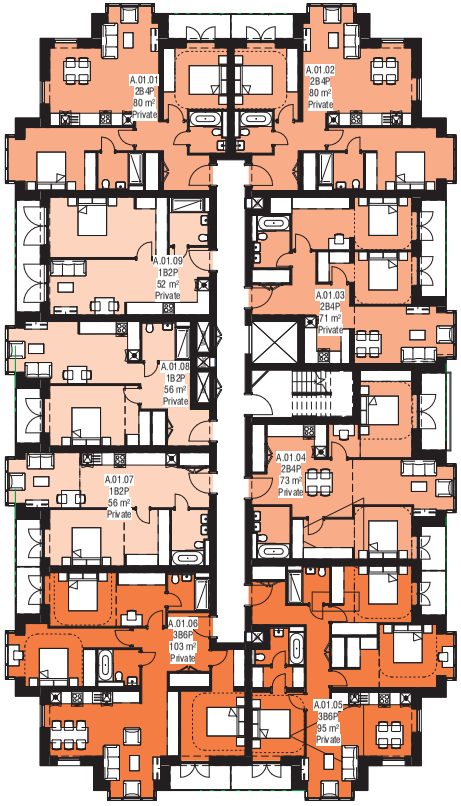
11.1 TYPICAL RESIDENTIAL LAYOUTS

Block A

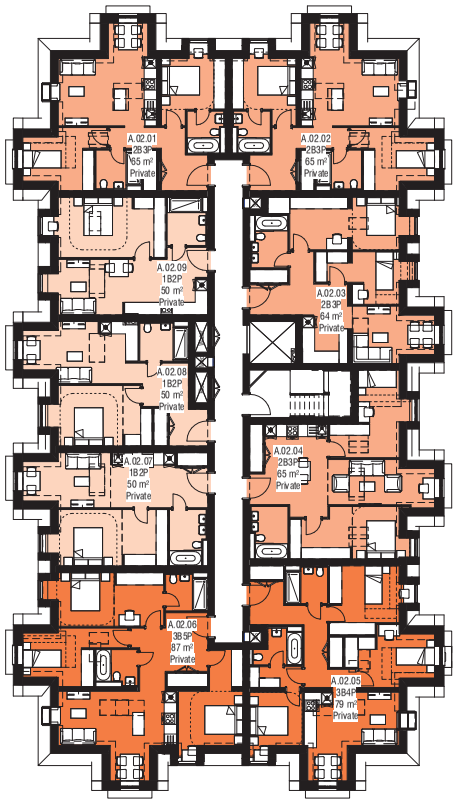
Level 0



Level 01



Level 02



Key:

- 1 Bed - Private
- 2 Bed - Private
- 3 Bed - Private

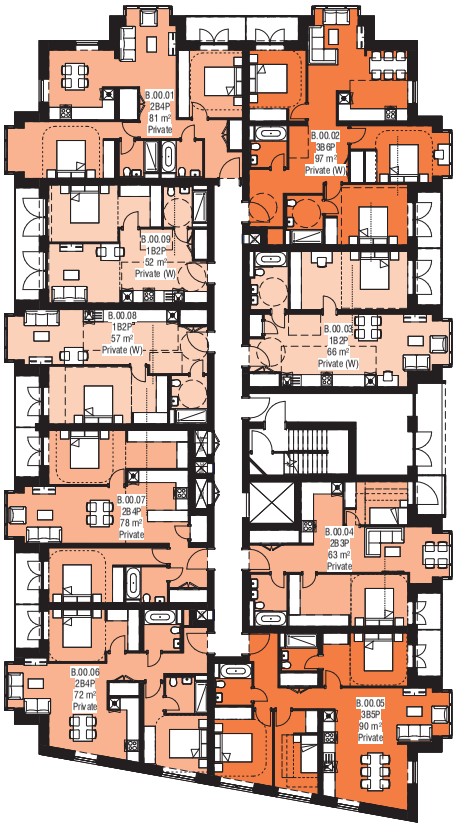
Total Apartment Mix

Block	Studio	1 Bed	2 Bed	3 Bed	Total
Block A	0	10	11	6	27
Block B	0	9	19	8	36
Block C	0	20	19	4	43
BTM	1	0	1	1	3
Totals	1	39	50	19	109
Mix	1%	36%	46%	17%	

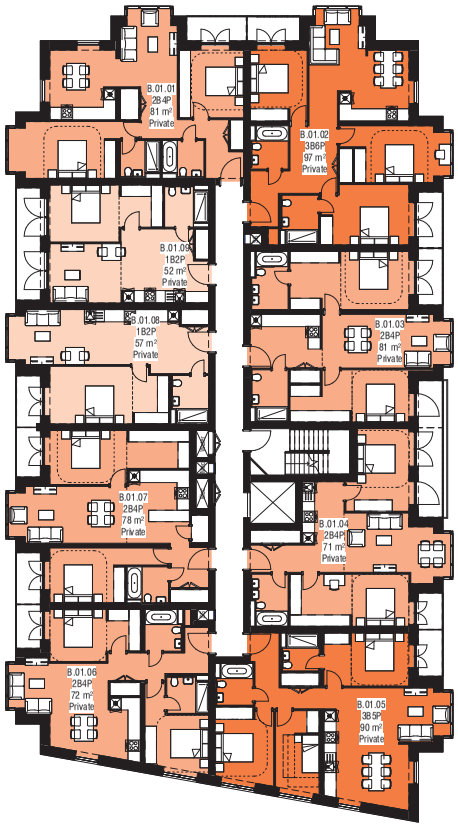
SCOTT BROWNRIGG

Block B

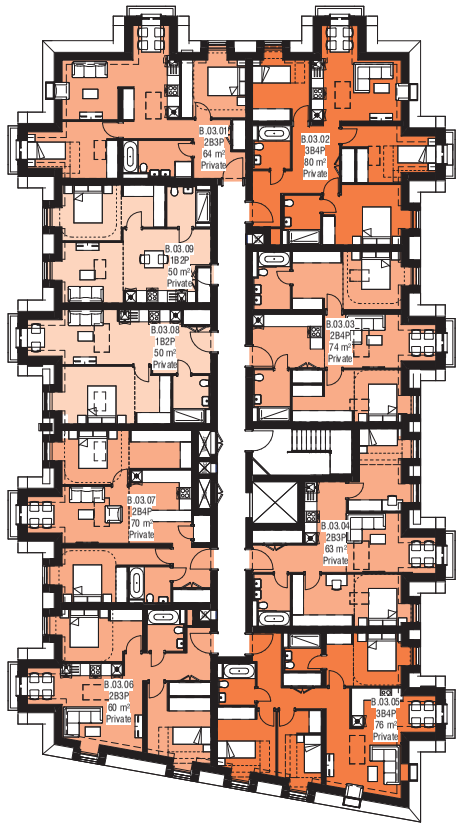
Level 0



Level 01-02



Level 03



Key:

- 1 Bed - Private
- 2 Bed - Private
- 3 Bed - Private

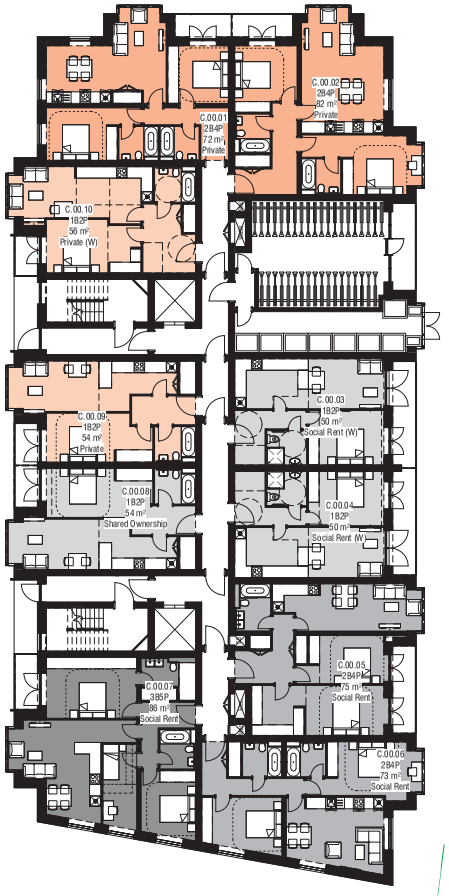
Total Apartment Mix

Block	Studio	1 Bed	2 Bed	3 Bed	Total
Block A	0	10	11	6	27
Block B	0	9	19	8	36
Block C	0	20	19	4	43
BTM	1	0	1	1	3
Totals	1	39	50	19	109
Mix	1%	36%	46%	17%	

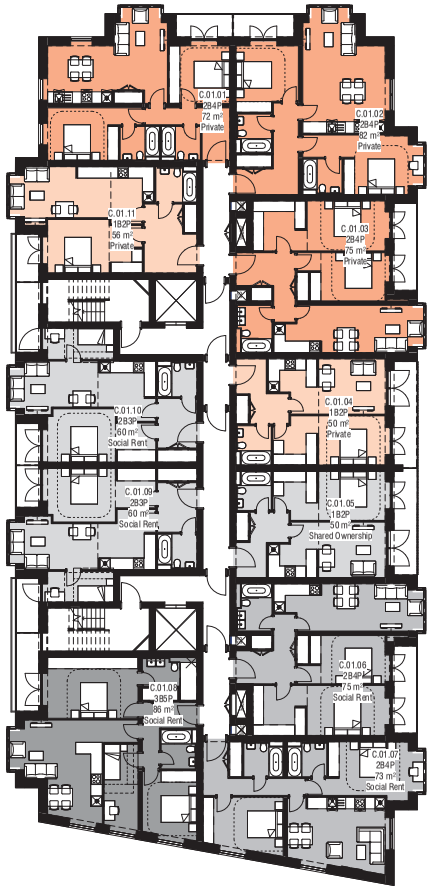
Block C

SCOTT BROWNRIGG

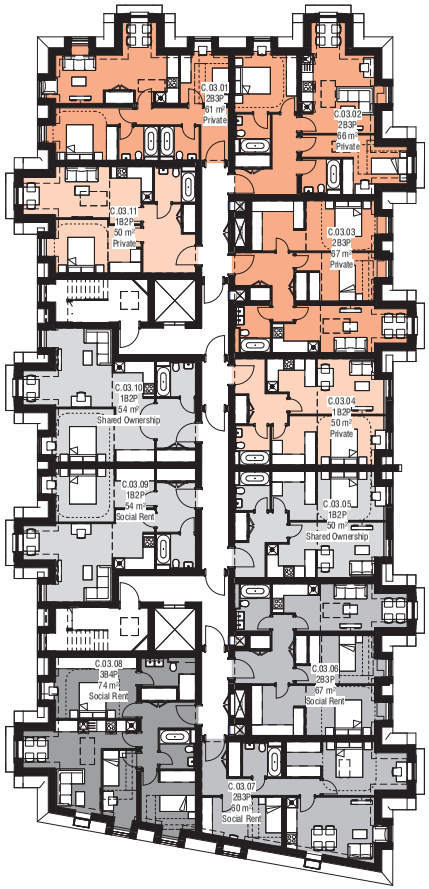
Level 0



Level 01-02



Level 03



Key:

- 1 Bed - Private
- 2 Bed - Private
- 3 Bed - Private
- 1 Bed - Affordable
- 2 Bed - Affordable
- 3 Bed - Affordable

Total Apartment Mix

Block	Studio	1 Bed	2 Bed	3 Bed	Total
Block A	0	10	11	6	27
Block B	0	9	19	8	36
Block C	0	20	19	4	43
BTM	1	0	1	1	3
Totals	1	39	50	19	109
Mix	1%	36%	46%	17%	

Block C Mix

Block	1 Bed	2 Bed	3 Bed	Total
Private	4	8	0	12
Mix	33%	67%	0%	
Affordable	12	8	4	24
Mix	50%	33%	17%	

*AH = 22% of 109 total residential units on site.

11.2 BUILDINGS OF TOWNSCAPE MERIT

The proposal looks to preserve and enhance, the significance, character and setting of BTMs.

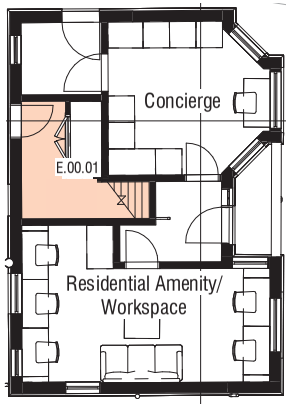
Both buildings will be retained and integrated into the residential masterplan through landscaping and internal accommodation. The existing Recreation Hall will be refurbished and split into two residential units; both 2-beds. This refurbishment will look to retain the building's feature characters, while accommodating contemporary living standards. Block A has been pushed away from this BTM by an additional 1.5m to improve residents' outlook.

Due to its location and proximity to the central entrance of the Barnes Hospital Site, the Entrance Lodge will be converted into a studio unit at the first floor, leaving the ground floor free to accommodate various ancillary and residential uses. The entrance Lodge will be the primary point of contact for pedestrians entering the site, and to this extent it will provide a concierge facility with a secure post room. The building will also contain an amenity space for residential use in the form of a communal lounge, with the possibility of providing dedicated work stations to meet current working needs.

This will provide all residents with an opportunity to experience and appreciate the heritage and character of a BTM.

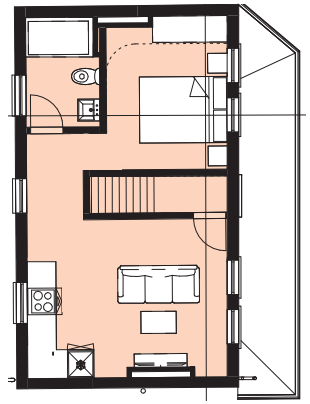
Entrance Lodge

Ground Floor

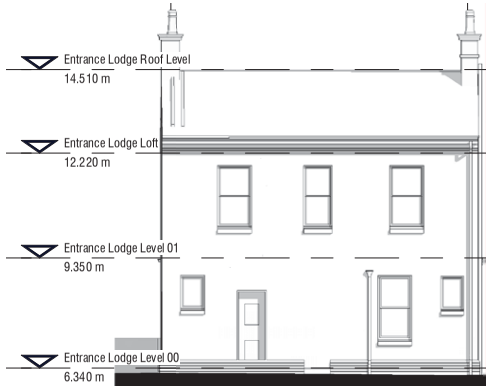


Entrance Lodge

First Floor



Front Elevation

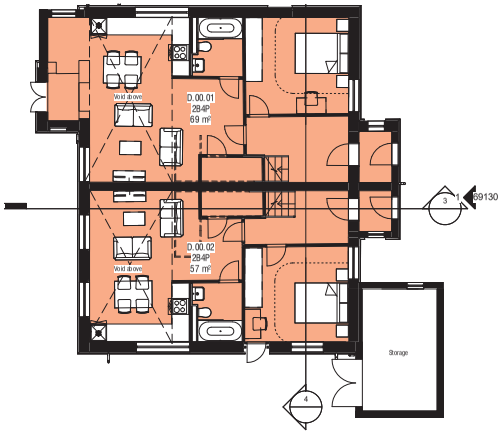


Rear Elevation

Not to scale

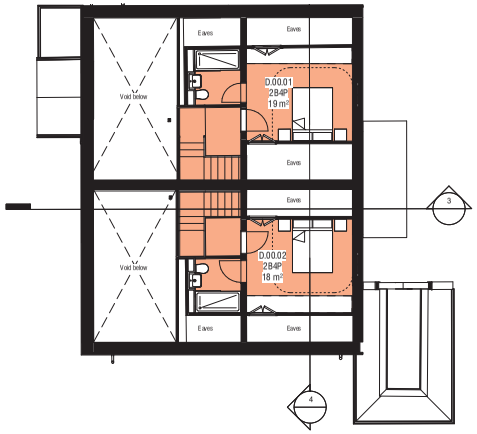
Former Recreation Hall -
Barnes Cottages

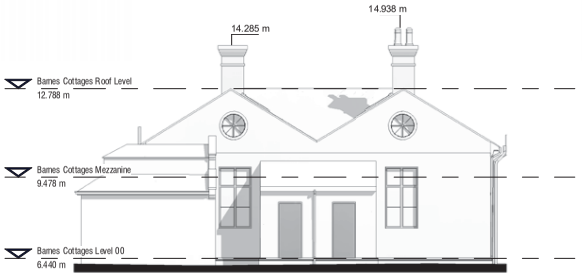
Ground Floor



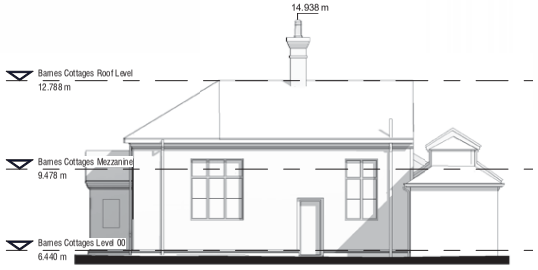
Former Recreation Hall -
Barnes Cottages

First Floor





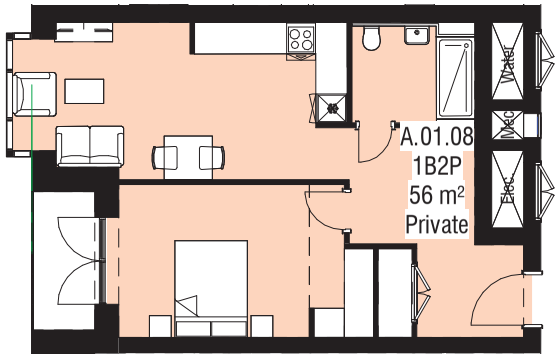
Front Elevation



Rear Elevation

Not to scale

11.3 TYPICAL APARTMENT LAYOUTS

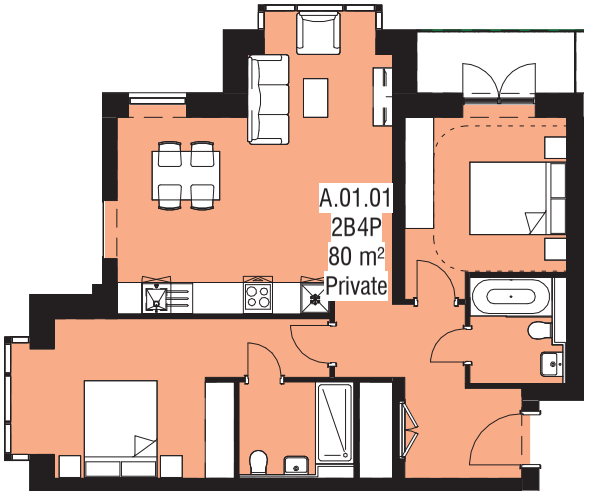


1 Bed 2 People

1 Bedroom apartments are designed to accommodate one to two people, at an average of 50m2.

Bedrooms are sized to afford ease of access around a standard double-bed, with the bathroom being accessible for visitors and occupants. The kitchen provision is appropriate for this type of property.

- Open plan layout
- Entrance looks into the living area
- Clustered wet zones
- Possibility for walk in wardrobes
- Possibility for study areas
- Addition of private external amenity



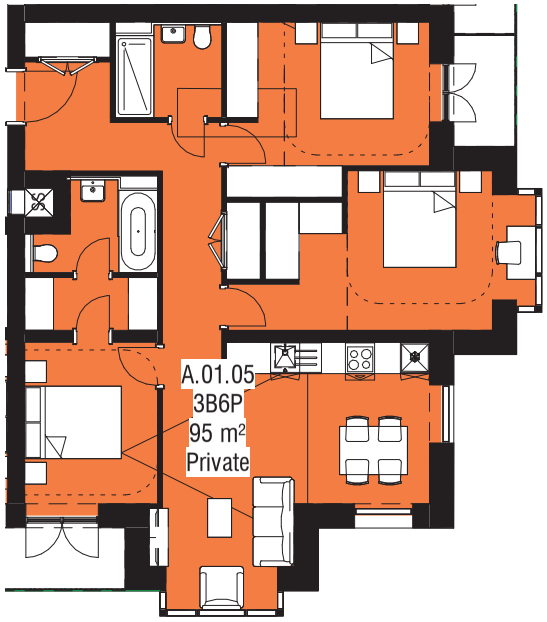
2 Bedroom 4 People

2 Bedroom apartments are designed to accommodate three or four people, and are sized at a minimum of 72m2.

Both bedrooms are sized to afford ease of access around a standard single or double-bed, and an en suite is provided to the 'master bedroom' where possible.

A further accessible family bathroom is provided for visitors and occupants. The kitchen provision is appropriate for this type of property.

- Open living/ dining/ kitchen area
- Dual aspect living space
- Entrance hall
- En suite bathroom
- Possibility for study areas
- Addition of private external amenity



3 Bed 6 People

Family Units

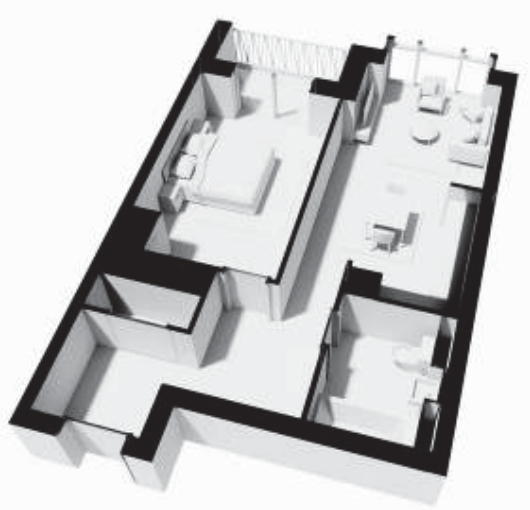
Particular importance in the scheme is given to Family Units. These are usually located in he corners of the blocks, allowing them to benefit from a dual aspect views.

3 Bedroom Family Units are designed to accommodate family of 6 people, and are sized at a minimum of 95m2. Bedrooms are sized to afford ease of access around a standard single or double-bed, and bathroom are accessible for visitors and occupants. The kitchen provision is generous for this type of property.

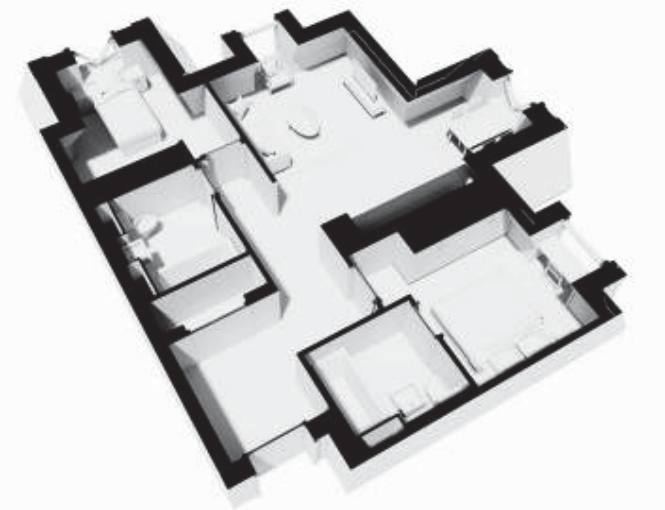
Bedrooms are sized to afford ease of access around a standard single or double sized bed with an en suite shower room and a family bathroom that can be accessible for visitors and occupants.

- Open living/ dining/ kitchen area
- Dual aspect living space
- Possibility for walk in wardrobes
- Entrance hall
- Bays utilised for study/ dining areas
- En suite shower room
- Possibility for study areas
- Addition of private external amenity

TYPICAL APARTMENT AXONOMETRIC VIEWS



1 Bed 2 People



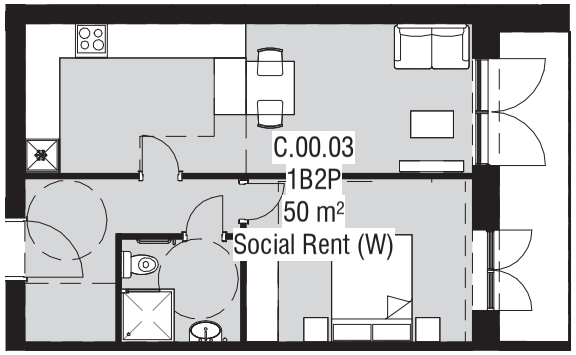
2 Bedroom 4 People

3 Bed 6 People

11.4 INCLUSIVE ACCESS & WHEELCHAIR

The scheme design to comply with 10% of Accesible and adaptable wheelchair units. All units are located on the ground floor with a levelled acccess. There is a mix of 1B, 2B & 3B provision depending on the need. Typical layout designs and floorplans are presented on the following pages.

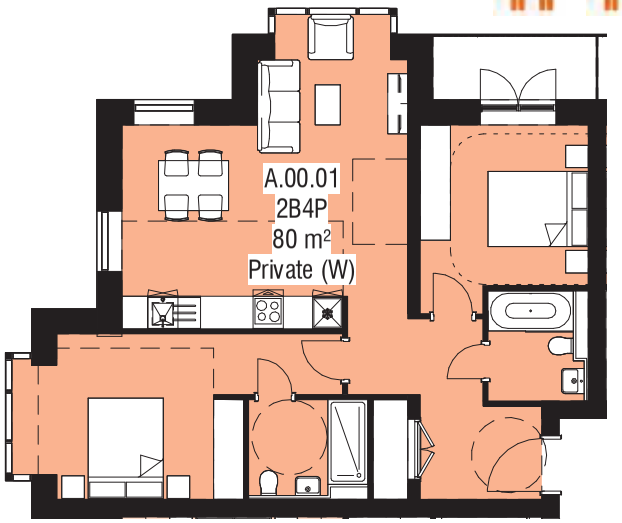
TYPICAL WHEELCHAIR ACCESIBLE & ADAPTABLE APARTMENT LAYOUTS



1 Bed 2 People

1 Bedroom apartments are designed to accommodate one to two people, at an average of 50m2. These apartments designed to comply with Part M requirements for wheelchair accesible & adaptable units.

Bedroom is sized to afford ease of access around a standard double-bed with 1m free zone for circulation, with the shower room being accessible for wheelchair user and if required convertable to a disable shower. The kitchen provision is increased to allow easy access.



2 Bedroom 4 People

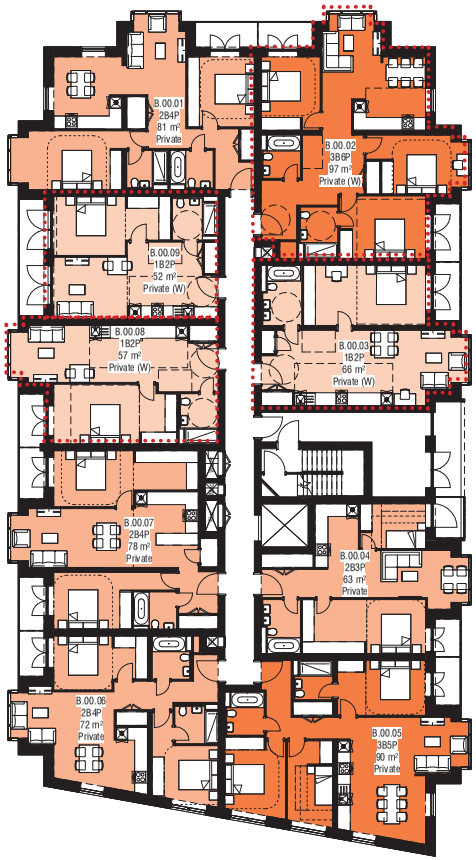
2 Bedroom apartments are designed to accommodate three or four people, and are sized at a minimum of 72m2. These apartments designed to comply with Part M requirements for wheelchair accesible & adaptable units.

Accesible and adaptable Bedroom is sized to afford ease of access around a standard double-bed with 1m free zone for circulation, with the shower room being accessible for wheelchair user and if required convertable to a disable shower. The kitchen provision is increased to allow easy access.

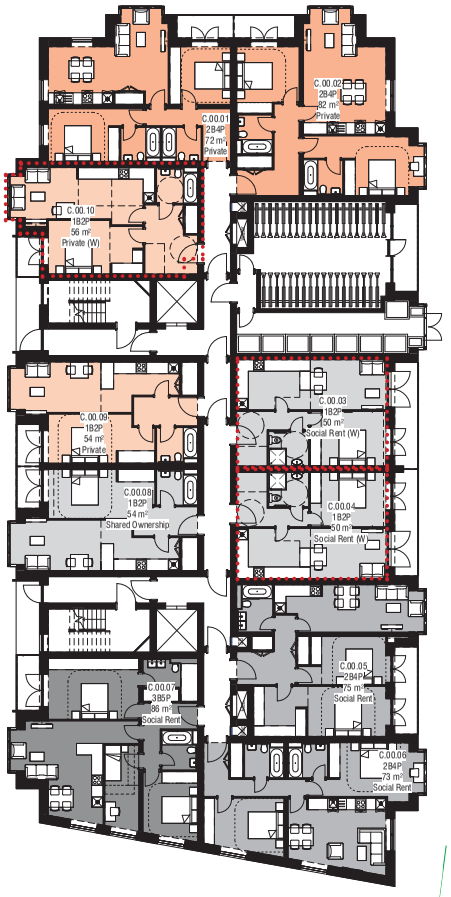
WHEELCHAIR ACCESSIBLE & ADAPTABLE UNITS

Block A - Level 0

Block B - Level 0



Block C - Level 0



MASTERPLAN SCHEDULE

GEA (sqm)

Block	Level 0	Level 1	Level 2	Level 3	Totals
Residential					
Block A	839	839	823	0	2,501
Block B	852	852	852	839	3,395
Block C	899	981	981	968	3,829
BTM	156	106	0	0	262
Undercroft					89
Ancilliary					
Parking					1193
Plant					228
Storage					623
Amenity					42
Totals	2,746	2,778	2,656	1,807	12,162

Total GIA (sqm)

Block	Level 0	Level 1	Level 2	Level 3	Totals
Residential					
Block A	776	776	711	0	2,263
Block B	788	788	788	728	3,092
Block C	831	911	911	849	3,502
BTM	137	80	0	0	223
Undercroft					89
Ancilliary					
Parking					1115
Plant					174
Storage					585
Amenity					35
Totals	2,532	2,555	2,410	1,577	11,078

Total NIA (sqm)

Block	Level 0	Level 1	Level 2	Level 3	Totals
Block A	643	666	575	0	1,884
Block B	656	679	679	593	2,607
Block C	652	739	739	657	2,787
BTM	132	59	0	0	191
Totals	2,083	2,143	1,993	1,250	7,469

Total Apartment Mix

Block	Studio	1 Bed	2 Bed	3 Bed	Total
Block A	0	10	11	6	27
Block B	0	9	19	8	36
Block C	0	20	19	4	43
BTM	1	0	1	1	3
Totals	1	39	50	19	109
Mix	1%	36%	46%	17%	

Private Apartment Mix

Block	Stuido	1 Bed	2 Bed	3 Bed	Total
Block A	0	10	11	6	27
Block B	0	9	19	8	36
Block C	0	8	11	0	19
BTM	1	0	1	1	3
Totals	1	27	42	15	85
Mix	1%	32%	49%	18%	

Affordable Apartment Mix

Block	Stuido	1 Bed	2 Bed	3 Bed	Total
SR Units	0	7	8	4	19
SR NIA	0	402	573	333	1,308
SR Mix	0%	37%	42%	21%	
S/O Units	0	5	0	0	5
S/O NIA	0	254	0	0	254
S/O Mix	0%	100%	0%	0%	
Total Units	0	12	8	4	24
Total NIA	0	656	573	333	1,562
Total Mix	0%	50%	33%	17%	

*AH = 22% of 109 total residential units on site.

ACCOMMODATION SCHEDULE

SCOTT BROWNRIGG

Block A				
Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 00	A.00.01	80	2B4P	Private (W)
Level 00	A.00.02	80	2B4P	Private
Level 00	A.00.03	71	2B4P	Private
Level 00	A.00.04	50	1B2P	Private
Level 00	A.00.05	95	3B6P	Private
Level 00	A.00.06	103	3B6P	Private
Level 00	A.00.07	56	1B2P	Private (W)
Level 00	A.00.08	56	1B2P	Private (W)
Level 00	A.00.09	52	1B2P	Private (W)
Total	**9 Units**	**643**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 01	A.01.01	80	2B4P	Private
Level 01	A.01.02	80	2B4P	Private
Level 01	A.01.03	71	2B4P	Private
Level 01	A.01.04	73	2B4P	Private
Level 01	A.01.05	95	3B6P	Private
Level 01	A.01.06	103	3B6P	Private
Level 01	A.01.07	56	1B2P	Private
Level 01	A.01.08	56	1B2P	Private
Level 01	A.01.09	51	1B2P	Private
Total	**9 Units**	**665**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 02	A.02.01	65	2B3P	Private
Level 02	A.02.02	65	2B3P	Private
Level 02	A.02.03	64	2B3P	Private
Level 02	A.02.04	65	2B3P	Private
Level 02	A.02.05	79	3B4P	Private
Level 02	A.02.06	87	3B5P	Private
Level 02	A.02.07	50	1B2P	Private
Level 02	A.02.08	50	1B2P	Private
Level 02	A.02.09	50	1B2P	Private
Total	**9 Units**	**575**		

Block A Grand Total **1,883**

Barnes Cottages				
Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 00	D.00.01	69	2B4P	Private
Level 00	D.00.02	57	2B3P	Private
Level 01	D.00.01	19	2B4P	Private
Level 01	D.00.02	18	2B3P	Private
Total	**2 Units**	**163**		

Entrance Lodge				
Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 00	E.00.01	6	Studio	Private
Level 01	E.00.01	34	Studio	Private
Total	**1 Unit**	**40**		

Total Newbuild Apartments NIA **7,470**

Block B				
Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 00	B.00.01	81	2B4P	Private
Level 00	B.00.02	97	3B6P	Private (W)
Level 00	B.00.03	66	1B2P	Private (W)
Level 00	B.00.04	63	2B3P	Private
Level 00	B.00.05	90	3B5P	Private
Level 00	B.00.06	72	2B4P	Private
Level 00	B.00.07	78	2B4P	Private
Level 00	B.00.08	57	1B2P	Private (W)
Level 00	B.00.09	52	1B2P	Private (W)
Total	**9 Units**	**656**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 01	B.01.01	81	2B4P	Private
Level 01	B.01.02	97	3B6P	Private
Level 01	B.01.03	81	2B4P	Private
Level 01	B.01.04	71	2B4P	Private
Level 01	B.01.05	90	3B5P	Private
Level 01	B.01.06	72	2B4P	Private
Level 01	B.01.07	78	2B4P	Private
Level 01	B.01.08	57	1B2P	Private
Level 01	B.01.09	52	1B2P	Private
Total	**9 Units**	**679**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 02	B.02.01	81	2B4P	Private
Level 02	B.02.02	97	3B6P	Private
Level 02	B.02.03	81	2B4P	Private
Level 02	B.02.04	71	2B4P	Private
Level 02	B.02.05	90	3B5P	Private
Level 02	B.02.06	72	2B4P	Private
Level 02	B.02.07	78	2B4P	Private
Level 02	B.02.08	57	1B2P	Private
Level 02	B.02.09	52	1B2P	Private
Total	**9 Units**	**679**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 03	B.03.01	64	2B3P	Private
Level 03	B.03.02	80	3B4P	Private
Level 03	B.03.03	74	2B4P	Private
Level 03	B.03.04	63	2B3P	Private
Level 03	B.03.05	76	3B4P	Private
Level 03	B.03.06	60	2B3P	Private
Level 03	B.03.07	70	2B4P	Private
Level 03	B.03.08	50	1B2P	Private
Level 03	B.03.09	50	1B2P	Private
Total	**9 Units**	**587**		

Block B Grand Total **2,601**

BlockC				
Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 00	C.00.01	72	2B4P	Private
Level 00	C.00.02	82	2B4P	Private
Level 00	C.00.03	50	1B2P	SR (W)
Level 00	C.00.04	50	1B2P	SR (W)
Level 00	C.00.05	75	2B4P	SR
Level 00	C.00.06	73	2B4P	SR
Level 00	C.00.07	86	3B5P	SR
Level 00	C.00.08	54	1B2P	S/O
Level 00	C.00.09	54	1B2P	Private
Level 00	C.00.10	56	1B2P	Private (W)
Total	**10 Units**	**652**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 01	C.01.01	72	2B4P	Private
Level 01	C.01.02	82	2B4P	Private
Level 01	C.01.03	75	2B4P	Private
Level 01	C.01.04	50	1B2P	Private
Level 01	C.01.05	50	1B2P	S/O
Level 01	C.01.06	75	2B4P	SR
Level 01	C.01.07	73	2B4P	SR
Level 01	C.01.08	86	3B5P	SR
Level 01	C.01.09	60	1B2P	SR
Level 01	C.01.10	60	1B2P	SR
Level 01	C.01.11	56	1B2P	Private
Total	**11 Units**	**739**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 02	C.02.01	72	2B4P	Private
Level 02	C.02.02	82	2B4P	Private
Level 02	C.02.03	75	2B4P	Private
Level 02	C.02.04	50	1B2P	Private
Level 02	C.02.05	50	1B2P	S/O
Level 02	C.02.06	75	2B4P	SR
Level 02	C.02.07	73	2B4P	SR
Level 02	C.02.08	86	3B5P	SR
Level 02	C.02.09	60	1B2P	SR
Level 02	C.02.10	60	1B2P	SR
Level 02	C.02.11	56	1B2P	Private
Total	**11 Units**	**739**		

Level	Apartment Number	Area (sqm)	Apartment Type	Tenure
Level 03	C.03.01	61	2B3P	Private
Level 03	C.03.02	66	2B3P	Private
Level 03	C.03.03	67	2B3P	Private
Level 03	C.03.04	50	1B2P	Private
Level 03	C.03.05	50	1B2P	S/O
Level 03	C.03.06	67	2B3P	SR
Level 03	C.03.07	60	2B3P	SR
Level 03	C.03.08	74	3B4P	SR
Level 03	C.03.09	54	1B2P	SR
Level 03	C.03.10	54	1B2P	S/O
Level 03	C.03.11	50	1B2P	Private
Total	**11 Units**	**653**		

Block C Grand Total **2,783**

12.0

ARCHITECTURE & MATERIALITY

12.1 LOCAL ARCHITECTURE

The existing buildings in the conservation area and along Fitzgerald Avenue provide inspiration for the volumes and forms of the proposal. Typical building forms, details and materials in the surrounding context have been identified, which help give the site its scale and character.

The proposal looks to draw inspiration from these vernacular details as well as the guidelines set in the design code, to ultimately enhance the site character.

Gables - Mono Pitch




12.2 EXISTING SITE MATERIALITY

The existing buildings on site has a palette of red bricks various shades.

The proposals take precedent from the existing building palette as well as retained BTM's for contextual material response.

12.3 FACADE STRATEGY

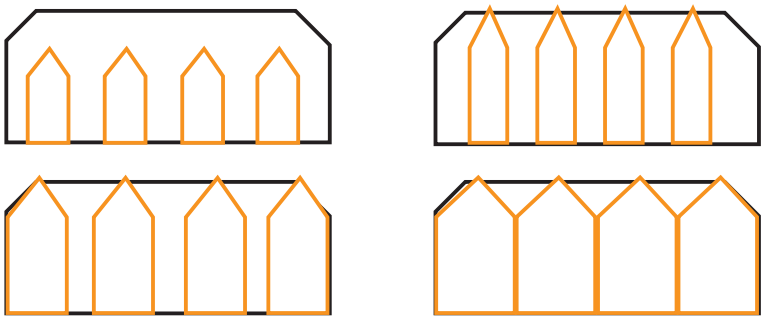
The facade strategy seeks to break down the massing of the blocks through high quality design, detailing and use of materials. An array of architectural features will be used to create a layered facade impact and avoid excessive standardisation.

3 typical bay conditions are identified to help divide the building mass and relate its scale and features to the surrounding residential terrace houses.

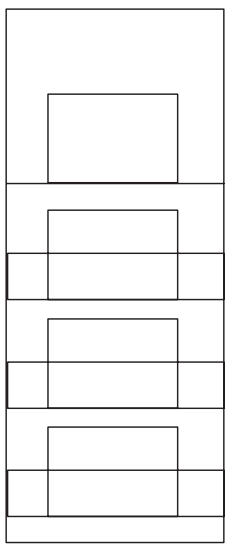
Various typologies have been tested to determine a suitable scale for the **gable** element; considering both the gable's impact on the perceived scale of the block, as well as the internal spaces contained within.

Whilst the gables break down the length of the facades, **balcony bays** add depth and animation in between the gables. A variety of window configurations can be accommodated within these bays to suit the internal spaces, weather they may be living rooms or bedrooms.

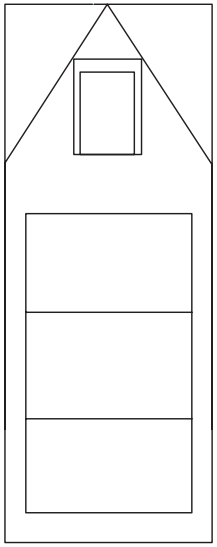
The typical **window bay** can also host an array of window types and configurations to add variety to the facade as a whole. The following pages demonstrate how the principles of these typical bays can be used together in a variety of configurations to create animation and depth along the facades and reduce the impression of standardisation.



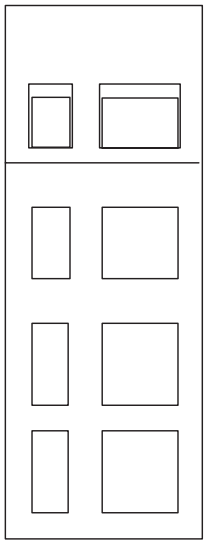
Gable scale study



Typical Balcony Bay



Typical Gable Bay



Typical Window Bay

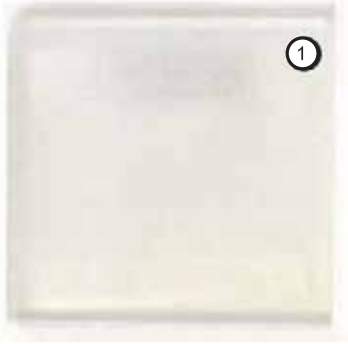
12.4 PROPOSED MATERIAL PALETTE

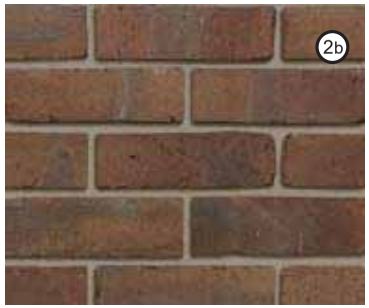
The proposed pallette of materials reflects the traditional masonry work found throughout the existing site and the surrounding context. The red-toned brick, stone detailing and roof tiles link the proposed buildings to the retained BTMs on site to create a sense of unison throughout the scheme.

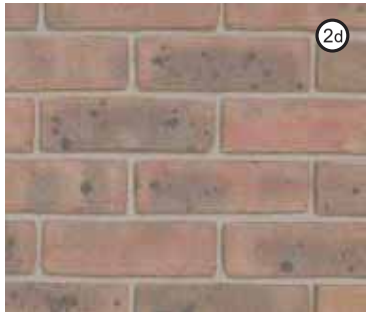
Lightweight metalwork is proposed to add some contemporary details to window frames, balustrades and dormer surrounds. The earthy colour tones of the metalwork will complement the masonry and add an elegant layer of detail without compromising the integrity of the brick expression.

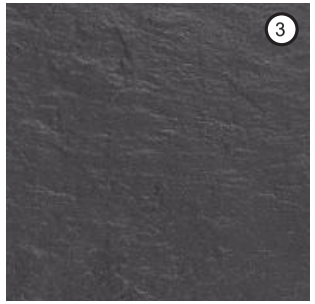
KEY:

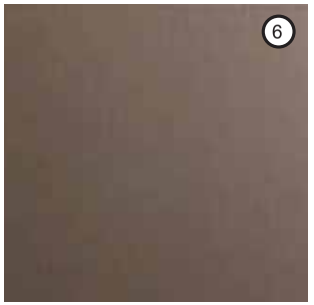
1. Window/ door clear glass /laminated glass
2. Stretcher bond brickwork with soldier course detailing to match
3. Natural slate roof tiles
4. Window frames black grey finish
5. Brown tone metalwork to residential balconies
6. Zinc dormer surround









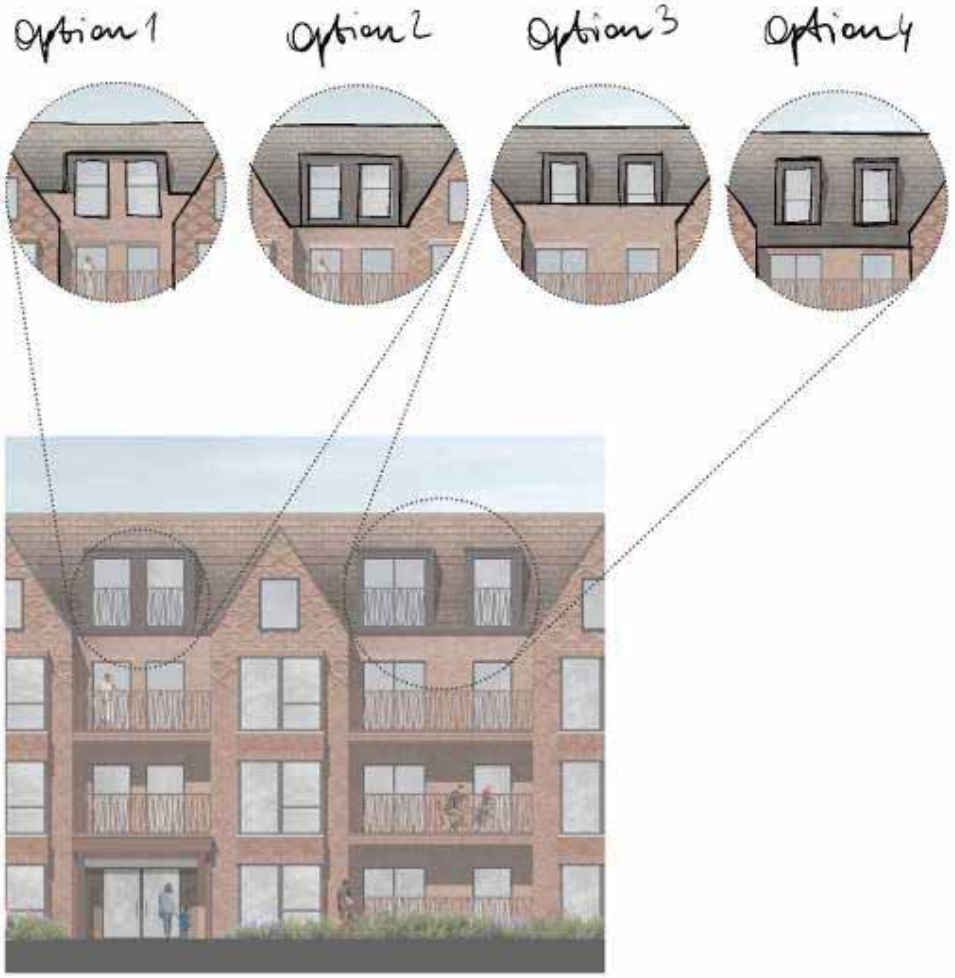


12.5 DESIGN WORKSHOP NO 1

Design Workshop 1, 30th April 2021 – a design workshop with the Case Officer, Conservation Officer and the Urban Design Officer whereby the proposals from the 2nd pre-app meeting were presented and discussed in detail.

ROOF

- Natural Slate roof tiles
- Review eaves line and relationship with the lower floor

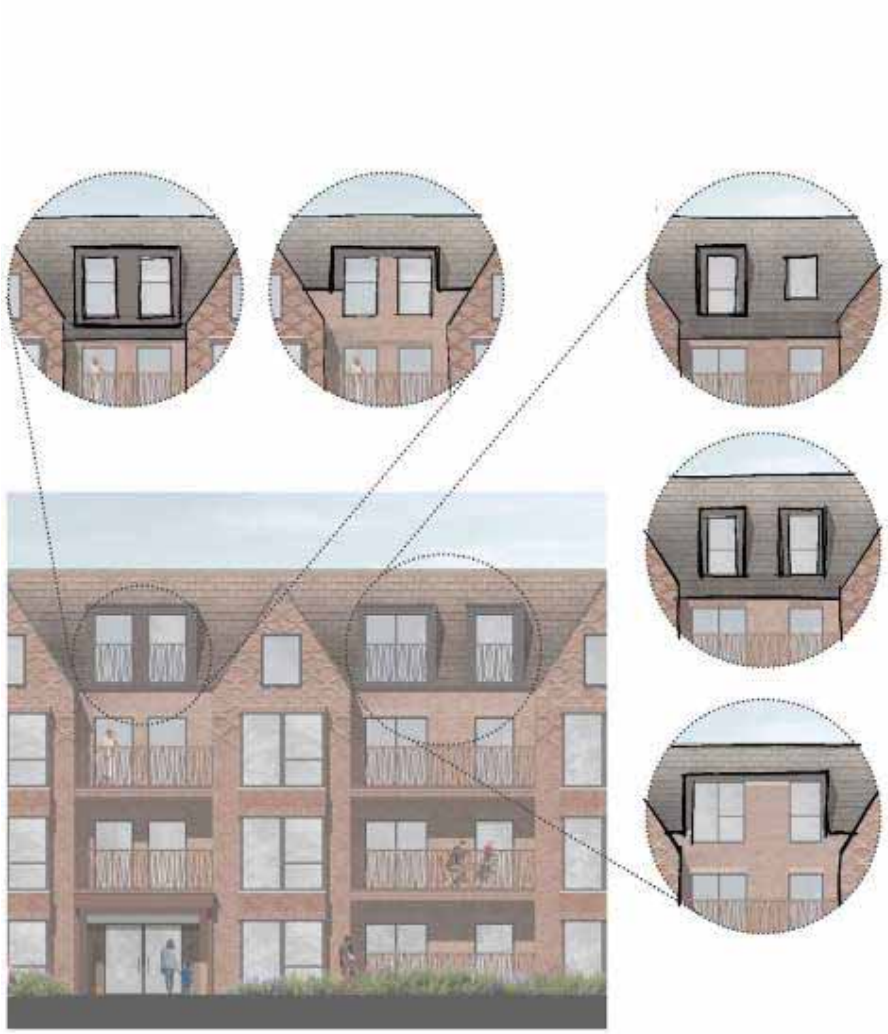


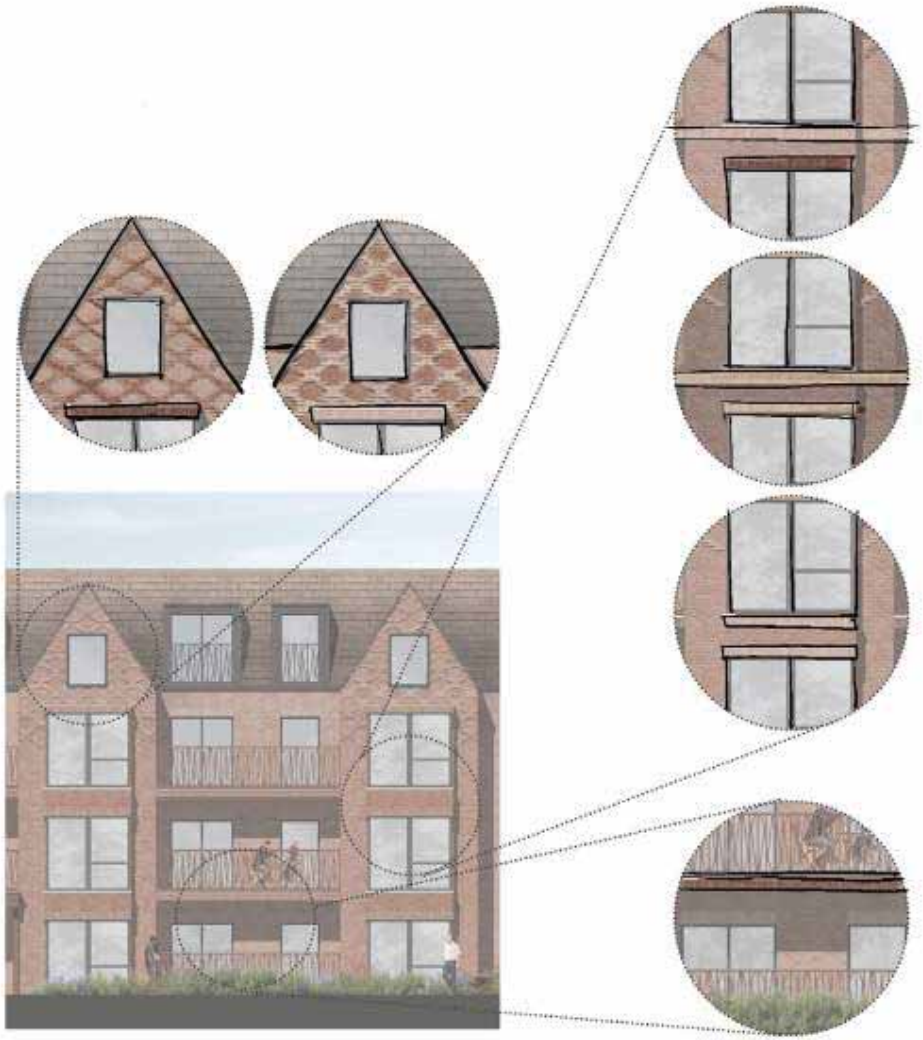
DORMERS

- Reduce number of dormers and full sized double dormers
- Dormer surrounds should be in lead or zinc.
- Remove Juliette balconies to minimise metal work

MATERIALITY

- Introduce variation across blocks
- Introduction of different brick tones on blocks





12.6 DESIGN WORKSHOP NO 2

Design Workshop 2, 19th May 2021 – a follow-up design workshop whereby the updated design (incorporating reduced massing to Block A) was discussed, with an additional focus on the detailed design elements of the scheme including elevational treatments, brick types, roofscape, gable ends and dormer windows.

ROOF & DORMERS

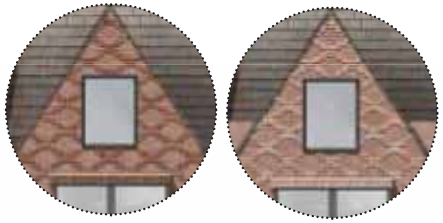
- Single dormers only proposed– some deeper/ taller than others
- Review eaves line and relationship with the lower floor

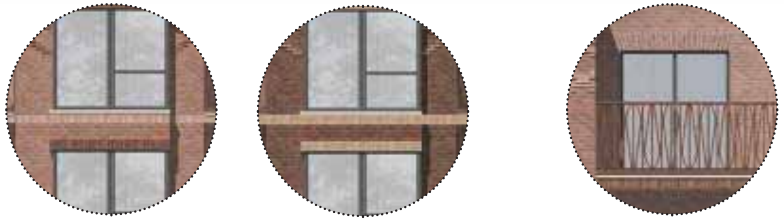
GABLES

- The gables intersect with the roof ridge and could vary in width to add further interest
- Variation of window types in the top of the gable
- Widen gable bays to have variation/ varying hierarchies

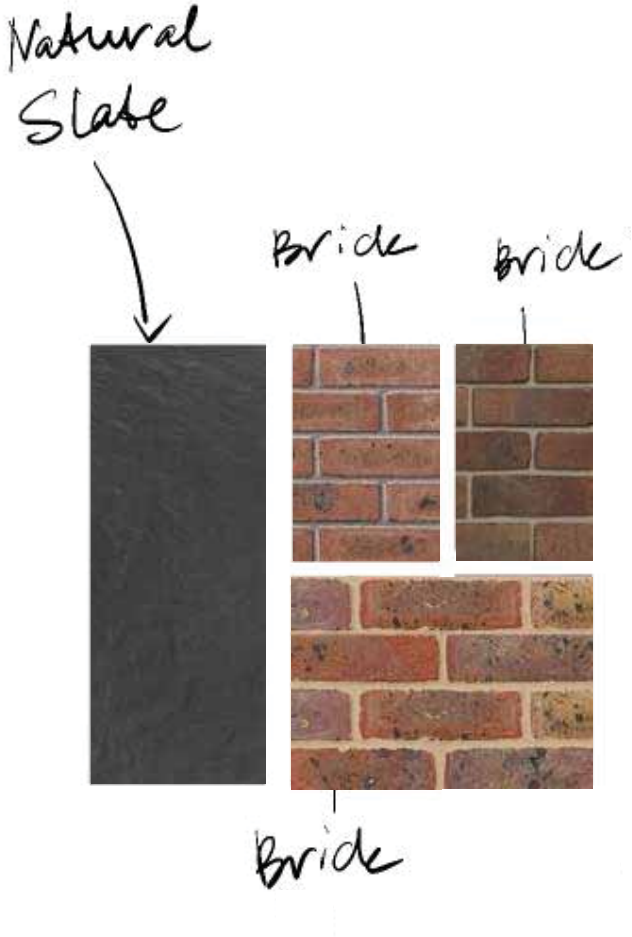
MATERIALITY & DETAILS

- Introduced variation across blocks and include Richmond blend brick
- Gauged detail above windows
- String courses/ lintels to add variety between each block





12.7 MATERIALITY & DETAILS



Gable end details

Accent brick - Bay window details

Accent brick - Bay window details

Balcony details

TYPICAL BAY

Materials:

Various brick shade and slate roof to complement the BTMs and surrounding context

Detail and interest created with decorative brickwork and architectural features

Gables:

Gables help break up the building mass and reduce the scale impact to suit the surrounding terraced housing.

Decorative brickwork detail at the top of the gables in Blocks B&C

Balconies:

An opportunity to provide private external amenity for residents between the gables

Entrance Portal:

A bronze tone metal portal with a canopy to signify the entrance to each block

Block B bay study

Dormers:

Dormers help to further break down the solidity of the roof mass.

Window sits within dormer reveal to reduce overheating effect

Bay windows:

Full height triple aspect bay windows to improve daylight to living areas.

Soldier Course brick detail at the top of the windows and a stone sill at the bottom

Windows:

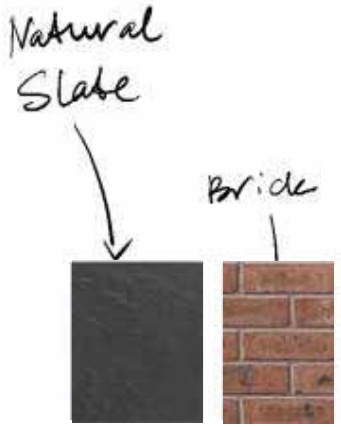
Windows are set back into a brick reveal and have a soldier course lintel detail.

Various window types are used to reduce the impression of standardisation

ELEVATIONS DESIGN DEVELOPMENT

Block A

KEY FEATURES:
- Single dormers
- Variation of window types in the top of the gable
- Widen end gable bays
- Gauged detail above windows

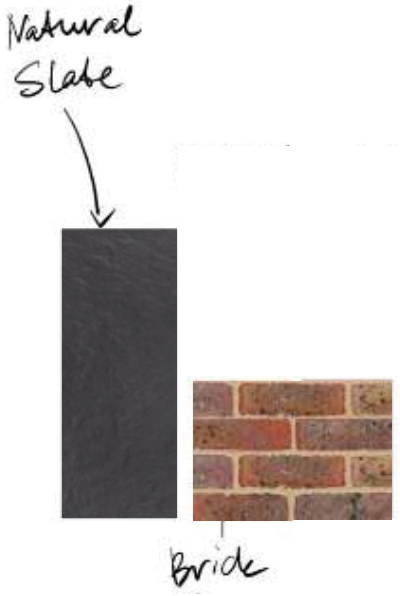


ELEVATIONS DESIGN DEVELOPMENT

Block B

KEY FEATURES:

- Single dormers
- Variation of window types in the top of the gable
- Widen end gable bays
- Gauged detail above windows



ELEVATIONS DESIGN DEVELOPMENT

Block C

KEY FEATURES:

- Single dormers
- Variation of window types in the top of the gable
- Widen end gable bays
- Gauged detail above windows

COLOURED SITE ELEVATIONS

TYPICAL BAY - BLOCK B & C

TYPICAL BAY - BLOCK B & C

TYPICAL BAY - BLOCK A

Typical Entrance Bay Elevation

Typical Entrance Bay 3D

BLOCK ENTRANCES DETAILS

On this page presented proposed principles for the block entrances - given their location between the projecting bays, they have a recessed configuration with a cantilevered canopy that will signify the entrance.

The variance between blocks will depend on the space between the projecting gables. There will be block name / wayfinding on each entrances as well as appropriate lighting.

1. Glazed double door with dark grey metal frame
2. Canopy in brown toned metal cladding
3. Metal portal reveal
4. Brick lintel detail
5. Engraved block name
6. Entrance Metal panels
7. Integrated intercom and letter box

CGI VIEW

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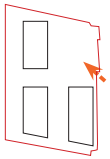

13.0

SUSTAINABILITY

13.1 SUSTAINABILITY PRINCIPLES

This section provides a summary of key Sustainability principles.

For more information, please see the Flatts statement submitted with the application.

The Energy Statement is prepared using Building Regulation 2010 (SAP 2012) and SAP 10 carbon factors according to the GLA Energy Assessment Guidance.

Air Source Heat pumps (ASHP) are proposed, which being an energy efficient system, is prioritised in the energy hierarchy over renewables and the benefits exceed the planning targets. They are electrically powered systems, which means no localized air quality concerns (as no fossil fuels are burnt on site) and they benefit from the new SAP10 carbon factors which makes them an efficient and low carbon technology.

Waste water heat recovery is also proposed as a means of reducing the most significant Energy usage for new build properties which is domestic hot water.

