IMMINGHAM EASTERN RO-RO TERMINAL

Environmental Statement: Volume 3
Appendix 12.1: Phase 1 Desk Study - Part 4
Document Reference: 8.4.12 (a)

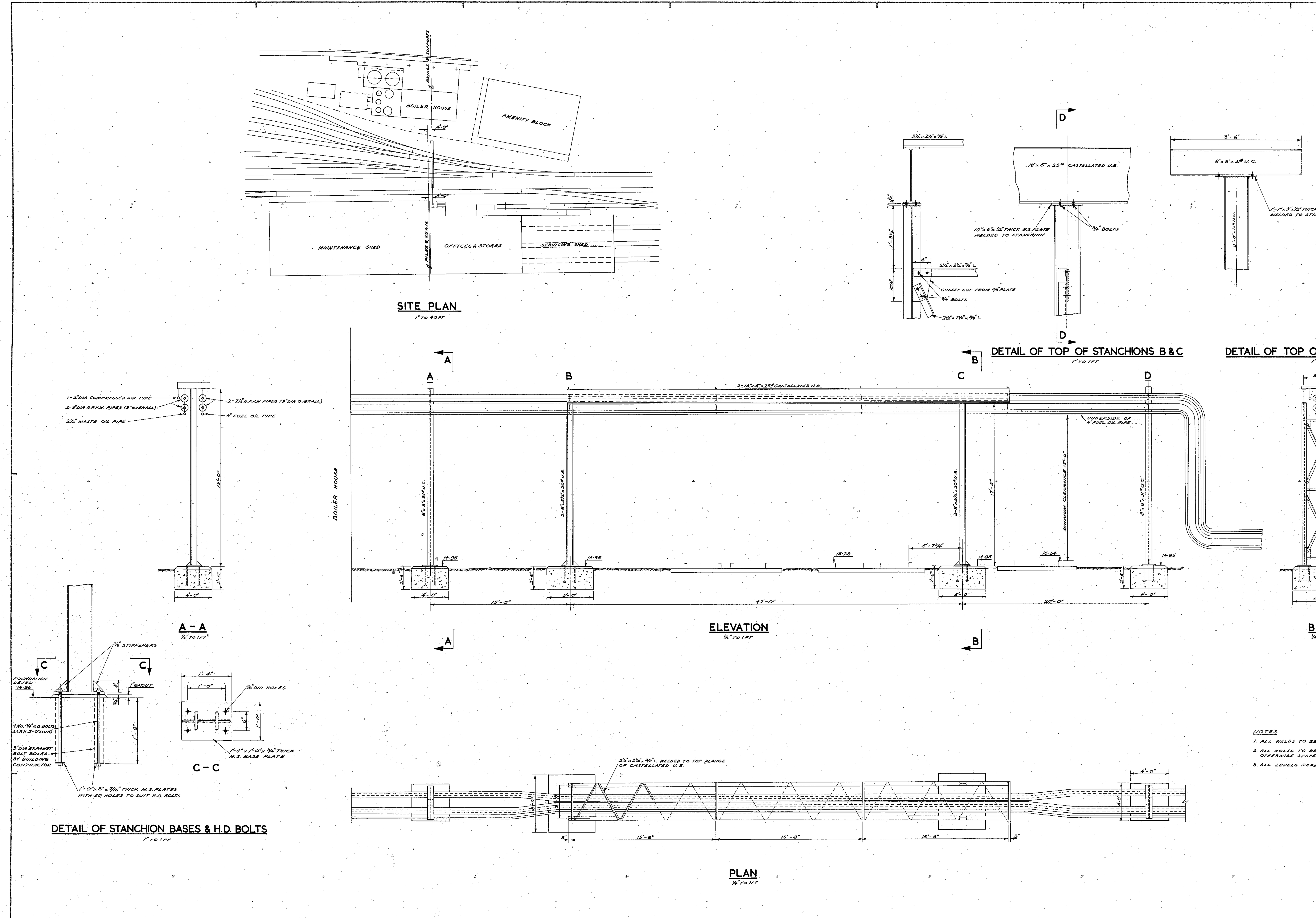
APFP Regulations 2009 – Regulation 5(2)(a) and 5(2)(e)
PINS Reference – TR030007

February 2023

CONTRACT

DRAWING No. 42A

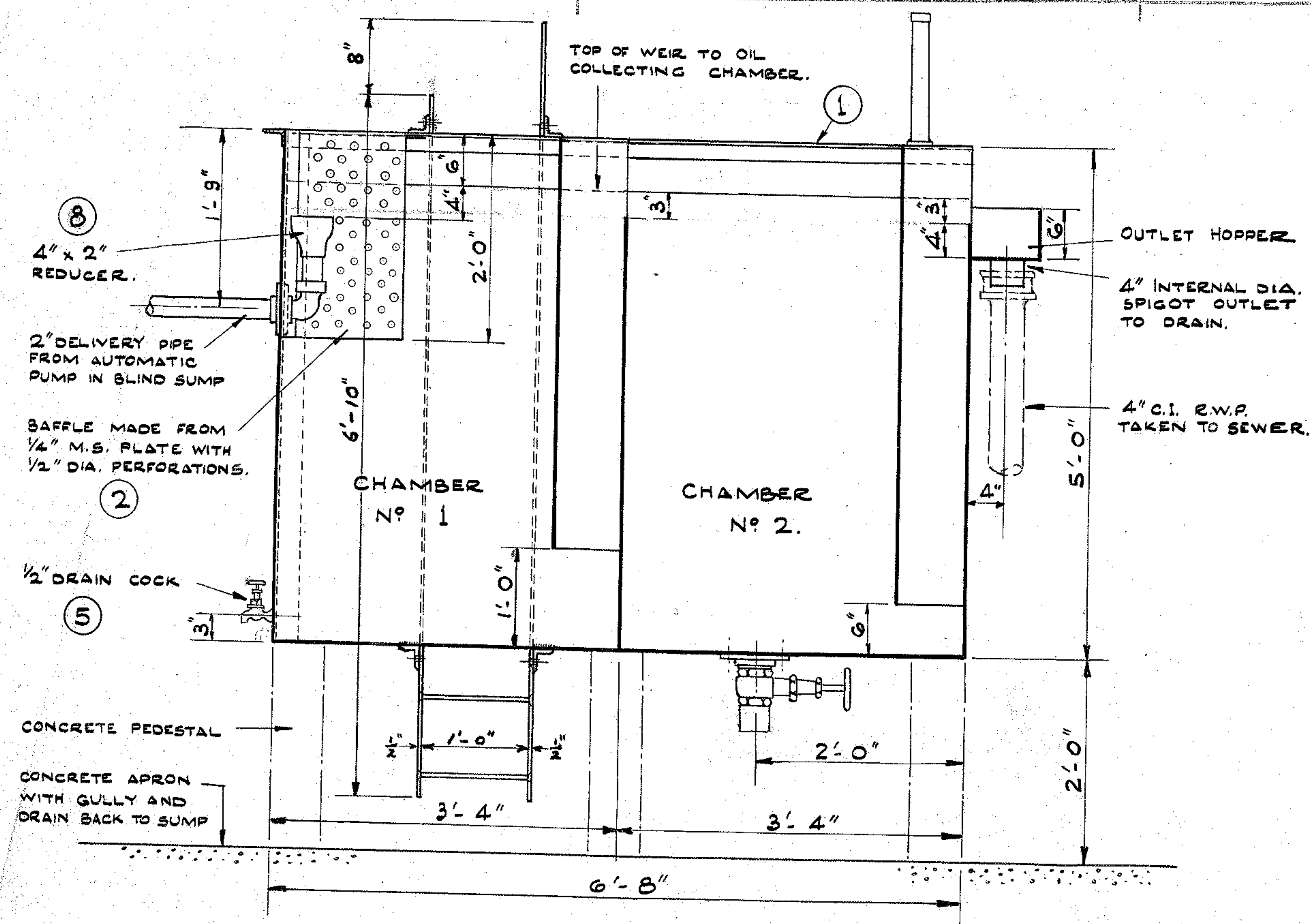
THIS DRAWING SUPERSEDES DRAWING No. 42



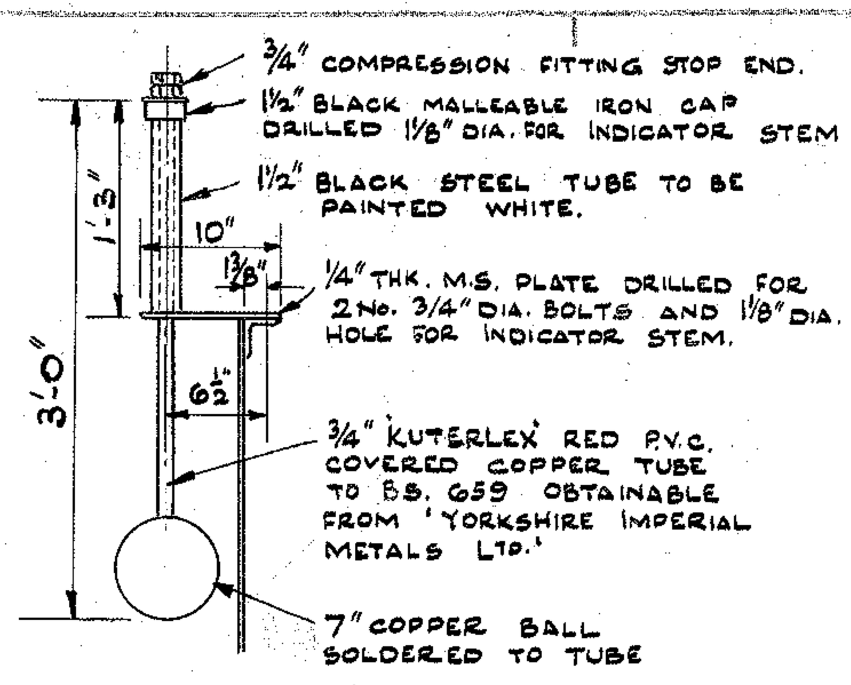
NOTES.
1. ALL WELDS TO BE ¼" FILLET WELDS.
2. ALL HOLES TO BE 13/16" DIA FOR ¾" DIA BOLTS UNLESS OTHERWISE STATED.
3. ALL LEVELS REFER TO ORDNANCE DATUM (NEWLYN)

B.T.C. BRITISH RAILWAYS CIVIL ENGINEER'S DEPT.		EASTERN REGION KING'S CROSS STATION
REVISED A. 12.8.65 HEIGHT INCREASED FOR ALTERED POSITION OF PIPES.	IMMINGHAM DIESEL MAINTENANCE AND SERVICING DEPOT SERVICES BRIDGE	
D.E. CORRES. C.E.	APPROVED [redacted] 18.3.65	SCALES— ¼" & 1" TO 1 FT
F.J.K. Z.G. / J.W.F.	J. D. WEST [redacted] A.C.E.(N) CIVIL ENGINEER	D.E's No. C711 C.E's No. 65NW/87 A
SHEET OF		

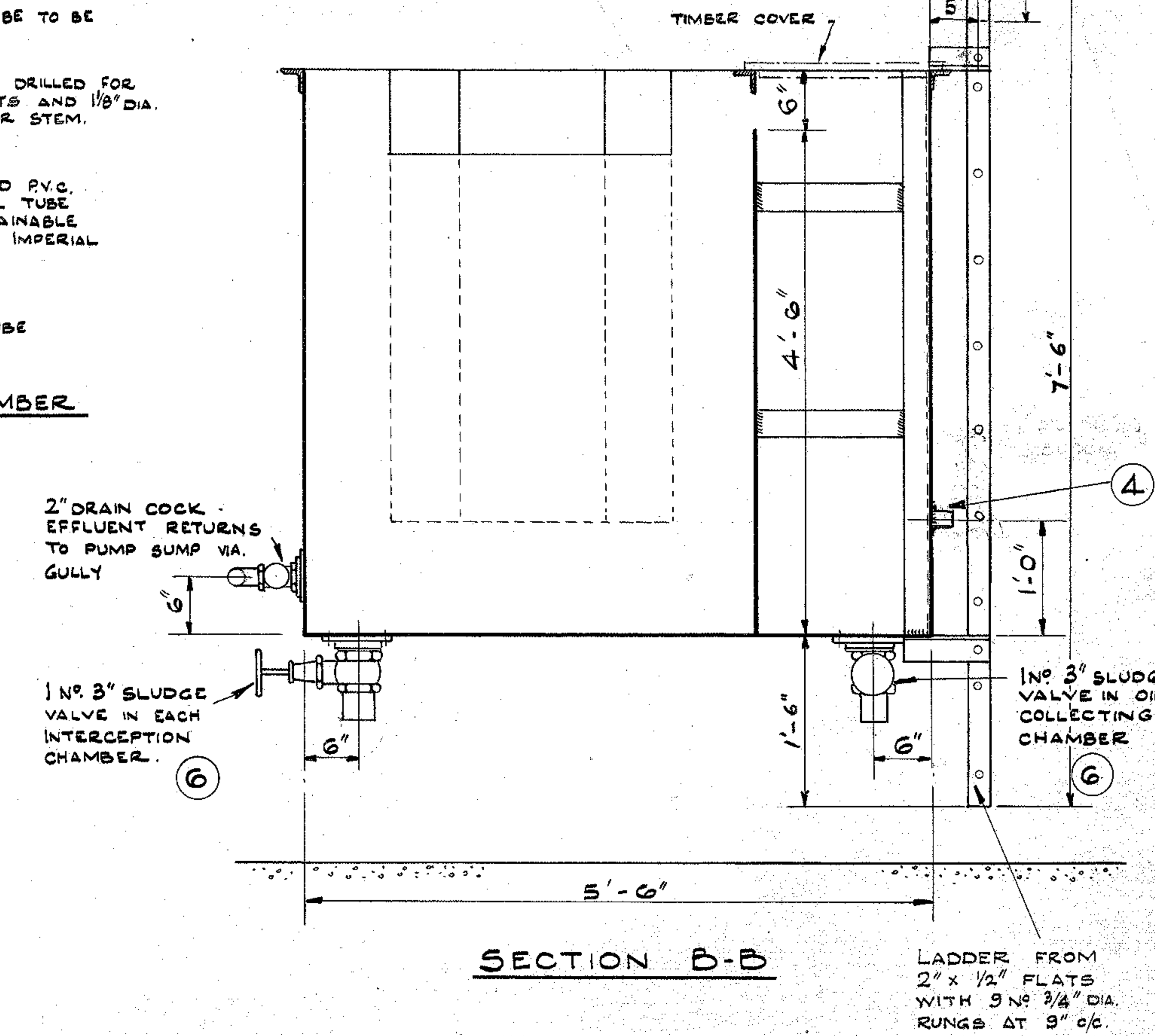
PHa11 E765/3



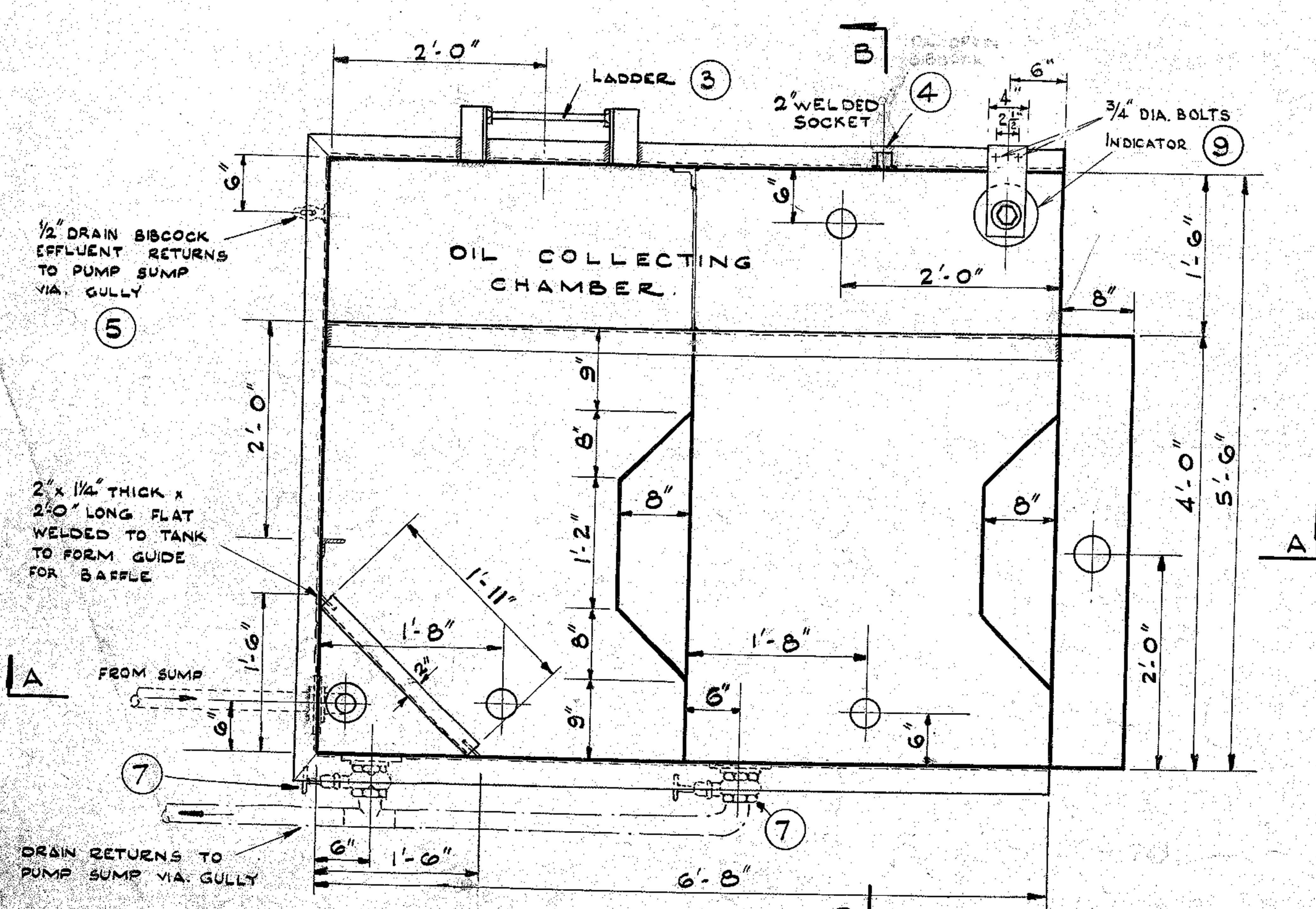
SECTION A-A



OIL COLLECTING CHAMBER INDICATOR.



SECTION B-B



PLAN

SCHEDULE OF COMPONENTS.		
ITEM No.	DESCRIPTION	Nº OFF
1	TANK WITH BAFFLES, OUTSIDE HOPPER AND LADDER BRACKETS.	1
	THE FOLLOWING ITEMS TO BE SUPPLIED, PREPARED FOR SITE FIXING AND COMPLETE WITH ALL NUTS, BOLTS, GASKETS etc.	
2	PERFORATED BAFFLE	1
3	LADDER	1
4	2" WELDED SOCKET - OIL	1
5	BIBCOCK 1/2 INCH DIA - OIL	1
6	SLUDGE VALVE 3 IN. DIA. WITH FLANGED BOSS	3
7	DRAINCOCK 2 INCH DIA. WITH FLANGED BOSS	2
8	4" x 2" REDUCER, 2" ELBOW, 6" LENGTH G.S. TUBE AND 2Nº 2" DIA. FLANGED BOSSES. (SEE NOTE 5)	1
9	OIL COLLECTING CHAMBER INDICATOR COMPLETE	1

NOTES.

1. 1/4" M.S. PLATE. 2 1/2" x 2 1/2" x 5/16" M.S. ANGLE AND CONTINUOUS WELDS TO BE USED THROUGHOUT.
2. WORK INDICATED BY LINES THUS ——·—— TO BE SUPPLIED AND/OR CONSTRUCTED BY ERECTOR.
3. A TIMBER COVER 1" NOMINAL THICKNESS, IN SECTIONS CONVENIENT FOR LIFTING - (APPROXIMATE SIZE 1'-9" x 1'-9") TO OIL COLLECTING CHAMBER TO BE PROVIDED. (THIS ITEM TO BE SUPPLIED BY ERECTOR.)
4. POSITIONS OF INLET PIPE, OIL DRAIN COCKS etc. MAY BE VARIED TO SUIT SITE CONDITIONS.
5. DELIVERY FROM PUMP MAY BE REDUCED IF AREA TO BE DRAINED IS SMALL. C.M. & E.E. SHOULD BE CONSULTED.

BRITISH RAILWAYS BOARD.
CHIEF CIVIL ENGINEER'S DEPT.

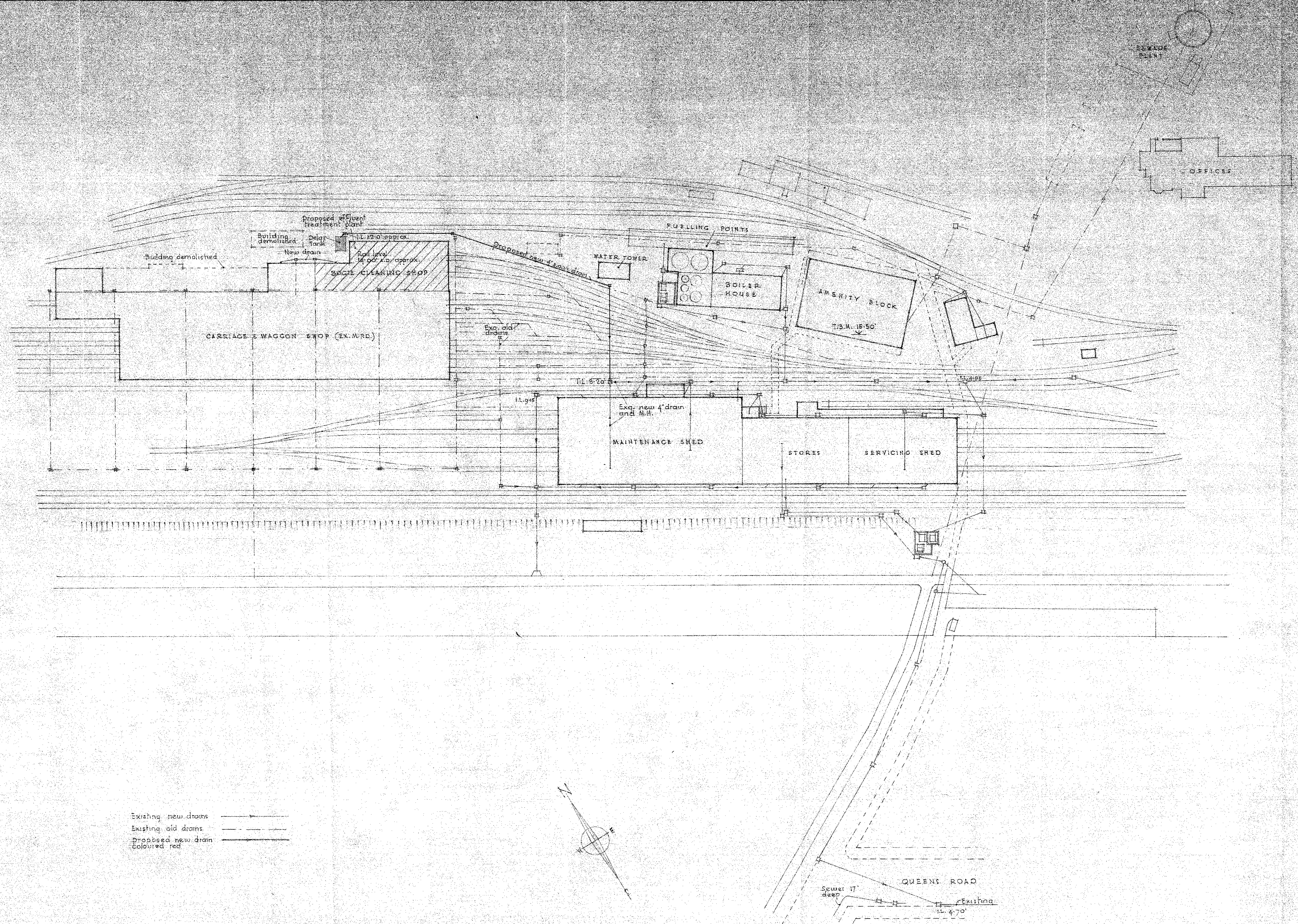
EASTERN REGION
NEW WORKS SECTION.

REVISED
A - Oil Level Indicator deleted. 12-3-68.
B - Ladder dimensions added. 3-7-68.
C - Oil Level Indicator restored 31-7-68

TYPICAL AUTOMATIC OIL INTERCEPTOR.
(ELEVATED PATTERN.)

D.E. CORRES | C.C.E. | APPROVED 7.5.65. | SCALES - 1" TO 1 FT.
[redacted]
W.H.H. | M.M.
[redacted]
SHEET OF
ASST. ENGINEER (NEW WORKS) | D.E.'s No.
CHIEF CIVIL ENGINEER | C.C.E.'s No. 65-YNW-50 | A B C

706 [redacted]



FOR & ON BEHALF OF,
[redacted]

OFFICE COPY. [redacted]

TRACED FROM DRAWING No 65/AW/48

13 APR 1967

C705

B.R.B. BRITISH RAILWAYS
CHIEF CIVIL ENGINEER'S DEPT.

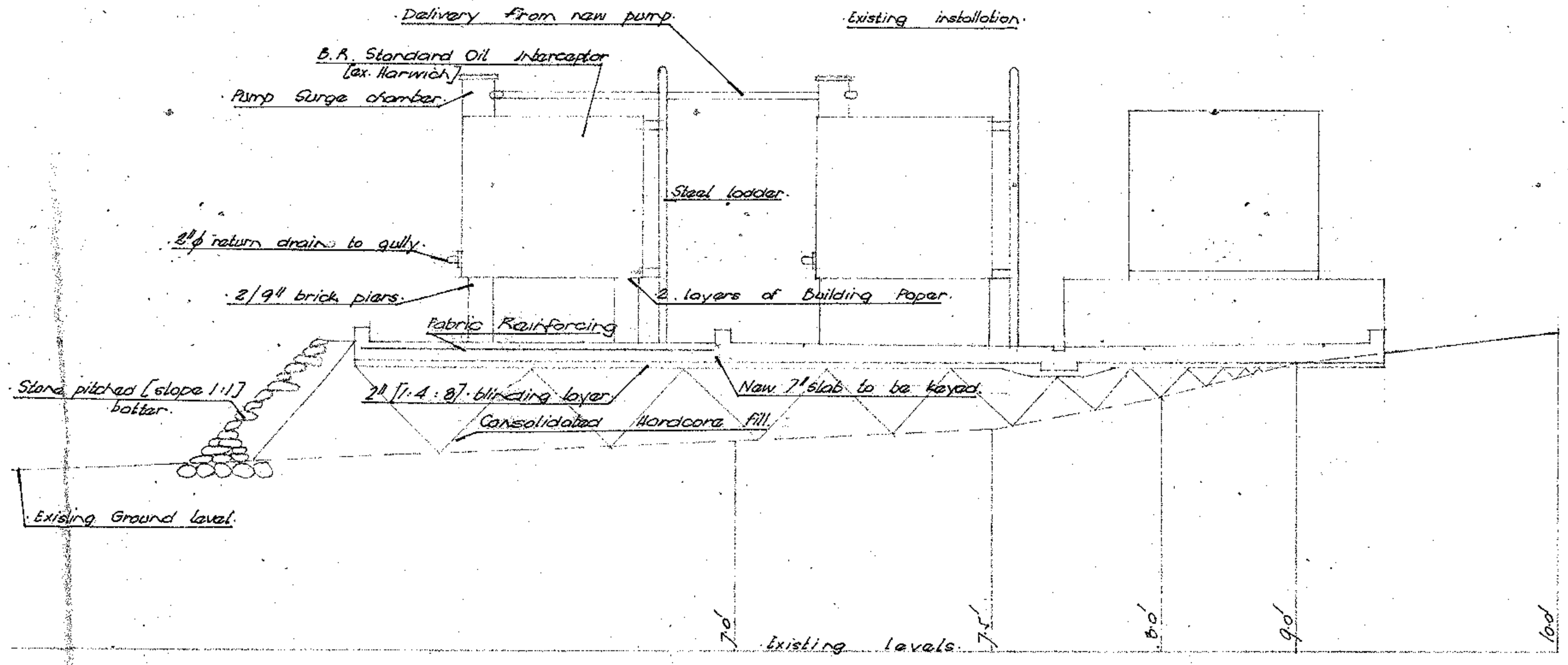
EASTERN REGION
KING'S CROSS STATION

REVISED

IMMINGHAM M.P.D.
BOGIE CLEANING SHOP
EXTENSION TO LIFTING SHOP
DRAINAGE PLAN

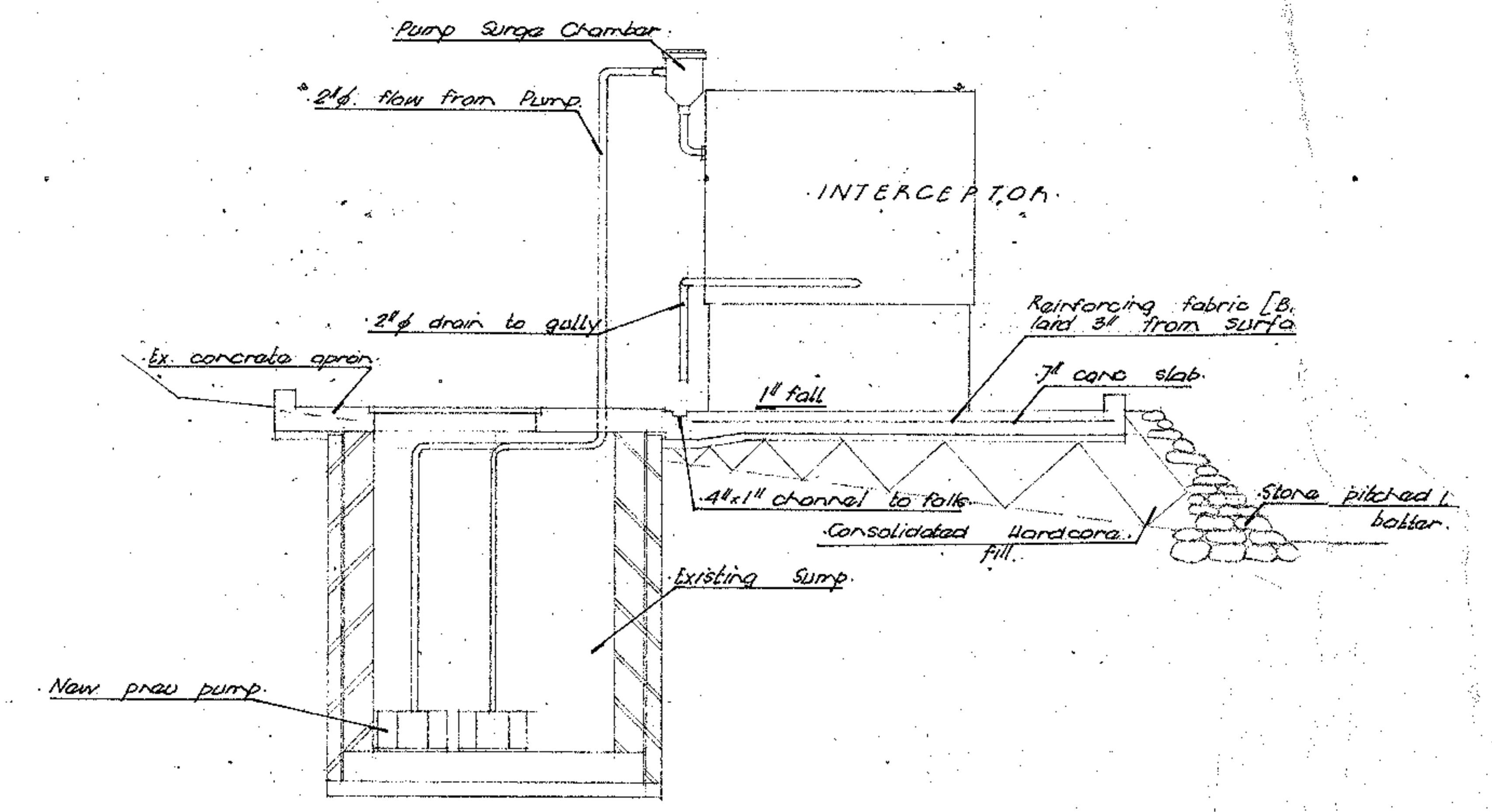
D.E.	CORRES.	C.C.I.	APPROVED	JUNE 66	SCALES
	29624		[redacted]		40' to 1 inch
A.L.B.					
R.J.L.C.					
SHEET OF 3			CHIEF CIVIL ENGINEER	C.C.E.'s No.	66/ME

SUPPLEMENTARY C



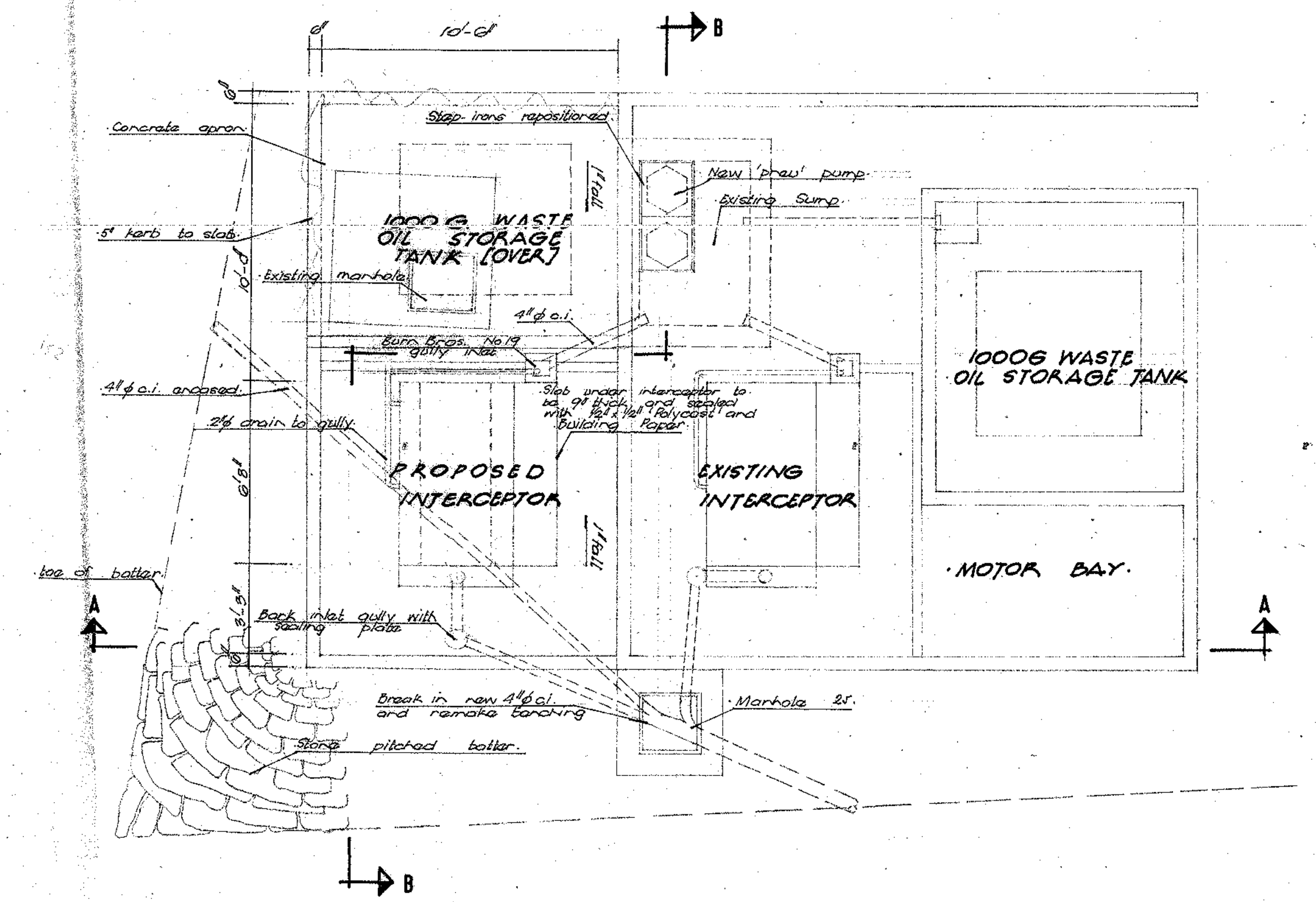
·SECTION : AA·

[scale : 1/4 in = 1 ft.]



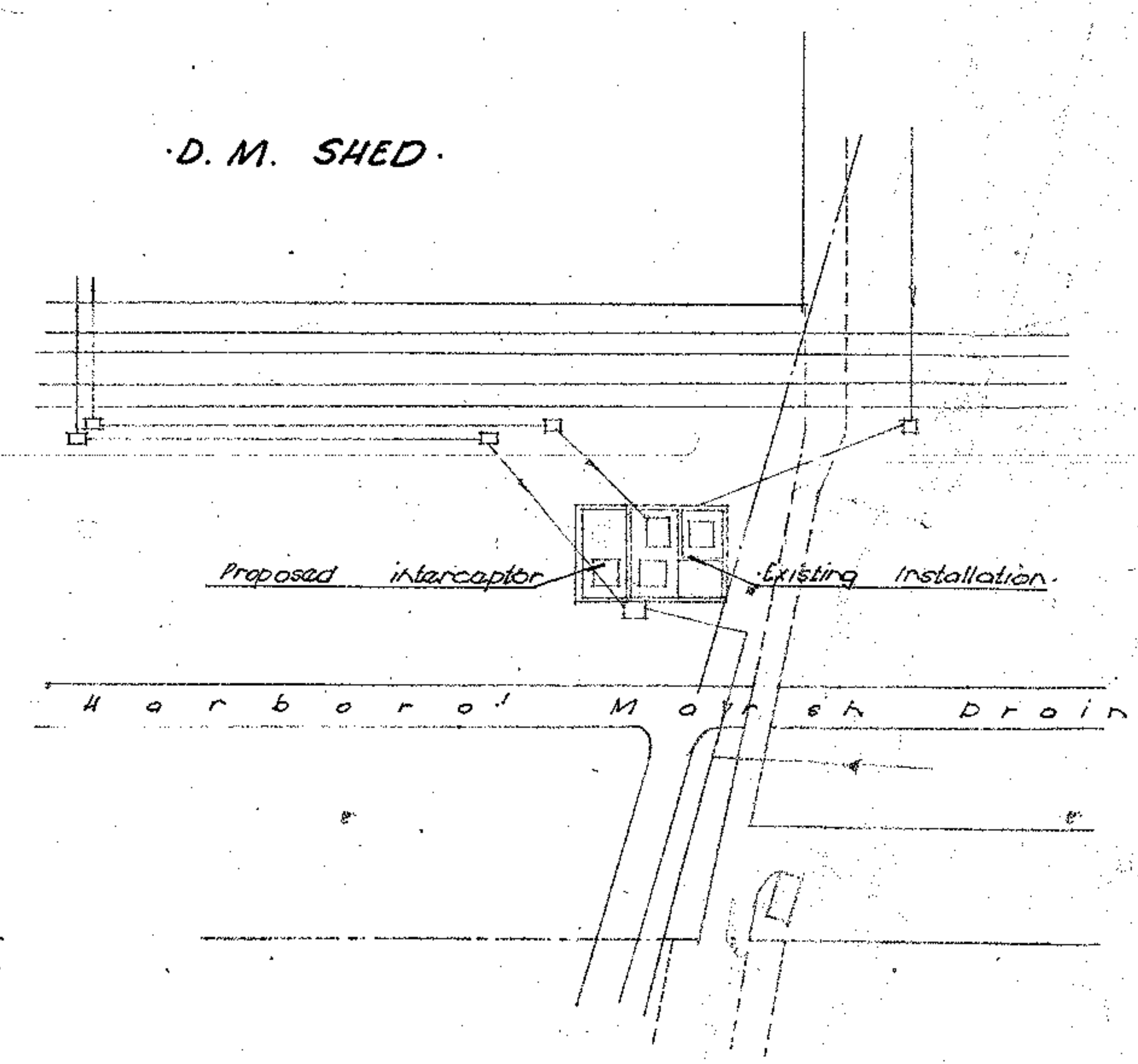
·SECTION : BB·

[scale : 1/4 in = 1 ft.]



·PLAN·

[scale : 1/4.in.= 1ft.]



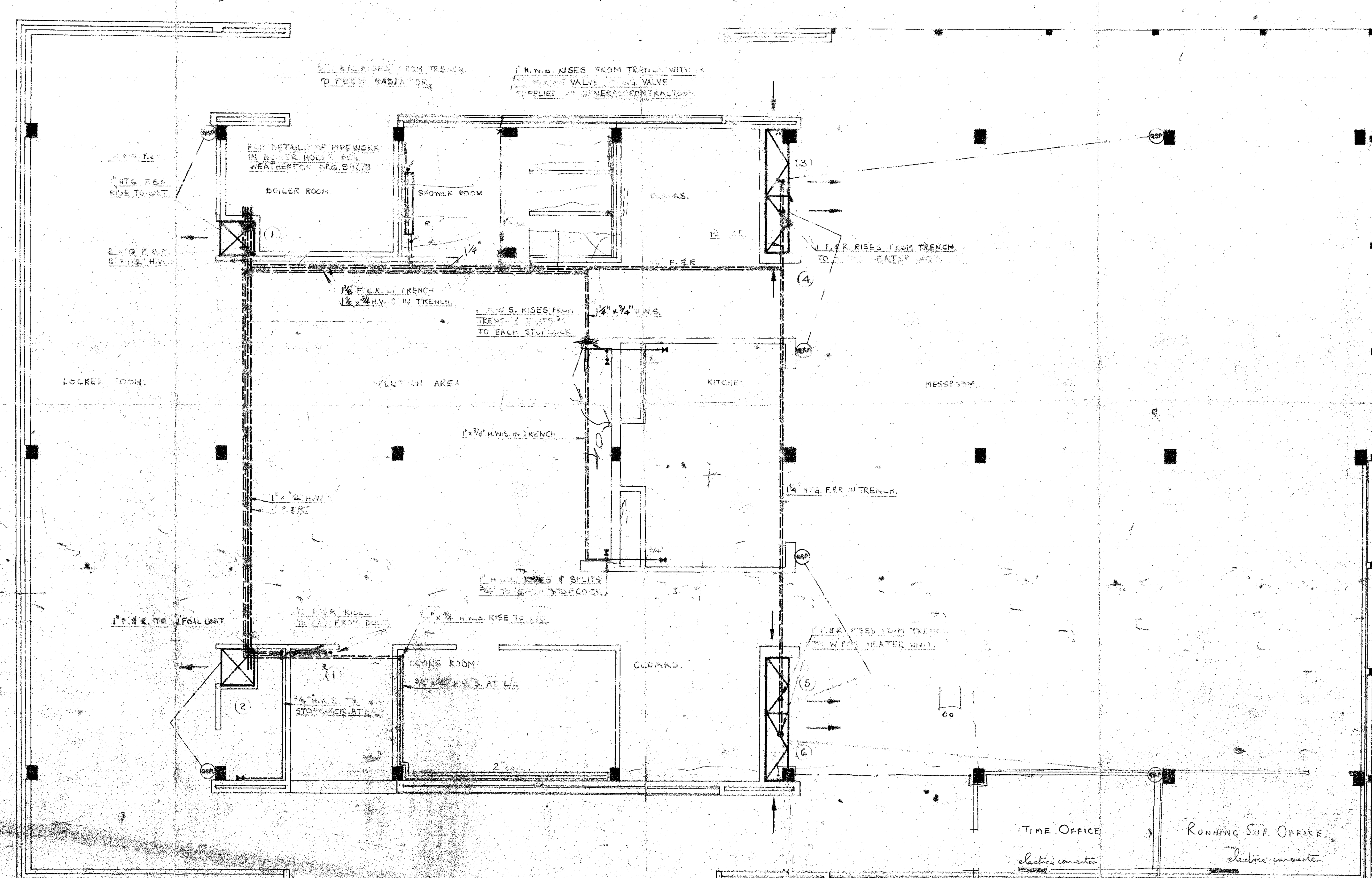
·SITE PLAN·

[scale : 40 ft. = 1 in.]