The results of the analysis are summarised below:

SAP2012

- Domestic

o 11% reduction in regulated emissions compared to Building Regulations Part L1A 2013 on energy efficiency measures alone (Be Lean)

o An overall reduction in regulated emissions of 36%

o 24% reduction in regulated emissions attributable to renewables (ASHP)

SAP10

- Domestic

o 14% reduction in regulated emissions compared to Building Regulations Part L1A 2013 on energy efficiency measures alone (Be Lean)

o An overall reduction in regulated emissions of 67%

o 53% reduction in regulated emissions attributable to renewables (ASHP)

Climate Change:

Climate Change mitigation and adaptation measures have been in incorporated within the building design strategy.

Passive design measures combined with energy efficient services and renewable technologies result in significant carbon emission reduction for the project. Monitoring of the operational energy aims to reduce the performance gap and further contribute to minimising the carbon footprint of the building.

Implementing more efficient ways of making, using and disposing of materials will allow resources to flow in a more circular pattern therefore reducing the greenhouse gas emissions and resource depletion. Consumption of potable water for sanitary use has been minimised through water efficient components.

Ecological features will aim at increasing the overall ecological value of the site while improving biodiversity but also reducing the effect of the urban heat island which is a common issue in big cities.

Adaptation to climate change has been achieved through structural and fabric durability measures addressing the potential for extreme weather conditions such as temperature fluctuations, winds and heavy rainfall. Building services design, architectural and structural solutions will ensure the building flexibility to adapt to various climate change conditions.

SUSTAINABILITY TARGETS

Energy Strategy and performance

- Sustainable design i.e. low carbon enhanced building fabric, minimising energy use through air-tightness, natural ventilation, heat recovery and LED lighting.
- Designed-in energy efficiencies to achieve a minimum of 35% reduction in carbon emissions
- Use of clean sources of energy and no fossil fuels i.e. no gas fired boilers.
- Use of renewable energy sources, e.g. air source heat pumps and the Green Grid.

Embodied Carbon

- Reducing demand for high carbon embodied materials with alternatives to the traditional concrete frame and reinforced concrete floors.
- Combining brick and low carbon blocks for walls to reduce the high carbon footprint of an all brick building.

Ecology

- Resizing basement to reflect the footprints of the buildings above to reduce dig waste and impact on ground ecology.
- An ecology zone is proposed which provides sanctuaries for bats, bees and other insects
- A grow zone is provided to encourage residents to grow their own fruits and vegetables
- Proposed 70% of the roof area will be green roof.

Circular Economy

- Considering building in layers, allows not only for future demolition, but also repairs;

Transport

- Electrical charging points provided for 20% of parking spaces with passive provision for the remainder.
- Cycle parking is provided in excess to the LHDG requirements both on ground and basement levels.

Adaptation & Resilience

- Sizing windows to maximise the heat gain in winter and minimise solar gain in summer, while providing for good levels of internal daylight.
- Overheating calculations to TM59 to ensure good levels of thermal comfort.

Equity and Social Justice

- Communal facilities are provided to encourage socialisation and leisure activities. There are proposed in the form of a residents' lounge, play spaces, grow gardens, landscape furniture and centralisted gardens.

Health and Wellbeing

- Grow gardens/ allotments to allow for resident-grown produce
- Pedestrian paths integrated within the landscaping to connect residents with nature
- Outdoor natural children's playspace

14.0

CONCLUSION

16.1 CONCLUSION

The Proposed Development provides an opportunity to deliver an increased provision of both affordable and market residential accommodation over and above the OPP. This includes the provision of 22% affordable housing with a tenure split of 79% affordable rent and 21% intermediate accommodation.

The proposals will deliver significant public realm and urban greening benefits as well as enhancing ecology and biodiversity on the site.

Design Summary:

Scale and Massing

- Additional storey added to Block C to match existing building height
- Comprehensive townscape assessment has been carried out
- Increased distance between Block A and the BTMs
- The scale of the proposal has been considered through massing, sections and elevations in relation to the surrounding existing and proposed context.
- Block B&C have been moved away from boundary for fire access and maintenance

Masterplan and Access Strategy

- Reduction in basement dig to improve site ecology and construction reduce construction traffic and export of soil from site
- Removal of the basement from Block C
- Improvements to basement layout and vehicular access thought the site including emergency services.

Residential Quality

- Providing a residential amenity/ work spaces and a post room/ concierge at the entrance to the site
- Improvements to construction and servicing strategies through a strategic sustainability analysis
- Introduction of air sourced heat pump to reduce energy consumption and improve the ESG of the development
- Introduction of sprinklers over code to improve safety
- Block C contains all of the scheme's affordable units with the exact quantum to be determined following feedback from registered providers and viability assessments
- Entrances to Block C are proposed to be of equal design quality and area both accessed from the linear garden.

Architecture and Materiality

- Height impact of Block A has been considered and mitigated through updates on massing and design. Its impact on South Worple way, as well as its relationship with the BTMs and the cemetery have been considered through a comprehensive townscape assessment, as well as facade design.
- Variation of architectural details and features through the facade design
- Material palette has been updated to complement the existing context

Landscaping

- Developed landscaping plan with improvements to play space provisions
- Proposals to improve the ecology of the site through the introduction of an eco-zone with sanctuaries proposed for bats, bees and other insects
- Creation of natural pockets of play, and reflection moments to encourage a sense of community throughout the site.

15.0

APPENDIX

SUMMARY OF UPDATES

We have been reviewing design during the consultation period and responded to the comments from Local Planning Authority as detailed below:

- Dormers moved away from the eaves by approximate. 200mm;
- Reduced the size of the dormers and omission of some dormers;
- Eaves overhang introduced to all blocks;
- Dormer removed on the far right in elevation 4 of Block C;
- Accessible units internal layouts update;
- Revision of attenuation volume and bin store in Block C and collection point layout;
- Revised site boundary.

Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

SCALE BAR: 1:250

Rev	Description	Date	Drawn	Checked
21	For Planning Submission	10/02/2022	FS	GM
20	For Planning Submission	14/09/2022	FS	GM
19	For Planning Submission	31/05/2022	FS	GM
18	For Planning Submission	04/02/2022	FS	GM
17	For Planning Submission	20/01/2022	FS	GM
16	For Planning Submission	12/11/2021	FS	GM
15	For Planning Submission	11/08/2021	FS	GM
14	For Planning Submission	13/08/2021	FS	GM
13	For Planning Submission	12/08/2021	FS	GM
12	Update Cooling Kiosk	23/07/2021	FS	GM
11	Draft Planning Submission	09/07/2021	FS	GM
10	For information	05/07/2021	FS	GM
9	For information	23/06/2021	FS	GM
8	For Information	04/06/2021	FS	GM
7	For information	12/05/2021	FS	GM
6	For Information	10/05/2021	FS	GM
5	For information	27/04/2021	FS	GM
4	Pre-App 2 Issue	23/02/2021	FS	GM
3	Building overlay update	09/02/2021	FS	GM
2	For information	28/01/2021	FS	GM
1	For information	14/01/2021	FS	GM

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Client's Name
Star Land Realty UK Ltd.

Job Title
Barnes Hospital Site

Drawing Title
Proposed Site Plan

Scale
1 : 250 @A1

SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR-ZZ-00-DR-A-80101

Suitability Code | Status | Rev
S4 - FOR STAGE APPROVAL | **21**

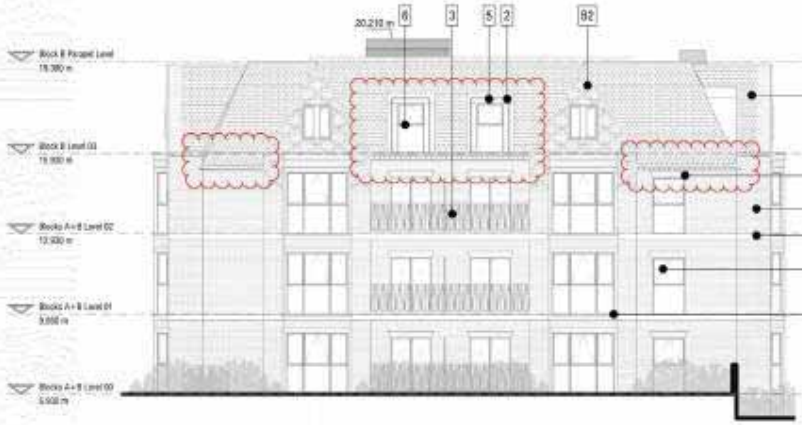
Block B revised elevation

Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

SCALE BAR: 1:100

1 Block B Elevation 1
1 : 100

2 Block B Elevation 2
1 : 100



3 Block B Elevation 3
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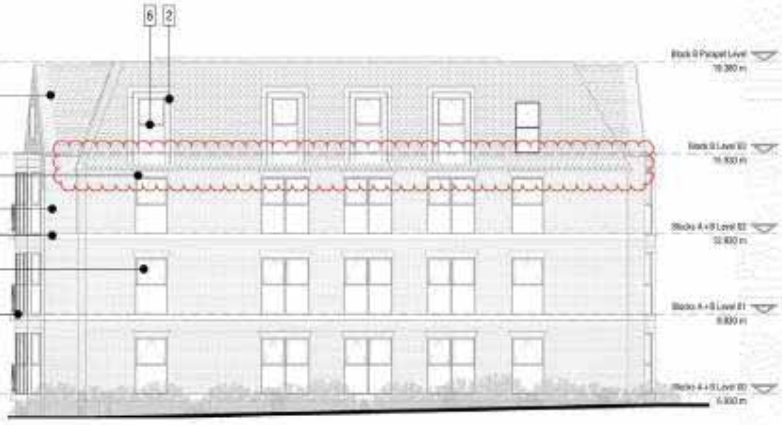

4 Block B Elevation 4
1 : 100

Common Materials
1. Natural slate roof tiles
2. Zinc cladding
3. Brown laced metalwork
4. Clear laminated glass
5. Grey backpainted glass panels
6. Black grey window frames

Block B Brickwork
B1. Main brick
B2. Lighter Accent Brick
B3. Darker Accent Brick

DRAFT

Revision	Description	Date	Drawn	Checked
4	For Planning Submission	13/08/2021	RS	SM
3	Update Zoning Areas	23/07/2021	RS	SM
2	Draft Planning Submission	09/07/2021	RS	SM
1	For Information	10/06/2021	RS	SM

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77 Endell Street
London WC2H 9DZ
T: +44 (0)20 7240 7766
W: scottbrownrigg.com

Client's Name
Star Land Realty UK Ltd

Job Title
Barnes Hospital Site

Drawing Title
Block B Elevations

Scale
As indicated @A1

SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR-BB-XX-DR-A-84102

Suitability Code | Status | Rev
S4 - FOR STAGE APPROVAL | 4

Block C revised elevation

1 Block C Elevation 1 1:100

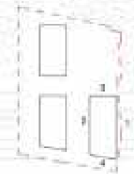
2 Block C Elevation 2 1:100

3 Block C Elevation 3 1:100

4 Block C Elevation 4 1:100

Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

SCALE BAR 1:100



Common Materials
- 1. Natural slate roof tiles
- 2. Zinc cladding
- 3. Brown toned metalwork
- 4. Clear laminated glass
- 5. Black grey window frames

Block C Brickwork
- C1. Main brick
- C2. Lighter Accent Brick
- C3. Darker Accent Brick

Revision	Description	Date	Drawn	Checked
5	For Planning Submission	[illegible]	FS	DM
4	For Planning Submission	12/08/2021	FS	DM
3	Update Drawing Frame	[illegible]	FS	DM
2	Draft Planning Submission	[illegible]	FS	DM
1	For Information	[illegible]	FS	DM

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Barnes Hospital Site

Drawing Title
Block C Elevations

Scale
As indicated @A1

SBR Project No
18387

18387-SBR-BC-XX-DR-A-84103

S4 - FOR STAGE APPROVAL

Rev
5

Block C revised layouts

Level 00

Levels 01-02

Level 03

- Private - 1 Bed
- Private - 2 Bed
- Private - 3 Bed
- Affordable - 1 Bed
- Affordable - 2 Bed
- Affordable - 3 Bed

Revision	Description	Date	Drawn	Checked
14	For Planning Submission	01/05/2022	FS	DM
13	For Planning Submission	20/01/2022	FS	DM
12	For Planning Submission	12/11/2021	FS	DM
11	For Planning Submission	10/09/2021	FS	DM
10	For Planning Submission	10/09/2021	FS	DM
9	Update Zoning Plans	23/07/2021	FS	DM
8	Draft Planning Submission	09/07/2021	FS	DM
7	For information	01/07/2021	FS	DM
6	For information	23/06/2021	FS	DM
5	For information	04/06/2021	FS	DM
4	For information	10/05/2021	FS	DM
3	Pre-App 2 Issue	25/02/2021	FS	DM
2	Building position update	08/02/2021	FS	DM
1	For information	14/01/2021	FS	DM

SCOTT BROWNRIGG

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Client Name
Star Land Realty UK Ltd.

Job Title
Barnes Hospital Site

Drawing Title
Block C Layouts

Scale
1 : 150 @A1

SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR-BC-XX-DR-A-83003

Suitability Code | Status | Rev
S4 - FOR STAGE APPROVAL | **14**

APPENDIX C
PREVIOUS SITE INVESTIGATION REPORTS

18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT
UK
Telephone: +44 (0)1442 437500
Fax: +44 (0)1442 437550
www.rsk.co.uk

Our Ref: 1920514-L01(00)

21st March 2019

LS Estates Limited
128 Cheapside,
London,
EC2V 6BT

For the attention of: Mr. M. Swetman

Dear Mark

RE: LAND AT BARNES HOSPITAL, SOUTH WORPLE WAY, LONDON, SW14 8SU

FURTHER GROUND GAS RISK ASSESSMENT

1. INTRODUCTION

The following letter presents an addendum to the ground investigation completed by RSK in March 2019 (Report No. 1920514-R01 00) and should be read in conjunction with this document.

Following the main fieldwork and subsequent single monitoring event, additional visits were undertaken within the dedicated 35mm diameter HDPE wells (designated WS1 to WS4).

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO2), methane (CH4) and oxygen (O2) in percentage by volume, while hydrogen sulphide (H2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

This report is also subject to the service constraints given in the Appendix A of the previous report.

2. PROJECT BACKGROUND

A total of two investigations have been carried out with reference to the above site, namely:

- Ove Arup and Partners Limited (Arup): Phase 1 Ground Contamination Desk Study - Barnes Hospital, dated October 2018 (ref. 247776-00); and
- RSK Environment Ltd (RSK): Geo-environmental Site Assessment – Land At Barnes Hospital, South Worple Way, London, SW14 8SU, dated March 2019 (ref. 1920514-R01 00).

Information contained within the above reports pertinent to the gas assessment is referenced in the relevant subsections.

3. GROUND GAS CONCEPTUAL SITE MODEL (GGCSM)

3.1 ON-SITE SOURCES

A review of the site's historical land uses as part of previous phase of assessment has indicated the potential for contaminants to be present beneath the site. With particular reference to permanent ground gases, the initial conceptual site model (prepared by Arup) identified viable sources beneath the site, principally relating to made ground. To generate large volumes of methane and carbon dioxide, a large mass of readily degradable organic content is required. The gas generated will depend on the volume of degradable material that is present in the soil and the total volume. The soil profile recorded by RSK (ref.1920514-R01) confirmed a variable thickness of made ground (ranging between 0.50m and 2.3m bgl) overlying superficial deposits of the Kempton Park Gravel. Very little degradable material with low gas generating potential was observed within the made ground.

The presence of hydrocarbon contamination from historical fuel spills or leaks in locations such as the diesel tank (north-west) and suspected tank bases (north and north-west) may present a potential source. However, vapours are typically present due to volatilisation from contamination rather than biodegradation and therefore do not have a generation rate. Vapours volatilise very slowly but need careful consideration because adverse health effects occur at relatively low concentrations. Some volatile compounds can also migrate easily via groundwater due to relative high solubility. A qualitative assessment together with in-situ testing (i.e. screening of soil samples using photo-ionisation detector) was undertaken (as part of the assessment by RSK) to determine the potential risk from vapours, which was considered to be low. Furthermore, there was no visual evidence declared of gross hydrocarbon contamination during the course of the main fieldwork. It was recommended that further investigation is carried out in the vicinity of the former diesel tank and suspected tank bases so that the areas can be assessed in respect to possible 'hotspots'.

3.2 OFF-SITE SOURCES

Potential off-site sources of permanent ground gas include the following:

- Material deposited to the north within the former open cast quarry excavation; and
- Alluvium deposits, which are anticipated to the north of the site associated with the River Thames.

With regards to the off-site quarrying, available information suggest landfilling activities were undertaken to the north (c.440m) associated with Duke's Meadows and comprised the disposal of demolition waste, forming backfill to gravel extraction pits. The site is identified as being listed by the Environment Agency as an historic landfill. It is also considered that land raising may have occurred as part of the flood defences along the River Thames. There are two BGS borehole logs within the site boundary, one of which indicates no Made Ground present, with River Gravels logged from ground

level. The second indicates Made Ground from ground level to a depth of 4.9mbgl, which comprises predominantly brick and concrete rubble.

The available information and past land uses identified in and around the former landfill site and the anticipated ground conditions suggest a low potential for contamination based on the nature of the historic landfill/land raising activities.

Information obtained from the Duke's Meadows Trust website indicated that from the 1920s to the late 1930s, the land comprising Dukes Meadows was used by The Riverside Sand and Ballast Company. During this time, two million cubic yards of sand and gravel were reported to have been excavated from the area. The infill for the exhausted pits was brought from demolition sites. It is understood that filling was complete in the late 1930s and the topsoil which had been placed along side the railway line was returned for grassing.

Alluvium deposits are considered to have a very low gas generation potential and pose a very low risk to on-site development, with negligible risk of lateral migration.

Whilst, carbon dioxide can also be formed as decay products from the nearby cemetery, the risk of gas migrating beneath the site is considered to be low.

In conclusion, the potential off-site sources of permanent gas are not considered to be significant.

3.3 MIGRATION PATHWAYS

Gas primarily migrates via either pressure driven (advective) flow or via diffusive flow. In general, the predominant mechanism for migration of gases such as that encountered on this site is diffusive, with no driving pressure. This is supported by the negligible flow rates recorded during gas monitoring. As such, gas generated within the material identified across the site will diffuse through the soils forming a continuum between the source and ground level, with only minor concentrations of gas reaching ground level, and no perceivable flow.

Many ground gases are soluble in groundwater and can migrate within flowing groundwater. The solubility of all gases in water increases with increasing pressure and decreases with increasing temperature. It is possible for this mechanism to generate high concentrations in soil gas above the water table (partitioning is reversible, so equilibrium soil gas concentration is the same as partial pressure in the source), but mass transport rates are likely to be low. This mechanism may become more significant when considering geological sources at great depth and high pressure, because gases are much more soluble under these conditions.

Ground gases become most hazardous when they intrude into buildings and structures, such as utility access pits/inspection chambers, where they can accumulate at explosive or toxic concentrations, or form an asphyxiating atmosphere. Ground gas intrusion pathways into buildings are highly dependent upon building design and condition. For slab-on-ground construction, cracks, service penetrations and poorly filled construction joints provide the most likely pathways. Cavity wall vents may also allow ingress, particularly where convective currents occur due to a stack effect. Preferential pathways

formed by service ducts and trenches and drains are frequently present. Whilst diffusion is considered the primary mechanism for ground gas intrusion to buildings, pressure-driven flow may occur due to stack effects and wind-driven pressure gradients.

3.4 POTENTIAL RECEPTORS

The development proposals outlined for the site will inherently introduce receptors to the site. Receptors introduced to the site will typically comprise future residents. Detailed proposed layout has not been provided at the time of writing this report.

4. SUMMARY OF GROUND GAS DATASET

A total of three return visits were carried out (between 12th and 19th March) to undertake spot monitoring and take flow measurements. The monitoring data is presented in Appendix A and summarised below.

Table 1 Summary of gas monitoring results

Exp point	Monitoring days/ rounds	Range steady CO_2 (% vol/vol)	Range CH_4 (% vol/vol)	Range O_2 (% vol/vol)	Flow (l/hr)	Atmospheric pressure (mb)	Groundwater (m bgl)
WS1	3	0.1-4.3	<0.1	17.9-21.1	0.0-0.1	1006-1027	Dry
WS2	3	0.5-1.4	<0.1	20.0-21.2	0.0-0.2	1006-1027	Dry
WS3	3	<0.1-1.9	<0.1	19.8-21.0	0.0-0.2	1006-1027	Dry
WS4	3	<0.1-0.7	<0.1	20.0-21.0	0.0-0.2	1006-1027	Dry

5. ASSESSMENT OF DATA

The results have been assessed in accordance with the guidance provided in BS8485:2015+A1:2019 and CIRIA Report C665. In the assessment of risks and selection of appropriate mitigation measures, both reports highlight the importance of the conceptual site model. CIRIA C665 identifies two types of development, termed Situation A (modified Wilson and Card method), appropriate to all development excluding traditional low-rise construction, and Situation B (National House-Building Council, NHBC) only appropriate to traditional low-rise construction with ventilated sub-floor voids.

Both methods are based on calculations of the limiting borehole gas volume flow for methane and carbon dioxide, renamed as the gas screening value (GSV). The GSV (litres of gas per hour) is calculated by multiplying borehole flow rate (litres per hour) and gas concentration (percent by volume).

In both situations, it is important to note that the GSV thresholds are guideline values and not absolute. The GSV thresholds may be exceeded in certain circumstances, if the conceptual site model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt a higher risk classification than the GSV threshold indicates. Since the proposed development will comprise both apartment blocks, Situation A has been adopted for the flats.

As the data set is temporally/spatially limited, peak data was combined from more than one monitoring standpipe location, for each gas source. The gas monitoring data recorded to date has identified negligible concentrations of methane and a maximum concentration of carbon dioxide of 4.3%. A maximum gas flow rate of 0.2l/hr has been recorded. On this basis, the calculated GSV for methane is <0.0002 l/hr and the GSV for carbon dioxide is 0.0086l/hr.

Based on the GSVs, the site has been characterised as Situation CS1, indicating that a negligible gas regime has been identified and that gas protection measures are not considered necessary.

No construction details have been provided, however we have assumed reinforced concrete floor slabs will be adopted. BS8485:2015 indicates that a reinforced ground bearing slab with minimum surface penetrations as would afford some protection against the ingress of ground gas.

6. CONCLUSIONS

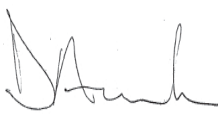
Based on the findings of this investigation, there is no significant source of ground gas below the site. The risk posed to the development and its occupiers by the presence of small volumes of gas is negligible. This is demonstrated by multiple lines of evidence:

1. The desk study has not identified any high risk sources of ground gas below or near the site.
2. There is no evidence of large volumes of degradable material contamination below the site.
3. The gas monitoring data shows very smalls volumes of gas.

It should be noted that the investigation was limited and therefore a detailed assessment is recommended to fully characterise the ground conditions in sufficient detail and increase the confidence in the preliminary assessment.

Yours sincerely
for **RSK Environment Limited - Geosciences**

Ziaul Hoque
Principal Geo-environmental Engineer



Dave Anchor
Director

Encl. Appendix A – Ground Gas Monitoring Data

APPENDIX A

IN-SITU GAS MONITORING RESULTS

	Start Date	End Date	[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round 1	12/03/2019	12/03/2019		Constant	Constant	-	-	
Round 2	15/03/2019	15/03/2019		Constant	Constant	-	-	
Round 3	19/03/2019	19/03/2019		Constant	Constant	-	-	

Exploratory Position ID	Monitoring Round	Measured Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS1	1	---	12/03/2019	-	1008	$0.0_{(I)}$	DRY	0.1	0.0	21.1	0.0	0.0	0	0	
WS1	1	---	15 secs	-	1008	$0.0_{(SS)}$	DRY	0.1	0.0	21.0	0.0	0.0	0	0	
WS1	1	---	30 secs	-	1008	$0.0_{(SS)}$	DRY	0.2	0.0	19.9	0.0	0.0	0	0	
WS1	1	---	45 secs	-	1008	$0.0_{(SS)}$	DRY	0.2	0.0	19.9	0.0	0.0	0	0	
WS1	1	---	60 secs	-	1008	$0.0_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	90 secs	-	1008	$0.0_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	120 secs	-	1008	$0.0_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	150 secs	-	1008	$0.0_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	180 secs	-	1008	$0.0_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	2 (2)	---	15/03/2019	-	1006	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS1	2 (2)	---	15 secs	-	1006	$0.1_{(SS)}$	DRY	2.7	0.0	20.3	0.0	0.0	0	0	
WS1	2 (2)	---	30 secs	-	1006	$0.1_{(SS)}$	DRY	2.8	0.0	19.0	0.0	0.0	0	0	
WS1	2 (2)	---	45 secs	-	1006	$0.1_{(SS)}$	DRY	2.9	0.0	18.8	0.0	0.0	0	0	
WS1	2 (2)	---	60 secs	-	1006	$0.1_{(SS)}$	DRY	3.0	0.0	18.8	0.0	0.0	0	0	
WS1	2 (2)	---	90 secs	-	1006	$0.1_{(SS)}$	DRY	3.1	0.0	18.7	0.0	0.0	0	0	
WS1	2 (2)	---	120 secs	-	1006	$0.1_{(SS)}$	DRY	3.2	0.0	18.6	0.0	0.0	0	0	
WS1	2 (2)	---	150 secs	-	1006	$0.1_{(SS)}$	DRY	3.2	0.0	18.6	0.0	0.0	0	0	
WS1	2 (2)	---	180 secs	-	1006	$0.1_{(SS)}$	DRY	3.3	0.0	18.6	0.0	0.0	0	0	

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date	Contract Ref:
	20/03/19			1920514

Contract: **Barnes Hospital**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS1	3 (3)	---	19/03/2019	-	1027	$0.1_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS1	3 (3)	---	15 secs	-	1027	$0.1_{(SS)}$	DRY	2.5	0.0	19.7	0.0	0.0	0	0	
WS1	3 (3)	---	30 secs	-	1027	$0.1_{(SS)}$	DRY	2.8	0.0	19.2	0.0	0.0	0	0	
WS1	3 (3)	---	45 secs	-	1027	$0.1_{(SS)}$	DRY	3.0	0.0	18.9	0.0	0.0	0	0	
WS1	3 (3)	---	60 secs	-	1027	$0.1_{(SS)}$	DRY	3.1	0.0	18.7	0.0	0.0	0	0	
WS1	3 (3)	---	90 secs	-	1027	$0.1_{(SS)}$	DRY	3.3	0.0	18.5	0.0	0.0	0	0	
WS1	3 (3)	---	120 secs	-	1027	$0.1_{(SS)}$	DRY	3.5	0.0	18.5	0.0	0.0	0	0	
WS1	3 (3)	---	150 secs	-	1027	$0.1_{(SS)}$	DRY	4.0	0.0	18.0	0.0	0.0	0	0	
WS1	3 (3)	---	180 secs	-	1027	$0.1_{(SS)}$	DRY	4.2	0.0	17.9	0.0	0.0	0	0	
WS1	3 (3)	---	210 secs	-	1027	$0.1_{(SS)}$	DRY	4.3	0.0	17.9	0.0	0.0	0	0	
WS1	3 (3)	---	240 secs	-	1027	$0.1_{(SS)}$	DRY	4.3	0.0	17.9	0.0	0.0	0	0	
WS1	3 (3)	---	270 secs	-	1027	$0.1_{(SS)}$	DRY	4.3	0.0	17.9	0.0	0.0	0	0	
WS2	1	---	12/03/2019	-	1008	$0.2_{(I)}$	DRY	0.2	0.0	21.2	0.0	0.0	0	0	
WS2	1	---	15 secs	-	1008	$0.1_{(SS)}$	DRY	0.9	0.0	21.0	0.0	0.0	0	0	
WS2	1	---	30 secs	-	1008	$0.0_{(SS)}$	DRY	1.2	0.0	20.7	0.0	0.0	0	0	
WS2	1	---	45 secs	-	1008	$0.0_{(SS)}$	DRY	1.2	0.0	20.5	0.0	0.0	0	0	
WS2	1	---	60 secs	-	1008	$0.0_{(SS)}$	DRY	1.1	0.0	20.5	0.0	0.0	0	0	
WS2	1	---	90 secs	-	1008	$0.0_{(SS)}$	DRY	1.4	0.0	20.5	0.0	0.0	0	0	
WS2	1	---	120 secs	-	1008	$0.0_{(SS)}$	DRY	1.4	0.0	20.4	0.0	0.0	0	0	
WS2	1	---	150 secs	-	1008	$0.0_{(SS)}$	DRY	1.4	0.0	20.4	0.0	0.0	0	0	
WS2	1	---	180 secs	-	1008	$0.0_{(SS)}$	DRY	1.4	0.0	20.4	0.0	0.0	0	0	
WS2	2 (2)	---	15/03/2019	-	1006	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS2	2 (2)	---	15 secs	-	1006	$0.0_{(SS)}$	DRY	1.0	0.0	20.6	0.0	0.0	0	0	
WS2	2 (2)	---	30 secs	-	1006	$0.0_{(SS)}$	DRY	1.0	0.0	20.3	0.0	0.0	0	0	

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS2	2 (2)	---	45 secs	-	1006	$0.0_{(SS)}$	DRY	0.9	0.0	20.3	0.0	0.0	0	0	
WS2	2 (2)	---	60 secs	-	1006	$0.0_{(SS)}$	DRY	0.8	0.0	20.3	0.0	0.0	0	0	
WS2	2 (2)	---	90 secs	-	1006	$0.0_{(SS)}$	DRY	0.9	0.0	20.5	0.0	0.0	0	0	
WS2	2 (2)	---	120 secs	-	1006	$0.0_{(SS)}$	DRY	1.3	0.0	20.6	0.0	0.0	0	0	
WS2	2 (2)	---	150 secs	-	1006	$0.0_{(SS)}$	DRY	1.1	0.0	20.2	0.0	0.0	0	0	
WS2	2 (2)	---	180 secs	-	1006	$0.0_{(SS)}$	DRY	0.5	0.0	20.4	0.0	0.0	0	0	
WS2	3 (3)	---	19/03/2019	-	1027	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS2	3 (3)	---	15 secs	-	1027	$0.0_{(SS)}$	DRY	0.3	0.0	20.5	0.0	0.0	0	0	
WS2	3 (3)	---	30 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.1	0.0	0.0	0	0	
WS2	3 (3)	---	45 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.0	0.0	0.0	0	0	
WS2	3 (3)	---	60 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.0	0.0	0.0	0	0	
WS2	3 (3)	---	90 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.0	0.0	0.0	0	0	
WS2	3 (3)	---	120 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.0	0.0	0.0	0	0	
WS2	3 (3)	---	150 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.0	0.0	0.0	0	0	
WS2	3 (3)	---	180 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.0	0.0	0.0	0	0	
WS3	1	---	12/03/2019	-	1008	$0.2_{(I)}$	DRY	0.1	0.0	21.0	0.0	0.0	0	0	
WS3	1	---	15 secs	-	1008	$0.1_{(SS)}$	DRY	0.5	0.0	20.5	0.0	0.0	0	0	
WS3	1	---	30 secs	-	1008	$0.1_{(SS)}$	DRY	1.1	0.0	19.9	0.0	0.0	0	0	
WS3	1	---	45 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	60 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	90 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	120 secs	-	1008	$0.1_{(SS)}$	DRY	1.8	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	150 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	180 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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Compiled By	Date	Checked By	Date	Contract Ref:
	20/03/19			1920514

Contract: **Barnes Hospital**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS3	2 (2)	---	15/03/2019	-	1006	$0.1_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS3	2 (2)	---	15 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.8	0.0	0.0	0	0	
WS3	2 (2)	---	30 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS3	2 (2)	---	45 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS3	2 (2)	---	60 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS3	2 (2)	---	90 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS3	2 (2)	---	120 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS3	2 (2)	---	150 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.7	0.0	0.0	0	0	
WS3	2 (2)	---	180 secs	-	1006	$0.2_{(SS)}$	DRY	0.1	0.0	20.8	0.0	0.0	0	0	
WS3	3 (3)	---	19/03/2019	-	1027	$0.1_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS3	3 (3)	---	15 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.7	0.0	0.0	0	0	
WS3	3 (3)	---	30 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS3	3 (3)	---	45 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS3	3 (3)	---	60 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS3	3 (3)	---	90 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS3	3 (3)	---	120 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS3	3 (3)	---	150 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS3	3 (3)	---	180 secs	-	1027	$0.1_{(SS)}$	DRY	0.1	0.0	20.5	0.0	0.0	0	0	
WS4	1	---	12/03/2019	-	1008	$0.1_{(I)}$	DRY	0.0	0.0	21.0	0.0	0.0	0	0	
WS4	1	---	15 secs	-	1008	$0.0_{(SS)}$	DRY	0.5	0.0	20.8	0.0	0.0	0	0	
WS4	1	---	30 secs	-	1008	$0.0_{(SS)}$	DRY	0.7	0.0	20.7	0.0	0.0	0	0	
WS4	1	---	45 secs	-	1008	$0.0_{(SS)}$	DRY	0.8	0.0	20.5	0.0	0.0	0	0	
WS4	1	---	60 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.5	0.0	0.0	0	0	
WS4	1	---	90 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.1	0.0	0.0	0	0	

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IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS4	1	---	120 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.1	0.0	0.0	0	0	
WS4	1	---	150 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.0	0.0	0.0	0	0	
WS4	1	---	180 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.1	0.0	0.0	0	0	
WS4	2 (2)	---	15/03/2019	-	1006	$0.1_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS4	2 (2)	---	15 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.8	0.0	0.0	0	0	
WS4	2 (2)	---	30 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS4	2 (2)	---	45 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS4	2 (2)	---	60 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS4	2 (2)	---	90 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS4	2 (2)	---	120 secs	-	1006	$0.2_{(SS)}$	DRY	0.0	0.0	20.6	0.0	0.0	0	0	
WS4	2 (2)	---	150 secs	-	1006	$0.2_{(SS)}$	DRY	0.1	0.0	20.7	0.0	0.0	0	0	
WS4	2 (2)	---	180 secs	-	1006	$0.2_{(SS)}$	DRY	0.1	0.0	20.6	0.0	0.0	0	0	
WS4	3 (3)	---	19/03/2019	-	1027	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0	
WS4	3 (3)	---	15 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.7	0.0	0.0	0	0	
WS4	3 (3)	---	30 secs	-	1027	$0.0_{(SS)}$	DRY	0.5	0.0	20.6	0.0	0.0	0	0	
WS4	3 (3)	---	45 secs	-	1027	$0.0_{(SS)}$	DRY	0.6	0.0	20.5	0.0	0.0	0	0	
WS4	3 (3)	---	60 secs	-	1027	$0.0_{(SS)}$	DRY	0.7	0.0	20.5	0.0	0.0	0	0	
WS4	3 (3)	---	90 secs	-	1027	$0.0_{(SS)}$	DRY	0.7	0.0	20.5	0.0	0.0	0	0	
WS4	3 (3)	---	120 secs	-	1027	$0.0_{(SS)}$	DRY	0.7	0.0	20.5	0.0	0.0	0	0	
WS4	3 (3)	---	150 secs	-	1027	$0.0_{(SS)}$	DRY	0.7	0.0	20.5	0.0	0.0	0	0	
WS4	3 (3)	---	180 secs	-	1027	$0.0_{(SS)}$	DRY	0.7	0.0	20.5	0.0	0.0	0	0	

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Contract: **Barnes Hospital**

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LS Estates Limited

Land at Barnes Hospital, South Worple Way, East Sheen, London, SW14 8SU

Geo-environmental Site Assessment

1920514-R01(00)

MARCH 2019

RSK GENERAL NOTES

Project No.: 1920514-R01(00)

Title: Geo-environmental Site Assessment: Land at Barnes Hospital, South Worple Way, East Sheen, London, SW14 8SU

Client: LS Estates Limited

Date: 13th March 2019

Office: RSK Environment Limited, 18 Frogmore Road, Hemel Hempstead, HP3 9RQ
Contact: Ziaul Hoque, Tel: 01442 416682.

Status: Rev 00

Author	Ziaul Hoque	**Technical reviewer**	Dave Anchor
Signature		Signature	
Date:	13th March 2019	Date:	13th March 2019
Project manager	Ziaul Hoque	**Quality reviewer**	Carys Baker
Signature		Signature	
Date:	13th March 2019	Date:	13th March 2019

Revision control sheet

Revision reference	Date	Reason for revision
Rev 00	13th March 2019	First issue

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

1.1 Commissioning

On the instruction of the Richard Bird Group, acting on behalf of LS Estates Limited (''the Client''), RSK Environment Limited (RSK) has undertaken a geo-environmental site assessment of the land at Barnes Hospital, off South Worple Way, in East Sheen, hereafter referred to as 'the Site'.

The project was commissioned to obtain and collate information on the ground conditions with respect to its contamination status.

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described through this document.

1.2 Project background

The site has been the subject of a previous desktop study carried out by Ove Arup and Partners Limited (Arup) in October 2018 (ref. 247776-00) and made available for review. The report provided a preliminary risk assessment aimed at identifying the potential geo-environmental liabilities associated with the site.

Salient information from the above report is summarised in the relevant section (**Section 3**).

1.3 Proposed development

The precise development plans are yet unknown, however it is understood that it is likely to be of a residential nature.

1.4 Scope of works

The project was carried out to an agreed brief as set out in RSK's proposal (ref. 1920514-T01(00), dated February 2019). The scope of works for the assessment included:

- Drilling of four shallow boreholes using drive-in sampler techniques to a maximum depth of 3.0m bgl;
- Associated sampling and on-site testing including the use of a photo ionisation detector for the purpose of screening for the presence of volatile organic compounds (VOC);
- A programme of environmental laboratory testing;
- Ground gas and groundwater monitoring across a period of two to three weeks;
- Development of a refined conceptual site model followed by generic quantitative risk assessment (GQRA) to assess complete pollutant linkages that may require the implementation of mitigation measures to facilitate redevelopment; and
- Identification of outline mitigation measures for complete pollutant linkages or recommendations for further work.

1.5 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

2 SITE DETAILS

2.1 Site location and surrounding area

The Site, which is located at National Grid Reference 521212^{E}, 175677^{N}, is situated south of the River Thames in a residential area between Richmond Park and Barnes Common.

The Site is located to the west of Mortlake, to the south of the Richmond line on South Worple Way. It lies adjacent to Old Mortlake Burial Ground, which forms its western boundary. A number of hospital buildings occupy the immediate area to the east with South Worple Avenue beyond, and to the south the site is bounded by the gardens to the rear of residential properties along Grosvenor Avenue.

An extract of the 1:50,000 Ordnance Survey map showing the location of the site is included in **Figure 1**.

2.2 Site description

The Site, measuring an approximate area of 0.8Ha, is set within the Barnes Hospital grounds and accommodates a number of redundant buildings, which historically provided mental health facilities. The remainder of the Site is occupied by hardstanding providing car parking and associated soft landscaping.

A site layout plan is presented as **Figure 2**.

3 SUMMARY OF PRECEDING REPORT

3.1 General

As outlined in **Section 1**, the site has been subject to a previous assessment as part of wider desk-based assessment encompassing the parcel of land to the east of the site.

In October 2018, Ove Arup and Partners Limited were commissioned by South West London and St George's Mental Health NHS Trust to assess the ground conditions in relation to the client's proposal to redevelop the hospital grounds for a mixed-use development. The information presented below in Section 3 is taken from the desk-based report (Ref. 247776-00 Issue 4).

3.1.1 Historical site setting and surrounding area

The earliest historical map edition identified the site to comprise a section of a larger field dissected by a footpath. In the late 1800s, Barnes Hospital was initially developed in the western half of its current boundaries, bordering onto the eastern boundary of Old Mortlake Burial Ground. The hospital is shown on the OS map of 1896 as consisting of a fever or isolation hospital with three buildings to the north of the main building and a mortuary in the northeast corner.

By the early 1900s, the hospital increased in size, extending across the entire site footprint. Ancillary buildings and footpaths were constructed to the eastern extension of Barnes Hospital including a Lodge facing onto South Worple Way and another Mortuary in the northeast corner of the Site. More facilities were added by 1935 and the Mortuary moved to one smaller building to the east of the entrance Lodge. In the 1940s, the hospital joined the new National Health Service and became known by its recent name of Barnes Hospital in 1949-50.

No significant changes were observed in the subsequent years until the 1990s, by which time a number of buildings had been demolished and an electricity substation constructed along the site's southern boundary.

In the late 1700s, the surrounding area was largely occupied by open fields. The footpath passing diagonally through the site from Priests Bridge remains today to the southeast of the hospital site. Residential development to the northeast and southwest of the site had occurred in the late 1800s with the addition of the railway constructed to the immediate north. Mortlake Cemetery was established in the 1850s extending to the west to its current western limit at Lodge Avenue in the 1890s.

By the early 1930s, a garage is noted to the southeast of site c.20m and an omnibus depot is shown c.120m to the northwest.

Little or no significant changes were observed until the 1990s, by which time the Omnibus Depot was relabelled as the 'Bus Station'.

3.1.2 Geological, hydro-geological and hydrological setting

The published geological record (1:50,000 geological map sheet 256, North London) indicates that the site is underlain by superficial deposits of the Kempton Park Gravel (River Terrace Deposits) overlying the London Clay formation.

The Environment Agency designates the River Terrace Deposits as a Secondary A aquifer. The London Clay is considered unproductive.

The report has identified records for two groundwater abstractions within 1km of the site. The closest abstraction is listed as historical, 660m north of the site for use in spray irrigation at Dukes Meadows. The other abstraction listed is active, 860m northwest and also for spray irrigation at Dukes Meadows Golf Club. The site is not situated within a Source Protection Zone (SPZ) for potable water supply.

The nearest surface water feature is Beverley Brook, c.230m southeast of the site. The River Thames is approximately 340m north of the site, and there is also an enclosed culvert linking Beverley Brook to the River Thames running along White Hart Lane around 100m east of the site. There are no EA recorded pollution incidents to Controlled Waters within 500m of the site.

3.1.3 Arup's Preliminary Conceptual Site Model (CSM)

Based on the desk study, the findings identified the possibility that some shallow made ground may exist on site associated with the historic and current development of the site. In addition, the site has been used for hospital activities for more than 50 years and some releases of contamination may have occurred during that time. The most significant potential sources of on-site contamination are associated with the former/current site operations (i.e. storage fuel oils, spills/leaks associated with the electricity sub-station, laundry, plant rooms and handling of medical waste). However, the study has identified no direct evidence of ground contamination on the site, which in its current form of development, is very unlikely to be acting as a source of potentially on-going contamination.

A number of potential off-site sources of contamination have been identified (including a garage, railway track and bus station). However, none are considered to pose a direct risk to the site.

4 UNEXPLODED ORDNANCE

This assessment was undertaken to assess the likely potential of encountering unexploded ordnance (UXO) in general accordance with CIRIA C681. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

During WWII, the wider surrounding area sustained high density bomb damage. Mapping of the area indicates several incidents of bombing across the site area, including both HE and incendiary bombing on numerous occasions during the war.

It is recommended a detailed assessment is undertaken to enable an estimate to be made of the likelihood of creating a UXO hazard on site, giving due consideration to the proposed development type and construction methods to be employed.

A copy of the risk assessment report is presented in **Appendix B**.

5 SITE INVESTIGATION STRATEGY & METHODOLOGY

5.1 Introduction

RSK carried out an intrusive investigation 07th March 2019 and subsequent ground gas monitoring to further characterise the ground conditions as per the scope determined by Robert Bird Group (RBG).

5.2 Selection of investigation methods

The techniques adopted for the investigation have been chosen considering the anticipated ground conditions and the existing land use.

5.2.1 Health, safety and environment considerations

The site work was undertaken in line with RSK's Safety, Health, Environmental and Quality Management System (SHEQMS), which is accredited to ISO9001: 2008 (Quality Management System standard) and ISO14001:2004 (Environmental Management System standard).

A site-specific health and safety plan was completed in advance of the intrusive works and all available buried utilities plans were consulted. Copies of statutory service records obtained by RSK are contained in **Appendix C**.

All locations were scanned with a cable avoidance tool (CAT) and Ground Penetrating Radar (GPR) techniques. Furthermore, risk mitigation measures (in the form of a magnetometer survey) were adopted with respect to the potential UXO risk.

As an extra precautionary measure, inspection pits were excavated by hand to 1.2m depth at all borehole locations prior to the commencement of drilling.

5.3 Investigation strategy

The site work comprised the activities summarised in **Table 1** along with a justification for each exploratory location.

The investigation and the soil descriptions were carried out in general accordance with 'BS 5930:2015 Code of Practice for Ground Investigations'. The exploratory hole records and other site work records are presented in **Appendix D**. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

Table 1 Exploratory hole and monitoring well location rationale

Investigation Type	Exploratory hole number	Rationale
Shallow drive-in sampler boreholes.	WS1 to WS4	To prove the geological succession and obtain data for the purpose of contamination assessment in the vicinity of diesel tank, suspected tank base and plant rooms.
		To enable installation of monitoring wells.
Monitoring wells	WS1 to WS4 (3No. Return Visits)	Measurement of ground gas emission rates and groundwater depths.

5.3.1 Soil sampling, in-situ testing and laboratory analysis

The sampling strategy was designed to characterise the shallow soils and locally underlying strata. Testing was primarily targeted towards the upper ground profile in order to test the environmental status of the made ground as well as the natural superficial deposits. Selected soil samples were placed in polythene bags for headspace screening with a photo-ionisation detector (PID) fitted with a 10.2 eV bulb.

Soils collected for laboratory analysis were recovered in a variety of containers appropriate to the anticipated testing suite required. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross-contamination.

Representative samples were taken and are recorded together with their depths and the PID screening results on the exploratory hole records in **Appendix D**.

The samples were transported to the laboratory in chilled cool boxes. Laboratory chain of custody forms can be provided if required. The rationale for soil sample chemical analysis is presented in **Table 2**.

Table 2 Scheduled analysis – soil

Exploratory hole no. and sample depth (m bgl)	Analyte	Rationale
WS1 (0.20m), WS2 (0.40m), WS3 (0.80m), WS4 (0.30m), WS4 (0.80m).	Basic contamination suite (includes heavy metals, speciated PAH's, TPH CWG, total sulphate, WS sulphate, Total organic carbon and asbestos soil screen.	To assess the suitability of made ground for use within a residential setting.
WS1 (0.60m), WS2 (1.50m), WS4 (1.50m).	Basic contamination suite (includes heavy metals, speciated PAH's, TPH CWG, total sulphate, WS sulphate, Total organic carbon.	To assess the underlying natural strata.
Notes: PAH – Polycylic aromatic hydrocarbons, TPH – Total petroleum hydrocarbons		

Test results are given on the borehole records presented in **Appendix D**. Disturbed samples were taken from each stratum encountered for potential future testing requirements. Geotechnical testing and the classification of the site soils for geotechnical purposes was outside the scope of this investigation.

5.3.2 Ground gas and groundwater monitoring

Subsequent to the installation of ground water monitoring wells within the borehole locations (WS1 to WS4) depths to groundwater were recorded using an electronic dip meter.

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Monitoring results recorded to date are contained within **Appendix F**.

6 SITE INVESTIGATION FACTUAL FINDINGS

6.1 Ground conditions encountered

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in **Appendix F**.

The exploratory holes revealed that the site is underlain by a variable thickness of made ground over superficial deposits of the Kempton Park Gravel. This appears to confirm the stratigraphical succession described within the Arup desk study report.

For the purpose of discussion, the ground conditions encountered during the fieldworks are summarised in **Table 3** with the strata discussed in subsequent subsections.

Table 3 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Proven thickness (m)
Made ground	WS1 to WS4	0.00 (GL)	0.50 to 2.30
Kempton Park Gravel	WS1 to WS4	0.50 to 2.30	Proven to the full depth of the investigation (3.00m)

6.1.1 Made ground

The exploratory holes encountered a variable thickness of made ground ranging between 1.00m and 2.30m bgl. The Made Ground was heterogeneous in nature and reference should be made to the individual records. In general, it comprised variable proportions of anthropogenic material in a granular matrix. Sandy clay portion with frequent inclusions of gravel sized brick fragments and brick cobbles.

No significant visual/olfactory evidence of contamination was encountered during the investigation. On-site PID screening of disturbed samples indicated concentrations of volatile organic compounds (VOC) <1ppm, indicating the absence of significant VOC within the samples.

6.1.2 Kempton Park Gravel

Soils recovered as the Kempton Park Gravel were encountered beneath the made ground, characterised by gravelly fine to coarse sand. The gravel fraction consisted of fine to coarse flint. Cohesive portion was recorded locally (WS1 and WS2) above the granular deposits, which typically comprised gravelly sandy clay.

No significant visual/olfactory evidence of contamination was encountered during the investigation. On-site PID screening of disturbed samples indicated concentrations of volatile organic compounds (VOC) <1ppm, indicating the absence of significant VOC within the samples.

6.2 Groundwater

Groundwater was not encountered during the investigation works or subsequent monitoring (carried out to date).

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations. On-going monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.

6.3 Ground gas monitoring

The gas monitoring results recorded to date has identified a negligible concentration of methane (<0.1% v/v), maximum carbon dioxide concentration of 1.9% v/v and minimum oxygen concentrations of 19.8%vol with maximum flow rate of 0.2l/hr recorded. Atmospheric pressure was recorded at 1008mbar.

The results from the individual monitoring wells are presented in **Appendix D** and discussed further in **Section 7**.

6.4 Uncertainty

The spatial extent of the investigation and the density of sampling regime was limited due to the scope of works determined by RGB and on-site constraints (i.e. the presence of existing buildings and restricted areas to the north). Furthermore, there is uncertainty as to the groundwater table within the River Terrace Deposits.

7 GENERIC QUANTITATIVE AND QUALITATIVE RISK ASSESSMENT

7.1 Refinement of initial CSM

The investigation generally confirmed the predicted ground model which comprised a variable thickness of made ground overlying the superficial deposits of the Kempton Park Gravel. No visual or olfactory signs of contamination were observed.

With respect to ground gas, very little degradable material with low gas generating potential was observed within the made ground. Therefore, the made ground is unlikely to be a significant source of ground gas.

With respect to ground gas, to generate large volumes of methane and carbon dioxide, a large mass of readily degradable organic content is required. The gas generated will depend on the volume of degradable material that is present in the soil and the total volume of the source. A review of the field records observed very little degradable material with low gas generating potential within the made ground. Furthermore, the presence of volatiles was not identified following the in-situ screening using a photo-ionisation detector (<1ppm). However, in light of the credible sources recorded within the CSM, potential risk may exist in the vicinity of the fuel storage diesel tank and suspected tank base.

Whilst a groundwater table, predicted within the Kempton Park Gravel, was not fully established during the ground investigation and subsequent monitoring to date, the pollution linkage was further assessed qualitatively. In addition, the permeable granular deposits within the made ground/Kempton Park Gravels will allow potential contaminants to laterally migrate into the nearby surface watercourse to the southeast.

7.2 Linkages for assessment

In line with CLR11 (Environment Agency, 2004), there are two stages of quantitative risk assessment, generic (GQRA) and detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted.

Following the refinement of the initial CSM, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in **Table 4**.

Table 4 Linkages for GQRA

Potentially relevant contaminant linkage	Assessment method
1. Direct contact with impacted soil and dust by future residents	No precise details have been provided at this stage however, it is understood that the proposed development will be of a residential nature. We have assumed low-rise residential apartment blocks with associated communal landscaping. To provide an initial assessment of the potential human health risk, the chemical results have been directly compared against generic assessment criteria values under a residential scenario (**Appendix H**) as these are considered to be the most conservative guidelines to protect the most critical targets from contaminants. Chemical analyses have been performed on a total of 8 No. soil samples to the maximum depth of 1.50 m bgl.
2. Inhalation exposure of future residents to asbestos fibres	Due to uncertainty regarding risk assessment (in particular appropriate toxicological criterion and soil to air relationships), no acceptable concentration of asbestos in soil exists. However, the potential for fibre release is likely to reflect the concentrations in soil, the soil type and surface cover, disturbance, the form and type of asbestos and the soil moisture content (CIRIA, C733, 2014). Qualitative assessment based on the asbestos minerals present, their form, concentration, location and the nature of the proposed development. A total of six samples of the near-surface soil material (made ground) were screened in the laboratory for the presence of asbestos materials.
3. Inhalation exposure of future residents to contaminants in the vapour phase	In the absence of indoor inhalation data (mg/m^3), the vapour pathway particularly in areas where the vapour pathway is the predominant pathway (i.e. in the vicinity of the infilling in the north), has been assessed qualitatively and by the comparison of soil data against residential GACs as above.
4. Uptake of contaminants by vegetation potentially impacting plant growth (phytotoxicity) from contaminated soils and via site run-off/ drainage/ dust deposition	Several compounds can inhibit plant growth; hence it is important to have generic assessment criteria (GAC) to promote healthy plant growth. In the absence of other published GAC, the GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields. The specified limits (designed to protect plant growth) of concentrations of selected elements in soil are outlined in updated 2nd Edition of the DoE Code of Practice and are presented in **Appendix I**.
5. Contaminants permeating potable water supply pipes, and the potential for chemical attack.	Comparison of soil data to GAC in **Appendix J** for plastic water supply pipes using UKWIR (2010) guidance.

Potentially relevant contaminant linkage	Assessment method
6. An assessment on ground gas regime. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in enclosed spaces or small rooms in new buildings, which could affect future residents. In the case of methane this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. Owing to the proposed development, the GSV have been compared with the Wilson and Card classification presented in C665 and BS8485:2015+A1:2019.
7. Leaching of soil contaminants and dissolved phase migration to the underlying Secondary A and nearby surface water course (Beverley Brook c.230m south-east).	In the absence of any leachate and groundwater/surface chemical data, the pollutant linkage has been assessed qualitatively.

7.3 Methodology and assessment of soil results

The analysis of laboratory results relating to soil samples submitted for testing, including leachate analysis, is included in the following sections.

7.3.1 Direct contact via oral and dermal exposure with impacted soil by future occupants/site users

In order to assess the soil results against the appropriate GAC, the soil results have been segregated into appropriate data sets. The datasets being considered in the assessment are:

- Data set 1 Made Ground
- Data set 2 Kempton Park Gravel (cohesive and granular portion)

7.3.1.1 Data set 1 – Made Ground

All made ground results have been compared with the aforementioned GAC. A soil organic matter (SOM) of 2.5% has been selected since laboratory results for total organic carbon (TOC) within the made ground (ranging between 0.1% to 2.4%). Only those determinants where exceedances have been reported are included within **Table 5**.

Table 5 Data summary table – Data set 1 (Made Ground)

Determinand	No. of samples tested	GAC (mg/kg)	No of exceedances	Maximum concentration (mg/kg)	
				Value	Location / depth (m bgl)
Lead	6	310	1	380	WS1@0.20
Dibenzo(ah)anthracene (polycyclic aromatic hydrocarbon)	6	0.32	3	0.34	WS1@0.20
				0.62	WS2@0.40
				0.46	WS4@0.80

In addition to the simple comparison of data to the adopted screening values, the CIEH document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', dated May 2008 recommends a statistical review should be conducted to demonstrate the site's 'suitability for use' with a defined level of confidence. Given the targeted nature of the investigation, it is not considered appropriate to conduct a statistical assessment.

Whilst contamination has been identified within discrete areas, we have assumed the anticipated finished floor level will mitigate the potential risk via source removal. Furthermore, should the proposed development predominantly comprise hardcover, as such the risk driving pathway considered will be outdoor vapour inhalation. PAH compounds have a very low volatility and therefore the vapour pathway is also not relevant and similarly not considered cause for concern if encapsulated beneath the hardstanding. The source of the recorded PAH compounds is most likely associated with bituminous material recorded and therefore not considered of any significant concern. With respect to Lead, there is no risk to human health via the inhalation pathway since it is not volatile, therefore the elevated concentrations of lead are not considered to pose a risk to human health if encapsulated beneath hardstanding.

Where areas of soft landscaping are proposed, further testing will be required to confirm the absence of contamination within the made ground soils. Alternatively, consideration will need to be given to incorporation of a clean capping layer to break the potential pollutant pathway.

Detectable concentrations of Total Petroleum Hydrocarbons were noted, however, the results indicate that the concentrations are generally associated with the higher chain hydrocarbon range (Aliphatic C_{16}-C_{21} and C_{21}-C_{35}) and below the adopted threshold limits. Whilst soil concentrations exceeded the corresponding theoretical saturation limits (Aliphatic C_{16}-C_{21}, C_{21}-C_{35}), which indicates the potential presence of free phase product within the unsaturated zone, no direct evidence of non-aqueous phase liquids (NAPL) were observed during the course of the investigation.

7.3.1.2 *Data set 2 – Kempton Park Gravel*

The results have been compared with the aforementioned GAC. A soil organic matter (SOM) of 1% has been selected since laboratory results for total organic carbon (TOC) within the drift deposits ranged between 0.2% and 1.4%.

Assessment of the results indicates that there were no exceedances of the GAC for the analytes tested.

7.3.2 Inhalation exposure of future residents to asbestos fibres

The visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples of made ground.

7.3.3 Inhalation exposure of future residents to contaminants in the vapour phase

The following lines of evidence have been assessed in respect to the risk from VOC's:

- The ground investigation indicated that the underlying residual made ground largely consists of inert material i.e. bituminous material, clinker, flint, brick and concrete.
- Petroleum hydrocarbons were recorded below the assessment criteria. The detectable concentrations generally represent higher chain hydrocarbons consistent with degraded petroleum products (C_{16}-C_{21} and C_{21}-C_{35}) with low volatility rates; and
- Low emission rates have been recorded during the gas monitoring of up to 0.2 l/hr.

Based on the above lines of evidence it is considered that the risk to future site users from VOC's is low. However, it is recommended that further investigation is carried out in the vicinity of the former diesel tank and suspected tank base so that the areas can be assessed in respect to possible 'hotspots'.

7.3.4 Uptake of contaminants by vegetation potentially inhibiting plant growth

For this linkage, the results were conservatively assessed against the GAC derived from the DoE Code of Practice. The results are summarised in the table below.

Table 6 Summary of soil results with respect to plant phytotoxicity effects

Determinant	Generic assessment criteria (mg/kg)				Concentrations of determinants in excess of assessment value
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0	
Zinc	200	200	200	300	None recorded

Determinant	Generic assessment criteria (mg/kg)				Concentrations of determinants in excess of assessment value
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0	
Copper	80	100	135	200	None recorded
Nickel	50	60	75	110	None recorded
Lead	300	300	300	300	WS1 at 0.20 (380mg/kg)
Cadmium	3	3	3	3	None recorded
Mercury	1	1	1	1	WS1 at 0.20 (2.6mg/kg) WS2 at 0.40 (2.0mg/kg)
Note: Only compounds with assessment criteria documented within the Directive 86/278/EEC have been included, although criteria for 5 additional compounds have been presented within the 2006 CoP.					

As shown above, elevated concentrations of lead and mercury have been recorded above the assessment criterion in the made ground at WS1 and WS2. However, the made ground is not conducive to plant growth and consideration should be given to incorporating clean soil material suitable as a growing medium.

7.3.5 Impact of organic contaminants on potable water supply pipes

Since water supply pipes are typically laid at a minimum depth of 750 mm below finished ground levels, sample results from depths between **0.5m and 1.5m** below finished level were considered for assessing risks to water supply.

The results indicate that a relevant linkage is unlikely to exist associated with organic contaminants and therefore pollutant polyethylene (PE) and/or polyvinyl chloride (PVC) water supply pipes are expected to be suitable for use on the development.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

7.3.6 An assessment of ground gas regime

7.3.6.1 General

The three mechanisms which permit gas to flow through the ground are advective flow (pressure driven), diffusion flow (along a concentration gradient) and/or dissolved in solution. Typically, advection and diffusion flows are considered to be the most critical mechanisms for gas migration. Migration of gas could occur within the made ground on site via the matrix of the fill material.

The anticipated development proposals will inherently introduce receptors to the site. These typically comprise future residents. Although, the main areas of risk are limited to restricted access/confined spaces.

7.3.6.2 Assessment of data

The results have been assessed in accordance with the guidance provided in BS8485:2015+A1:2019 and *CIRIA Report C665*. In the assessment of risks and selection of appropriate mitigation measures, both reports highlight the importance of the conceptual site model.

CIRIA C665 identifies two types of development, termed Situation A (modified Wilson and Card method), appropriate to all development excluding traditional low-rise construction, and Situation B (National House-Building Council, NHBC) only appropriate to traditional low-rise construction with ventilated sub-floor voids.

Both methods are based on calculations of the limiting borehole gas volume flow for methane and carbon dioxide, renamed as the gas screening value (GSV). The GSV (litres of gas per hour) is calculated by multiplying borehole flow rate (litres per hour) and gas concentration (percent by volume).

In both situations, it is important to note that the GSV thresholds are guideline values and not absolute. The GSV thresholds may be exceeded in certain circumstances, if the conceptual site model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt a higher risk classification than the GSV threshold indicates.

Since the proposed development will comprise both apartment blocks, Situation A has been adopted for the flats.

As the data set is temporally/spatially limited, peak data was combined from more than one monitoring standpipe location, for each gas source.

The gas monitoring data recorded to date has identified negligible concentrations of methane and a maximum concentration of carbon dioxide of 1.9%. A maximum gas flow rate of 0.2l/hr has been recorded. On this basis, the calculated GSV for methane is <0.0002 l/hr and the GSV for carbon dioxide is 0.0038l/hr.

Based on the GSVs, the site has been characterised as Situation CS1, indicating that a negligible gas regime has been identified and that gas protection measures are not considered necessary.

Assuming removal of the fuel storage tank in the north-west of the site, the potential for ground gas generation is considered very low. However, to increase data confidence and establish a ‘worst case’ scenario (i.e. during low or falling barometric pressure periods), it is recommended that monitoring is continued. It should be noted that further monitoring has been scheduled and will be reported as an addendum to this report.

7.3.7 Leaching and dissolved phase migration of contaminants to controlled waters

No significant sources of contamination have been identified to drive the need for a detailed assessment of this potential pollution linkage. Whilst marginally elevated concentrations were recorded locally, the anticipated presence of hardcover will restrict

any infiltration. As such, no major pathways via which contamination may migrate and impact groundwater are present. Furthermore, the anticipated thickness of the unsaturated zone will provide a significant medium for natural attenuation and the site is not situated within a groundwater Source Protection Zone.

It is recommended that further assessment of groundwater quality be conducted beneath the site to confirm the absence of any impact.

7.4 Environmental assessment conclusions

Owing to the nature of the investigation and the restrictions encountered, sufficient information is not currently available to determine fully the necessary mitigation measures. However, at this stage consideration should be given to the points listed out in **Table 7**.

Table 7 Outline of Recommended Contamination Alleviation Measures

Potential Alleviation Measures	Area(s) of Site Likely to be Affected		Development Considerations
	Whole Site	Targeted Areas	
Removal of fuel storage tank located in the north/north-eastern portion of the site		✔	Fuel/oil storage should be carefully emptied, made safe and removed off site in accordance with best industry practice with any hydrocarbon impacted soil to a suitably licensed waste management facility. The resulting remedial excavation will have to be validated by the Environmental Consultant prior to backfilling with 'clean' material.
Specialist demolition	✔		Prior to demolition of the existing buildings it is recommended that a hazardous materials survey is carried out and all necessary measures stemming from the survey implemented.
Remove/seal existing drains/services	✔		To close off any existing drains/services ducts that could provide a pathway for contaminant migration

Potential Alleviation Measures	Area(s) of Site Likely to be Affected		Development Considerations
	Whole Site	Targeted Areas	
Provision of clean soil cover for all soft landscaped areas	✔		In areas of proposed soft landscaping (i.e. eastern portion of the site), further sampling should be undertaken to confirm the absence of any contamination. Alternatively, provisions should be made to incorporate a clean capping layer. Dependent on the proposed finished levels, this may involve the excavation and removal of some or all of the Made Ground. Any residual contamination may be isolated below a suitable thickness of subsoil and topsoil cover (**450mm** recommended), which will also provide a suitable growing medium.
Use only validated sources of imported materials for clean soil cover.	✔		Proposed imported materials from each individual source should be validated with appropriate chemical test certificates and approved in advance of materials being delivered to site.
Selection of appropriate materials for buried water pipes in contact with the made ground.	✔		Where passing through potentially contaminated ground, buried services should be placed in a service corridor and surrounded with clean uncontaminated material.

Notwithstanding the alleviation measures detailed above, which are likely to be required within the proposed residential development, data gaps remain, which will require further assessment to fully establish the potential pollutant linkages requiring mitigation.

Of particular concern is the remaining uncertainty regarding the potential areas of concern recorded by Arup. Additional sampling/testing is considered essential to determine the implications for the health and safety of construction workers, waste classification and scope of remediation to protect the health of future residents.

8 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings from the intrusive investigation, the site is generally underlain by a variable thickness of made ground over the superficial deposits of Kempton Park Gravel. No olfactory/visual evidence of contamination was recorded. No groundwater was identified during the course of the investigation and subsequent monitoring to date. Furthermore, no degradable material was noted within the underlying soil material.

Whilst elevated concentrations of lead and PAH compounds were noted locally, any potential risk may be mitigated through encapsulation or excavation. In areas of soft landscaping it is recommended further sampling is undertaken to determine its contamination status.

Given the nature of the investigation and spatial extent of the sampling locations, data gaps and uncertainties remain, notably associated with the potential areas of concern identified within the CSM prepared by Arup.

It should be noted that the gas monitoring is on-going, and the results shall be provided under a separate cover.

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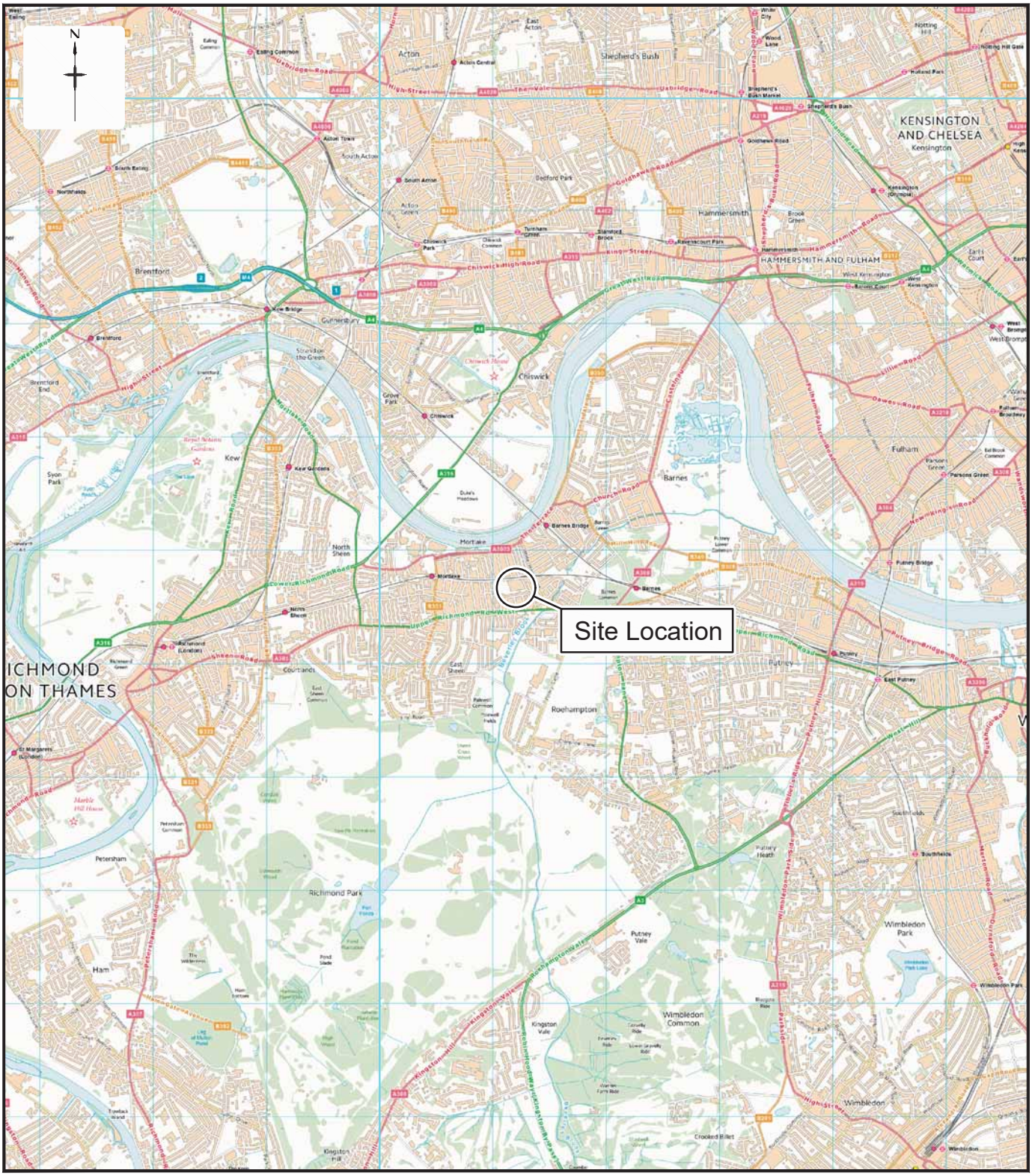
FIGURES



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Client: LS ESTATES LTD

Project Title: BARNES HOSPITAL

Drawing Title: SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	ASC	11.03.19	HE	11.03.19	ZH	11.03.19

Dimensions	Scale	Original Size
m	1:50,000	A4

Project Number	Drawing File	Drawing Number
1920514 - R01 (00)	1920514 - SLP.dwg	FIGURE 1

LEGEND

- Site Boundary
- Window Sample Location

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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Client

LS ESTATES LTD

Project Title

BARNES HOSPITAL

Drawing Title

EXPLORATORY HOLE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
ASC	11.03.19	HE	11.03.19	HE	11.03.19

Scale	Orig Size	Dimensions
1:600	A3	m

Project No.	Drawing File
1920514 - R01 (00)	1920514 (R01-00) Fig 2.dwg

Drawing No.	Rev.
FIGURE 2	P1

Scale 1 : 600

0 8 16 24 32 40m

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for LS Estates Limited (the "client") in accordance with the terms of a contract [RSK Group Standard Terms and Conditions] between RSK and the "client", dated 14th February 2019. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.

7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

    a. the Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely

    b. the Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection

    c. the Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on-site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on-site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
PRELIMINARY UXO RISK ASSESSMENT

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Express Preliminary UXO Risk Assessment

Client	RSK
Project	Barnes Hospital
Site Address	Barnes Hospital, South Worple Way, London, SW14 8SU
Report Reference	EP8245-00
Date	20/02/19
Originator	JS

Assessment Objective

This preliminary risk assessment is a qualitative screening exercise to assess the likely potential of encountering unexploded ordnance (UXO) at the Barnes Hospital site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

Background

This assessment uses the sources of information available in-house to 1st Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1st Line Defence's extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.

The assessment directly follows CIRIA C681 guidelines "Unexploded Ordnance, a Guide for the Construction Industry". The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense 'first step' in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1st Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely 'no' risk from UXO to a project.

Risk Assessment Considerations	
Site location and description/current use	The area of works is located in the London Borough of Richmond upon Thames.  The proposed site boundary encompasses an area of land off within the grounds of the Barnes Hospital. Several multi-tiered structures associated with the hospital occupy the site area, whilst several roadways provide access across the site area. Open areas of undeveloped land are seldom present across the site of works, save for pockets of vegetation across the southern and western perimeters of the site boundary. The northern perimeter of the site is defined by South Worple Way whilst South Worple Avenue forms the eastern border of the site. Residential properties run across the southern periphery of the site boundary. The site is approximately centred on the OS grid reference: TQ 2121975700
Are there any indicators of current/historical military activity on/close to the site?	At this stage, in-house records do not indicate that the site footprint had any former military use. No features such as WWII defensive positions, encampments or firing ranges are recorded to have been located at the site. In addition, no information of ordnance being stores, produced, or disposed of within the proposed site boundary could be found. The closest Heavy Anti-Aircraft (HAA) batteries was situated approximately 1.6km to the south-west of the site. The conditions in which unexploded anti-aircraft ordnance may have fallen unrecorded are analogous to that of aerial delivered German bombs - see the sections below for further information.
What was the pre- and post-WWII history of the site?	Research indicates that the site area has been situated within hospital grounds since the opening of The Barnes Isolation Hospital in 1889. The original purpose of the institution is understood to have been concerned with the treatment and care for patients with diseases such as diphtheria and scarlet fever, which reflects of OS map editions prior to the war that specify the institution was a *Hospital (Infectious Diseases)*. Prior to WWII, an OS map edition 1934 – 1936 indicates several structures across the northern and western sections of the site that appear to correlate to the present day structures on-site. A *mortuary* structure is specified in the northern section of the site across South Worple Way, whilst a *lodge* was situated adjacent to the west; all other structures are not specified in this map edition. Residential properties and their respective roads bound the site to the south and east, whilst *Mortlake Cemetry* neighboured the site to the west. Post-WWII OS mapping indicates that the hospital complex on-site was no longer explicitly concerned with infectious diseases; the hospital was now specified as the *Barnes Hospital*. An OS map edition dated 1952 – 1953 indicates that, within the south-eastern section of the site, two pre-war structures adjacent were cleared. Aside from this, no other substantial changes to the structural composition of the occupying areas is visible on this map edition, nor are any other areas of clearance visible (save for an area of clearance at a point where Priests Bridge meets with White Hart Lane, approximately 100m south-east).

Was the area subject to bombing during WWII?	During WWII, the site was situated within the Municipal Borough of Barnes. According to Home Office statistics, this district sustained a high density of bombing with an average of 114 items dropped per 1,000 acres. This consisted of 240 High Explosive (HE), 3 parachute mines, 15 oil bombs, 15 phosphorous bombs, 1 fire pot, 9 V-1 pilotless aircraft and 3 long-range rocket bombs across 12,599 acres of land. Consulted bomb mapping covering Barnes indicates several incidents of bombing across the site area, including both HE and incendiary bombing on numerous occasions during the war.
Is there any evidence of bomb damage on/close to the site?	Whilst consulted OS mapping does not explicitly record any structures are ruinous, the clearance of two structures between pre- and post-WWII map editions in the south-east of the section is of concern given that it is known that the site sustained several incidents of bombing during the war.
To what degree would the site have been subject to access?	It is anticipated that the site generally would have been accessed frequently during the war by hospital staff and patient alike, thus increasing the initial access and observation levels favourable to the detection of evidence of UXO across the site. However, of concern is the clearance shown on post-war historic OS mapping of two structures in the south-eastern section of the site, which appear to corroborate with incidents of bombing plotted on relevant bomb census maps for the area. Should this indicate that structures on-site were removed due to enemy action, it is considered likely that for a period during the war this area of the site would have been accessed less frequently, and signs of UXO could have been missed.
To what degree has the site been developed post-WWII?	Several structures on historical OS map editions appear to correspond to the present-day structures across the site area, save for development and extension works that have been carried out post-WWII.
What is the nature and extent of the intrusive works proposed?	The nature and extent of works proposed was not available at the time of writing.

Summary and Conclusions

During WWII, the site was situated within the Municipal Borough of Barnes. According to Home Office statistics, this district sustained a high density of bombing with an average of 114 items dropped per 1,000 acres. Consulted bomb mapping covering Barnes indicates several incidents of bombing across the site area, including both HE and incendiary bombing on numerous occasions during the war. The approximate locations of these incidents of bombing corresponds with areas of structural clearance indicated between pre- and post-WWII OS map editions consulted for the purposes of this assessment.

Damaged structures and associated debris possess the ability to conceal evidence of UXO, such as UXO entry holes, and impede access across the site to carry out post-raid inspections. As a result, the risk that UXO remains cannot be discredited at a preliminary stage.

Recommendations

Given the findings of this preliminary report, it is recommended that **further research** should be conducted in the form of a **Detailed UXO Risk Assessment**. This would allow for the cross-referencing of any available sources, and would involve archive visits to consult any local bomb mapping and written records. Further research would also include the consultation of WWII-era aerial photography, which would assist with the understanding of the wartime composition and conditions of the site. Any other available relevant historical records will be utilised to assess the risk on site.

Based on the conditions identified at this preliminary stage, it is anticipated that, following the acquisition of such information, it is possible that the risk from UXO could be lowered in certain areas and the site 'zoned' in the form of a risk map.

Prior to or in lieu of a Detailed Assessment, it is recommended that appropriate UXO Risk Mitigation Measures are provided for intrusive works proposed.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1st Line Defence.

APPENDIX C
UTILITY SERVICE RECORDS

Asset location search

Property Searches

RSK Environment Limited
18

HEMEL HEMPSTEAD
HP3 9RT

Search address supplied

Barnes Hospital
South Worple Way
London
SW14 8SU

Your reference 28836

Our reference ALS/ALS Standard/2019_3954752

Search date 18 February 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

Asset location search

Property Searches

Search address supplied: Barnes Hospital, South Worple Way, London, SW14 8SU

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

Asset location search

Property Searches

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3954752

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 521196,175690

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3901	6.71	.7
39TX	n/a	n/a
09XZ	n/a	n/a
09ZV	n/a	n/a
1911	6.04	4.46
1904	6.05	3.89
19XS	n/a	n/a
181A	n/a	n/a
19YP	n/a	n/a
1705	6.43	4.6
0701	6	3.72
0708	5.92	4.73
1703	6.45	5.02
07WR	n/a	n/a
17YZ	n/a	n/a
171A	n/a	n/a
17YW	n/a	n/a
17ZT	n/a	n/a
17ZV	n/a	n/a
171B	n/a	n/a
07WW	n/a	n/a
07WQ	n/a	n/a
17YY	n/a	n/a
071E	n/a	n/a
17ZP	n/a	n/a
18TZ	n/a	n/a
18XZ	n/a	n/a
18YS	n/a	n/a
0801	5.76	3.32
181C	n/a	n/a
181B	n/a	n/a
1805	6.23	4.77
081B	n/a	n/a
1801	6.15	4.65
18XP	n/a	n/a
18YT	n/a	n/a
07YP	n/a	n/a
07XQ	n/a	n/a
08ZQ	n/a	n/a
08YZ	n/a	n/a
08YY	n/a	n/a
08YW	n/a	n/a
08YV	n/a	n/a
9802	5.7	3.13
08YS	n/a	n/a
08YR	n/a	n/a
0803	5.69	4.61
08YP	n/a	n/a
08XZ	n/a	n/a
08XX	n/a	n/a
08XW	n/a	n/a
98KC	n/a	n/a
081C	n/a	n/a
08XT	n/a	n/a
081A	n/a	n/a
08XS	n/a	n/a
98KE	n/a	n/a
9804	5.62	4.66
08XQ	n/a	n/a
0802	5.58	4.55
08XP	n/a	n/a
98KJ	n/a	n/a
981A	n/a	n/a
08WY	n/a	n/a
061A	n/a	n/a
961D	n/a	n/a
971F	n/a	n/a
97MJ	n/a	n/a
97MK	n/a	n/a
97MN	n/a	n/a
071A	n/a	n/a
971G	n/a	n/a
9707	6.64	2.63
9710	6.67	4.13
0710	6.43	4.6
9703	6.11	n/a
0702	4.09	3.43
9709	5.94	4.62
0709	5.88	4.98
07ZP	n/a	n/a
07YT	n/a	n/a
07ZV	n/a	n/a
07YQ	n/a	n/a
071D	n/a	n/a
071C	n/a	n/a
071B	n/a	n/a
07YZ	n/a	n/a
07YS	n/a	n/a
07XX	n/a	n/a
07ZT	n/a	n/a
07YY	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
97MD	n/a	n/a
96KJ	n/a	n/a
96LH	n/a	n/a
96MD	n/a	n/a
971E	n/a	n/a
96LF	n/a	n/a
96LE	n/a	n/a
991B	n/a	n/a
9801	5.44	2.75
091A	n/a	n/a
09WS	n/a	n/a
09WT	n/a	n/a
08ZS	n/a	n/a
08ZT	n/a	n/a
08WX	n/a	n/a
0906	5.45	2.91
081D	n/a	n/a
4509	6.06	4.3
4402	6.55	3.02
48WT	n/a	n/a
4707	6.42	4.87
49WT	n/a	n/a
48WY	n/a	n/a
481I	n/a	n/a
4805	5.91	3.67
48XT	n/a	n/a
4804	5.93	2.88
481D	n/a	n/a
48YP	n/a	n/a
3604	6.01	1.49
3611	6.19	4.93
4604	6.23	1.28
4602	n/a	n/a
47XV	n/a	n/a
4705	5.56	2.48
47XS	n/a	n/a
4708	5.67	5.05
47WR	n/a	n/a
461B	n/a	n/a
46VQ	n/a	n/a
46VV	n/a	n/a
46TT	n/a	n/a
46SV	n/a	n/a
38ZQ	n/a	n/a
38YZ	n/a	n/a
3809	6.18	5.17
38WR	n/a	n/a
3806	5.96	2.62
38WZ	n/a	n/a
38XX	n/a	n/a
38XS	n/a	n/a
38XW	n/a	n/a
38VV	n/a	n/a
38VW	n/a	n/a
38YP	n/a	n/a
391C	n/a	n/a
381B	n/a	n/a
48VW	n/a	n/a
48XQ	n/a	n/a
49YQ	n/a	n/a
48WP	n/a	n/a
4906	6.29	3.2
48XP	n/a	n/a
481F	n/a	n/a
49YT	n/a	n/a
48WX	n/a	n/a
48WR	n/a	n/a
49WS	n/a	n/a
49YV	n/a	n/a
48WS	n/a	n/a
3606	6.46	3.37
3605	5.9	2.58
36WQ	n/a	n/a
36WZ	n/a	n/a
36WV	n/a	n/a
36XT	n/a	n/a
36XX	n/a	n/a
36VS	n/a	n/a
36YQ	n/a	n/a
36TW	n/a	n/a
36YV	n/a	n/a
36SZ	n/a	n/a
36YZ	n/a	n/a
36TY	n/a	n/a
36VR	n/a	n/a
36SX	n/a	n/a
36TR	n/a	n/a
36TV	n/a	n/a
36TS	n/a	n/a
36TP	n/a	n/a
36ZR	n/a	n/a
36TQ	n/a	n/a
36TT	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
36ZV	n/a	n/a
3610	6.2	5.62
3601	6.2	4.44
37ZQ	n/a	n/a
37WW	n/a	n/a
37XW	n/a	n/a
371H	6.1	3.77
37YV	n/a	n/a
37ZT	n/a	n/a
37YW	n/a	n/a
27YZ	n/a	n/a
37XT	n/a	n/a
371G	6.24	4.02
37XV	n/a	n/a
3712	6.27	5.41
3711	6.14	4.64
3705	6.09	5.41
37XR	n/a	n/a
37XS	n/a	n/a
37YZ	n/a	n/a
37WR	n/a	n/a
37ZP	n/a	n/a
37YY	n/a	n/a
37XP	n/a	n/a
27YQ	n/a	n/a
371E	n/a	n/a
37XQ	n/a	n/a
371N	6.24	4.24
37XX	n/a	n/a
37VZ	n/a	n/a
371F	n/a	n/a
37WY	n/a	n/a
371J	6.34	4.39
37WZ	n/a	n/a
3709	6.31	5.4
27ZX	n/a	n/a
37XZ	n/a	n/a
371I	n/a	n/a
471A	n/a	n/a
3708	6.48	5.03
3710	6.24	5.07
2704	6.26	1.81
3701	6.59	1.2
3702	6.75	1.06
371B	6.6	.9
3707	5.84	5.02
4701	n/a	n/a
4706	5.81	4.98
2707	6.46	4.9
2703	6.59	4.61
4702	5.62	4.2
371C	n/a	n/a
3706	6.44	.43
381A	n/a	n/a
48SS	n/a	n/a
3802	n/a	n/a
3805	6.46	.69
3810	6.38	5.12
3811	6.29	2.76
381E	n/a	n/a
38ZS	n/a	n/a
381D	n/a	n/a
2810	n/a	n/a
2805	6.31	4.2
381C	n/a	n/a
381F	n/a	n/a
2806	n/a	n/a
2811	6.35	5.21
3804	6.51	.86
3808	6.48	4.55
381H	n/a	n/a
381G	n/a	n/a
281B	n/a	n/a
281A	n/a	n/a
38TZ	n/a	n/a
3807	n/a	n/a
3803	6.5	.7
38TW	n/a	n/a
281D	n/a	n/a
2919	6.44	4.9
2912	6.54	4.58
3903	6.65	3.86
391A	n/a	n/a
29YS	n/a	n/a
2920	n/a	n/a
2601	6.22	4.41
2509	6.24	4.87
26YP	n/a	n/a
26XW	n/a	n/a
26XR	n/a	n/a
26WY	n/a	n/a
25ZY	n/a	n/a
251B	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3609	6.23	4.62
3613	6.21	n/a
3607	5.99	3
3612	5.86	5.07
3608	5.86	1.72
36VV	n/a	n/a
36VW	n/a	n/a
36VX	n/a	n/a
3505	5.73	4.38
461A	n/a	n/a
4516	5.72	4.35
4502	5.89	1.74
451A	n/a	n/a
4515	5.83	4.3
4610	6.05	4.73
451B	n/a	n/a
4605	6.11	1.44
4611	6.05	4.88
4510	4.01	4.31
4614	5.94	4.58
1501	6.37	4.36
1409	6.12	2.62
1406	6.22	4.09
151A	n/a	n/a
151B	n/a	n/a
1507	6.41	4.97
1405	6.14	4.64
15QQ	n/a	n/a
15QR	n/a	n/a
16ZX	n/a	n/a
2411	n/a	n/a
2410	n/a	n/a
26WV	n/a	n/a
25QT	n/a	n/a
25QP	n/a	n/a
2401	n/a	n/a
2502	6.41	4.72
2507	6.37	5.05
2501	6.41	4.63
26ZV	n/a	n/a
2508	6.39	5.03
26ZR	n/a	n/a
25QW	n/a	n/a
25QR	n/a	n/a
26YY	n/a	n/a
26YT	n/a	n/a
171G	n/a	n/a
18TR	n/a	n/a
18TT	n/a	n/a
18VR	n/a	n/a
171C	n/a	n/a
1802	6.15	5.19
171F	n/a	n/a
1803	6.12	5.11
18VP	n/a	n/a
1701	5.89	4.72
17ZW	n/a	n/a
1704	6.04	5.28
1702	6.43	2.63
28YP	n/a	n/a
28XX	n/a	n/a
28XS	n/a	n/a
2801	6.24	4.11
28WZ	n/a	n/a
2808	6.23	4.87
2706	6.43	4.98
2701	6.55	4.59
281C	n/a	n/a
281F	n/a	n/a
2814	n/a	n/a
2804	n/a	n/a
2708	6.33	5.67
2702	8.05	5.57
28YS	n/a	n/a
2809	6.29	5.6
2803	6.29	5.6
1804	6.32	3.73
281E	n/a	n/a
2802	6.23	4.63
2918	6.23	4.97
1913	6.26	4.55
2905	6.32	3.87
2917	6.23	4.97

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

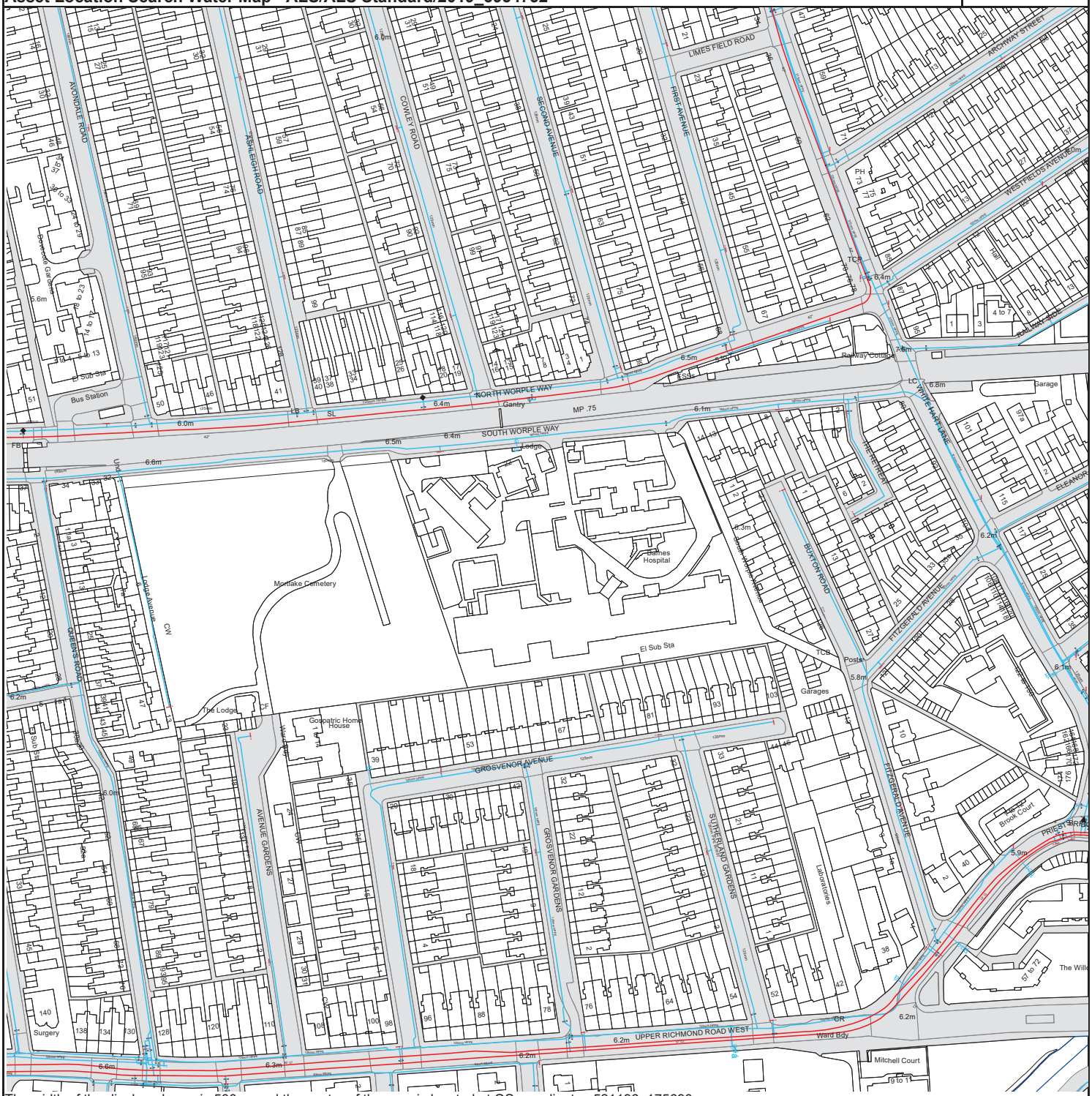
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019_3954752



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 521196, 175690.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Terms and Conditions

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the code.

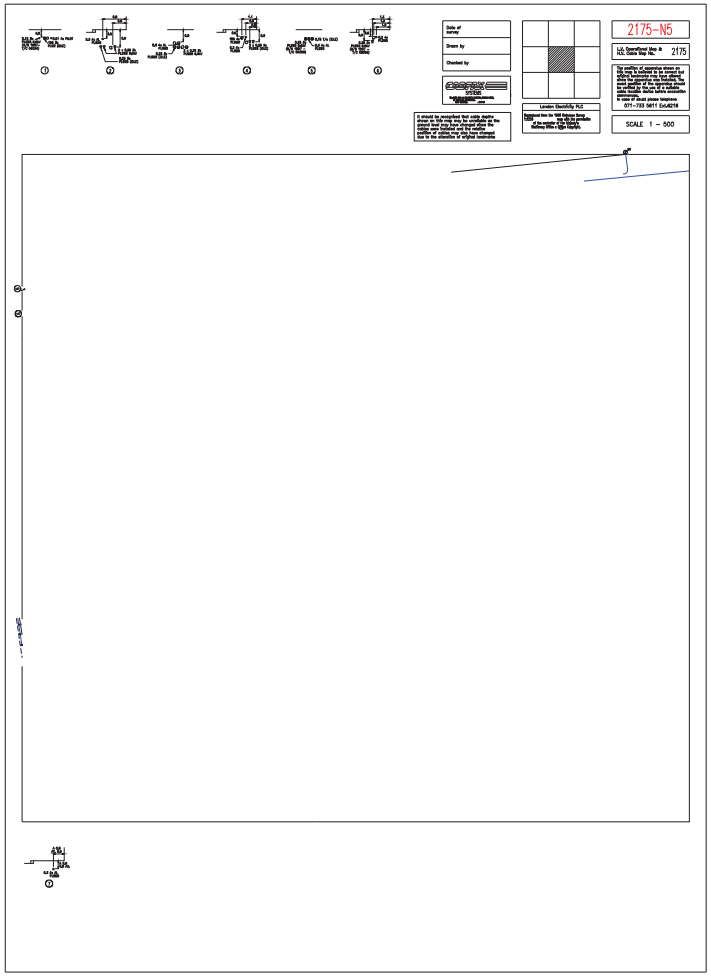
Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Web site: www.tpos.co.uk
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE


2175-N5
2175
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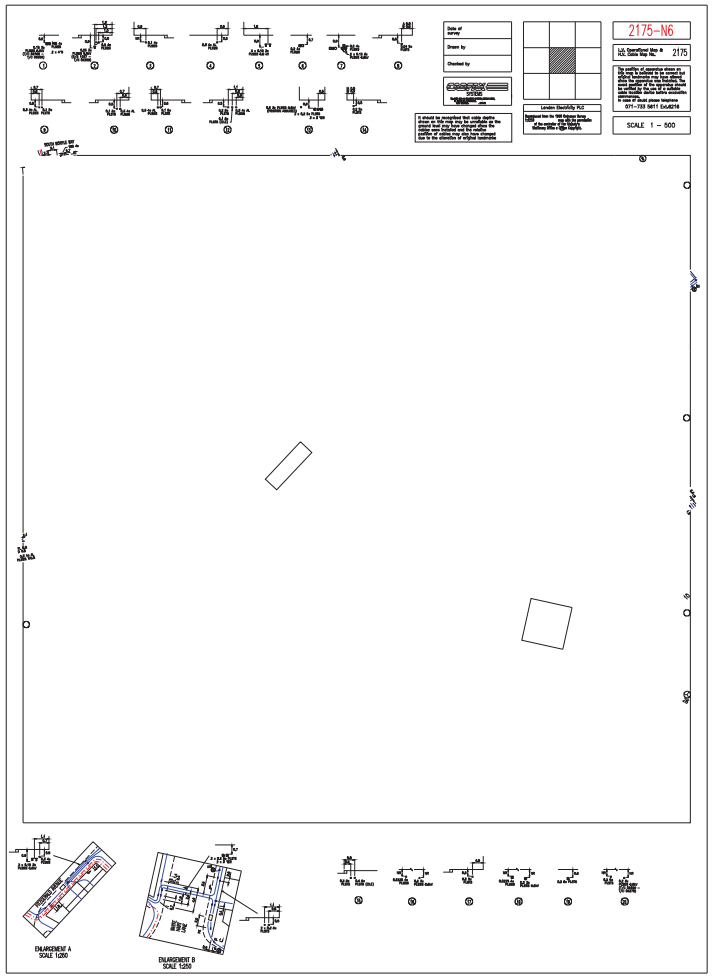
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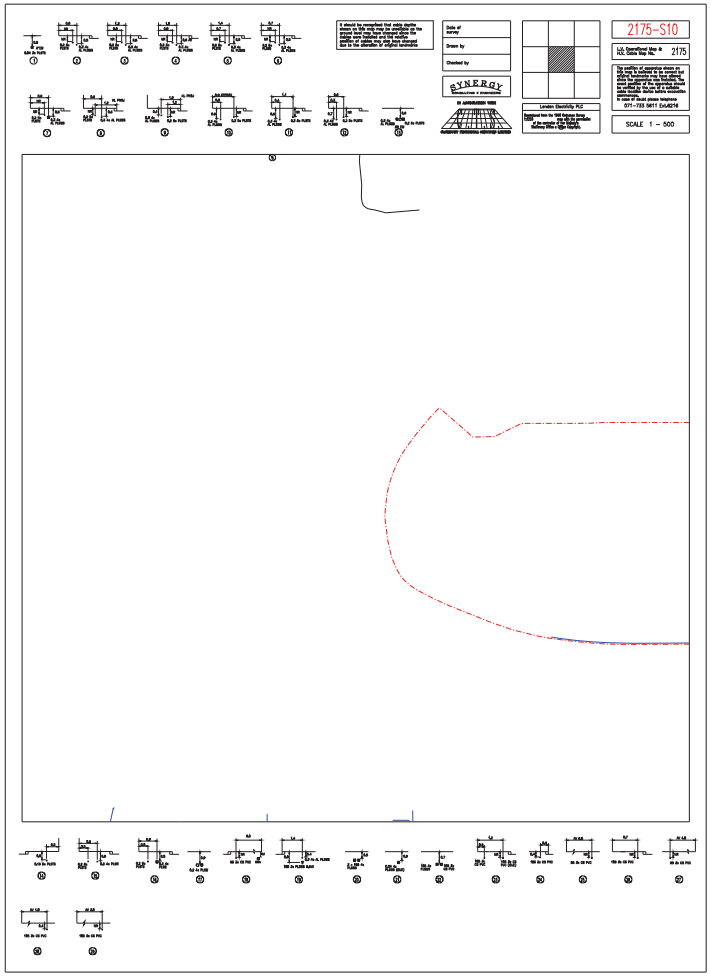
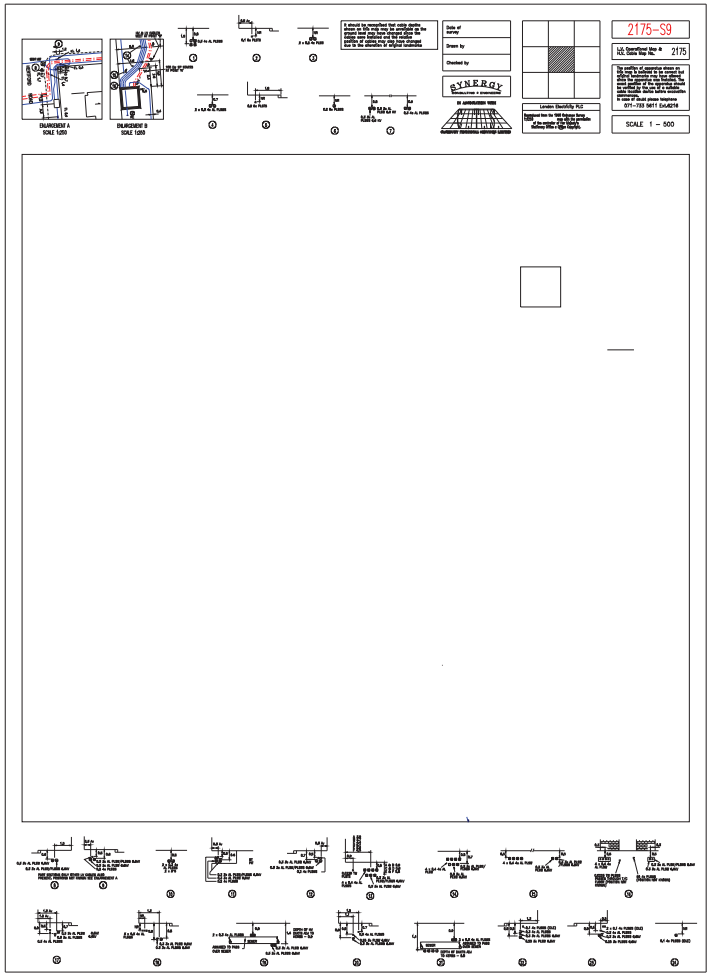
ENLARGEMENT A
SCALE 1/200
ENLARGEMENT B
SCALE 1/250


2175-S10
SCALE 1 – 500


2175-S9
SCALE 1 – 500
ENLARGEMENT A
SCALE 1:250
ENLARGEMENT B
SCALE 1:250

Jessica Western

From: Gopalakrishnan, Roshni <Roshni.Gopalakrishnan@atkinsglobal.com>
Sent: 27 February 2019 09:24
To: Jessica Western
Subject: RE: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Please accept this email as confirmation that Vodafone: Fixed **does not** have apparatus within the vicinity of your proposed works detailed below.

Many thanks.

Plant Enquiries Team
T: +44 (0)1454 662881
E: osm.enquiries@atkinsglobal.com

ATKINS working on behalf of Vodafone: Fixed

This response is made only in respect to electronic communications apparatus forming part of the Vodafone Limited electronic communications network formerly being part of the electronic communications networks of Cable & Wireless UK, Energis Communications Limited, Thus Group Holdings Plc and Your Communications Limited.

PLEASE NOTE:

The information given is indicative only. No warranty is made as to its accuracy. This information must not be solely relied upon in the event of excavation or other works carried out in the vicinity of Vodafone plant. No liability of any kind whatsoever is accepted by Vodafone, its servants, or agents, for any error or omission in respect of information contained on this information. The actual position of underground services must be verified and established on site before any mechanical plant is used. Authorities and contractors will be held liable for the full cost of repairs to Vodafone's apparatus and all claims made against them by Third parties as a result of any interference or damage.

IMPORTANT - PLEASE READ:-
Diversionary works may be necessary if the existing line of the highway/railway or its levels are altered, where apparatus is affected. Where apparatus is affected and requires diversion, you must submit draft details of the proposed scheme with a request for a 'C3 Budget Estimate' to c3requests@vodafone.com These estimates should be provided by Vodafone normally within 20 working days from receipt of your request. Please include proof of this C2 response when requesting a C3 (using the 'forward' option).

Please consider the environment before printing this e-mail

From: Jessica Western <JWestern@rsk.co.uk>
Sent: 18 February 2019 20:04
To: 'plantenquiries@instalcom.co.uk' <plantenquiries@instalcom.co.uk>; 'asset.team@cityfibre.com' <asset.team@cityfibre.com>; 'plantenquiries@catelecomuk.com' <plantenquiries@catelecomuk.com>; 'plantenquiries@energetics-uk.com' <plantenquiries@energetics-uk.com>; 'nrswa@cofely-gdfsuez.com' <nrswa@cofely-gdfsuez.com>; 'interoute.enquiries@plancast.co.uk' <interoute.enquiries@plancast.co.uk>; 'kpn.plantenquiries@instalcom.co.uk' <kpn.plantenquiries@instalcom.co.uk>; 'mbnl.plant.enquiries@turntown.com' <mbnl.plant.enquiries@turntown.com>; 'OPBuriedServicesEnquiries@networkrail.co.uk' <OPBuriedServicesEnquiries@networkrail.co.uk>; 'highwaysandtransport@richmond.gov.uk' <highwaysandtransport@richmond.gov.uk>; 'nrswa@sky.uk' <nrswa@sky.uk>; 'SOTA.plantenquiries@instalcom.co.uk' <SOTA.plantenquiries@instalcom.co.uk>; 'Gavin Clifton' <gavin.clifton-CT@telent.com>; 'assetrecords@utilityassets.co.uk' <assetrecords@utilityassets.co.uk>; 'osp-team@uk.verizonbusiness.com' <osp-team@uk.verizonbusiness.com>; '>Plant Enquiries Team' <PlantEnquiriesTeam@virginmedia.co.uk>; National Plant Enquiry's <OSM.enquiries@atkinsglobal.com>
Subject: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Good Afternoon,

Our company is currently undertaking an intrusive site investigation of the area detailed below.

Our reference: 28836
Location of works: Barnes Hospital, South Worple Way, London
O.S. Grid Ref.: 521162, 175679
Address/Nearest Postcode: SW14 8SU
Expected Start Date:
Expected Completion Date:

A plan of the site has been enclosed, please cover the entire area shown within the boundary on the attached map.

In order that all reasonable precautions may be taken to avoid the risk to health and safety through contacts with any of your existing apparatus during execution of the proposed works, please indicate the position and depth of all main statutory services and wayleaves on site and in the adjoining roads where applicable. In addition, please highlight any likely special problems that could arise in connection with your apparatus as a result of the proposed works.

We therefore request that you supply us with relevant plan information or written confirmation to declare that no apparatus is affected at your earliest convenience.

Should you encounter any problems or require any further information, please contact me on the above address or by telephoning 01442 416626, any costs will be accepted with approval first.

Many Thanks,

Jessica Western
Utility Report Co-ordinator

I work part-time Mondays (until 3.00pm), Tuesdays (all day), Wednesdays (until 3.00pm), Thursdays (all day) Friday (until 3.00pm) I will respond to your e mail as soon as I am back in the office.

RSK
18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT, UK
Switchboard: +44 (0)1442 437500 · Fax: +44 (0)1442 437550 · Direct dial: +44 01442 416626 (0) · Mobile: +44 (0) 7471 354 928
jwestern@rsk.co.uk

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Maps by email Plant Information Reply

IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

openreach

CLICK BEFORE YOU DIG

FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED
(Office hours: Monday - Friday 08.00 to 17.00)
www.openreach.co.uk/cbyd

KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

Change Of State	+	Hatchings	
Split Coupling	×	Built	
Duct Tee	▲	Planned	
Building		Inferred	
Kiosk	K	Duct	

Other proposed plant is shown using dashed lines. BT Symbols not listed above may be disregarded. Existing BT Plant may not be recorded. Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

	Pending Add	In Place	Pending Remove	Not In Use
Power Cable				
Power Duct				N/A

BT Ref : IJQ02397Y
Map Reference : (centre) TQ2116275679
Easting/Northing : (centre) 521162,175679
Issued : 18/02/2019 14:40:08

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk

Jessica Western

From: Plantenquiries <plantenquiries@catelecomuk.com>
Sent: 26 February 2019 11:23
To: Jessica Western
Subject: RE: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Please Note: Our search criteria has changed. We previously searched for Colt Network which was within 200 metres, this has now changed to 50 metres. The negative response will be for all enquiries that the network is 50 metres or more away from the place of enquiry.

Dear Sir/Madam,

Thank you for your enquiry for the above reference.

We can confirm that Colt Technology Services do not have apparatus near the above location as presented on your submitted plan, if any development or scheme amendments fall outside the 50 metre perimeter new plans must be submitted for review.

Search is based on Overseeing Organisation Agent data supplied; we do not accept responsibility for O.O. Agent inaccurate data.

If we can be of any further assistance please do not hesitate to contact us.

Kind regards,

Plant Enquiry Team

C.A. TELECOM UK LIMITED

Please consider the environment before printing this email.

From: Jessica Western [mailto:JWestern@rsk.co.uk]
Sent: 18 February 2019 14:34
To: 'plantenquiries@instalcom.co.uk' <plantenquiries@instalcom.co.uk>; 'asset.team@cityfibre.com' <asset.team@cityfibre.com>; Plantenquiries <plantenquiries@catelecomuk.com>; 'plantenquiries@energetics-uk.com' <plantenquiries@energetics-uk.com>; 'nrswa@cofely-gdfsuez.com' <nrswa@cofely-gdfsuez.com>;

'interoute.enquiries@plancast.co.uk' <interoute.enquiries@plancast.co.uk>; 'kpn.plantenquiries@instalcom.co.uk' <kpn.plantenquiries@instalcom.co.uk>; 'mbnl.plant.enquiries@turntown.com' <mbnl.plant.enquiries@turntown.com>; 'OPBuriedServicesEnquiries@networkrail.co.uk' <OPBuriedServicesEnquiries@networkrail.co.uk>; 'highwaysandtransport@richmond.gov.uk' <highwaysandtransport@richmond.gov.uk>; 'nrswa@sky.uk' <nrswa@sky.uk>; 'SOTA.plantenquiries@instalcom.co.uk' <SOTA.plantenquiries@instalcom.co.uk>; 'Gavin Clifton' <gavin.clifton-CT@telent.com>; 'assetrecords@utilityassets.co.uk' <assetrecords@utilityassets.co.uk>; 'osp-team@uk.verizonbusiness.com' <osp-team@uk.verizonbusiness.com>; '>Plant Enquiries Team' <PlantEnquiriesTeam@virginmedia.co.uk>; 'National Plant Enquiry's' <OSM.enquiries@atkinsglobal.com>
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O.S. Grid Ref.: 521162, 175679
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Expected Start Date:
Expected Completion Date:

A plan of the site has been enclosed, please cover the entire area shown within the boundary on the attached map.

In order that all reasonable precautions may be taken to avoid the risk to health and safety through contacts with any of your existing apparatus during execution of the proposed works, please indicate the position and depth of all main statutory services and wayleaves on site and in the adjoining roads where applicable. In addition, please highlight any likely special problems that could arise in connection with your apparatus as a result of the proposed works.

We therefore request that you supply us with relevant plan information or written confirmation to declare that no apparatus is affected at your earliest convenience.

Should you encounter any problems or require any further information, please contact me on the above address or by telephoning 01442 416626, any costs will be accepted with approval first.

Many Thanks,

Jessica Western
Utility Report Co-ordinator

I work part-time Mondays (until 3.00pm), Tuesdays (all day), Wednesdays (until 3.00pm), Thursdays (all day) Friday (until 3.00pm) I will respond to your e mail as soon as I am back in the office.

RSK
18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT, UK
Switchboard: +44 (0)1442 437500 · Fax: +44 (0)1442 437550 · Direct dial: +44 01442 416626 (0) · Mobile: +44 (0) 7471 354 928 jwestern@rsk.co.uk

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Jessica Western

From: Plant Enquiries <plantenquiries@energetics-uk.com>
Sent: 19 February 2019 09:35
To: Jessica Western
Subject: RE: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Dear Sir/Madam,

Thank you for submitting your recent plant enquiry.

Based on the information provided, I can confirm that Energetics **does not** have any plant within the area(s) specified in your request.

If you require further assistance with outstanding enquiries, please call 03300 587 443.

Please ensure all plant enquiries are sent to plantenquiries@energetics-uk.com

Regards

energetics

Plant Enquiries

|
e: plantenquiries@energetics-uk.com | w: www.energetics-uk.com
a: Fenick House, Lister Way, Hamilton International Technology Park

From: Jessica Western <JWestern@rsk.co.uk>
Sent: 18 February 2019 14:34
To: 'plantenquiries@instalcom.co.uk' <plantenquiries@instalcom.co.uk>; 'asset.team@cityfibre.com' <asset.team@cityfibre.com>; 'plantenquiries@catelecomuk.com' <plantenquiries@catelecomuk.com>; Plant Enquiries <plantenquiries@energetics-uk.com>; 'nrswa@cofely-gdfsuez.com' <nrswa@cofely-gdfsuez.com>; 'interoute.enquiries@plancast.co.uk' <interoute.enquiries@plancast.co.uk>; 'kpn.plantenquiries@instalcom.co.uk' <kpn.plantenquiries@instalcom.co.uk>; 'mbnl.plant.enquiries@turntown.com' <mbnl.plant.enquiries@turntown.com>; 'OPBuriedServicesEnquiries@networkrail.co.uk' <OPBuriedServicesEnquiries@networkrail.co.uk>; 'highwaysandtransport@richmond.gov.uk' <highwaysandtransport@richmond.gov.uk>; 'nrswa@sky.uk' <nrswa@sky.uk>; 'SOTA.plantenquiries@instalcom.co.uk' <SOTA.plantenquiries@instalcom.co.uk>; 'Gavin Clifton' <gavin.clifton-CT@telent.com>; 'assetrecords@utilityassets.co.uk' <assetrecords@utilityassets.co.uk>; 'osp-team@uk.verizonbusiness.com' <osp-team@uk.verizonbusiness.com>; '>Plant Enquiries Team' <PlantEnquiriesTeam@virginmedia.co.uk>; 'National Plant Enquiry's' <OSM.enquiries@atkinsglobal.com>
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Jessica Western
Utility Report Co-ordinator

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RSK
18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT, UK
Switchboard: +44 (0)1442 437500 · Fax: +44 (0)1442 437550 · Direct dial: +44 01442 416626 (0) · Mobile: +44 (0) 7471 354 928 jwestern@rsk.co.uk

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Jessica Western

From: Plantenquiries <Plantenquiries@instalcom.co.uk>
Sent: 18 February 2019 15:05
To: Jessica Western
Subject: E02-19-3437 RE: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Dear Sir or Madam,

Thank you for your plant enquiry below.

We can confirm that CenturyLink Communications UK Limited (formerly Level 3), Global Crossing (Uk) Ltd, Global Crossing PEC, Fibernet UK Ltd and Fibrespan Ltd do not have any apparatus within the indicated works area.

Instalcom responds to plant enquiries for all of the above and therefore you only need send one plant enquiry to cover all of these companies.

Please note that this response is only valid for 3 months. If your works do not commence within this time period, please resubmit your plant enquiry for assessment before any works commence.

Regards

Plant Enquiries Dept
Instalcom Limited
Borehamwood Ind. Park
Rowley Lane
Borehamwood
WD6 5PZ

Office: +44 (0)208 731 4613
Fax: +44 (0)208 731 4601
Email: plantenquiries@instalcom.co.uk
Web: http://www.instalcom.co.uk

From: Jessica Western [mailto:JWestern@rsk.co.uk]
Sent: 18 February 2019 14:34
To: Plantenquiries <Plantenquiries@instalcom.co.uk>; 'asset.team@cityfibre.com' <asset.team@cityfibre.com>; 'plantenquiries@catelecomuk.com' <plantenquiries@catelecomuk.com>; 'plantenquiries@energetics-uk.com' <plantenquiries@energetics-uk.com>; 'nrswa@cofely-gdfsuez.com' <nrswa@cofely-gdfsuez.com>; 'interoute.enquiries@plancast.co.uk' <interoute.enquiries@plancast.co.uk>; KPN Plant Enquiries <kpn.plantenquiries@instalcom.co.uk>; 'mbnl.plant.enquiries@turntown.com'

<mbnl.plant.enquiries@turntown.com>; 'OPBuriedServicesEnquiries@networkrail.co.uk' <OPBuriedServicesEnquiries@networkrail.co.uk>; 'highwaysandtransport@richmond.gov.uk' <highwaysandtransport@richmond.gov.uk>; 'nrswa@sky.uk' <nrswa@sky.uk>; SOTA Plant Enquiries <SOTA.PlantEnquiries@instalcom.co.uk>; 'Gavin Clifton' <gavin.clifton-CT@telent.com>; 'assetrecords@utilityassets.co.uk' <assetrecords@utilityassets.co.uk>; 'osp-team@uk.verizonbusiness.com' <osp-team@uk.verizonbusiness.com>; '>Plant Enquiries Team' <PlantEnquiriesTeam@virginmedia.co.uk>; 'National Plant Enquiry's' <OSM.enquiries@atkinsglobal.com>
Subject: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Good Afternoon,

Our company is currently undertaking an intrusive site investigation of the area detailed below.

Our reference: 28836
Location of works: Barnes Hospital, South Worple Way, London
O.S. Grid Ref.: 521162, 175679
Address/Nearest Postcode: SW14 8SU
Expected Start Date:
Expected Completion Date:

A plan of the site has been enclosed, please cover the entire area shown within the boundary on the attached map.

In order that all reasonable precautions may be taken to avoid the risk to health and safety through contacts with any of your existing apparatus during execution of the proposed works, please indicate the position and depth of all main statutory services and wayleaves on site and in the adjoining roads where applicable. In addition, please highlight any likely special problems that could arise in connection with your apparatus as a result of the proposed works.

We therefore request that you supply us with relevant plan information or written confirmation to declare that no apparatus is affected at your earliest convenience.

Should you encounter any problems or require any further information, please contact me on the above address or by telephoning 01442 416626, any costs will be accepted with approval first.

Many Thanks,

Jessica Western
Utility Report Co-ordinator

I work part-time Mondays (until 3.00pm), Tuesdays (all day), Wednesdays (until 3.00pm), Thursdays (all day) Friday (until 3.00pm) I will respond to your e mail as soon as I am back in the office.

RSK
18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT, UK
Switchboard: +44 (0)1442 437500 · Fax: +44 (0)1442 437550 · Direct dial: +44 01442 416626 (0) · Mobile: +44 (0) 7471 354 928 jwestern@rsk.co.uk

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Disclaimer

Plant Protection
Cadent
Block 1; Floor 1
Brick Kiln Street
Hinckley
LE10 0NA
E-mail: plantprotection@cadentgas.com
Telephone: +44 (0)800 688588

National Gas Emergency Number:
0800 111 999*

National Grid Electricity Emergency Number:
0800 40 40 90*
* Available 24 hours, 7 days/week.
Calls may be recorded and monitored.

www.cadentgas.com

Jessica Western
RSK
18 Frogmore Road

Hemel Hempstead

Hertfordshire

Date: 28/02/2019
Our Ref: NL_TE_Z5_3WWP_887308
Your Ref: 28836 Barnes Hospital (LH)
RE: Scheduled Works, SW14 8SU, Barnes Hospital, South Worple Way, London

Thank you for your enquiry which was received on 27/02/2019.
Please note this response and any attached map(s) are valid for 28 days.

An assessment has been carried out with respect to Cadent Gas Limited, National Grid Electricity Transmission plc's and National Grid Gas Transmission plc's apparatus. Please note it does not cover the items listed in the section "Your Responsibilities and Obligations", including gas service pipes and related apparatus.
For details of Network areas please see the Cadent website (http://cadentgas.com/Digging-safely/Dial-before-you-dig) or the enclosed documentation.

Are My Works Affected?

Your proposal **is in proximity to the Cadent and/or National Grid apparatus** specified within the "Assessment" section, which may impact, and possibly prevent, your proposed activities for safety and/or legal reasons.

You must not commence any work until you have complied with all of the guidance provided and been contacted by all of the teams (if any) listed in the Contact Requirements section.

As set out in the table in the "Assessment" section of this response; in respect of **all** the apparatus listed you must read and follow all the guidance provided when planning or undertaking any activities at this location. Additionally, for apparatus assessed as having a high potential to be affected, a member of the respective team will contact you within **7** working days.

The details contained within this enquiry are valid for 28 days. If the scheduled work is not completed within this time, or should the location, date or nature of your activities change, you must submit another enquiry.

Your Responsibilities and Obligations

The "Assessment" Section below outlines the detailed requirements that must be followed when planning or undertaking your scheduled activities at this location.

It is your responsibility to ensure that the information you have submitted is accurate and that all relevant documents including links are provided to all persons (either direct labour or contractors) working for you near Cadent and/or National Grid's apparatus, e.g. as contained within the Construction (Design and Management) Regulations.

This assessment solely relates to Cadent Gas Limited, National Grid Electricity Transmission plc (NGET) and National Grid Gas Transmission plc (NGGT) and apparatus. This assessment does **NOT** include:

- Cadent and/or National Grid's legal interest (easements or wayleaves) in the land which restricts activity in proximity to Cadent and/or National Grid's assets in private land. You must obtain details of any such restrictions from the landowner in the first instance and if in doubt contact Plant Protection.
- Gas service pipes and related apparatus
- Recently installed apparatus
- Apparatus owned by other organisations, e.g. other gas distribution operators, local electricity companies, other utilities, etc.

It is **YOUR** responsibility to take into account whether the items listed above may be present and if they could be affected by your proposed activities. Further "Essential Guidance" in respect of these items can be found on either the National Grid or Cadent website.

This communication does not constitute any formal agreement or consent for any proposed development work; either generally or with regard to Cadent and/or National Grid's easements or wayleaves nor any planning or building regulations applications.

Cadent Gas Limited, NGGT and NGET or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law nor does it supersede the express terms of any related agreements.

If you require further assistance please contact the Plant Protection team via e-mail (click here) or via the contact details at the top of this response.

Yours faithfully

Plant Protection Team

ASSESSMENT

Affected Apparatus
The apparatus that has been identified as being in the vicinity of your proposed works is:

- Low or Medium pressure (below 2 bar) gas pipes and associated equipment. (As a result it is highly likely that there are gas services and associated apparatus in the vicinity)

Requirements

BEFORE carrying out any work you must:
(N.B. Works only to be undertaken when contact has been made as per the Contact Requirements section)

- Carefully read these requirements including the attached guidance documents and maps showing the location of apparatus.
- Contact the landowner and ensure any proposed works in private land do not infringe Cadent and/or National Grid's legal rights (i.e. easements or wayleaves). If the works are in the road or footpath the relevant local authority should be contacted.
- Ensure that all persons, including direct labour and contractors, working for you on or near Cadent and/or National Grid's apparatus follow the requirements of the HSE Guidance Notes HSG47 - 'Avoiding Danger from Underground Services' and GS6 – 'Avoidance of danger from overhead electric power lines'. This guidance can be downloaded free of charge at http://www.hse.gov.uk
- In line with the above guidance, verify and establish the actual position of mains, pipes, cables, services and other apparatus on site before any activities are undertaken.
- Ensure that you have been in contact with **all** of the teams listed in the **Contact Requirements** section and complied with any additional guidance provided.

DURING any work you must:

- Ensure that no mechanical excavation takes place above or within 0.5m of the Cadent buried medium and low pressure gas pipes and associated equipment.
- Comply with all guidance relating to general activities and any specific guidance for each asset type as specified in the Guidance Section below.
- Ensure that access to Cadent and/or National Grid apparatus is maintained at all times.
- Prevent the placing of heavy construction plant, equipment, materials or the passage of heavy vehicles over Cadent and/or National Grid apparatus unless specifically agreed with Cadent and/or National Grid in advance.
- Exercise extreme caution if slab (mass) concrete is encountered during excavation works as this may be protecting or supporting Cadent and/or National Grid apparatus.
- Maintain appropriate clearances between gas apparatus and the position of other buried plant.

Please refer to the "General Guidance" or contact the Plant Protection Team for further information regarding the above.

Contact Requirements

Searches based on your enquiry have identified that the following apparatus types may be affected by your enquiry and further consultation may be required. Please use the boxes provided to record the details of the consultation (where applicable).

Apparatus	Team or Guidance	Contact Details and Ref	Date of Contact
Low or Medium pressure gas pipes	Cadent Maintenance Team	>	>

Each team will endeavour to contact you directly within **7** working days from the date of this response to undertake a more detailed assessment. Please contact Plant Protection if you have not had a response within this period. This may also have an impact on any preparatory works.

GUIDANCE

Excavating Safely - Avoiding injury when working near gas pipes:
http://www.nationalgrid.com/NR/rdonlyres/2D2EEA97-B213-459C-9A26-18361C6E0B0D/25249/Digsafe_leaflet3e2finalamends061207.pdf

Standard Guidance

Essential Guidance document:
http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589934982

General Guidance document:
http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=35103

Excavating Safely in the vicinity of gas pipes guidance (Credit card):
http://www.nationalgrid.com/NR/rdonlyres/A3D37677-6641-476C-9DDA-E89949052829/44257/ExcavatingSafelyCreditCard.pdf

Excavating Safely in the vicinity of electricity cables guidance (Credit card):
http://www.nationalgrid.com/NR/rdonlyres/35DDEC6D-D754-4BA5-AF3C-D607D05A25C2/44858/ExcavatingSafelyCreditCardelectricitycables.pdf

Copies of all the Guidance Documents can also be downloaded from the National Grid and Cadent websites.