·NOTES·

1. Apron concrete to be 1:2:4 [3/4"] mix.
2. Apron concrete to be treated with 'Lithurin'.
3. Joint and bed stone pitching with 1:6 cement.
4. Bricks to be Engineering Class B [B.S. 1301 : 46]
5. Horizontal Paving joints to be sealed.

BRITISH RAILWAYS BOARD CHIEF CIVIL ENGINEER'S DEPT.	EASTERN REGION KINGS CROSS STATION
REVISED	·IMMINGHAM D.M. SHED· Proposed Interceptor augmenting existing main outfall and waste-oil storage arrangements
D.E. CORRES. C.C.E.	APPROVED 13.7.67
B.S. Gambrill	J.D. WES[redacted]
SHEET OF	CHIEF CIVIL ENGINEER
SCALES 1/4 in. = 1 ft. ; 40 ft. = 1 in.	C.C.E's No. 67 WS 98



WEATHERFOIL UNIT SCHEDULE						
No	BATTERY	FANS	FANPLATE	GRILLES	CONNS.	DRG. No.
1	UN4	2 x SEM	2N/S/X/33/29	66/25/23	1	404/75 R.F.1
2	"	"	2N/S/X/33/[illegible]	66/25/25	"	"
3	VBES	2 x SEM	2N/[illegible]/32/27	66/19/25	1	401/62
4	"	"	"	66/20/22	1	
5	"	"	"	66/[illegible]/25/22	1	
6	"	"	"	66/19/22	1	"

RADIATOR SCHEDULE					
No	COLS.	HEIGHT	SECTS.	CONNS.	NOTES.
[illegible]	[illegible]	[illegible]	[illegible]	½" [illegible]	

CODE

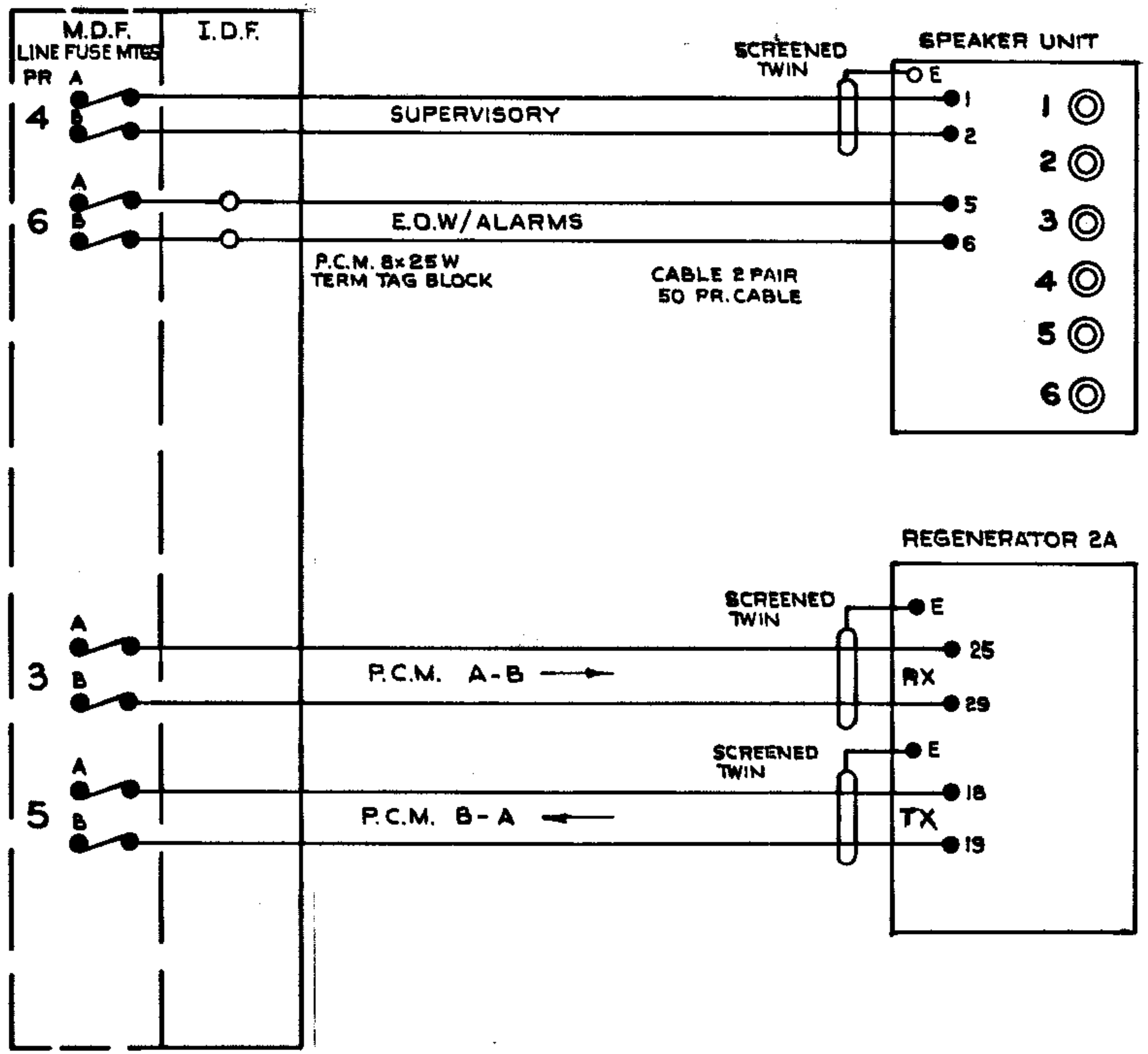
PIPES IN CEILING SPACE
AT HIGH LEVEL
LOW
IN TRENCH
WEATHERFOIL UNIT (HORIZONTAL)
RADIATOR
WEATHERFOIL UNIT (VERTICAL)

DRAWN.	[redacted]	B.R. IMMINGHAM. MESSROOM & WASHING FACILITIES. LAYOUT OF HEATING & HOT WATER SERVICES.	WEATHERFOIL HEATING SYSTEMS LTD. 19 BERKELEY STREET LONDON. W.1
DATE.	16/12/57	A [redacted] DRAINING VALVES ADDED TO HEATING ... HOT WATER ... H.W.S. ... TAKEN TO ABOVE ...	
SCALE.	⅛" - 1 ft.		DRG. No S1[illegible]
REF.	H.T.4.		

708

[redacted]

[redacted]
[redacted]



ISSUE	1
DRAWN BY	A.F.C./M.F.C.
CHECKED BY	
ASST. TEL. ENG.	
CORR. REF.	ST.2990
AUTHORITY	199120/10531
DATE	14·6·74

H.O. BALDWIN

BRITISH RAILWAYS E. REGION

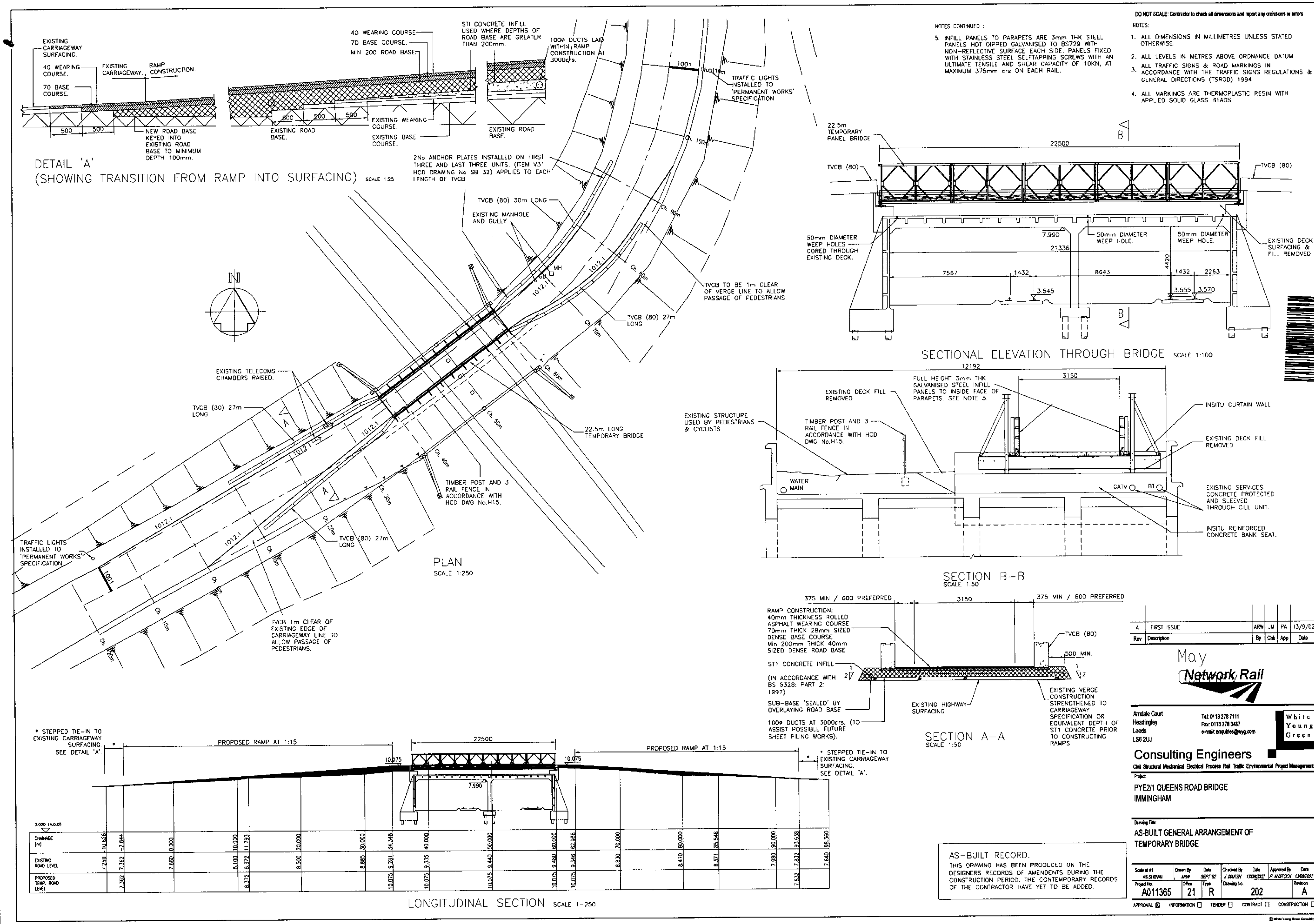
CHIEF SIGNAL & TELECOMMUNICATIONS ENGINEER'S OFFICE, YORK

IMMINGHAM P.C.M. SYSTEM

TERMINAL - M.D.F.

WIRING DETAILS

DRAWING NO. 102151



DO NOT SCALE: Contractor to check all dimensions and report any omissions or errors
NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE.
2. ALL LEVELS IN METRES ABOVE ORDNANCE DATUM
3. ALL TRAFFIC SIGNS & ROAD MARKINGS IN ACCORDANCE WITH THE TRAFFIC SIGNS REGULATIONS & GENERAL DIRECTIONS (TSRGD) 1994
4. ALL MARKINGS ARE THERMOPLASTIC RESIN WITH APPLIED SOLID GLASS BEADS
NOTES CONTINUED :
5. INFILL PANELS TO PARAPETS ARE 3mm THK STEEL PANELS HOT DIPPED GALVANISED TO BS729 WITH NON-REFLECTIVE SURFACE EACH SIDE. PANELS FIXED WITH STAINLESS STEEL SELFTAPPING SCREWS WITH AN ULTIMATE TENSILE AND SHEAR CAPACITY OF 10KN, AT MAXIMUM 375mm crs ON EACH RAIL.
DETAIL 'A'
(SHOWING TRANSITION FROM RAMP INTO SURFACING) SCALE 1:25
EXISTING CARRIAGEWAY SURFACING.
40 WEARING COURSE.
70 BASE COURSE.
EXISTING CARRIAGEWAY.
RAMP CONSTRUCTION.
NEW ROAD BASE KEYED INTO EXISTING ROAD BASE TO MINIMUM DEPTH 100mm.
40 WEARING COURSE
70 BASE COURSE.
MIN 200 ROAD BASE
EXISTING ROAD BASE.
EXISTING WEARING COURSE.
EXISTING BASE COURSE.
ST1 CONCRETE INFILL USED WHERE DEPTHS OF ROAD BASE ARE GREATER THAN 200mm.
100ø DUCTS LAID WITHIN RAMP CONSTRUCTION AT 3000crs.
2No ANCHOR PLATES INSTALLED ON FIRST THREE AND LAST THREE UNITS. (ITEM V31 HCD DRAWING No SB 32) APPLIES TO EACH LENGTH OF TVCB
TRAFFIC LIGHTS INSTALLED TO 'PERMANENT WORKS' SPECIFICATION
TVCB (80) 30m LONG
EXISTING MANHOLE AND GULLY
TVCB TO BE 1m CLEAR OF VERGE LINE TO ALLOW PASSAGE OF PEDESTRIANS.
TVCB (80) 27m LONG
EXISTING TELECOMS CHAMBERS RAISED.
22.5m LONG TEMPORARY BRIDGE
TIMBER POST AND 3 RAIL FENCE IN ACCORDANCE WITH HCD DWG No.H15.
TVCB 1m CLEAR OF EXISTING EDGE OF CARRIAGEWAY LINE TO ALLOW PASSAGE OF PEDESTRIANS.
PLAN
SCALE 1:250
22.5m TEMPORARY PANEL BRIDGE
TVCB (80)
50mm DIAMETER WEEP HOLES CORED THROUGH EXISTING DECK.
50mm DIAMETER WEEP HOLE.
EXISTING DECK SURFACING & FILL REMOVED
SECTIONAL ELEVATION THROUGH BRIDGE SCALE 1:100
EXISTING DECK FILL REMOVED
FULL HEIGHT 3mm THK GALVANISED STEEL INFILL PANELS TO INSIDE FACE OF PARAPETS. SEE NOTE 5.
INSITU CURTAIN WALL
EXISTING STRUCTURE USED BY PEDESTRIANS & CYCLISTS
TIMBER POST AND 3 RAIL FENCE IN ACCORDANCE WITH HCD DWG No.H15.
WATER MAIN
EXISTING SERVICES CONCRETE PROTECTED AND SLEEVED THROUGH CILL UNIT.
INSITU REINFORCED CONCRETE BANK SEAT.
SECTION B–B
SCALE 1:50
375 MIN / 600 PREFERRED
RAMP CONSTRUCTION: 40mm THICKNESS ROLLED ASPHALT WEARING COURSE 70mm THICK 28mm SIZED DENSE BASE COURSE Min 200mm THICK 40mm SIZED DENSE ROAD BASE
ST1 CONCRETE INFILL
(IN ACCORDANCE WITH BS 5328: PART 2: 1997)
SUB-BASE 'SEALED' BY OVERLAYING ROAD BASE
100ø DUCTS AT 3000crs. (TO ASSIST POSSIBLE FUTURE SHEET PILING WORKS).
EXISTING HIGHWAY SURFACING
EXISTING VERGE CONSTRUCTION STRENGTHENED TO CARRIAGEWAY SPECIFICATION OR EQUIVALENT DEPTH OF ST1 CONCRETE PRIOR TO CONSTRUCTING RAMPS
500 MIN.
SECTION A–A
SCALE 1:50
* STEPPED TIE-IN TO EXISTING CARRIAGEWAY SURFACING SEE DETAIL 'A'.
PROPOSED RAMP AT 1:15
LONGITUDINAL SECTION SCALE 1-250
CHAINAGE (m)
EXISTING ROAD LEVEL
PROPOSED TEMP. ROAD LEVEL
AS-BUILT RECORD.
THIS DRAWING HAS BEEN PRODUCED ON THE DESIGNERS RECORDS OF AMENDENTS DURING THE CONSTRUCTION PERIOD. THE CONTEMPORARY RECORDS OF THE CONTRACTOR HAVE YET TO BE ADDED.
A FIRST ISSUE ARW JM PA 13/9/02
Rev Description By Chk App Date
May
Network Rail
Arndale Court Headingley Leeds LS6 2UJ
Tel: 0113 278 7111 Fax: 0113 278 3487 e-mail: enquiries@wyg.com
White Young Green
Consulting Engineers
Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management
Project
PYE2/1 QUEENS ROAD BRIDGE IMMINGHAM
Drawing Title
AS-BUILT GENERAL ARRANGEMENT OF TEMPORARY BRIDGE
Scale at A1 AS SHOWN
Project No A011365 Office 21 Type R Drawing No. 202 Revision A
APPROVAL INFORMATION TENDER CONTRACT CONSTRUCTION
DMFP00143911


ORIGINAL & FINAL RAIL POSITION
EXISTING SLEWED RAIL POSITION
M.H. 24
M.H. 19 I.L. 3.70
M.H. 23
M.H. 20
OIL INTERCEPTOR
1,000 GALL WASTE OIL STORAGE TANK
WHEN INDICATOR SHOWS RED CHECK PUMP INSTALLATION
HABROUGH MARSH DRAIN
EXISTING FOOTBRIDGE & PATH
PIPE SUPPORT 'A'
PIPE SUPPORT 'B'
ARRANGEMENT OF 2 No. PIPE STRAPS AT 'X'
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
DETAIL OF WATER LEVEL INDICATOR
SCALE 1" TO 1'
DETAIL OF SUMP IN WASTE OIL TANK ENCLOSURE
SCALE 2" TO 1'
PLAN
SECTION M.H. 25
ALL PIPEWORK & PIPE FITTINGS ABOVE GROUND TO BE WRAPPED WITH 2" FIBRE GLASS BOUND WITH 'LASSO'.
HABROUGH MARSH DRAIN
DETAIL OF DITCH CROSSING
SCALE 2" TO 1'
Arrangement of 6 No. Pipe straps at 'Z'
Existing ash path
NOTES
1. All concrete to be 1:2:4 (3v) mix unless noted.
2. Concrete blinding to be 1:4:8 (1N) mix.
3. All drains cased in 6" thick concrete 1:2½:6 (2N) mix
4. For details of reinforced concrete work see drawing nos.
5. For details of mechanical and electrical work see particular drawings
6. All brickwork to be 2nd quality engineering bricks.
7. All drainage pipework and fittings shown on this drawing which are above ground, are to be wrapped with 2" of fibre glass and bound with 'Lasso'.
8. Pipe support beam and fittings to be painted 2 coats bituminous paint.
9. Apron to be treated with 'Lithurin' No 5. Obtainable from "Building Products" Warple Rd. S.W. 18
10. All horizontal joints in paving to be sealed with Polycast ⅝"x ⅝" cross-section.
11. Stone pitching to batter to be jointed with & bedded in cement mortar (1:6)
Rev. 'E' 29-9-65 Inverts levels of effluent drain from office & stores amended.
Rev 'D' 3-8-65 Levels added to show Level Indicator, Pump Sump base & steps amended.
Rev 'C' 29-6-65 Pipe support beam & strap details amended.
Rev 'B' 15-6-65 Steps, path & position of M.H. 25 amended.
Rev 'A' Generally Revised and Redrawn
BRITISH RAIL
Diesel Service Station Immingham.
Detail of Outfall Drain and General arrangments of waste oil installation on outfall drain.
DRAWN G.W.F.
TRACED A.G.Q.
CHECKED
DATE 26-5-65
SCALE ¼ to 1ft. or as shown
DRAWING NO. E.D. 1897/2
GEORGE WIMPEY & CO LTD. 27 HAMMERSMITH GROVE. LONDON. W 6

British Rail
Chief Mechanical & Electrical Engineer
Eastern Region
Outdoor Machinery Section
YORK

IMMINGHAM CENTRIFUGE
600 GAL DIRTY OIL STORAGE TANK

Scale 1/8 DO NOT SCALE

Drg. No. IM/MH/1/19 | A | B | Date 1-5-74

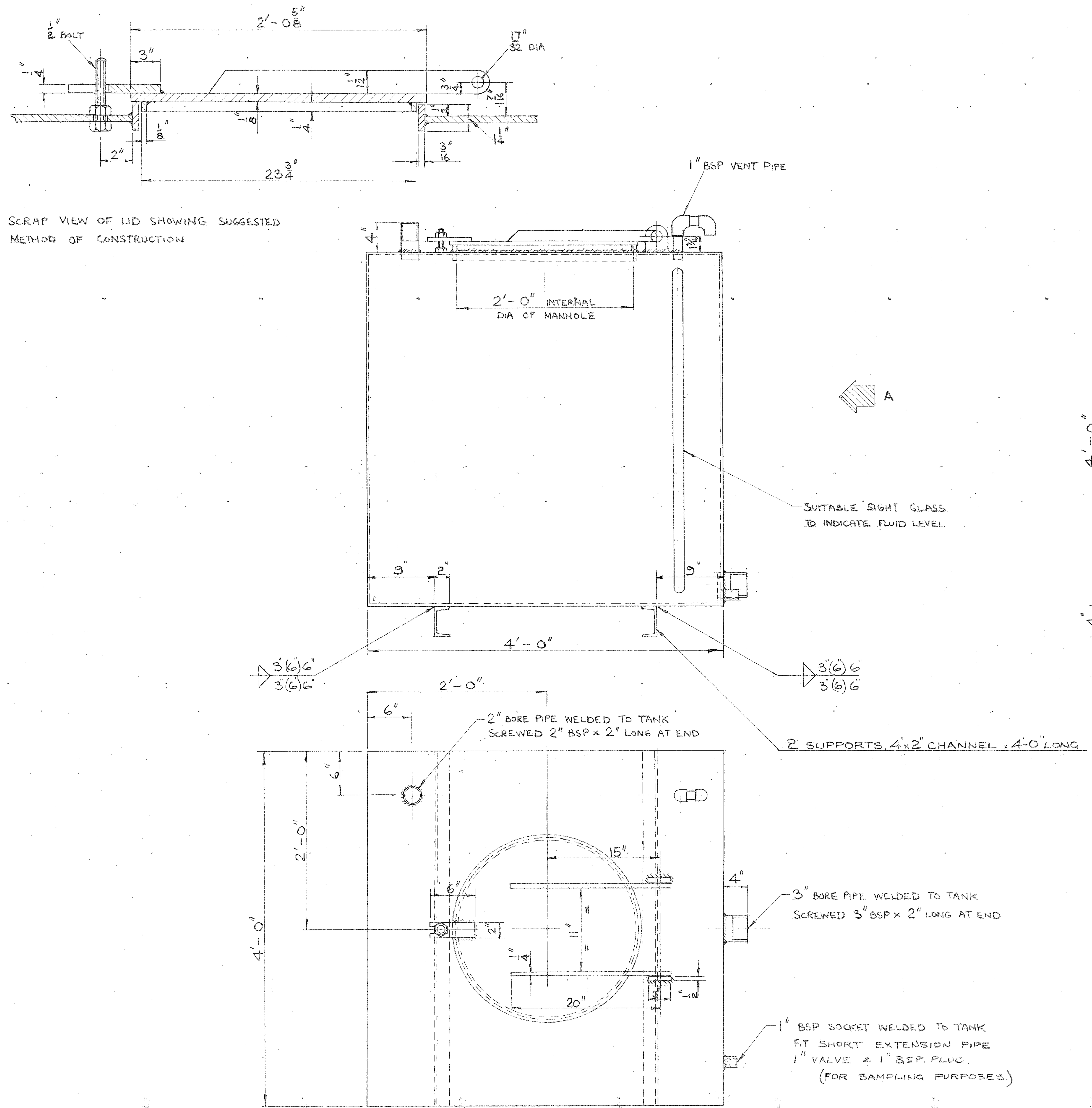
Ref. L18/22/84/14

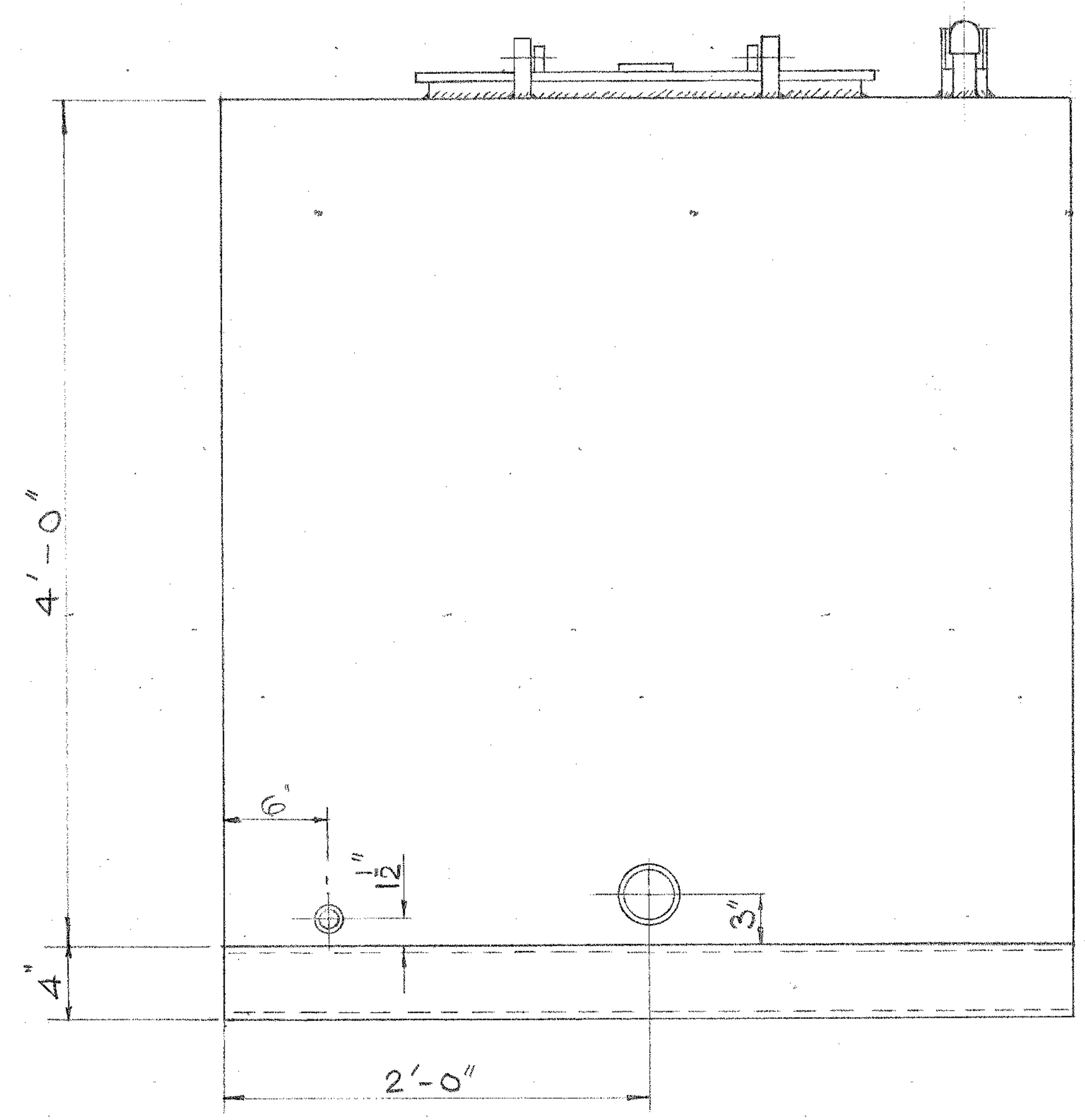
Drawn [redacted] Traced Checked [redacted] Approved For [redacted] CM & EE

	A	B	Modifications
Details	2 SUPPORTS, 4"x2" CHANNEL x 4'-0 LONG - WELDED TO U/SIDE OF TANK.	CERTAIN DIMENSIONS ALTERED ON MANHOLE COVER.	
Date / Sig.	23/10/74 MB	4/8/75 MB	

BR 867/114

ME 248





VIEW ON ARROW 'A'

MATERIAL REQUIREMENTS

4 SIDES } 1/4" THICK MS PLATE BS 4360 GRADE 40B
1 TOP }
1 BOTTOM 3/8" ——— " ———

	A	B	Modifications
Details	2 SUPPORTS - 4"x2" CHANNEL x 4'-0" LONG - WELDED TO U/SIDE OF TANK	CERTAIN DIMENSIONS ALTERED ON MANHOLE COVER	
Date / Sig.	23/10/74 MB	4/8/75 MB	

887/114

British Rail
Chief Mechanical & Electrical Engineer
Eastern Region
Outdoor Machinery Section
YORK

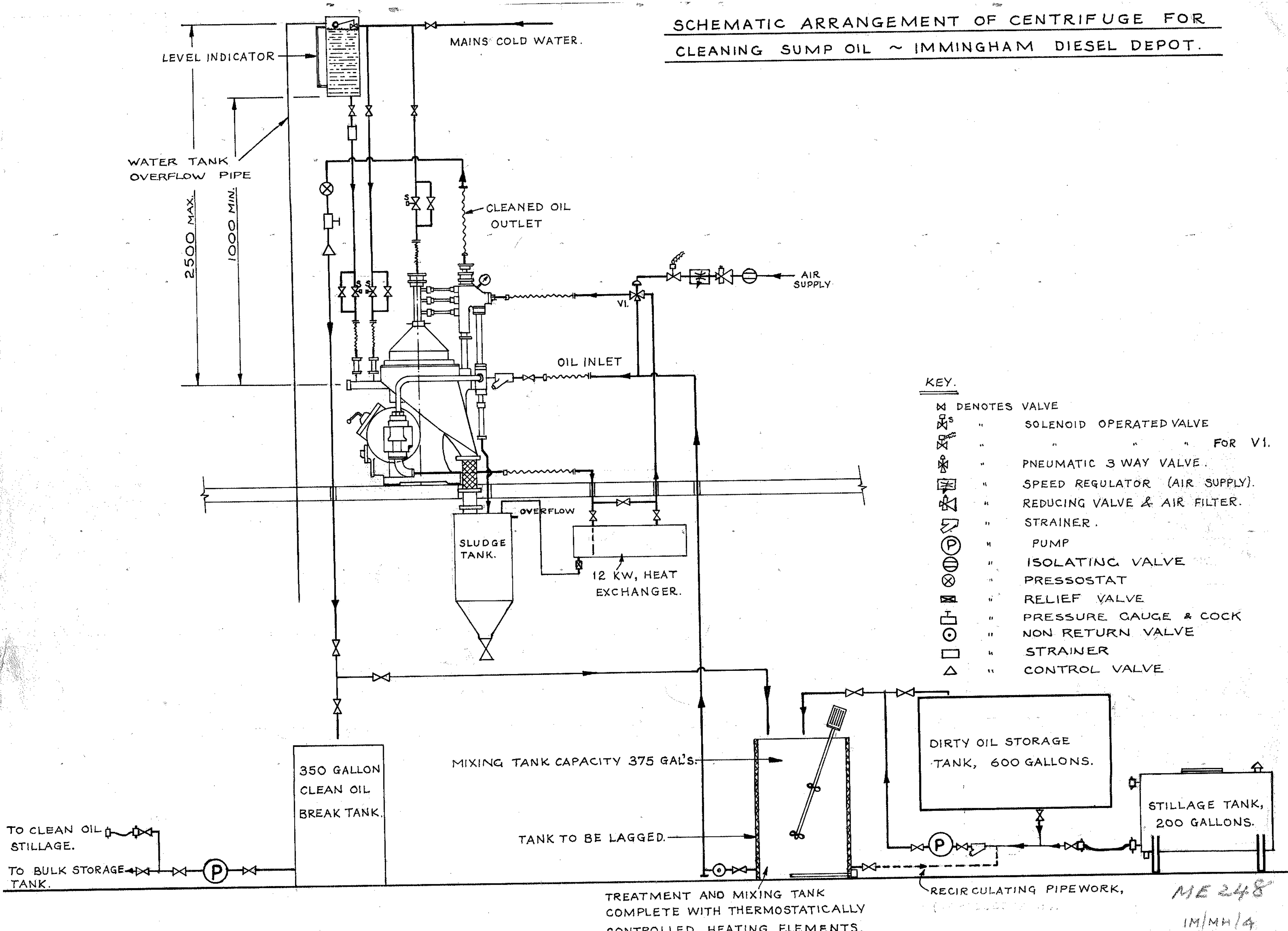
IMMINGHAM CENTRIFUGE
350 GAL CLEAN OIL BREAK TANK

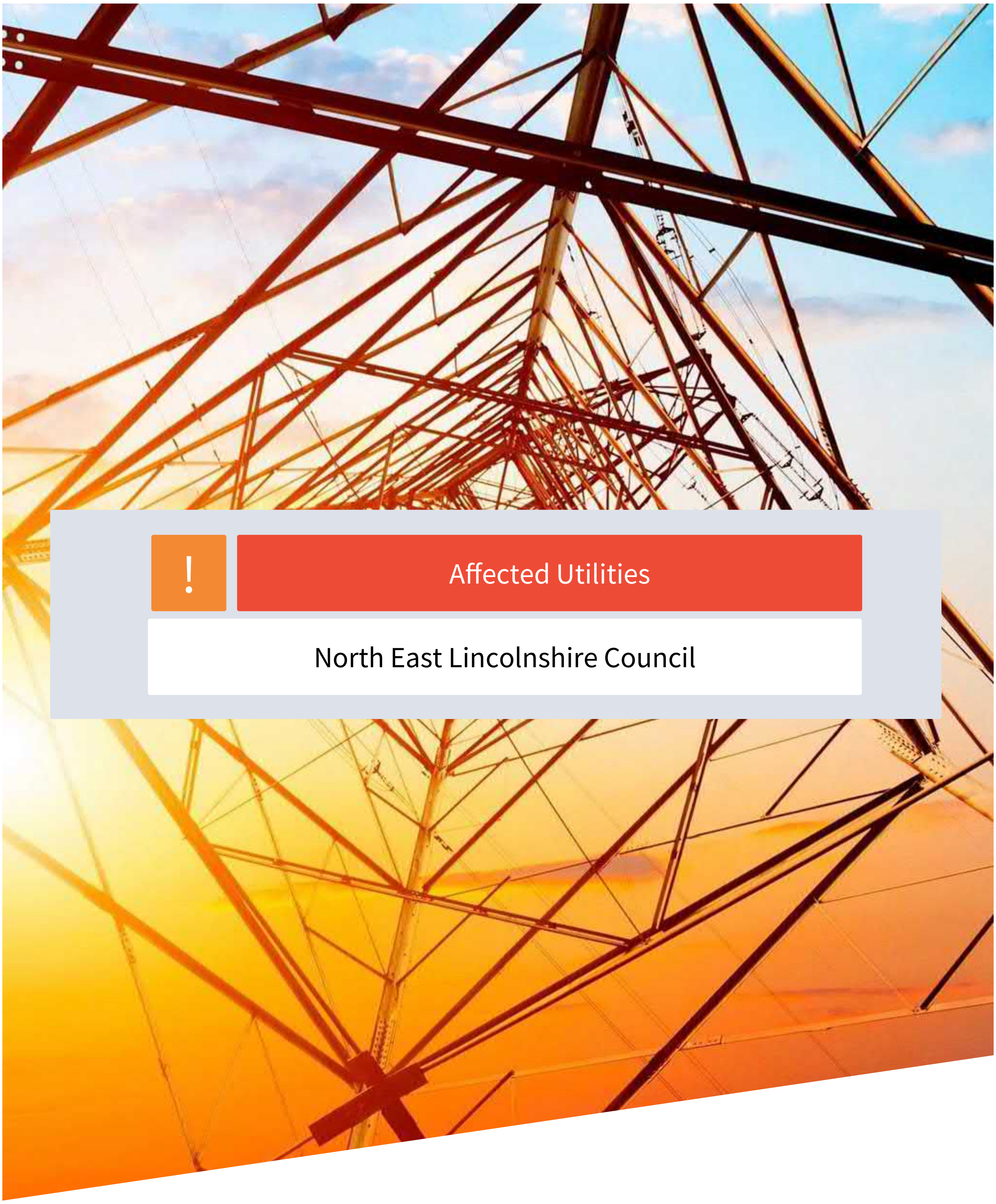
Scale 1/8 DO NOT SCALE
Date 1-5-74
Drg. No. IM/MH/1/21 A B
Ref. L18/22/84/14
Drawn [redacted] Traced Checked [redacted] Approved For C SCUT [redacted] CM & EE

MY 35817

ME 248

SCHEMATIC ARRANGEMENT OF CENTRIFUGE FOR CLEANING SUMP OIL ~ IMMINGHAM DIESEL DEPOT.





!

Affected Utilities

North East Lincolnshire Council

Landmark INFORMATION

From: Malcolm Kearns (Engie) <Malcolm.Kearns@nelincs.gov.uk>
Sent: 29 September 2021 16:49
To: Utility Solutions GDC Requests
Subject: Saved/RPA RE: Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021
Attachments: LM_100245.pdf

Reference: 100245
Site Name: Site off Queens Road, Immingham

I refer to your email dated 27th September 2021, regarding the location of any highway underground apparatus **Site off Queens Road, Immingham.**

I have enclosed plans from within our authority area indicating highway assets within the vicinity and only in area 2, DN41 please note however, none of the gully leads are shown, but should be anticipated to be connected directly into the public sewers. Apparatus which is visible on the surface such as lighting, traffic signal equipment and illuminated signs are shown. I would advise you that there might be electrical cables serving highway apparatus, which are not shown on Electricity Company's records. These cables could be connected to a photocell switch and may therefore not be energised during daylight hours.

My records of underground apparatus are not complete. Please take reasonable care to identify and protect any additional apparatus, which you may discover. I will require an adequate replacement of any apparatus, which is damaged. Should any pipe, drain, sewer, culvert or land drain be damaged during the works then a member of the Council's Drainage Section should be contacted to arrange inspection and agree the method of repair.

I would appreciate your assistance in informing me of the location of any additional apparatus, which you may discover, so that I can improve my records.