ID: NL_TE_Z5_3WWP_687308	View extent: 361m, 196m
USER: lee.hardwell	LP MAINS MP MAINS IP MAINS LHP MAINS NHP MAINS
DATE: 28/02/2019	
DATA DATE: 27/02/2019	
REF: 28836 Barnes Hospital (LH)	
MAP REF: TQ2175 CENTRE: 521176, 175683	0m 25m Approximate scale 1:1250 on A4 Colour Landscape

Some examples of Plant Items:

Valve | Depth of Cover | Syphon | Diameter Change | Material Change | Out of Standard Service

Do not proceed without further consultation

This plan shows those pipes owned by Cadent Gas Limited in its role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc., are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Cadent Gas Limited or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

Map 1 of 1 (GAS)

MAPS Plot Server Version 1.11.0

Cadent

Your Gas Network

Requested by: RSK

ENQUIRY SUMMARY

Received Date
27/02/2019

Your Reference
28836 Barnes Hospital (LH)

Location
Centre Point: 521176, 175683
X Extent: 108
Y Extent: 114
Location Description: SW14 8SU, Barnes Hospital, South Worple Way, London

Map Options
Paper Size: A4
Orientation: LANDSCAPE
Requested Scale: 1250
Actual Scale: 1:1250 (GAS)
Real World Extents: 361m x 196m (GAS)

Start Date
11/03/2019

Recipients
pprsteam@cadentgas.com

Enquirer Details
Organisation Name: RSK
Contact Name: Jessica Western
Email Address: jwestern@rsk.co.uk
Telephone: 01442 416626 (07471 354 928)
Address: 18 Frogmore Road, , Hemel Hempstead, , Hertfordshire, , HP3 9RT

Description of Works
(E) Intrusive site investigation which involve drilling 4 shallow boreholes (up to a maximum depth of 3m below ground level)

Enquiry Type
Scheduled Works

Activity Type
General Excavation

Work Types
Work Type: Boring/Moling/Horizontal Drilling greater than 300mm

Worksite Survey Team
National Records Centre
Audax Road
YORK

YO30 4US
Tel:

NRSWA Asset Enquiries

Date: 11 March 2019

MA1

Your Reference **2019_26370**

Our Reference: **SET195957**

Dear NRSWA,

Re: Buried Services Search: **OP Barnes Hospital, South Worple Way, London**

Please find information available as per the checklist.

The information contained herein is based on Network Rail's records and, where appropriate, third parties such as utility companies. The search enclosed does not cover a search of local council records. Also, schematic Signal and Telecom (S&T) cables plans are not provided as part of the search results, therefore you must assume S&T cables are present until proven otherwise.

Although at the date of this letter the information is as up to date as possible, it is **NOT** a statement of validity, accuracy or completeness as to any of the enclosed search information and must not be relied on as such.

Your risk assessment **MUST** take into account:

- That the information supplied, including the services shown on the map from the Rail Infrastructure Network Model (RINM), does not provide any guarantee as to the accuracy of the actual location of services on site and **MUST** be considered as for guidance purposes only.
- That new/unrecorded services are likely to be present
- That the enclosed buried services search information has been collated only for the ELR and Mileage boundaries as stated on the original request form

Included in your buried services search is a list of local engineers and managers you **MUST** contact before any ground disturbance is carried out, to check whether further information is held locally.

Further guidance can be obtained from the Health and Safety Executive publication HSG47 "Avoiding Danger from Underground Services" and the Network Rail Publication NR/L2/INI/CP1030.

Should you become aware of any additional underground services or assets within the locality during your investigations and/or works, including redundant assets, please identify them as a matter of urgency to the site manager. Records of the location of these assets should be kept for onward transmission and entry into the Hazard Directory.

Yours sincerely

Stephen Elcock

Distribution Administrator

BURIED SERVICES INFORMATION CHECKLIST

YOUR REF	2019_26370	OUR REF	SET195957
LOCATION	**OP** Barnes Hospital, South Worple W	ELR	RDG1
MILEAGE FROM	7.1255	MILEAGE TO	7.1477

Utility Company/Internal Source	Category	Enc	Notes
Site Map	GIS Systems	Yes	
Hazard Directory	Hazard	Yes	
Civils SE	NRG	Yes	
eB	NRG	Yes	

NIL RETURN: After interrogating the information made available to us, no records containing buried services information have been returned for this worksite.

However, reference must be made to the guidelines supplied with this buried services search, which contain important information on safe working practices.

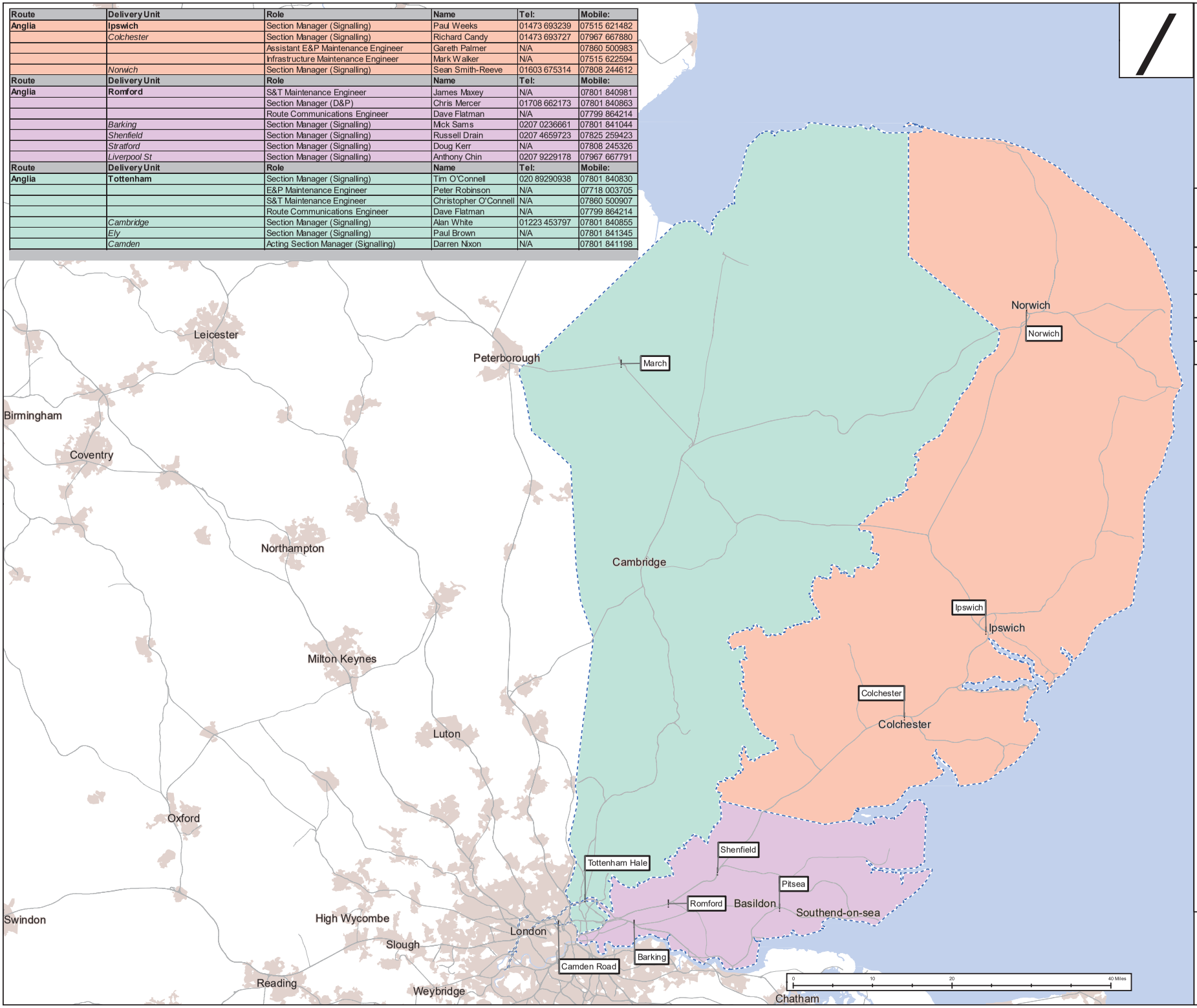
Upon receipt can you please check that the information provided agrees with this listing and if there are any discrepancies please contact the Worksite Survey Team at:

National Records Centre, Audax Road, York. YO30 4US

WorksiteSurveyTeam@networkrail.co.uk

Checklist printed on: 11/03/1

Route	Delivery Unit	Role	Name	Tel:	Mobile:
Anglia	**Ipswich**	Section Manager (Signalling)	Paul Weeks	01473 693239	07515 621482
	Colchester	Section Manager (Signalling)	Richard Candy	01473 693727	07967 667880
		Assistant E&P Maintenance Engineer	Gareth Palmer	N/A	07860 500983
		Infrastructure Maintenance Engineer	Mark Walker	N/A	07515 622594
	Norwich	Section Manager (Signalling)	Sean Smith-Reeve	01603 675314	07808 244612
Route	**Delivery Unit**	**Role**	**Name**	**Tel:**	**Mobile:**
Anglia	**Romford**	S&T Maintenance Engineer	James Maxey	N/A	07801 840981
		Section Manager (D&P)	Chris Mercer	01708 662173	07801 840863
		Route Communications Engineer	Dave Flatman	N/A	07799 864214
	Barking	Section Manager (Signalling)	Mick Sams	0207 0236661	07801 841044
	Shenfield	Section Manager (Signalling)	Russell Drain	0207 4659723	07825 259423
	Stratford	Section Manager (Signalling)	Doug Kerr	N/A	07808 245326
	Liverpool St	Section Manager (Signalling)	Anthony Chin	0207 9229178	07967 667791
Route	**Delivery Unit**	**Role**	**Name**	**Tel:**	**Mobile:**
Anglia	**Tottenham**	Section Manager (Signalling)	Tim O'Connell	020 89290938	07801 840830
		E&P Maintenance Engineer	Peter Robinson	N/A	07718 003705
		S&T Maintenance Engineer	Christopher O'Connell	N/A	07860 500907
		Route Communications Engineer	Dave Flatman	N/A	07799 864214
	Cambridge	Section Manager (Signalling)	Alan White	01223 453797	07801 840855
	Ely	Section Manager (Signalling)	Paul Brown	N/A	07801 841345
	Camden	Acting Section Manager (Signalling)	Darren Nixon	N/A	07801 841198



NetworkRail

Asset Information Services

GeospatialReportingAnalysis@NetworkRail.co.uk

LOCAL CONTACTS LIST - ANGLIA IMDMs

BURIED SERVICES

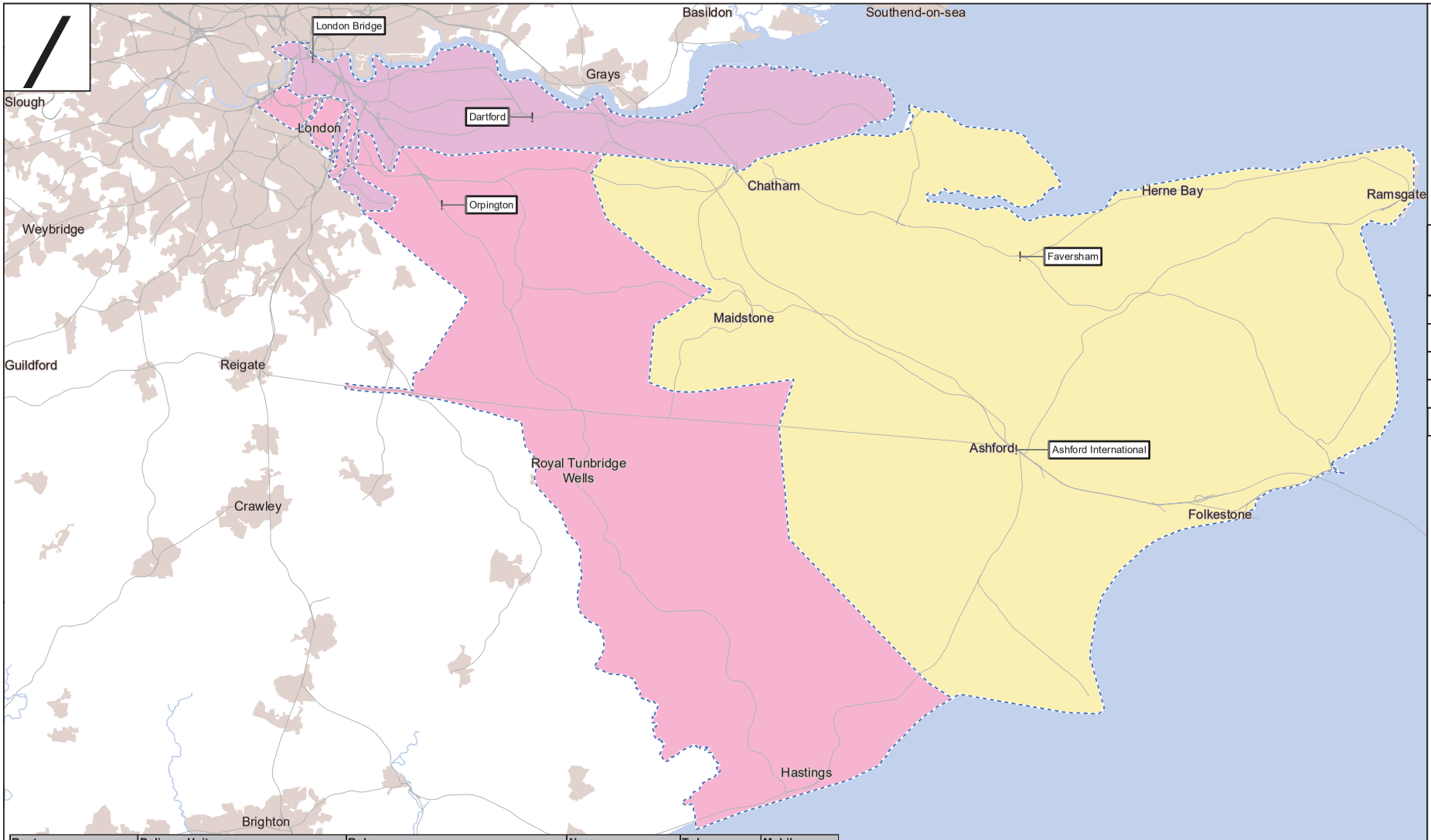
JOB NO.:	10104.115		
SCALE:	1:700,000 @ A3		
USE TYPE:	[INTERNAL]	DATE:	21/02/2019
VERSION: 1	QA BY: SD	PRODUCED BY:	DJ

LEGEND

- ! Stations
- Rail Network
- IMDM Boundaries

IMDM Boundaries

- IMDM Ipswich
- IMDM Romford
- IMDM Tottenham
- Urban Areas



Route	Delivery Unit	Role	Name	Tel:	Mobile:
Kent	Ashford	Section Manager (Signalling)	Lee Hayward	01233 617483	07515 627043
		S&T Maintenance Engineer	Daniel Neudeck	N/A	07967 668505
		E&P Maintenance Engineer	Martin Allcock	01223 617481	07515 619237
		Route Communications Engineer	Jeff Ross	01233 617318	07818 011081
	Canterbury	Section Manager (D&P)	Andrew Beale	01227 765242	07515 619345
	Ramsgate	Section Manager (Signalling)	Anthony Taylor	N/A	07966 337334
	Sittingbourne	Section Manager (Signalling)	Alastair Robb	N/A	07850 405837
Route	**Delivery Unit**	**Role**	**Name**	**Tel:**	**Mobile:**
Kent	London Bridge	Section Manager (Signalling)	Michael Martinez	N/A	07515 621093
		S&T Maintenance Engineer	Scott Cadzow	N/A	07710 961022
	Hither Green	Section Manager (Signalling)	Oscar Kibale	N/A	07412 337404
		S&T Maintenance Engineer	Scott Cadzow	N/A	07710 961022
		E&P Maintenance Engineer	Kevin Crocker	N/A	07917 857149
		Route Communications Engineer	Jeff Ross	01223 617318	07818 011081
	Dartford	Section Manager (Signalling)	Scott Dolby	N/A	07967 668413
		S&T Maintenance Engineer	Scott Cadzow	N/A	07710 961022
Route	**Delivery Unit**	**Role**	**Name**	**Tel:**	**Mobile:**
Kent	Orpington	Section Manager (Signalling)	Adam Southon	0207 922 9961	07718 004079
		Section Manager (Signalling)	Graham Stock	N/A	07515 620283
		Section Manager (Signalling)	William Brown	N/A	07740 226048
		S&T Maintenance Engineer	Terry Loughnane	01689 893039	07515 621101
	Orpington Inner	E&P Maintenance Engineer	Kevin Crocker	N/A	07917 857149
	Orpington Outer	E&P Maintenance Engineer	Martin Allcock	01223 617481	07515 619237
		Route Communications Engineer	Jeff Ross	01223 617318	07818 011081

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GeospatialReportingAnalysis@NetworkRail.co.uk

LOCAL CONTACTS LIST - KENT IMDMs

BURIED SERVICES

JOB NO.:	10104.115
SCALE:	1:400,000 @ A3
USE TYPE: [INTERNAL]	DATE: 21/02/2019
VERSION: 1	QA BY: SD / PRODUCED BY: DJ

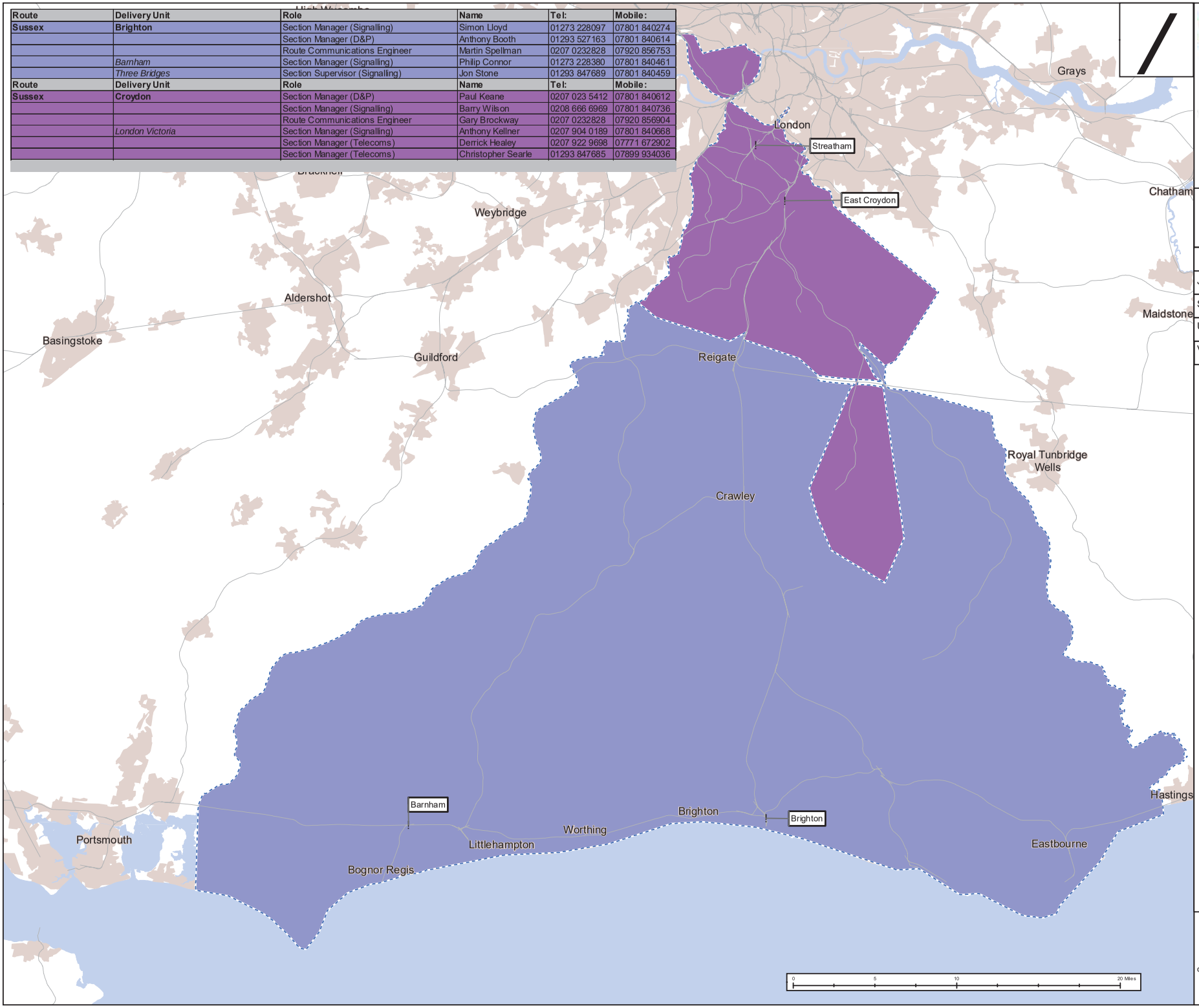
LEGEND

- ! Stations
- Rail Network
- IMDM Boundaries

IMDM Boundaries

- IMDM Ashford
- IMDM London Bridge
- IMDM Orpington
- Urban Areas

Route	Delivery Unit	Role	Name	Tel:	Mobile:
Sussex	Brighton	Section Manager (Signalling)	Simon Lloyd	01273 228097	07801 840274
		Section Manager (D&P)	Anthony Booth	01293 527163	07801 840614
		Route Communications Engineer	Martin Spellman	0207 0232828	07920 856753
	Barnham	Section Manager (Signalling)	Philip Connor	01273 228380	07801 840461
	Three Bridges	Section Supervisor (Signalling)	Jon Stone	01293 847689	07801 840459
Route	**Delivery Unit**	**Role**	**Name**	**Tel:**	**Mobile:**
Sussex	Croydon	Section Manager (D&P)	Paul Keane	0207 023 5412	07801 840612
		Section Manager (Signalling)	Barry Wilson	0208 666 6969	07801 840736
		Route Communications Engineer	Gary Brockway	0207 0232828	07920 856904
	London Victoria	Section Manager (Signalling)	Anthony Kellner	0207 904 0189	07801 840668
		Section Manager (Telecoms)	Derrick Healey	0207 922 9698	07771 672902
		Section Manager (Telecoms)	Christopher Searle	01293 847685	07899 934036



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GeospatialReportingAnalysis@NetworkRail.co.uk

LOCAL CONTACTS LIST - SUSSEX IMDMs

BURIED SERVICES

JOB NO.:	10104.115		
SCALE:	1:340,000 @ A3		
USE TYPE:	[INTERNAL]	DATE:	21/02/2019
VERSION: 1	QA BY: SD	PRODUCED BY:	DJ

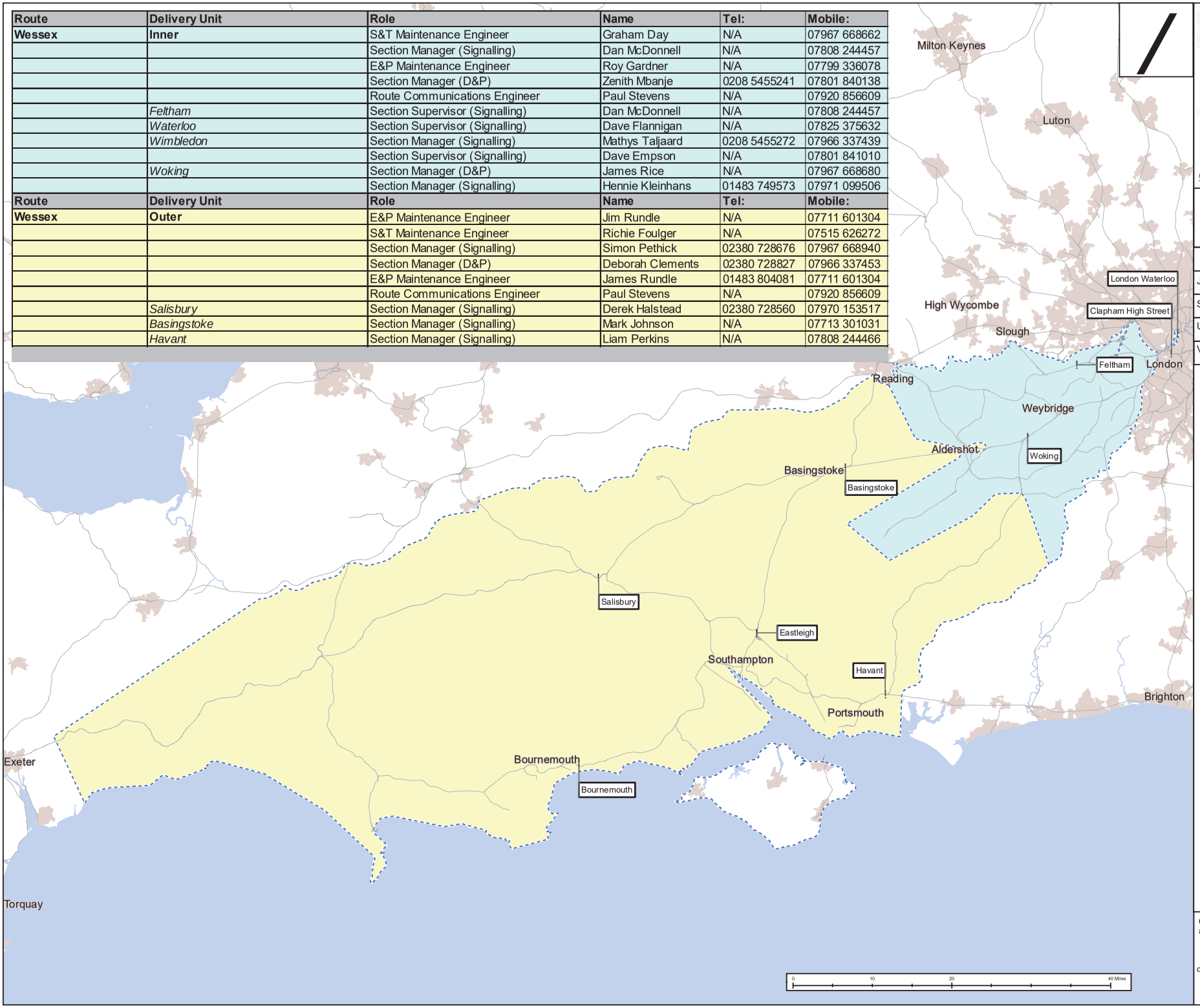
LEGEND

- ! Stations
- Rail Network
- IMDM Boundaries

IMDM Boundaries

- IMDM Brighton
- IMDM Croydon
- Urban Areas

Route	Delivery Unit	Role	Name	Tel:	Mobile:
Wessex	**Inner**	S&T Maintenance Engineer	Graham Day	N/A	07967 668662
		Section Manager (Signalling)	Dan McDonnell	N/A	07808 244457
		E&P Maintenance Engineer	Roy Gardner	N/A	07799 336078
		Section Manager (D&P)	Zenith Mbanje	0208 5455241	07801 840138
		Route Communications Engineer	Paul Stevens	N/A	07920 856609
	Feltham	Section Supervisor (Signalling)	Dan McDonnell	N/A	07808 244457
	Waterloo	Section Supervisor (Signalling)	Dave Flannigan	N/A	07825 375632
	Wimbledon	Section Manager (Signalling)	Mathys Taljaard	0208 5455272	07966 337439
		Section Supervisor (Signalling)	Dave Empson	N/A	07801 841010
	Woking	Section Manager (D&P)	James Rice	N/A	07967 668680
		Section Manager (Signalling)	Hennie Kleinhans	01483 749573	07971 099506
Route	**Delivery Unit**	**Role**	**Name**	**Tel:**	**Mobile:**
Wessex	**Outer**	E&P Maintenance Engineer	Jim Rundle	N/A	07711 601304
		S&T Maintenance Engineer	Richie Foulger	N/A	07515 626272
		Section Manager (Signalling)	Simon Pethick	02380 728676	07967 668940
		Section Manager (D&P)	Deborah Clements	02380 728827	07966 337453
		E&P Maintenance Engineer	James Rundle	01483 804081	07711 601304
		Route Communications Engineer	Paul Stevens	N/A	07920 856609
	Salisbury	Section Manager (Signalling)	Derek Halstead	02380 728560	07970 153517
	Basingstoke	Section Manager (Signalling)	Mark Johnson	N/A	07713 301031
	Havant	Section Manager (Signalling)	Liam Perkins	N/A	07808 244466



Asset Information Services

GeospatialReportingAnalysis@NetworkRail.co.uk

LOCAL CONTACTS LIST - WESSEX IMDMs

BURIED SERVICES

JOB NO.:	10104.115		
SCALE:	1:700,000 @ A3		
USE TYPE:	[INTERNAL]	DATE:	21/02/2019
VERSION: 1	QA BY: SD	PRODUCED BY:	DJ

LEGEND

- ! Stations
- Rail Network
- IMDM Boundaries

IMDM Boundaries

- IMDM Wessex Inner
- IMDM Wessex Outer
- Urban Areas

GEO-RINM

This material from the Rail Infrastructure Network Model (RINM) is a guide only and although every effort will be made to ensure that the information is correct you should be aware that the information may be incomplete, inaccurate or out of date. Network Rail shall not be liable for any loss or damage, which may arise from the use of any information, contained.

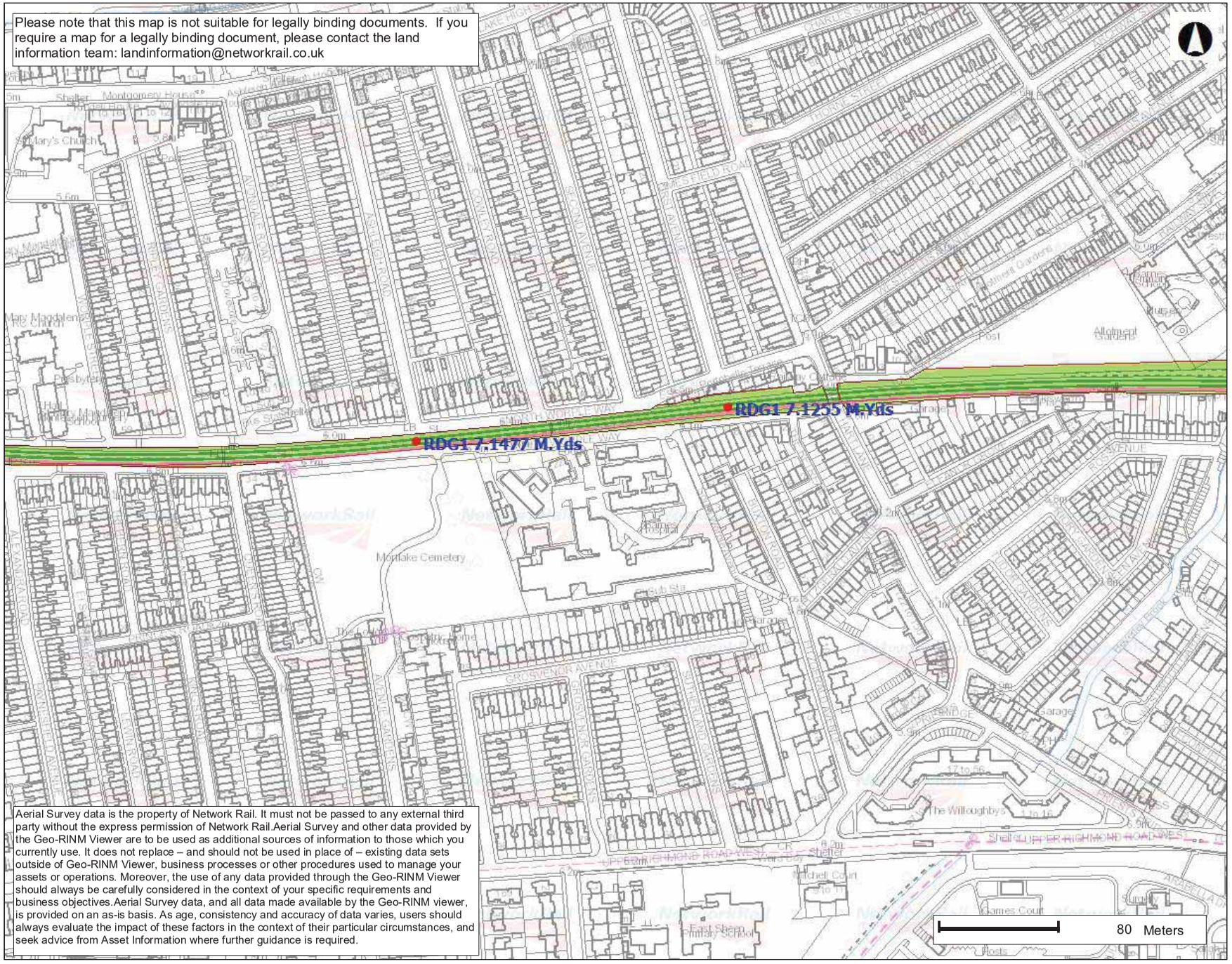
- Infrastructure Features
  - Tunnel Bore
- Infrastructure Network Model
  - Track Link
- OS MasterMap
  - Points
    - General Feature, Positioned
    - General Feature, Positioned
    - Height Control, Bench Mark
    - Historic Interest, Structure
    - Inland Water, Culvert
    - Political Or Administrative, Boundary
    - Rail, Structure
    - Roadside, Structure
    - Structure,
    - Structure, Triangulation Point Or Pillar
    - Terrain And Height, Spot Height
  - Symbols
    - Bench Mark
    - Boundary Half Mereing
    - Direction of Flow
    - Switch
    - Road Related Flow
  - Line Features
    - Building
    - Building
    - Building Overhead
    - General Feature Edge
    - General Feature

- General Feature Underground
- Top of Slope
- Bottom of Slope
- Bottom of Slope
- Narrow Gauge Railway
- Standard Gauge Railway
- Overhead Construction
- Validate General Feature
- Rail
- Mean High Water
- Mean High Water
- Mean Low Water
- Mean Low Water

- Boundaries
  - Political Or Administrative, County
  - Political Or Administrative, District
  - Political Or Administrative, Electoral
  - Political Or Administrative, Parish
  - Political Or Administrative, Parliamentary

- **Buried Services - Network Rail**
  - Historic Cable Route

- **Land Information**
  - Company Ownership
    - Freehold Ownership
    - Leasehold Ownership
    - Prohibitive Interest
    - Bridge (Rail over Rail)
    - Bridge (Rail over River)
    - Bridge (Rail over Road)
    - Bridge (Road over Rail)
    - Level Crossing
    - Tunnel



Legend

- Track Link
- Points
  - General Feature, Positioned Coniferous Tree
  - General Feature, Positioned Nonconiferous Tree
  - Height Control, Bench Mark
  - Historic Interest, Structure
  - Inland Water, Culvert
  - Political Or Administrative, Boundary Post Or Stone
  - Rail, Structure
  - Roadside, Structure
  - Structure,
  - Structure, Triangulation Point Or Pillar
  - Terrain And Height, Spot Height
- Symbols
  - Bench Mark
  - Boundary Half Mereing
  - Direction of Flow
  - Switch
  - Road Related Flow
- Line Features
  - Building
  - Building
  - Building Overhead
  - General Feature Edge
  - General Feature
  - General Feature Underground
  - Top of Slope
  - Top of Slope
  - Bottom of Slope
  - Bottom of Slope
  - Narrow Gauge Railway
  - Standard Gauge Railway
  - Overhead Construction
  - Validate General Feature
  - Rail
  - Mean High Water
  - Mean High Water
  - Mean Low Water
  - Mean Low Water

NetworkRail

SET195957

Barnes Hospital, South Worple Way,

Scale	1 : 2,500
Plot Date	06/03/19 13:23
Printed By	SE1

Output created from GeoRINM Viewer

National Hazard Directory

Terms and Conditions

The National Hazard Directory (NHD) is issued by Network Rail to provide information on those hazards recorded as present on Network Rail's infrastructure. Its' purpose is to alert users to the typical hazards they may come across whilst working on Network Rail's Infrastructure. The National Hazard Directory is maintained by Network Rail to provide its employees and contractors with information on known hazards present on the infrastructure in order to assist in the identification of the associated risks working 'on or near the line'.

The records are updated regularly and therefore Network Rail believe that the contents are reasonably accurate at the time of issue, but some of the information can vary in age and accuracy so for that reason Network Rail will give no warranty as to the suitability of its use. It is recommended that all searches (in particular for buried services) should be conducted together with a site specific risk assessment/site visit, taking into account the requirements of the appropriate track safety rules, rule books/industry standards and so on. Network Rail will accept no liability in respect of the content or subsequent use of the National Hazard Directory or any of the information contained within.

Users of the Directory must note that when working on or near the line that the appropriate requirements of the Rule Book, especially the provisions of the track safety rules, must be applied as appropriate to the activity concerned.

OnTrac Ltd does not warrant the use of the Network Rail National Hazard Directory or any of the information contained within and no representations or warranties are made as to completeness or accuracy of the data. The data should be used for reference purposes only. Accordingly, OnTrac Ltd will accept no responsibility for loss of profit or for any indirect, incidental or consequential damages.

National Hazard Directory

Customised Report

Search Criteria: ELR(s) = RDG1; Mileage From = 7.1255; Mileage To = 7.1477
Date: 06/03/2019

6 Hazards found.

ELR	ELR Name	Mileage From	Mileage To	Hazard Code	Hazard Description	Local Name	Track ID	Free Text
RDG1	WATERLOO (WINDSOR LINES) - WOKINGHAM JN	7.0550	9.1606	HBE	Buried Electrical Cables	Barnes S/S - Richmond S/S	Up Slow	
RDG1	WATERLOO (WINDSOR LINES) - WOKINGHAM JN	7.1276	7.1276	HBE	Buried Electrical Cables	Mortlake buried electrical cable	All/Multiple Tracks	66KV Cable U/G across Rly Info on underground/overhead services <gas, water, electricity> has not been validated.
RDG1	WATERLOO (WINDSOR LINES) - WOKINGHAM JN	7.1319	7.1319	HXE	Buried & Overhead Electric Cable	Mortlake buried & overhead electric cable	All/Multiple Tracks	Elect Cables at Second Ave.
RDG1	WATERLOO (WINDSOR LINES) - WOKINGHAM JN	7.1320	8.0330	HWR	Red Zone Working Prohibited	White Hart Lane LX - Mortlake LX Down/Up Richmond	All/Multiple Tracks	
RDG1	WATERLOO (WINDSOR LINES) - WOKINGHAM JN	7.1342	8.1100	HWR	Red Zone Working Prohibited	Mortlake - North Sheen Down/Up Richmond lines	All/Multiple Tracks	
RDG1	WATERLOO (WINDSOR LINES) - WOKINGHAM JN	7.1358	7.1358	HWT	Signal Post Telephone Barred to Hand-signal Person	Mortlake signal post telephone	Up Main/Fast	

Adams Mandy

From: Verster Robyn on behalf of NRG Enquiries
Sent: 11 March 2019 12:57
To: OP Buried Services Enquiries
Subject: Buried Service search: SET195957

Categories: Steve

Thank you for your recent enquiry for buried services records from the NRG.

With reference to **OP** Barnes Hospital, South Worple Way, London

X	No Network Rail records have been found
	Record(s) sent via email *
	Record(s) sent via CD/DVD *
	Record(s) sent via SharePoint *

All other aspects including the Utility Companies search results will be sent to you separately by the Worksite Survey Team.

Please direct all queries to WorksiteSurveyTeam@networkrail.co.uk.

* Please note that a copy of your request will only be kept for **4 weeks**, so you must notify the NRG within this timeframe if you do not receive the records or there are any issues. After this time, your request must be re-submitted quoting the unique ID reference number which is indicated in the subject header of this e-mail. This will then be logged and dealt with in accordance with our Service Level Agreements.

Kind regards,

National Records Group

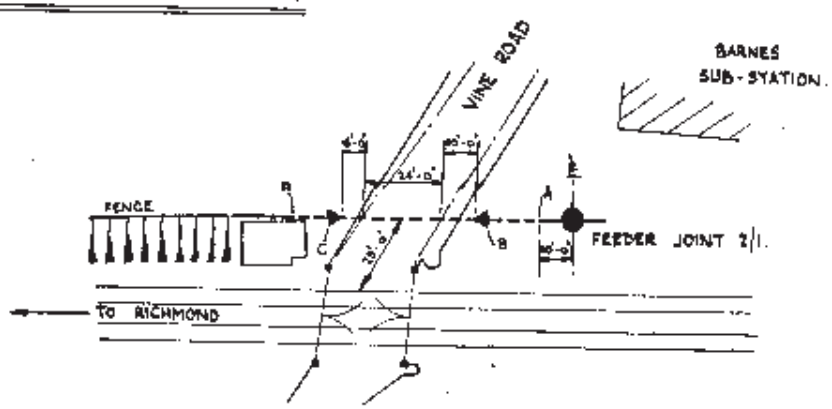
Kind regards,

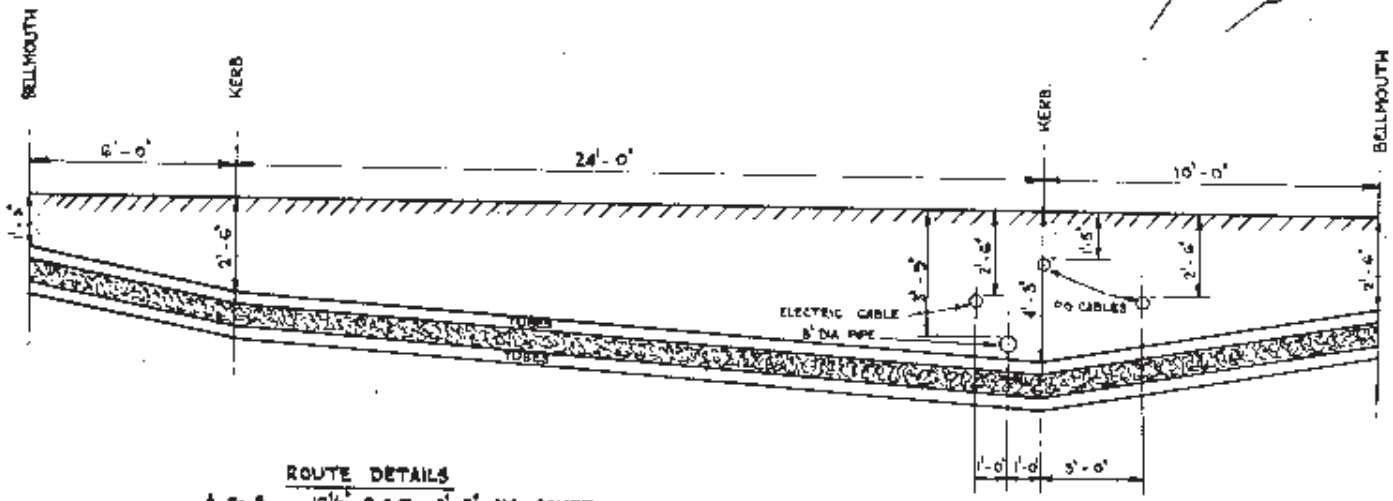
Robyn Verster
Records Assistant

National Records Group
National Record Centre | Audax Road | York YO30 4US
T 01904 386354
Anna-marie.Britton@networkrail.co.uk
www.networkrail.co.uk

In order to help us improve our services please take this short two question survey

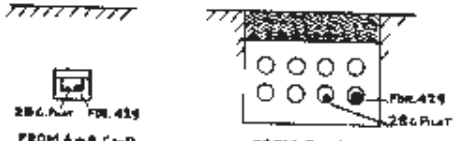
BARNES – VINE ROAD CROSSING.





ROUTE DETAILS

A to B. 12¼" B.C.T. 2'-3" AV. COVER.
B to C. 8 - 5" DUCTS (SEE ENLARGED DETAIL)
C to D. 12¼" B.C.T. 1'-6" AV. COVER.



CROSS-SECTIONS FACING RICHMOND

3953

BURIED ROUTE
SURFACE ROUTE
BELLMOUTH TO DUCTS

SCALES 1" = 40' & 1" = 4'0"

DIMENSIONS FOR ROUTE LOCATION ONLY & DO NOT REFER TO CABLE LENGTH

BURIED CABLE CHART

[redacted]

FEEDER No. 429
& PILOT CABLE
BARNES S/S TO RICHMOND S/S

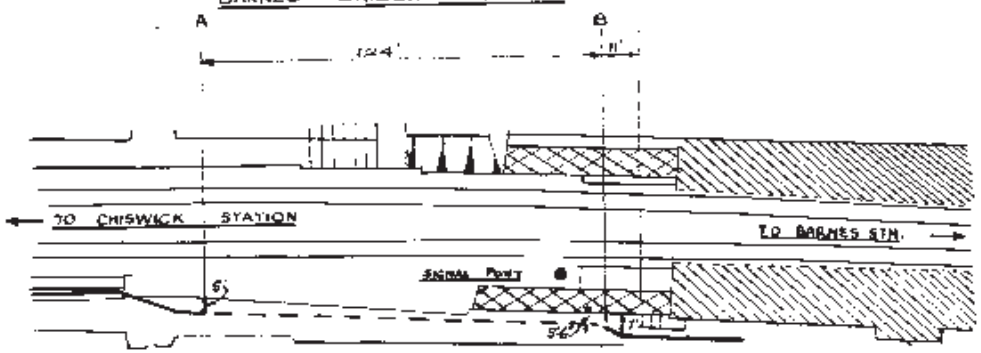
[redacted]

BETWEEN BARNES SUBSTATION & 7¾ MILE POST

PIRELLI-GENERAL CABLE WORKS LTD
DRAWN BY
DATE 13/1-58
CHECKED BY
DRG. No 713100/WESTERN/B.C.C.85

FEEDER No 438 BARNES TO BRENTFORD
28 CORE PILOT BARNES SUBSTATION TO CHISWICK Y.P. NOT T.6
SUPPLEMENTARY TO DRG. No 713100/WESTERN/F.C.30 Sheet 1.

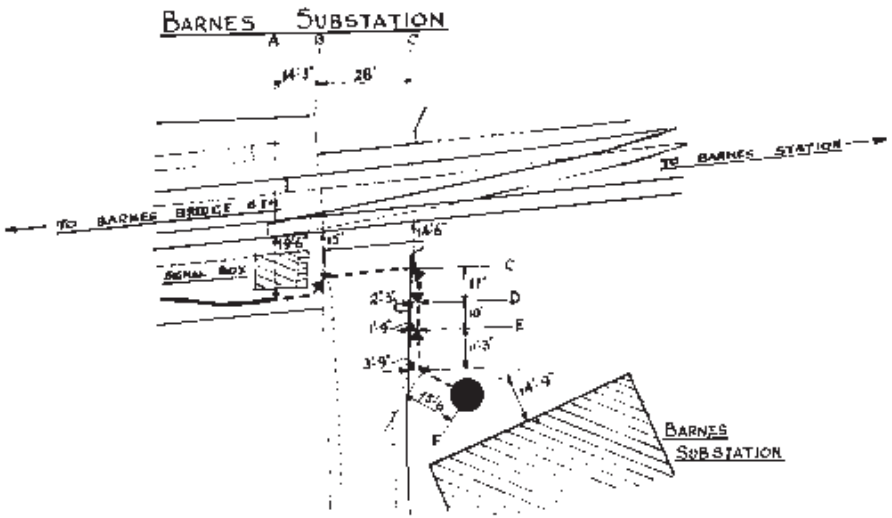
BARNES BRIDGE STATION



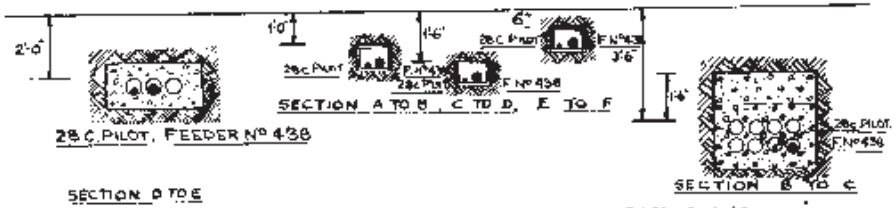
FROM A TO B. 12½" B.C.T. (6" AVERAGE COVER)

SECTION A TO B. FACING BARNES STN.

BARNES SUBSTATION



FROM A TO B, 12½" B.C.T (11'0" AVERAGE COVER)
FROM B TO C, 8 x 3" DUCTS (TOP OF DUCT - SURFACE - 3'6")
FROM C TO D, 12½" B.C.T. (1'6" AVERAGE COVER)
FROM D TO E, 3 x 5" DUCTS (TOP OF DUCT TO SURFACE 2'0")
FROM E TO F, 12½" B.C.T. (6" AVERAGE COVER)



SECTION D TO E

ALL SECTIONS FACING BARNES S/S.

FEEDER No 438
& PILOT CABLE
BARNES S/S TO BRENTFORD S/S.

SURFACE ROUTE
BURIED ROUTE

SCALES 1"=40 & 1"=4'0"
DIMENSIONS FOR ROUTE LOCATION ONLY & DO NOT REFER TO CABLE LENGTH

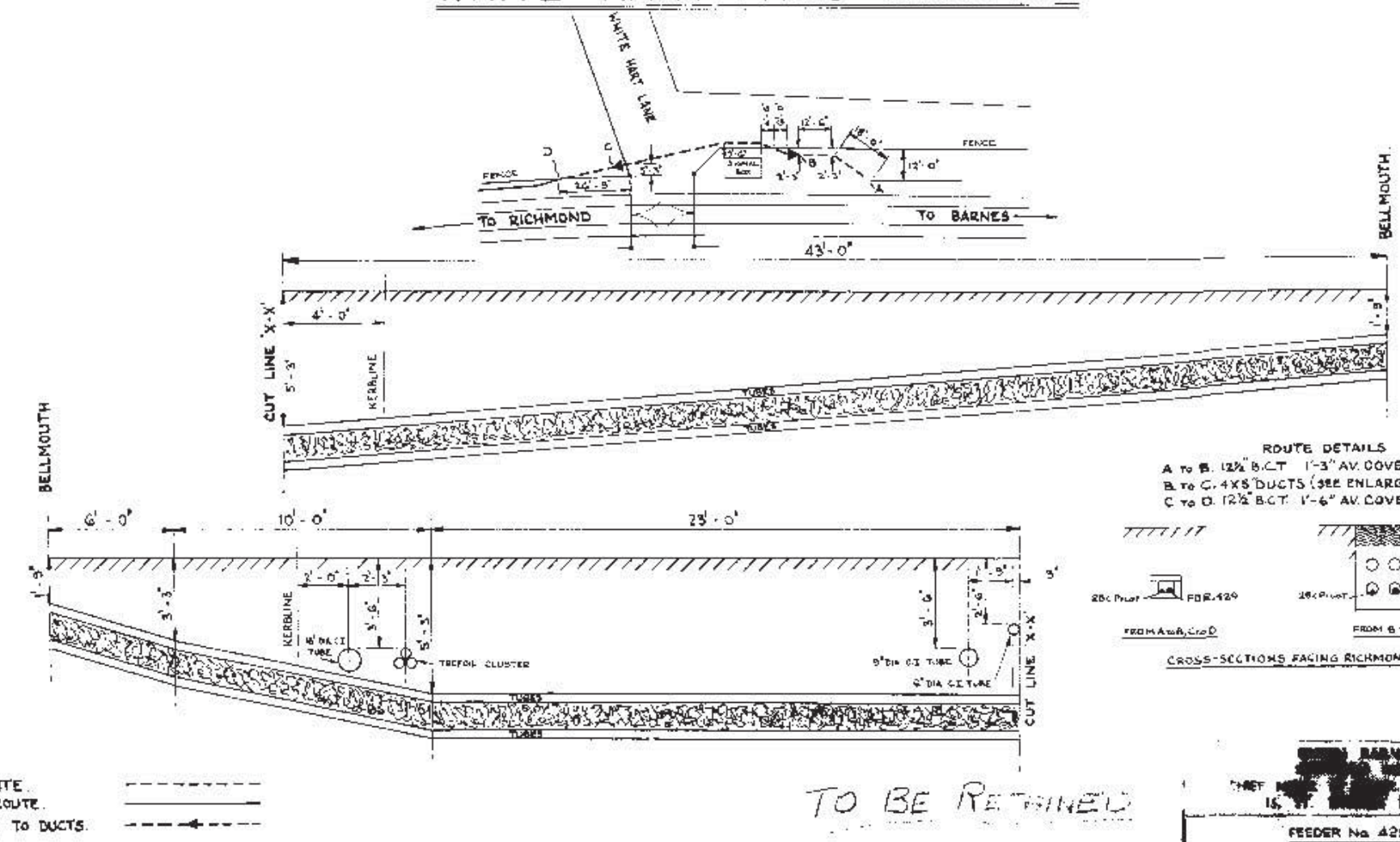
BURIED CABLE CHART

VELOGRAPH 2W/SHT

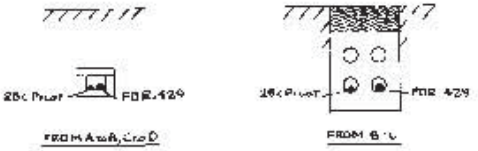
BARNES TO RICHMOND. FEEDER Nº 429.
BARNES S/S TO MORTLAKE T.P. HUT. 28c. PILOT CABLE.
SUPPLEMENTARY TO DRAWING Nº T13100/WESTERN/E.C. 27. SHT. 1.

T13100/WESTERN/B.C.C. 45 SHEET 2.
P. M. J.
11-10-57

WHITE HART LANE CROSSING.



ROUTE DETAILS
A to B. 12½" B.C.T. 1'-3" AV. COVER
B to C. 4 X 5" DUCTS (SEE ENLARGED DETAIL).
C to D. 12½" B.C.T. 1'-6" AV. COVER.



CROSS-SECTIONS FACING RICHMOND

BURIED ROUTE.
SURFACE ROUTE.
BELLMOUTH TO DUCTS.

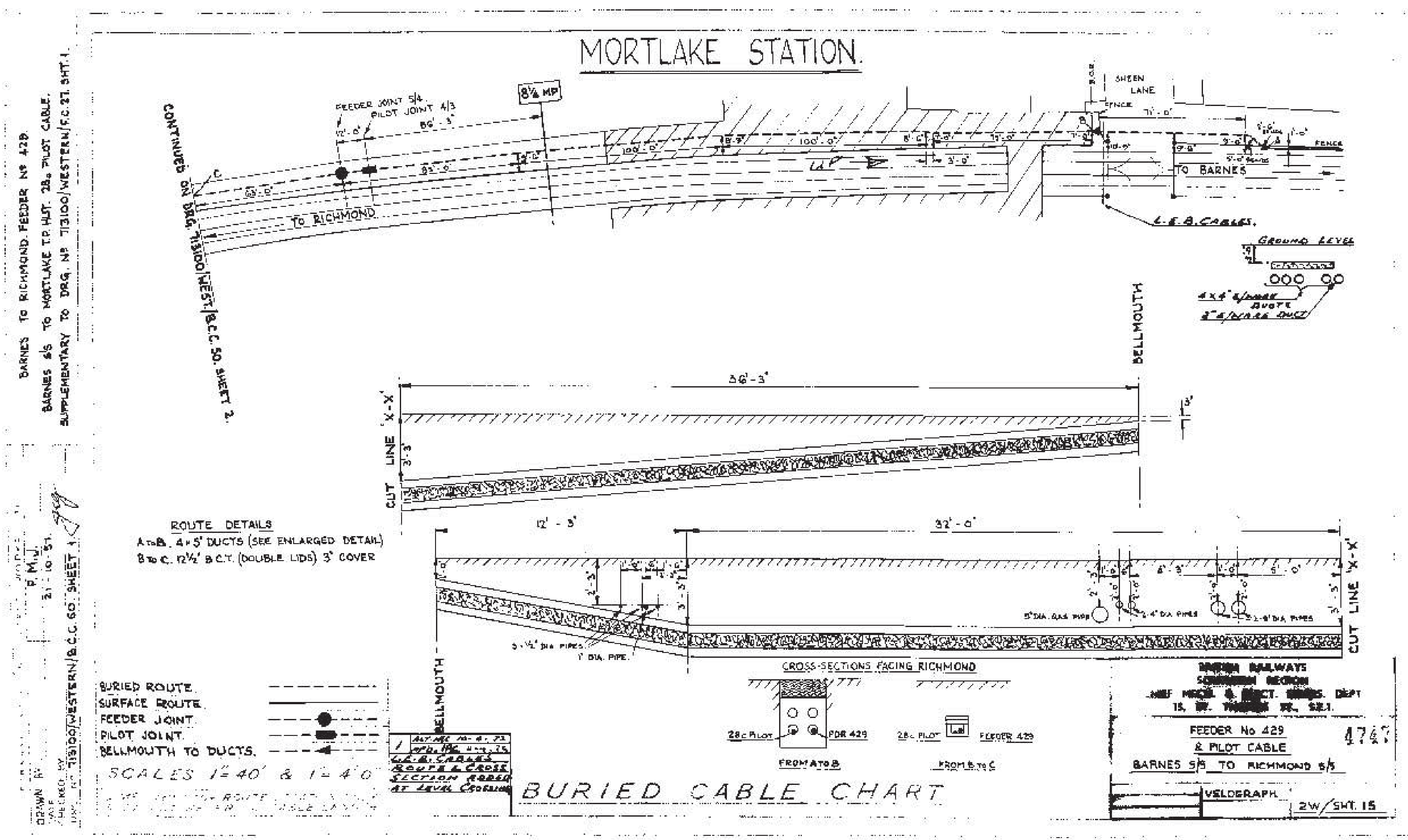
TO BE RETAINED

4748

[redacted] DEPT.
SHEET No. [redacted] SHT.

FEEDER No 429
& PILOT CABLE
BARNES S/S TO RICHMOND S/S

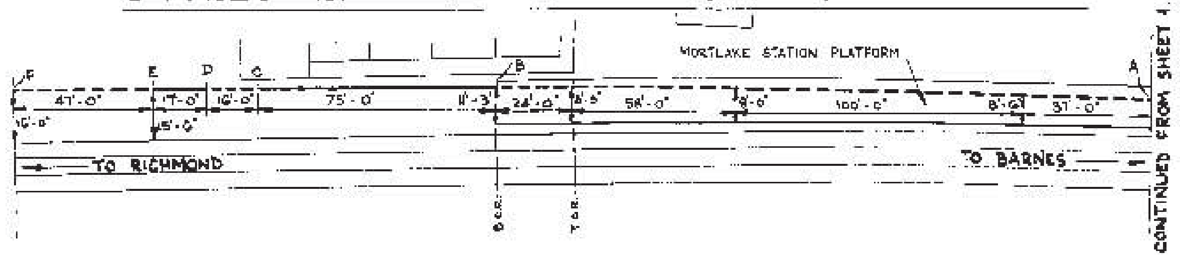
VELOGRAPH. 2W/SHT 14

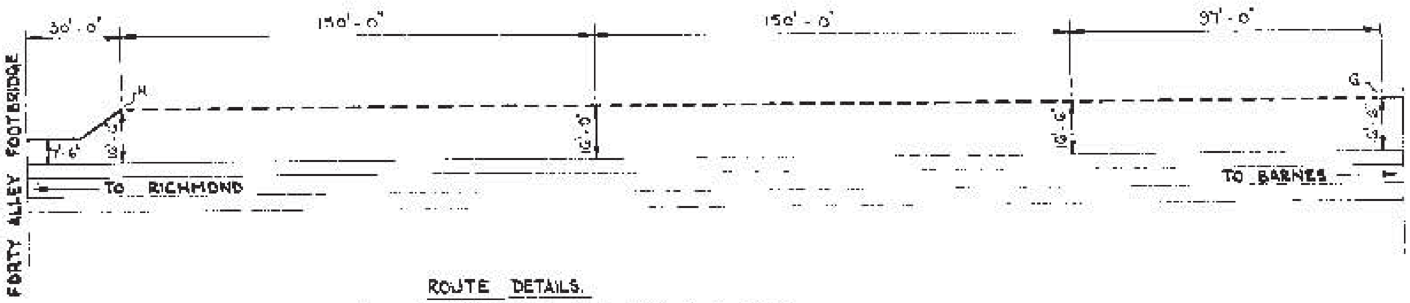


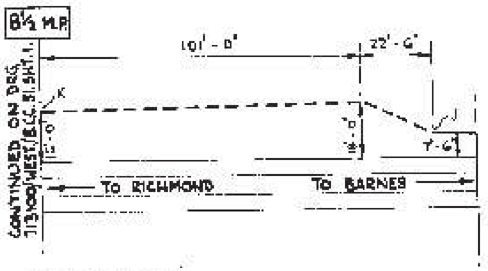
MORTLAKE STATION.
BARNES TO RICHMOND. FEEDER Nº 429.
BARNES S/S TO MORTLAKE T.P. HUT. 28c PILOT CABLE.
SUPPLEMENTARY TO DRG. Nº 713100/WESTERN/F.C.27. SHT.1.
CONTINUED ON DRG. 713100/WEST./B.C.C. 50. SHEET 2.
FEEDER JOINT 5/4.
PILOT JOINT 4/3
8¼ MP
TO RICHMOND.
UP
SHEEN LANE
FENCE
TO BARNES
L.E.B. CABLES.
GROUND LEVEL
4x4" S/WARE DUCTS
3" S/WARE DUCT
BELLMOUTH
36'-3"
CUT LINE 'X-X'
12'-3"
32'-0"
5"DIA. GAS PIPE
4" DIA PIPES
2-4" DIA PIPES
5-1½" DIA PIPES
1" DIA. PIPE.
ROUTE DETAILS
A to B. 4x5" DUCTS (SEE ENLARGED DETAIL)
B to C. 12½" B.C.T. (DOUBLE LIDS) 3" COVER
CROSS-SECTIONS FACING RICHMOND
28c PILOT
FDR 429
FROM A to B
FEEDER 429
FROM B to C
BURIED ROUTE.
SURFACE ROUTE.
FEEDER JOINT.
PILOT JOINT.
BELLMOUTH TO DUCTS.
SCALES 1"=40' & 1"=4'0"
BURIED CABLE CHART
L.E.B. CABLES ROUTE & CROSS SECTION ADDED AT LEVEL CROSSING
FEEDER No 429
& PILOT CABLE
BARNES S/S TO RICHMOND S/S
VELDERAPH
2W/SHT. 15
4747
DRAWN BY
CHECKED BY
P.M.J.
21-10-51.
713100/WESTERN/B.C.C. 50 SHEET 1.

BARNES TO RICHMOND FEEDER No 429
BARNES S/S TO MORTLAKE T.P. HUT. 28c PILOT CABLE.
SUPPLEMENTARY TO DRG. No 713100/WESTERN/F.C.21 SHT.1.

8 MILES 22¾ CHAINS TO 8 MILES 40 CHAINS.

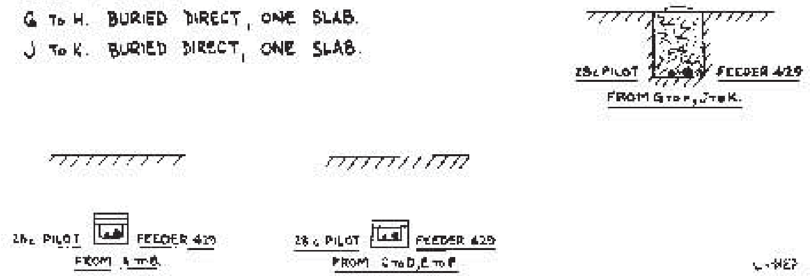






ROUTE DETAILS.

A To B. 12½" B.C.T. DOUBLE LIDS, 3' AV. COVER.
C To D. 12½" B.C.T. 6' AV. COVER.
E To F. 12½" B.C.T. 5' AV. COVER.
G To H. BURIED DIRECT, ONE SLAB.
J To K. BURIED DIRECT, ONE SLAB.



CROSS-SECTIONS FACING RICHMOND

BURIED ROUTE. - - - - -
SURFACE ROUTE. ————

P.M.J.
16-10-57.

713100/WESTERN/B.C.C. SQ. SHEET 2.

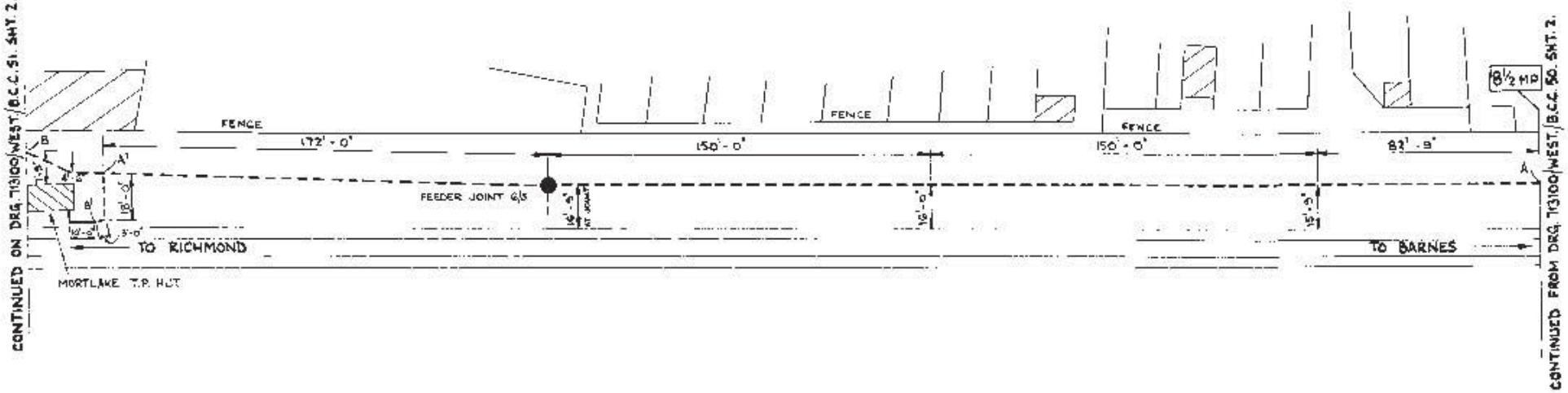
BRITISH RAILWAYS
SOUTHERN REGION
CHIEF MECH. & ELECT. ENGRS. DEPT
1 ... ST., S.E.1.

FEEDER No 429
& PILOT CABLE
BARNES S/S TO RICHMOND S/S

VELOGRAPH | 2W/SHT.16

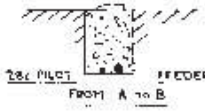
8½ MILE POST TO MORTLAKE T.P. HUT.

BARNES TO RICHMOND. FEEDER Nº 429.
BARNES S/S TO MORTLAKE T.P. HUT. 28c PILOT CABLE
SUPPLEMENTARY TO DRG. Nº 73100/WESTERN/F.C. 27. SHT. 1.



ROUTE DETAILS

A to B, BURIED DIRECT, ONE SLAB.
A' to B', 10" B.C.T. 6' AV. COVER.



2-28c PILOT CABLES.
FROM A' to B'

CROSS-SECTIONS FACING RICHMOND.

BURIED ROUTE.
SURFACE ROUTE.
FEEDER JOINT.

BRITISH RAILWAYS
SOUTHERN REGION
CHIEF MECH. & ELECT. ENGRS. DEPT
U. ST. THOMAS ST., S.E.1.

FEEDER No 429
& PILOT CABLE,
BARNES S/S TO RICHMOND S/S

VELOGRAPH

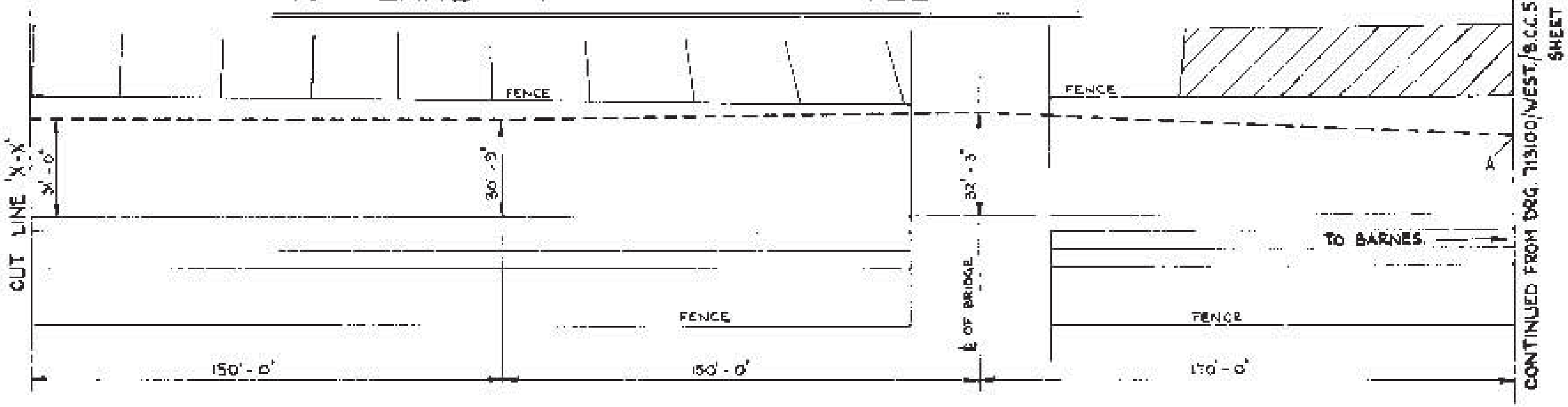
2W/SHT.17

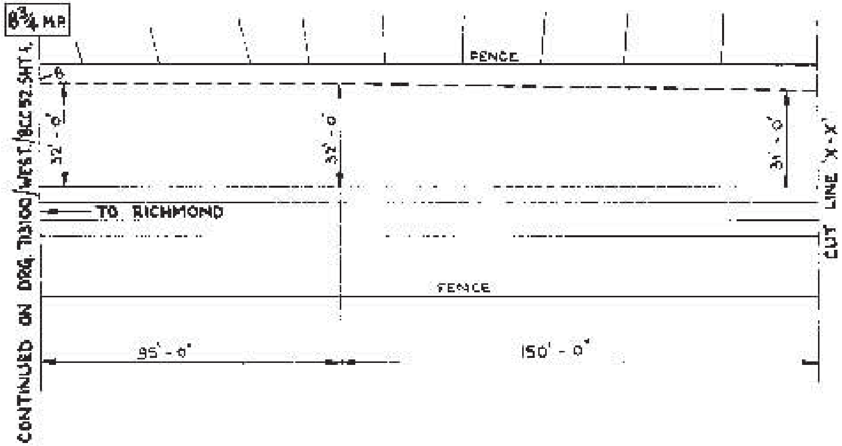
P.M.J.
17-10-57.

73100/WESTERN/B.C.C. SI. SHEET 1.

BURIED CABLE CHART

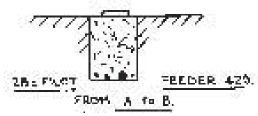
MORTLAKE T.P HUT TO 8¾ MILE POST.





ROUTE DETAILS.

A to B BURIED DIRECT, ONE SLAB.



CROSS - SECTION FACING RICHMOND.

BURIED ROUTE

SCALES 1:40 & [illegible]

BURIED CABLE CHART

4750

BRITISH RAILWAYS
SOUTHERN REGION
MECH. & ELECT. ENGRS.
ST THOMAS ST., SE.

FEEDER Nº 429

& PILOT CABLE

BARNES S/S TO RICHMOND S/S.

VELOGRAPH.

2W/SHT 18.

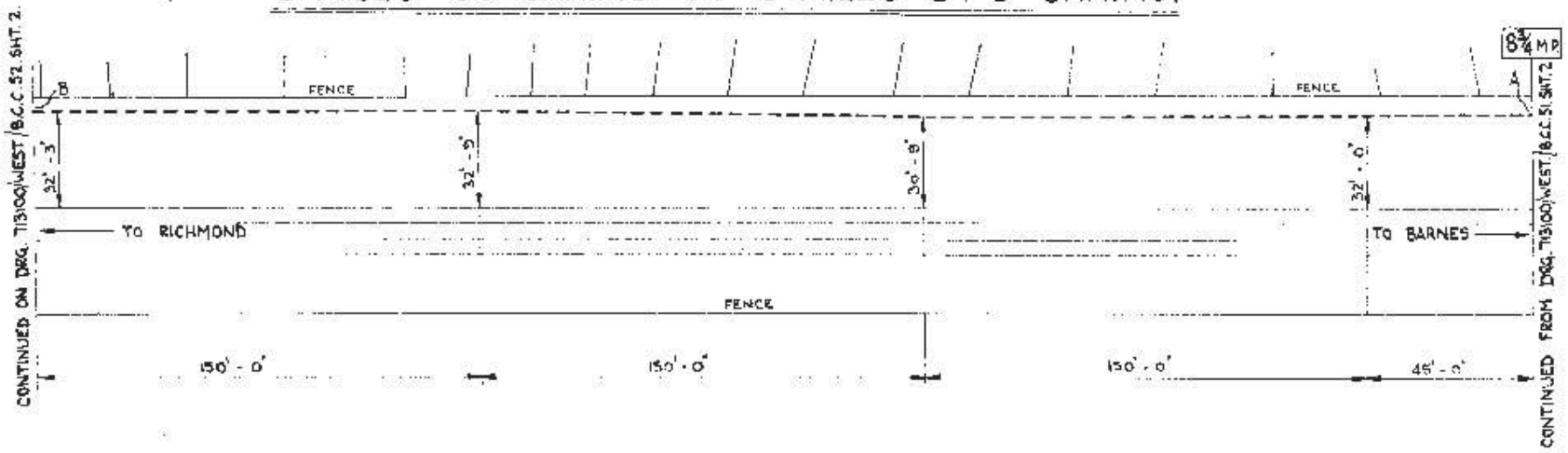
BARNES TO RICHMOND FEEDER Nº 429.
MORTLAKE T.P.HUT TO RICHMOND S/S. 28 c PILOT CABLE.
SUPPLEMENTARY TO DRG. Nº 713100/WESTERN/F.C.27. SHT. 1.

713100/WESTERN/B.C.C.51 SHEET 2.

P.M.J.
17-10-51.

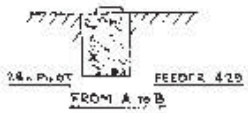
BARNES TO RICHMOND FEEDER Nº 429.
WESTLAKE Y.P. HUT TO RICHMOND S/S. 28c. PILOT CABLE.
SUPPLEMENTARY TO DRG. Nº 713100/WESTERN/F.C. 27. SHT. 1.

8 MILES 60 CHAINS TO 8 MILES 67½ CHAINS.



ROUTE DETAILS.

A to B. BURIED DIRECT, ONE SLAB.



CROSS - SECTION FACING RICHMOND.

P.M.J.

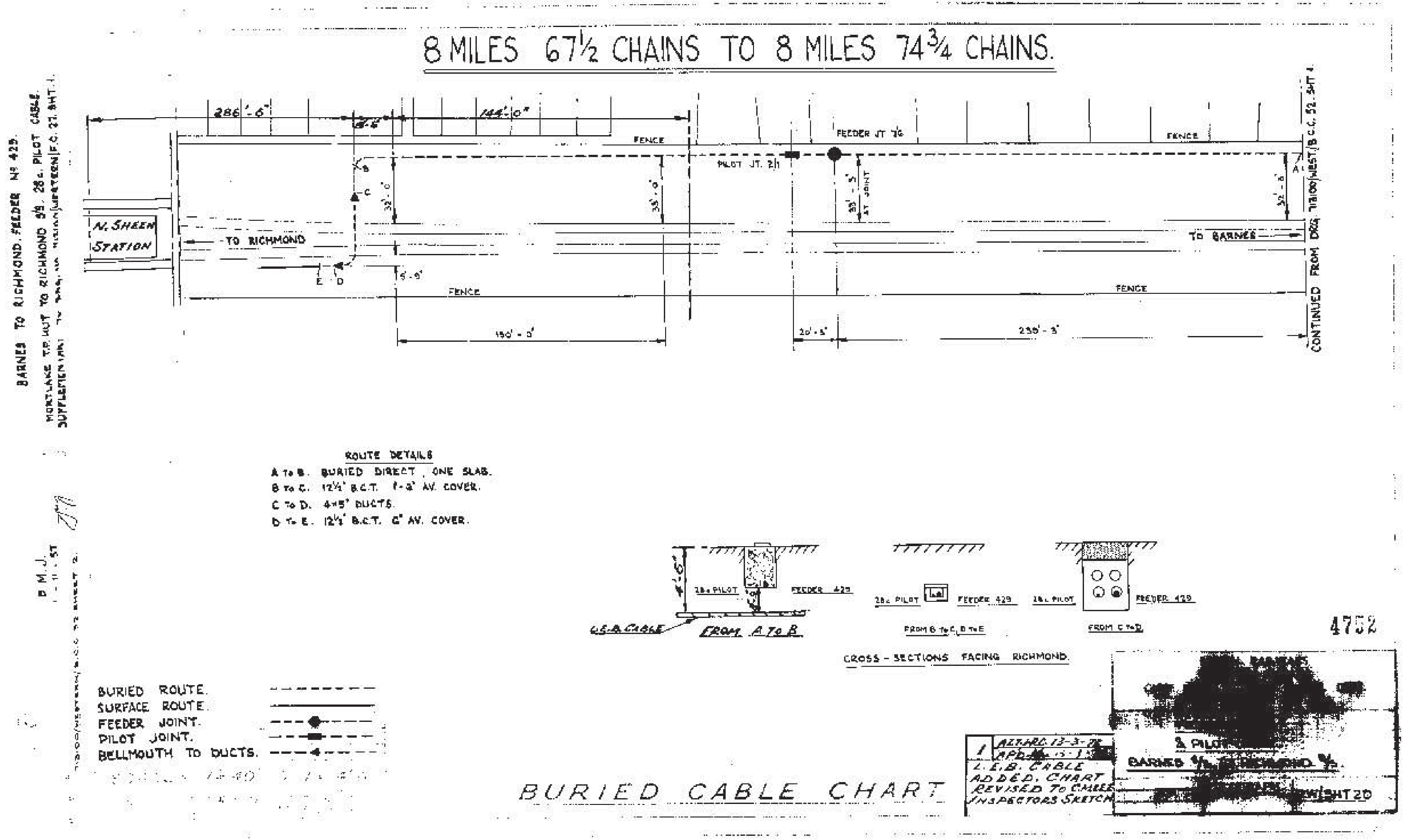
713100/WESTERN/B.C.C. 52. SHEET 1.

BURIED ROUTE. ----------

47233

BRITISH RAILWAYS
SOUTHERN REGION
[illegible] MECH. & ELECT. ENGRS. DEPT.
15, ST. [illegible] ST., S.E.1.

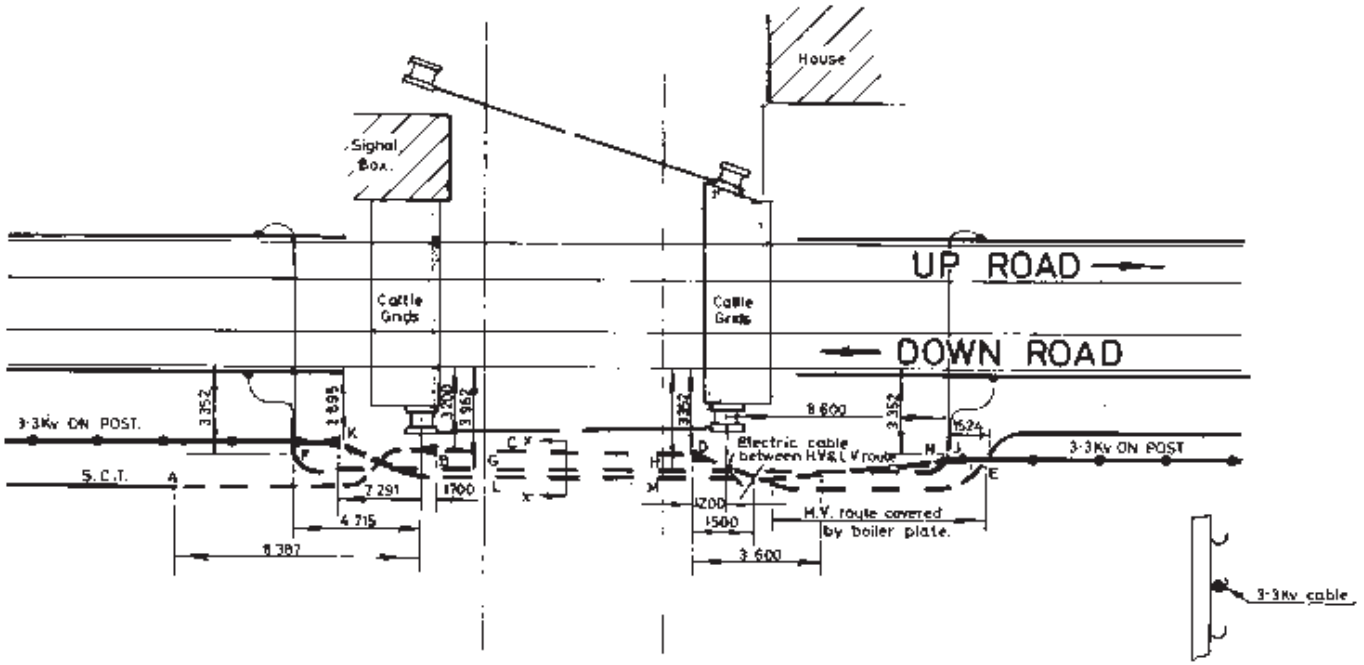
FEEDER Nº429
& PILOT CABLE
BARNES S/s TO RICHMOND S/s.
VELOGRAPH 2W/SHT 19

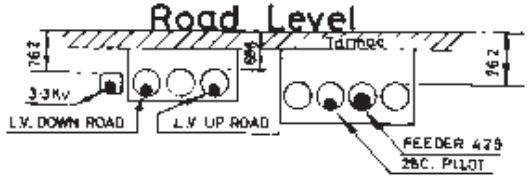

8 MILES 67½ CHAINS TO 8 MILES 74¾ CHAINS.
BARNES TO RICHMOND. FEEDER № 429.
MORTLAKE T.P. HUT TO RICHMOND 3/5. 28 L. PILOT CABLE.
CONTINUED FROM DRG. 11800/WEST/B.C.C. 52. SHT. 1.
286'-6"
144'-0"
FENCE
FEEDER JT 76
PILOT JT. 211
32'-0"
33'-0"
33'-5" ST. JOINT
32'-8"
N. SHEEN STATION
TO RICHMOND
TO BARNES
5'-9"
150'-0"
20'-5"
235'-3"
ROUTE DETAILS
A to B. BURIED DIRECT, ONE SLAB.
B to C. 12½" B.C.T. 1'-2" AV. COVER.
C to D. 4×5" DUCTS.
D to E. 12½" B.C.T. 6" AV. COVER.
4'-6"
28 L PILOT
FEEDER 429
L.E.B. CABLE
FROM A TO B
FROM B to C, D to E
FROM C to D
CROSS-SECTIONS FACING RICHMOND.
BURIED ROUTE.
SURFACE ROUTE.
FEEDER JOINT.
PILOT JOINT.
BELLMOUTH TO DUCTS.
B.M.J.
BURIED CABLE CHART
4752
L.E.B. CABLE ADDED. CHART REVISED TO CABLE INSPECTORS SKETCH
BARNES
RICHMOND
SHT 20

MANOR ROAD CROSSING

TO RICHMOND

TO MORTLAKE





Section across road XX

Standard metric troughing:	S M T.
Bell mouth in inspection chamber.	
Surface route.	
Buried route.	
Lead to ducts.	
Surface feeder joint.	
Buried feeder joint	
Surface pilot joint	
Buried pilot joint.	

Scale: 1 : 200

Dimensions are for route location only & do not refer to cable length

ROUTE DETAILS

H.V. ROUTE.

A — B 12½" B.C.T. FALLS THROUGH BANK TO 762 COVER AT BELLMOUTH.

B — C 4 × 5"A/C TUBES 2 OVER 2 FORMATION 610 COVER TOP TUBES.

C — D SEE SECTION XX.

D — E 12½" B C.T. 6" COVER

L.V. ROUTE.

F — G 3 × 5"A/C TUBES FLAT FORMATION THROUGH BANK TO 686 OF COVER

G — H SEE SECTION XX

H — J 3 × 5"A/C TUBES 686 COVER, SURFACES AT "J"

3·3Kv ROUTE.

K — L CABLE BURIED IN BANK TO 762 COVER AT ROADSIDE.

L — M SEE SECTION XX (IN HOWARD TROUGHING).

M — N CABLE BURIED 686 AVERAGE COVER, SURFACES AT POINT "N"

NOTE

THIS CHART SUPERSEDES THE OLD CHART Nº 2W/21 (Chart redrawn to show new Lifting Barriers, all buried dimensions taken from old chart)

ALL DIMENSION IN MM. UNLESS OTHERWISE STATED

British Railways (S.R.) C.M. & E.E. Dept. Southern House Croydon

FEEDER 429 & 28C PILOT

BARNES S/S TO RICHMOND S/S

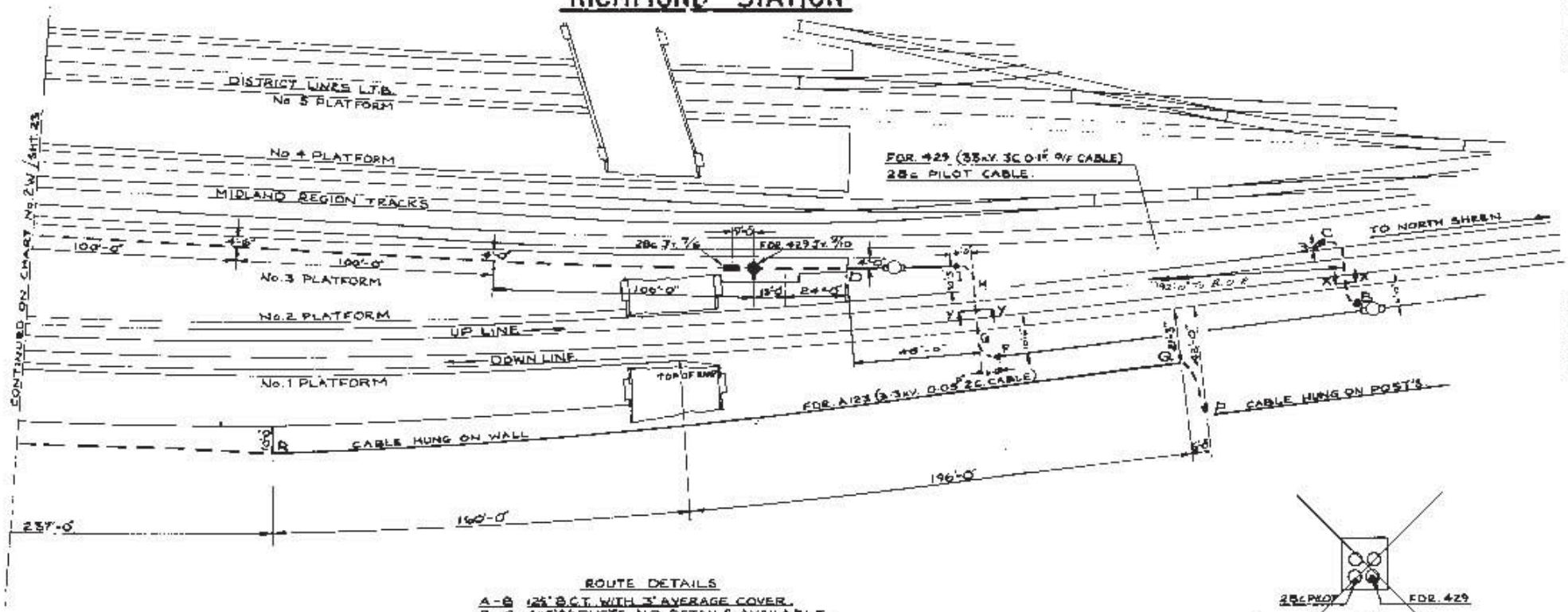
RICHMOND D.P. TO EAST PUTNEY D.P. FEEDER Nº A. 123/8 (3·3 Kv)

Chart Nº 2W/21

BR 968/11

MT 1000438

RICHMOND STATION

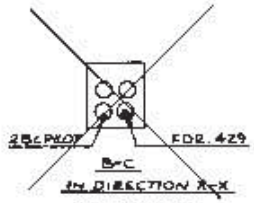


ROUTE DETAILS

A-B	12" B.C.T. WITH 3" AVERAGE COVER.
B-C	4 6" ½ DUCTS NO DETAILS AVAILABLE.
D-E	12" B.C.T DOUBLE LIDS 3" AVERAGE COVER.
F-G	HOWARD TROUGHING 2'-0" DEEP.
B-S	HOWARD TROUGHING NO DETAILS AVAILABLE

CONTINUED ON CHART No 2W/SHT 23

E-G	4 x 5" ½ DUCTS FROM SURFACE TO 3'-4" BELOW RAIL.
G-H	3'-4" BELOW RAIL.
H-I	TO SURFACE.

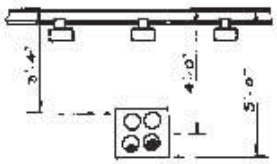


ABANDONED

SURFACE ROUTE	
BURIED ROUTE	
LEAD TO DUCTS	
SURFACE FEEDER JOINT	
BURIED FEEDER JOINT	
SURFACE PILOT JOINT	
BURIED PILOT JOINT	

SCALE : 1" TO 40'-0"

DIMENSIONS ARE FOR ROUTE LOCATION ONLY & DO NOT REFER TO CABLE LENGTH



SECTION Y-Y

2 TRACK CROSSING T.T. ADDED. 4/10/72 APP

CHART REDRAWN TO INCLUDE S.R.N. ROUTE. 4/8/72 APP

BRITISH RAILWAYS
SOUTHERN REGION
CHIEF MECH. & ELEC. ENGRS. DEPT.
SOUTHERN HOUSE CROYDON

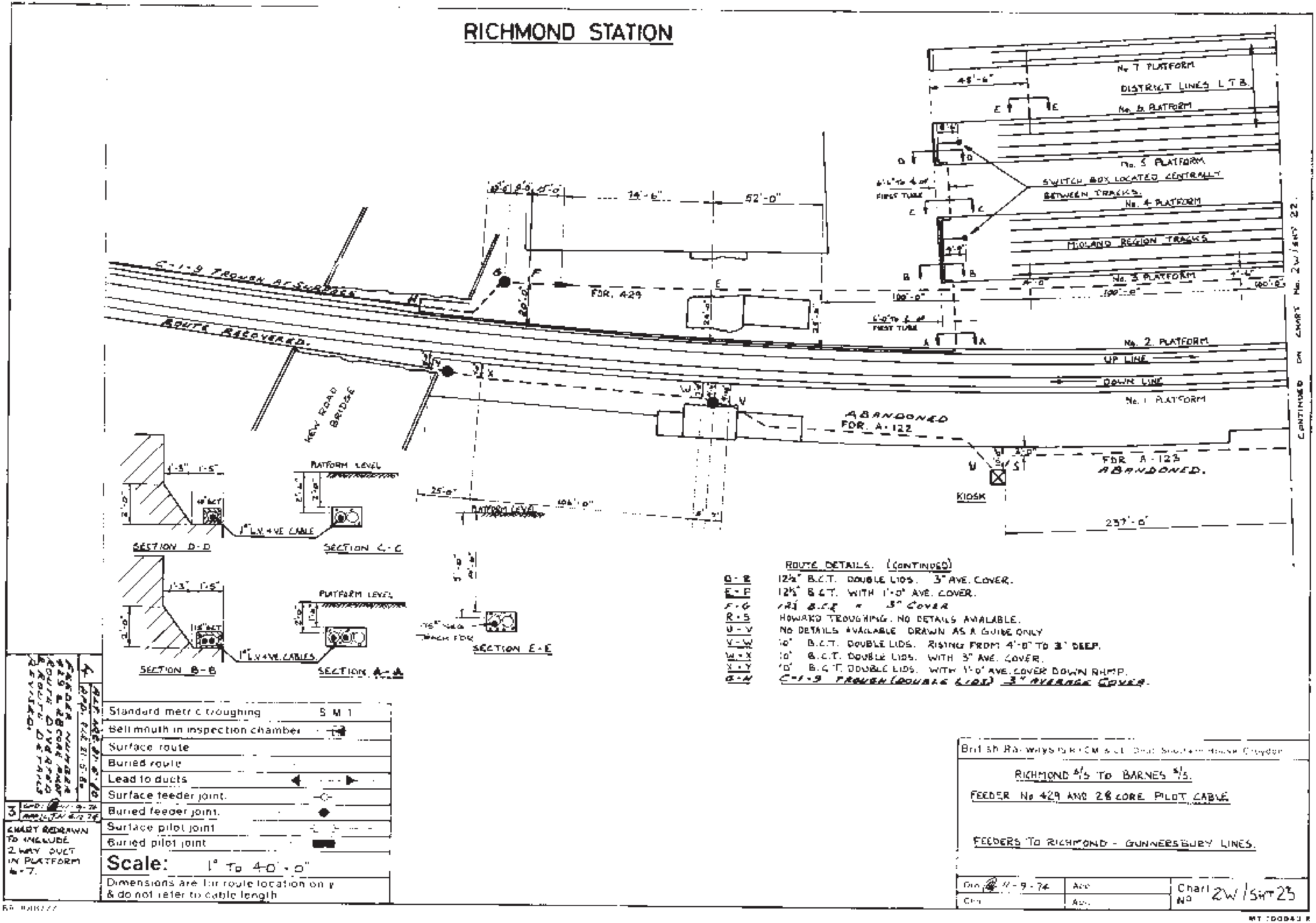
RICHMOND S/S TO BARNES S/S

FEEDER No. 429 AND 20 CORE PILOT CABLE.

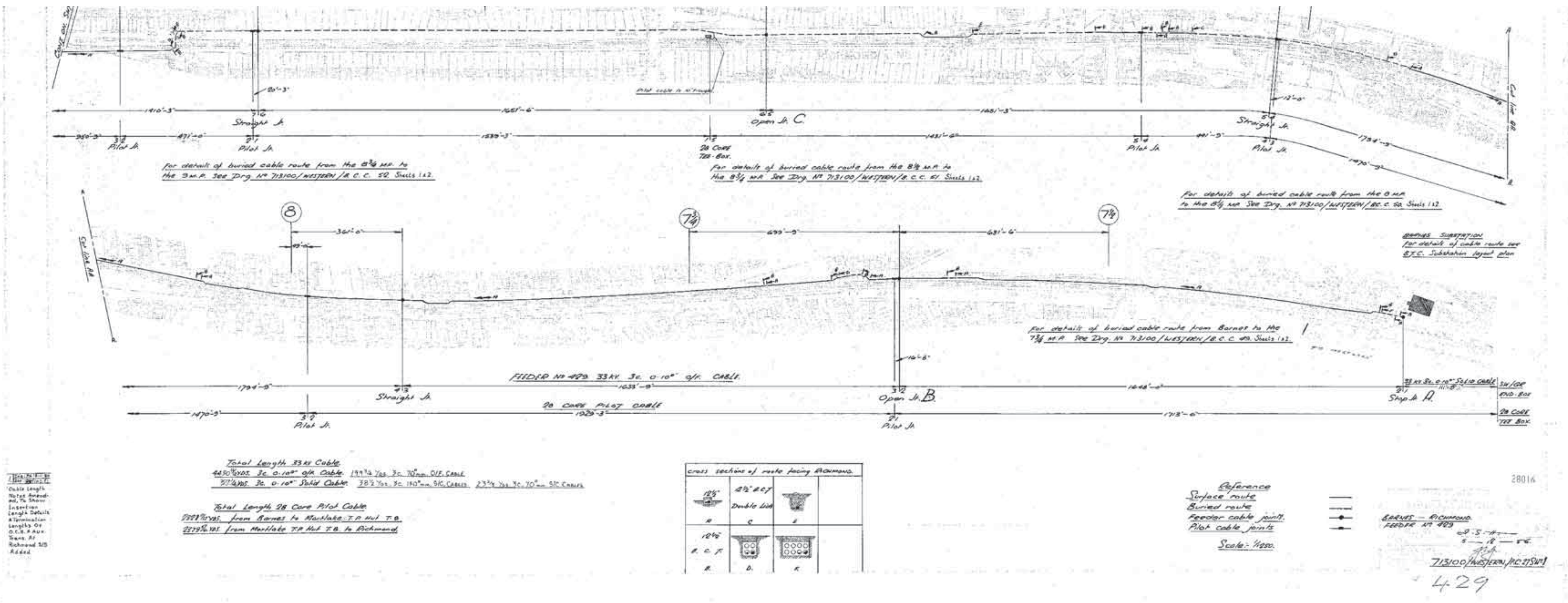
FEEDER No. A 123.

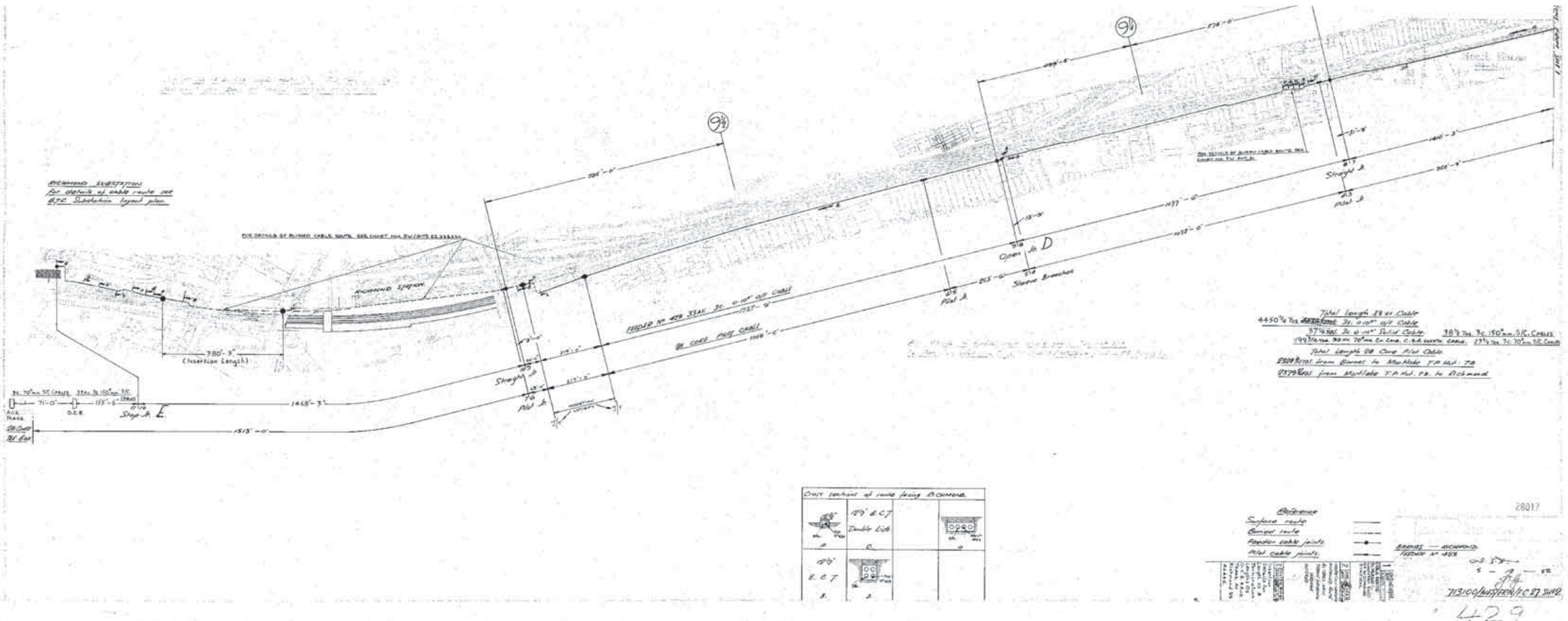
DRN:- AGD:- CHD:- APP:-

CHART No. 2W/SHT. 22



RICHMOND STATION
No. 7 PLATFORM
DISTRICT LINES L.T.B.
No. 6 PLATFORM
No. 5 PLATFORM
SWITCH BOX LOCATED CENTRALLY BETWEEN TRACKS.
No. 4 PLATFORM
MIDLAND REGION TRACKS
No. 3 PLATFORM
No. 2 PLATFORM
UP LINE
DOWN LINE
No. 1 PLATFORM
CONTINUED ON CHART No. 2W/SHT 22.
C-1-9 TROUGH AT SURFACE
ROUTE RECOVERED.
FDR. 429
KEW ROAD BRIDGE
ABANDONED FOR. A-122
FDR. A-123 ABANDONED.
KIOSK
74'-6"
52'-0"
237'-0"
25'-0"
PLATFORM LEVEL
SECTION D-D
SECTION C-C
SECTION B-B
SECTION A-A
SECTION E-E
1" L.V. +VE CABLE
1" L.V. +VE CABLES
ROUTE DETAILS. (CONTINUED)
D-E 12½" B.C.T. DOUBLE LIDS. 3" AVE. COVER.
E-F 12½" B.C.T. WITH 1'-0" AVE. COVER.
F-G 12½ B.C.T. " 3" COVER
R-S HOWARD TROUGHING. NO DETAILS AVAILABLE.
U-V NO DETAILS AVAILABLE. DRAWN AS A GUIDE ONLY
V-W 10" B.C.T. DOUBLE LIDS. RISING FROM 4'-0" TO 3' DEEP.
W-X 10" B.C.T. DOUBLE LIDS. WITH 3" AVE. COVER.
X-Y 10" B.C.T. DOUBLE LIDS. WITH 1'-0" AVE. COVER DOWN RAMP.
G-H C-1-9 TROUGH (DOUBLE LIDS) 3" AVERAGE COVER.
4 ALT. APP.
FEEDER NUMBER 429 & 28 CORE PILOT ROUTE DIVERTED & ROUTE DETAILS REVISED.
3 CHART REDRAWN TO INCLUDE 2 WAY DUCT IN PLATFORM 6-7.
Standard metric troughing S M 1
Bellmouth in inspection chamber
Surface route
Buried route
Lead to ducts
Surface feeder joint.
Buried feeder joint.
Surface pilot joint
Buried pilot joint
Scale: 1" To 40'-0"
Dimensions are for route location only & do not refer to cable length
British Railways S.R. C.M.& E.E. Dept. Southern House Croydon
RICHMOND S/S TO BARNES S/S.
FEEDER No 429 AND 28 CORE PILOT CABLE
FEEDERS TO RICHMOND - GUNNERSBURY LINES.
Drn 11-9-74
Chart No 2W/SHT 23

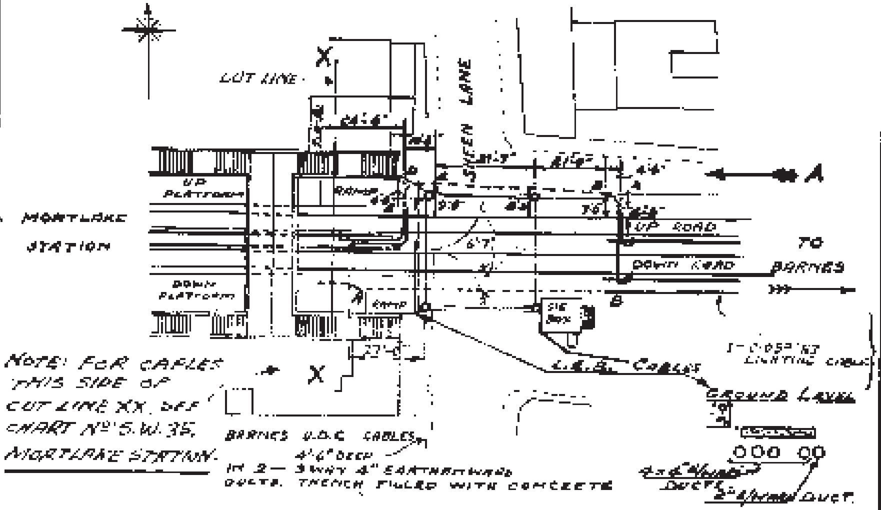

Straight Jt.
Open Jt. C
Pilot Jt.
28 Core Tee-Box.
For details of buried cable route from the 8¾ m.p. to the 9 m.p. See Drg. No 713100/WESTERN/B.C.C. 52 Sheets 1&2.
For details of buried cable route from the 8½ m.p. to the 8¾ m.p. See Drg. No 713100/WESTERN/B.C.C. 51 Sheets 1&2.
For details of buried cable route from the 8 m.p. to the 8½ m.p. See Drg. No 713100/WESTERN/B.C.C. 50 Sheets 1&2.
Barnes Substation for details of cable route see B.T.C. Substation layout plan
For details of buried cable route from Barnes to the 7¾ m.p. See Drg. No 713100/WESTERN/B.C.C. 49 Sheets 1&2.
FEEDER No 429 33 KV. 3c. 0·10" o/r. CABLE.
28 CORE PILOT CABLE
Open Jt. B
Stop Jt. A
Cut line AA
Cut line BB
28 Core Tee Box.
Total Length 33 KV Cable.
4490⅚ YDS. 3c. 0·10" o/r Cable. 199¾ Yds. 3c. 70mm. O/F. Cable
371¼ YDS. 3c. 0·10" Solid Cable. 38½ Yds. 3c. 180mm. S/C. Cables 23¾ Yds. 3c. 70mm. S/C Cables
Total Length 28 Core Pilot Cable.
from Barnes to Mortlake T.P. Hut T.B.
2379⅚ YDS. from Mortlake T.P. Hut T.B. to Richmond.
Cable Length Notes Amended, To Show Insertion Length Details & Termination Lengths Of O.C.B. & Aux. Trans. At Richmond S/S Added
cross sections of route facing Richmond.
Double Lid
Reference
Surface route
Buried route
Feeder cable joints.
Pilot cable joints
Scale:- 1/1250.
BARNES — RICHMOND.
FEEDER No 429
713100/WESTERN/F.C. 27 SH 1
28016
429



RICHMOND SUBSTATION
for details of cable route see
B.T.C. Substation layout plan.
RICHMOND STATION
380'-3" (Insertion Length)
FEEDER No 429 33KV 3c. 0·10" o/f Cable
28 CORE PILOT CABLE
1468'-7"
1515'-0"
795'-0"
Straight Jt.
Pilot Jt.
Stop Jt. E
Open Jt. D
Sleeve Branches
9½
9¼
Total length 33 kV Cable
4450½ Yds. 3c. 0·10" o/f Cable
37¼ Yds. 3c. 0·10" Solid Cable.
38½ Yds. 3c. 150 mm. S/C. CABLES
Total length 28 Core Pilot Cable.
from Barnes to Mortlake T.P. Hut - TB
from Mortlake T.P. Hut. TB. to Richmond
Cross sections of route facing Richmond.
12'0" B.C.T.
Double Lid
Reference
Surface route
Buried route
Feeder cable joints
Pilot cable joints.
BARNES — RICHMOND
FEEDER No 429
28017
713100/WESTERN/FC87 SUPP.
429

SOUTHERN RAILWAY - BURIED CABLE CHARTS.

SHEEN LANE PUBLIC LEVEL CROSSING. MORTLAKE.



A-B. E.H.T., LIGHTING & PILOT CABLES APPX. 92'-0" IN HOWARD TROUGHING 6'-2" DEEP.

LOW VOLTAGE ROUTE

A to E	3 x 4" ?? DUCTS.
A to B	" FALL FROM SURFACE TO 3'-3" COVER
B to C	" 3'-3" COVER.
C to D	" RISE FROM 3'-3" TO BALLAST LEVEL.
D to E	" IN PLATFORM AT BALLAST LEVEL

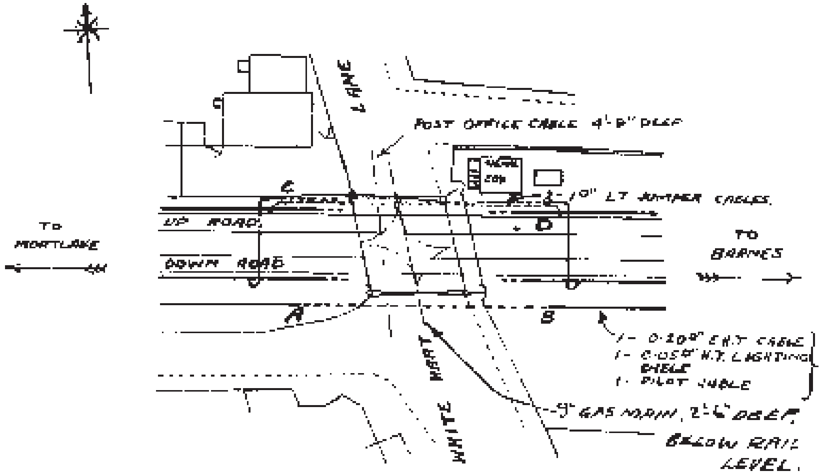
IN DIRECTION ARROW "A"

FOR DETAILS OF E.H.T. CABLE BURIED IN STATION PLATFORM WEST OF "A" SEE CHART Nº S.W.35.

A/23/B (3.3kV. Abandoned between A&B. Cable recovered where possible.

CHART Nº SW36

WHITE HART LANE PUBLIC LEVEL CROSSING. BARNES.



A. - B. E.H.T., LIGHTING & PILOT CABLES APPX. 74'-9" IN HOWARD TROUGHING 6'-3" DEEP.

C.- D. L.T. JUMPER CABLES APPROX. 76'-0" IN WOOD TROUGHING 3'-0" DEEP.

A/23/B. (3.3kV. Abandoned between A&B - Recovered elsewhere)

3839

CHART Nº S.W.37

ALL DEPTHS ARE TO TOP OF ITEM CONCERNED.

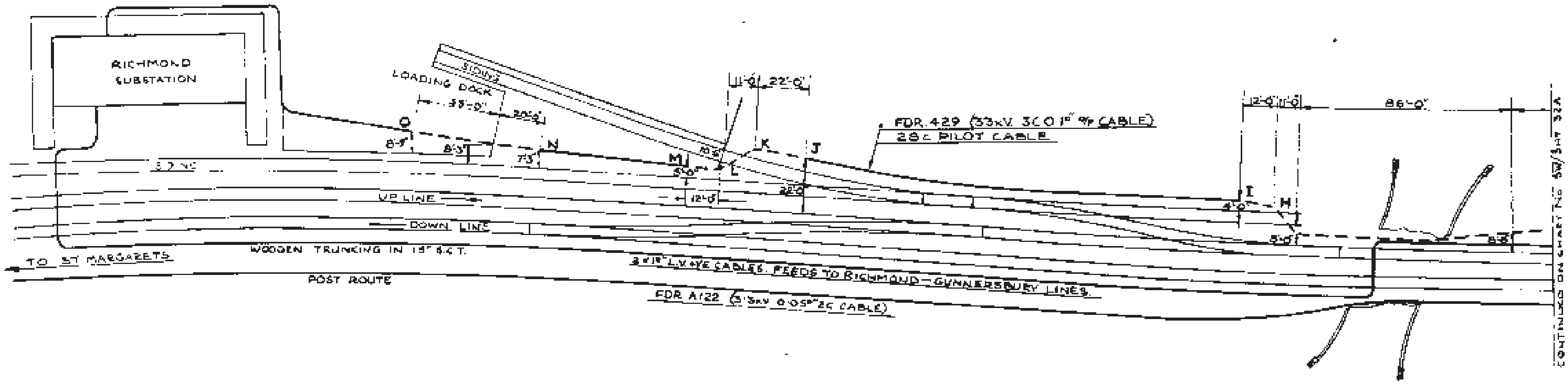
THIS DRAWING SUPERSEDES OLD L.&S.W.Ry. CHART Nos. 23 & 24.

26-11-26

ELECTRICAL ENGINEER, SOUTHERN RAILWAY, WATERLOO, S.E.1

DRG. Nº B-759C

RICHMOND SUBSTATION & SIDINGS.



ROUTE DETAILS (CONTINUED)

G-H	12" B.C.T. WITH 2'-6" AVERAGE COVER.
H-I	12" B.C.T. RISING FROM 2'-6" TO SURFACE.
J-K	12" B.C.T. FALLING FROM SURFACE TO 2'-6" DEEP
K-L	12" B.C.T. 2'-6" DEEP
L-M	12" B.C.T. RISING FROM 2'-6" TO SURFACE.
N-O	12" B.C.T. RISING THROUGH LOADING DOCK WITH 2'-6" COVER.

A121/2 (3·3kV. Abandoned H-I, J-M, N-O, Recovered elsewhere).

SURFACE ROUTE	
BURIED ROUTE	
LEAD TO DUCTS	
SURFACE FEEDER JOINT	
BURIED FEEDER JOINT	
SURFACE PILOT JOINT	
BURIED PILOT JOINT	
SCALE 1" TO 40'-0"	
DIMENSIONS ARE FOR ROUTE LOCATION ONLY & DO NOT REFER TO CABLE LENGTH	

CHART WAS PART OF 2W/SHT. 23 AND SW. 32.

CHD: [illegible]
APP:
AGD:

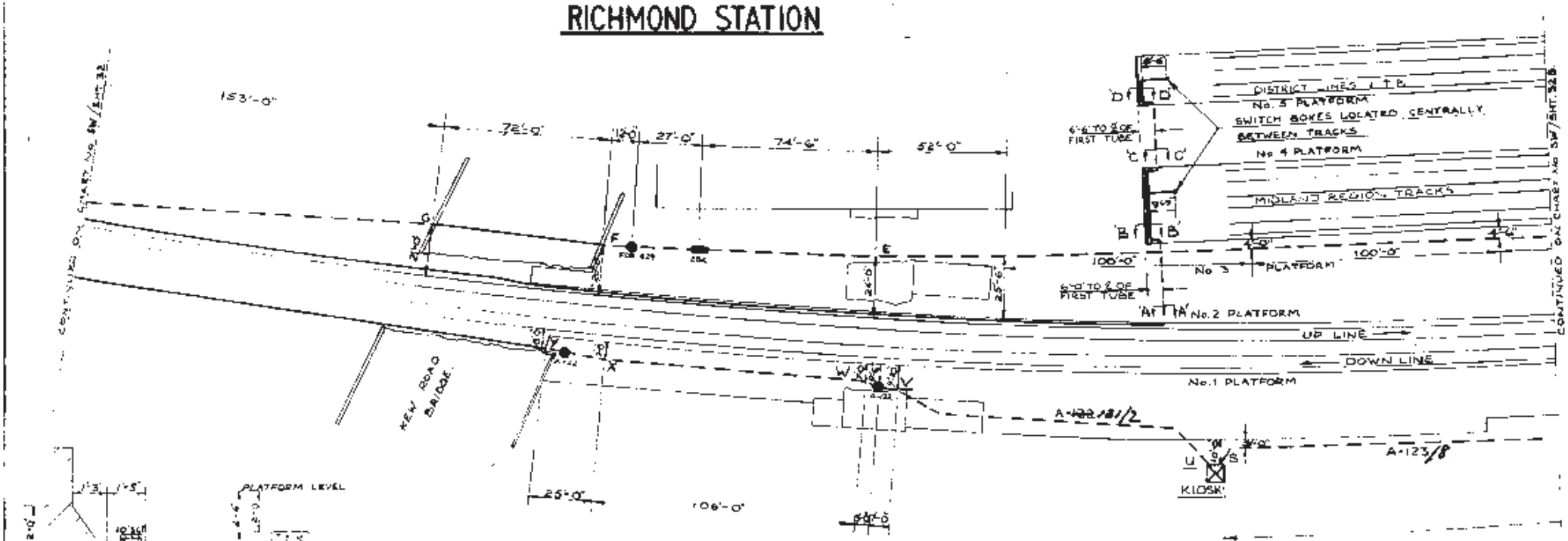
BRITISH RAILWAYS
SOUTHERN REGION
CHIEF MECH. & ELEC. ENGRS. DEPT.
SOUTHERN HOUSE CROYDON

RICHMOND S/S TO BARNES S/S
FEEDER No. 429 AND 28 CORE PILOT CABLE.
FEEDER No. A-122.
FEEDERS TO RICHMOND – GUNNERSBURY LINES.

DRN:–
CHD:–
APP:–
AGD:–

CHART No. SW/SHT. 32

RICHMOND STATION



ROUTE DETAILS (CONTINUED)

D-E	12½" B.C.T. (DOUBLE LIDS) 3' AVERAGE COVER.
E-F	12½" B.C.T. WITH 1'-0" AVERAGE COVER.
G-H	12½" B.C.T. WITH 2'-6" AVERAGE COVER.
R-S	HOWARD TROUGHING. NO DETAILS AVAILABLE.
U-V	NO DETAILS AVAILABLE. DRAWN AS A GUIDE ONLY.
V-W	10" B.C.T. (DOUBLE LIDS) RISING FROM 4'-3" TO 3'-0" (±).
W-X	10" B.C.T. (DOUBLE LIDS) WITH 3" AVERAGE COVER.
X-Y	10" B.C.T. (DOUBLE LIDS) WITH 1'-0" COVER DOWN RAMP

A 121/2 (3-3 AV. Abandoned. U-V - V-W - W-X Recovered eliminate. A123/8 (3-3 AV. Abandoned 5 no 2.)

SURFACE ROUTE	
BURIED ROUTE	
LEAD TO DUCTS	
SURFACE FEEDER JOINT	
BURIED FEEDER JOINT	
SURFACE PILOT JOINT	
BURIED PILOT JOINT	
SCALE 1" TO 40'-0"	
DIMENSIONS ARE FOR ROUTE LOCATION ONLY & DO NOT REFER TO CABLE LENGTH	

CHART REDRAWN TO INCLUDE RE-ROUTING OF FDRS. 429 & A122. DETAILS SUPPLIED BY CATM 2

2

BRITISH RAILWAYS
SOUTHERN REGION
CHIEF MECH. & ELEC. ENGRS. DEPT.
SOUTHERN HOUSE CROYDON

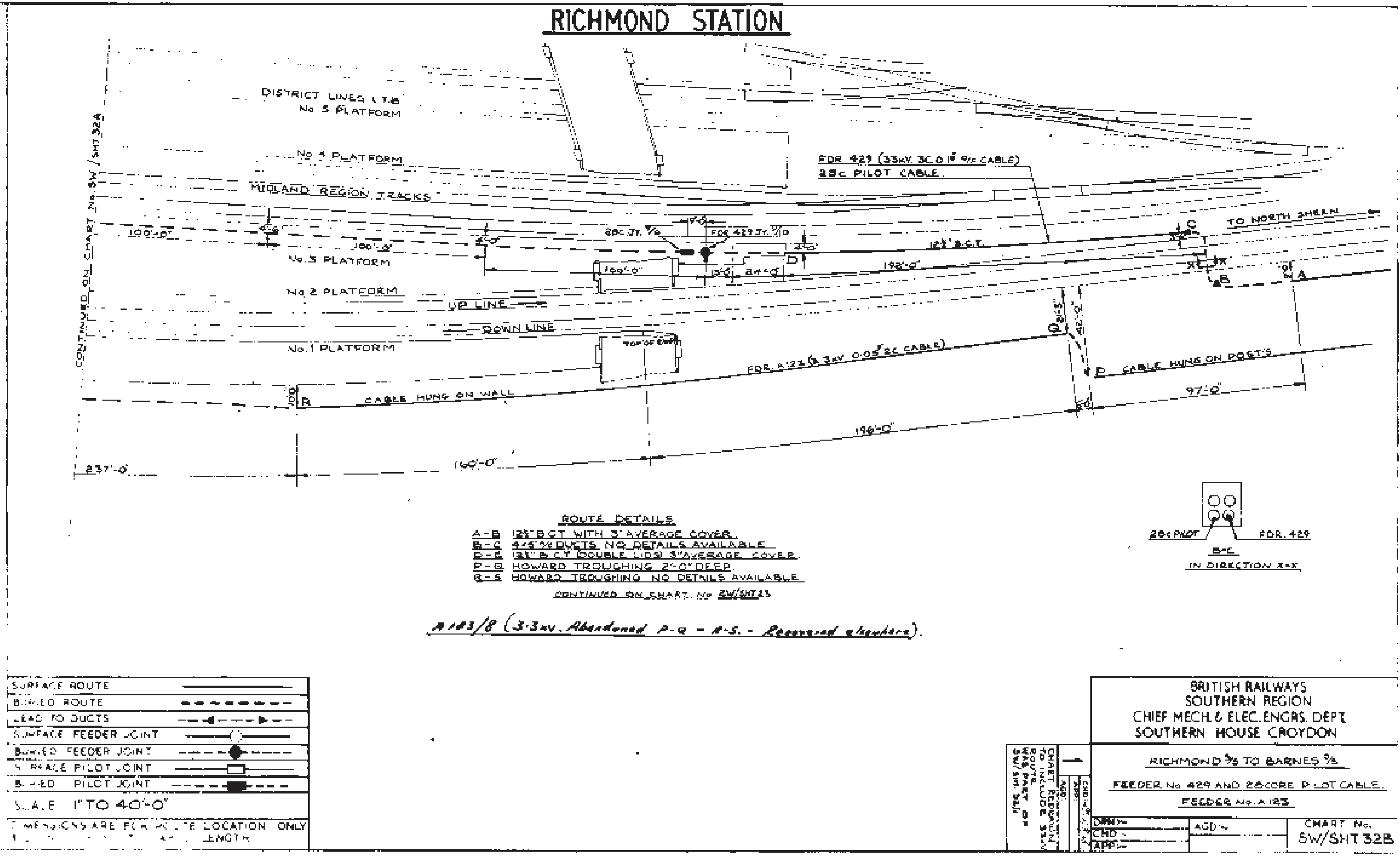
RICHMOND 5/5 TO BARNES 5/5

FEEDER No. 429 AND 28 CORE PILOT CABLE

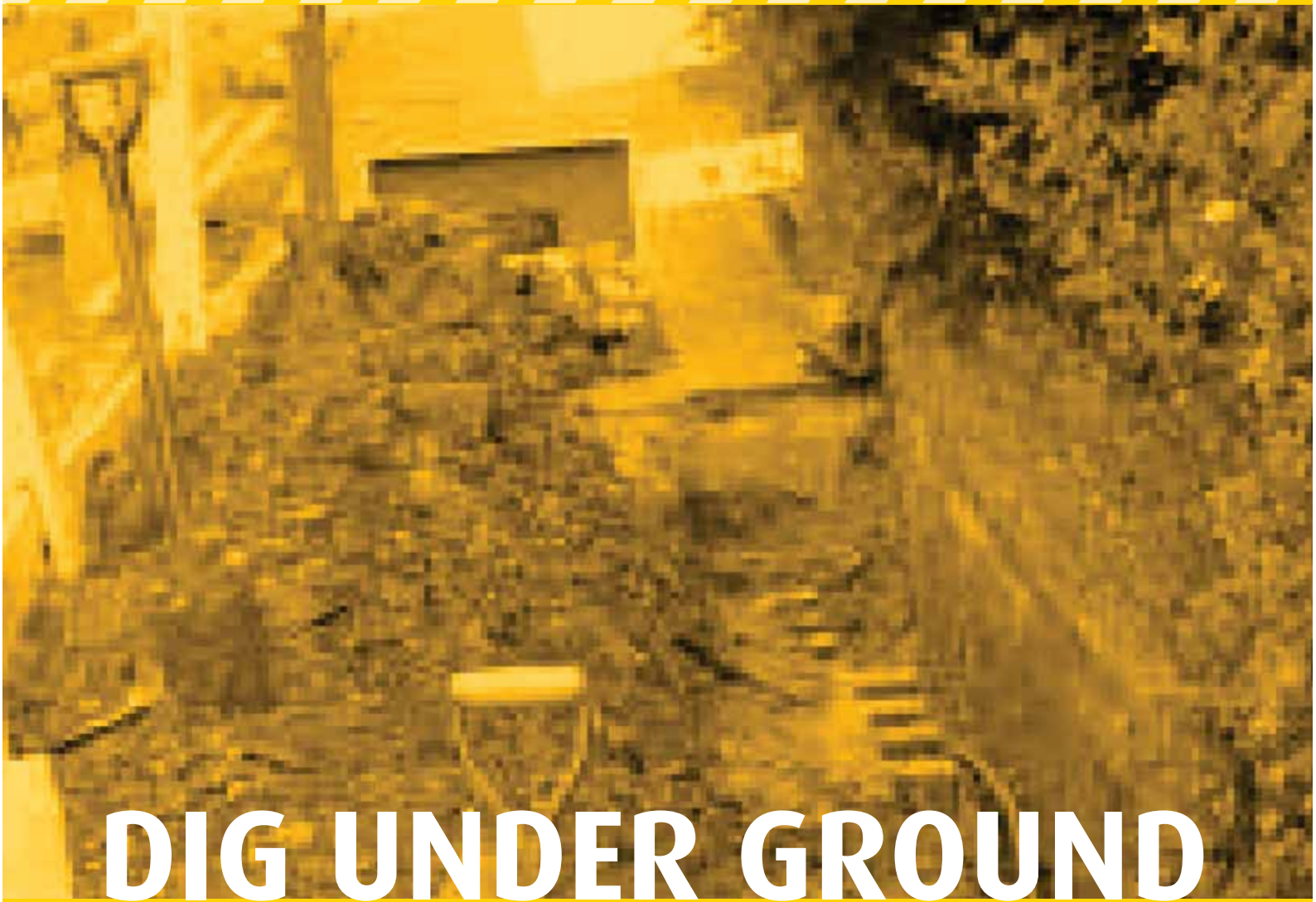
FEEDER Nos. A122 AND A123

FEEDERS TO RICHMOND - GUNNERSBURY LINES

DRN:-	AGD:-	CHART No.
CHD:-		SW/SHT 32A
APP:-		


RICHMOND STATION
DISTRICT LINES L.T.B
No 5 PLATFORM
No 4 PLATFORM
MIDLAND REGION TRACKS
No.3 PLATFORM
No 2 PLATFORM
UP LINE
DOWN LINE
No.1 PLATFORM
FDR 429 (33KV. 3C 0.1 □/□ CABLE)
28c PILOT CABLE.
TO NORTH SHEEN
FDR. A123 (3.3KV 0.05 2C CABLE)
CABLE HUNG ON WALL
CABLE HUNG ON POSTS
CONTINUED ON CHART No SW/SHT 32A
100'-0"
190'-0"
196'-0"
97'-0"
237'-0"
192'-0"
ROUTE DETAILS
A-B 12½" B.C.T WITH 3' AVERAGE COVER.
B-C 4×5" □/□ DUCTS NO DETAILS AVAILABLE
D-E 12½" B.C.T (DOUBLE LIDS) 3' AVERAGE COVER
P-Q HOWARD TROUGHING 2'-0" DEEP.
R-S HOWARD TROUGHING NO DETAILS AVAILABLE
CONTINUED ON CHART No SW/SHT 23
A123/B (3.3KV. Abandoned P-Q - R-S. - Recovered elsewhere).
28c PILOT
FDR. 429
B-C
IN DIRECTION X-X
SURFACE ROUTE
BURIED ROUTE
LEAD TO DUCTS
SURFACE FEEDER JOINT
BURIED FEEDER JOINT
SURFACE PILOT JOINT
BURIED PILOT JOINT
SCALE 1" TO 40'-0"
BRITISH RAILWAYS
SOUTHERN REGION
CHIEF MECH. & ELEC. ENGRS. DEPT.
SOUTHERN HOUSE CROYDON
RICHMOND S/S TO BARNES S/S
FEEDER No 429 AND 28CORE PILOT CABLE.
FEEDER No. A 123
CHART REDRAWN TO INCLUDE 33KV ROUTE WAS PART OF SW/SHT 32A
DRN.
CHD.
APP.
AGD.
CHART No.
SW/SHT 32B

Think
before you...