Regards

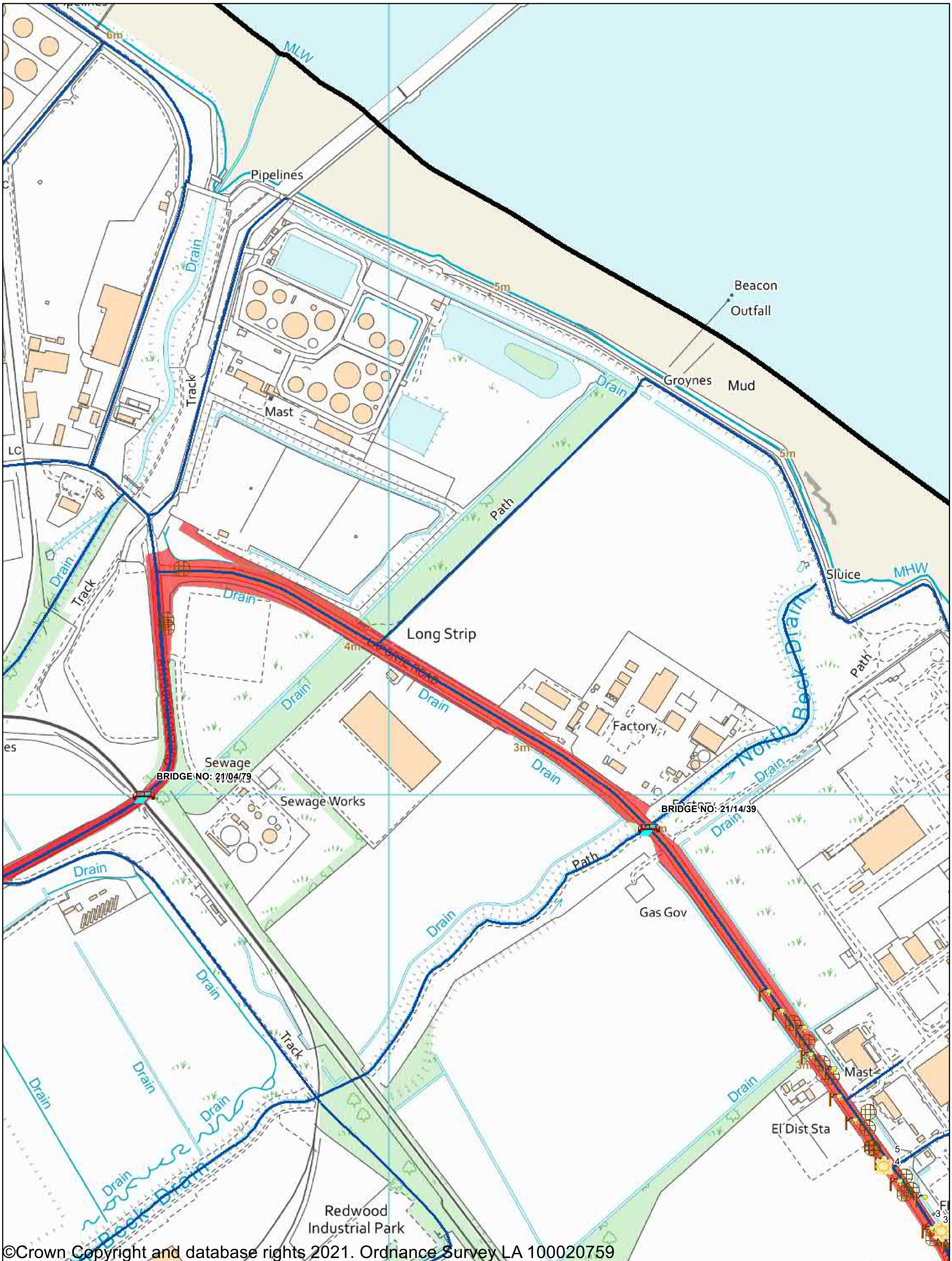
Malcolm

Malcolm Kearns
Higway Asset Management Officer, Street Authority Custodian
Highway Assets
Places & Communities North – NEL
Te +44 (0) 14 7232 4496
Mobile +44 (0) 7775 018247 | Fax +(0) 14 7232 5657

Working in partnership

engie.co.uk

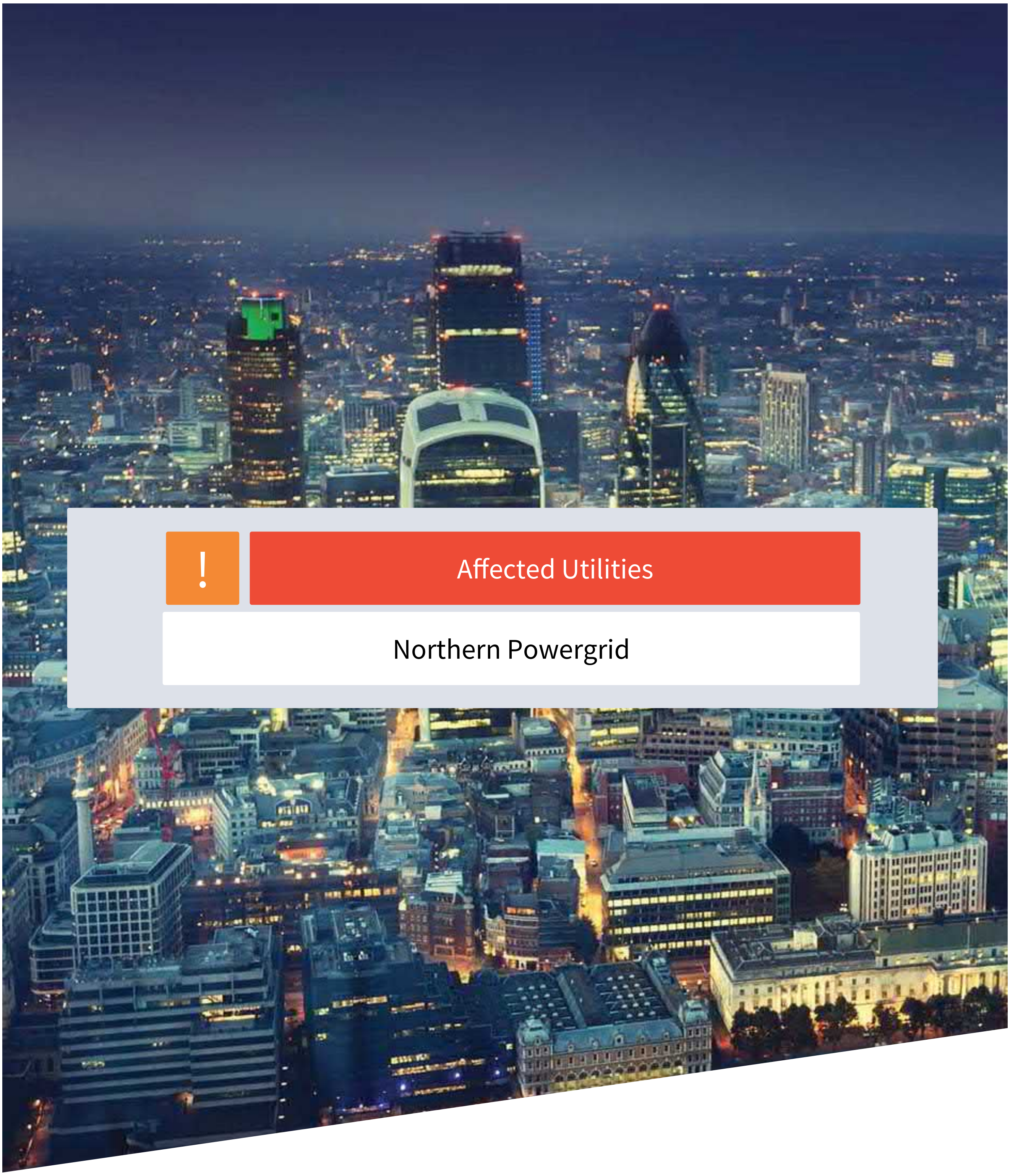
New Oxford House, George Street
Grimsby, North East Lincolnshire, DN31 1HB



ENGIE
NORTH EAST LINCOLNSHIRE COUNCIL
Working in Partnership

Engie
New Oxford House
George Street
Grimsby
North East Lincolnshire
DN31 1AB
Tel: 01472 313131
E-Mail: customerrequests@nelincs.gov.uk

User: NC.MALCOLM.KEARNS
Date: 29 Sep 2021
Scale:1:4,031



! Affected Utilities

Northern Powergrid

Landmark® INFORMATION

Date: 30/09/2021

Mr Evans
The Hub, 500 Park Avenue, Aztec West,
Bristol
BS32 4RZ

Tel: 0191 229 4294
Northern Powergrid Records Information Centre
New York Road
Shiremoor
Newcastle Upon Tyne
NE27 0LP

Dear Mr Evans

Enquiry No: SD641834
Scheme Reference: 100245

Thank you for using Northern Powergrid's online Safedig service for your planned works.

Your plan has been generated using our most up to date information. Due to the nature of the information we hold and how often works on the network are carried out, we can only guarantee this plan at the time of generation. We will do our best to notify you if we update the information in your indicated area, but you should endeavour to obtain an up to date plan whenever you commence your works.

The map that has been provided to you will show all the relevant Northern Powergrid electricity cables that are in your indicated dig site, we have included some of the surrounding area as well in case your dig extends further than you previously thought. At any point you may re-apply for your plan to increase the indicated area using the previously submitted details. This plan will be valid for 30 days from the point at which it became available to you.

The enclosed mains records only give the approximate location of known Northern Powergrid apparatus in the area. Great care is therefore needed and all cables and overhead lines must be assumed to be live.

Please note that while all efforts are made to ensure the accuracy of the data, no guarantee can be given. We would refer you to the Health & Safety Executive's publication HS(G)47 "Avoiding Danger From Underground Services" which emphasises that:

- Plans must only be used as a guide in the location of underground cables. The use of a suitable cable-tracing device is essential and careful hand digging of trial holes must be carried out to positively identify and mark the exact route of the cable. You should also bear in mind that a cable is unmistakably located only when it has been safely exposed.
- Cable depths are not generally indicated on our records and can vary considerably even when shown.
- Great caution must be exercised at all times when using mechanical plant. Careful trial digging should always be carried out on the whole route of the planned excavation to ascertain if cables exist.

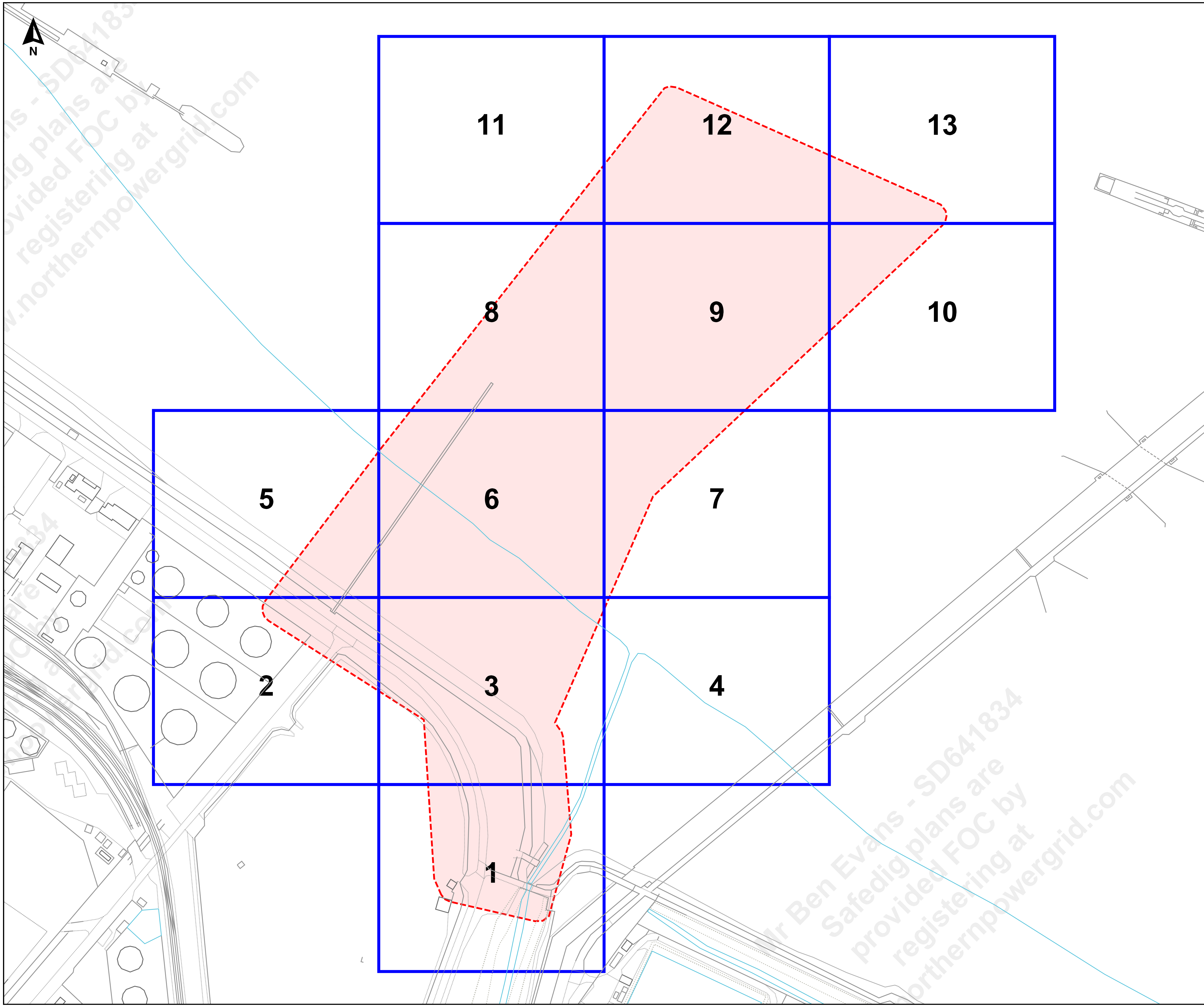
The Health & Safety executive have another publication, GS6 "Avoidance of Danger from Overhead Electric Lines" that you should be aware of if your work is near overhead powerlines. Both of these documents provide comprehensive guidance for observance of statutory duties under the Electricity at Work Regulations 1989 and the Health & Safety at Work Act 1974. Our provision of these records is based upon the assumption that people using them will have sufficient competence to interpret the information given. Any damage or injury caused will be the responsibility of the organization concerned who will be charged for any repairs.

Please note ground cover must not be altered either above our cables or below overhead lines, in addition no trees should be planted within 3 metres of existing underground cables or 10 metres of overheadlines. All our apparatus is legally covered by a wayleaves agreement, lease or deed or alternatively protected under the Electricity Act 1989. Should any alteration/diversion of our Company's apparatus be necessary to allow your work to be carried out, budget costs can be provided by writing to Network Connections, Alix House, Falcon Court, Stockton On Tees, TS18 3TU.

Tel:0800 0113433

Yours faithfully,

Safedig Team
Northern Powergrid



NORTHERN POWERGRID

Job Reference : SD641834
100245

Scale : 1:2600

Grid Coordinates : 520845 416015

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

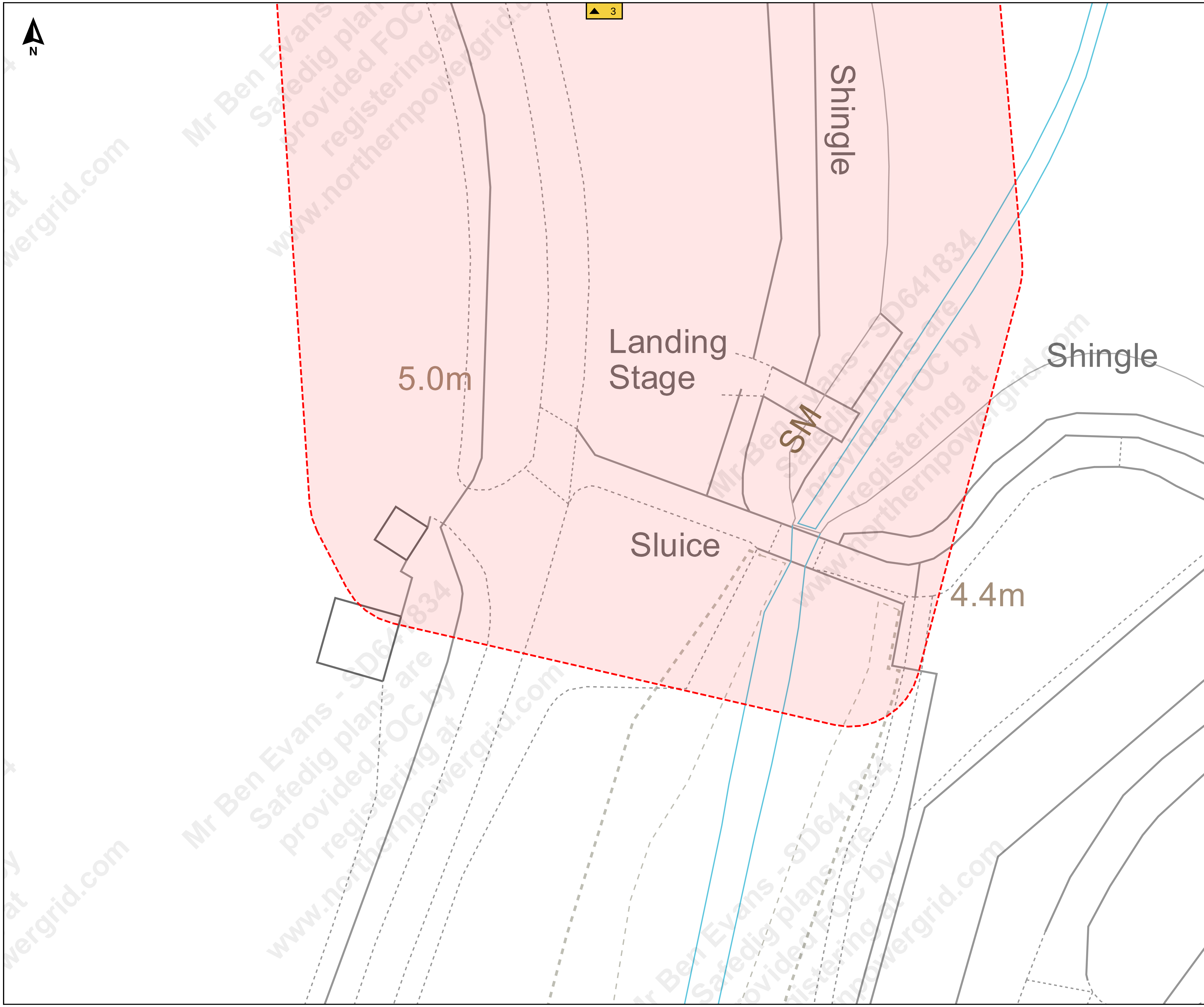
Underground Cables:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641834
100245

Scale : 1:500

Grid Coordinates : 520761 415737

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 1 of 13 (1,13)

Terms and Conditions

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Legend:

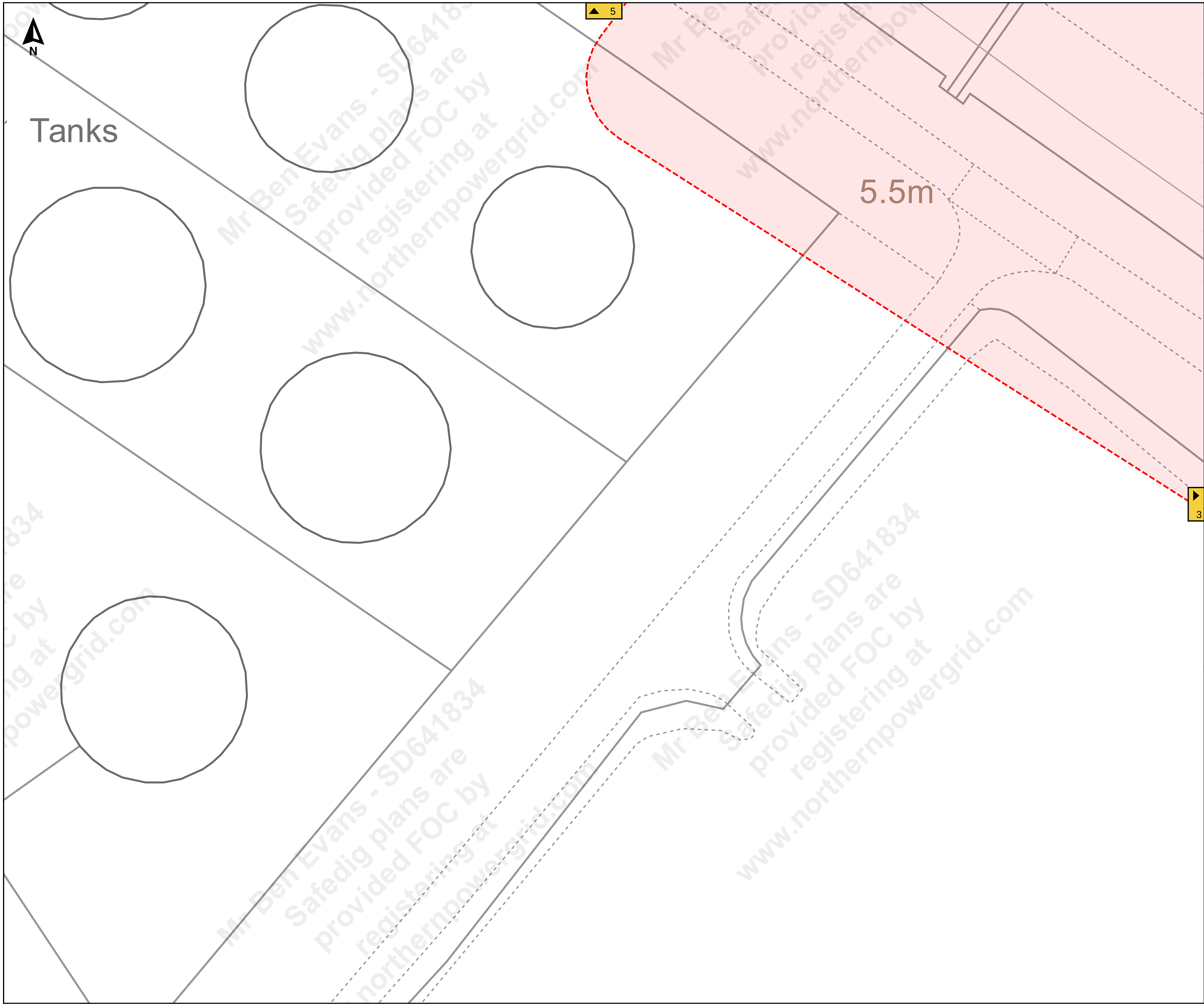
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834
100245

Scale : 1:500

Grid Coordinates : 520594 415876

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 2 of 13 (2,13)

Terms and Conditions

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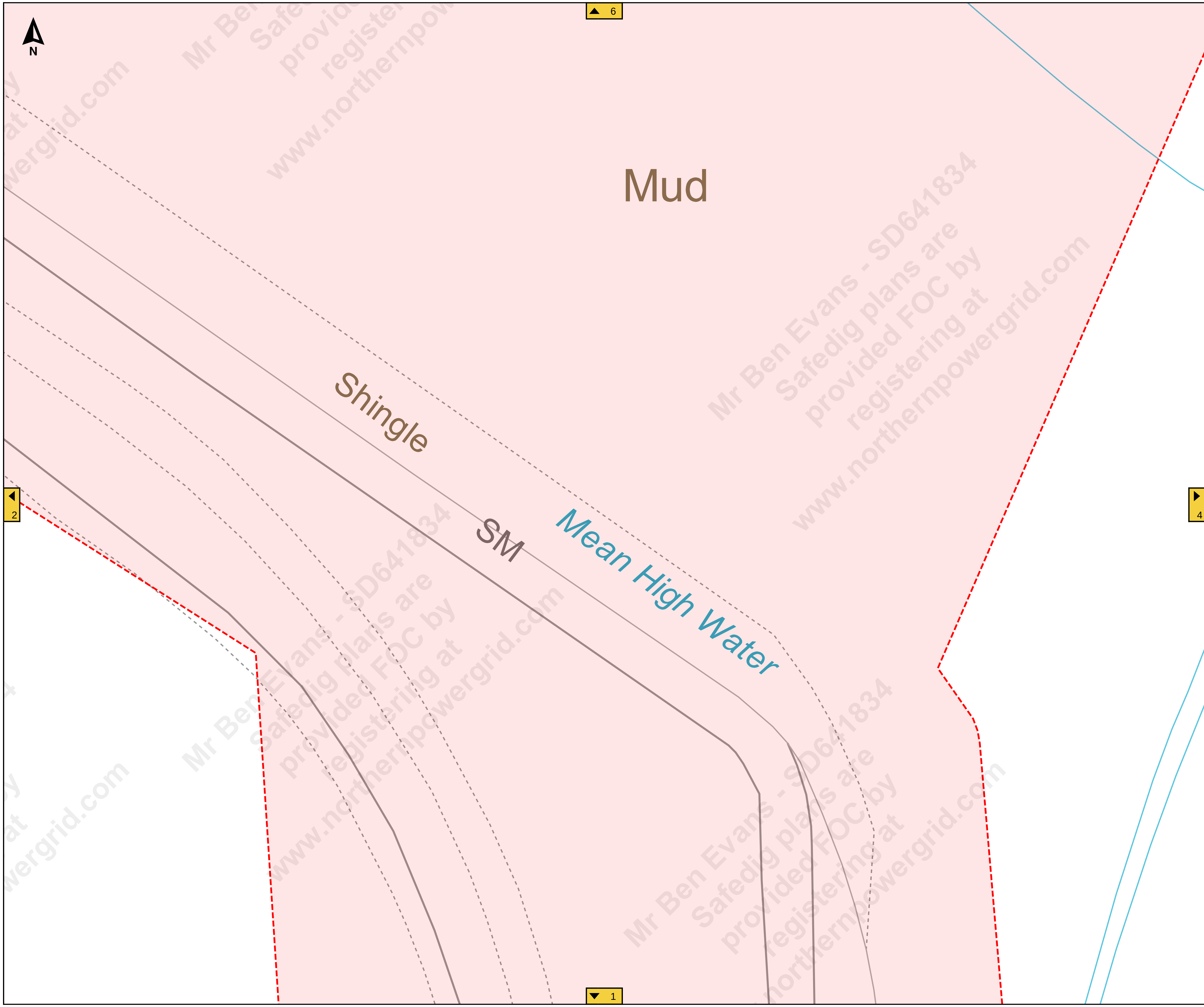
Legend:
Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route
Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520761 415876

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 3 of 13 (3,13)

Terms and Conditions

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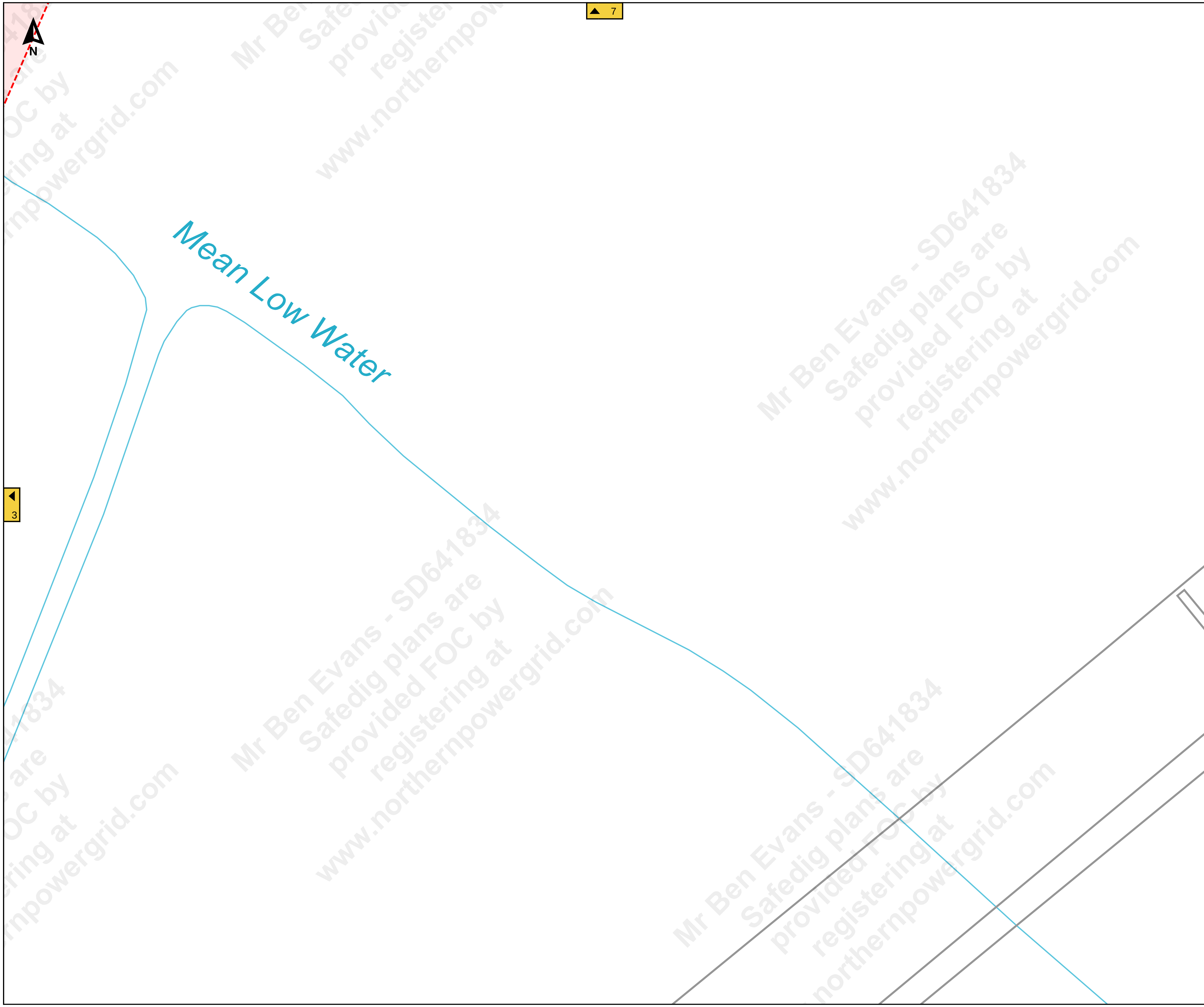
Underground Cables:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520929 415876

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 4 of 13 (4,13)

Terms and Conditions

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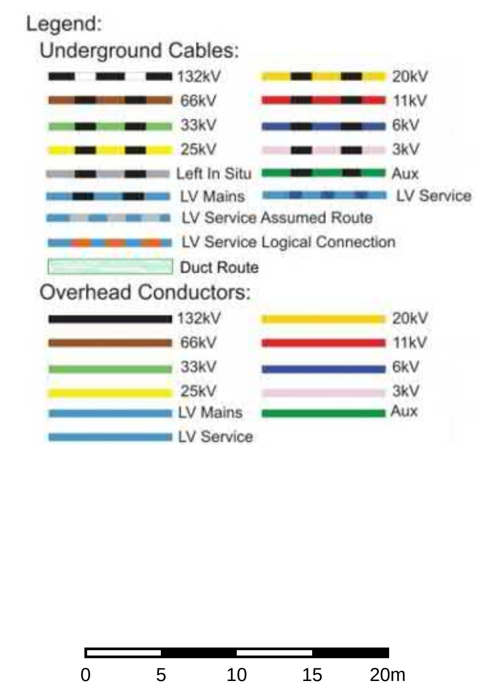

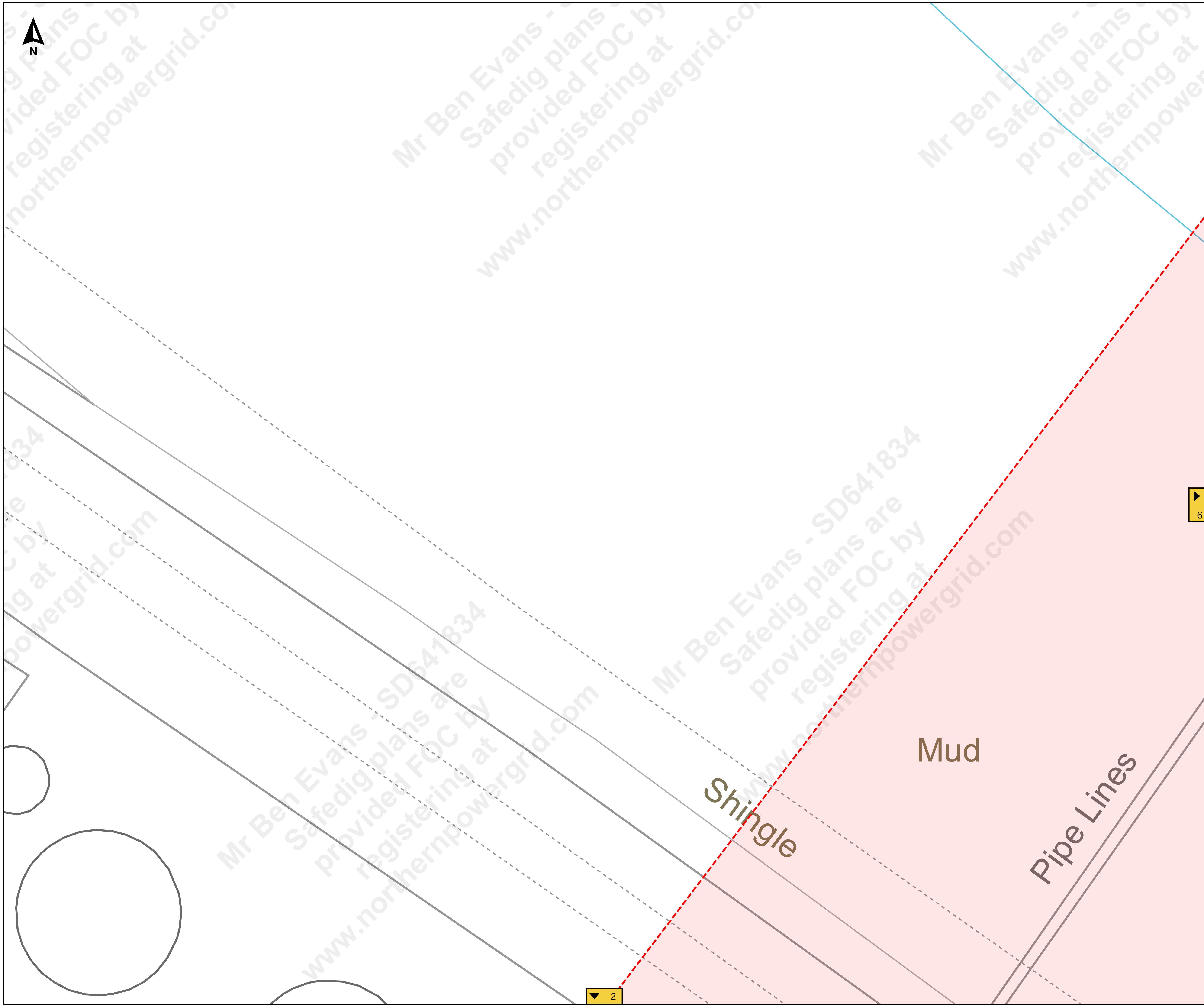

NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520594 416015

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 5 of 13 (5,13)

Terms and Conditions

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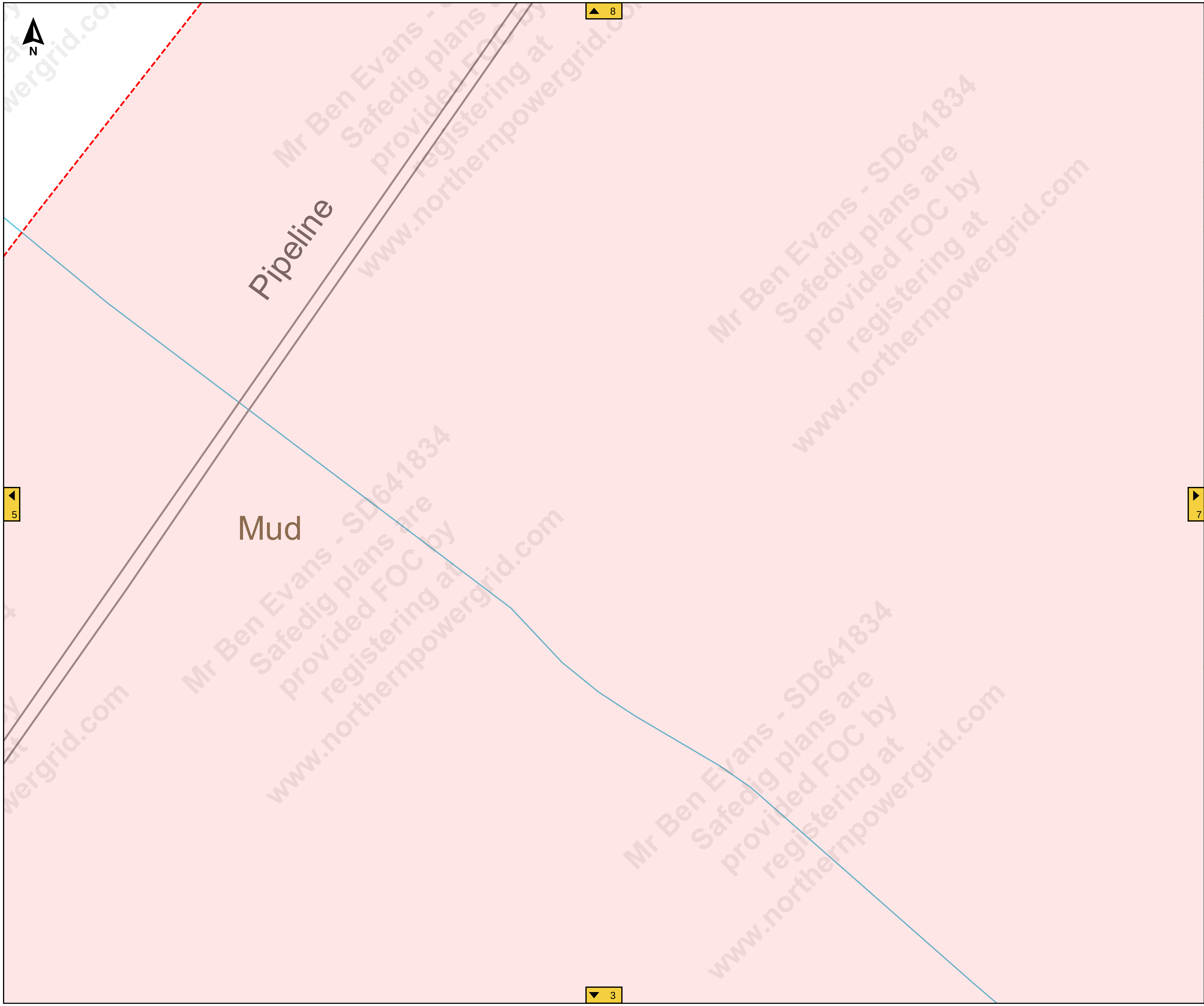
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834
100245

Scale : 1:500

Grid Coordinates : 520761 416015

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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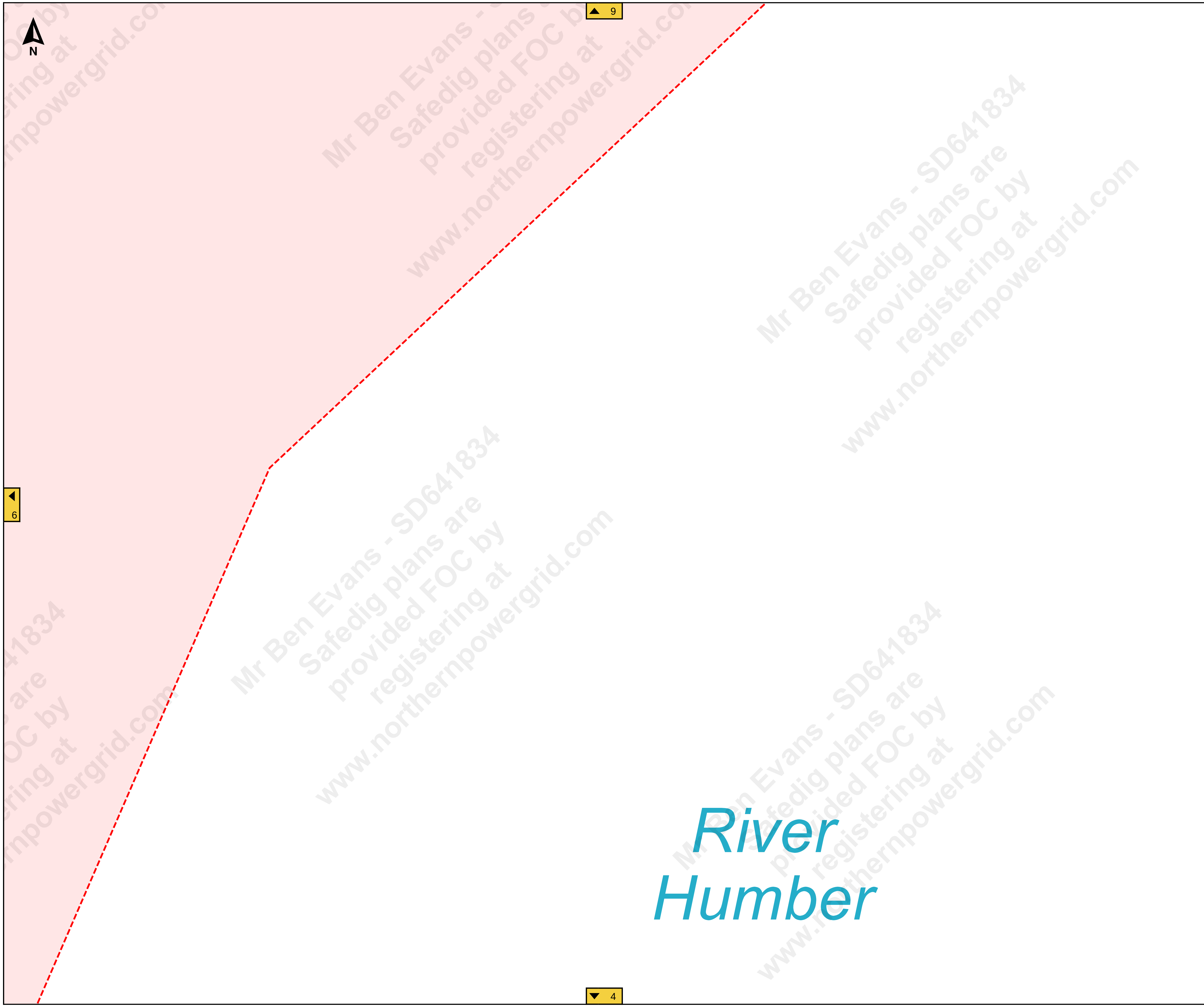
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520929 416015

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 7 of 13 (7,13)

Terms and Conditions

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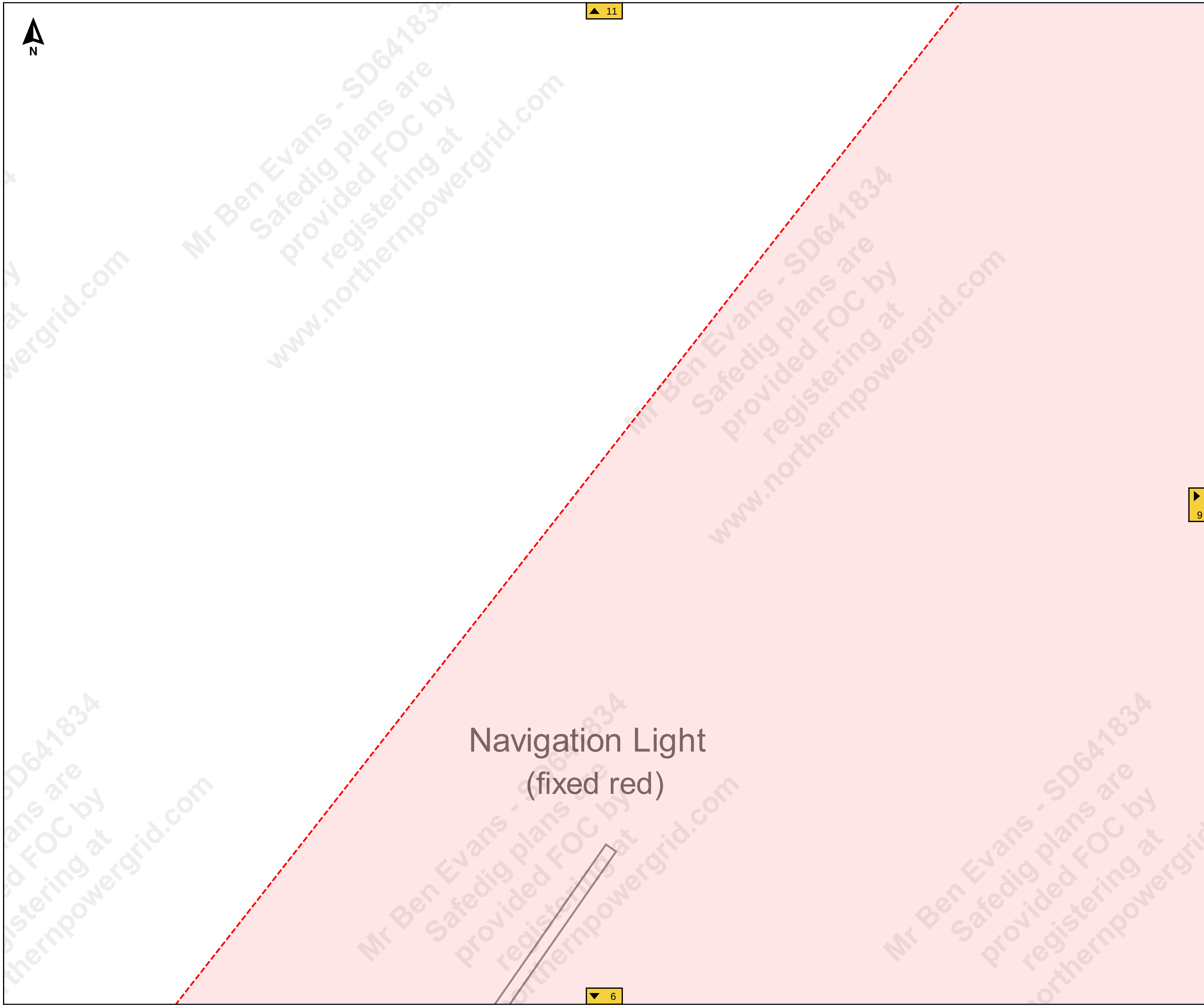
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520761 416153

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 8 of 13 (8,13)

Terms and Conditions

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Legend:

Underground Cables:
132kV
66kV
33kV
25kV
Left In Situ
LV Mains
LV Service Assumed Route
LV Service Logical Connection
Duct Route
20kV
11kV
6kV
3kV
Aux
LV Service

Overhead Conductors:
132kV
66kV
33kV
25kV
LV Mains
LV Service
20kV
11kV
6kV
3kV
Aux

0 5 10 15 20m

NORTHERN POWERGRID

Job Reference : SD641834
100245

Scale : 1:500

Grid Coordinates : 520929 416153

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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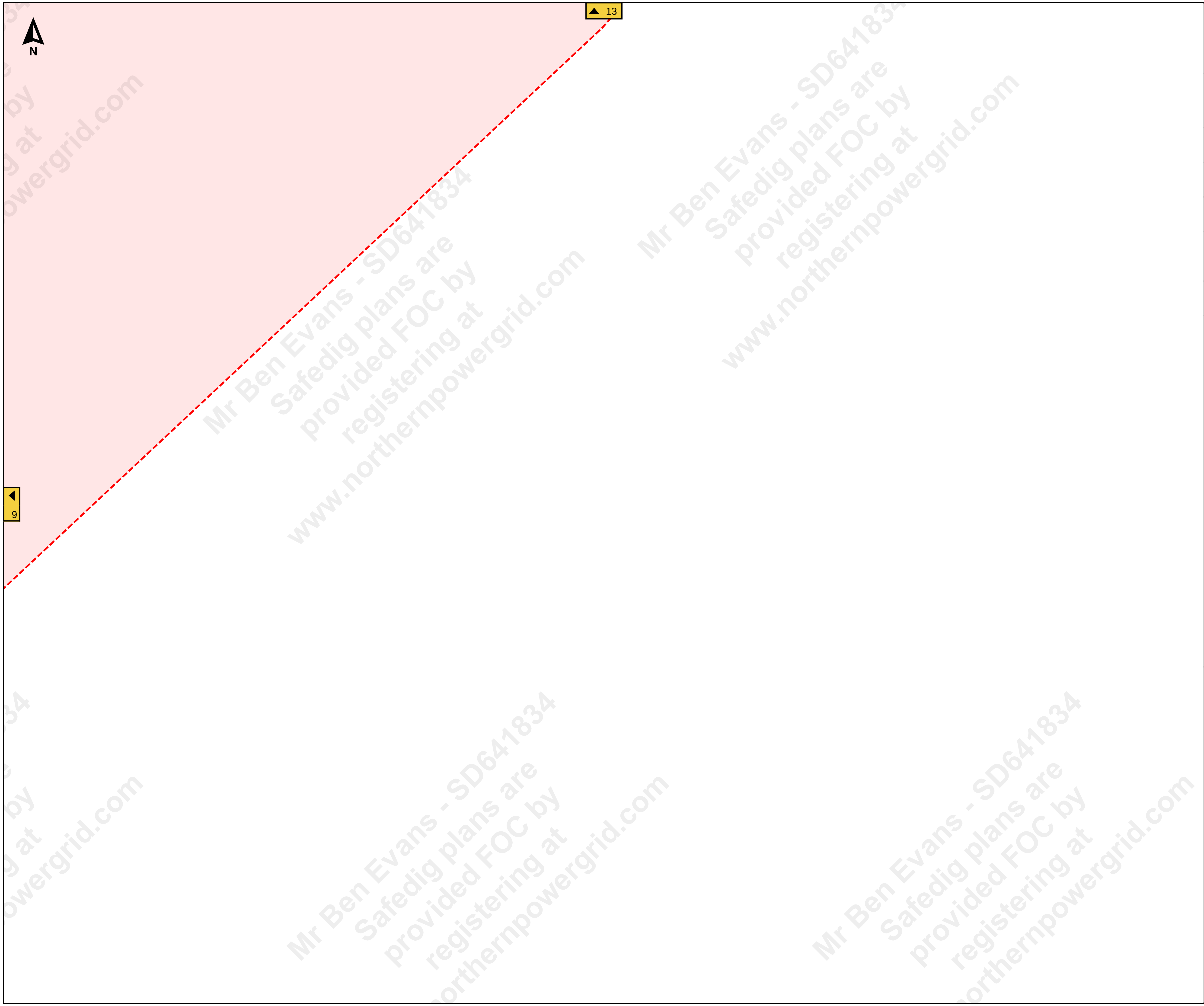
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 521096 416153

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520761 416292

Date : 27/09/2021

Produced For :
Mr Ben Evans

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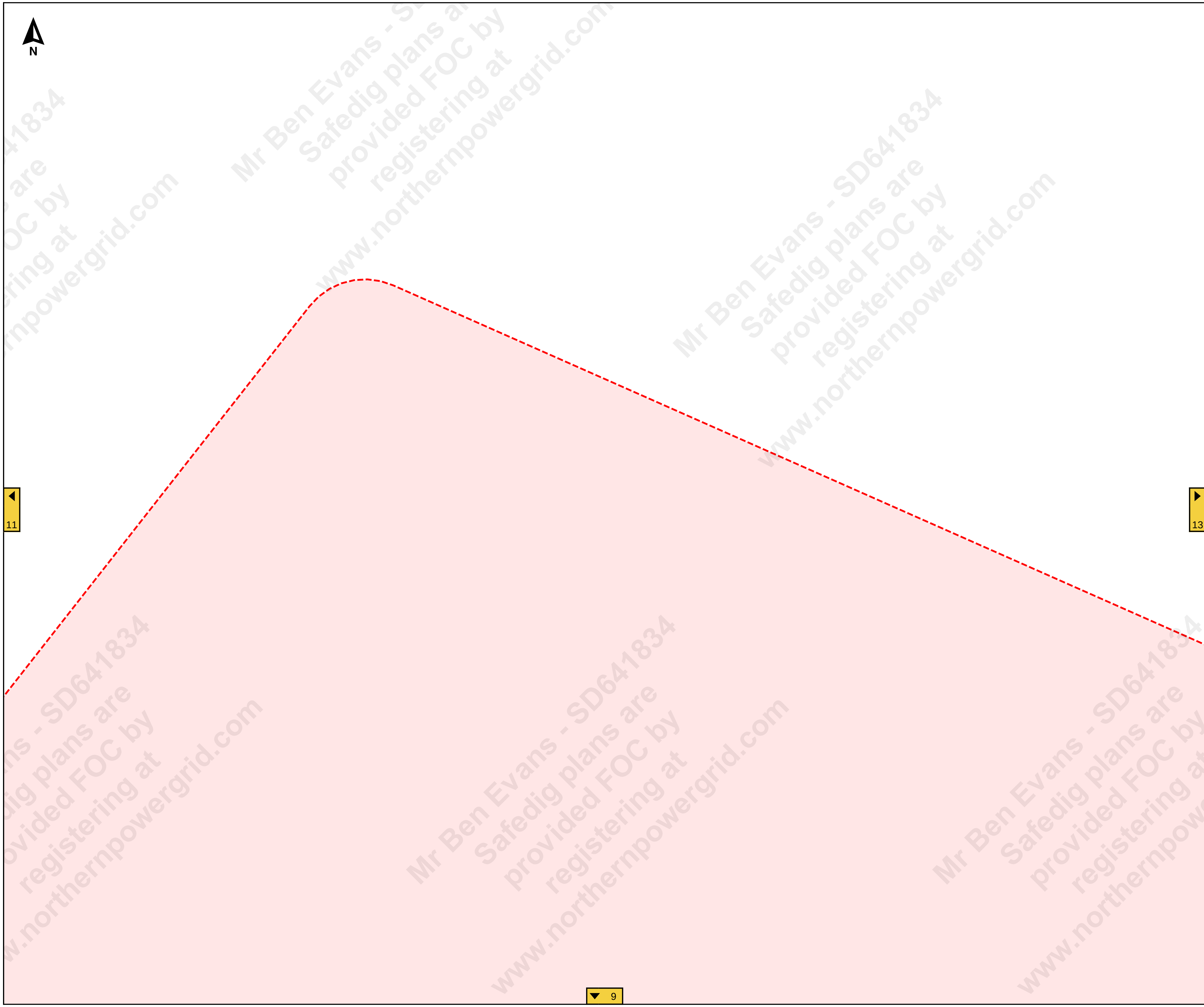
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 520929 416292

Date : 27/09/2021

Produced For :
Mr Ben Evans

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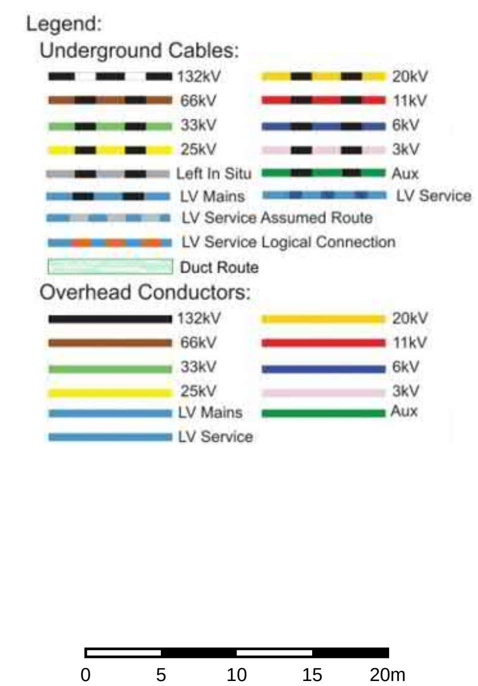

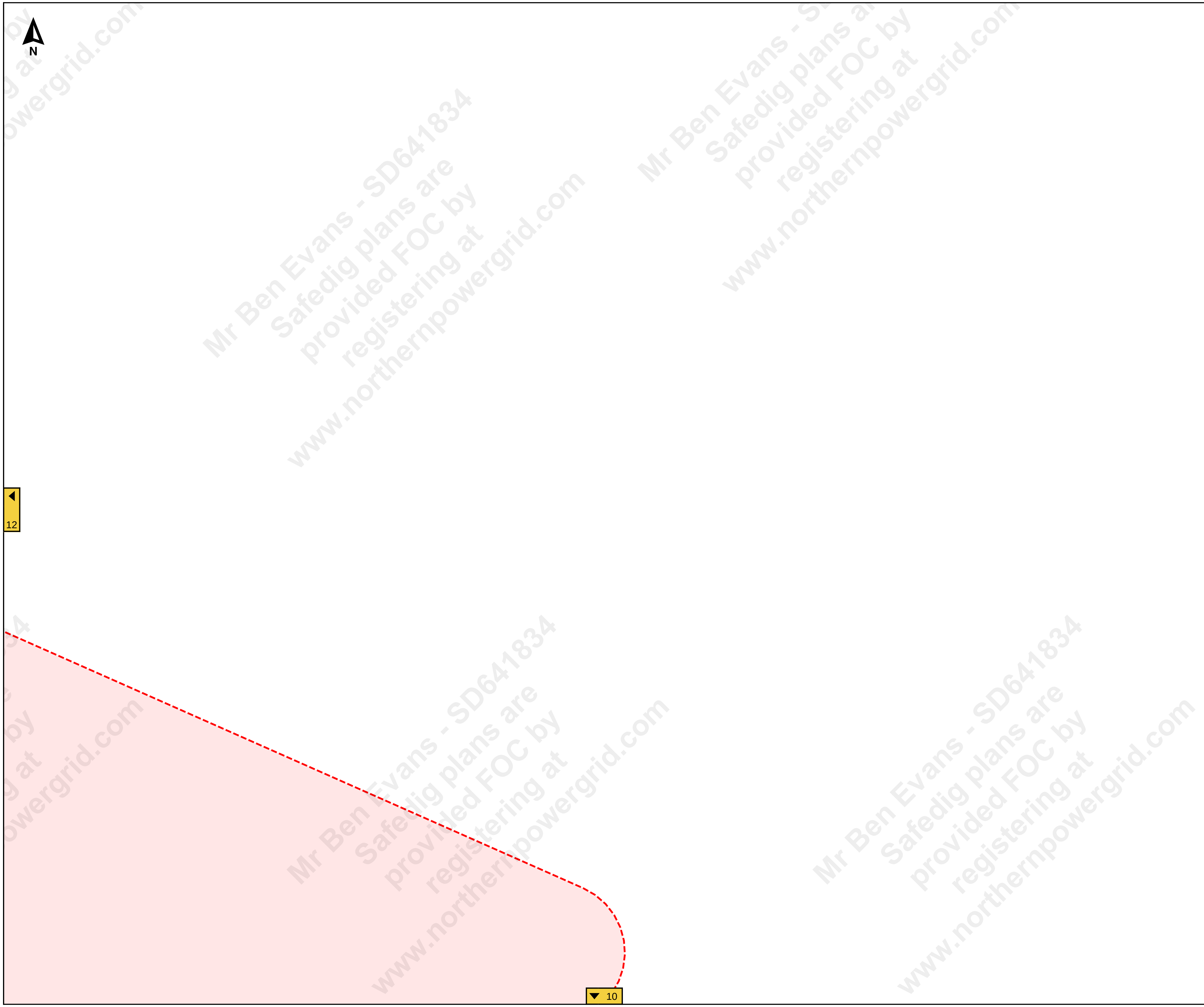

NORTHERN POWERGRID

Job Reference : SD641834

100245

Scale : 1:500

Grid Coordinates : 521096 416292

Date : 27/09/2021

Produced For :
Mr Ben Evans

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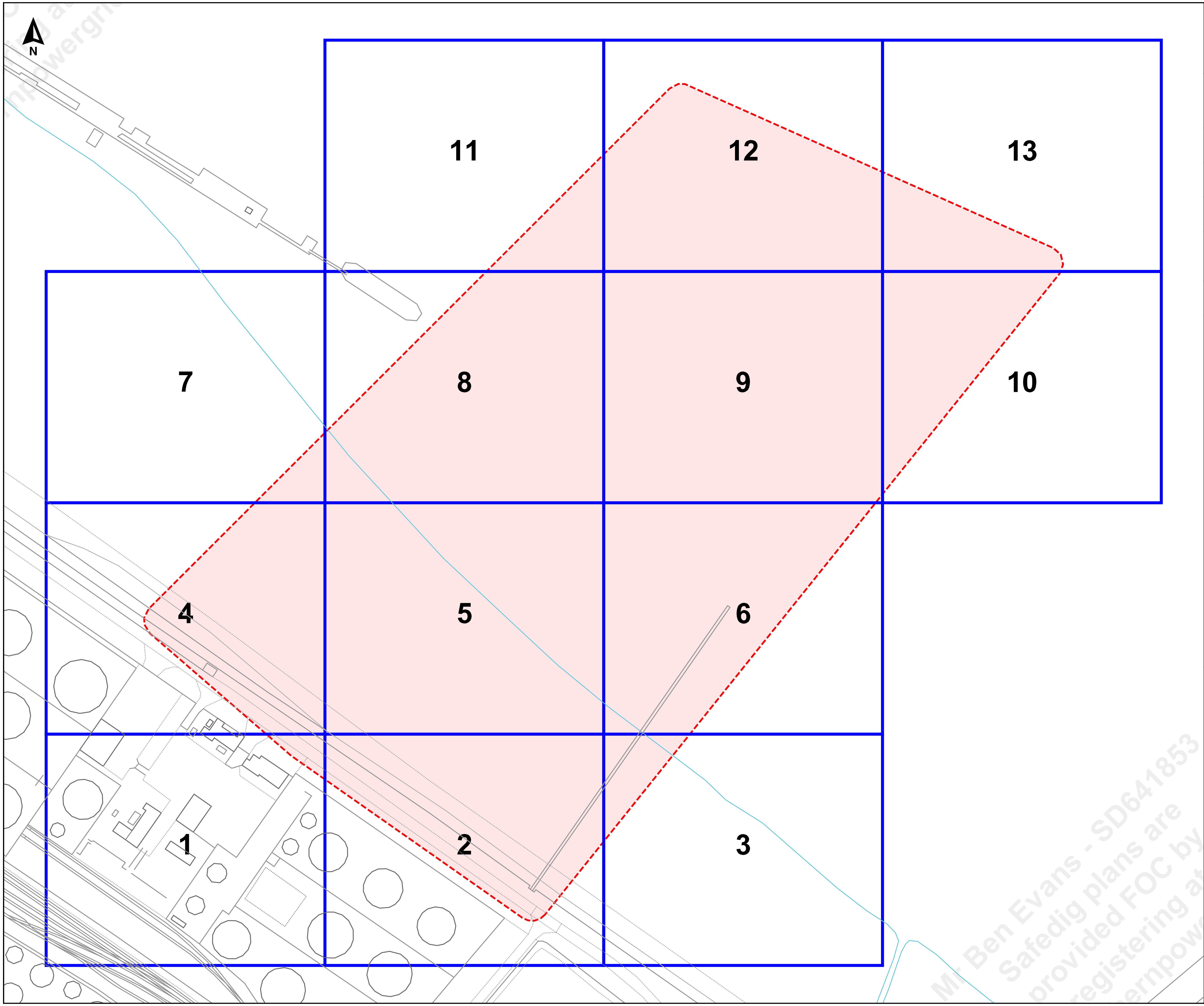
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:

132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:2100

Grid Coordinates : 520687 416166

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

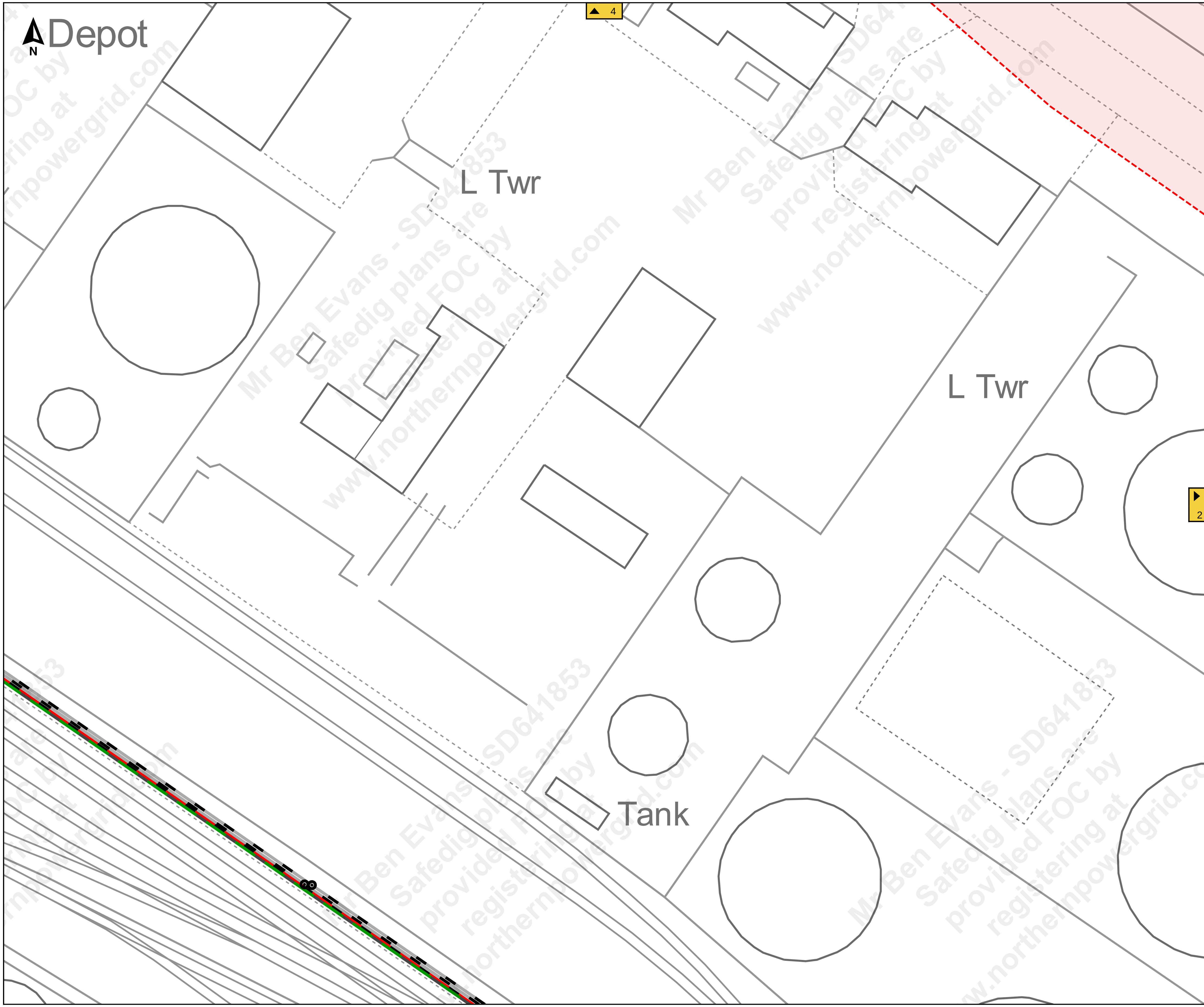
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520436 415958

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 1 of 13 (1,13)

Terms and Conditions

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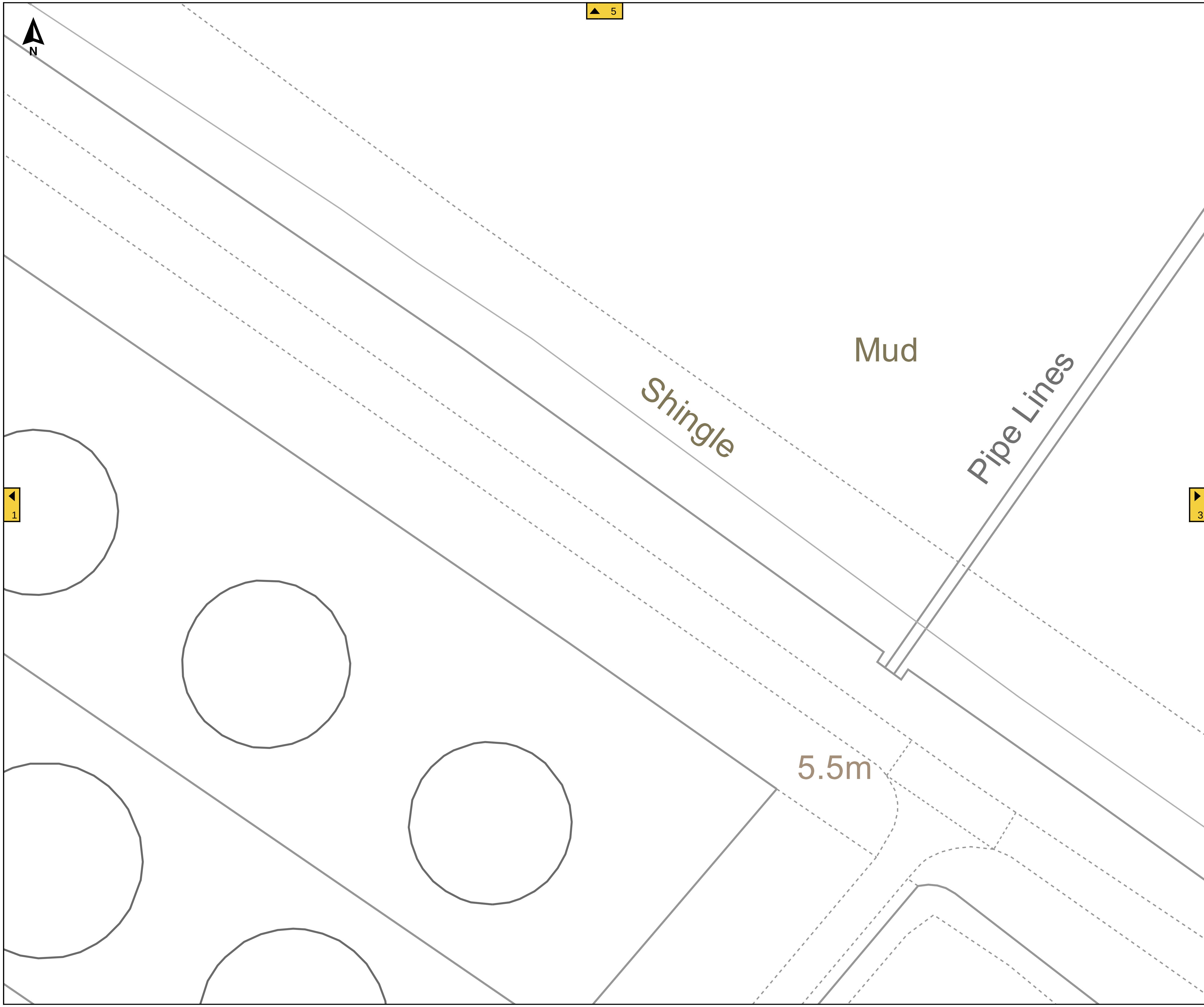
Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520603 415958

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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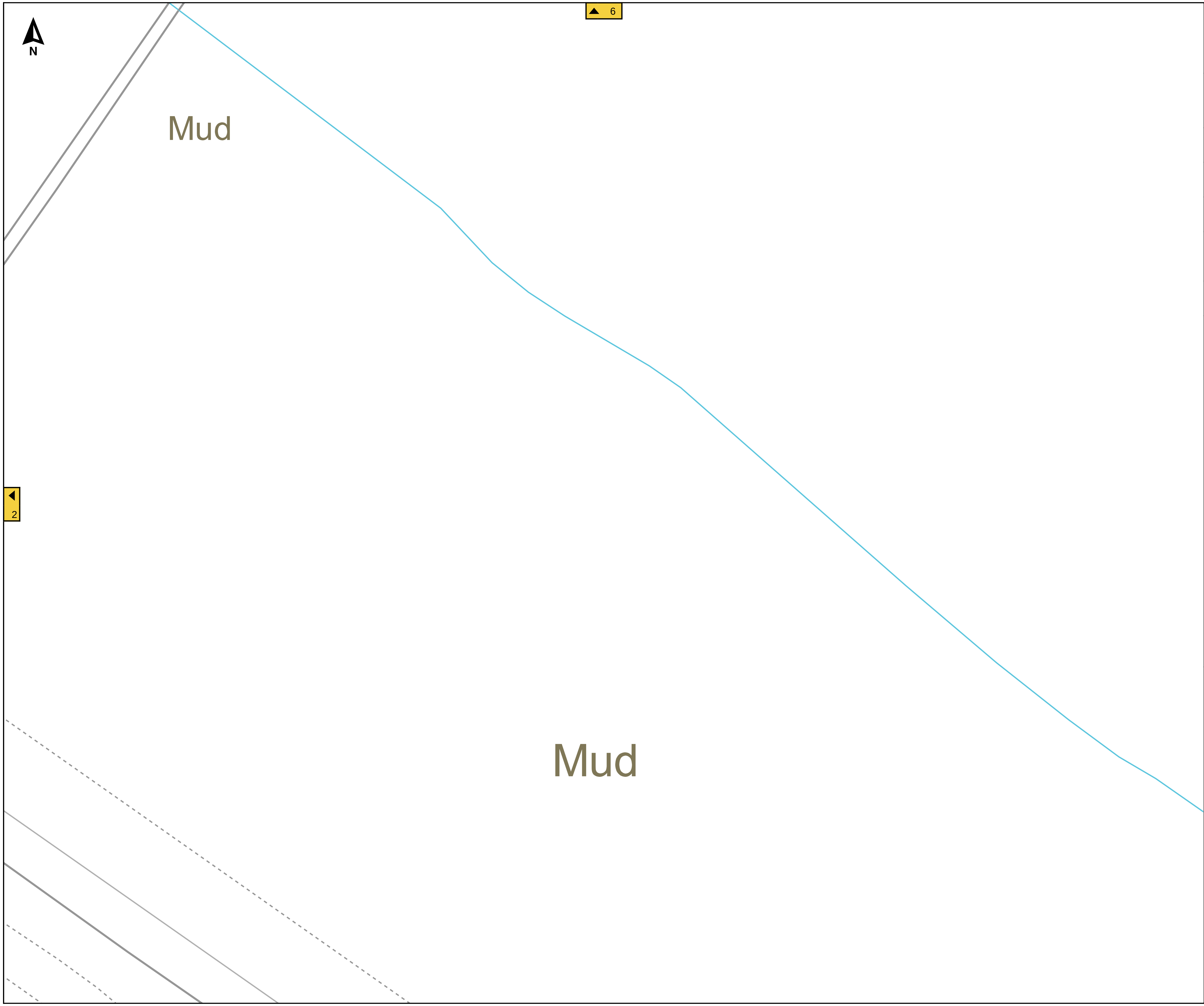
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520771 415958

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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Legend:

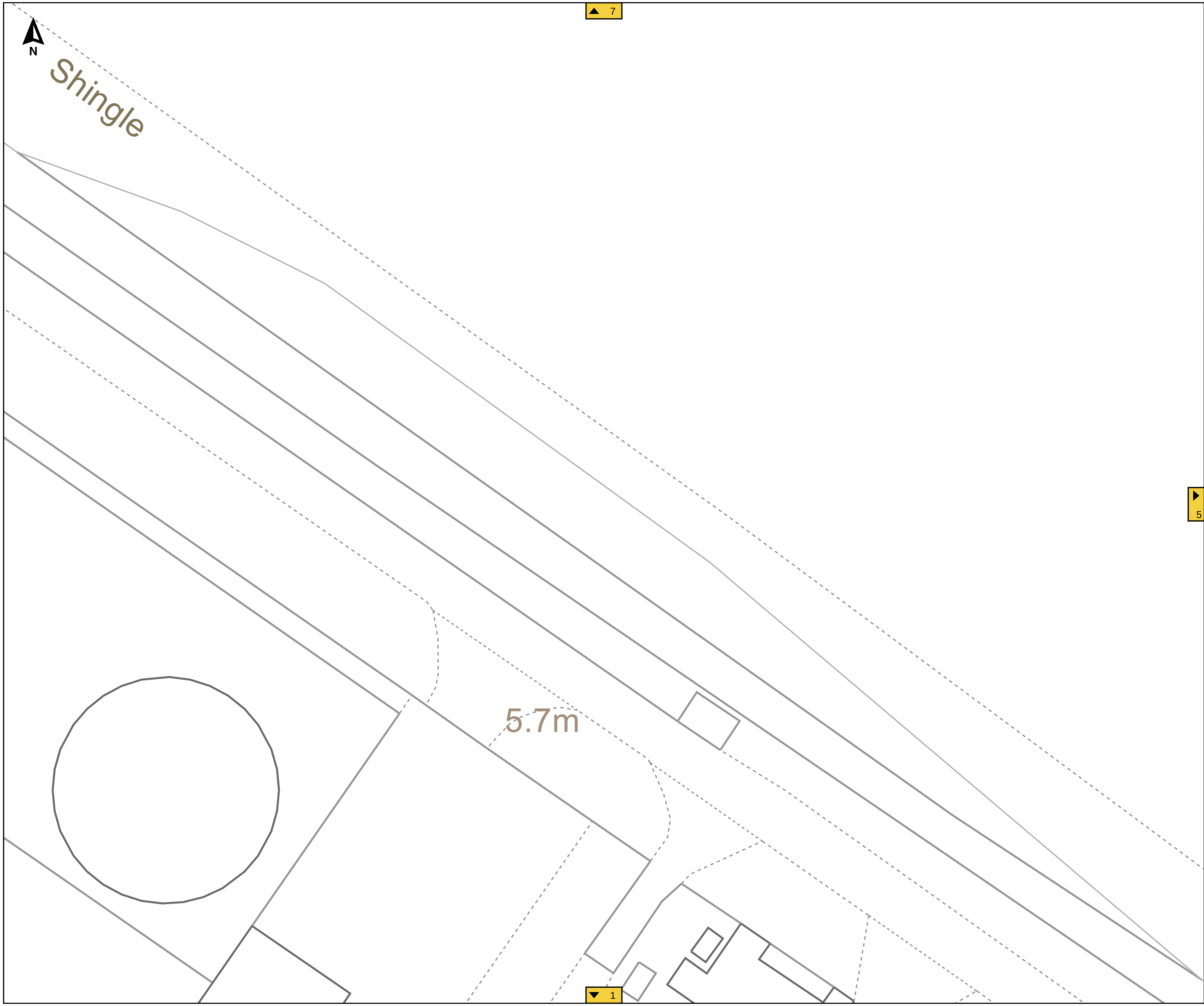
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520436 416097

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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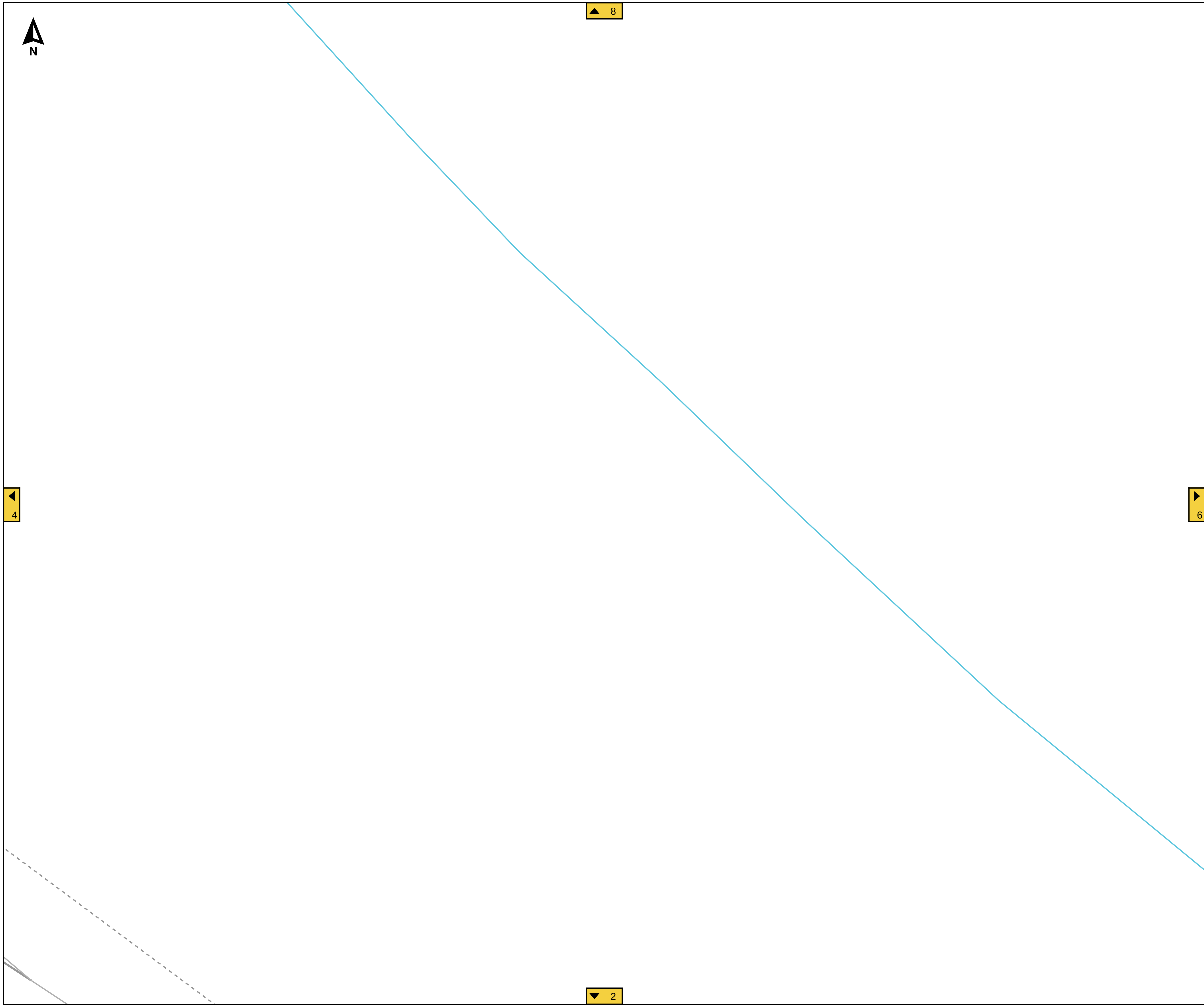
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520603 416097

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520771 416097

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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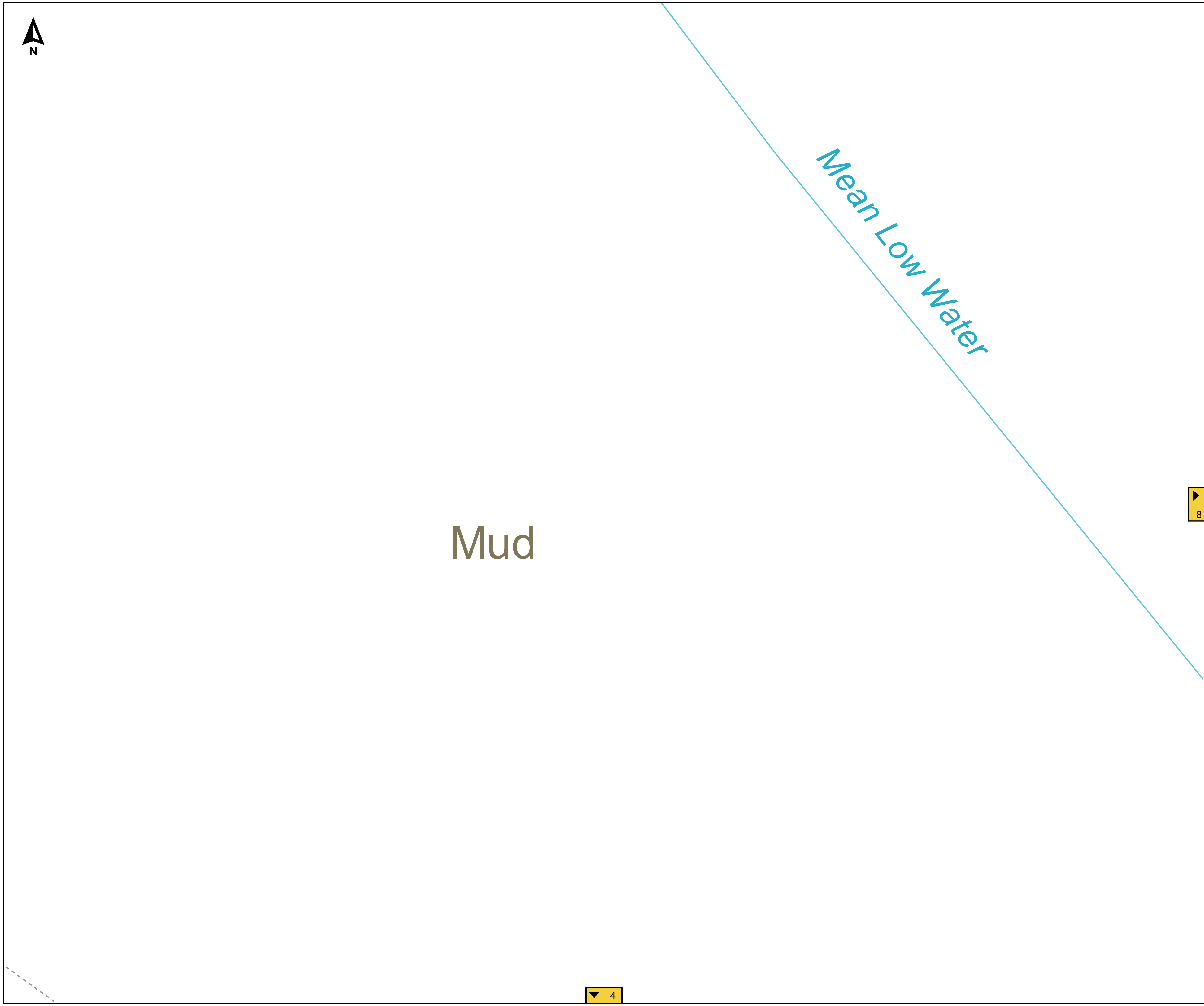
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520436 416235

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

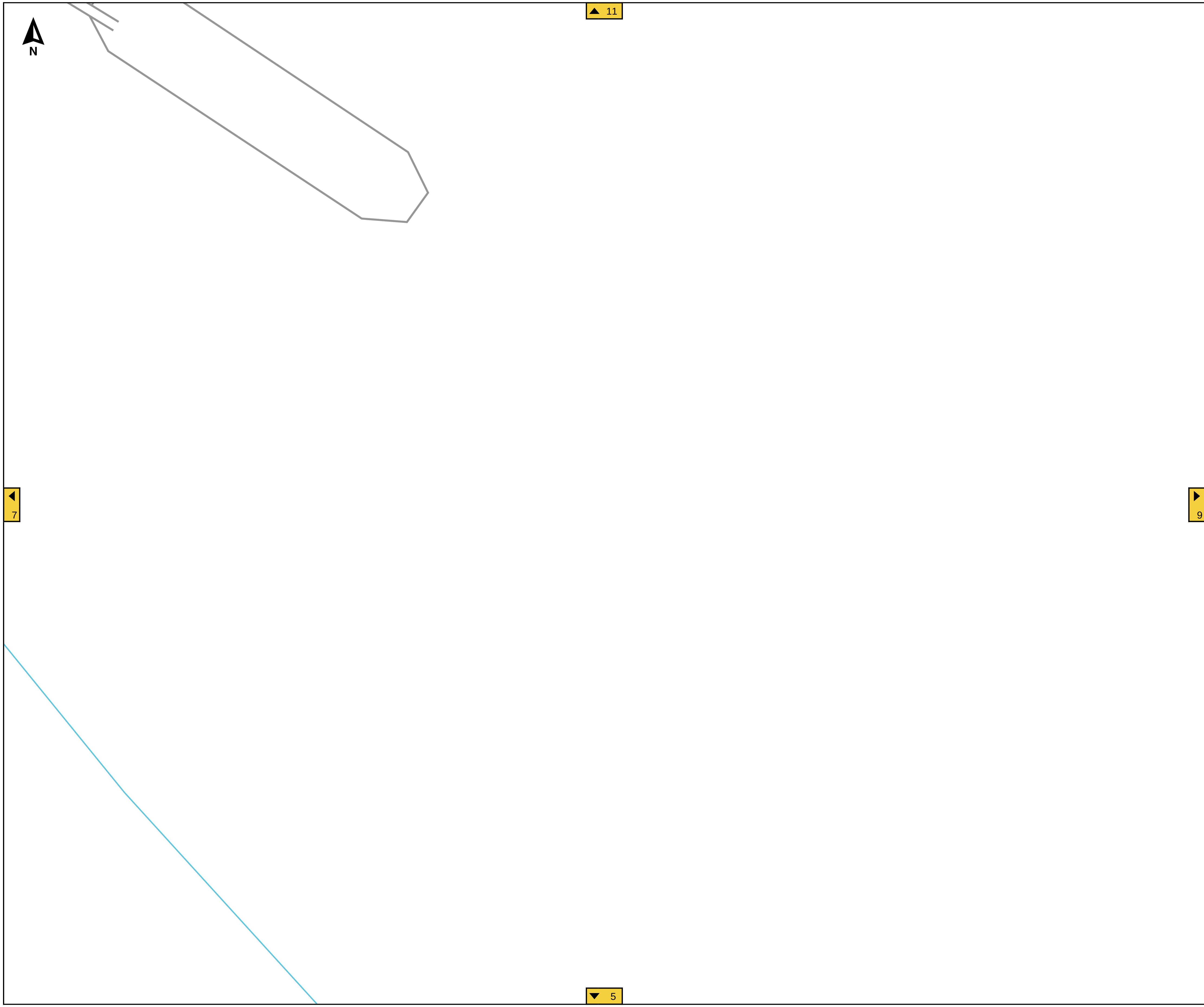
Underground Cables:

132kV	20kV
66kV	11kV
33kV	6kV
25kV	3kV
Left In Situ	Aux
LV Mains	LV Service
LV Service Assumed Route	
LV Service Logical Connection	
Duct Route	

Overhead Conductors:

132kV	20kV
66kV	11kV
33kV	6kV
25kV	3kV
LV Mains	Aux
LV Service	

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520603 416235

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

N

▲ 12

◀ 8

▶ 10

▼ 6

NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520771 416235

Date : 27/09/2021

Produced For :
Mr Ben Evans

Legend:

Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

13

N

9

NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520938 416235

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

Underground Cables:

132kV | 20kV
66kV | 11kV
33kV | 6kV
25kV | 3kV
Left In Situ | Aux
LV Mains | LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:

132kV | 20kV
66kV | 11kV
33kV | 6kV
25kV | 3kV
LV Mains | Aux
LV Service

0 5 10 15 20m

NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520603 416374

Date : 27/09/2021

Produced For :
Mr Ben Evans

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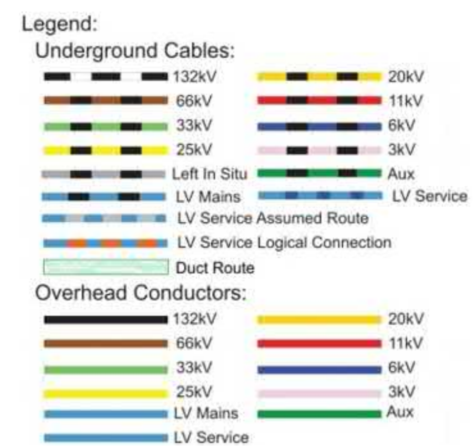

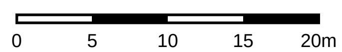

N

11

13

9

NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520771 416374

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:

132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m

N

NORTHERN POWERGRID

Job Reference : SD641853

100245_2

Scale : 1:500

Grid Coordinates : 520938 416374

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

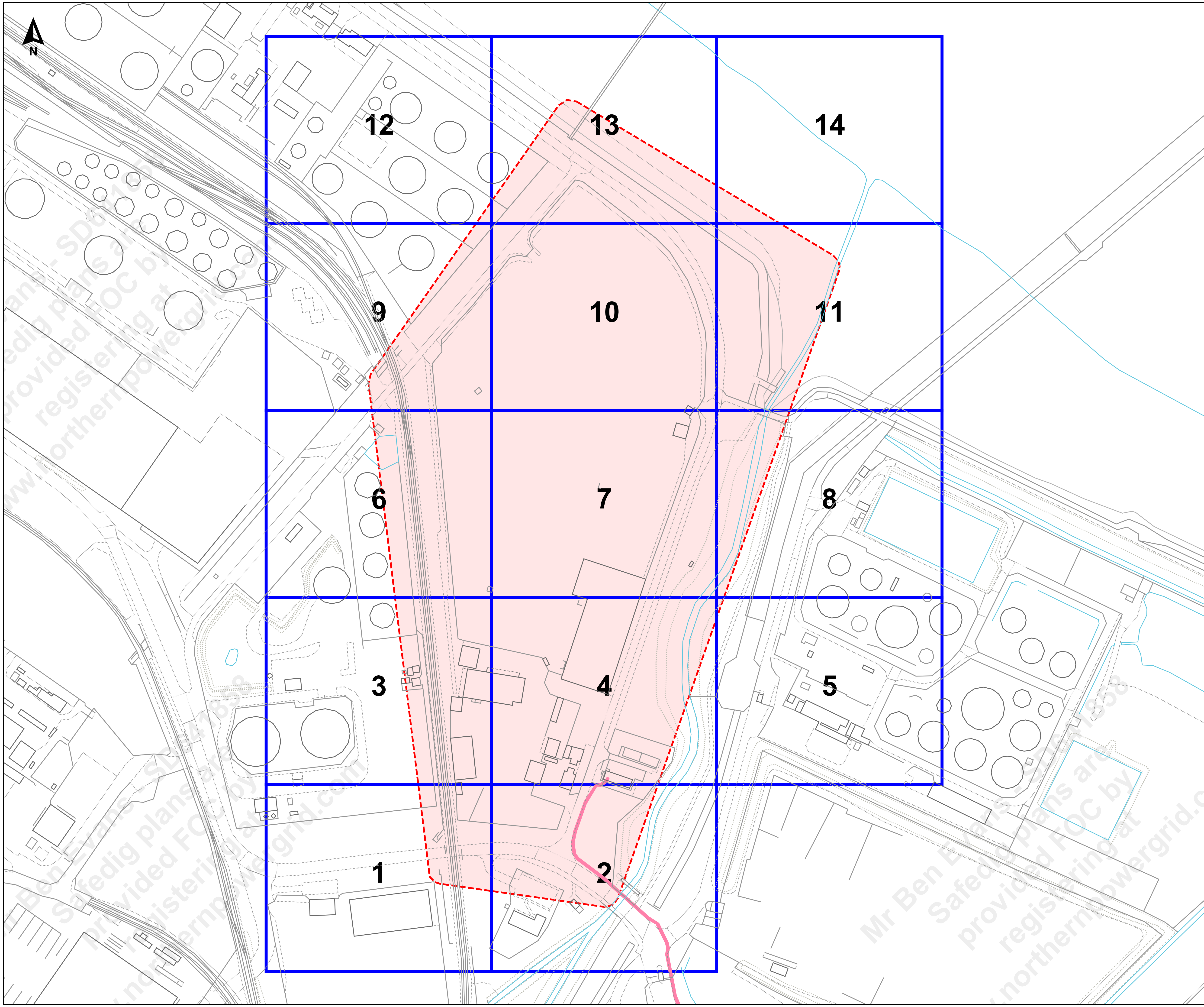
Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

12

10



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:2600

Grid Coordinates : 520669 415664

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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Legend:

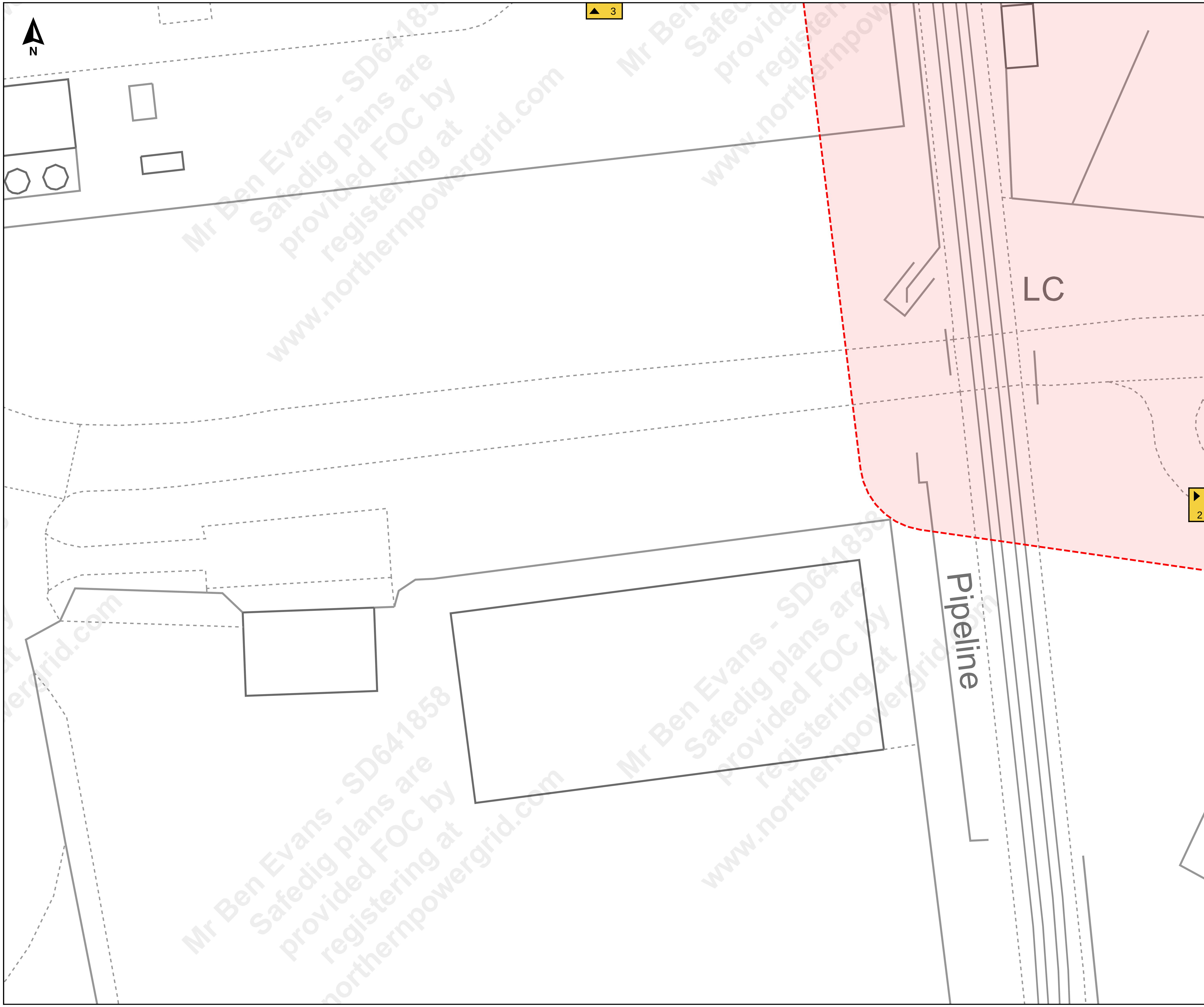
Underground Cables:

132kV, 66kV, 33kV, 25kV, Left In Situ, LV Mains, LV Service Assumed Route, LV Service Logical Connection, Duct Route, 20kV, 11kV, 6kV, 3kV, Aux, LV Service

Overhead Conductors:

132kV, 66kV, 33kV, 25kV, LV Mains, LV Service, 20kV, 11kV, 6kV, 3kV, Aux

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520502 415386

Date : 27/09/2021

Produced For :
Mr Ben Evans

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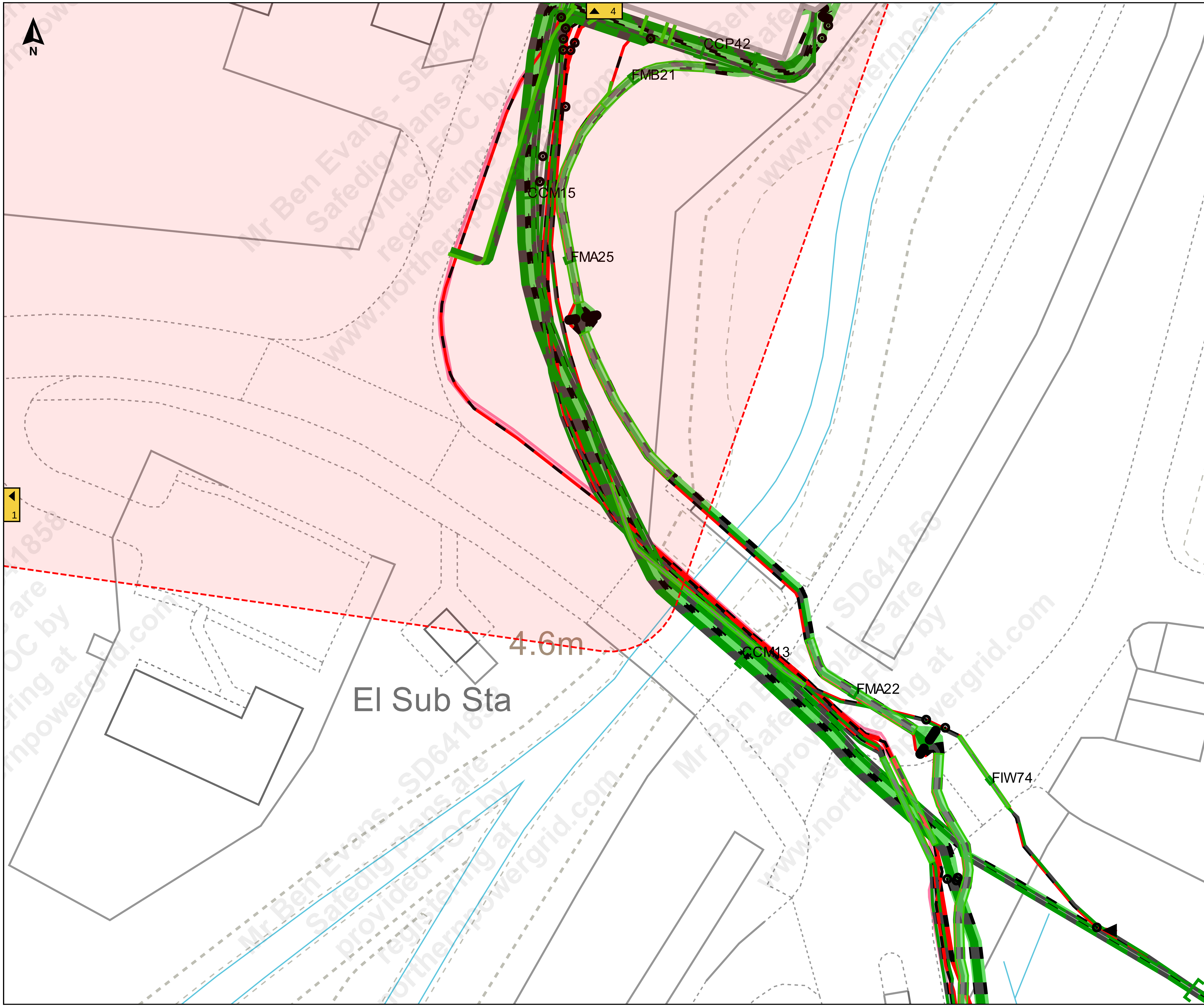
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858
100245_3

Scale : 1:500

Grid Coordinates : 520669 415386

Date : 27/09/2021

Produced For :
Mr Ben Evans

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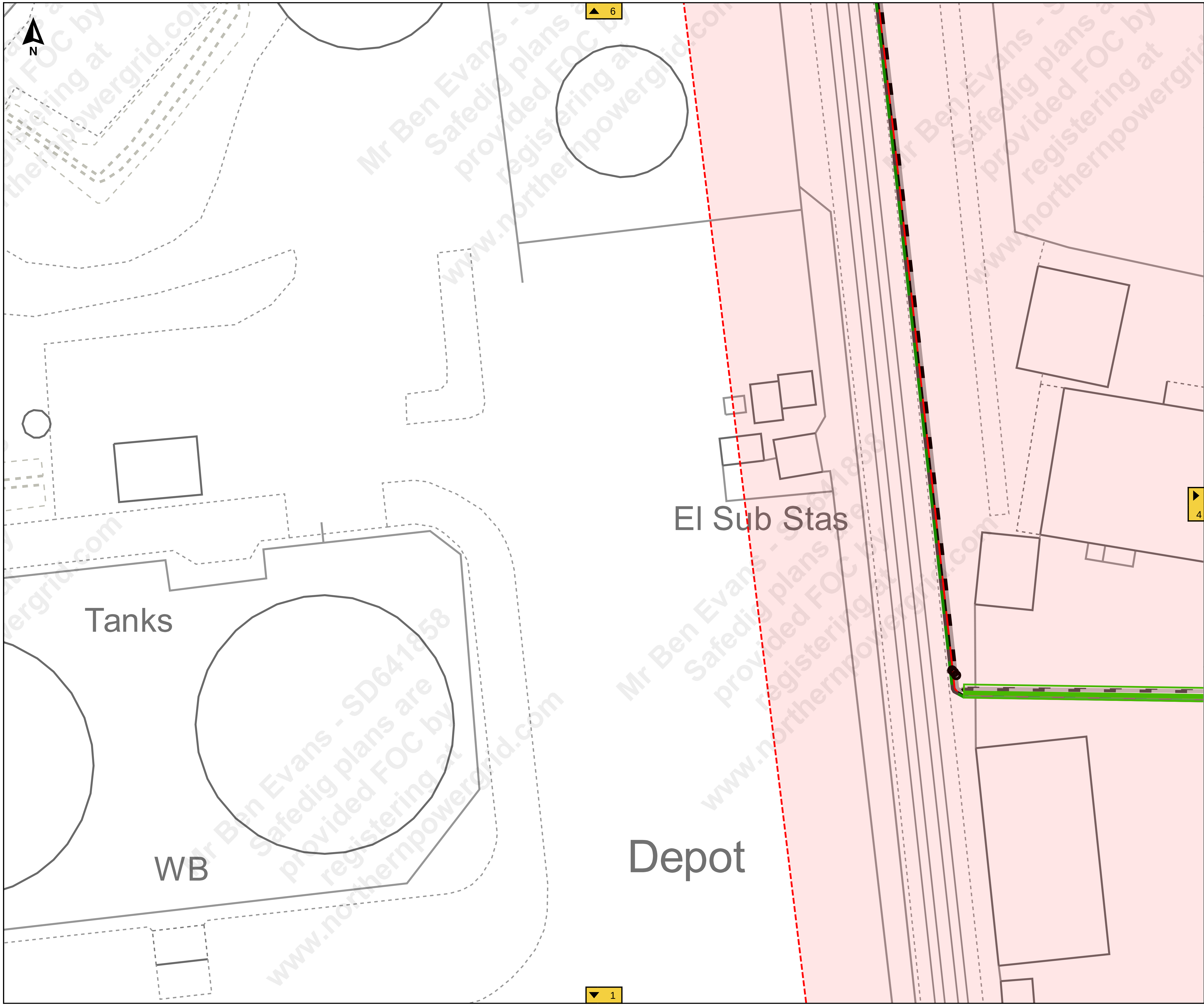
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route
Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520502 415525

Date : 27/09/2021

Produced For :

Mr Ben Evans

Terms and Conditions

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In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

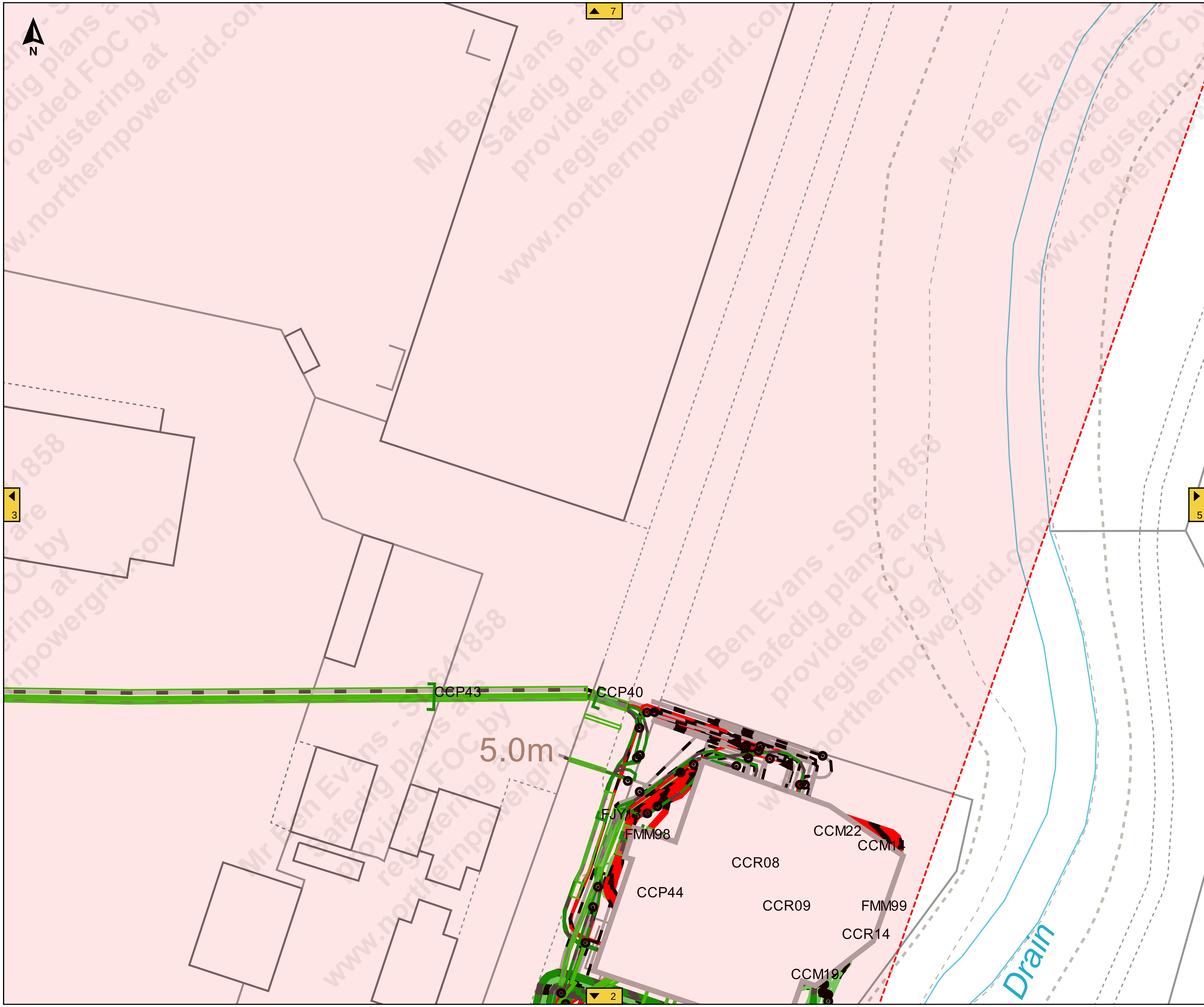
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858
100245_3

Scale : 1:500

Grid Coordinates : 520669 415525

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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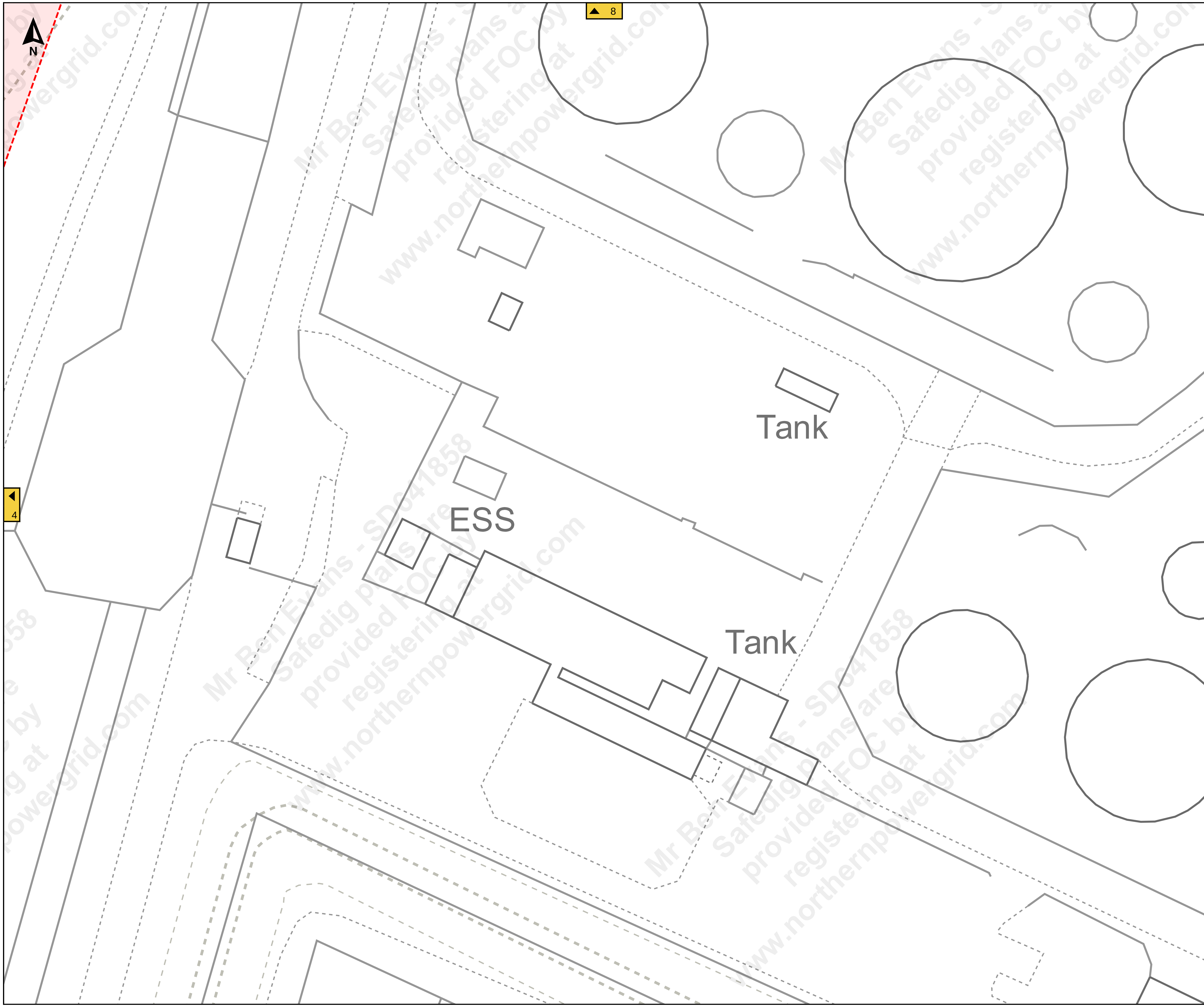
Legend:
Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520836 415525

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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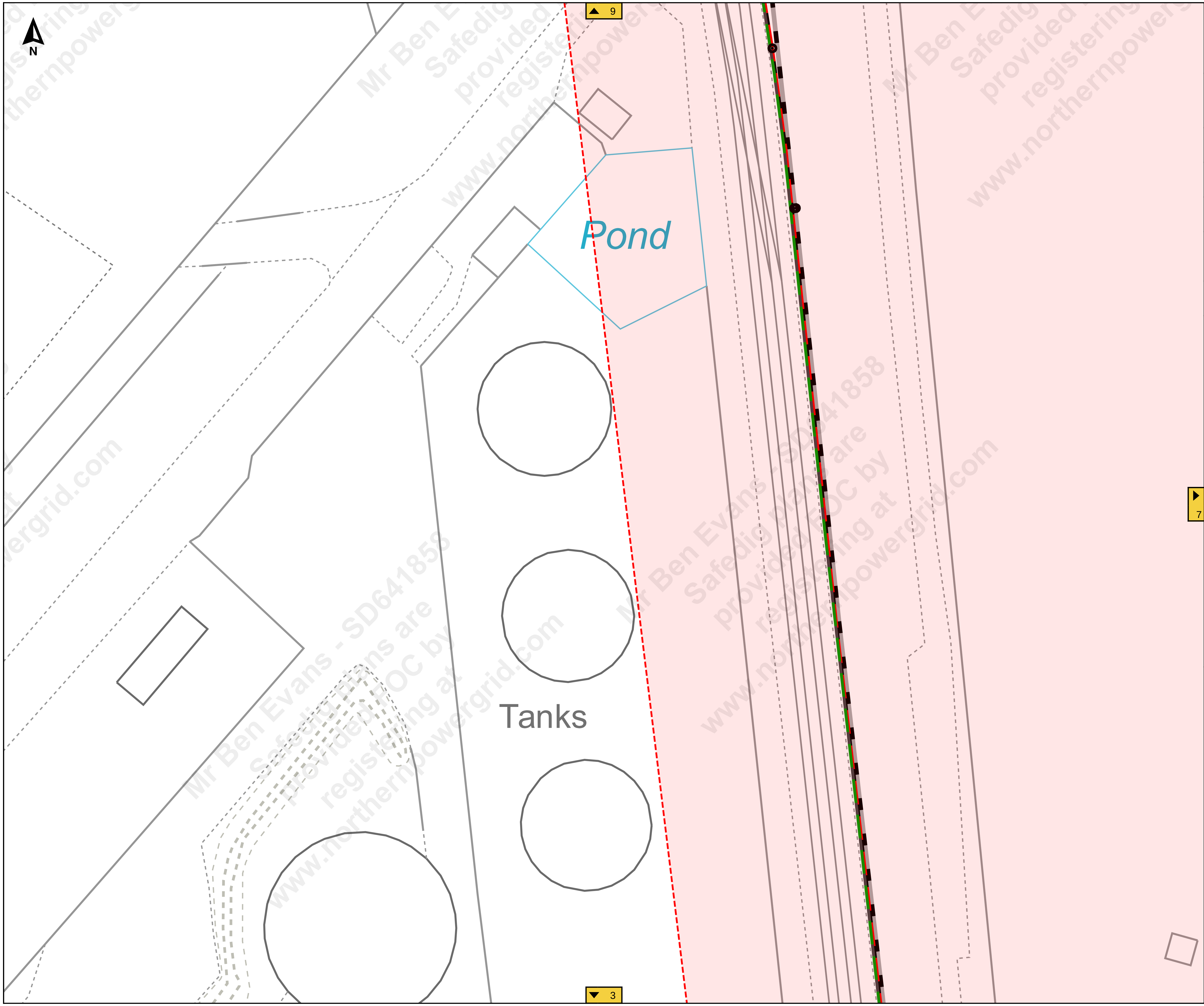
Legend:

Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520502 415664

Date : 27/09/2021

Produced For :
Mr Ben Evans

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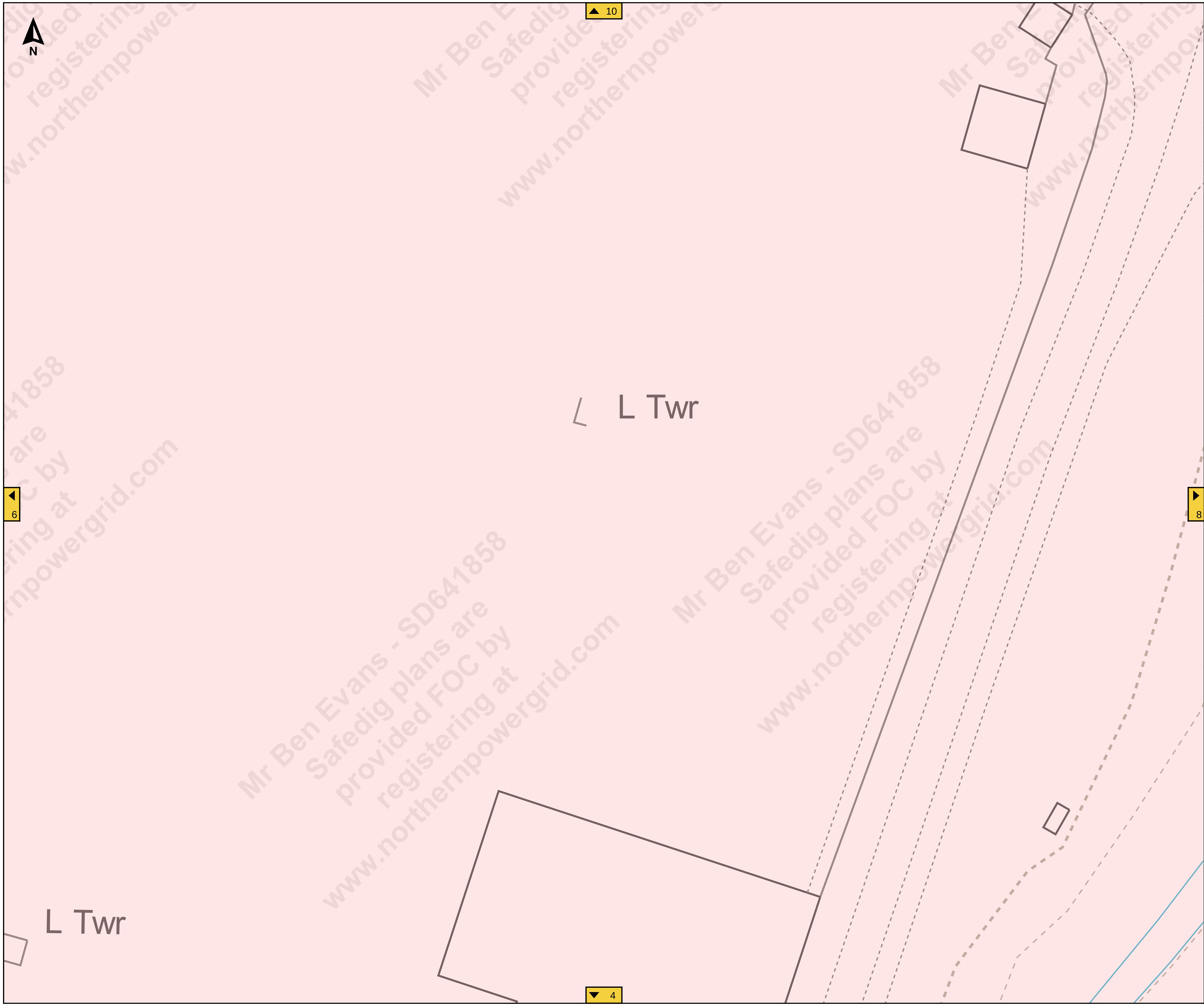
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858
100245_3

Scale : 1:500

Grid Coordinates : 520669 415664

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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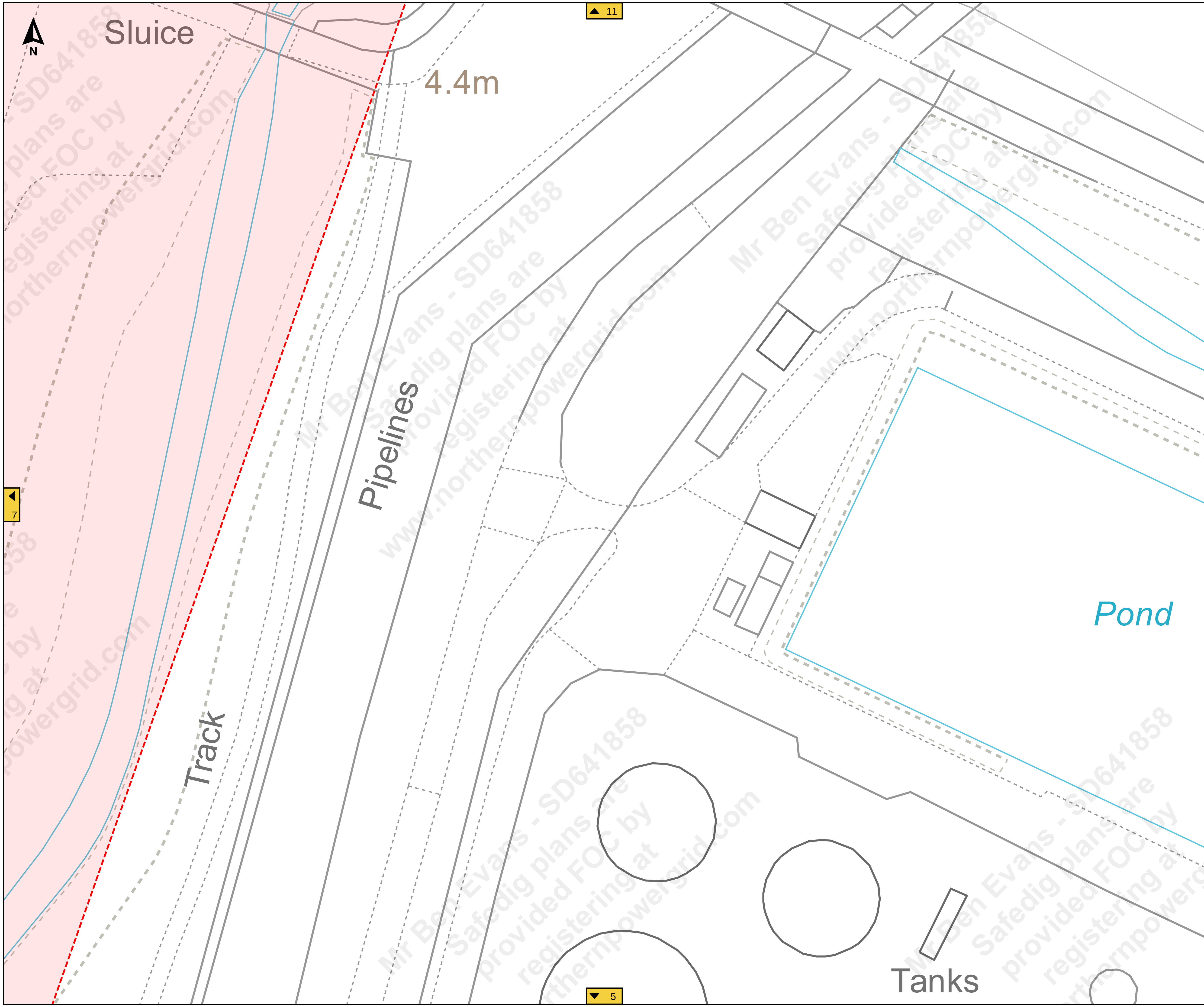
Legend:
Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520836 415664

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 8 of 14 (8,14)

Terms and Conditions

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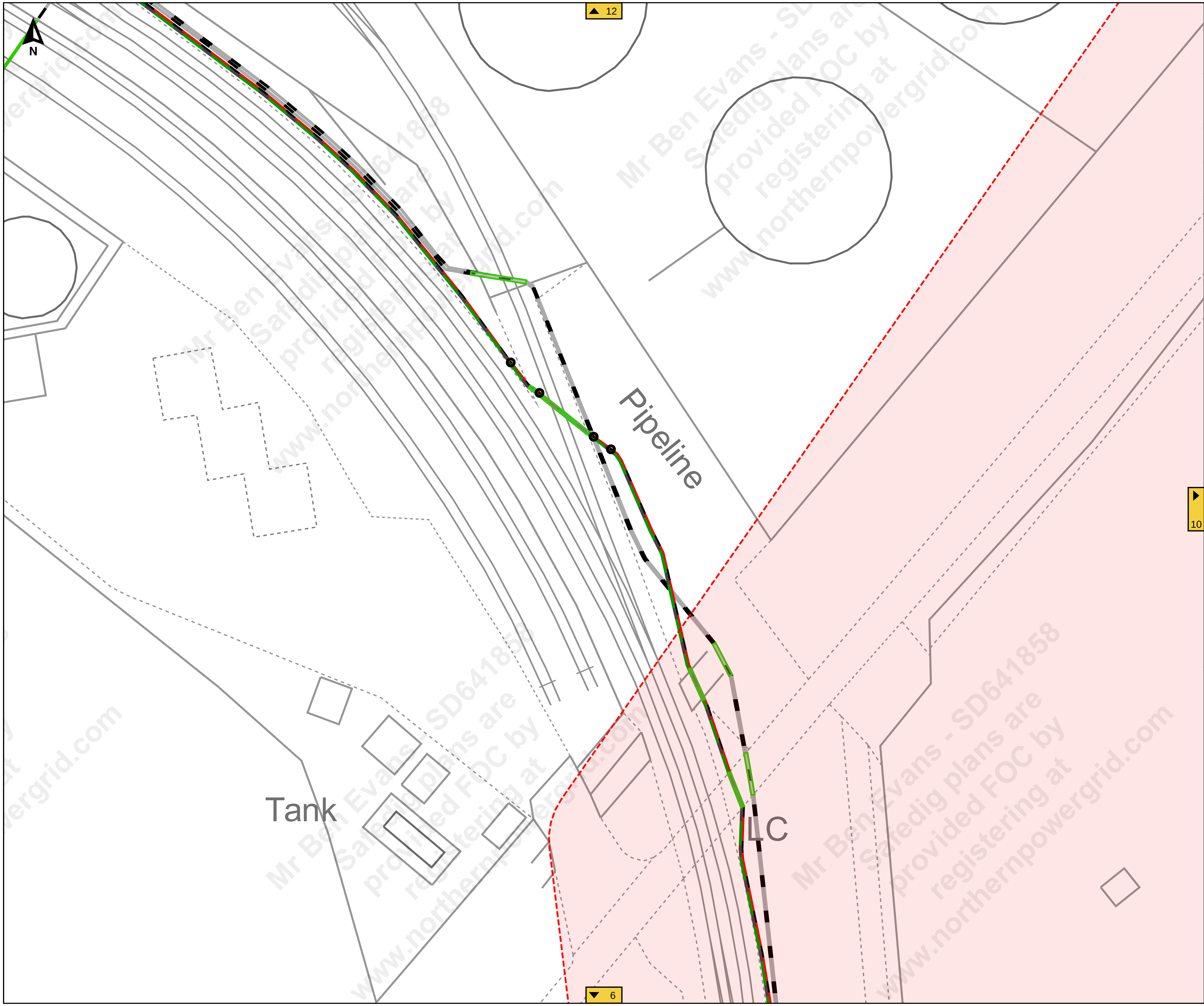
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520502 415802

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 9 of 14 (9,14)