DIG UNDER GROUND

UK Power Networks

THINK . . .

Every year people are killed or seriously injured in incidents involving underground electricity cables.

THE DANGER

Underground cables carry a powerful electrical charge which can be conducted through machinery and equipment with fatal consequences. Anyone working close to live underground cables should take time to read this simple safety leaflet and identify the precautions they should be taking.

WHO IS AT RISK?

People in construction, demolition, agriculture, infrastructure or anywhere else where excavation is taking place. That is why it is vital everyone working on or visiting a working site is fully aware of the hazards and the steps that must be taken to avoid them.

HOW INCIDENTS HAPPEN

Sadly, accidents where excavators, breakers or other tools make contact with power cables are not uncommon. Where equipment or machinery is used near underground cables the risk must be considered and controlled in the interests of everyone.

THINK AHEAD

Get the basics right. Familiarise yourself with the site. Mark the route of underground cables running across the site on all plans circulated to staff. Find out if the work could be carried out away from the cables, or avoided all together.

UK Power Networks is committed to safety and actively encourages anyone undertaking work to contact us in advance for advice and free cable locating maps.

These will help you avoid our underground cables during your work, which is vital for your safety as well as ensuring we can provide a reliable supply of electricity.

For free maps and advice call **0800 056 5866** or write to:
Plan Provision
UK Power Networks
Fore Hamlet
Ipswich
IP3 8AA
plans@ukpowernetworks.co.uk

We can advise you on what steps to take if essential work is necessary close to underground cables and help ensure safe working practises are implemented.

Good management reduces the risk of accidents. With proper planning and control, workers should not come into contact with underground cables.

If excavation work forms a part of your day-to-day activities obtain a copy of the Health & Safety Executive's Guidance Note "Avoiding Danger from Underground Services" HSG47, which is free to download from the HSE's website - **www.hse.gov.uk/pubns/priced/hsg47.pdf**

WHAT TO DO

- **Have cable drawings and records on site**, know how to read them and check them before starting work. Be aware that not all cables may be shown on the records.
- **Look around for anything in the vicinity** that would have an electricity service, such as street lights, CCTV cameras, phone boxes, etc. as well as the more obvious things like houses and industrial units.
- **Always** use a cable avoidance tool (CAT) to survey the entire site before digging commences. Once found, mark cable positions with spray paint or similar. Do not forget to use encroachment lines as well.
- **Dig trial holes**, by hand, alongside the indicated route of the cables(s).
- Use spades and shovels with **insulated handles** in preference to forks and picks.
- **Make sure everyone** on site, including visitors, **understand the risks**.
- If there is a **cable encased in concrete** contact **UK Power Networks to agree a safe method of work**. This may mean making the cable dead.
- Before demolishing a building **make sure that supplies are disconnected,** preferably well clear of the work area. For guidance on how to arrange a disconnection visit www.ukpowernetworks.co.uk – Our Services
- Have the **emergency contact telephone number** easily available on site.

WHAT NOT TO DO

- Never allow anyone near a damaged or suspected damaged cable or joint.
- Do not handle or attempt to alter the position of a cable or joint.
- Never assume that cables run in straight lines, they may be deflected around underground obstacles.
- Do not use mechanical excavator or powered digging tool within the vicinity of known cables.
- Never knock a road pin, or forcibly throw a spiked digging tool into the ground, without checking what is below the surface.

IF A CABLE IS DAMAGED

Notify UK Power Networks immediately:

London 0800 028 0247
East of England 0800 783 8838
South East 0800 783 8866

Call the emergency services if anyone is injured. Anyone who has received an electrical shock should go to hospital as damage may have occurred to the heart.

Always **treat the cable(s) as live** even if they are not sparking. Cables can be re-energised at any time without warning.

Never remove anything that is stuck **in a cable.**

Keep everyone well away from the area of the damage.

Do NOT attempt to remove anything that is in contact with the cable.

PLAN IT OUT

CHECK IT OUT BEFORE YOU DIG UNDER GROUND

DANGER OF DEATH

THINK BEFORE YOU DIG

Call the network operator

0800 587 3243

www.ukpowernetworks.co.uk

If you are unsure of your network operator then please visit www.energynetworks.org

UK Power Networks,
Registered office: Newington House, 237 Southwark Bridge Road, London SE1 6NP
Registered in England and Wales No: 3870728

UK Power Networks

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks (Operations) Limited

Our Ref: 14871202 Your Ref: 28836

Monday, 18 February 2019

Jessica Western
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Dear Jessica Western

Thank you for contacting us regarding UK Power Networks equipment at the above site. I have enclosed a copy of our records which show the electrical lines and/or electrical plant. I hope you find the information useful.

I have also enclosed a fact sheet which contains important information regarding the use of our plans and working around our equipment. Safety around our equipment is our number one priority so please ensure you have completed all workplace risk assessments before you begin any works.

Should your excavation affect our Extra High Voltage equipment (6.6 KV, 22 KV, 33 KV or 132 KV), please contact us to obtain a copy of the primary route drawings and associated cross sections.

If you have any further queries do not hesitate to contact us.

Plan Provision
0800 056 5866

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks (Operations) Limited

This information is made available to you on the terms set out below. If you do not accept the terms of use set out in this fact sheet please do not use the plans and return them to UK Power Networks.

1. UK Power Networks does not warrant that the information provided to you is correct. You rely upon it at your own risk.

2. UK Power Networks does not exclude or limit its liability if it causes the death of any person or causes personal injury to a person where such death or personal injury is caused by its negligence.

3. Subject to paragraph 2 UK Power Networks has no liability to you in contract, in tort (including negligence), for breach of statutory duty or otherwise how for any loss, damage, costs, claims, demands, or expenses that you or any third party may suffer or incur as a result of using the information provided whether for physical damage to property or for any economic loss (including without limitation loss of profit, loss of opportunity, loss of savings, loss of goodwill, loss of business, loss of use) or any special or consequential loss or damage whatsoever.

4. The information about UK Power Networks electrical plant and/or electric lines provided to you belongs to and remains the property of UK Power Networks. You must not alter it in any respect.

5. The information provided to you about the electrical plant and/or electric lines depicted on the plans may NOT be a complete record of such apparatus belonging to UK Power Networks. The information provided relates to electric lines and/or electrical plant belonging to UK Power Networks that it believes to be present but the plans are not definitive: other electric lines and/or electrical plant may be present and that may or may not belong to UK Power Networks.

6. Other apparatus not belonging to UK Power Networks is not shown on the plan. It is your responsibility to make your own enquiries elsewhere to discover whether apparatus belonging to others is present. It would be prudent to assume that other apparatus is present.

7. You are responsible for ensuring that the information made available to you is passed to those acting on your behalf and that all such persons are made aware of the contents of this letter.

8. Because the information provided to you may not be accurate, you are recommended to ascertain the presence of UK Power Networks electric lines and/or electrical plant by the digging of trial holes. Trial holes should be dug by hand only.

   Excavations must be carried out in line with the Health and Safety Executive guidance document HSG 47. We will not undertake this work. A copy of HSG 47 can be obtained from the Health and Safety Executives website.

   All electric lines discovered must be considered LIVE and DANGEROUS at all times and must not be cut, resited, suspended, bent or interfered with unless specially authorised by UK Power Networks.

   The electric line and electrical plant belonging to UK Power Networks remains so even when made dead and abandoned and any such electric line and/or electrical plant exposed shall be reported to UK Power Networks.

   Where your works are likely to affect our electric lines and/or electrical plant an estimate of the price of any protective /diversionary works can be prepared by UK Power Networks Branch at Metropolitan House, Darkes Lane, Potters Bar, Herts. , EN6 1AG, telephone no. 0845 2340040

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks (Operations) Limited

9 Any work near to any overhead electricity lines must be carried out by you in accordance with the Health and Safety Executive guidance document GS6 and the Electricity at Work Regulations.

The GS6 Recommendations may be purchased from HSE Books or downloaded from the Energy Networks Association's website.

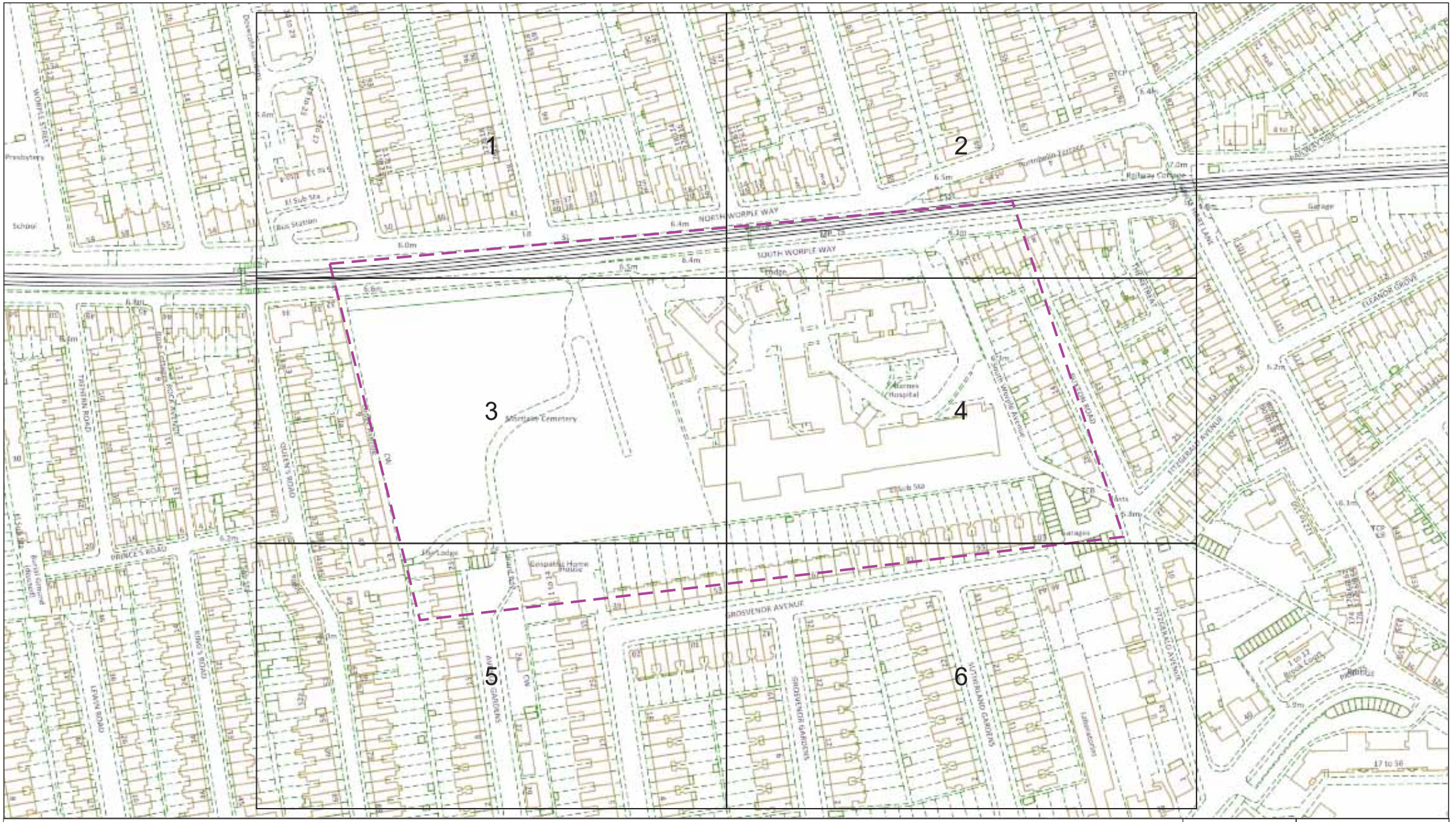
If given a reasonable period of prior notice UK Power Networks will attend on site without charge to advise how and where "goal posts" should be erected. If you wish to use this service, in the first instance please telephone: 0845 6014516 between 08:30 and 17:00 Monday to Friday.

10. You are responsible for the security of the information provided to you. It must not be given, sold or made available upon payment of a fee to a third party.

11. If in carrying out work on land in, on, under or over which is installed an electric line and/or electrical plant that belongs to UK Power Networks you and/or anyone working on your behalf damages (however slightly) that apparatus you must inform immediately UK Power Networks by our emergency 24 hour three digit telephone number **105** providing;

- your name, address and telephone number;
- the date, time and place at which such damage was caused;
- a description of the electric line and/or electrical plant to which damage was caused;
- the name of the person whom it appears to you is responsible for that damage;
- the nature of the damage.

12. The expression "UK Power Networks" includes UK Power Networks (EPN) plc, UK Power Networks (LPN) plc, UK Power Networks (SEPN) plc, UK Power Networks and any of their successors and predecessors in title.



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This plan must be used with the attached 'Symbols' document.

Date Requested: 18/02/2019
Job Reference: 14871202
Site Location: 520915 175488
Requested by:
Mrs Jessica Western
Your Scheme/Reference: 28836

Scale: 1:1538 (When plotted at A3)

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7. Please be aware that electric cables/lines belonging to other owners of licensed electricity distribution systems may be present and it is your responsibility to identify their location.

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3. Subject to paragraph 2 UK Power Networks has no liability to you in contract, in tort (including negligence), for breach of statutory duty or otherwise for any loss, damage, cost, claims, demands, or expenses that you or any third party may suffer or incur as a result of using the information provided whether for physical damage to property or for any economic loss (including without limitation loss of profit, loss of opportunity, loss of savings, loss of goodwill, loss of business, loss of use) or any special or consequential loss or damage whatsoever.
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UK Power Networks

IF IN DOUBT - ASK!
PHONE 0800 056 5866
EMERGENCY - If you damage a cable or line
Phone 0800 783 8838
(24hrs) URGENTLY

ALWAYS LOOK UP BEFORE YOU START WORK
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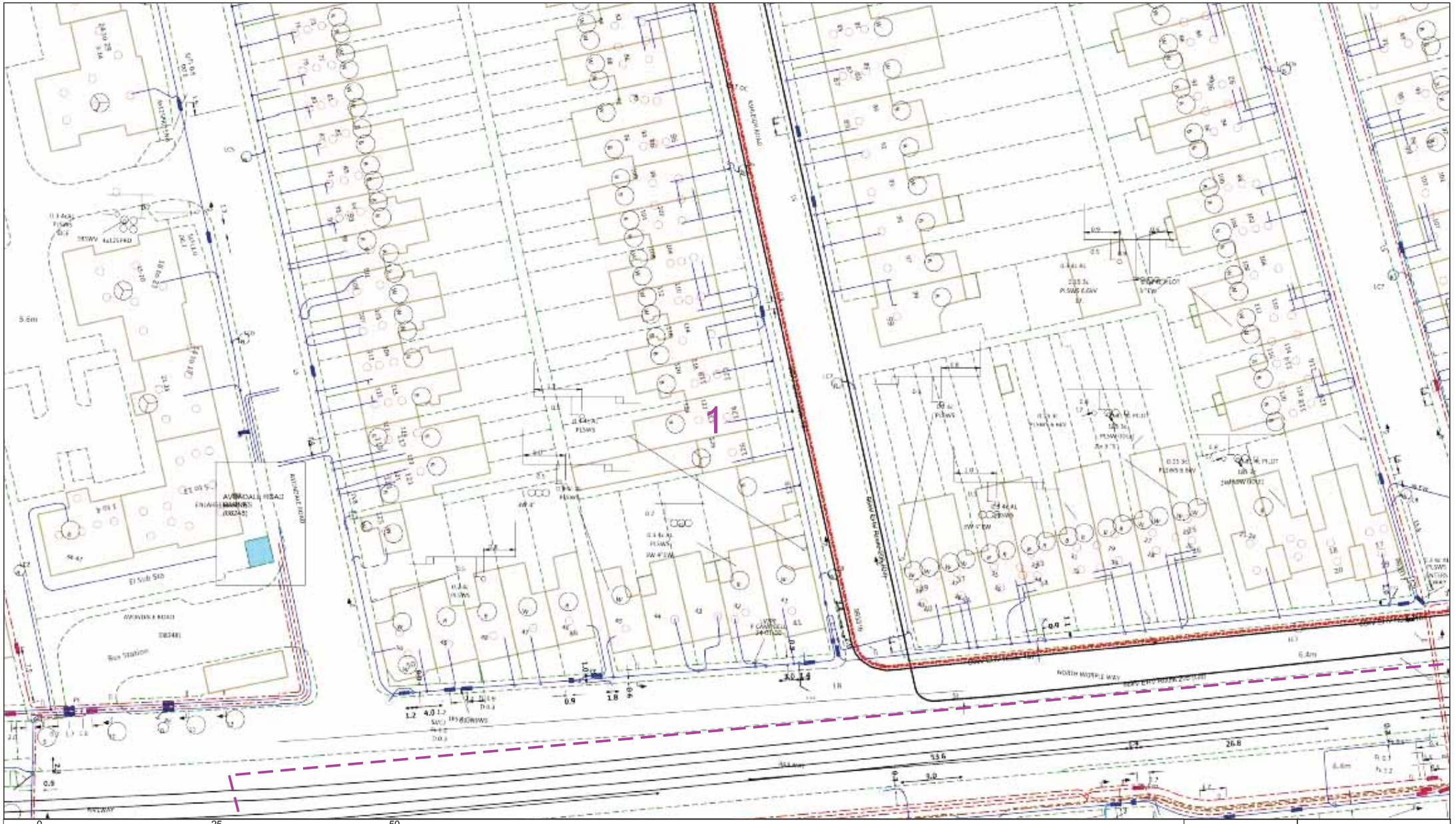

0 25 50
metres

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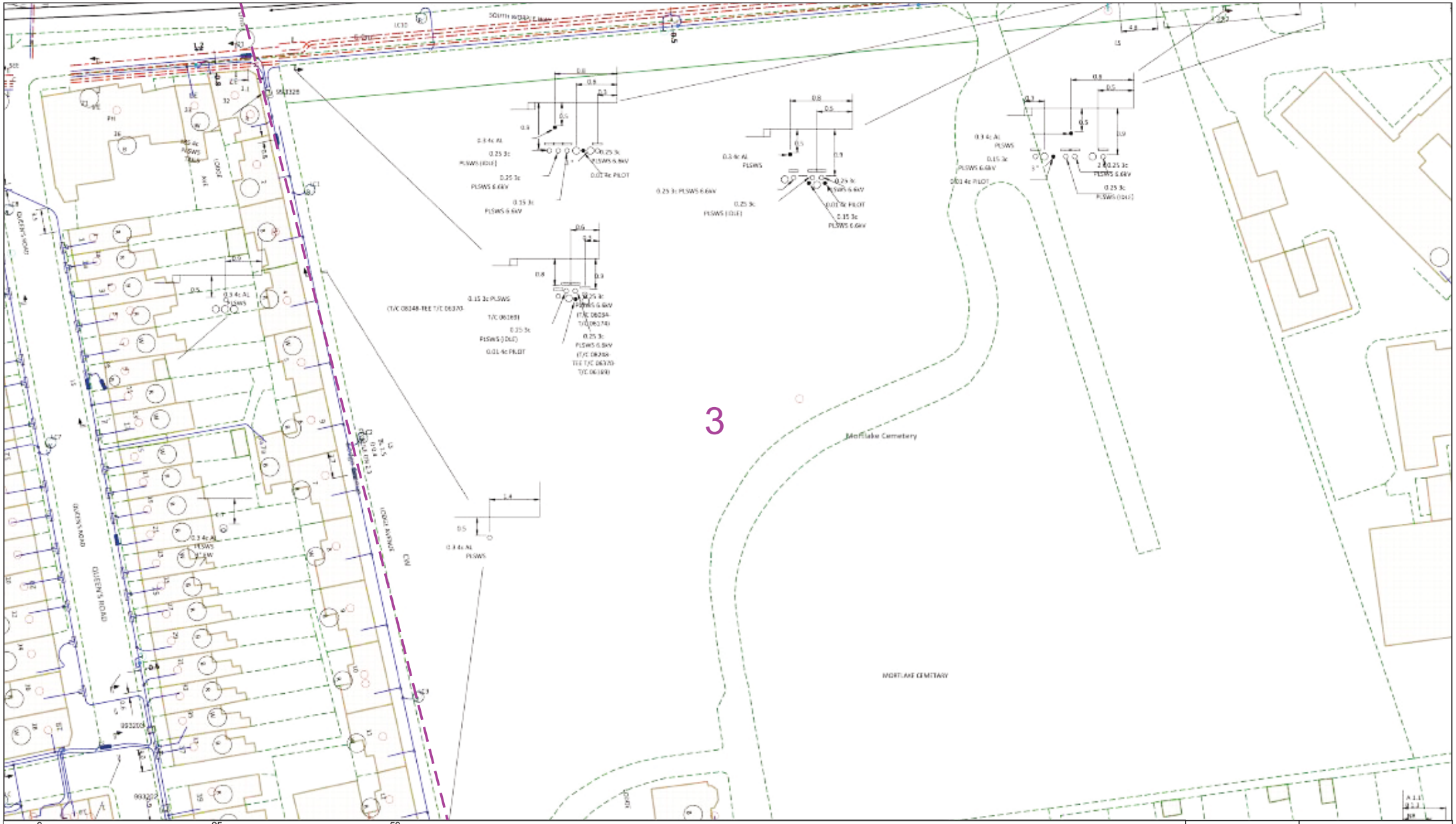

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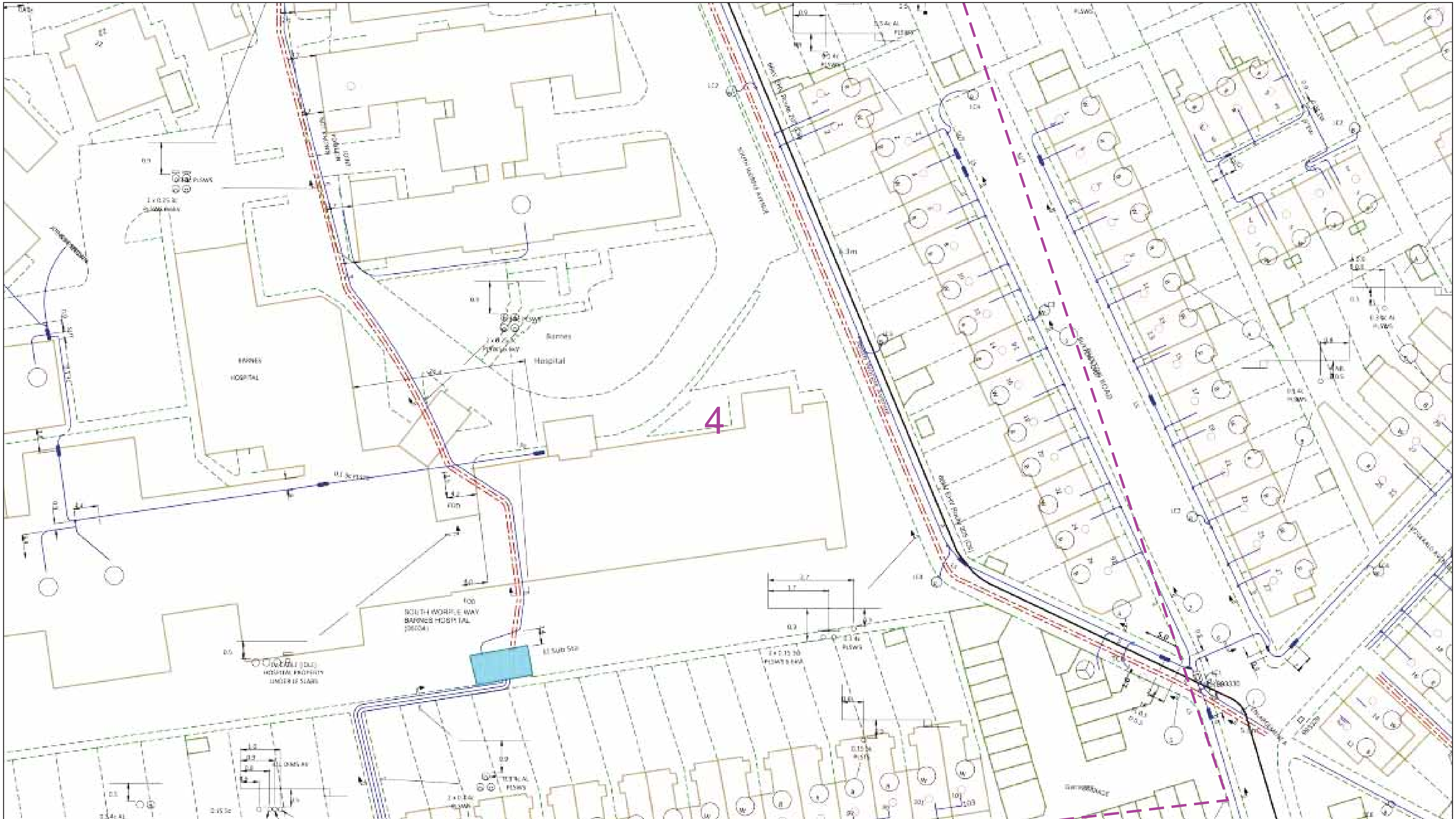

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0 25 50
metres

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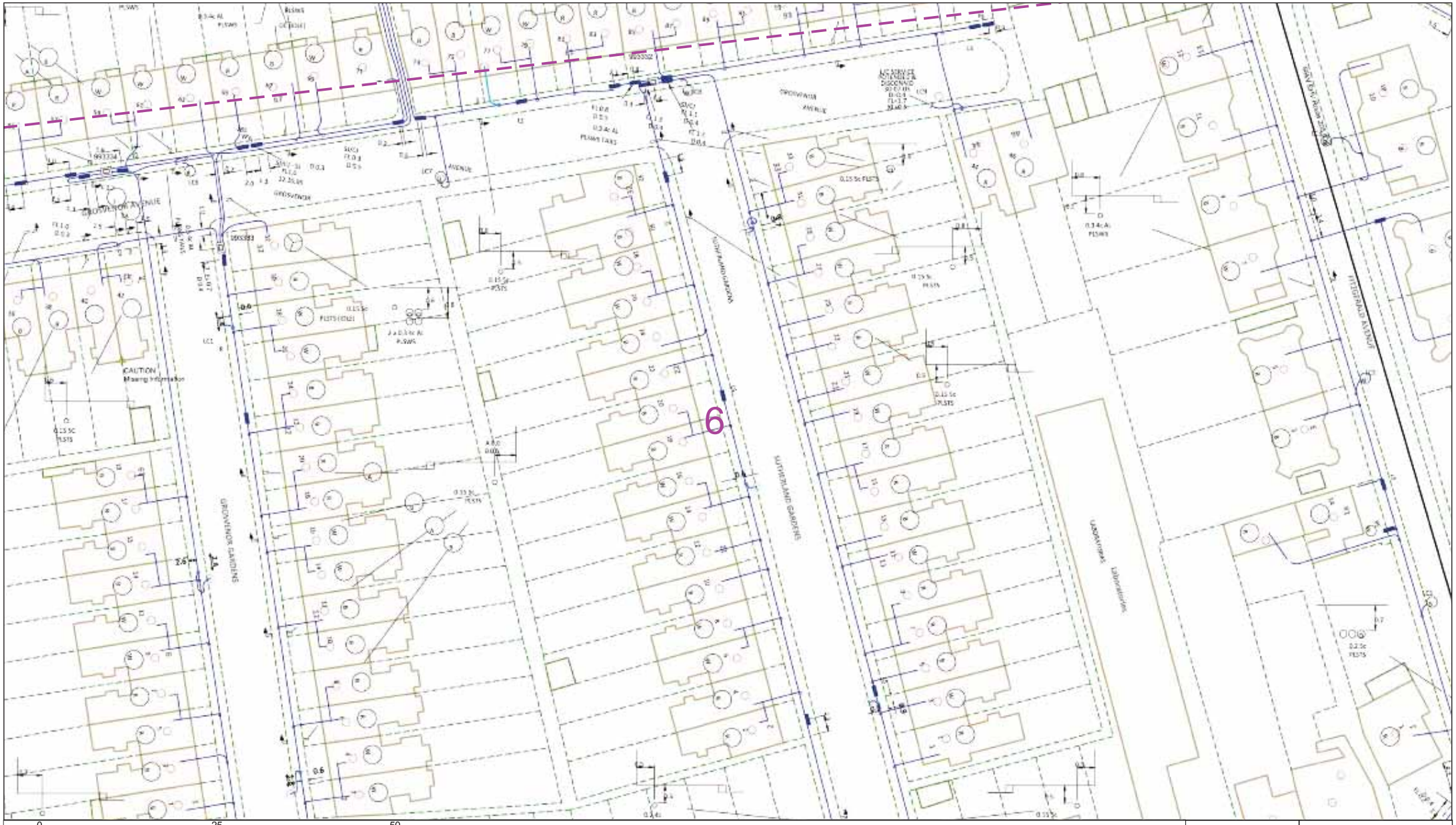

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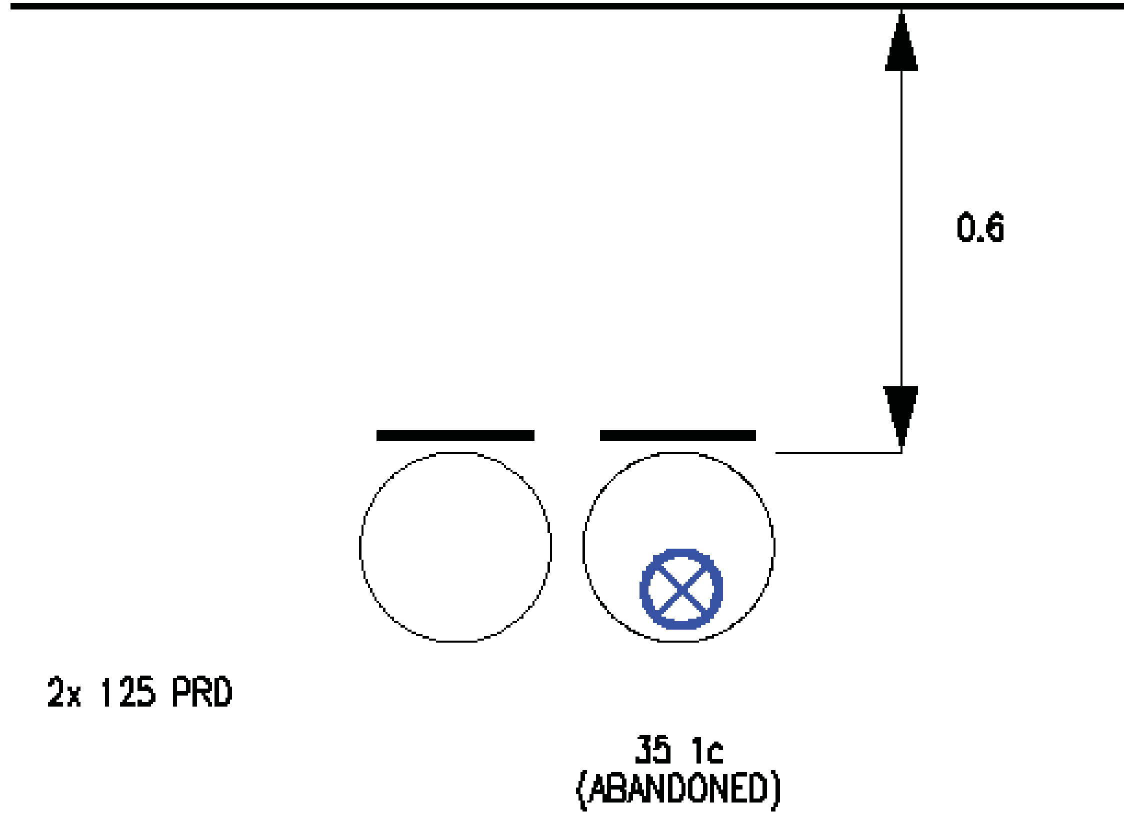
Cross Section : 2778621



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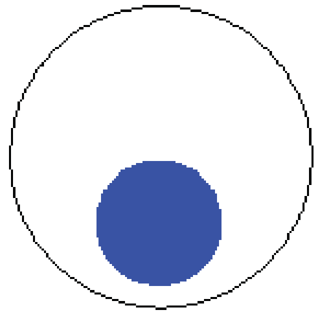
Cross Section : 2743948



.0225 2c
4" E.W.D

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4. This plan has been provided to you on the basis of the terms of use set out in the covering letter that accompanies this plan. If you do not accept and/or do not understand the terms of use set out in the covering letter you must not use the plan and must return it to the sender of the letter.
5. You are responsible for the security of the information provided to you. It must not be given, sold or made available upon payment of a fee to a third party.

IF IN DOUBT - ASK! PHONE
EMERGENCY - If you damage a cable or line
Phone URGENTLY

UK Power Networks

ALWAYS LOOK UP BEFORE YOU START WORK
Refer to HSE Guidance note GS6

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Important Information - please read The purpose of this plan is to identify Virgin Media apparatus. We have tried to make it as accurate as possible but we cannot warrant its accuracy. In addition, we caution that within Virgin Media apparatus there may be instances where mains voltage power cables have been placed inside green, rather than black ducting. Further details can be found using the "Affected Postcodes.pdf", which can be downloaded from this website. Therefore, you must not rely solely on this plan if you are carrying out any excavation or other works in the vicinity of Virgin Media apparatus. The actual position of any underground service must be verified by cable detection equipment, etc. and established on site before any mechanical plant is used. Accordingly, unless it is due to the negligence of Virgin Media, its employees or agents, Virgin Media will not have any liability for any omissions or inaccuracies in the plan or for any loss or damage caused or arising from the use of and/or any reliance on this plan. This plan is produced by Virgin Media Limited (c) Crown copyright and database rights 2019 Ordnance Survey 100019209.

Duct, Trench | Chamber | Cabinet

jagannathan.thiruvengadam@virginme

VM.1128222

APPENDIX D
FIELD RECORDS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Barnes Hospital	**LS Estates Limited**	**WS1**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
1920514	**07.03.19**	**6.22**	**E:521131.1 N:175715.3**	**1** of **1**
	End: **07.03.19**			

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.20 0.20	1	ES PID	0.0ppm			MADE GROUND: Dark brown slightly gravelly silty fine to coarse SAND with frequent rootlets. Gravel is subangular to subrounded fine to coarse of flint, brick, concrete and bituminous material.	(0.50)	
								0.50	
	0.60 0.60	2	ES PID	0.0ppm			Brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse flint. (KEMPTON PARK GRAVEL)	(0.80)	
								1.30	
1.20 - 2.00 (101mm dia) 100% rec							Firm brown sandy CLAY with occasional rootlets. Sand is fine to coarse. (KEMPTON PARK GRAVEL)	(0.90)	
								2.20	
2.00 - 3.00 (51mm dia) 100% rec							Orangish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint. (KEMPTON PARK GRAVEL)	(0.80)	
								3.00	
							Window sample terminated at 3.0m depth		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. 35mm diameter standpipe piezometer (complete with flush protective cover) installed to 3.00m depth on completion. Response zone 1.50m to 3.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 100**	**Jamie Fouracres**	**HEllson**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Barnes Hospital	**LS Estates Limited**	**WS2**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
1920514	**07.03.19** End: **07.03.19**	**6.23**	**E:521189.6 N:175734.7**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.40 0.40	1	ES PID	0.0ppm			MADE GROUND: Brown gravelly silty fine to coarse SAND with low cobble content. Gravel is subrounded to subangular, fine to coarse of flint, concrete, ceramic fragments and bituminous material. Cobbles are angular of concrete upto 80mm across.	(1.00) 1.00	
1.00 - 2.00 (101mm dia) 100% rec							Firm brown slightly gravelly slightly sandy slity CLAY with occasional rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint. (KEMPTON PARK GRAVEL)	(0.40) 1.40	
	1.50 1.50	2	ES PID	0.1ppm			Orangish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint. (KEMPTON PARK GRAVEL)	(1.60) 3.00	
2.00 - 3.00 (87mm dia) 100% rec							Window sample terminated at 3.0m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. 35mm diameter standpipe piezometer (complete with flush protective cover) installed to 2.50m depth on completion. Response zone 1.0m to 2.5m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 100**	**Jamie Fouracres**	**HEllson**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Barnes Hospital	**LS Estates Limited**	**WS3**

Contract Ref:	Start:	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
1920514	**07.03.19** End: **07.03.19**	**6.96**	**E:521195.0 N:175665.2**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete flagstone.	0.05	
	0.80 0.80	1	ES PID	0.0ppm			MADE GROUND: Dark brown slightly gravelly sandy CLAY with a low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of flint, clinker, brick and concrete. Cobbles are angular of brick up to 90mm across.	(1.25)	
1.20 - 2.20 (101mm dia) 100% rec								1.30	
							Orangish brown gravelly slightly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint. (KEMPTON PARK GRAVEL)	(0.90)	
								2.20	
							Window sample terminated at 2.2m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. 35mm diameter standpipe piezometer (complete with flush protective cover) installed to 1.80m depth on completion. Response zone 1.00m to 1.80m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 100**	**Jamie Fouracres**	**HEllson**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
Barnes Hospital	**LS Estates Limited**	**WS4**

Contract Ref:	Start: **07.03.19** End: **07.03.19**	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
1920514		**6.29**	**E:521151.0 N:175660.6**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.30 0.30	1	ES PID	0.0ppm			MADE GROUND: Dark brown gravelly clayey fine to coarse SAND with low cobble content and occasional rootlets. Cobbles are angular of concrete upto 90mm across. Gravel is subangular to subrounded fine to coarse of flint, brick, bituminous material and concrete.	(2.30)	
	0.80 0.80	2	ES PID	0.0ppm					
1.20 - 2.20 (101mm dia) 100% rec	1.50 1.50	3	ES PID	0.1ppm				2.30	
2.20 - 3.20 (87mm dia) 100% rec							Orangish brown gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of flint. (KEMPTON PARK GRAVEL)	(0.90)	
							Window sample terminated at 3.2m depth.	3.20	

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. Inspection pit hand dug to 1.20m depth.
3. No groundwater encountered.
4. 35mm diameter standpipe piezometer (complete with flush protective cover) installed to 3.00m depth on completion. Response zone 1.50m to 3.00m depth.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 100**	**Jamie Fouracres**	**HEllson**	

IN-SITU GAS MONITORING RESULTS

	Start Date	End Date	[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round 1	12/03/2019	12/03/2019		Constant	Constant	-	-	

Exploratory Position ID	Monitoring Round	Measured Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS1	1	---	12/03/2019	-	1008	0.0$_{(I)}$	DRY	0.1	0.0	21.1	0.0	0.0	0	0	
WS1	1	---	15 secs	-	1008	0.0$_{(SS)}$	DRY	0.1	0.0	21.0	0.0	0.0	0	0	
WS1	1	---	30 secs	-	1008	0.0$_{(SS)}$	DRY	0.2	0.0	19.9	0.0	0.0	0	0	
WS1	1	---	45 secs	-	1008	0.0$_{(SS)}$	DRY	0.2	0.0	19.9	0.0	0.0	0	0	
WS1	1	---	60 secs	-	1008	0.0$_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	90 secs	-	1008	0.0$_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	120 secs	-	1008	0.0$_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	150 secs	-	1008	0.0$_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS1	1	---	180 secs	-	1008	0.0$_{(SS)}$	DRY	0.1	0.0	20.0	0.0	0.0	0	0	
WS2	1	---	12/03/2019	-	1008	0.2$_{(I)}$	DRY	0.2	0.0	21.2	0.0	0.0	0	0	
WS2	1	---	15 secs	-	1008	0.1$_{(SS)}$	DRY	0.9	0.0	21.0	0.0	0.0	0	0	
WS2	1	---	30 secs	-	1008	0.0$_{(SS)}$	DRY	1.2	0.0	20.7	0.0	0.0	0	0	
WS2	1	---	45 secs	-	1008	0.0$_{(SS)}$	DRY	1.2	0.0	20.5	0.0	0.0	0	0	
WS2	1	---	60 secs	-	1008	0.0$_{(SS)}$	DRY	1.1	0.0	20.5	0.0	0.0	0	0	
WS2	1	---	90 secs	-	1008	0.0$_{(SS)}$	DRY	1.4	0.0	20.5	0.0	0.0	0	0	
WS2	1	---	120 secs	-	1008	0.0$_{(SS)}$	DRY	1.4	0.0	20.4	0.0	0.0	0	0	
WS2	1	---	150 secs	-	1008	0.0$_{(SS)}$	DRY	1.4	0.0	20.4	0.0	0.0	0	0	

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

RSK Environment Ltd
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date	Checked By	Date	Contract Ref:
	1/ 32/ 319			1952014

Contract: **Barnes Hospital**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Monitoring Round	Installation Depth (mbgl)	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	
WS2	1	---	180 secs	-	1008	$0.0_{(SS)}$	DRY	1.4	0.0	20.4	0.0	0.0	0	0	
WS3	1	---	12/03/2019	-	1008	$0.2_{(I)}$	DRY	0.1	0.0	21.0	0.0	0.0	0	0	
WS3	1	---	15 secs	-	1008	$0.1_{(SS)}$	DRY	0.5	0.0	20.5	0.0	0.0	0	0	
WS3	1	---	30 secs	-	1008	$0.1_{(SS)}$	DRY	1.1	0.0	19.9	0.0	0.0	0	0	
WS3	1	---	45 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	60 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	90 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	120 secs	-	1008	$0.1_{(SS)}$	DRY	1.8	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	150 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS3	1	---	180 secs	-	1008	$0.1_{(SS)}$	DRY	1.9	0.0	19.8	0.0	0.0	0	0	
WS4	1	---	12/03/2019	-	1008	$0.1_{(I)}$	DRY	0.0	0.0	21.0	0.0	0.0	0	0	
WS4	1	---	15 secs	-	1008	$0.0_{(SS)}$	DRY	0.5	0.0	20.8	0.0	0.0	0	0	
WS4	1	---	30 secs	-	1008	$0.0_{(SS)}$	DRY	0.7	0.0	20.7	0.0	0.0	0	0	
WS4	1	---	45 secs	-	1008	$0.0_{(SS)}$	DRY	0.8	0.0	20.5	0.0	0.0	0	0	
WS4	1	---	60 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.5	0.0	0.0	0	0	
WS4	1	---	90 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.1	0.0	0.0	0	0	
WS4	1	---	120 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.1	0.0	0.0	0	0	
WS4	1	---	150 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.0	0.0	0.0	0	0	
WS4	1	---	180 secs	-	1008	$0.0_{(SS)}$	DRY	0.6	0.0	20.1	0.0	0.0	0	0	

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

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Compiled By	Date	Checked By	Date	Contract Ref:
	1/ 32/ 319			1952014

Contract: **Barnes Hospital**

Page: **5** of **5**

APPENDIX E
LABORATORY CERTIFICATES FOR SOIL ANALYSIS

Ziaul Hoque
RSK Stats Ltd
18
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HP3 9RT

t: 01442 437500
f: 01442 437550
e: zhoque@rsk.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 19-31834

Project / Site name:	Barnes Hospital	**Samples received on:**	07/03/2019
Your job number:	1920514	**Samples instructed on:**	07/03/2019
Your order number:	PO290542	**Analysis completed by:**	12/03/2019
Report Issue Number:	1	**Report issued on:**	12/03/2019
Samples Analysed:	8 soil samples		

Signed:

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 19-31834

Project / Site name: Barnes Hospital
Your Order No: PO290542

Lab Sample Number				1171351	1171352	1171353	1171354	1171355
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.60	0.40	1.50	0.80
Date Sampled				07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken				0900	0900	0945	0945	1115
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	11
Moisture Content	%	N/A	NONE	13	11	13	3.4	17
Total mass of sample received	kg	0.001	NONE	1.4	1.1	1.1	1.2	1.8
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.7	7.8	8.1	8.2	7.7
Total Sulphate as SO_4	mg/kg	50	MCERTS	610	420	710	220	470
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.4	1.4	2.4	0.2	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.21	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.38	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.33	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.3	0.20	4.0	< 0.05	0.43
Anthracene	mg/kg	0.05	MCERTS	0.29	< 0.05	0.87	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	3.0	0.29	7.0	< 0.05	0.92
Pyrene	mg/kg	0.05	MCERTS	2.6	0.27	5.9	< 0.05	0.81
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.8	0.23	3.7	< 0.05	0.52
Chrysene	mg/kg	0.05	MCERTS	1.5	0.21	3.0	< 0.05	0.60
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.9	0.32	4.0	< 0.05	0.75
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.1	0.10	2.2	< 0.05	0.28
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.7	0.19	3.7	< 0.05	0.60
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.1	< 0.05	2.3	< 0.05	0.42
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.34	< 0.05	0.62	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.3	< 0.05	2.6	< 0.05	0.51
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	17.9	1.81	40.9	< 0.80	5.84

Analytical Report Number: 19-31834

Project / Site name: Barnes Hospital
Your Order No: PO290542

Lab Sample Number				1171351	1171352	1171353	1171354	1171355
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.60	0.40	1.50	0.80
Date Sampled				07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken				0900	0900	0945	0945	1115
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	16	16	14	15
Boron (water soluble)	mg/kg	0.2	MCERTS	2.3	1.4	3.8	0.8	0.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	< 0.2	1.0	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	22	26	20	15
Copper (aqua regia extractable)	mg/kg	1	MCERTS	89	45	88	9.3	34
Lead (aqua regia extractable)	mg/kg	1	MCERTS	380	160	290	16	170
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.6	1.2	2.0	< 0.3	0.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	18	17	18	13	11
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	92	56	190	21	54
Monoaromatics & Oxygenates								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 19-31834

Project / Site name: Barnes Hospital
Your Order No: PO290542

Lab Sample Number				1171351	1171352	1171353	1171354	1171355
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.60	0.40	1.50	0.80
Date Sampled				07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken				0900	0900	0945	0945	1115
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	6.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	21	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	73	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	100	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	5.9	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	21	< 10	17	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	46	< 10	24	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	73	< 10	40	< 10	< 10

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Your Order No: PO290542

Lab Sample Number				1171356	1171357	1171358		
Sample Reference				WS4	WS4	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.30	0.80	1.50		
Date Sampled				07/03/2019	07/03/2019	07/03/2019		
Time Taken				1200	1200	1200		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	30	22	14		
Moisture Content	%	N/A	NONE	14	10	4.7		
Total mass of sample received	kg	0.001	NONE	1.5	1.3	1.6		
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected		
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	9.0	8.3	6.7		
Total Sulphate as SO_4	mg/kg	50	MCERTS	1400	410	220		
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.9	1.2	< 0.1		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Acenaphthylene	mg/kg	0.05	MCERTS	0.22	0.27	< 0.05		
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Fluorene	mg/kg	0.05	MCERTS	0.22	0.26	< 0.05		
Phenanthrene	mg/kg	0.05	MCERTS	2.6	3.7	< 0.05		
Anthracene	mg/kg	0.05	MCERTS	0.43	0.50	< 0.05		
Fluoranthene	mg/kg	0.05	MCERTS	3.8	6.6	< 0.05		
Pyrene	mg/kg	0.05	MCERTS	3.2	5.5	< 0.05		
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.6	2.6	< 0.05		
Chrysene	mg/kg	0.05	MCERTS	1.8	3.1	< 0.05		
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.9	3.0	< 0.05		
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.97	1.7	< 0.05		
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.8	2.8	< 0.05		
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.91	1.6	< 0.05		
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.27	0.46	< 0.05		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.2	1.8	< 0.05		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	20.9	33.8	< 0.80		

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Your Order No: PO290542

Lab Sample Number				1171356	1171357	1171358		
Sample Reference				WS4	WS4	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.30	0.80	1.50		
Date Sampled				07/03/2019	07/03/2019	07/03/2019		
Time Taken				1200	1200	1200		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	15	16		
Boron (water soluble)	mg/kg	0.2	MCERTS	1.5	1.6	0.4		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	< 0.2	< 0.2		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	21	17		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	43	39	7.8		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	170	130	7.9		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.0	0.9	< 0.3		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	15	16		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	93	70	20		
Monoaromatics & Oxygenates								
Benzene	ug/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		

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Project / Site name: Barnes Hospital
Your Order No: PO290542

Lab Sample Number				1171356	1171357	1171358		
Sample Reference				WS4	WS4	WS4		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.30	0.80	1.50		
Date Sampled				07/03/2019	07/03/2019	07/03/2019		
Time Taken				1200	1200	1200		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001		
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001		
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001		
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0		
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0		
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	14	< 8.0	< 8.0		
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	14	< 10	< 10		
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001		
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001		
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001		
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0		
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	15	19	< 10		
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	24	21	< 10		
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	38	39	< 10		

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* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1171351	WS1	None Supplied	0.20	Brown loam and clay with vegetation and gravel
1171352	WS1	None Supplied	0.60	Brown clay and sand with vegetation.
1171353	WS2	None Supplied	0.40	Brown loam and clay with vegetation and gravel
1171354	WS2	None Supplied	1.50	Light brown sandy clay with gravel.
1171355	WS3	None Supplied	0.80	Brown clay and gravel with stones.
1171356	WS4	None Supplied	0.30	Brown clay and sand with stones.
1171357	WS4	None Supplied	0.80	Brown clay and sand with stones.
1171358	WS4	None Supplied	1.50	Light brown sandy gravel with stones.

The results included within the report are representative of the samples submitted for analysis.

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Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX F
GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH

Generic assessment criteria for human health: residential scenario without home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Where a C4SL has been published, the RSK GAC duplicates the C4SL published values using all input parameters within the SP1010 final project report[3] and associated appendices[6], and adopts them as GAC for these six substances.

For all other substances the C4SL exposure modifications relevant for residential without home-grown produce end use have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) and reducing exposure frequency for dermal contact outdoors.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the Contaminated Land Exposure Assessment (CLEA) tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential without home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential without home-grown produce scenario are

- direct soil and dust ingestion in areas of soft landscaping
- dermal contact with soil and indoor dust

- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the

polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated appendices[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a C4SL has been published, the RSK GAC have duplicated the C4SL published values using all input parameters within the SP1010 final project report[3] and associated appendices[6], and has adopted them as GAC for these six substances. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential without home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential without home-grown produce

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Table 2 below.

The final selected GAC are presented by pathway in Table 3 and the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA residential scenario without home-grown produce

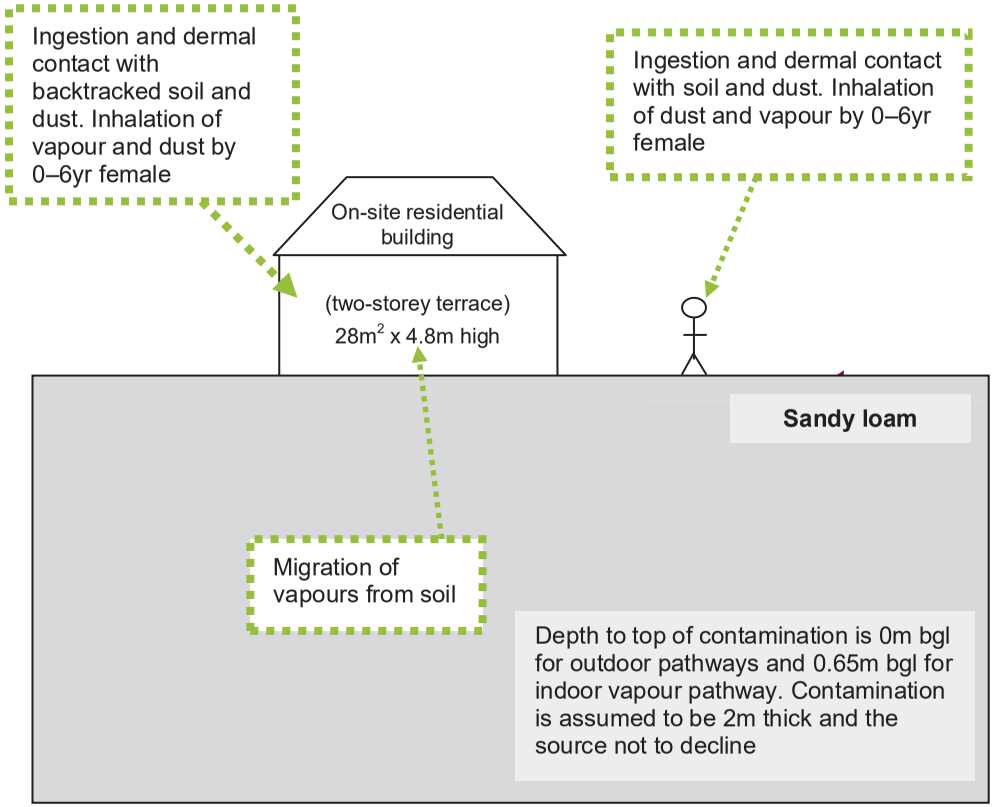

Table 1: Exposure assessment parameters for residential scenario without home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential without home-grown produce	Chosen land use
Receptor	Female child	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3[5]. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start age class (AC)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential without home-grown produce – modified receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
Soil to skin adherence factor – (outdoor)	mg soil/cm^2 skin	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010[3]					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9	10.1	10.1	10.1
Justification		Mean value USEPA, 2011[12]; Table 3.2, SP1010[3]					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3[1], Science Report SC050021/Cadmium SGV[1] and the project report SP1010[3] for more information.							

References

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3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

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11. CL:AIRE (2009), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).

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GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR
Cadmium	(a)	1.95E+02	4.88E+02	1.49E+02	NR	1.95E+02	4.88E+02	1.49E+02	NR	1.95E+02	4.88E+02	1.49E+02	NR
Chromium (III) - trivalent	(c)	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR
Copper		1.08E+04	1.41E+04	7.13E+03	NR	1.08E+04	1.41E+04	7.13E+03	NR	1.08E+04	1.41E+04	7.13E+03	NR
Lead	(a)	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.41E-01	NR	4.31E+00	NR	5.74E-01	NR	1.07E+01	NR	1.25E+00	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		5.71E+01	3.63E+03	5.62E+01	NR	5.71E+01	3.63E+03	5.62E+01	NR	5.71E+01	3.63E+03	5.62E+01	NR
Methyl Mercury (Hg^{4+})		1.80E+01	1.87E+01	9.16E+00	7.33E+01	1.80E+01	3.62E+01	1.20E+01	1.42E+02	1.80E+01	7.68E+01	1.46E+01	3.04E+02
Nickel	(d)	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR
Selenium	(b)	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR
Zinc	(b)	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR
Cyanide (free)		4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR
Volatile Organic Compounds													
Benzene	(a)	7.36E+01	9.01E-01	8.90E-01	1.22E+03	7.36E+01	1.68E+00	1.64E+00	2.26E+03	7.36E+01	3.48E+00	3.33E+00	4.71E+03
Toluene		2.87E+04	9.08E+02	8.80E+02	8.69E+02	2.87E+04	2.00E+03	1.87E+03	1.92E+03	2.87E+04	4.55E+03	3.93E+03	4.36E+03
Ethylbenzene		1.29E+04	8.34E+01	8.29E+01	5.18E+02	1.29E+04	1.96E+02	1.93E+02	1.22E+03	1.29E+04	4.58E+02	4.42E+02	2.84E+03
Xylene - m		2.32E+04	8.25E+01	8.22E+01	6.25E+02	2.32E+04	1.95E+02	1.93E+02	1.47E+03	2.32E+04	4.56E+02	4.47E+02	3.46E+03
Xylene - o		2.32E+04	8.87E+01	8.83E+01	4.78E+02	2.32E+04	2.08E+02	2.06E+02	1.12E+03	2.32E+04	4.86E+02	4.76E+02	2.62E+03
Xylene - p		2.32E+04	7.93E+01	7.90E+01	5.76E+02	2.32E+04	1.86E+02	1.85E+02	1.35E+03	2.32E+04	4.36E+02	4.28E+02	3.17E+03
Total xylene		2.32E+04	7.93E+01	7.90E+01	6.25E+02	2.32E+04	1.86E+02	1.85E+02	1.47E+03	2.32E+04	4.36E+02	4.28E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		3.87E+04	1.04E+02	1.04E+02	2.04E+04	3.87E+04	1.69E+02	1.69E+02	3.31E+04	3.87E+04	3.21E+02	3.19E+02	6.27E+04
Trichloroethene		6.45E+01	1.72E-02	1.72E-02	1.54E+03	6.45E+01	3.59E-02	3.59E-02	3.22E+03	6.45E+01	7.98E-02	7.97E-02	7.14E+03
Tetrachloroethene		7.13E+02	1.79E-01	1.79E-01	4.24E+02	7.13E+02	4.02E-01	4.02E-01	9.51E+02	7.13E+02	9.21E-01	9.20E-01	2.18E+03
1,1,1-Trichloroethane		7.74E+04	9.01E+00	9.01E+00	1.43E+03	7.74E+04	1.84E+01	1.84E+01	2.92E+03	7.74E+04	4.04E+01	4.04E+01	6.39E+03
1,1,1,2 Tetrachloroethane		7.34E+02	1.54E+00	1.53E+00	2.60E+03	7.34E+02	3.56E+00	3.55E+00	6.02E+03	7.34E+02	8.29E+00	8.20E+00	1.40E+04
1,1,2,2-Tetrachloroethane		7.34E+02	3.92E+00	3.90E+00	2.67E+03	7.34E+02	8.04E+00	7.95E+00	5.46E+03	7.34E+02	1.76E+01	1.72E+01	1.20E+04
Carbon Tetrachloride		5.15E+02	2.58E-02	2.58E-02	1.52E+03	5.15E+02	5.65E-02	5.64E-02	3.32E+03	5.15E+02	1.28E-01	1.28E-01	7.54E+03
1,2-Dichloroethane		1.55E+01	9.20E-03	9.20E-03	3.41E+03	1.55E+01	1.33E-02	1.33E-02	4.91E+03	1.55E+01	2.28E-02	2.27E-02	8.43E+03
Vinyl Chloride		1.81E+00	7.73E-04	7.73E-04	1.36E+03	1.81E+00	1.00E-03	9.99E-04	1.76E+03	1.81E+00	1.53E-03	1.53E-03	2.69E+03
1,2,4-Trimethylbenzene		NR	5.58E+00	NR	4.74E+02	NR	1.29E+01	NR	1.16E+03	NR	2.69E+01	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		7.64E+03	4.86E+04	6.60E+03	5.70E+01	7.64E+03	1.18E+05	7.17E+03	1.41E+02	7.64E+03	2.68E+05	7.43E+03	3.36E+02
Acenaphthylene		7.65E+03	4.59E+04	6.55E+03	8.61E+01	7.65E+03	1.11E+05	7.15E+03	2.12E+02	7.65E+03	2.53E+05	7.42E+03	5.06E+02
Anthracene		3.82E+04	1.53E+05	3.06E+04	1.17E+00	3.82E+04	3.77E+05	3.47E+04	2.91E+00	3.82E+04	8.76E+05	3.66E+04	6.96E+00
Benzo(a)anthracene		1.98E+01	2.47E+01	1.10E+01	1.71E+00	1.98E+01	4.37E+01	1.36E+01	4.28E+00	1.98E+01	6.26E+01	1.50E+01	1.03E+01
Benzo(a)pyrene	(a)	5.34E+00	3.51E+01	NR	9.11E-01	5.34E+00	3.77E+01	NR	2.28E+00	5.34E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		4.97E+00	1.93E+01	3.95E+00	1.22E+00	4.97E+00	2.13E+01	4.03E+00	3.04E+00	4.97E+00	2.22E+01	4.06E+00	7.29E+00
Benzo(g,h,i)perylene		4.38E+02	1.87E+03	3.55E+02	1.54E-02	4.38E+02	1.94E+03	3.58E+02	3.85E-02	4.38E+02	1.97E+03	3.59E+02	9.23E-02
Benzo(k)fluoranthene		1.31E+02	5.41E+02	1.06E+02	6.87E-01	1.31E+02	5.76E+02	1.07E+02	1.72E+00	1.31E+02	5.91E+02	1.07E+02	4.12E+00
Chrysene		3.95E+01	1.19E+02	2.97E+01	4.40E-01	3.95E+01	1.49E+02	3.12E+01	1.10E+00	3.95E+01	1.66E+02	3.19E+01	2.64E+00
Dibenzo(a,h)anthracene		3.95E-01	1.45E+00	3.10E-01	3.93E-03	3.95E-01	1.64E+00	3.18E-01	9.82E-03	3.95E-01	1.74E+00	3.22E-01	2.36E-02
Fluoranthene		1.59E+03	3.83E+04	1.53E+03	1.89E+01	1.59E+03	8.87E+04	1.56E+03	4.73E+01	1.59E+03	1.83E+05	1.58E+03	1.13E+02
Fluorene		5.09E+03	6.20E+03	2.80E+03	3.09E+01	5.09E+03	1.53E+04	3.82E+03	7.65E+01	5.09E+03	3.62E+04	4.47E+03	1.83E+02
Indeno(1,2,3-cd)pyrene		5.65E+01	2.12E+02	4.46E+01	6.13E-02	5.65E+01	2.38E+02	4.56E+01	1.53E-01	5.65E+01	2.50E+02	4.60E+01	3.68E-01

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Naphthalene		2.50E+03	2.33E+01	2.31E+01	7.64E+01	2.50E+03	5.58E+01	5.46E+01	1.83E+02	2.50E+03	1.31E+02	1.25E+02	4.32E+02
Phenanthrene		1.58E+03	7.17E+03	1.30E+03	3.60E+01	1.58E+03	1.76E+04	1.45E+03	8.96E+01	1.58E+03	4.07E+04	1.52E+03	2.14E+02
Pyrene		3.82E+03	8.79E+04	3.66E+03	2.20E+00	3.82E+03	2.04E+05	3.75E+03	5.49E+00	3.82E+03	4.23E+05	3.79E+03	1.32E+01
Phenol		6.48E+04	4.58E+02	4.55E+02	2.42E+04	6.48E+04	6.95E+02	6.88E+02	3.81E+04	6.48E+04	1.19E+03	1.17E+03	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		3.23E+05	4.24E+01	4.24E+01	3.04E+02	3.23E+05	7.79E+01	7.79E+01	5.58E+02	3.23E+05	1.61E+02	1.61E+02	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		3.23E+05	1.04E+02	1.04E+02	1.44E+02	3.23E+05	2.31E+02	2.31E+02	3.22E+02	3.23E+05	5.29E+02	5.29E+02	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		6.45E+03	2.68E+01	2.68E+01	7.77E+01	6.45E+03	6.55E+01	6.53E+01	1.90E+02	6.45E+03	1.56E+02	1.55E+02	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		6.45E+03	1.33E+02	1.32E+02	4.75E+01	6.45E+03	3.31E+02	3.27E+02	1.18E+02	6.45E+03	7.93E+02	7.67E+02	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		6.45E+03	1.11E+03	1.06E+03	2.37E+01	6.45E+03	2.78E+03	2.42E+03	5.91E+01	6.45E+03	6.67E+03	4.37E+03	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC_8-EC_{10}		2.58E+03	4.74E+01	4.72E+01	6.13E+02	2.58E+03	1.16E+02	1.15E+02	1.50E+03	2.58E+03	2.77E+02	2.69E+02	3.58E+03
Aromatic hydrocarbons >EC_{10}-EC_{12}		2.58E+03	2.58E+02	2.52E+02	3.64E+02	2.58E+03	6.39E+02	5.94E+02	8.99E+02	2.58E+03	1.52E+03	1.24E+03	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		2.58E+03	2.85E+03	1.80E+03	1.69E+02	2.58E+03	7.07E+03	2.30E+03	4.19E+02	2.58E+03	1.68E+04	2.48E+03	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	1.86E+03	NR	NR	5.37E+01	1.90E+03	NR	NR	1.34E+02	1.92E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

Table 4
Human health generic assessment criteria for residential without home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	40	40	40
Cadmium	149	149	149
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	7,100	7,100	7,100
Lead	310	310	310
Elemental Mercury (Hg^0)	0.2	0.6	1.2
Inorganic Mercury (Hg^{2+})	56	56	56
Methyl Mercury (Hg^{4+})	9	12	15
Nickel	180	180	180
Selenium	430	430	430
Zinc	40,000	40,000	40,000
Cyanide (free)	40	40	40
Volatile Organic Compounds			
Benzene	0.9	1.6	3.3
Toluene	900 (869)	1,900	3,900
Ethylbenzene	80	190	440
Xylene - m	80	190	450
Xylene - o	90	210	480
Xylene - p	80	180	430
Total xylene	80	180	430
Methyl tertiary-Butyl ether (MTBE)	100	170	320
Trichloroethene	0.02	0.04	0.08
Tetrachloroethene	0.2	0.4	0.9
1,1,1-Trichloroethane	9.0	18.4	40.4
1,1,1,2 Tetrachloroethane	1.5	3.5	8.2
1,1,2,2-Tetrachloroethane	3.9	8.0	17.2
Carbon Tetrachloride	0.026	0.056	0.128
1,2-Dichloroethane	0.009	0.013	0.023
Vinyl Chloride	0.0008	0.0010	0.0015
1,2,4-Trimethylbenzene	5.6	12.9	26.9
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	6,600 (57)	7,200	7,400
Acenaphthylene	6,600 (86)	7,200	7,400
Anthracene	31,000 (1.17)	35,000	37,000
Benzo(a)anthracene	11.0	13.6	15.0
Benzo(a)pyrene	5.3	5.3	5.3
Benzo(b)fluoranthene	4.0	4.0	4.1
Benzo(g,h,i)perylene	355	358	359
Benzo(k)fluoranthene	106	107	107
Chrysene	30	31	32
Dibenzo(a,h)anthracene	0.31	0.32	0.32
Fluoranthene	1,500	1,600	1,600
Fluorene	2,800 (31)	3,800 (77)	4,500 (183)
Indeno(1,2,3-cd)pyrene	45	46	46
Naphthalene	23	55	125
Phenanthrene	1,300 (36)	1,450	1,520
Pyrene	3,700	3,800	3,800
Phenol	440*	688	1,170
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	42	78	161
Aliphatic hydrocarbons >EC_6-EC_8	100	230	530
Aliphatic hydrocarbons >EC_8-EC_{10}	27	65	155
Aliphatic hydrocarbons >EC_{10}-EC_{12}	130 (48)	330 (118)	770 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	1,100 (24)	2,400 (59)	4,400 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	65,000 (8)	92,000 (21)	111,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	65,000 (8)	92,000 (21)	111,000
Aromatic hydrocarbons >EC_8-EC_{10}	47	115	269
Aromatic hydrocarbons >EC_{10}-EC_{12}	300	600	1,200
Aromatic hydrocarbons >EC_{12}-EC_{16}	1,800 (169)	2,300 (419)	2,500
Aromatic hydrocarbons >EC_{16}-EC_{21}	1,900	1,900	1,900
Aromatic hydrocarbons >EC_{21}-EC_{35}	1,900	1,900	1,900
Aromatic hydrocarbons >EC_{35}-EC_{44}	1,900	1,900	1,900
Minerals			
Asbestos	No asbestos detected with ID or <0.001% dry weight[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. SAC - soil assessment criteria.

[1] LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58.
1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS)

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.

APPENDIX G
GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

APPENDIX G
GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

Several compounds can inhibit plant growth; hence it is important to have generic assessment criteria (GAC) to promote healthy plant growth. In the absence of other published GAC, the GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields.

The Council of European Communities Sewage Sludge Directive (86/278/EEC) dated 1986, has been transposed into UK law by Statutory Instrument No. 1263, The Sludge (use in Agriculture) Regulations 1989 (Public Health England, Wales and Scotland), as ammended in 1990 and The Sludge (use in Agriculture) Regulations (Northern Ireland) SR No, 245, 1990. In addition the Department of Environment (DoE) produced a Code of Practice (CoP) (Updated 2nd Edition) in 2006 which provided guidance on the application of sewage sludge on agricultural land (however the status of this document is unclear as it is on the archive section of the Defra website).

The directive seeks to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to "***prevent harmful effects on soil, vegetation, animals and man".*** To this end, it prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. Treated sludge is defined as having undergone "biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use". To provide protection against potential health risks from residual pathogens, sludge must not be applied to soil in which fruit and vegetable crops are growing, or less than ten months before fruit and vegetable crops are to be harvested. Grazing animals must not be allowed access to grassland or forage land less than three weeks after the application of sludge.

The specified limits of concentrations of selected elements in soil are presented in Table 4 of the updated 2nd Edition of the DoE Code of Practice and are designed to protect plant growth. It is noted that these values are more stringent than the values set in current UK regulations. However since they were ammended following recommendations from the Independent Scientific Committee in 1993. (MAFF/DOE 1993). The GAC are presented in Table 1.

Table 1: Generic assessment criteria

Determinant	Generic assessment criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110
Lead	300	300	300	300
Cadmium	3	3	3	3
Mercury	1	1	1	1
Note: Only compounds with assessment criteria documented within the Directive 86/278/EEC have been included, although criteria for 5 additional compounds have been presented within the 2006 CoP.				

APPENDIX H
GENERIC ASSESSMENT CRITERIA FOR POTABLE WATER SUPPLY PIPES

A range of pipe materials is available and careful selection, design and installation is required to ensure that water supply pipes are satisfactorily installed and meet the requirements of the Water Supply (Water Fittings) Regulations 1999 in England and Wales, the Byelaws 2000 in Scotland and the Northern Ireland Water Regulations. The regulations include a requirement to use only suitable materials when laying water pipes and laying water pipes without protection is not permitted at contaminated sites. The water supply company has a statutory duty to enforce the regulations.

Contaminants in the ground can pose a risk to human health by permeating potable water supply pipes. To fulfil their statutory obligation, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that the proposed remedial strategy will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or in specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies.

The focus of the UKWIR research project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was intended to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipe failing prematurely due to the presence of contamination.

The report concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for polyethylene (PE) and polyvinyl chloride (PVC) pipes for the organic contaminants of concern. The report also makes recommendations for the procedures to be adopted in the design of site investigations and sampling strategies, and the assessment of data, to ensure that the ground through which water supply pipes will be laid is adequately characterised.

Risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GAC for this linkage and are reproduced in Table A3 below.

Since water supply pipes are typically laid at a minimum depth of 0.75 m below finished ground levels, sample results from depths between 0.5 m and 1.5 m below finished level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used, providing the stratum is the same as that in which water supply pipes are likely to be located. The report specifies that sampling should characterise the ground conditions to a minimum of 0.5 m below the proposed depth of the pipe.

It should be noted that the assessment provided in this report is a guide and the method of assessment and recommendations should be checked with the relevant water supply company.

Table Q1: Generic assessment criteria for water supply pipes

		Pipe material	
		GAC (mg/kg)	
	Parameter group	**PE**	**PVC**
1	Extended VOC suite by purge and trap or head space and GC-MS with TIC (Not including compounds within group 1a)	0.5	0.125
1a	• BTEX + MTBE	0.1	0.03
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C_5–C_{10}) (Not including compounds within group 2e and 2f)	2	1.4
2e	• Phenols	2	0.4
2f	• Cresols and chlorinated phenols	2	0.04
3	Mineral oil C_{11}–C_{20}	10	Suitable
4	Mineral oil C_{21}–C_{40}	500	Suitable
5	Corrosive (conductivity, redox and pH)	Suitable	Suitable
Specific suite identified as relevant following site investigation			
2a	Ethers	0.5	1
2b	Nitrobenzene	0.5	0.4
2c	Ketones	0.5	0.02
2d	Aldehydes	0.5	0.02
6	Amines	Not suitable	Suitable
Notes: where indicated as 'suitable', the material is considered resistant to permeation or degradation and no threshold concentration has been specified by UKWIR.			

1ST LINE DEFENCE

Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	Barnes Hospital, London
Client	Beadmans
Site Address	South Worple Way, London, SW14 8SU
Report Reference	DA8245a-00
Date	3rd October 2019
Originator	CB

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Executive Summary

Site Location and Description

The area of works is located in the London Borough of Richmond upon Thames. The northern perimeter of the site is defined by South Worple Way whilst South Worple Avenue forms the eastern border of the site. Residential properties run across the southern periphery of the site boundary. The proposed site boundary encompasses the grounds of the Barnes Hospital. Several multi-tiered structures associated with the hospital occupy the site area, whilst several roadways provide access across the site area. Open areas of undeveloped land are seldom present across the site of works, save for pockets of vegetation across the southern and western perimeters of the site boundary.

The site is approximately centred on the OS grid reference: **TQ 2121975700**.

Proposed Works

The works are understood to involve excavations of existing foundations and installing a basement.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the site area to be underlain by the London Clay Formation – clay and silt, of the Palaeogene Period. Superficial deposits are indicated to be comprised of the Kempton Park Gravel Member – sand and gravel, of the Quaternary Period.

Site specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that the risk posed by aerial delivered UXO at the area of works is not homogeneous. A risk map has been presented in **Annex P**, zoning the site into areas of low and medium risk. There is also an assessed **Negligible Risk** from Allied ordnance. This assessment is based on the following factors:

- During WWII, the site was situated within the Municipal Borough of Barnes, which according to Home Office statistics was subject to a high density bombing campaign; an average of 113.5 items of ordnance were recorded per 1,000 acres. This bomb density can be attributed to the site's location in close proximity to the Thames and a number of viable Luftwaffe targets.
- At the outset of WWII, the site was occupied by a hospital, consisting of several structures and areas of open hard surfaced ground, utilised as roadways and pathways. London bomb census mapping records a high explosive bombing incident to have occurred in the east of the boundary in November 1940. This is corroborated by a local bomb map for Barnes, which also shows this bomb strike with the description "Isolation Hospital grounds, no casualties. The Barnes map records an additional bomb in this eastern area of the site in October 1940 with the associated reference "South Worple Way, Isolation Hospital, no casualties".
- Post-WWII aerial photography and OS mapping both indicate two structures to have been removed in the south-east of the site which were present in pre-war mapping. The recorded bomb strikes were in this approximate area of the site – although mapping indicates they were slightly further north. It is thought possible that the removal of these buildings was as a direct result of serious bomb damage sustained. No other reason for the clearance of these buildings could be found during the research for this report – although it should be additionally noted that no direct references to bomb damage at the hospital could be found either. The remainder of the structures within the boundary and its immediate surrounds are indicated to have survived WWII externally structurally intact.
- The site's occupation by a hospital is likely to have resulted in frequent and regular levels of access throughout WWII. However, if the south-eastern section had been subject to significant damage, it is considered likely that access levels in this area of the site would have decreased significantly, potentially ceasing altogether; increasing the likelihood of an item of UXO falling unnoticed in this area of the site unnoticed. Furthermore, whilst the majority of the boundary was occupied by structures, hard surfaced ground and gardens – considered largely conducive to the detection of items of UXO – any rubble and debris in the south-eastern area is likely to have resulted in ground conditions unconducive to the observation of evidence of UXO.

UXO Risk Assessment

- To summarise, the majority of the site was seemingly unaffected by bombing incidents, with no evidence of damage occurring found, and no reason to think that the majority of the hospital would not have been subject to access and checks. However, if the south-eastern region of the site was subject to significant damage resulting in structural clearance and reduced levels of access, conditions unconducive to the detection of UXO would likely have resulted in this area. As such, the likelihood of contamination is considered to be elevated in this south-eastern area of the site - this has been reflected in a risk map (see Annex P). A 'buffer zone' has been added around these two cleared areas to account for the possibility of 'J-curve' effect (whereby a UXB can come to rest at a lateral offset from point of entry).
- There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the Barnes Hospital site in London:

All Works

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Medium Risk Areas

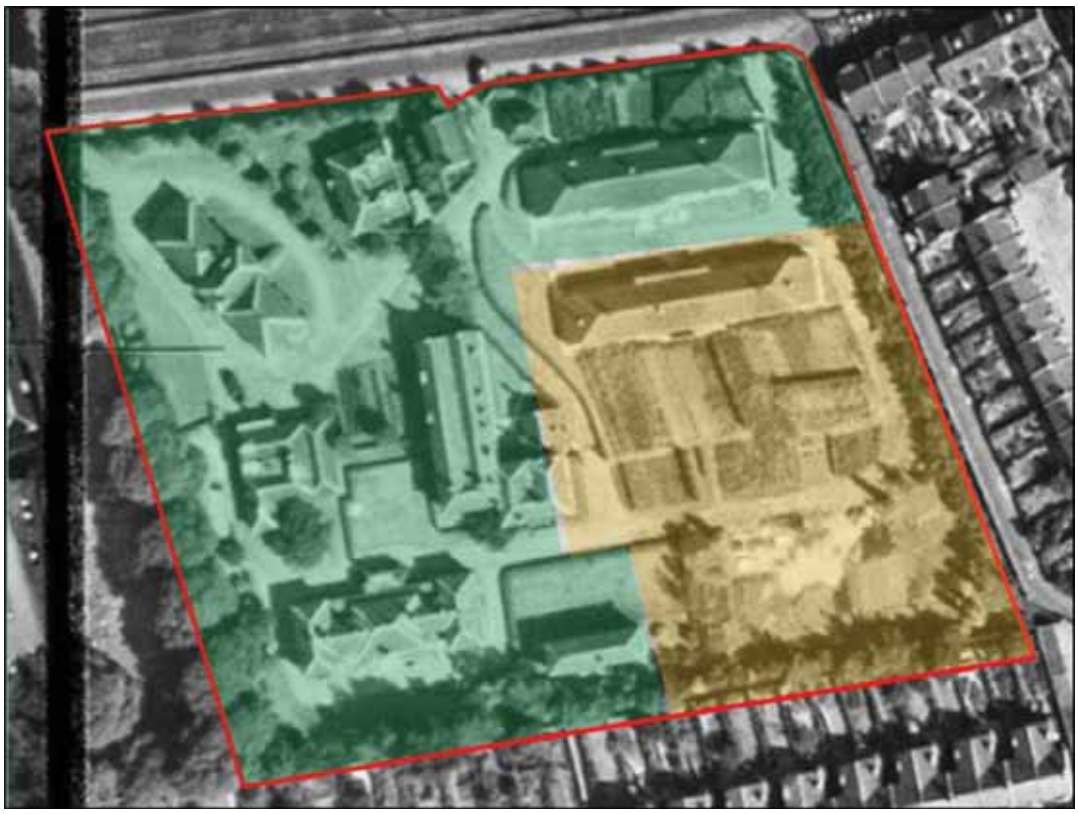
Open Intrusive Works (trial pits, service pits, open excavations, shallow foundations etc.)

- UXO Specialist On-site Support

Boreholes and Piled Foundations

- Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

Risk Map



For indicative purposes – not to scale.
Please note that this assessed risk map may not take into account all post-war redevelopment/excavations on site.

Low Risk

Medium Risk

1st Line Defence Risk Mitigation Services:

All Areas of the Site:

- Site Specific Unexploded Ordnance Awareness Briefings – a service recommended to all personnel conducting intrusive works.

Medium Risk Areas of the site:

- Unexploded Ordnance Specialist - a service to support open intrusive works.
- Intrusive Magnetometer Survey – a service to support any borehole or pile locations/clusters down to an assessed maximum bomb penetration depth.

Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
JSEODOC	Joint Services Explosive Ordnance Disposal Operation Centre
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
NFF	National Filling Factory
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD2	Anti-personnel "Butterfly Bomb"
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women's Auxiliary Air Force
X	Exploded

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1st Line Defence Limited
Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Barnes Hospital, London
Client: Beadmans

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Beadmans to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the proposed works at the proposed Barnes Hospital site in London.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in *CIRIA C681*, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the Barnes Hospital site in London. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German aerial delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Beadmans.
- Available material from 33 Engineer Regiment (EOD) Archive (now 28 Regt).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to The National Archives.

3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. Consequently, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are to a degree subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'[1]

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments, datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations, it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

[1] http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/bomb-census-survey-records-1940-1945/.

4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation on parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to UXO for the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII aerial bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection, they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD team's judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases, it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment, the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

6. The Site

6.1. Site Location

The area of works is located in the London Borough of Richmond upon Thames. The northern perimeter of the site is defined by South Worple Way whilst South Worple Avenue forms the eastern border of the site. Residential properties run across the southern periphery of the site boundary.

The site is approximately centred on the OS grid reference: **TQ 2121975700**.

Site location maps are presented in **Annex A**.

6.2. Site Description

The proposed site boundary encompasses the grounds of the Barnes Hospital. Several multi-tiered structures associated with the hospital occupy the site area, whilst several roadways provide access across the site area. Open areas of undeveloped land are seldom present across the site of works, save for pockets of vegetation across the southern and western perimeters of the site boundary.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

The works are understood to involve excavations of existing foundations and installing a basement.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the site area to be underlain by the London Clay Formation – clay and silt, of the Palaeogene Period. Superficial deposits are indicated to be comprised of the Kempton Park Gravel Member – sand and gravel, of the Quaternary Period.

8.2. Site Specific Geology

Site-specific geotechnical data was not available during the production of this report.

9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

9.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D.** See below for a summary of the site history shown on acquired mapping.

Pre-WWII		
Date	**Scale**	**Description**
1934 – 1936	1:2,500	This map indicates several structures across the northern and western sections of the site that appear to correlate to the present day structures on-site. A *mortuary* structure is specified in the northern section of the site across South Worple Way, whilst a *lodge* was situated adjacent to the west; all other structures are not specified in this map edition. Residential properties and their respective roads bound the site to the south and east, whilst *Mortlake Cemetry* neighboured the site to the west.

Post-WWII		
Date	**Scale**	**Description**
1952 – 1953	1:2,500	This map indicates the hospital complex on-site to no longer be explicitly concerned with infectious diseases; the hospital was now specified as the *Barnes Hospital*. Within the south-eastern section of the site, two pre-war structures adjacent were cleared. Aside from this, no other substantial changes to the structural composition of the occupying areas is visible on this map edition, nor are any other areas of clearance visible (save for an area of clearance at a point where Priests Bridge meets with White Hart Lane, approximately 100m south-east).

10. Introduction to German Aerial Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place, this occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German aerial delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Aerial Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German aerial delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Annex E**.

Generic Types of WWII German Aerial Delivered Ordnance		
Type	**Frequency**	**Likelihood of detection**
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see **Annex F**). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present–day intrusive works.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Aerial or Parachute mines (PM)	These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs generally would have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

10.3. Failure Rate of German Aerial Delivered Ordnance

It has been estimated that 10% of WWII German aerial delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg and over, 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK; see press articles in **Annex G1**.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an aerial delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex F**).

10.4.2. WWII UXB Ground Penetration Studies

During WWII, the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were made as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – London Clay Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the lack or limitations of site-specific geotechnical information. An assessment can be made once such information becomes available or by an UXO Specialist on-site.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1 known as the *flying bomb* or *pilotless aircraft* and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 2,419 V-1s and 517 V-2s were recorded in the London Civil Defence region alone.

Although these weapons caused considerable damage their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today since even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and dealt with at the time. Therefore, V-weapons are referenced in this report not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

11. The Likelihood of Contamination from German Aerial Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. An estimated 250 tons of ordnance (high explosive and incendiary bombs) was dropped on Greater London, more than half of which fell on the City of London. A WWI map of air raids and naval bombardments across England is presented in **Annex H**. This source does not record any WWI bombing incidents to have affected the site.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons, there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of Barnes

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII, the site was located within the Municipal Borough of Barnes during WWII, which sustained a high density of bombing, as represented by bomb density data figures and maps, see **Annex I**. This was mainly due to its location close to London and the presence of numerous viable Luftwaffe targets in the area. Luftwaffe target mapping, presented in **Annex J**, highlights West Middlesex Waterworks as a major target for German bombing. This facility was situated approximately 2.5km north-east of the site and was responsible for supplying water to much of West London. In the wider area, there were other targets including the Fulham Gas Works & Coke Company. The local vicinity of targets would have often affected the areas in which they were located – partly due to the inaccuracy of wartime targeting systems on aircraft and partly due to the common practice of Luftwaffe bomber aircrafts to deploy any remaining bombs on adjacent areas. Much of the bombing on the region can be attributed to these potential targets and any bombing inflicted upon the civilian population.

Records of bombing incidents in the civilian areas of Barnes were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents for Barnes are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German aerial delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Municipal Borough of Barnes between 1940 and 1945.

Record of German Ordnance Dropped on the Municipal Borough of Barnes		
Area Acreage		**2,519**
Weapons	High Explosive bombs (all types)	240
	Parachute mines	3
	Oil bombs	15
	Phosphorus bombs	15
	Fire pots	1
	Pilotless aircraft (V-1)	9
	Long range rocket bombs (V-2)	3
Total		**286**
Number of Items per 1,000 acres		**113.5**

Source: Home Office Statistics
This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. London Civil Defence Region Bomb Census Maps

During WWII, the ARP Department within the Research and Experiments Branch of the Ministry of Home Security produced both consolidated and weekly bomb census maps for the London Civil Defence Region, as well as census mapping of V-1 pilotless aircraft. These maps collectively show the approximate locations of bombs, mines and rockets dropped in the region. The site area was checked on each available map sheet; those showing bomb incidents on and in the immediate vicinity of the site are discussed below and are presented in **Annexes K-L**.

London Consolidated Bomb Census Maps – Annex K1	
Date Range	**Comments**
Night Bombing up to 7th October 1940	No bombing incidents are recorded within the boundary or its immediate surrounds.
7th October 1940 to 28th July 1941	A bombing incident is recorded in the east of the site boundary.

London Weekly Bomb Census Maps – Annex K2	
Date Range	**Comments**
25th November to 2nd December 1940	A HE bomb is recorded in the east of the boundary. An incendiary bomb 'shower' is also recorded over the boundary during this week.
14th to 20th February 1944	A 1000kg HE bomb is recorded approximately 100m east of the boundary during this week.

V-1 Pilotless Aircraft Bomb Census Map – Annex L	
Date Range	**Comments**
1944-45	A V-1 flying bomb is recorded approximately 200m to the west of the boundary. This is considered too far removed to have affected the site area.

11.5. Barnes and Mortlake Bomb Map

A consolidated bomb map for the Barnes and Mortlake areas was compiled by Frank Porter for the Barnes and Mortlake History Society. Unlike other parts of the modern London Borough of Richmond, an ARP bomb map was either not assembled during WWII or was lost in subsequent boundary changes. As a result, this visual representation is based on two surviving sources – the Chief Fire Warden's Report, and the 'annual bound of Barnes rates payments'.[2]

As neither source was concerned primarily with recording bombing incidents (instead occupying itself with the consequence), this map should not be seen to be fully comprehensive. Nevertheless, it acts as a representation of all local "incident records" available. A snippet of the map is presented in **Annex M**. Recorded incidents on site, or in its immediate vicinity, are discussed below.

Barnes and Mortlake Bomb Map	
Date Range	**Comments**
28 September 1940	Bomb number 21 – 73-95 Grosvenor Avenue, no casualties, no.65 also damaged.
13th October 1940	**Bomb number 47 – South Worple Way, Isolation Hospital, no casualties.**
29th November 1940	**Bomb number 132 – Isolation Hospital grounds, no casualties.**

11.6. WWII-Era Aerial Photography

A high-resolution scan of WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photograph provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (**see Annex N**).

WWII-Era Aerial Photography	
Date	**Description**
18th August 1947	The image indicates the site area to have been occupied by the premises of a hospital. Two structures are indicated to have been cleared in the south-east of the boundary; this area of the boundary is now occupied by vacant ground. There is no further evidence of clearance or potential bomb damage/ground disturbance within the boundary or its immediate surrounds; the remainder of the structures within the boundary are indicated to have survived the war externally structurally intact and in apparently good condition.

[2] http://www.barnes-history.org.uk/Bombmap/mappage.html

11.7. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.8. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) (now 29 Regt) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date, Beadmans will be advised.

11.9. Evaluation of German Aerial Delivered UXO Records

Factors	Conclusion
Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.*	During WWII, the site was situated within the Municipal Borough of Barnes, which according to Home Office statistics was subject to a high density bombing campaign; an average of 113.5 items of ordnance were recorded per 1,000 acres. This bomb density can likely be attributed to the site's location in close proximity to the Thames and a number of viable Luftwaffe targets. London bomb census mapping records a high explosive bombing incident to have occurred in the east of the boundary. This is corroborated by a local bomb map for Barnes, which records two incidents in the east of the boundary, with associated written references to two bombs on the Isolation Hospital.
Damage *If buildings or structures on a site sustained bomb or fire damage any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.*	Post-WWII RAF aerial photography from 1947 indicates clearance to have occurred in the south-east of the boundary; land formerly occupied by two structures associated with the hospital is shown to be vacant. This is corroborated by post-WWII OS mapping, which also indicates the two structures in question to have been cleared. It is considered possible that this clearance was a result of bomb damage – although it should be noted that no specific references to significant damage occurring to the hospital was noted in histories of the hospital. The remainder of the structures within the boundary appear to have survived WWII externally structurally intact. There is also no evidence to suggest significant damage occurred in the site's immediate surrounds. The grounds and buildings appear to have been well-maintained and in good condition.

Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.*	At the outset of WWII, the site was occupied by the premises of a hospital, which is likely to have resulted in frequent and regular levels of access. However, if the removal of the structures in the south-east corner of the site was a result of bomb damage, it is considered that there would have been a significant decrease in access levels in this area, potentially ceasing altogether. This would increase the likelihood that an item of UXO may have fallen unnoticed in this particular area of the boundary. Across the majority of the site, no reason could be found to indicate that access would not have been frequent.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	Given that the majority of the site boundary was occupied by structures and what appeared to have been hard surfaced ground in the form of roadways and pathways, the ground cover present within the boundary at the outset of WWII is considered largely conducive to the observation of evidence of UXO. Of concern is the south-eastern section of the site – had serious damage been sustained to the buildings in this area, rubble and debris is likely to have been present, creating conditions unconducive to the detection of UXO.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

12. Introduction to Allied Explosive Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military were usually subject to clearance before they returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas such as the location of the site can however be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2. Defending the UK From Aerial Attack

During WWII, the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.2.1. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	**Description**			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers, They often fired large HE projectiles, which were usually initiated by integral fuzes triggered by impact, area, time delay or a combination of aforementioned mechanisms.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LSA Ammunition	**Gun type**	**Calibre**	**Shell Weight**	**Shell Dimensions**
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm
	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as ''Z'' batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			

The closest recorded HAA to the site was located approximately 1.5km south-west of the site, however the range of a projectile can be up to 15km. The site would also have been in range of mobile light anti-aircraft guns.

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Aerial Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex O**.

13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

When undertaking construction work within or immediately adjacent to a site with previous and/or current military use, it is often considered likely to contain an elevated risk of contamination from Allied UXO. This assumption of risk is based on the following reasoning:

- The clearance of ordnance from military camps, depots, storage facilities, ranges and training areas were not always effectively managed, or undertaken to equivalent degrees of certainty. In addition, search and detection equipment used over seventy years ago following WWII has proved ineffective both for certain types of UXO and at depths beyond capability.
- In the vast majority of cases, explosive ordnance would have been stored and available for use at military installations. Ordnance ranged from small arms and land service ammunition to weapons components and larger, aerial delivered items. During periods of heightened activity, ordnance was also frequently lost in transit, particularly between stores and assigned training locations.
- The military generally did not anticipate that their land would be later sold for civilian development, and consequently appropriate ordnance disposal procedure was not always adhered to. It was not uncommon for excess or unwanted ordnance to be buried or burnt within the perimeters of a military establishment as a means of disposal. Records of such practice were rarely kept.

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Allied UXO Contamination	Conclusion
Military Camps *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 1.5km south-west of the site, however the range of a projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance.

Home Guard Activity *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	1st Line Defence has no evidence of any Home Guard activities on the site.
Defensive Positions *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any defensive features formerly located on or bordering the site footprint.
Training or firing ranges *Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.*	There is no evidence of such features affecting the site.
Defensive Minefields *Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.*	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture *Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.*	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields *Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.*	The site was not situated within the perimeters or vicinity of a military airfield.

14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German aerial delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

UXO Contamination Summary	
Quality of the Historical Record	The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, consolidated and weekly London bomb census mapping, London bomb census reports, Barnes and Mortlake Bomb Map (the Chief Warden's Report and annual rates payments), WWII aerial photography, Home Office statistics and data held in-house. The record set is of adequate quality; London bomb census mapping and the local bomb map were corroborative of one another in regard to a bombing incident in the east of the site. However, no official written records, such as ARP incident records, regarding the incident could be found during the production of the report. This is likely due to the London Borough of Richmond absorbing Barnes post-war, resulting in the records being misplaced. As such, it is considered likely that the majority of information related to bombing in all areas of the Municipal Borough of Barnes will never be accessible.
German Aerial Delivered Ordnance	• During WWII, the site was situated within the Municipal Borough of Barnes, which according to Home Office statistics was subject to a high density bombing campaign; an average of 113.5 items of ordnance were recorded per 1,000 acres. This bomb density can be attributed to the site's location in close proximity to the Thames and a number of viable Luftwaffe targets. • At the outset of WWII, the site was occupied by a hospital, consisting of several structures and areas of open hard surfaced ground, utilised as roadways and pathways. London bomb census mapping records a high explosive bombing incident to have occurred in the east of the boundary in November 1940. This is corroborated by a local bomb map for Barnes, which also shows this bomb strike with the description "Isolation Hospital grounds, no casualties. The Barnes map records an additional bomb in this eastern area of the site in October 1940 with the associated reference "South Worple Way, Isolation Hospital, no casualties". • Post-WWII aerial photography and OS mapping both indicate two structures to have been removed in the south-east of the site which were present in pre-war mapping. The recorded bomb strikes were in this approximate area of the site – although mapping indicates they were slightly further north. It is thought possible that the removal of these buildings was as a direct result of serious bomb damage sustained. No other reason for the clearance of these buildings could be found during the research for this report – although it should be additionally noted that no direct references to bomb damage at the hospital could be found either. The remainder of the structures within the boundary and its immediate surrounds are indicated to have survived WWII externally structurally intact. • The site's occupation by a hospital is likely to have resulted in frequent and regular levels of access throughout WWII. However, if the south-eastern section had been subject to significant damage, it is considered likely that access levels in this area of the site would have decreased significantly, potentially ceasing altogether; increasing the likelihood of an item of UXO falling unnoticed in this area of the site unnoticed. Furthermore, whilst the majority of the boundary was occupied by structures, hard surfaced ground and gardens – considered largely conducive to the detection of items of UXO – any rubble and debris in the south-eastern area is likely to have resulted in ground conditions unconducive to the observation of evidence of UXO. • To summarise, the majority of the site was seemingly unaffected by bombing incidents, with no evidence of damage occurring found, and no reason to think that the majority of the hospital would not have been subject to access and

	checks. However, if the south-eastern region of the site was subject to significant damage resulting in structural clearance and reduced levels of access, conditions unconducive to the detection of UXO would likely have resulted in this area. As such, the likelihood of contamination is considered to be elevated in this south-eastern area of the site - this has been reflected in a risk map (see **Annex P**). A 'buffer zone' has been added around these two cleared areas to account for the possibility of 'J-curve' effect (whereby a UXB can come to rest at a lateral offset from point of entry).
Allied Ordnance	• There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.

15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 Regt). It should also be noted that in addition to 29 Regt archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-war Redevelopment

Post-war redevelopment has consisted of the clearance of hospital structures in the south-west of the boundary and the construction of a larger replacement structure. A new structure has also been erected in place of the cleared structure in the south-east of the boundary. The risk from deep-buried unexploded bombs is only considered mitigated at locations where post war piling or deep foundations have taken place.

16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

16.2. Encountering Aerial Delivered Ordnance

Since an aerial delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Aerial Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted (some examples are presented in **Annex G2**). There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clock	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that the risk posed by aerial delivered UXO at the area of works is not homogeneous. A risk map has been presented in **Annex** P, zoning the site into areas of low and medium risk.

Low Risk:

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Allied Anti-Aircraft Artillery Projectiles		✓		
Allied Land Service and Small Arms Ammunition	✓			

Medium Risk:

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs			✓	
German 1kg Incendiary Bombs			✓	
Allied Anti-Aircraft Artillery Projectiles			✓	
Allied Land Service and Small Arms Ammunition	✓			

Please note – although the risk from unexploded ordnance on this site has been assessed as 'Low', this does not mean there is 'no' risk of encountering UXO. This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the 'Proposed Works' section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at the Barnes Hospital site:

Type of Work	Recommended Mitigation Measure
All Works	• **UXO Risk Management Plan** It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information. • **Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.
Shallow Intrusive Works/Open Excavations in Medium Risk Areas	• **Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works** When on site the role of the UXO Specialist would include: • Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. • Providing UXO awareness briefings to any uninformed staff and advise staff of the need to modify working practices to take account of the ordnance risk. • To aid incident management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard.
Borehole/Piles in Medium Risk Areas	• **Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth:** 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited **3rd October 2019**

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be held accountable for any inherent errors. Furthermore, whilst every reasonable effort has been made to locate and access all relevant historical information, 1st Line Defence cannot be held responsible for any changes to risk level or mitigation recommendations resulting from documentation or other information which may come to light at a later date.

Site Location Maps

Annex: **A**

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: Google Maps

Approximate site boundary

N

Recent Aerial Photography

Annex: **B**

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Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

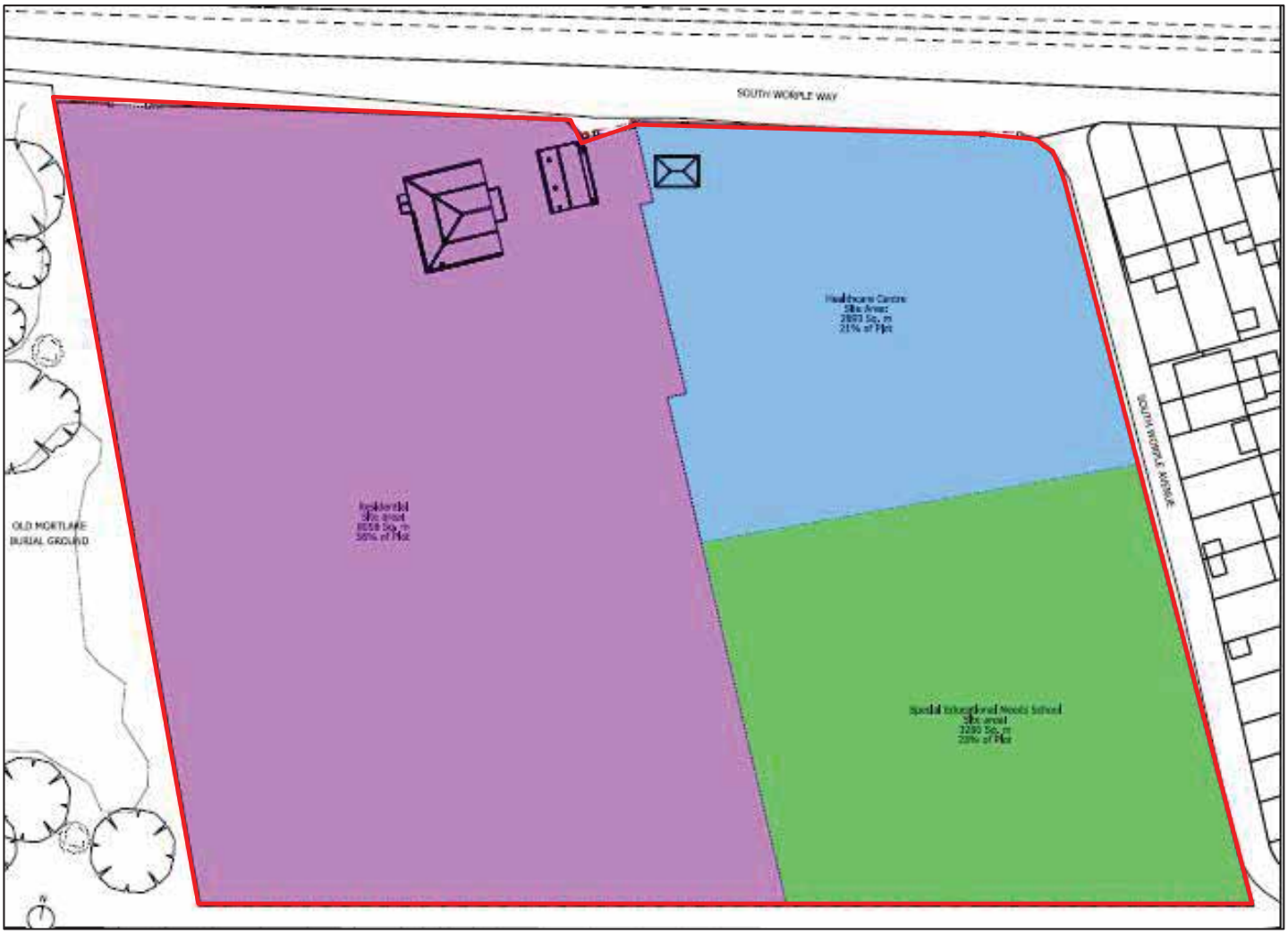
Source: Google Earth ™ Mapping Services

Approximate site boundary

N

Client Provided Site Plan

Annex: C



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Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: Beadmans

Approximate site boundary

N

1934 – 1936 Historical Map

Annex: **D1**

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Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: Landmark Maps

Approximate site boundary

N

1952 – 1953 Historical Map

Annex: D2

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Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: Landmark Maps

Approximate site boundary

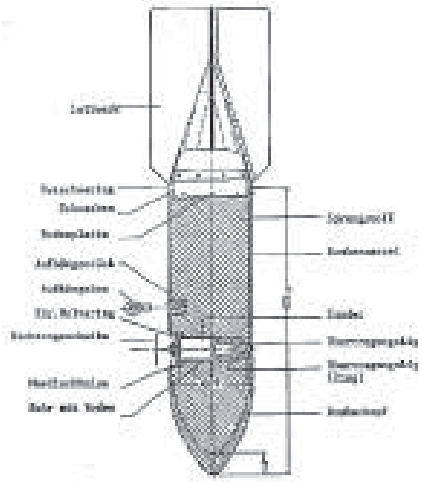
N

Examples of German Air-Delivered Ordnance

Annex: **E1**

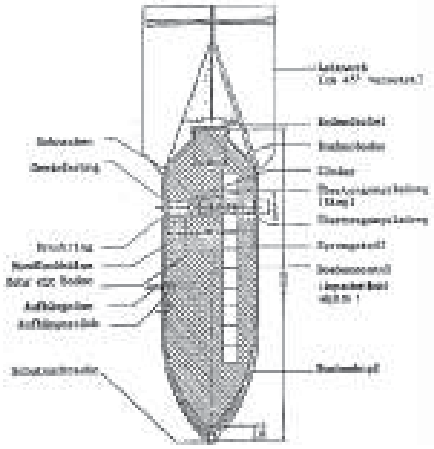
SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



SC 250kg High Explosive Bomb

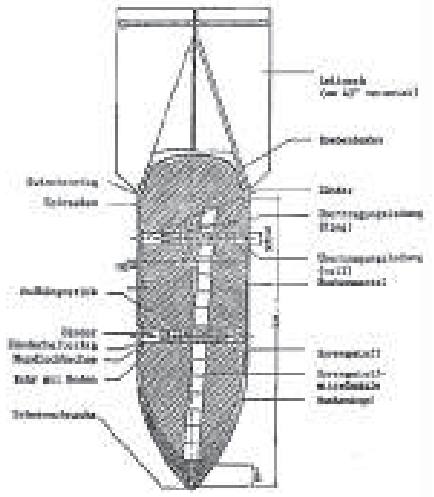
Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).

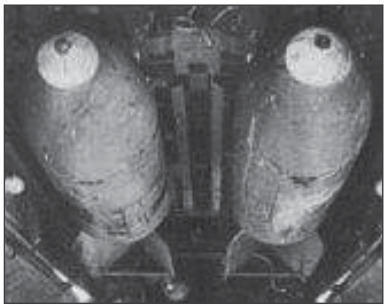


SC250 bomb being loaded onto German bomber

SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialen filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming





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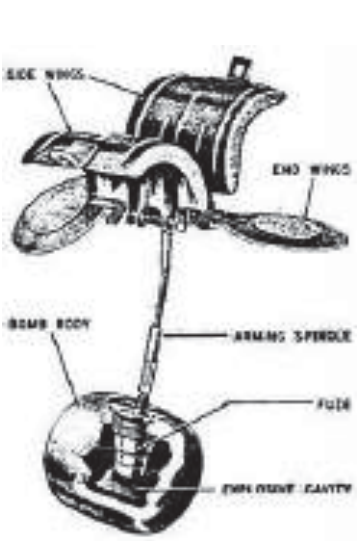
Source: Various sources

Examples of German Air-Delivered Ordnance

Annex: **E2**

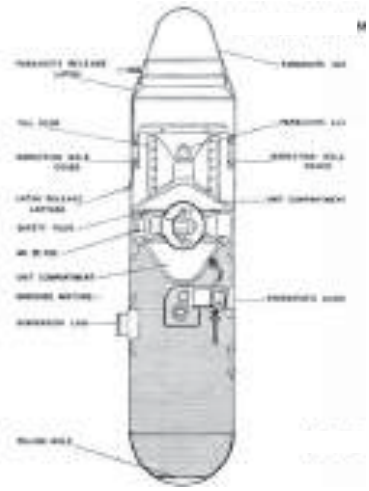
SD2 Anti-Personnel 'Butterfly Bomb'

Bomb Weight	Approx. 2kg (4.41lb)
Explosive Weight	Approx. 7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it span.



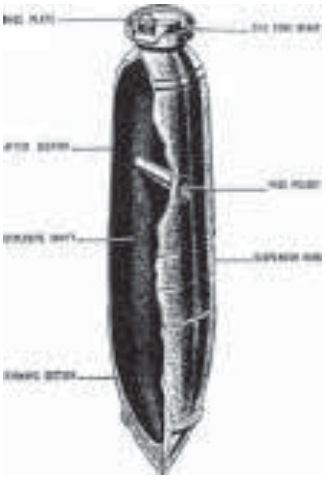
Parachute Mine (Luftmine B / LMB)

Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to cause extensive damage in a 100m radius.



SC 1000kg

Bomb Weight	Approx. 993-1027kg (2,189-2,264lb)
Explosive Weight	Approx. 530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction



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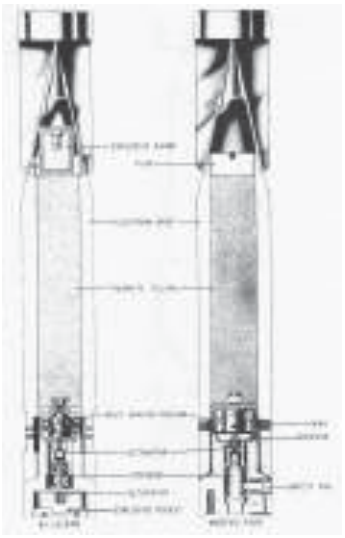
Source: Various sources

German Incendiary Bombs

Annex: **E3**

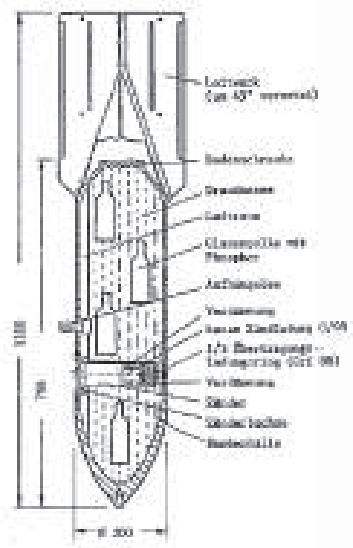
1kg Incendiary Bomb

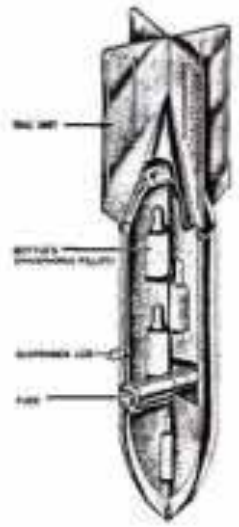
Bomb Weight	Approx. 1.0 - 1.3kg (2.2 and 2.9lb)
Explosive Weight	Approx. 680g (1.5lb) Thermite 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters on towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



C50 A Incendiary Bomb

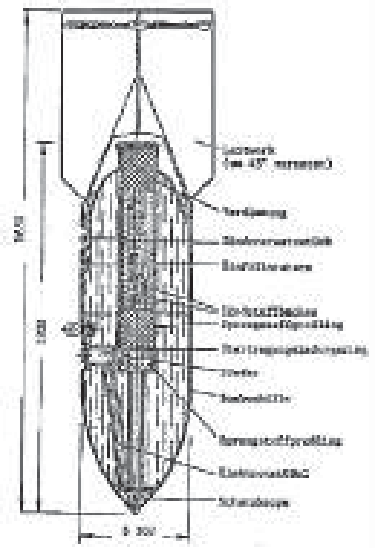
Bomb Weight	Approx. 41kg (90.4lb)
Explosive Weight	Approx. 0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against any targets where an incendiary effect is required
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture

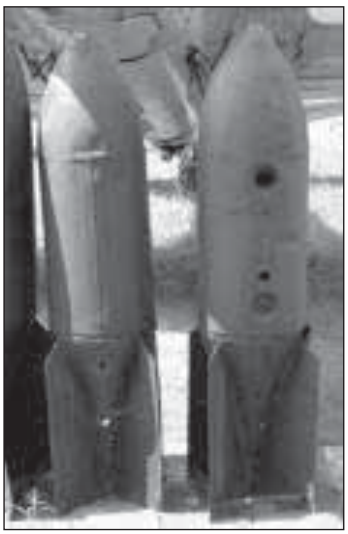




Flam C-250 Oil Bomb

Bomb Weight	Approx. 125kg (276lb)
Explosive Weight	Approx. 1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration





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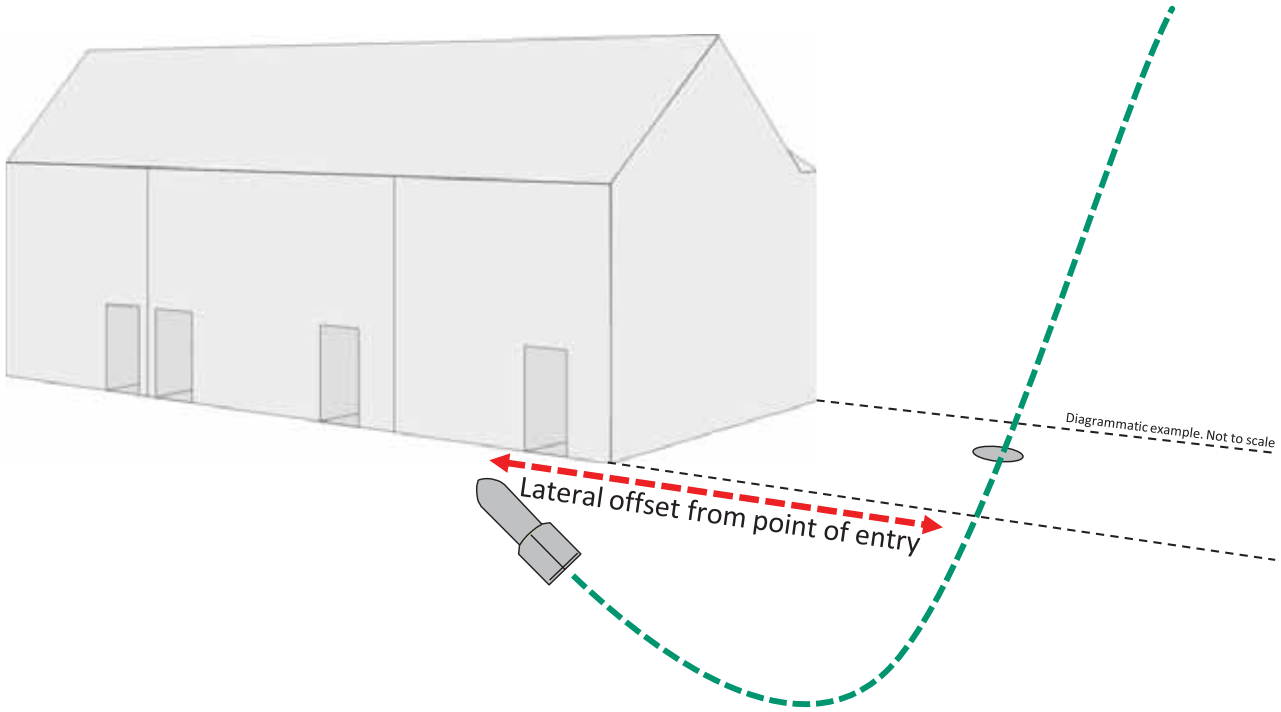

Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites. The photograph above shows 250kg bomb found in Bermondsey pointing upwards, demonstrating ‘J-curve’

One of the most common scenarios for UXO going unnoticed was when a UXB fell into a ‘bomb site’ (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).

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Ref: **DA8245a-00** Source: Various sources

BBC NEWS

Bermondsey bomb: World War Two device safely removed

An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

March 2015

BBC NEWS

Bethnal Green WW2 bomb: Experts remove unexploded device

An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

A 200m (650ft) exclusion zone was set up around the device.

August 2016

BBC NEWS

Bath WW2 bomb scare: Device defused, police say

A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

The discovery of the bomb on Thursday led to the evacuation of hundreds of homes and many road closures in the Lansdown area of the city.

A cordon around the site was lifted on Friday evening, more than 34 hours after residents were asked to leave their homes.

May 2016

BBC NEWS

London City Airport reopens after WW2 bomb moved

London City Airport has reopened after an unexploded 500kg World War Two bomb was safely moved from the area.

The device was discovered at the King George V Dock on Sunday during planned work at the east London airport.

All flights were cancelled on Monday after an exclusion zone was put in place, with the closure affecting up to 16,000 passengers and nearby residents being evacuated from their homes.

May 2015

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00** Source: BBC News

Examples of Unexpected Detonation of WWII Bombs

Annex: **G2**

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.

BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27) BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

WWII bomb injures 17 at Hattingen construction site

Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013

SPIEGEL ONLINE

Blast Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.

A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

23rd October 2006

BBC NEWS

World War II bomb kills three in Germany

A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 30 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

2nd June 2010

June 2006

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: Various news sources

World War Two bomb found in Ealing garden

11:50, 7 JUL 2011 UPDATED 10:34, 30 SEP 2015 BY JAMES GATES

HOMES were evacuated at the weekend when an unexploded bomb was discovered in West Ealing.

SHARES

Enter your e-mail for our daily newsletter Subscribe

HOMES were evacuated at the weekend when an unexploded bomb was discovered in West Ealing.

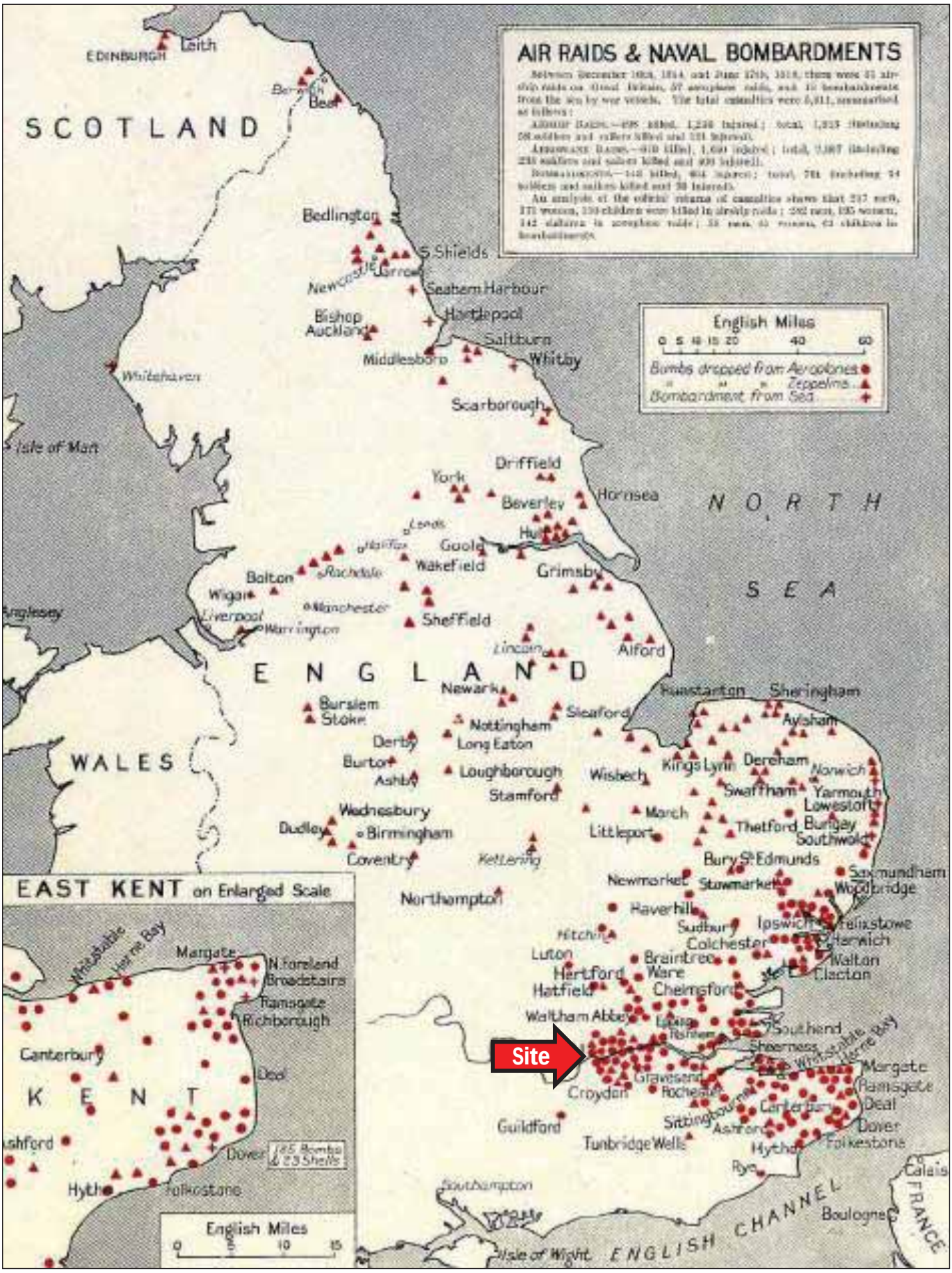
Police were called after a local gardener reportedly discovered the device, dating back to World War 2, in their back garden in Hessel Road at about 10.21am.

A 50 metre cordon was put in place around the house while an explosives unit arrived and confirmed that the shell was empty. The cordon was lifted at 11.13hrs and residents where allowed to return. No-one was reported injured.

Most Read in News

WWI Map of Air Raids and Naval Bombardments

Annex: H



1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

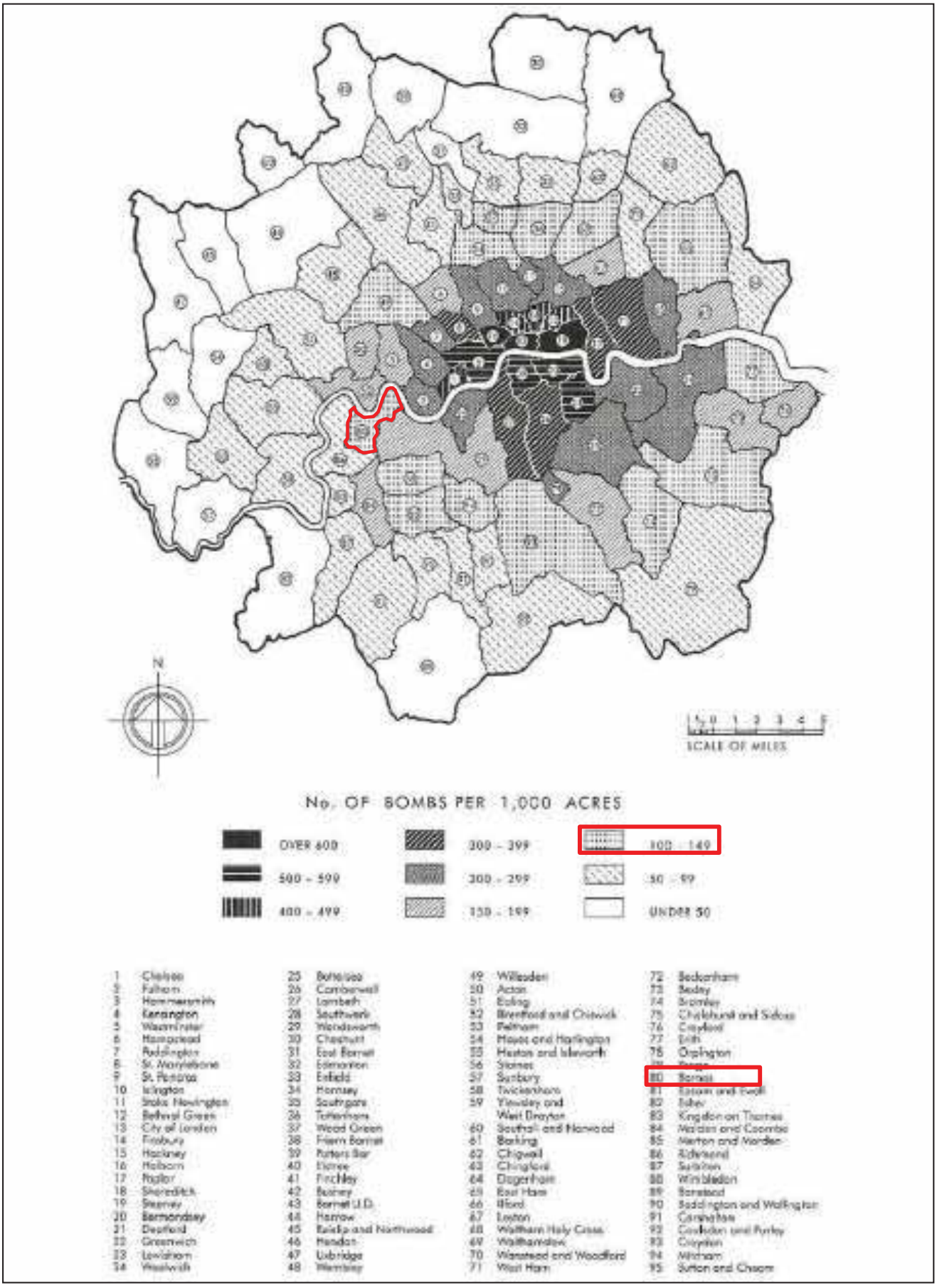
Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: J. Morris, *German Air Raids on Britain*

London WWII Bomb Density Map

Annex: I



1ST LINE DEFENCE

Unit 3, Maple Park
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Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: The London Metropolitan Archives

Luftwaffe Photograph, 1st October 1940

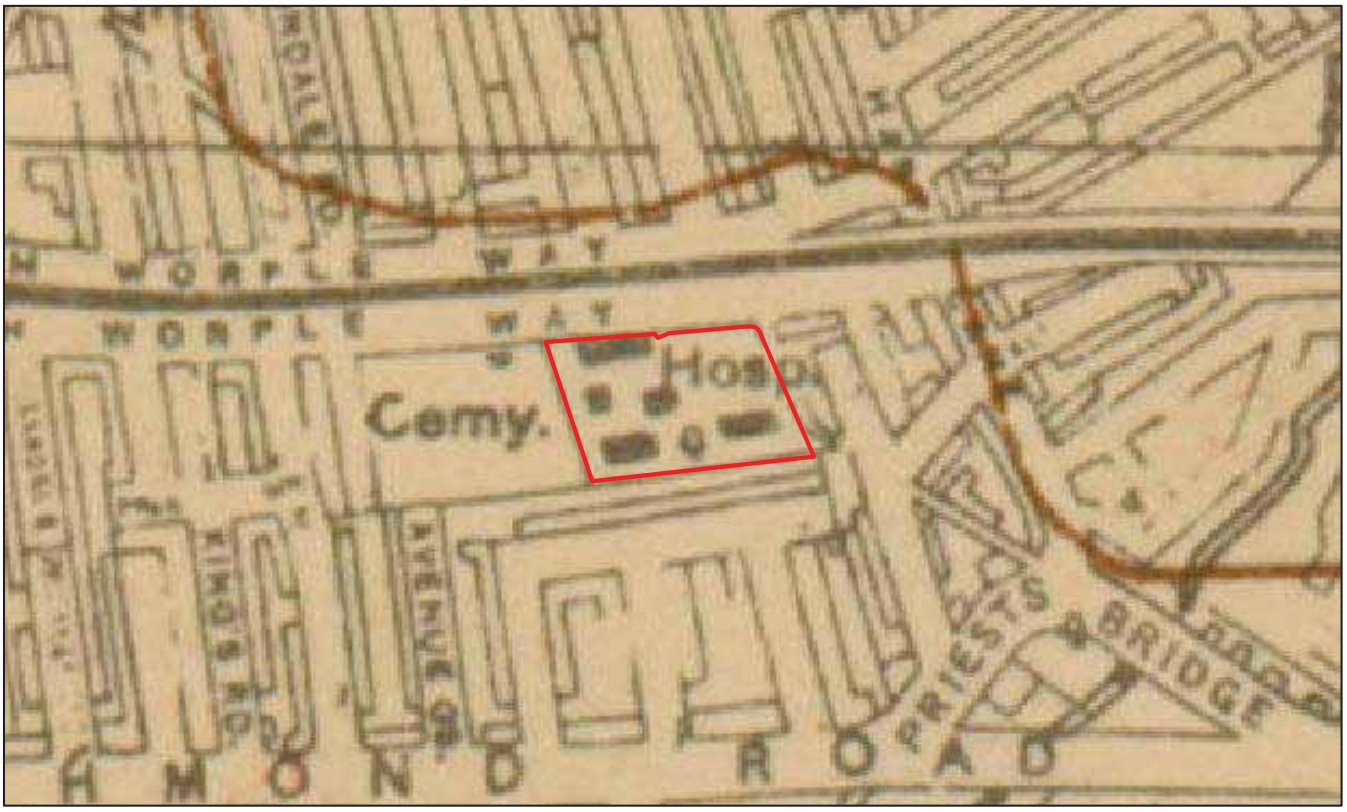
London – Barnes
A. West Middlesex Water Works
GB 734 & GB 74100 – Designated Luftwaffe targets

The site is located approximately 2.5km south-west of the West Middlesex Water Works.

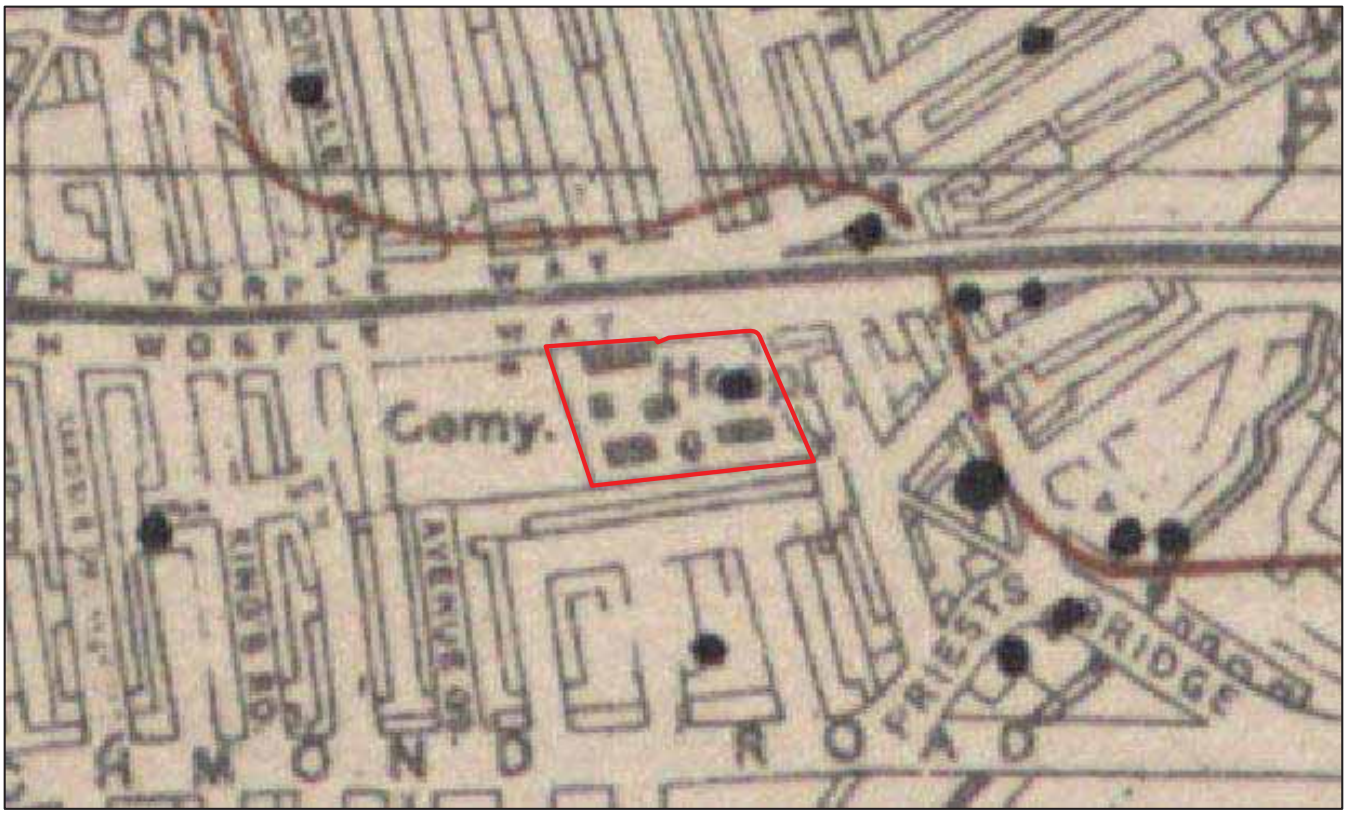
Consolidated London Bomb Census Mapping

Annex: **K1**

Night Bombing up to 7th October 1940



Night Bombing – 7th October 1940 to 28th July 1941



Recorded bomb strike

1ST LINE DEFENCE
Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Approximate site boundary

N

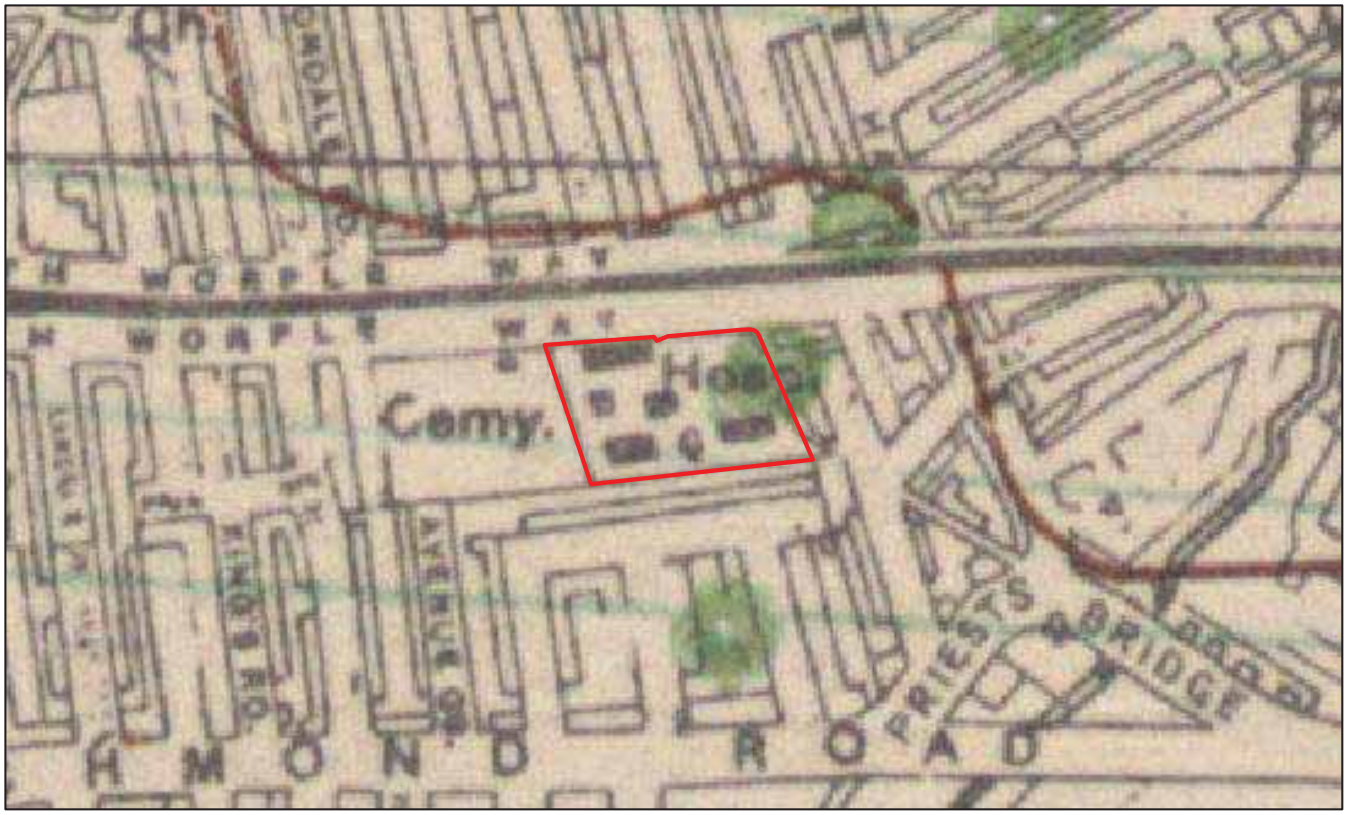
Ref: **DA8245a-00**

Source: The National Archives, Kew

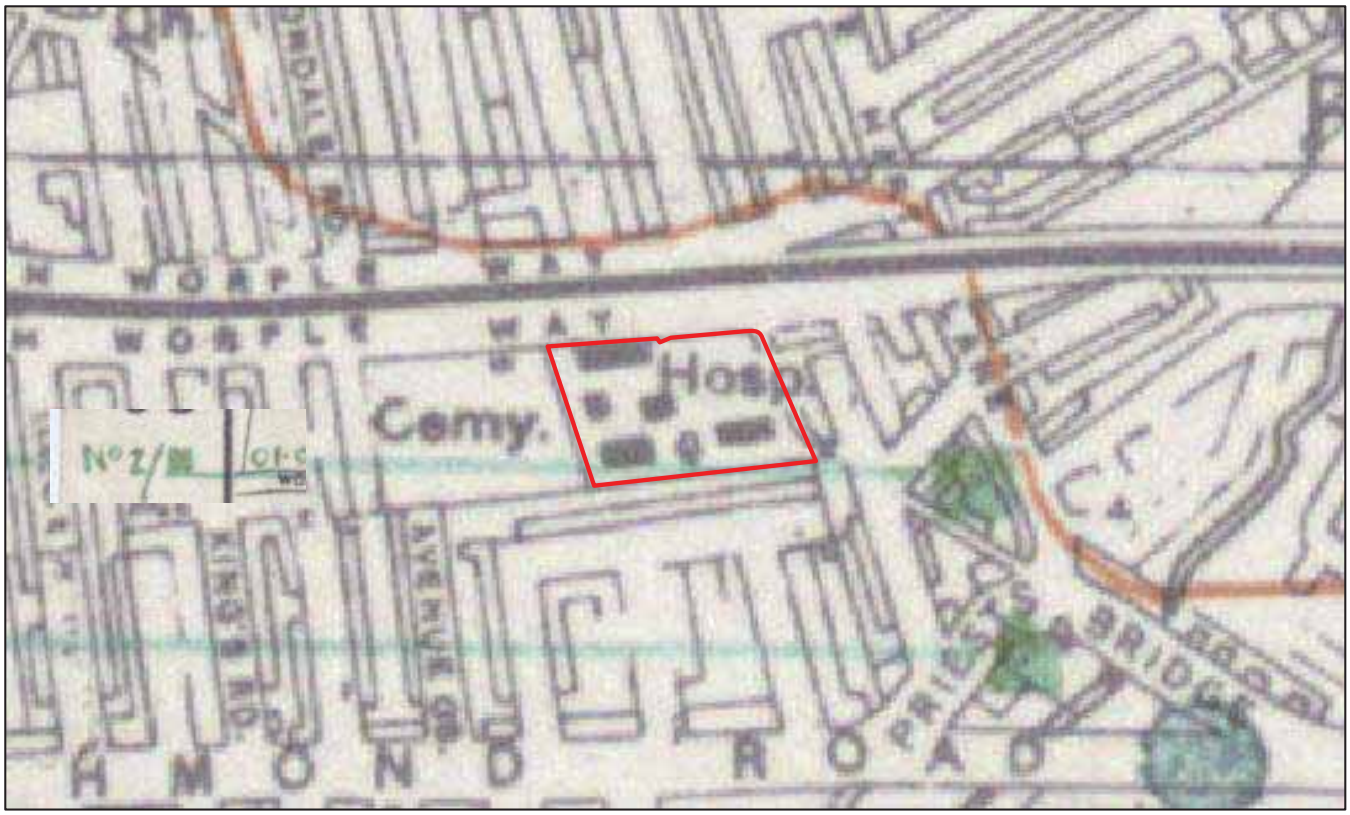
Weekly London Bomb Census Mapping

Annex: **K2**

Night Bombing – 25th November to 2nd December 1940



Night Bombing – 14th to 20th February 1944



- Recorded HE bomb strike
- Recorded UXB strike
- Recorded incendiary bomb shower
- Recorded oil bomb strike

Colour refers to day of the week.

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

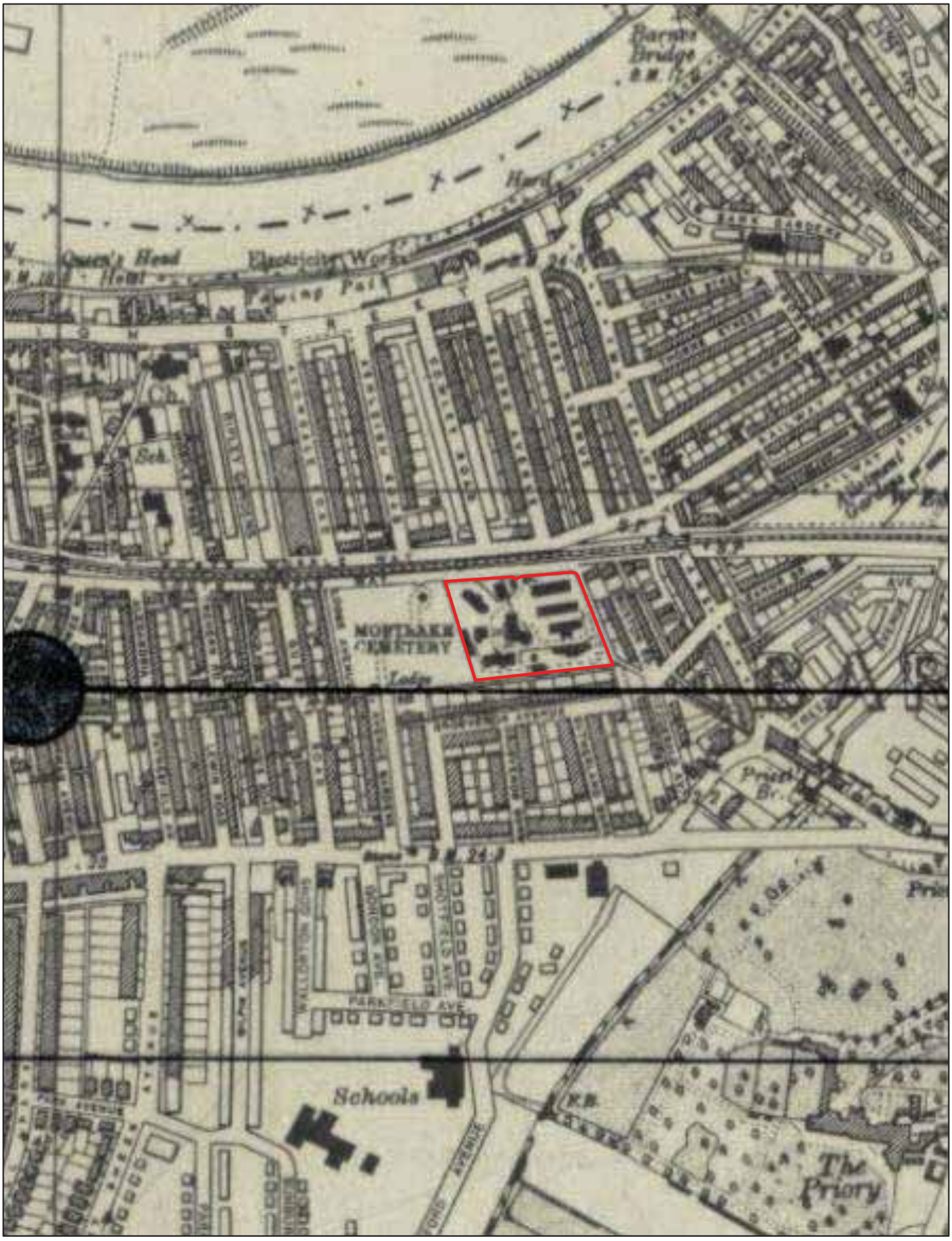
Source: The National Archives, Kew

Approximate site boundary

N

London V-1 Flying Bomb Map

Annex: L



V-1 flying bomb

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

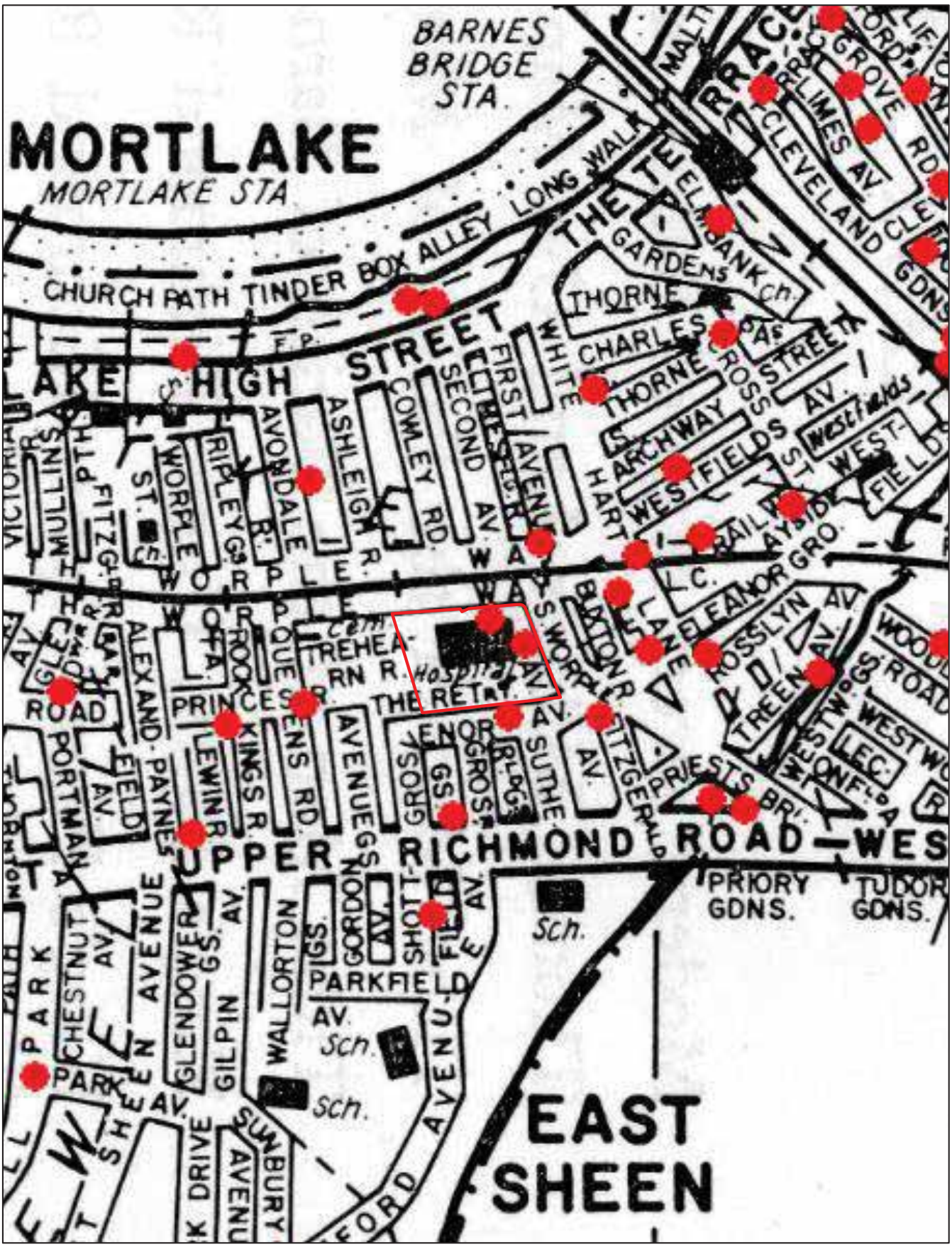
Source: The National Archives, Kew

Approximate site boundary

N

Barnes & Mortlake Bomb Map

Annex: **M**



Recorded bomb strike

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client:	**Beadmans**	**Approximate site boundary**	N
Project:	**Barnes Hospital, London**		
Ref:	**DA8245a-00**	Source: http://www.barnes-history.org.uk/Bombmap/mappage.html	

RAF Aerial Photography 18th August 1947

Annex: **N1**

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Approximate site boundary

N

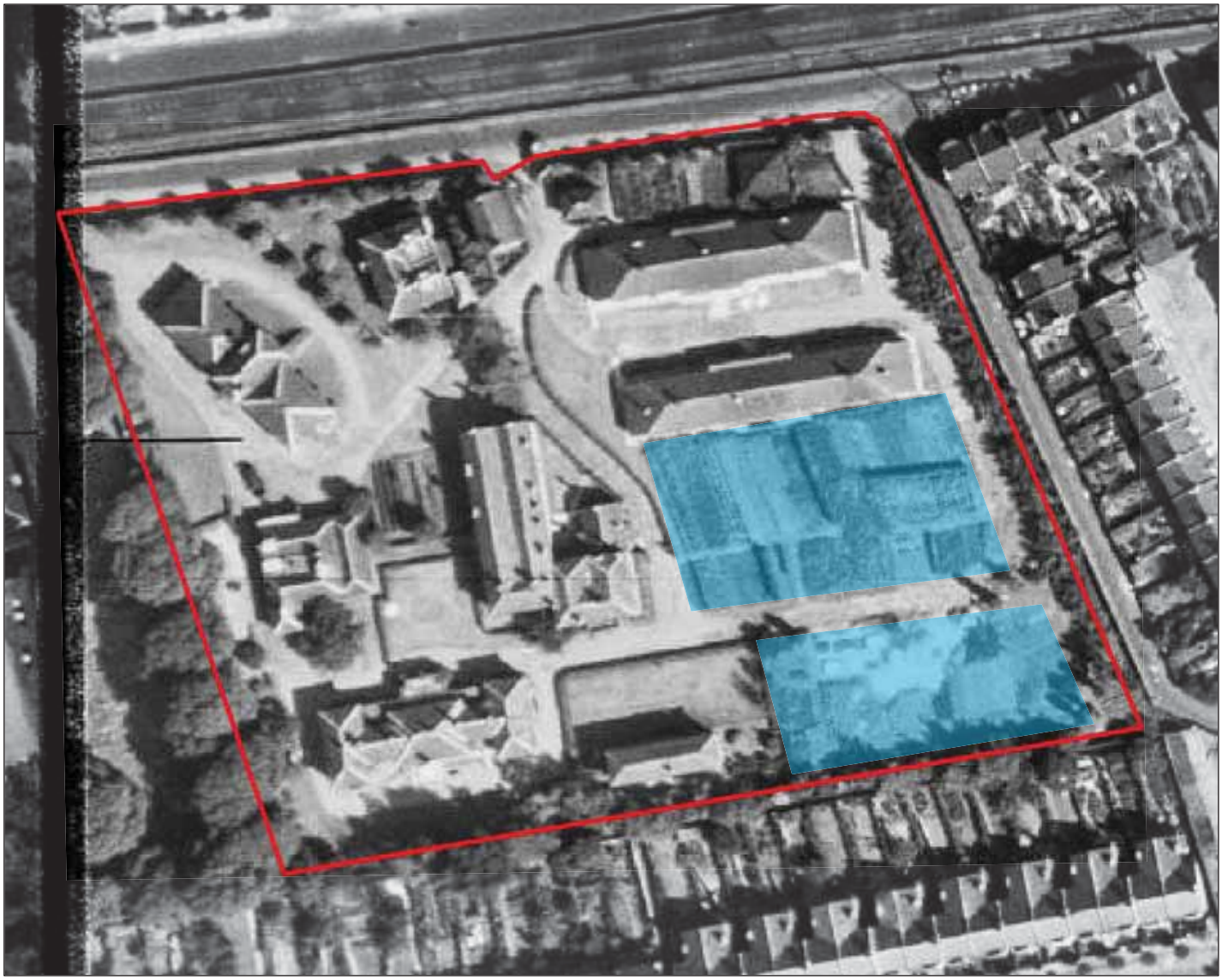
Project: **Barnes Hospital, London**

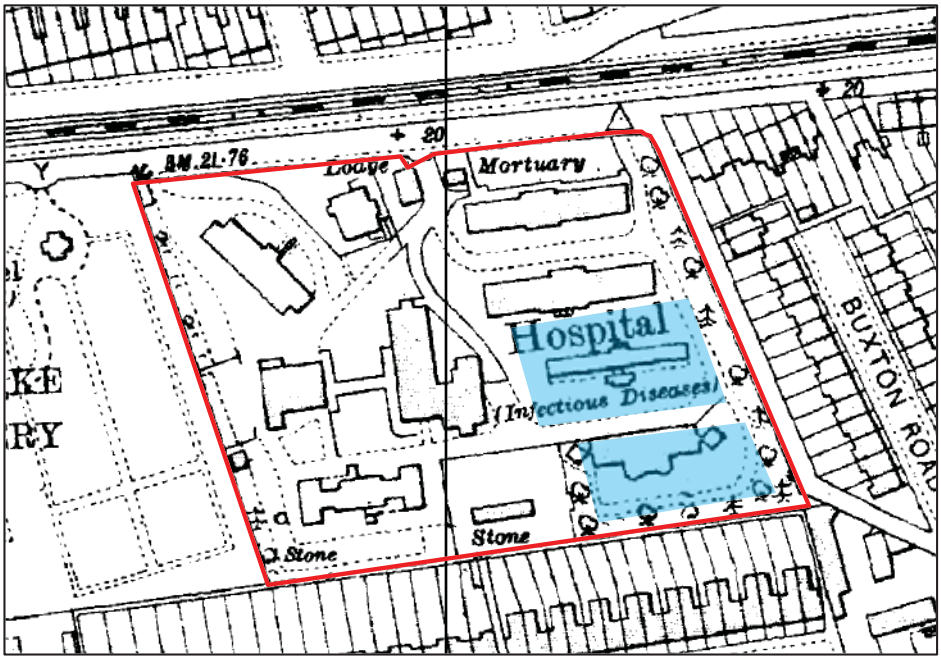
Ref: **DA8245a-00**

Source: National Monuments Record Office (Historic England)

RAF Aerial Photography 18th August 1947

Annex: **N2**





The blue shaded areas denote the areas cleared of buildings on the available post-war imagery (compared to pre-war mapping to left). At least two bombs were recorded in this eastern half of the site. It is considered that this clearance may have resulted from bomb damage.

1ST LINE DEFENCE

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Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: National Monuments Record Office (Historic England)

Approximate site boundary

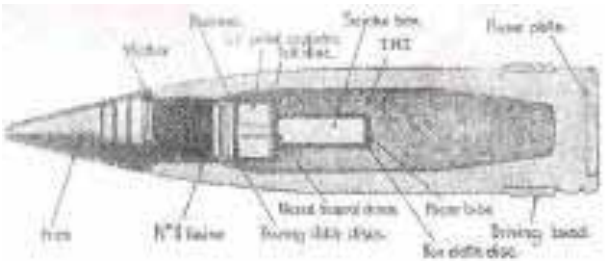
N

Examples of Anti-Aircraft Projectiles

Annex: O

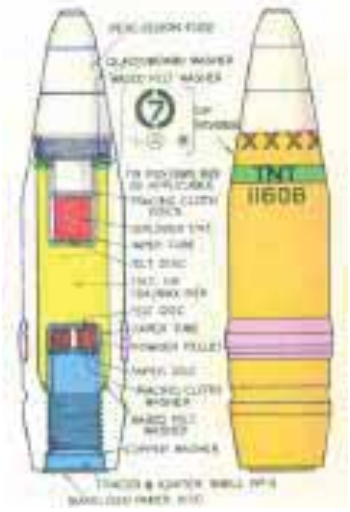
3.7 Inch QF Anti-Aircraft Projectile

Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft



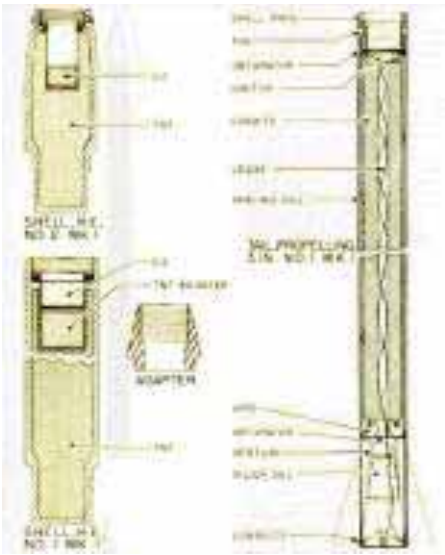
40mm Bofors Projectile

Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft



3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor



1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

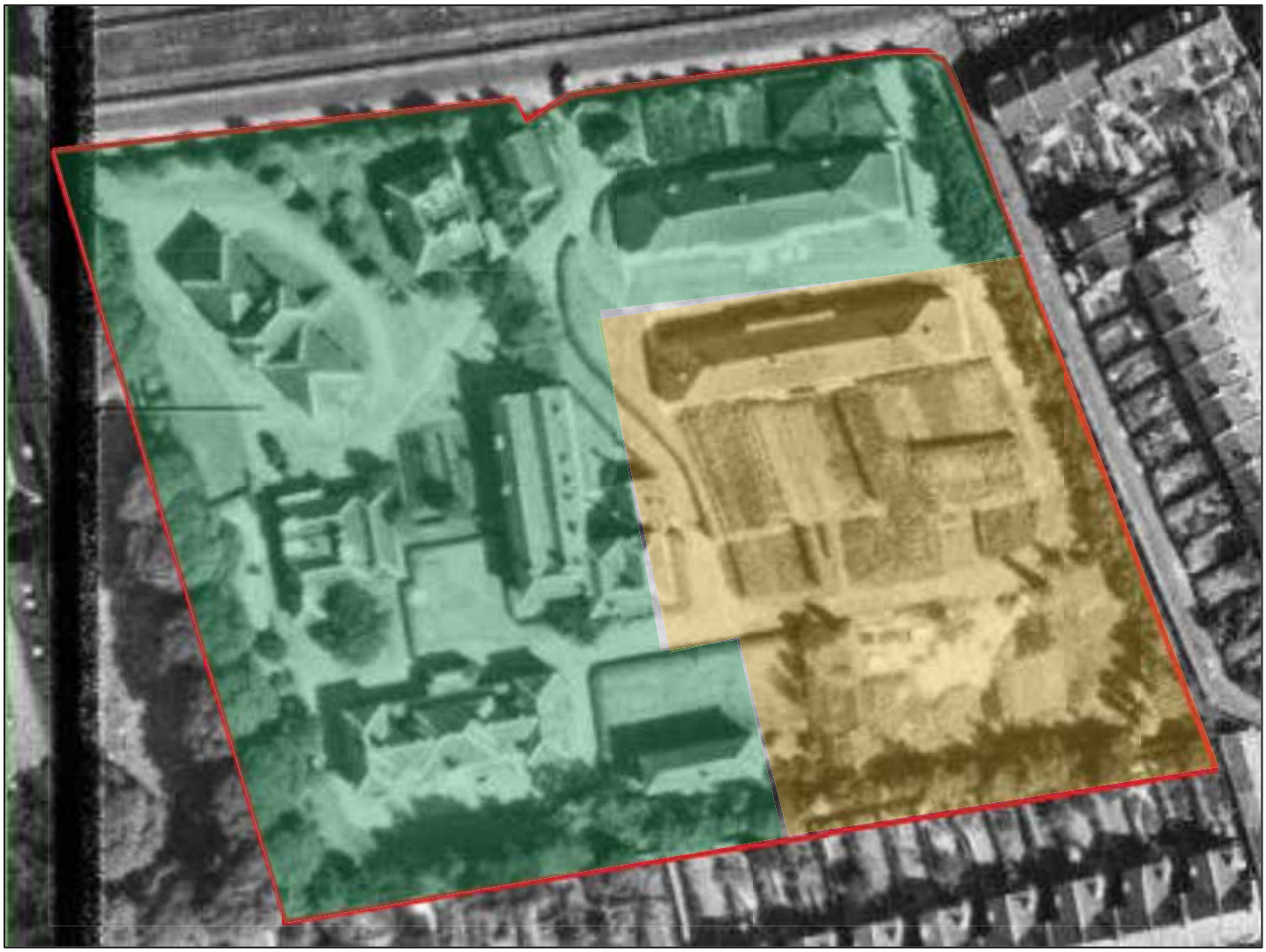
Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: Various sources

Risk Map – Site Plan Overlay

Annex: **P**



Low Risk

Medium Risk

Low and Medium Risk Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Medium Risk Area:

- Unexploded Ordnance (UXO) Specialist Presence on Site to support open intrusive works
- Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth

For indicative purposes – not to scale

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **Beadmans**

Project: **Barnes Hospital, London**

Ref: **DA8245a-00**

Source: 1st Line Defence

Approximate site boundary

N

1ST LINE DEFENCE
Unit 3, Maple Park
Essex Road
Hoddesdon
Hertfordshire
EN11 0EX
Tel: 01992 245020

www.1stlinedefence.co.uk

APPENDIX D
REGULATORY AUTHORITY CORRESPONDENCE

From:	Gavin Day
To:	Ziaul Hoque
Subject:	Planning application 18/3642/OUT - contaminated land investigation
Date:	20 November 2019 18:53:24

Hello Ziaul, Thank you for the mail. Alas LBM IT blocks your filetransfer link. We have no exceptional contamination concerns with regards the hospital and are happy that you wish to conduct additional sampling.

Gavin Day
Environmental Protection Officer
Regulatory Services Partnership
Serving Merton, Richmond and Wandsworth Councils

From: Pollution and Air Quality <Pollution@merton.gov.uk>
Sent: 15 November 2019 14:10
To: Gavin Day <Gavin.Day@merton.gov.uk>
Subject: Planning application 18/3642/OUT - contaminated land investigation LINK BLOCKED

From: Ziaul Hoque <ZHoque@rsk.co.uk>
Sent: 15 November 2019 09:05
To: Pollution and Air Quality <Pollution@merton.gov.uk>; Pollution and Air Quality <Pollution@merton.gov.uk>
Cc: Planning <Planning@merton.gov.uk>
Subject: Planning application 18/3642/OUT - contaminated land investigation

Dear Environmental Health / Pollution Team
Re. Barnes Hospital South Worple Way East Sheen London SW14 8SU – Richmond Council

With reference to the above, we have been appointed to oversee the environmental consultancy services relating to the GI/remediation works required to deliver a clean development platform b eneath the site (identified as 'Plot A'). To date, a desk based review and an intrusive ground inves tigation has been complete, albeit the spatial extent and dataset were limited. A copy of the pre vious report can be downloaded using the following link: https://we.tl/t-TTlVe9fZL1

To satisfy any planning obligations (i.e. pre-commencement conditions), we have provisionally scoped up supplementary site investigation scheme (please see attached) to obtain greater coverage of certain areas and/or target specific potential sources of contamination. The purpose of the supplementary investigations is to provide sufficient additional information to enable risks to a range of receptors to be fully assessed in relation to the proposed residential development.

We anticipate that a planning application (relating to contamination) will be submitted in due course. In the meantime, we would be grateful if you have any comments about the conclusions of the previous contaminated land assessments and subsequently seek clarification if Merton

Council approve the scope of the proposed supplementary investigation.

We look forward to hearing from you soon and shall be pleased to provide any additional information, as required

Ziaul Hoque
Principal Geo-environmental Engineer

Please note that normally I am not in the office on a Monday

RSK
18 Frogmore Road, Hemel Hempstead, Hertfordshire, HP3 9RT, UK

Switchboard: +44 (0)1442 437500
Fax: +44 (0)1442 437550
Direct dial: +44 (0)1442 416682
Mobile: +44 (0)7825943830
email: zhoque@rsk.co.uk

http://www.rsk.co.uk

RSK Environment Ltd is registered in Scotland at 65 Sussex Street, Glasgow, Scotland, G41 1DX, UK
Registered number: 115530

APPENDIX E
UTILITY SERVICE DRAWINGS

Asset location search

Property Searches

RSK Environment Limited
18

HEMEL HEMPSTEAD
HP3 9RT

Search address supplied

Barnes Hospital
South Worple Way
London
SW14 8SU

Your reference 28836

Our reference ALS/ALS Standard/2019_3954752

Search date 18 February 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

Asset location search

Property Searches

Search address supplied: Barnes Hospital, South Worple Way, London, SW14 8SU

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

Asset location search

Property Searches

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3954752

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 521196,175690

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3901	6.71	.7
39TX	n/a	n/a
09XZ	n/a	n/a
09ZV	n/a	n/a
1911	6.04	4.46
1904	6.05	3.89
19XS	n/a	n/a
181A	n/a	n/a
19YP	n/a	n/a
1705	6.43	4.6
0701	6	3.72
0708	5.92	4.73
1703	6.45	5.02
07WR	n/a	n/a
17YZ	n/a	n/a
171A	n/a	n/a
17YW	n/a	n/a
17ZT	n/a	n/a
17ZV	n/a	n/a
171B	n/a	n/a
07WW	n/a	n/a
07WQ	n/a	n/a
17YY	n/a	n/a
071E	n/a	n/a
17ZP	n/a	n/a
18TZ	n/a	n/a
18XZ	n/a	n/a
18YS	n/a	n/a
0801	5.76	3.32
181C	n/a	n/a
181B	n/a	n/a
1805	6.23	4.77
081B	n/a	n/a
1801	6.15	4.65
18XP	n/a	n/a
18YT	n/a	n/a
07YP	n/a	n/a
07XQ	n/a	n/a
08ZQ	n/a	n/a
08YZ	n/a	n/a
08YY	n/a	n/a
08YW	n/a	n/a
08YV	n/a	n/a
9802	5.7	3.13
08YS	n/a	n/a
08YR	n/a	n/a
0803	5.69	4.61
08YP	n/a	n/a
08XZ	n/a	n/a
08XX	n/a	n/a
08XW	n/a	n/a
98KC	n/a	n/a
081C	n/a	n/a
08XT	n/a	n/a
081A	n/a	n/a
08XS	n/a	n/a
98KE	n/a	n/a
9804	5.62	4.66
08XQ	n/a	n/a
0802	5.58	4.55
08XP	n/a	n/a
98KJ	n/a	n/a
981A	n/a	n/a
08WY	n/a	n/a
061A	n/a	n/a
961D	n/a	n/a
971F	n/a	n/a
97MJ	n/a	n/a
97MK	n/a	n/a
97MN	n/a	n/a
071A	n/a	n/a
971G	n/a	n/a
9707	6.64	2.63
9710	6.67	4.13
0710	6.43	4.6
9703	6.11	n/a
0702	4.09	3.43
9709	5.94	4.62
0709	5.88	4.98
07ZP	n/a	n/a
07YT	n/a	n/a
07ZV	n/a	n/a
07YQ	n/a	n/a
071D	n/a	n/a
071C	n/a	n/a
071B	n/a	n/a
07YZ	n/a	n/a
07YS	n/a	n/a
07XX	n/a	n/a
07ZT	n/a	n/a
07YY	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
97MD	n/a	n/a
96KJ	n/a	n/a
96LH	n/a	n/a
96MD	n/a	n/a
971E	n/a	n/a
96LF	n/a	n/a
96LE	n/a	n/a
991B	n/a	n/a
9801	5.44	2.75
091A	n/a	n/a
09WS	n/a	n/a
09WT	n/a	n/a
08ZS	n/a	n/a
08ZT	n/a	n/a
08WX	n/a	n/a
0906	5.45	2.91
081D	n/a	n/a
4509	6.06	4.3
4402	6.55	3.02
48WT	n/a	n/a
4707	6.42	4.87
49WT	n/a	n/a
48WY	n/a	n/a
481I	n/a	n/a
4805	5.91	3.67
48XT	n/a	n/a
4804	5.93	2.88
481D	n/a	n/a
48YP	n/a	n/a
3604	6.01	1.49
3611	6.19	4.93
4604	6.23	1.28
4602	n/a	n/a
47XV	n/a	n/a
4705	5.56	2.48
47XS	n/a	n/a
4708	5.67	5.05
47WR	n/a	n/a
461B	n/a	n/a
46VQ	n/a	n/a
46VV	n/a	n/a
46TT	n/a	n/a
46SV	n/a	n/a
38ZQ	n/a	n/a
38YZ	n/a	n/a
3809	6.18	5.17
38WR	n/a	n/a
3806	5.96	2.62
38WZ	n/a	n/a
38XX	n/a	n/a
38XS	n/a	n/a
38XW	n/a	n/a
38VV	n/a	n/a
38VW	n/a	n/a
38YP	n/a	n/a
391C	n/a	n/a
381B	n/a	n/a
48VW	n/a	n/a
48XQ	n/a	n/a
49YQ	n/a	n/a
48WP	n/a	n/a
4906	6.29	3.2
48XP	n/a	n/a
481F	n/a	n/a
49YT	n/a	n/a
48WX	n/a	n/a
48WR	n/a	n/a
49WS	n/a	n/a
49YV	n/a	n/a
48WS	n/a	n/a
3606	6.46	3.37
3605	5.9	2.58
36WQ	n/a	n/a
36WZ	n/a	n/a
36WV	n/a	n/a
36XT	n/a	n/a
36XX	n/a	n/a
36VS	n/a	n/a
36YQ	n/a	n/a
36TW	n/a	n/a
36YV	n/a	n/a
36SZ	n/a	n/a
36YZ	n/a	n/a
36TY	n/a	n/a
36VR	n/a	n/a
36SX	n/a	n/a
36TR	n/a	n/a
36TV	n/a	n/a
36TS	n/a	n/a
36TP	n/a	n/a
36ZR	n/a	n/a
36TQ	n/a	n/a
36TT	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
36ZV	n/a	n/a
3610	6.2	5.62
3601	6.2	4.44
37ZQ	n/a	n/a
37WW	n/a	n/a
37XW	n/a	n/a
371H	6.1	3.77
37YV	n/a	n/a
37ZT	n/a	n/a
37YW	n/a	n/a
27YZ	n/a	n/a
37XT	n/a	n/a
371G	6.24	4.02
37XV	n/a	n/a
3712	6.27	5.41
3711	6.14	4.64
3705	6.09	5.41
37XR	n/a	n/a
37XS	n/a	n/a
37YZ	n/a	n/a
37WR	n/a	n/a
37ZP	n/a	n/a
37YY	n/a	n/a
37XP	n/a	n/a
27YQ	n/a	n/a
371E	n/a	n/a
37XQ	n/a	n/a
371N	6.24	4.24
37XX	n/a	n/a
37VZ	n/a	n/a
371F	n/a	n/a
37WY	n/a	n/a
371J	6.34	4.39
37WZ	n/a	n/a
3709	6.31	5.4
27ZX	n/a	n/a
37XZ	n/a	n/a
371I	n/a	n/a
471A	n/a	n/a
3708	6.48	5.03
3710	6.24	5.07
2704	6.26	1.81
3701	6.59	1.2
3702	6.75	1.06
371B	6.6	.9
3707	5.84	5.02
4701	n/a	n/a
4706	5.81	4.98
2707	6.46	4.9
2703	6.59	4.61
4702	5.62	4.2
371C	n/a	n/a
3706	6.44	.43
381A	n/a	n/a
48SS	n/a	n/a
3802	n/a	n/a
3805	6.46	.69
3810	6.38	5.12
3811	6.29	2.76
381E	n/a	n/a
38ZS	n/a	n/a
381D	n/a	n/a
2810	n/a	n/a
2805	6.31	4.2
381C	n/a	n/a
381F	n/a	n/a
2806	n/a	n/a
2811	6.35	5.21
3804	6.51	.86
3808	6.48	4.55
381H	n/a	n/a
381G	n/a	n/a
281B	n/a	n/a
281A	n/a	n/a
38TZ	n/a	n/a
3807	n/a	n/a
3803	6.5	.7
38TW	n/a	n/a
281D	n/a	n/a
2919	6.44	4.9
2912	6.54	4.58
3903	6.65	3.86
391A	n/a	n/a
29YS	n/a	n/a
2920	n/a	n/a
2601	6.22	4.41
2509	6.24	4.87
26YP	n/a	n/a
26XW	n/a	n/a
26XR	n/a	n/a
26WY	n/a	n/a
25ZY	n/a	n/a
251B	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3609	6.23	4.62
3613	6.21	n/a
3607	5.99	3
3612	5.86	5.07
3608	5.86	1.72
36VV	n/a	n/a
36VW	n/a	n/a
36VX	n/a	n/a
3505	5.73	4.38
461A	n/a	n/a
4516	5.72	4.35
4502	5.89	1.74
451A	n/a	n/a
4515	5.83	4.3
4610	6.05	4.73
451B	n/a	n/a
4605	6.11	1.44
4611	6.05	4.88
4510	4.01	4.31
4614	5.94	4.58
1501	6.37	4.36
1409	6.12	2.62
1406	6.22	4.09
151A	n/a	n/a
151B	n/a	n/a
1507	6.41	4.97
1405	6.14	4.64
15QQ	n/a	n/a
15QR	n/a	n/a
16ZX	n/a	n/a
2411	n/a	n/a
2410	n/a	n/a
26WV	n/a	n/a
25QT	n/a	n/a
25QP	n/a	n/a
2401	n/a	n/a
2502	6.41	4.72
2507	6.37	5.05
2501	6.41	4.63
26ZV	n/a	n/a
2508	6.39	5.03
26ZR	n/a	n/a
25QW	n/a	n/a
25QR	n/a	n/a
26YY	n/a	n/a
26YT	n/a	n/a
171G	n/a	n/a
18TR	n/a	n/a
18TT	n/a	n/a
18VR	n/a	n/a
171C	n/a	n/a
1802	6.15	5.19
171F	n/a	n/a
1803	6.12	5.11
18VP	n/a	n/a
1701	5.89	4.72
17ZW	n/a	n/a
1704	6.04	5.28
1702	6.43	2.63
28YP	n/a	n/a
28XX	n/a	n/a
28XS	n/a	n/a
2801	6.24	4.11
28WZ	n/a	n/a
2808	6.23	4.87
2706	6.43	4.98
2701	6.55	4.59
281C	n/a	n/a
281F	n/a	n/a
2814	n/a	n/a
2804	n/a	n/a
2708	6.33	5.67
2702	8.05	5.57
28YS	n/a	n/a
2809	6.29	5.6
2803	6.29	5.6
1804	6.32	3.73
281E	n/a	n/a
2802	6.23	4.63
2918	6.23	4.97
1913	6.26	4.55
2905	6.32	3.87
2917	6.23	4.97

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

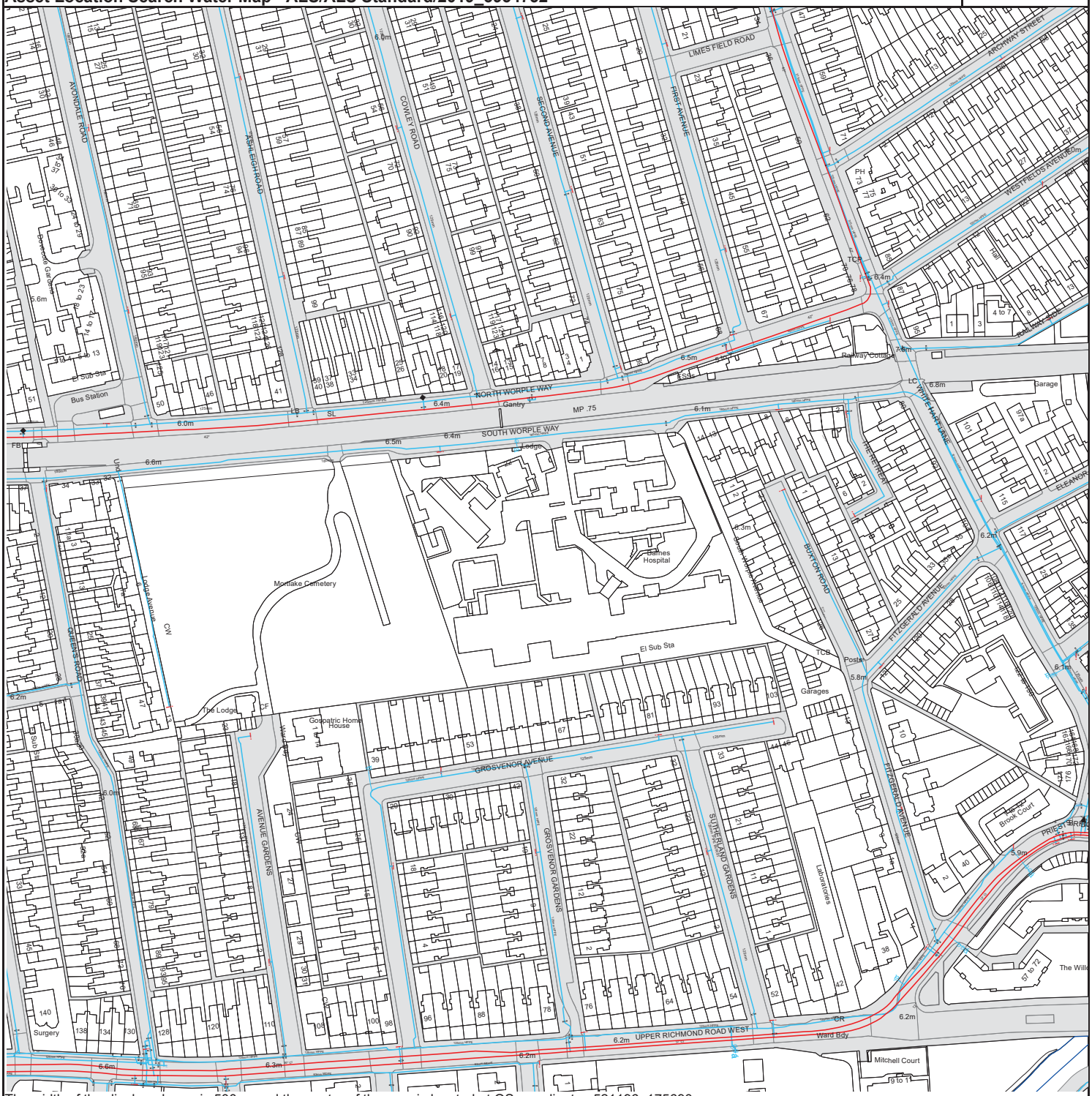
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019_3954752



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 521196, 175690.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Terms and Conditions

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Web site: www.tpos.co.uk
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Jessica Western

From: Gopalakrishnan, Roshni <Roshni.Gopalakrishnan@atkinsglobal.com>
Sent: 27 February 2019 09:24
To: Jessica Western
Subject: RE: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Please accept this email as confirmation that Vodafone: Fixed **does not** have apparatus within the vicinity of your proposed works detailed below.

Many thanks.

Plant Enquiries Team
T: +44 (0)1454 662881
E: osm.enquiries@atkinsglobal.com

ATKINS working on behalf of Vodafone: Fixed

This response is made only in respect to electronic communications apparatus forming part of the Vodafone Limited electronic communications network formerly being part of the electronic communications networks of Cable & Wireless UK, Energis Communications Limited, Thus Group Holdings Plc and Your Communications Limited.

PLEASE NOTE:

The information given is indicative only. No warranty is made as to its accuracy. This information must not be solely relied upon in the event of excavation or other works carried out in the vicinity of Vodafone plant. No liability of any kind whatsoever is accepted by Vodafone, its servants, or agents, for any error or omission in respect of information contained on this information. The actual position of underground services must be verified and established on site before any mechanical plant is used. Authorities and contractors will be held liable for the full cost of repairs to Vodafone's apparatus and all claims made against them by Third parties as a result of any interference or damage.

IMPORTANT - PLEASE READ:-
Diversionary works may be necessary if the existing line of the highway/railway or its levels are altered, where apparatus is affected. Where apparatus is affected and requires diversion, you must submit draft details of the proposed scheme with a request for a 'C3 Budget Estimate' to c3requests@vodafone.com These estimates should be provided by Vodafone normally within 20 working days from receipt of your request. Please include proof of this C2 response when requesting a C3 (using the 'forward' option).

Please consider the environment before printing this e-mail

From: Jessica Western <JWestern@rsk.co.uk>
Sent: 18 February 2019 20:04
To: 'plantenquiries@instalcom.co.uk' <plantenquiries@instalcom.co.uk>; 'asset.team@cityfibre.com' <asset.team@cityfibre.com>; 'plantenquiries@catelecomuk.com' <plantenquiries@catelecomuk.com>; 'plantenquiries@energetics-uk.com' <plantenquiries@energetics-uk.com>; 'nrswa@cofely-gdfsuez.com' <nrswa@cofely-gdfsuez.com>; 'interoute.enquiries@plancast.co.uk' <interoute.enquiries@plancast.co.uk>; 'kpn.plantenquiries@instalcom.co.uk' <kpn.plantenquiries@instalcom.co.uk>; 'mbnl.plant.enquiries@turntown.com' <mbnl.plant.enquiries@turntown.com>; 'OPBuriedServicesEnquiries@networkrail.co.uk' <OPBuriedServicesEnquiries@networkrail.co.uk>; 'highwaysandtransport@richmond.gov.uk' <highwaysandtransport@richmond.gov.uk>; 'nrswa@sky.uk' <nrswa@sky.uk>; 'SOTA.plantenquiries@instalcom.co.uk' <SOTA.plantenquiries@instalcom.co.uk>; 'Gavin Clifton' <gavin.clifton-CT@telent.com>; 'assetrecords@utilityassets.co.uk' <assetrecords@utilityassets.co.uk>; 'osp-team@uk.verizonbusiness.com' <osp-team@uk.verizonbusiness.com>; '>Plant Enquiries Team' <PlantEnquiriesTeam@virginmedia.co.uk>; National Plant Enquiry's <OSM.enquiries@atkinsglobal.com>
Subject: URGENT 28836 Barnes Hospital, South Worple Way, London SW14 8SU

Good Afternoon,

Our company is currently undertaking an intrusive site investigation of the area detailed below.

Our reference: 28836
Location of works: Barnes Hospital, South Worple Way, London
O.S. Grid Ref.: 521162, 175679
Address/Nearest Postcode: SW14 8SU
Expected Start Date:
Expected Completion Date:

A plan of the site has been enclosed, please cover the entire area shown within the boundary on the attached map.

In order that all reasonable precautions may be taken to avoid the risk to health and safety through contacts with any of your existing apparatus during execution of the proposed works, please indicate the position and depth of all main statutory services and wayleaves on site and in the adjoining roads where applicable. In addition, please highlight any likely special problems that could arise in connection with your apparatus as a result of the proposed works.

We therefore request that you supply us with relevant plan information or written confirmation to declare that no apparatus is affected at your earliest convenience.

Should you encounter any problems or require any further information, please contact me on the above address or by telephoning 01442 416626, any costs will be accepted with approval first.

Many Thanks,

Jessica Western
Utility Report Co-ordinator

I work part-time Mondays (until 3.00pm), Tuesdays (all day), Wednesdays (until 3.00pm), Thursdays (all day) Friday (until 3.00pm) I will respond to your e mail as soon as I am back in the office.

RSK
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