Terms and Conditions

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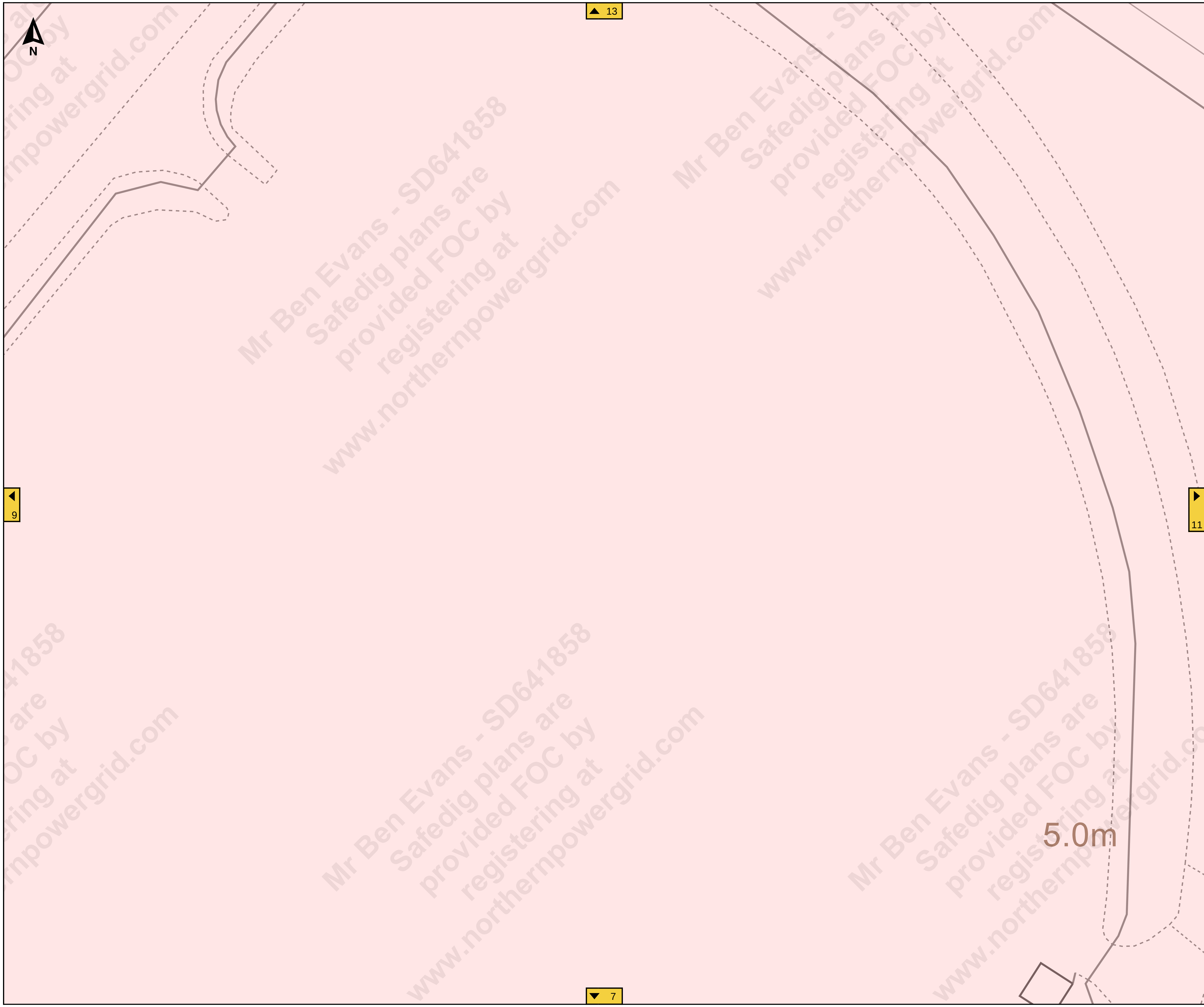
Legend:

Underground Cables:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520669 415802

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

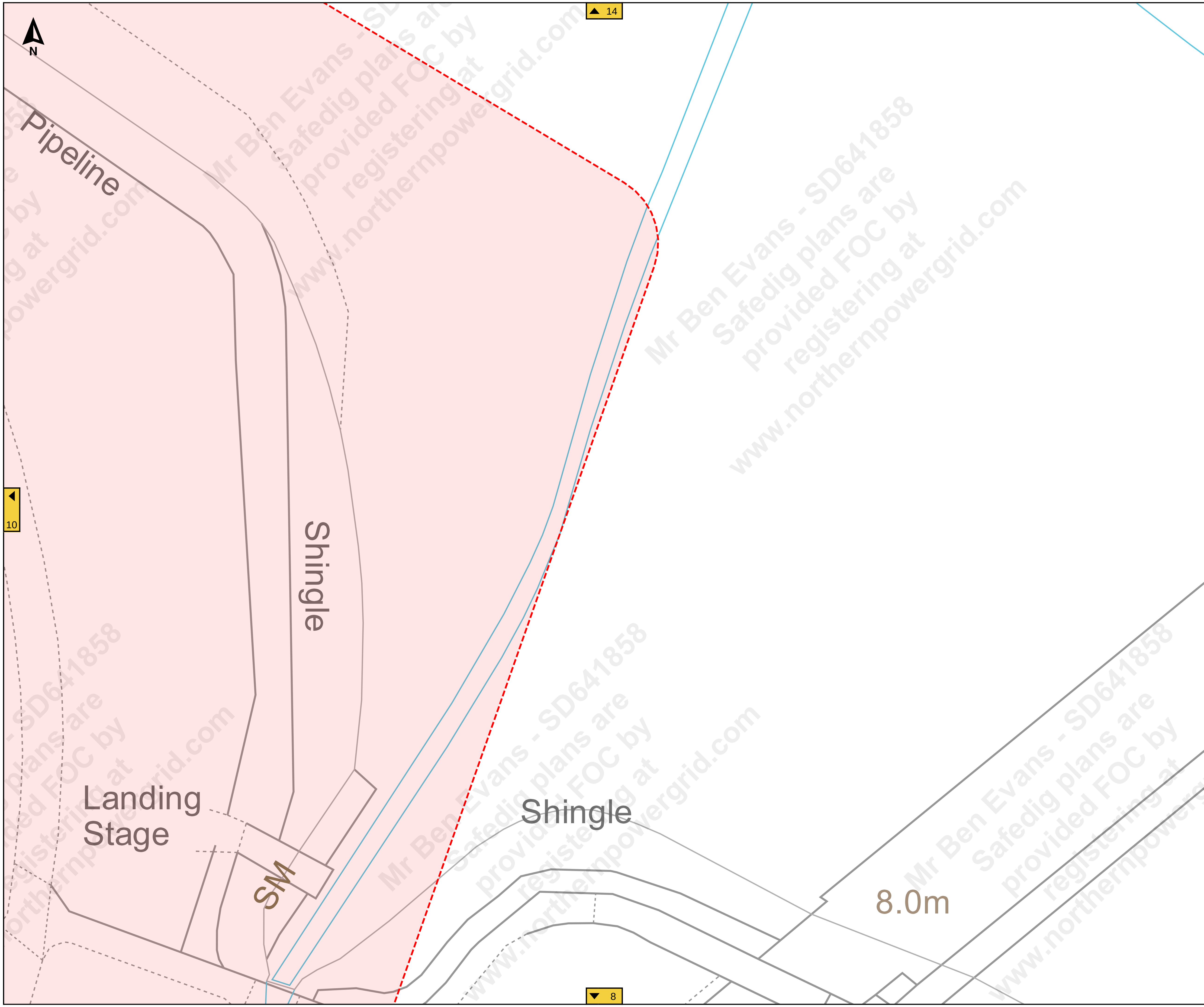
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520836 415802

Date : 27/09/2021

Produced For :
Mr Ben Evans

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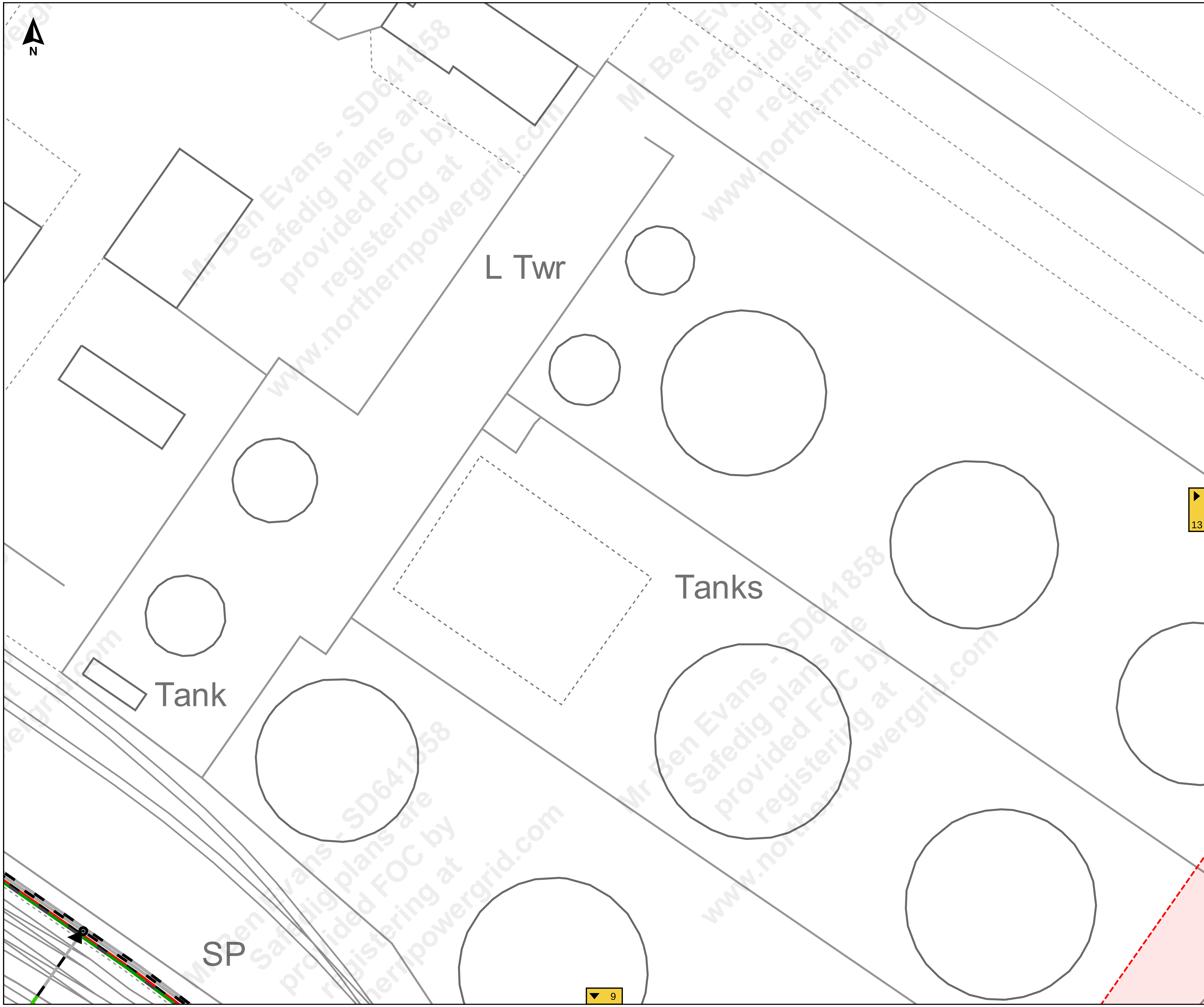
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520502 415941

Date : 27/09/2021

Produced For :
Mr Ben Evans

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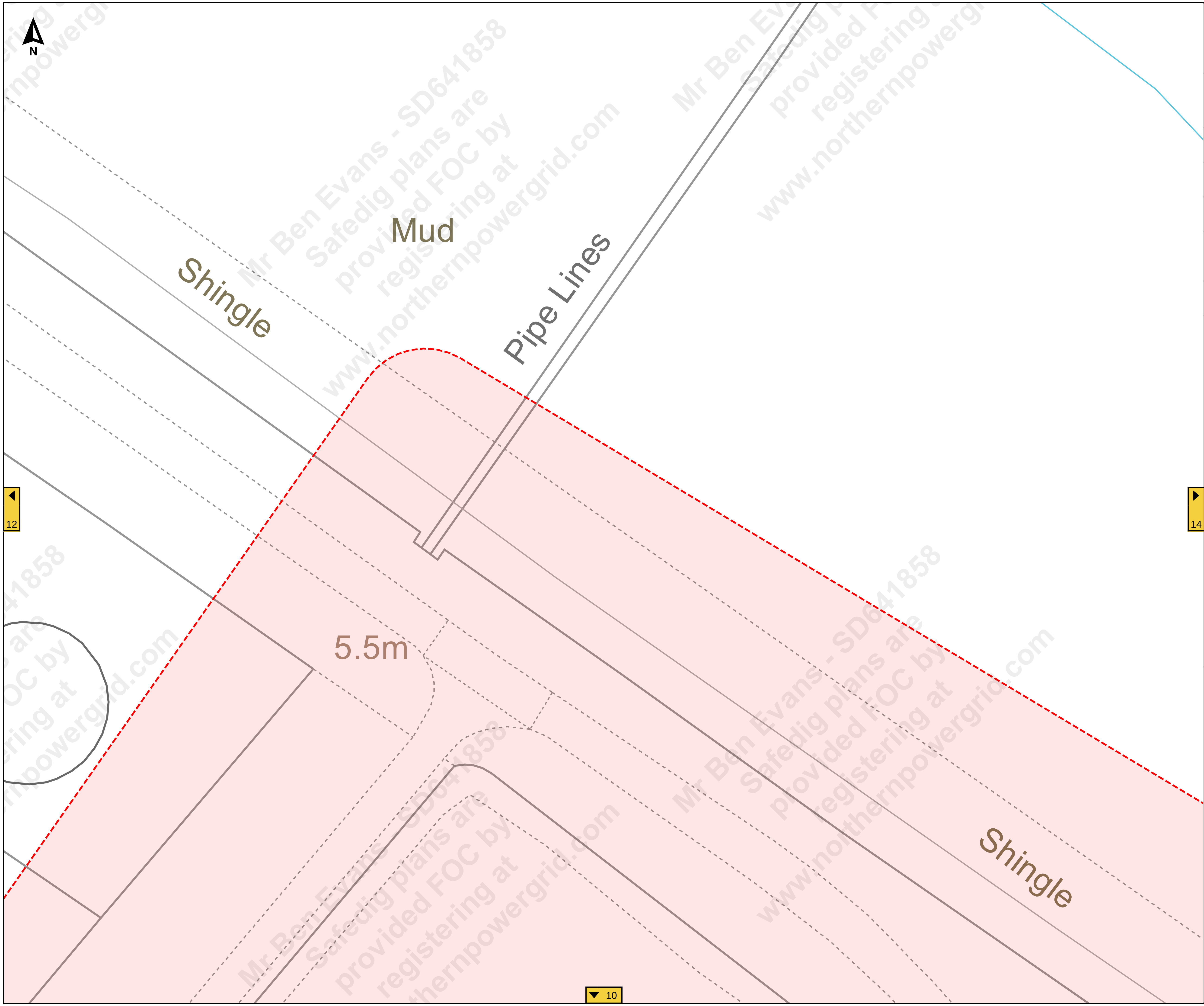
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858
100245_3

Scale : 1:500

Grid Coordinates : 520669 415941

Date : 27/09/2021

Produced For :
Mr Ben Evans

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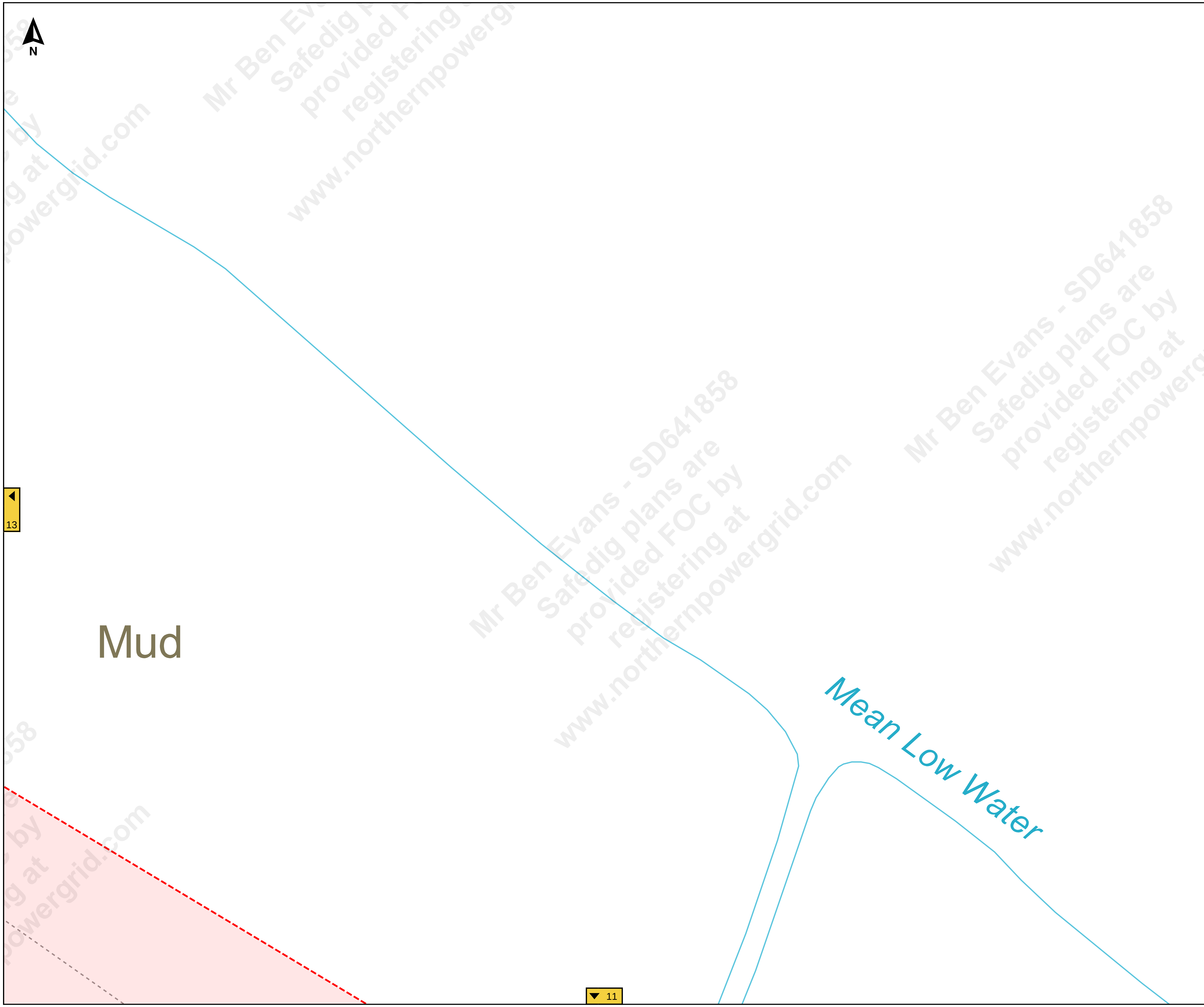
Legend:

Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641858

100245_3

Scale : 1:500

Grid Coordinates : 520836 415941

Date : 27/09/2021

Produced For :
Mr Ben Evans

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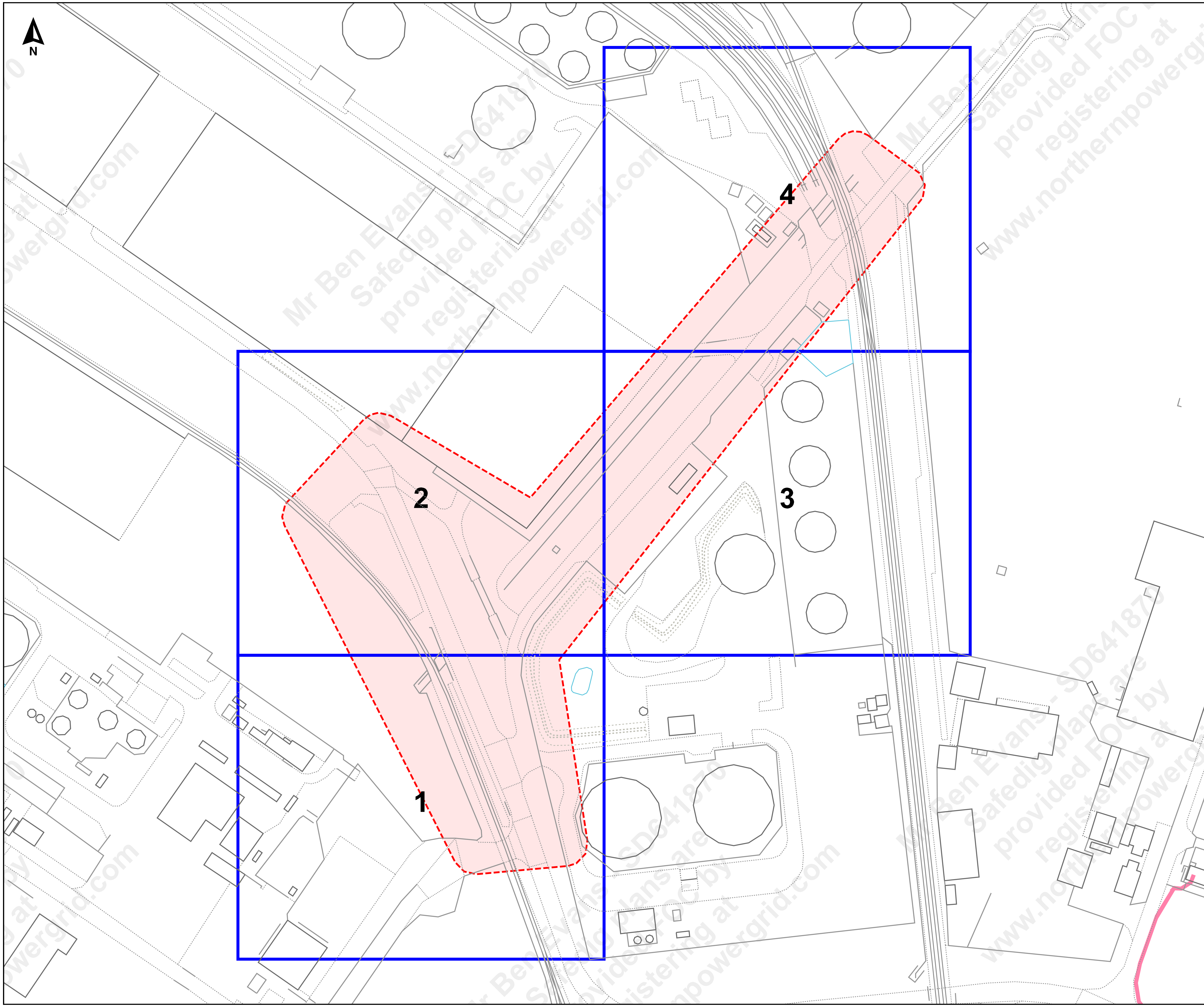
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



Job Reference : SD641870

100245_4

Scale : 1:1600

Grid Coordinates : 520403 415631

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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Legend:

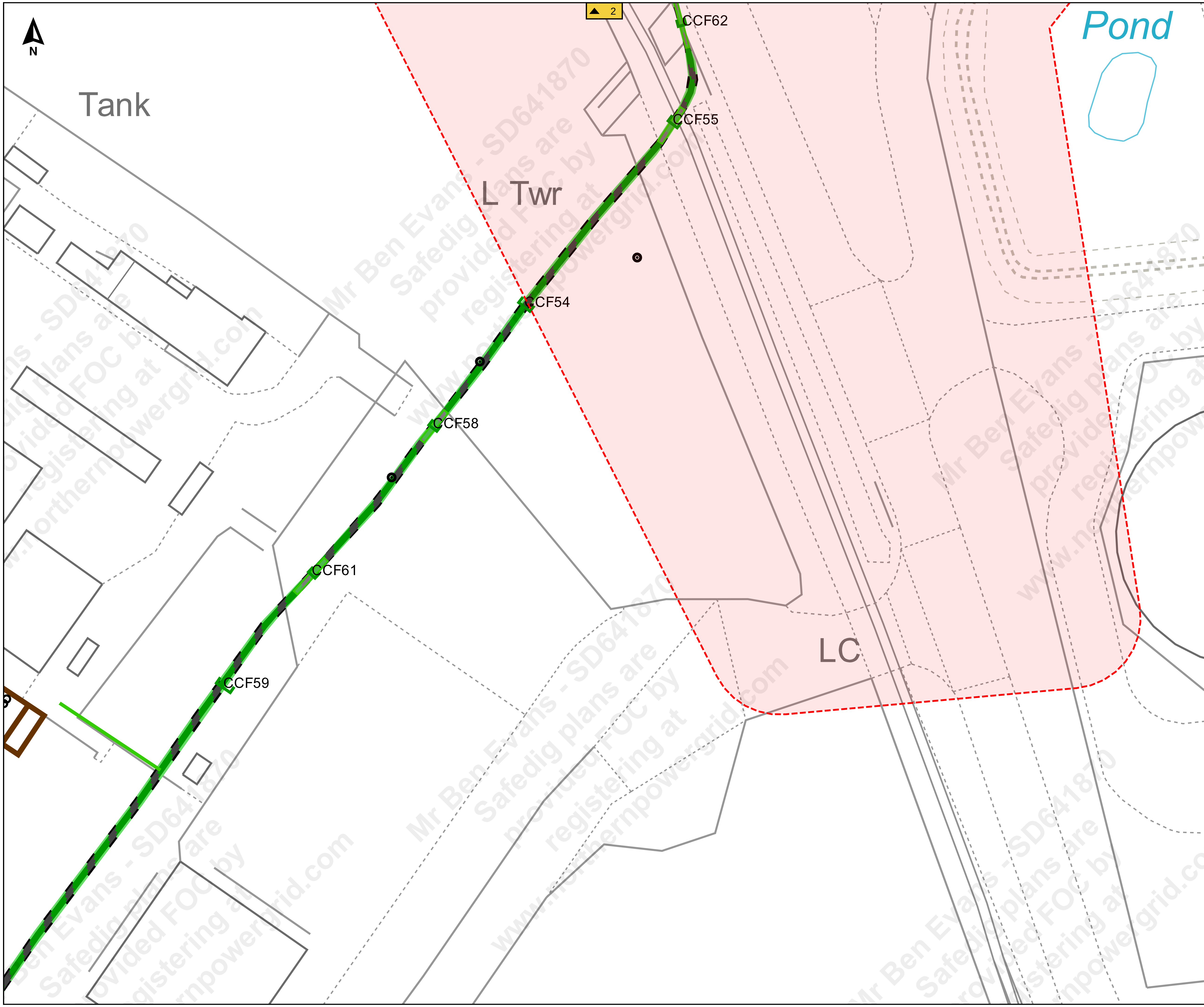
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641870

100245_4

Scale : 1:500

Grid Coordinates : 520319 415492

Date : 27/09/2021

Produced For :
Mr Ben Evans

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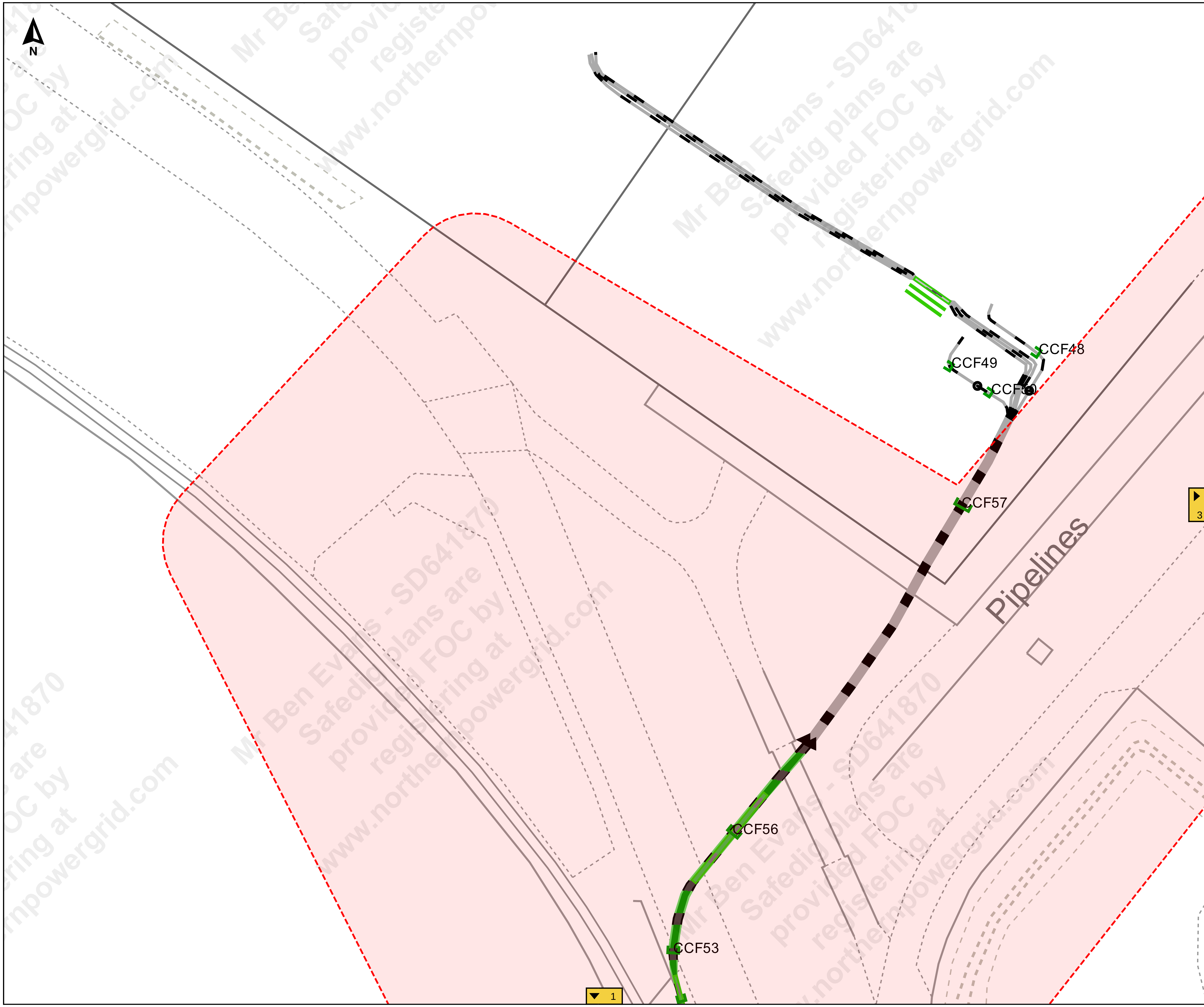
Legend:

Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641870
100245_4

Scale : 1:500

Grid Coordinates : 520319 415631

Date : 27/09/2021

Produced For :
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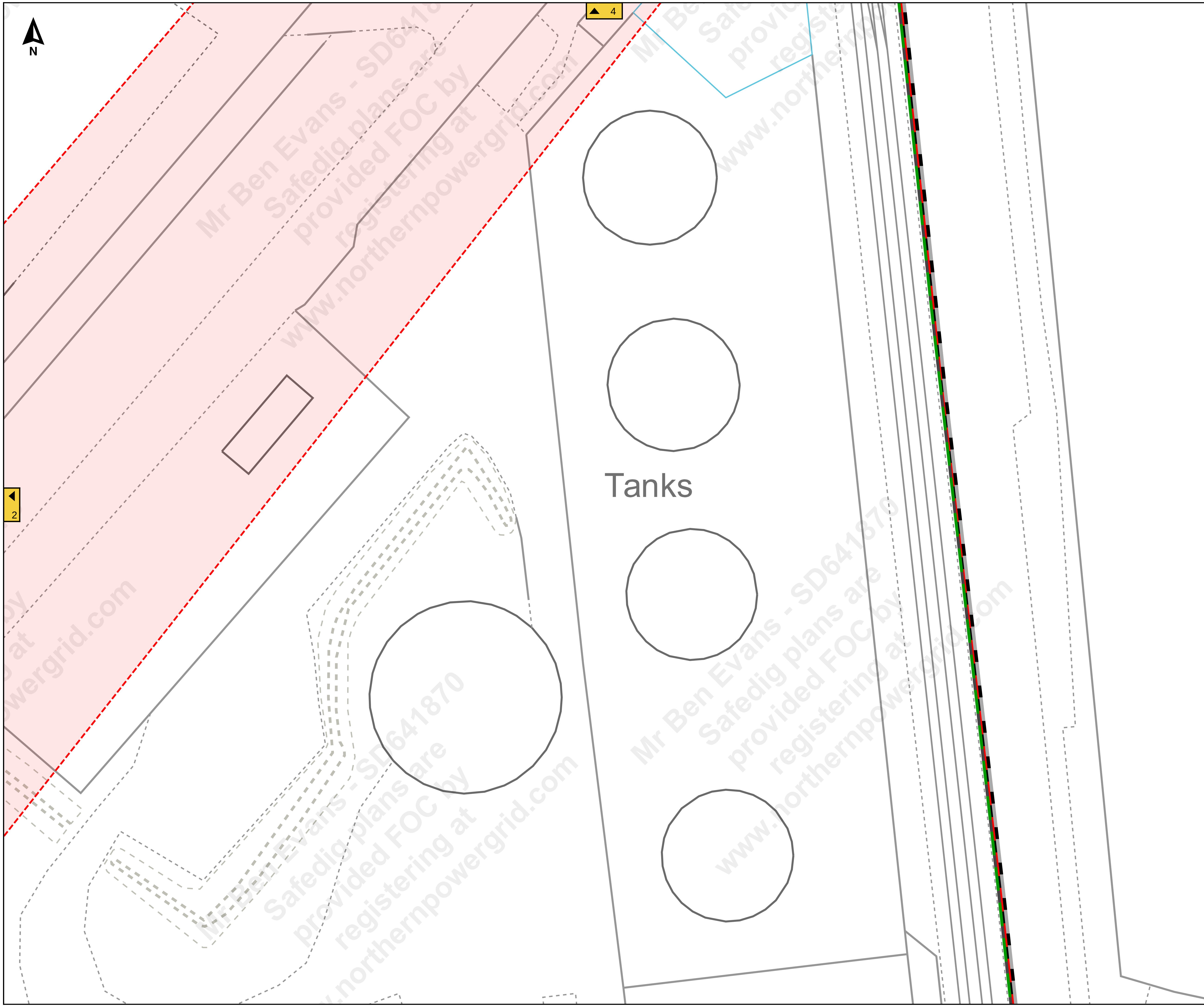
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641870

100245_4

Scale : 1:500

Grid Coordinates : 520487 415631

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 3 of 4 (3,4)

Terms and Conditions

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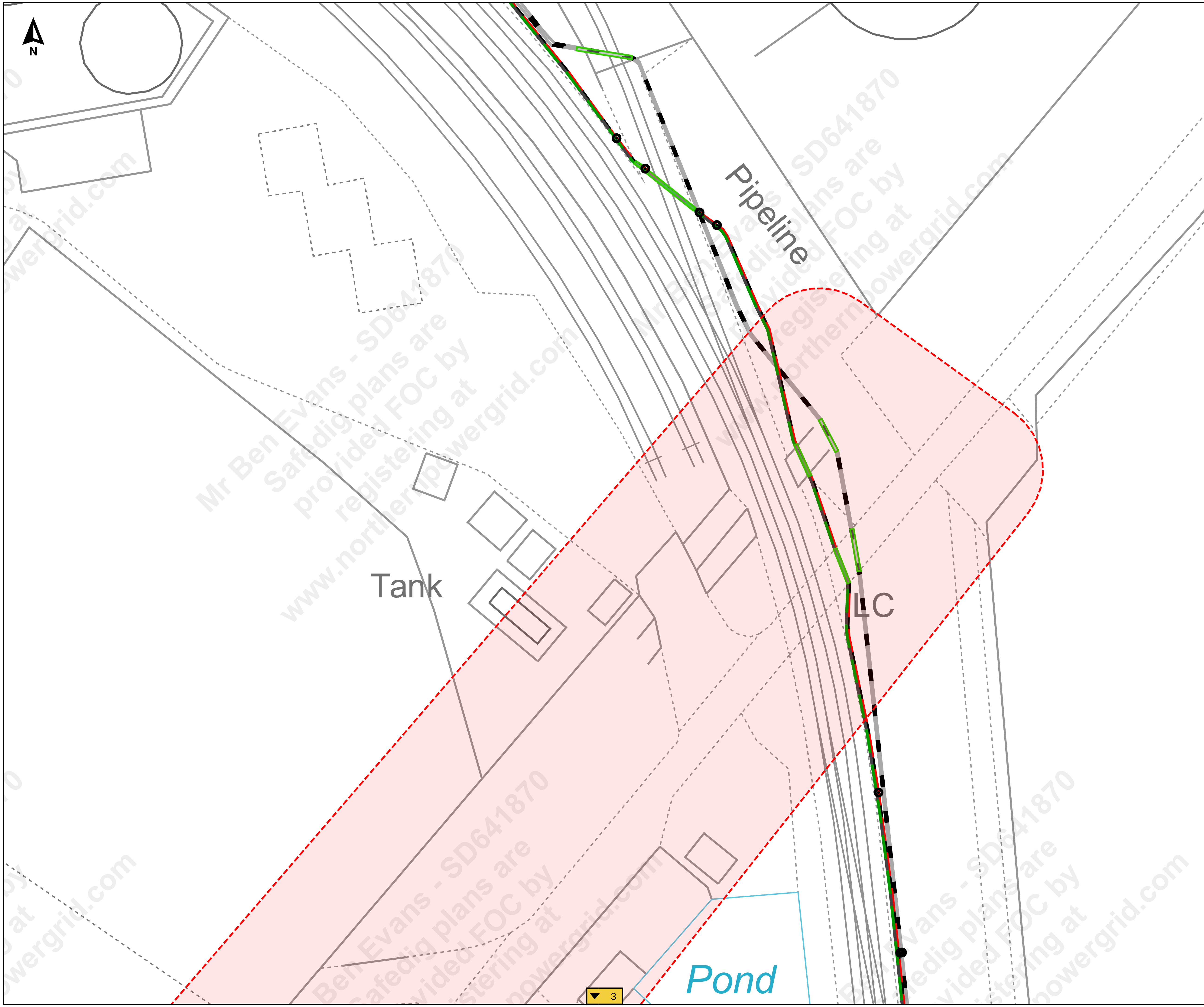
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641870
100245_4

Scale : 1:500

Grid Coordinates : 520487 415770

Date : 27/09/2021

Produced For :
Mr Ben Evans

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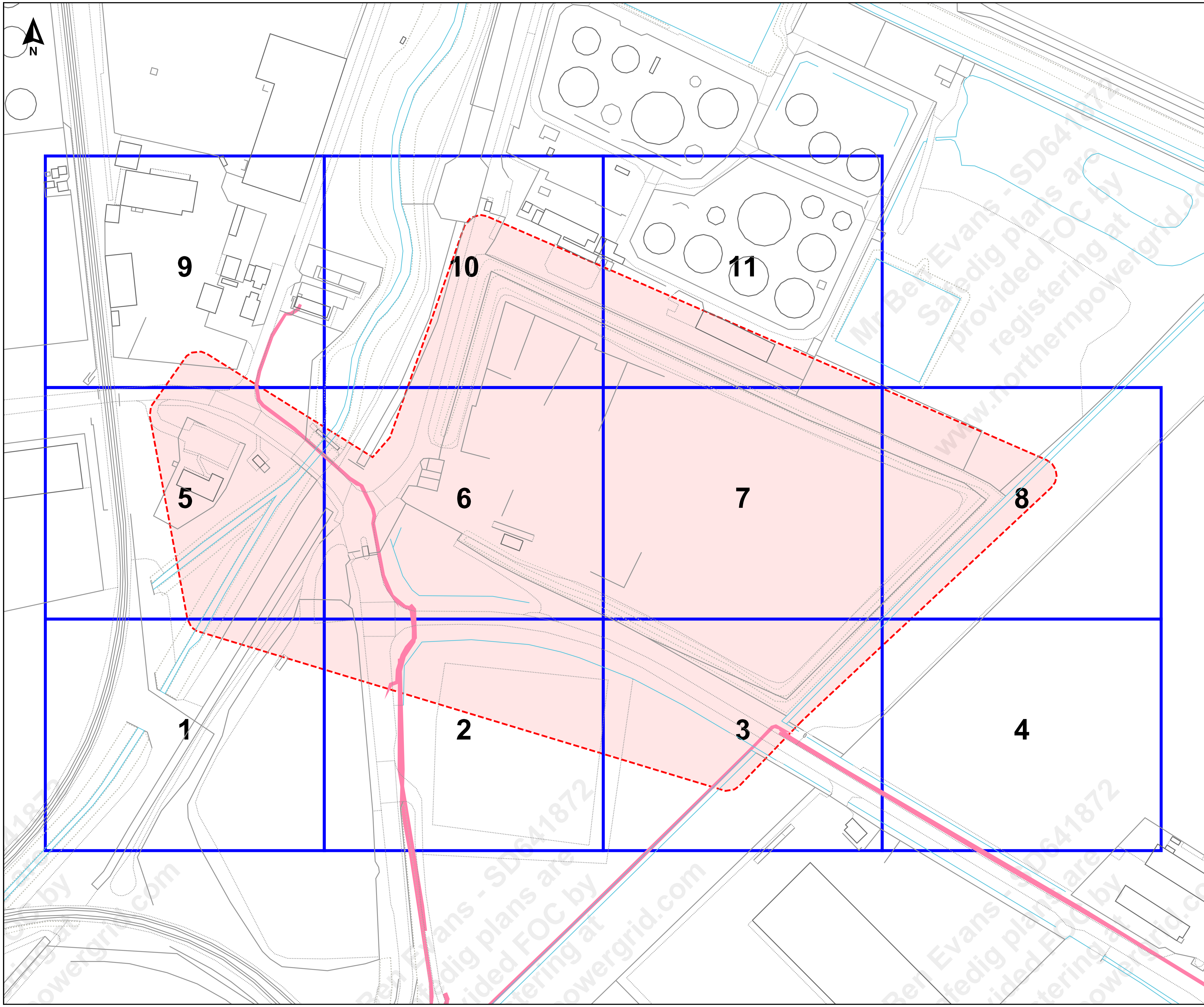
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:2100

Grid Coordinates : 520854 415342

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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Legend:

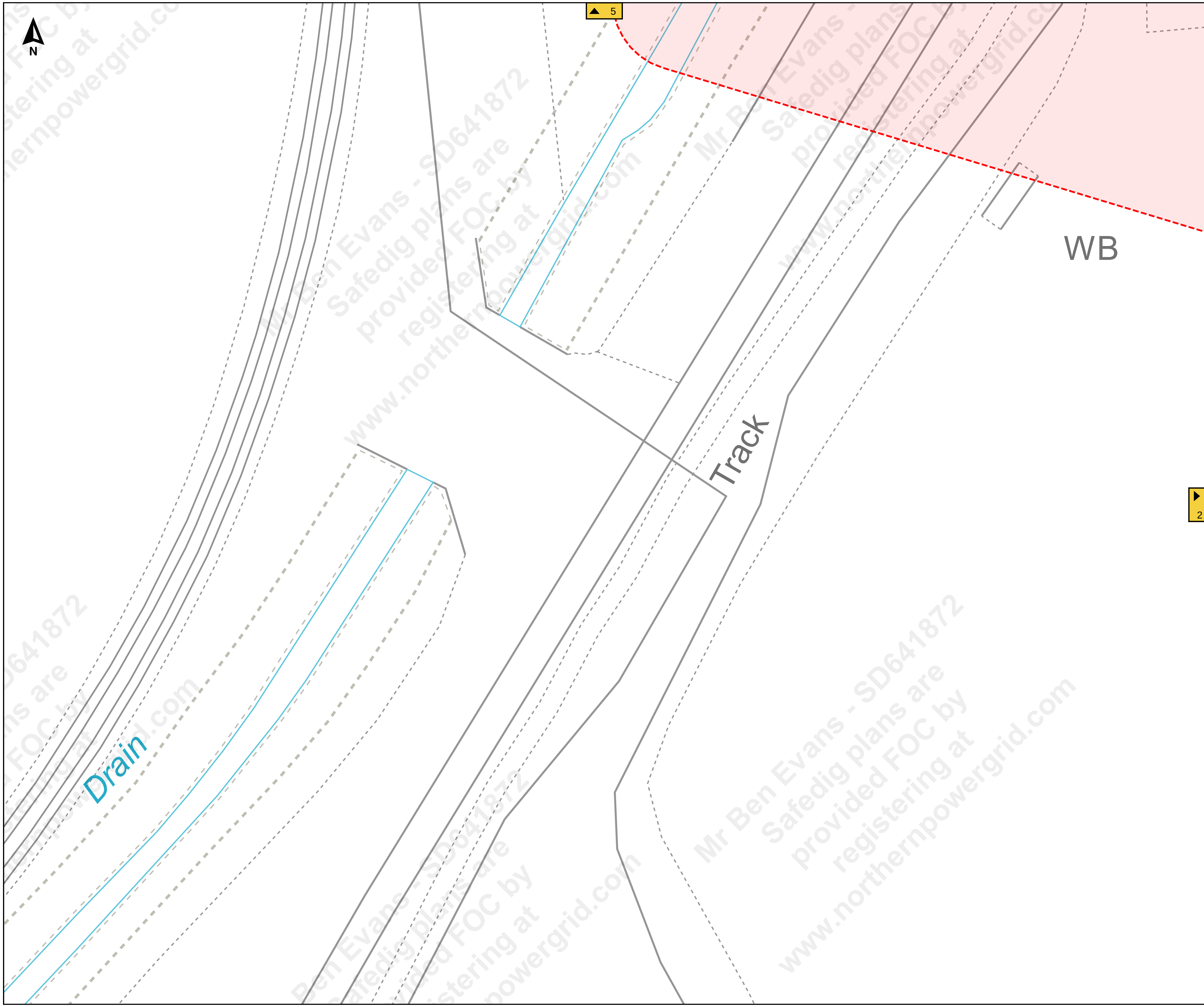
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641872
100245_5

Scale : 1:500

Grid Coordinates : 520603 415203

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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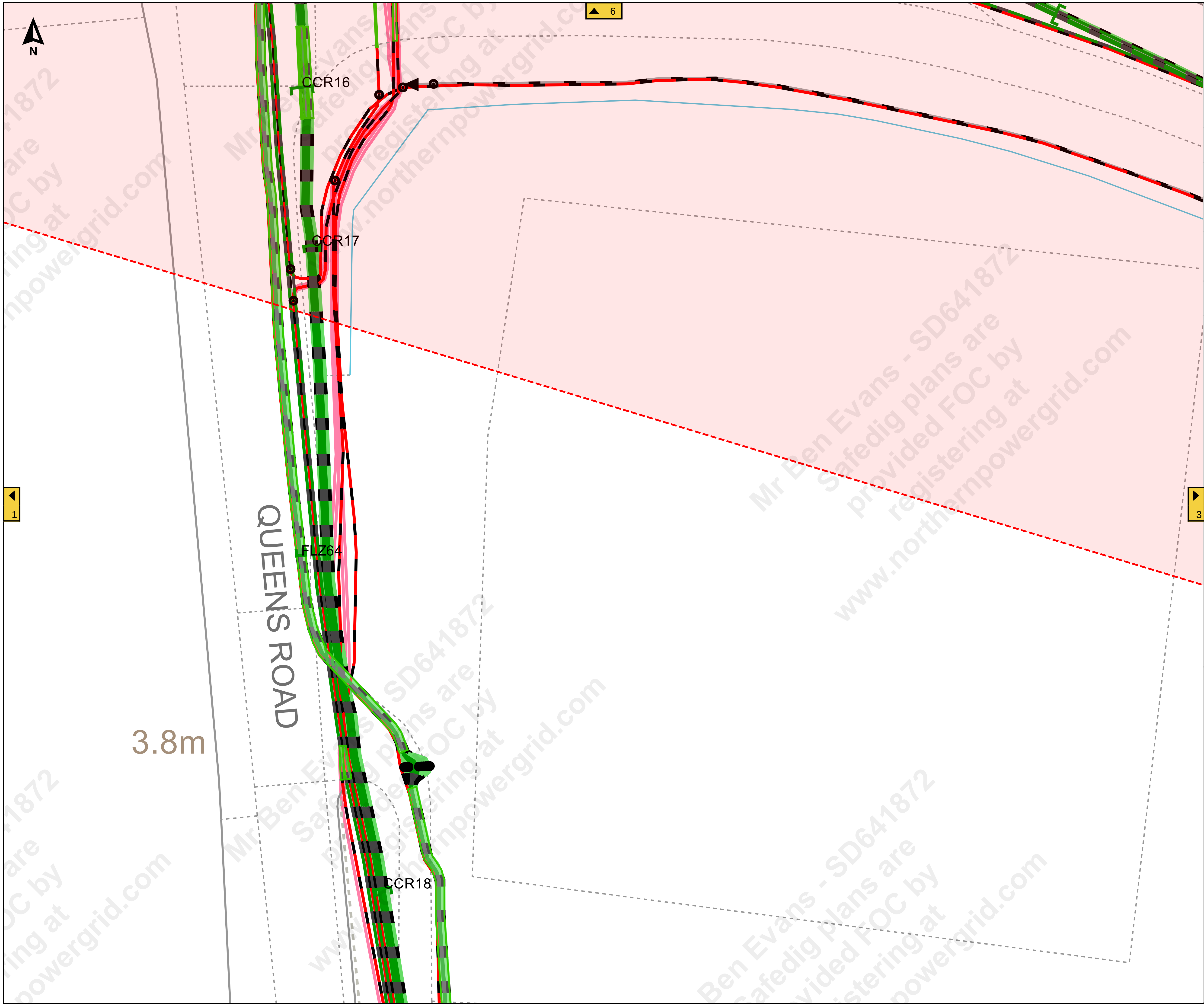
Legend:
Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route
Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520770 415203

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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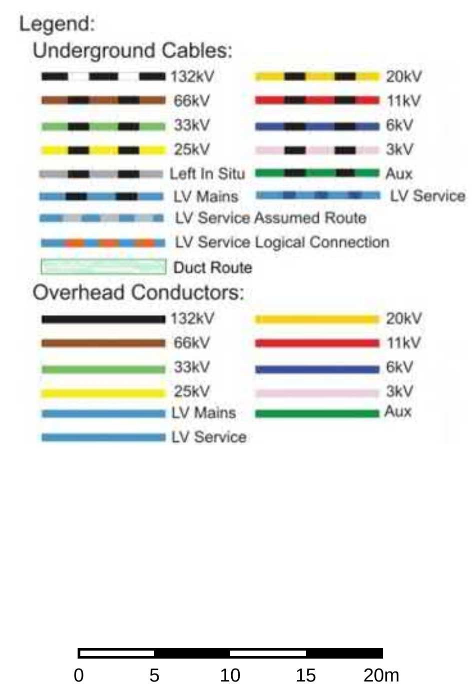

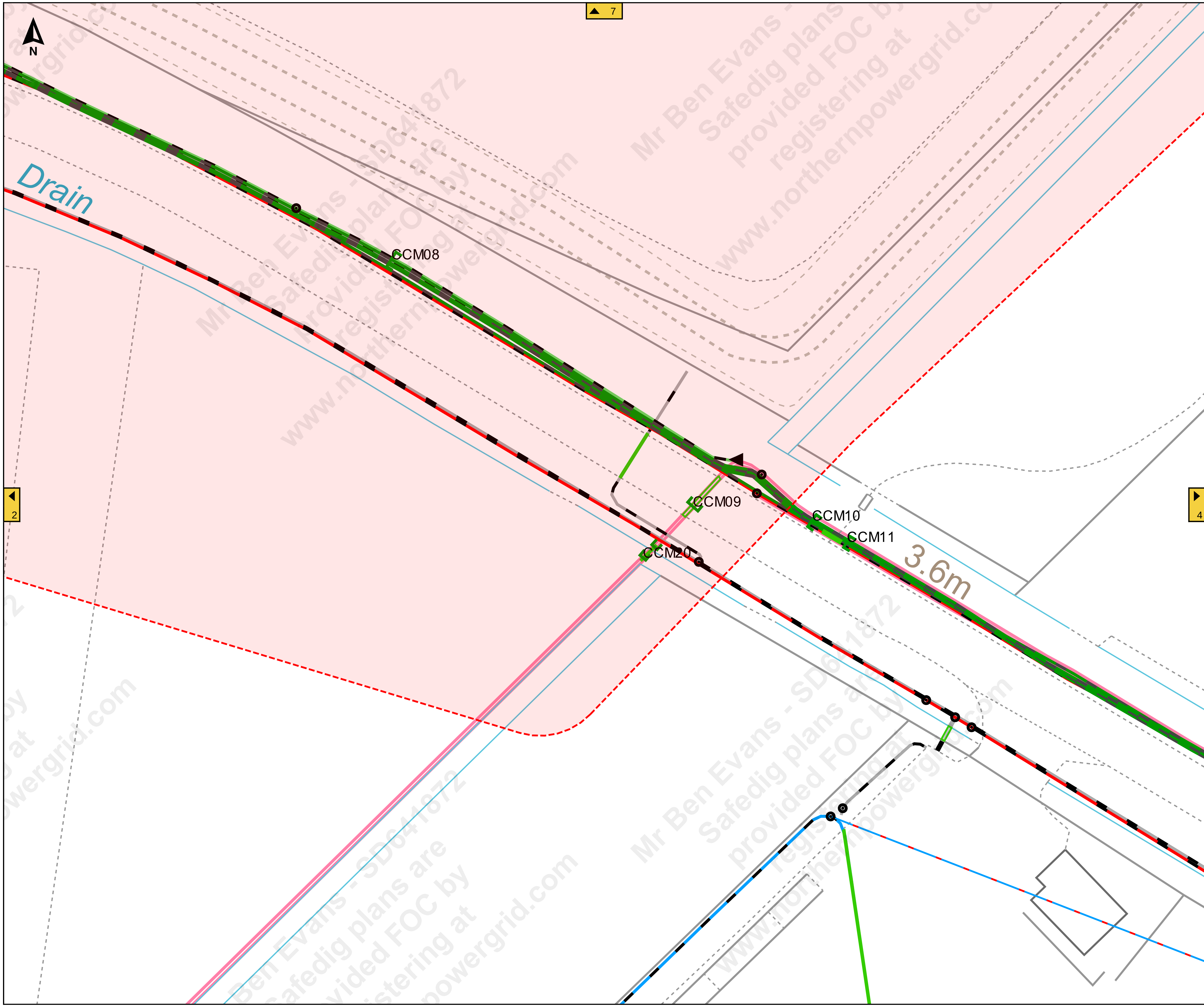

NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520937 415203

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 3 of 11 (3,11)

Terms and Conditions

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Legend:

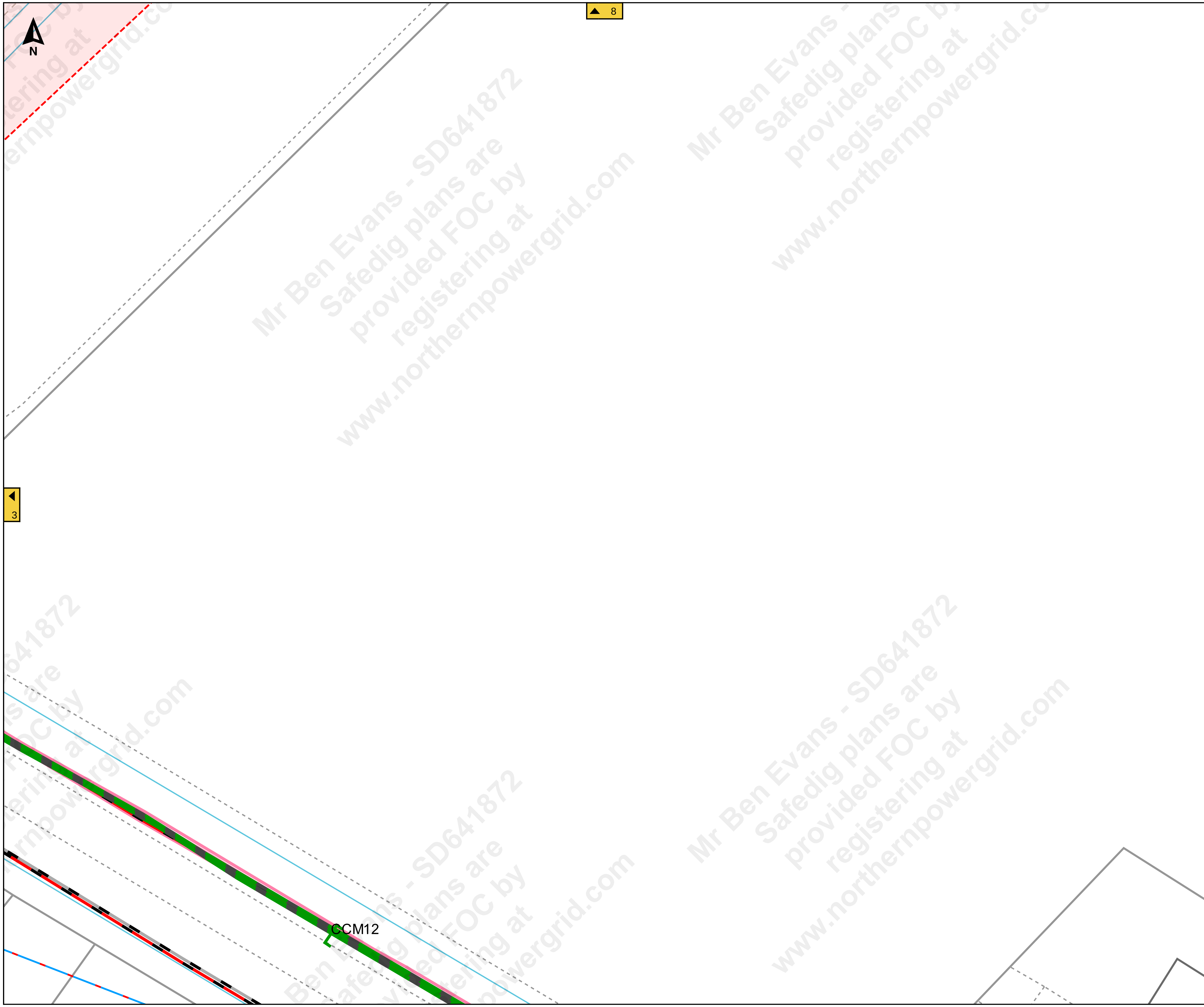
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 521104 415203

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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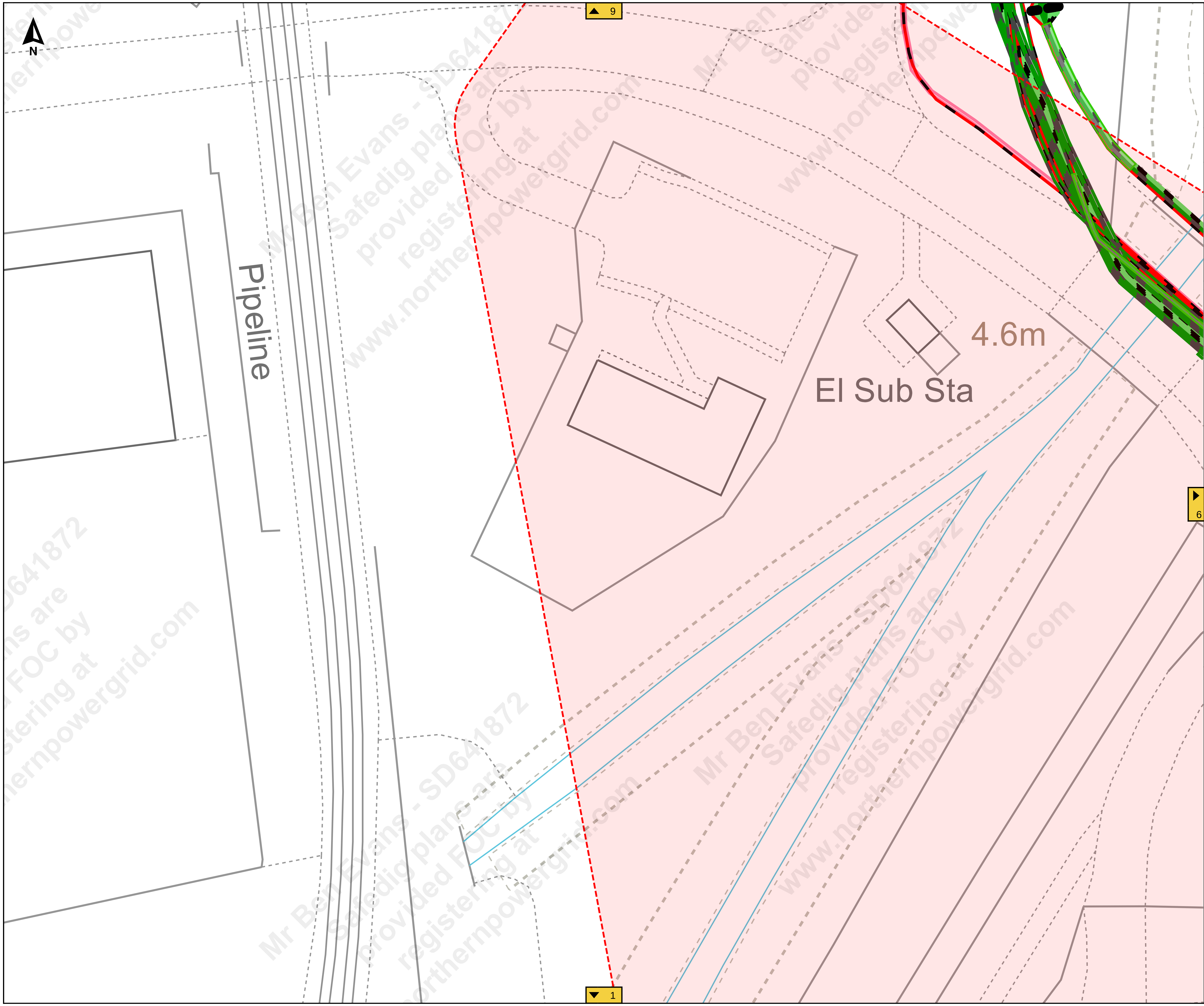
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520603 415342

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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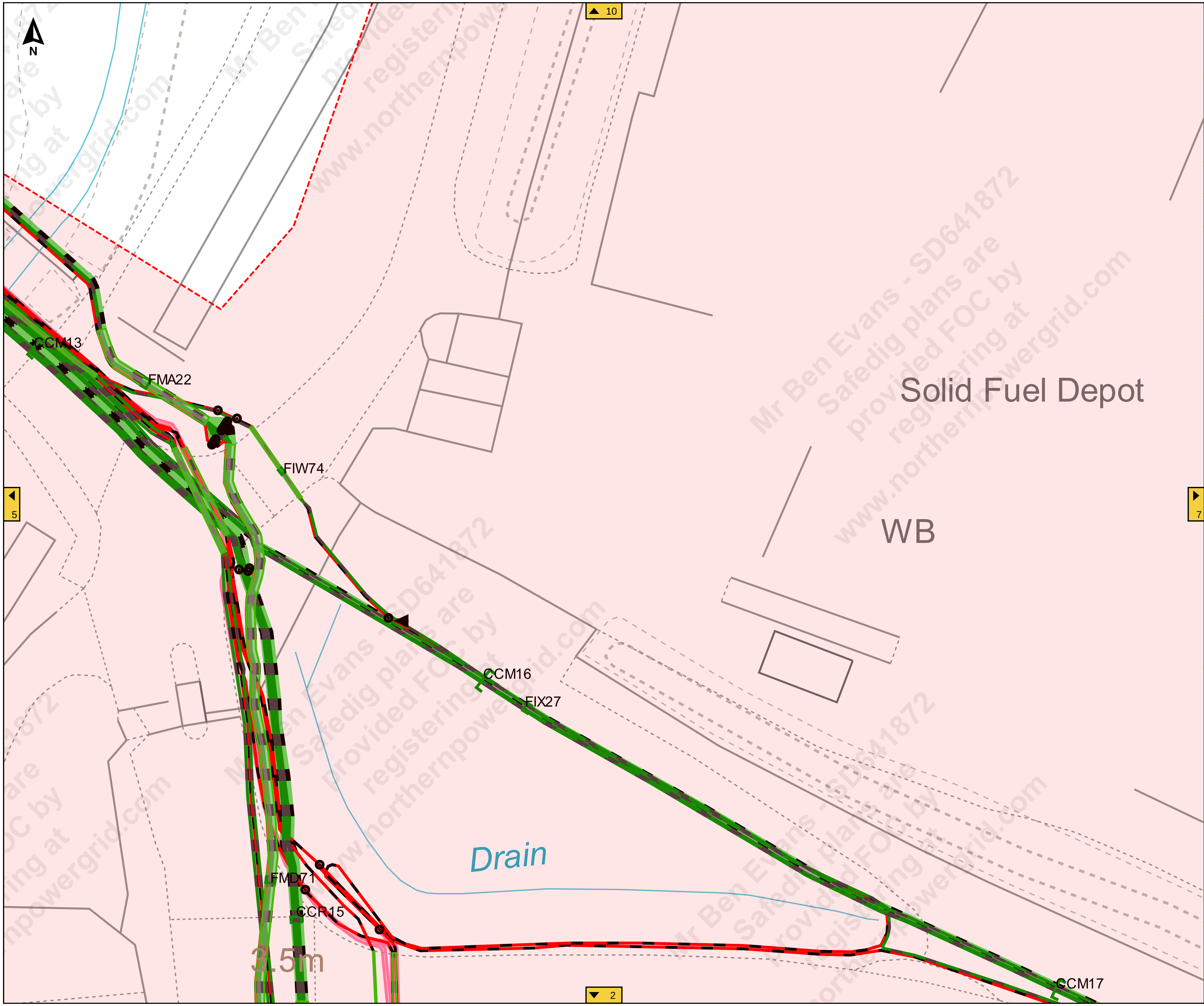
Legend:

Underground Cables:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520770 415342

Date : 27/09/2021

Produced For :
Mr Ben Evans

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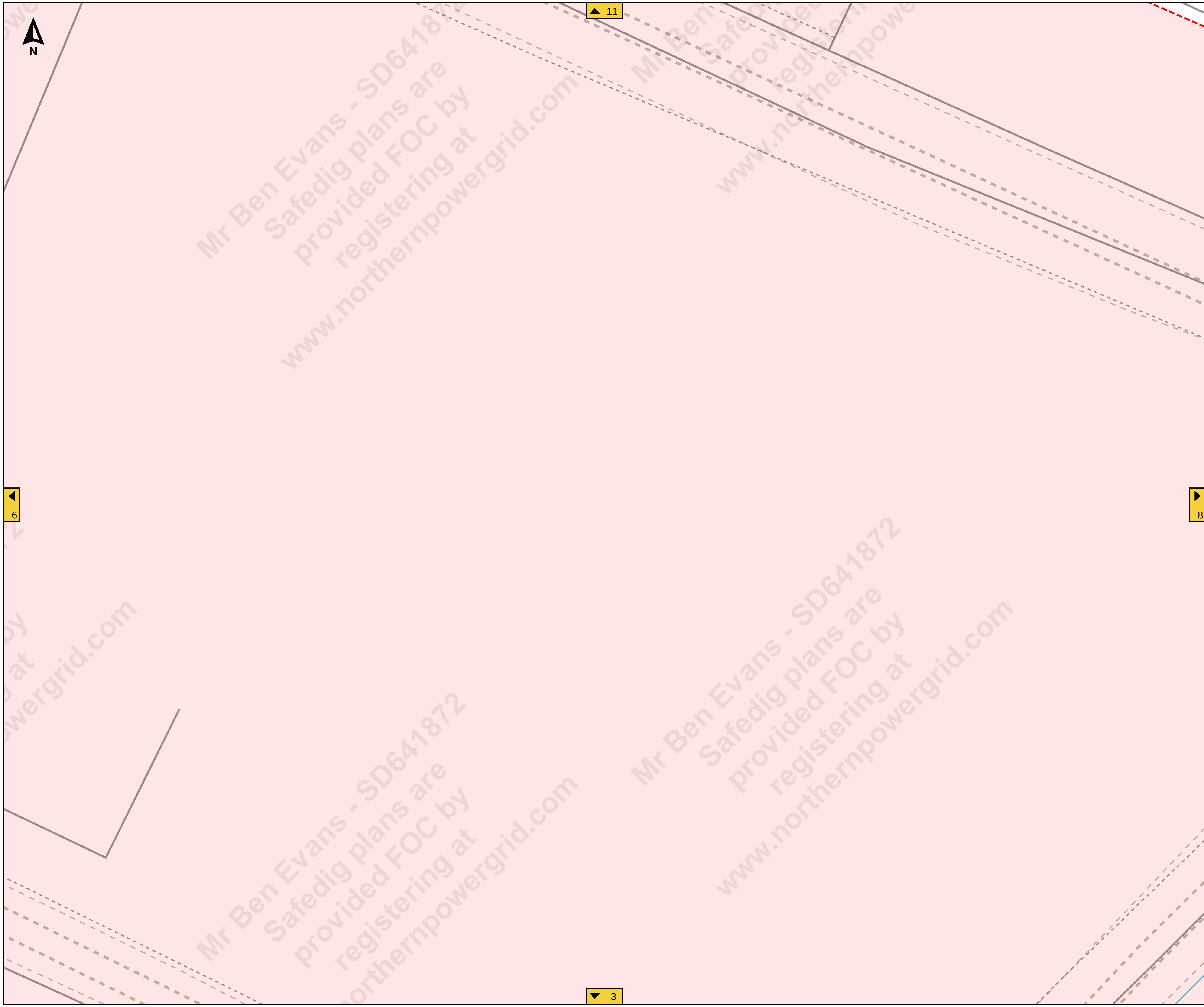
Legend:

Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520937 415342

Date : 27/09/2021

Produced For :
Mr Ben Evans

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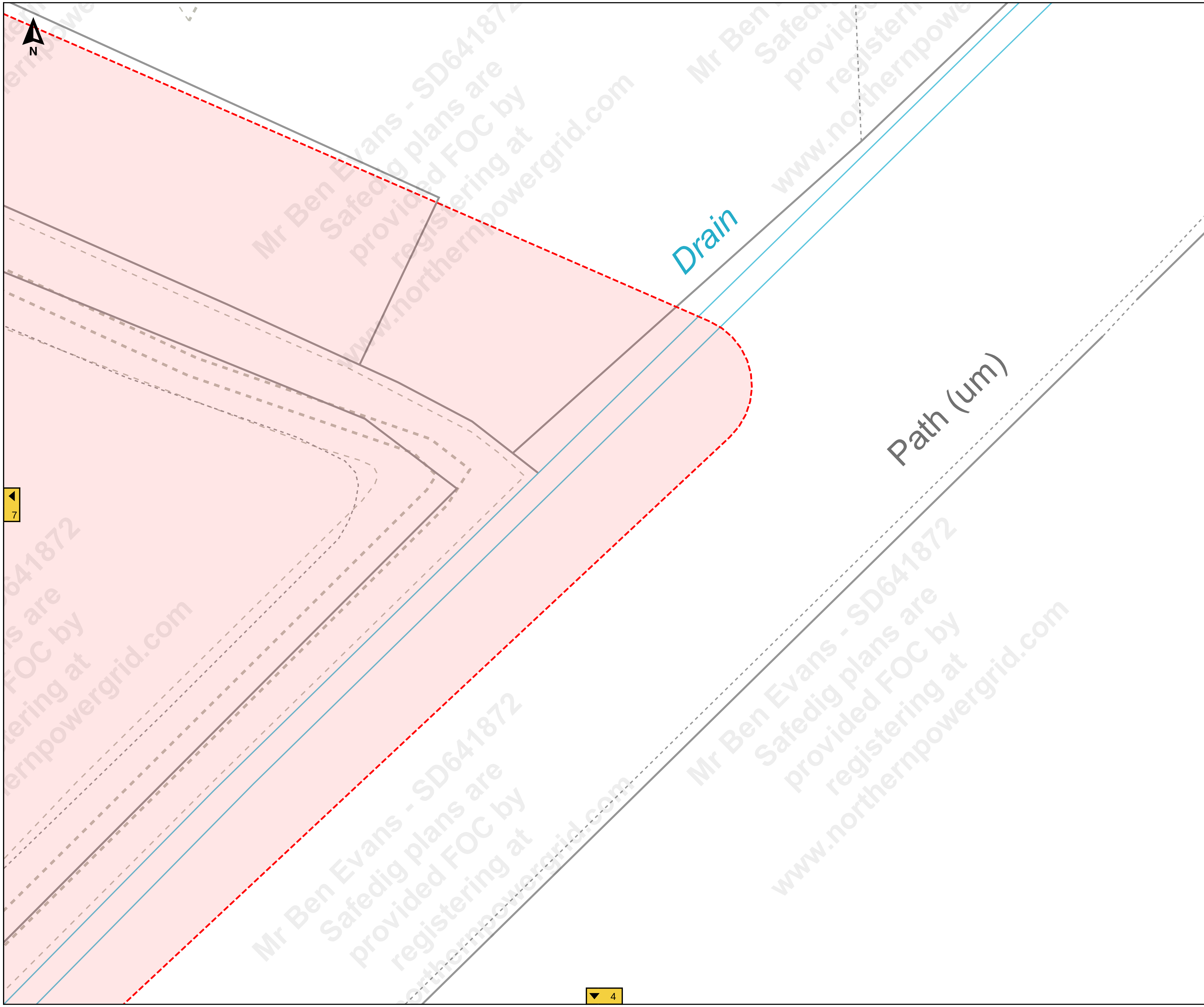
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 521104 415342

Date : 27/09/2021

Produced For :
Mr Ben Evans

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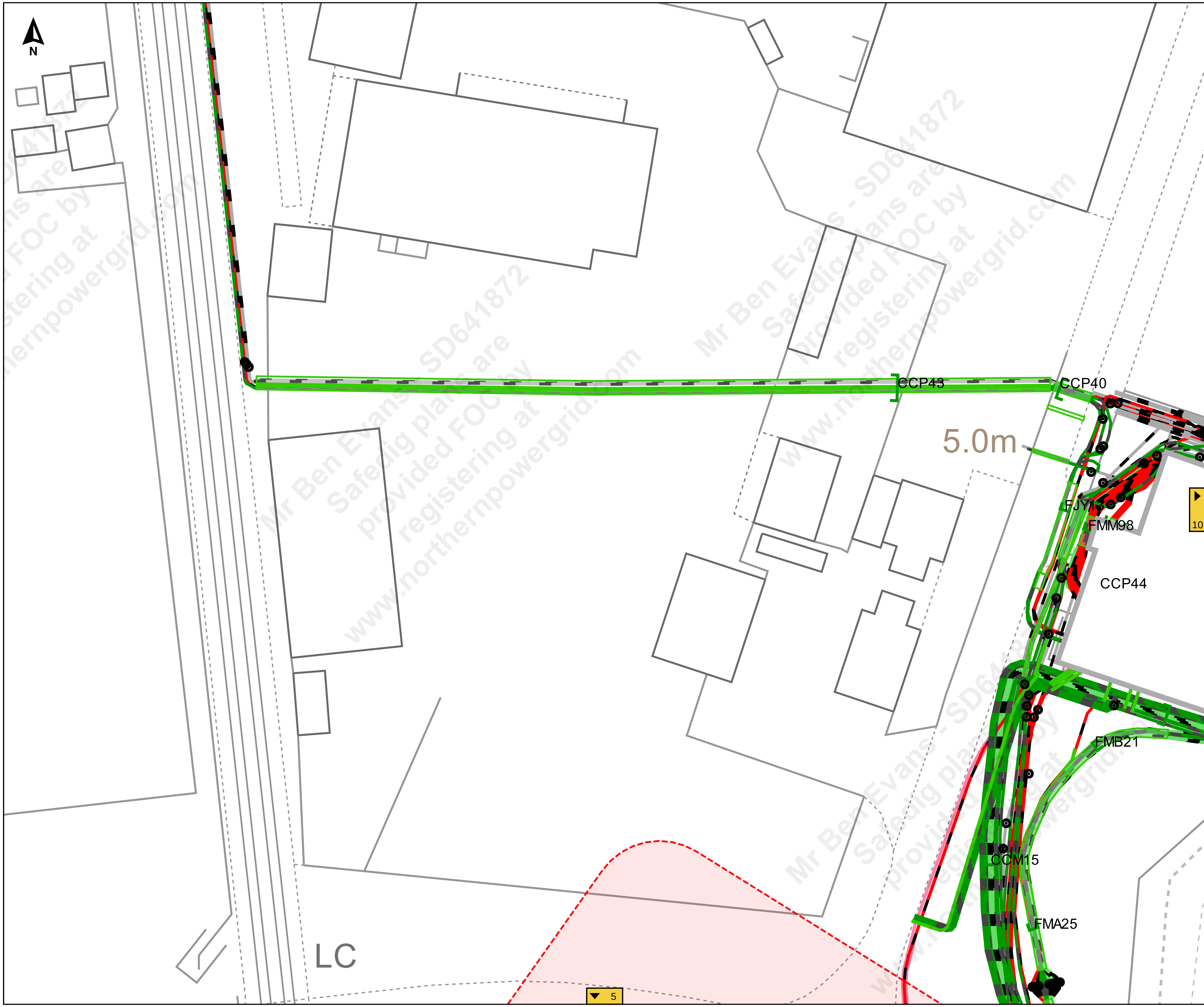
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872
100245_5

Scale : 1:500

Grid Coordinates : 520603 415481

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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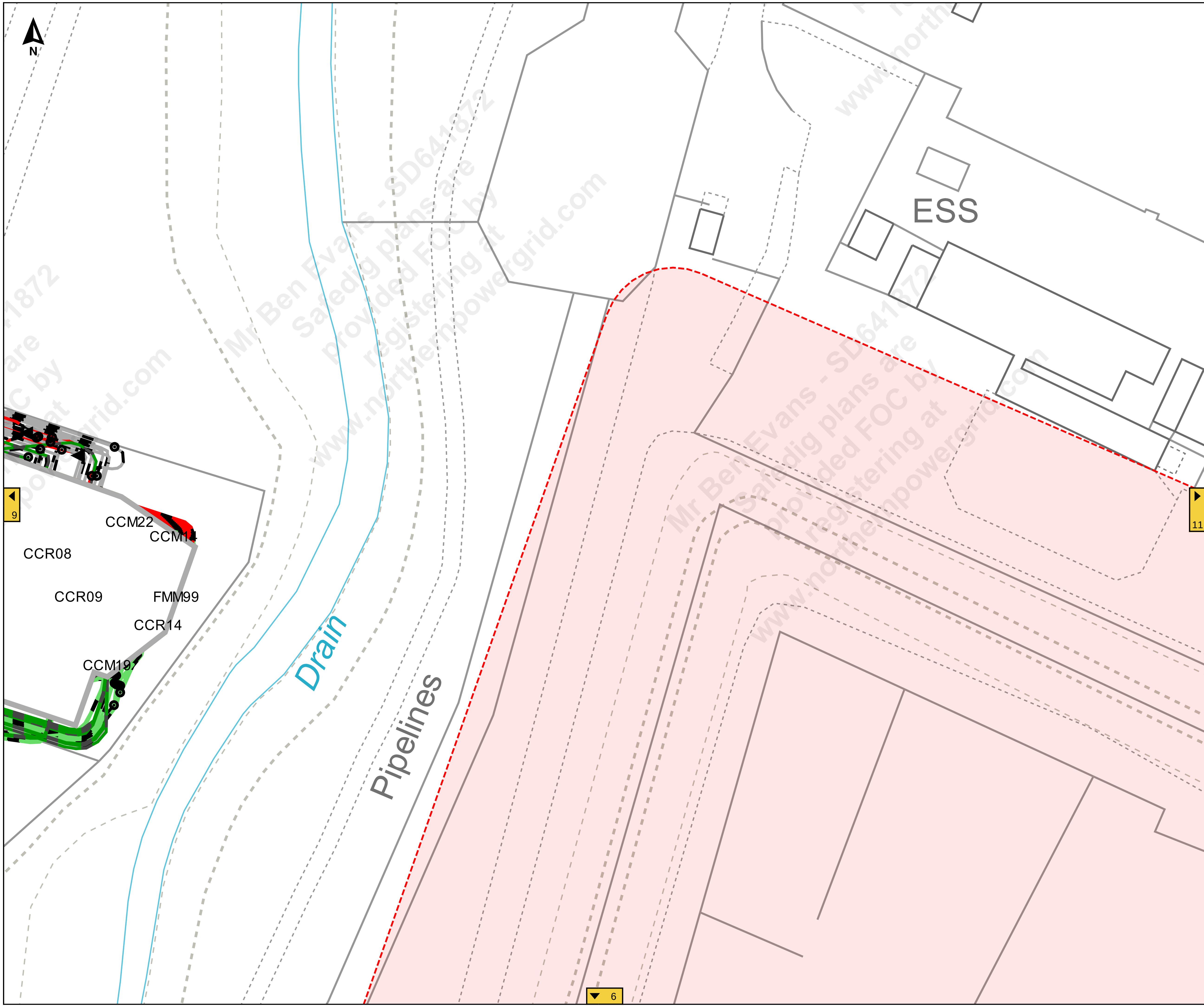
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520770 415481

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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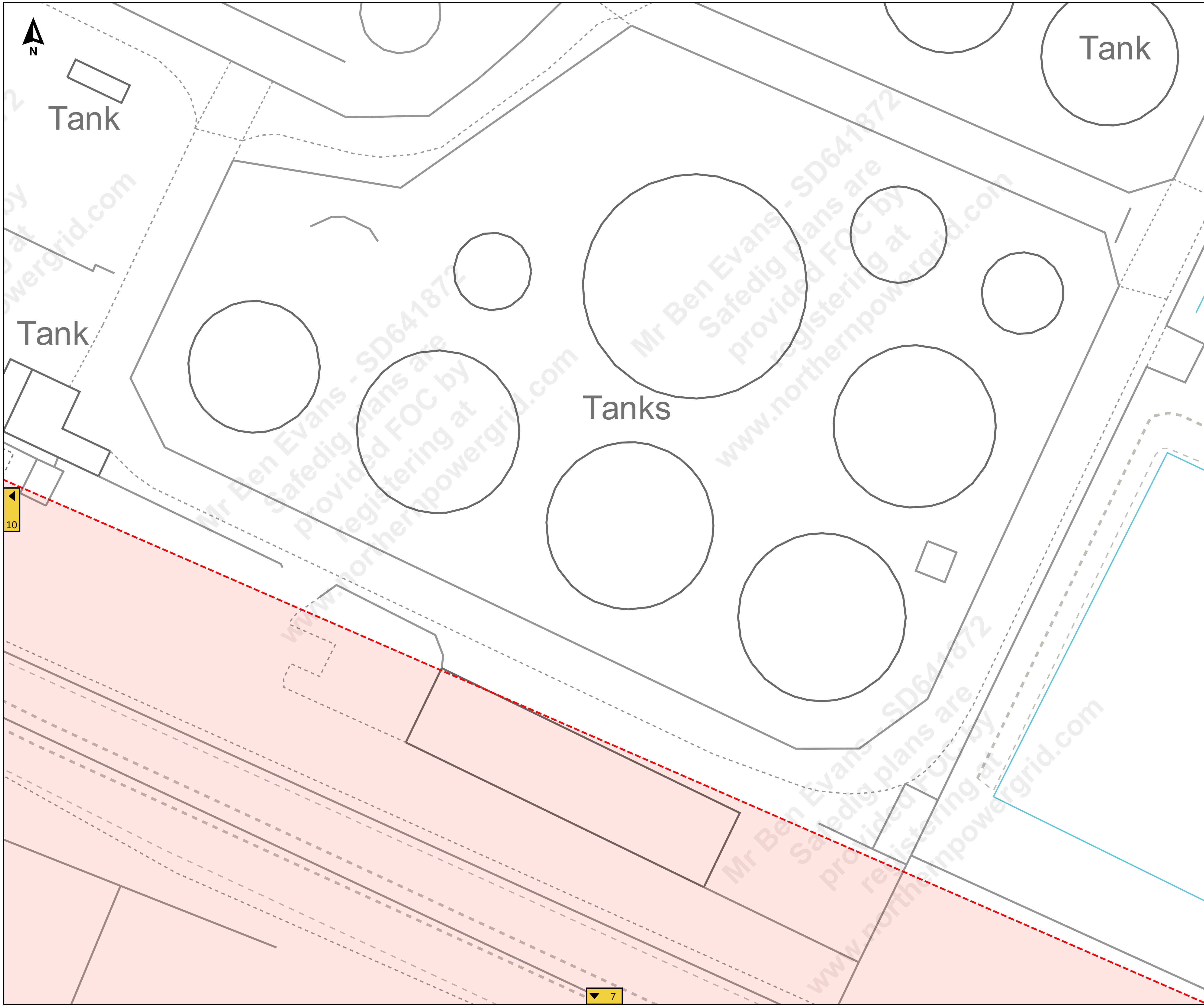
Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service



NORTHERN POWERGRID

Job Reference : SD641872

100245_5

Scale : 1:500

Grid Coordinates : 520937 415481

Date : 27/09/2021

Produced For :
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Legend:

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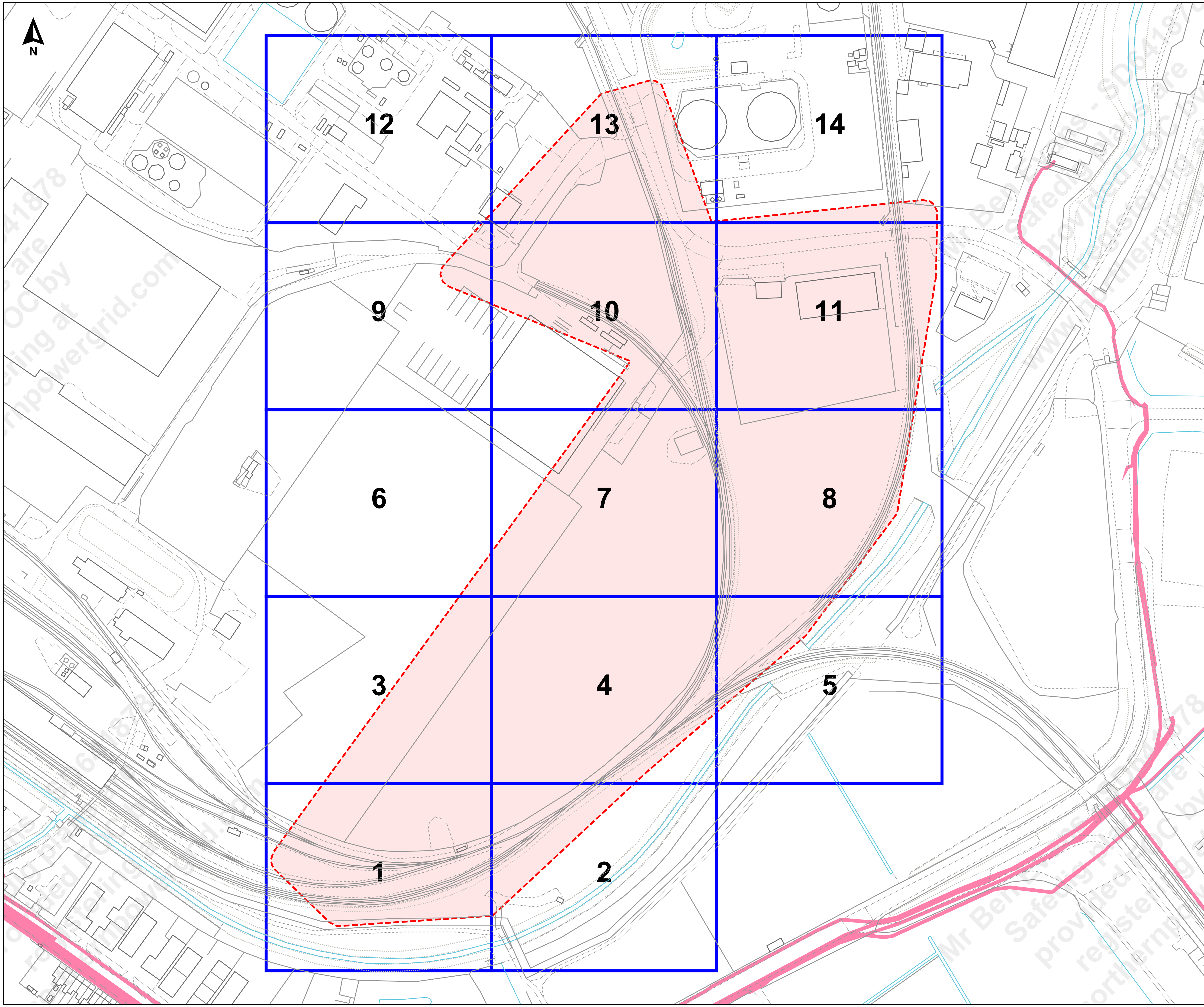
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:2600

Grid Coordinates : 520338 415207

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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Legend:

Underground Cables:

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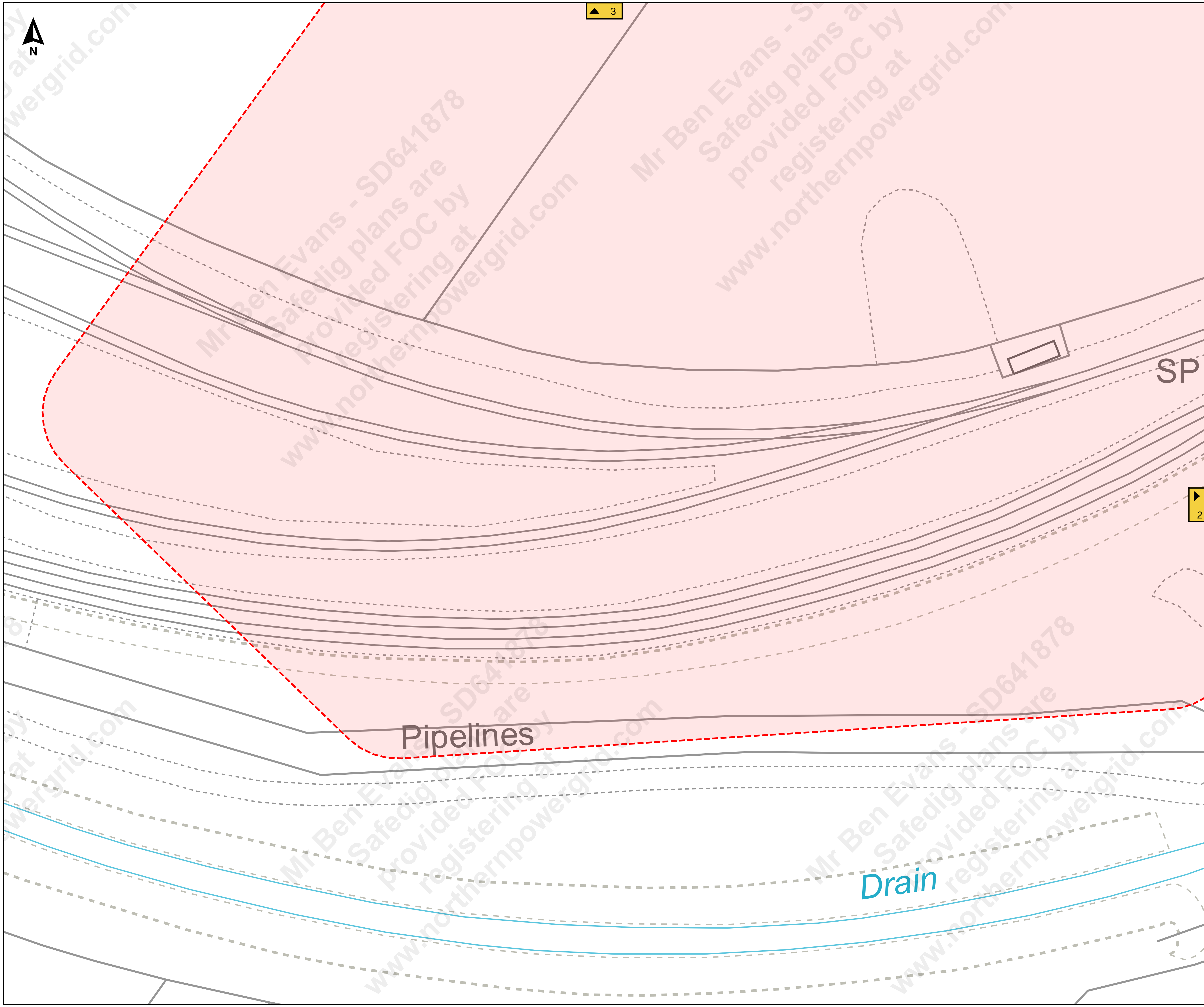
Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641878
100245_6

Scale : 1:500

Grid Coordinates : 520171 414930

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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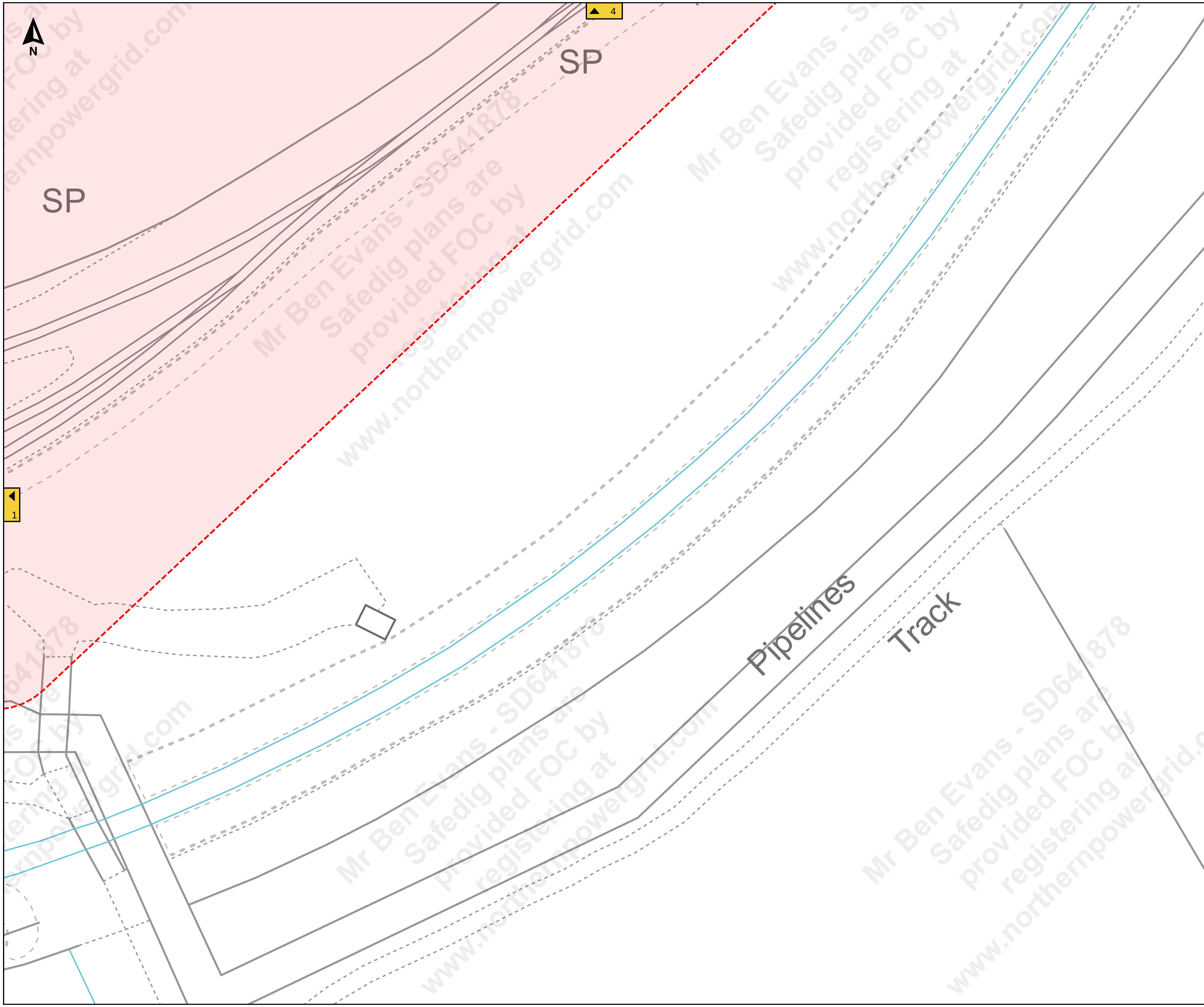
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
132kV
66kV
33kV
25kV
Left In Situ
LV Mains
LV Service Assumed Route
LV Service Logical Connection
Duct Route
20kV
11kV
6kV
3kV
Aux
LV Service

Overhead Conductors:
132kV
66kV
33kV
25kV
LV Mains
LV Service
20kV
11kV
6kV
3kV
Aux

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520338 414930

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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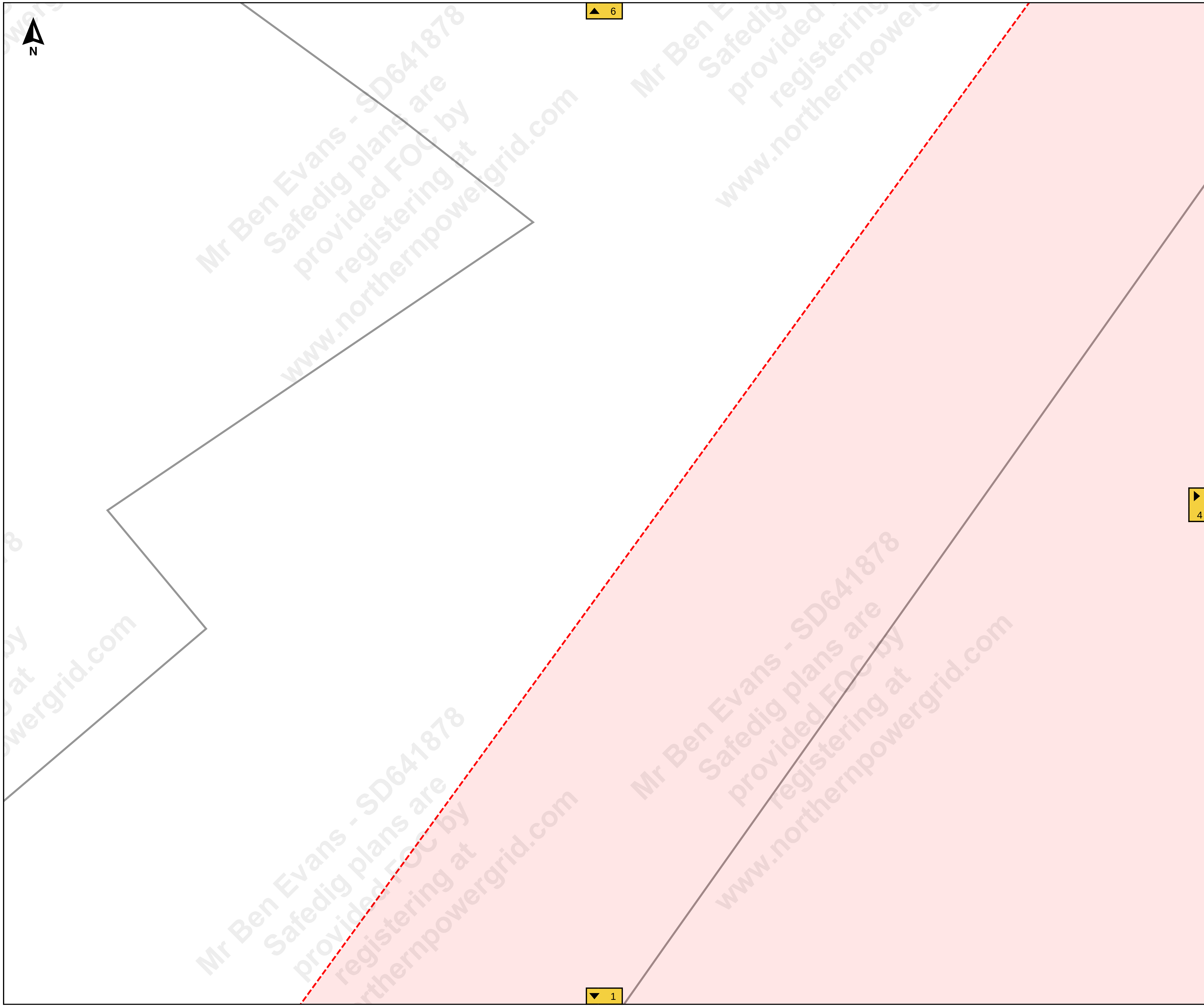
Legend:

Underground Cables:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878
100245_6

Scale : 1:500

Grid Coordinates : 520171 415068

Date : 27/09/2021

Produced For :
Mr Ben Evans

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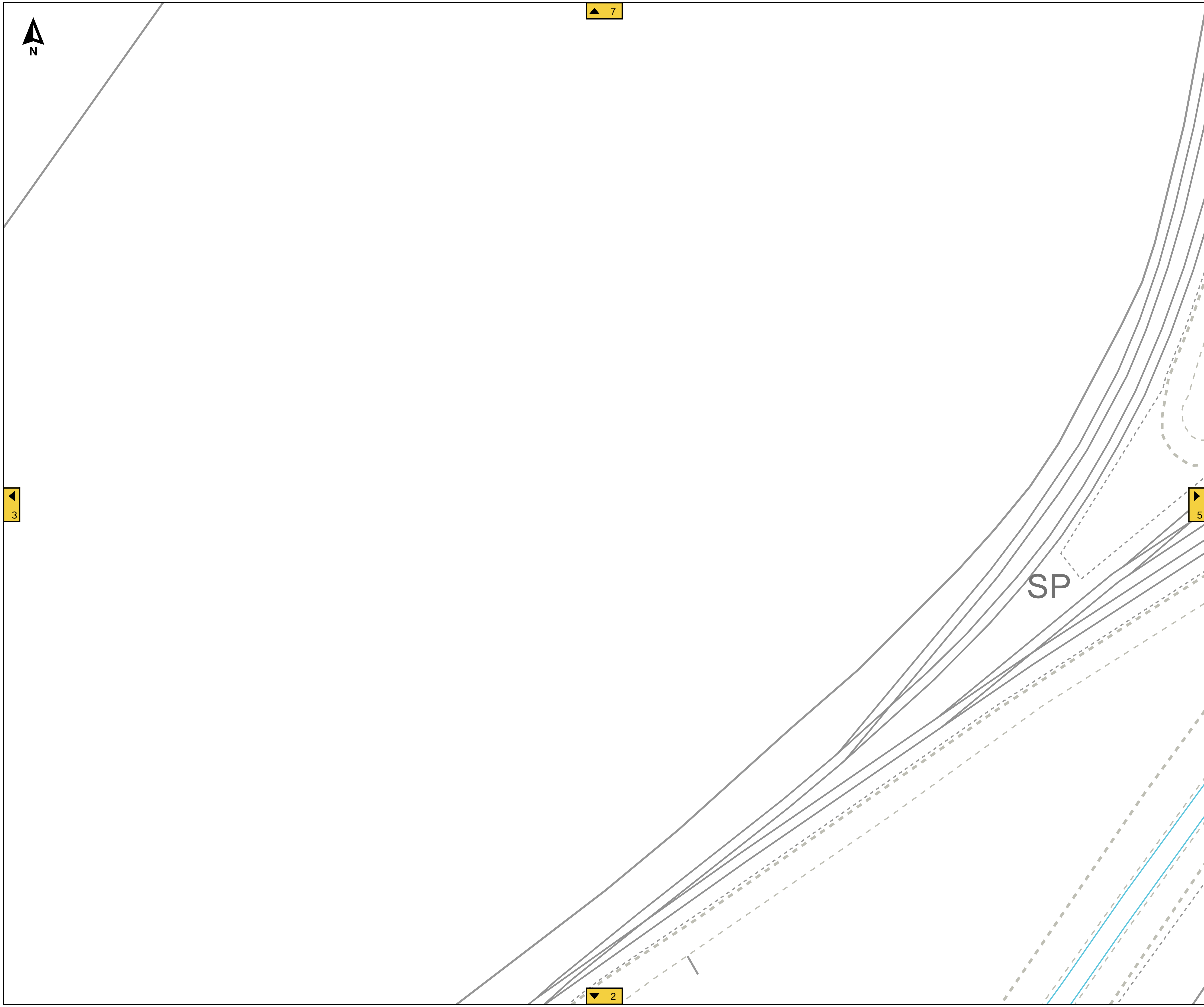
Legend:
Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520338 415068

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 4 of 14 (4,14)

Terms and Conditions

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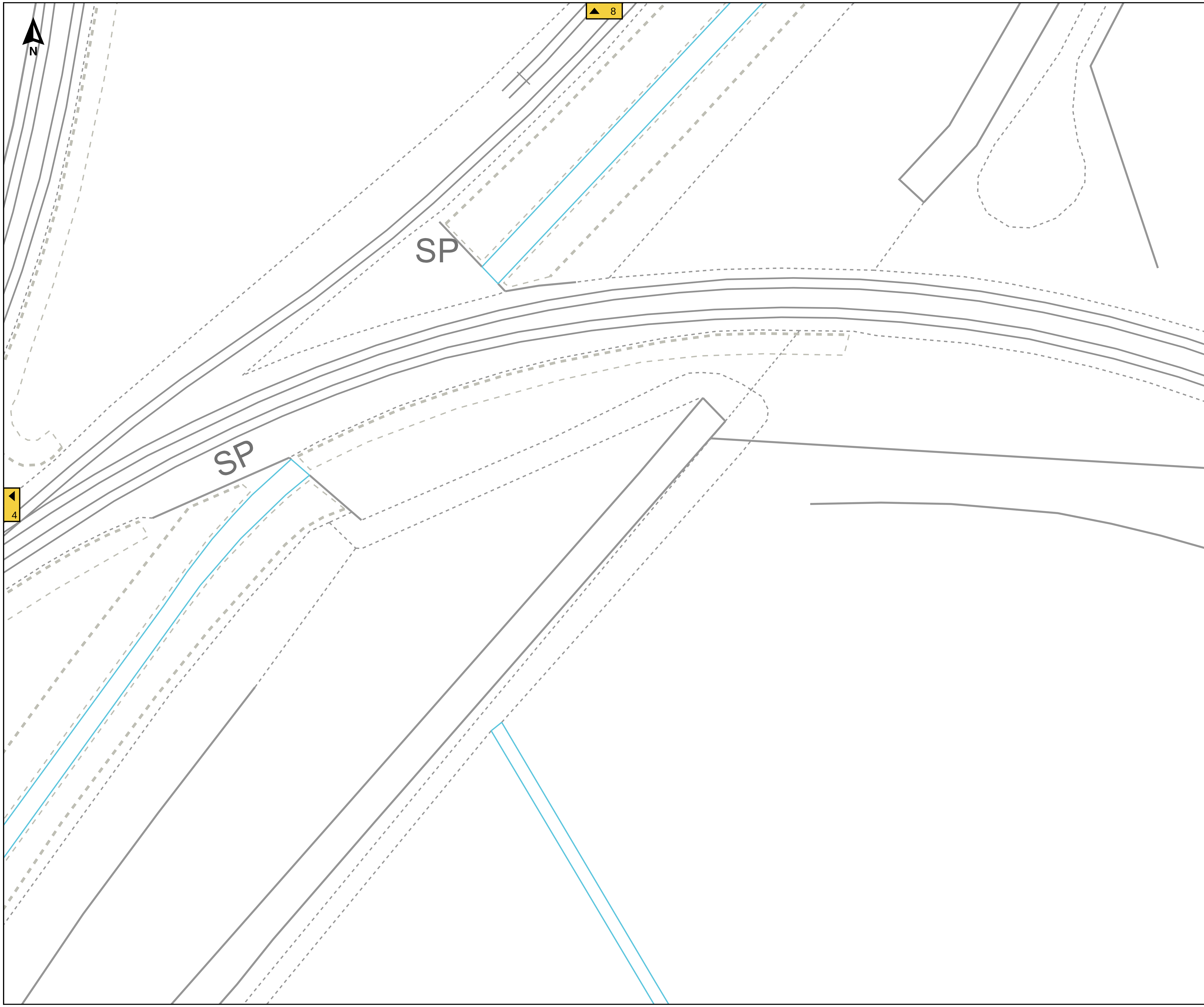
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520505 415068

Date : 27/09/2021

Produced For :
Mr Ben Evans

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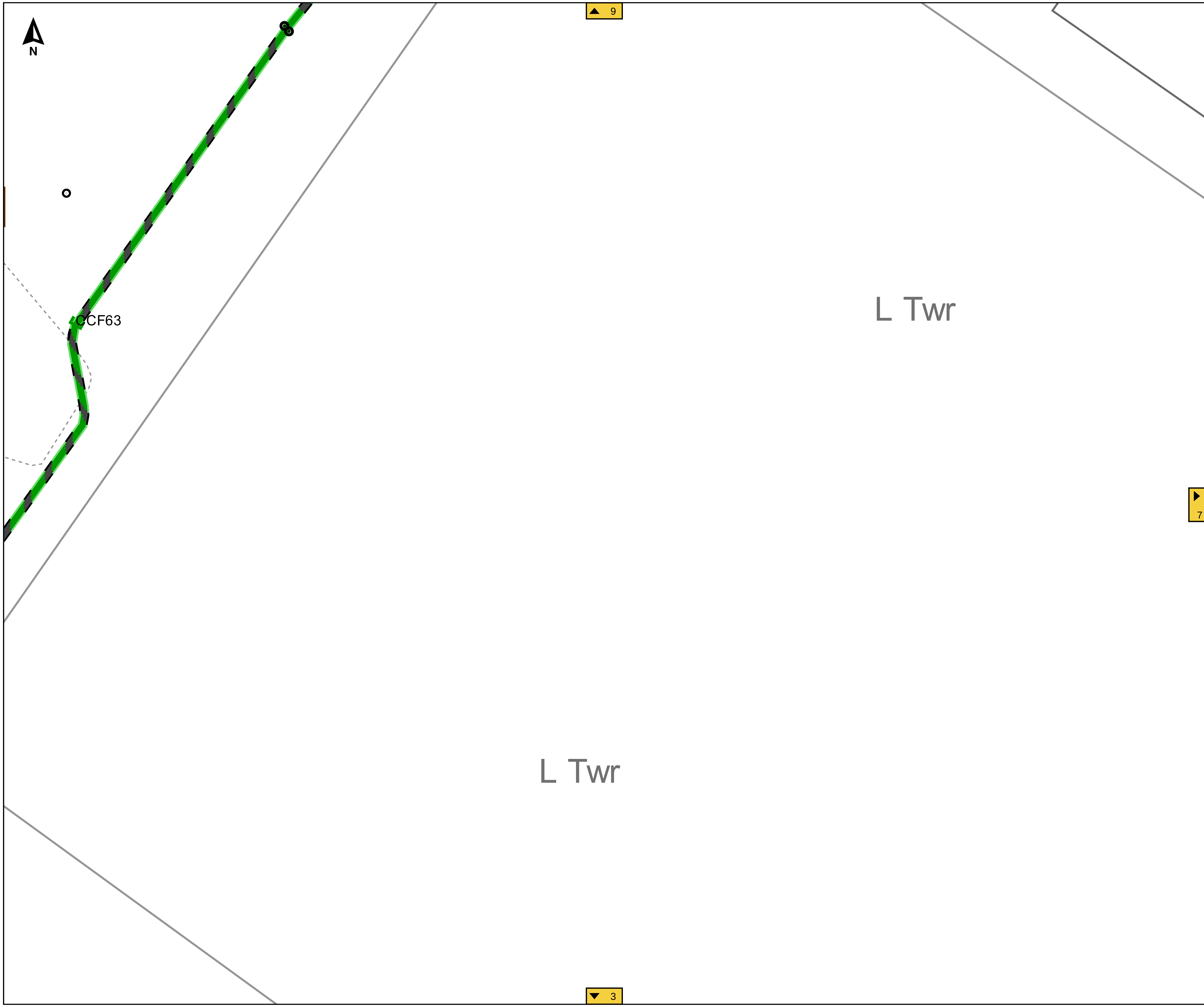
Legend:
Underground Cables:
132kV 20kV
66kV 11kV
33kV 6kV
25kV 3kV
Left In Situ Aux
LV Mains LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route
Overhead Conductors:
132kV 20kV
66kV 11kV
33kV 6kV
25kV 3kV
LV Mains Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520171 415207

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 6 of 14 (6,14)

Terms and Conditions

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Legend:

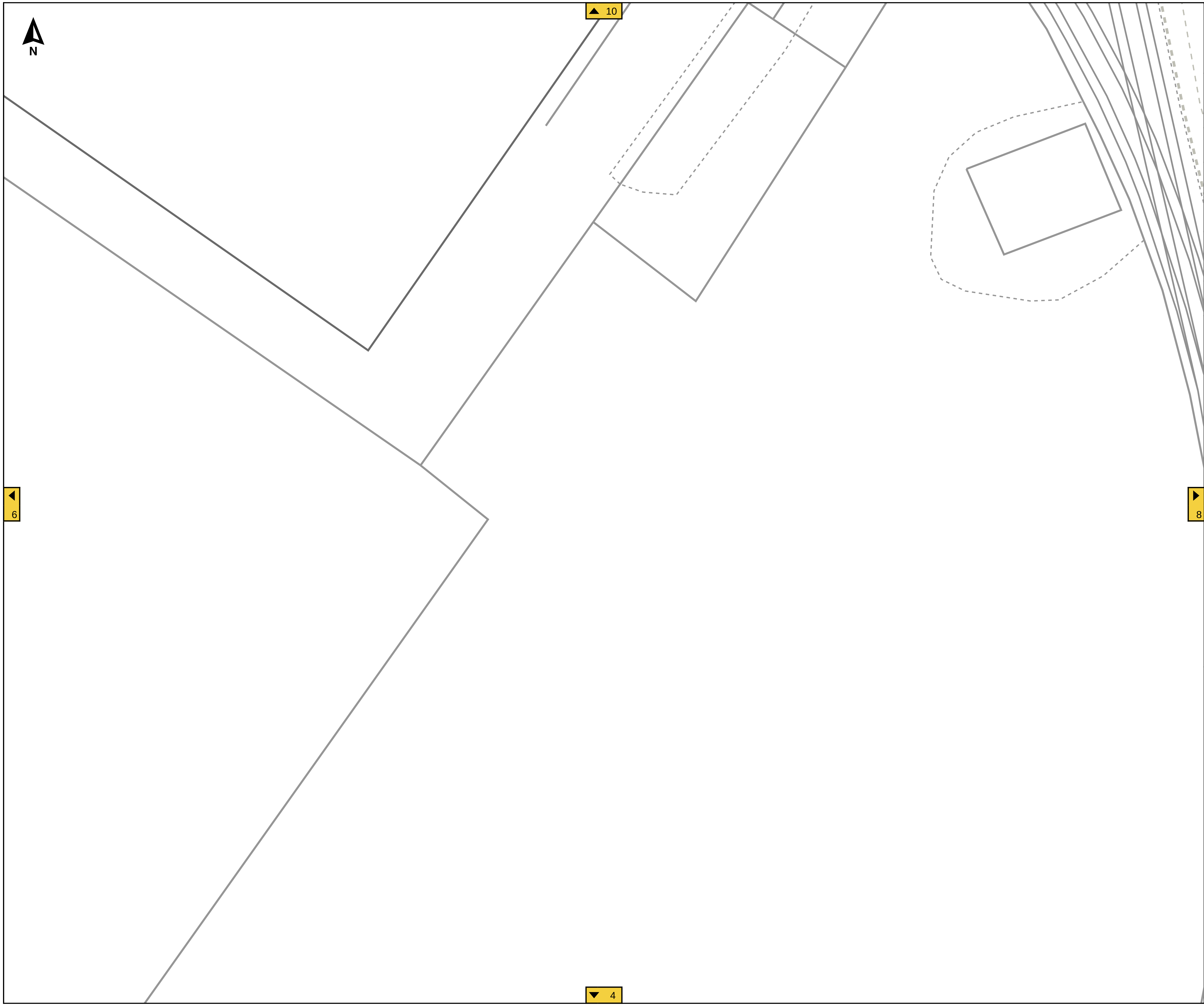
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520338 415207

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

Legend:

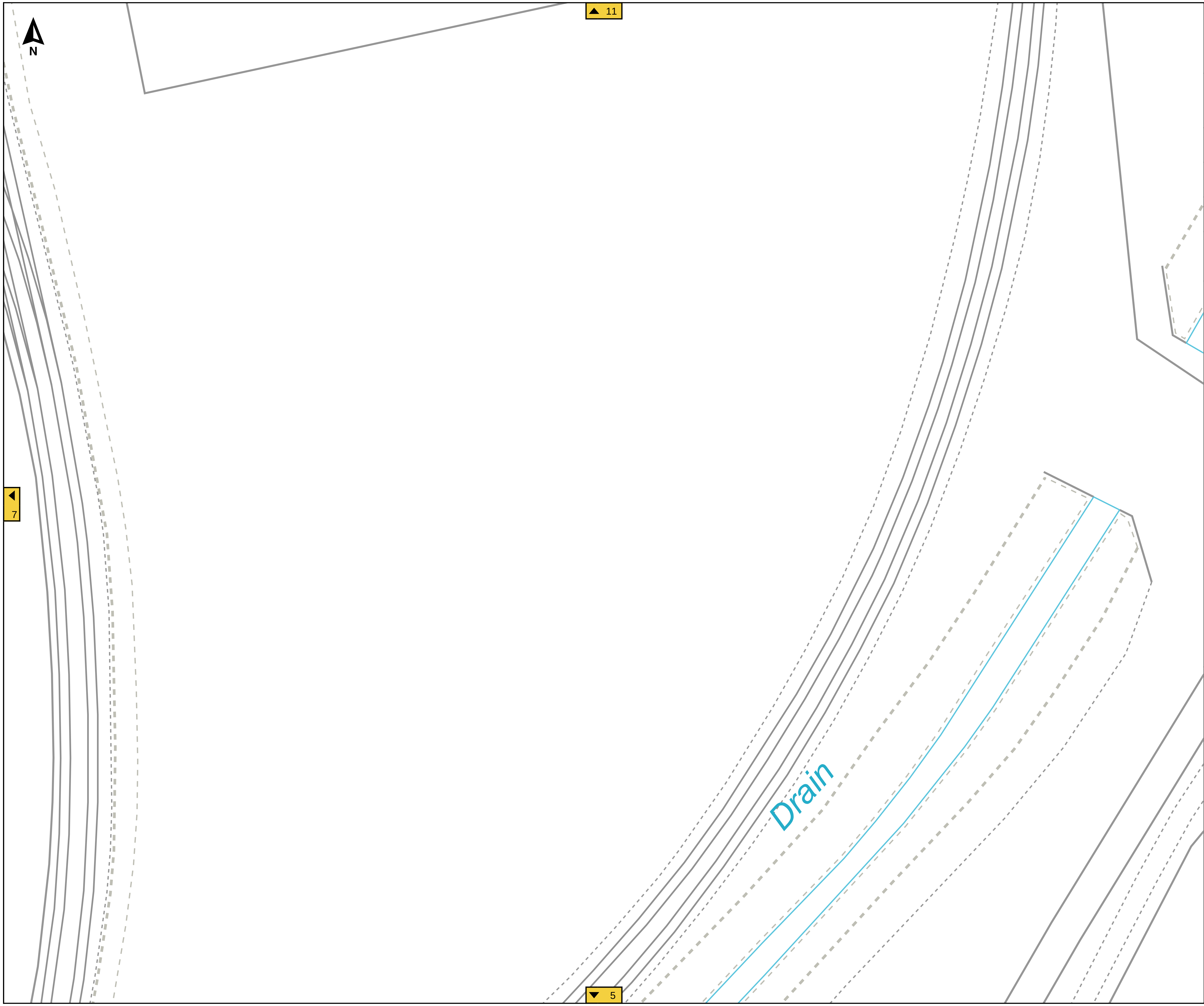
Underground Cables:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520505 415207

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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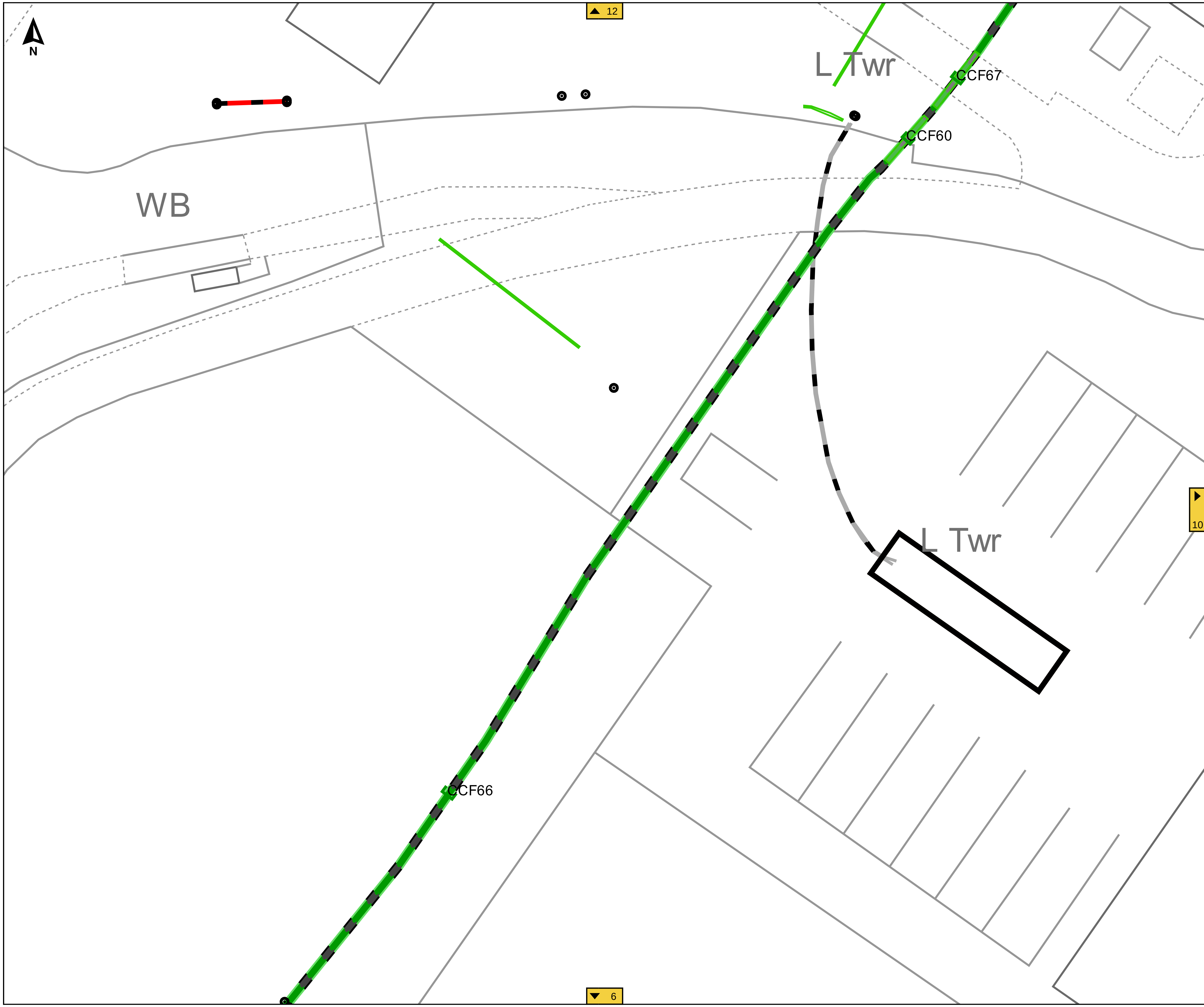
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520171 415346

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 9 of 14 (9,14)

Terms and Conditions

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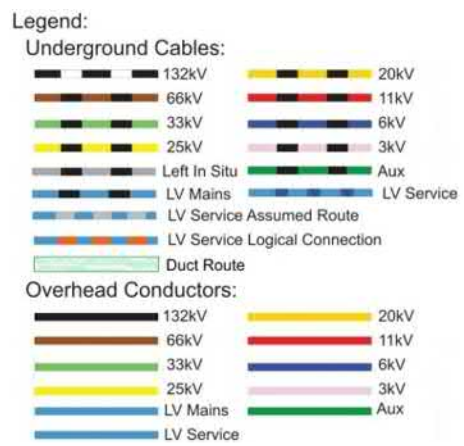

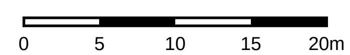

NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520338 415346

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

NORTHERN POWERGRID

Job Reference : SD641878
100245_6

Scale : 1:500

Grid Coordinates : 520505 415346

Date : 27/09/2021

Produced For :
Mr Ben Evans

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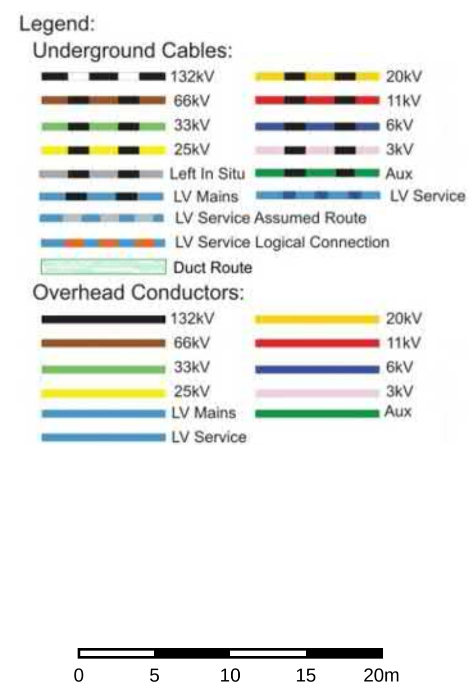

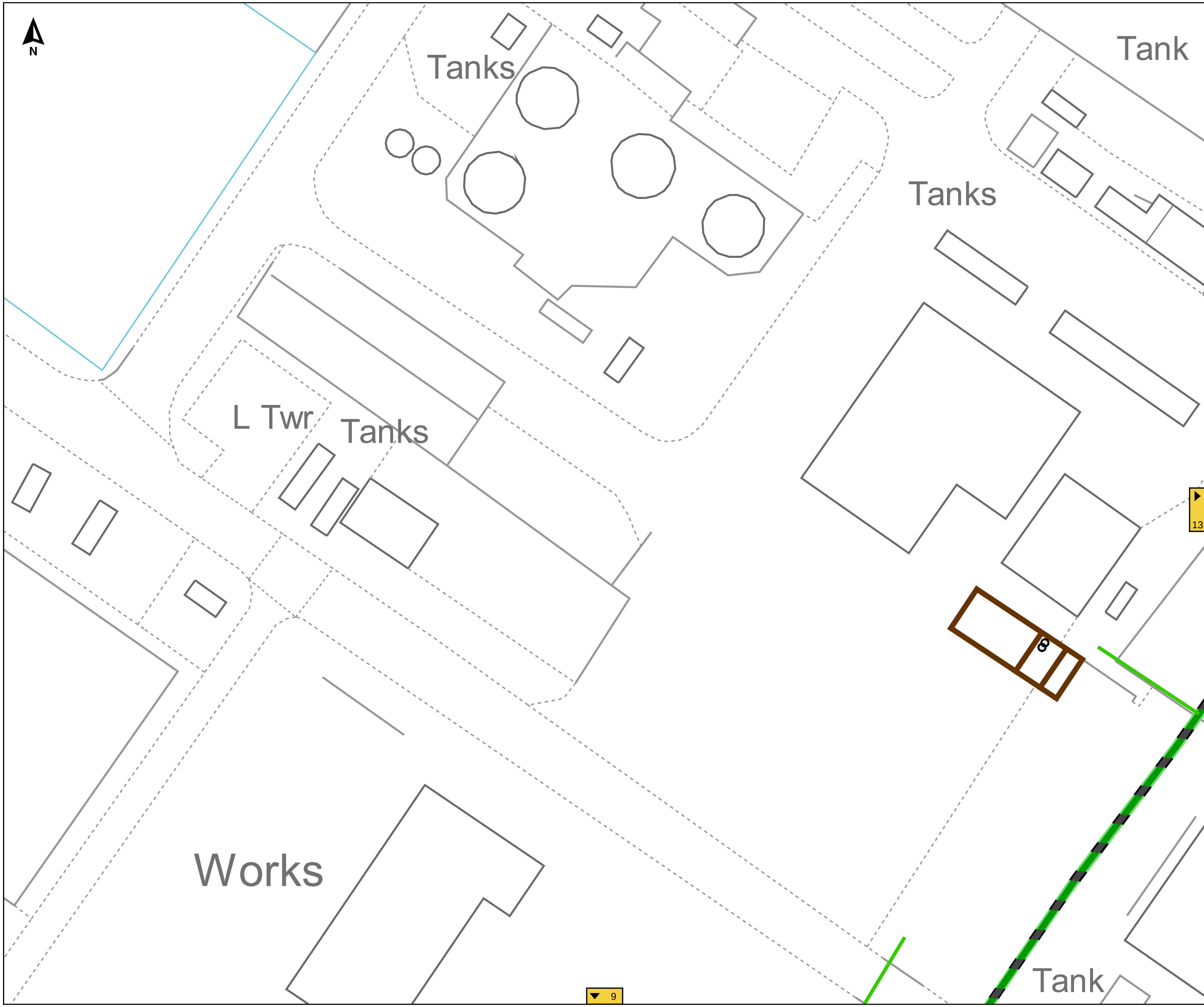

NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520171 415484

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

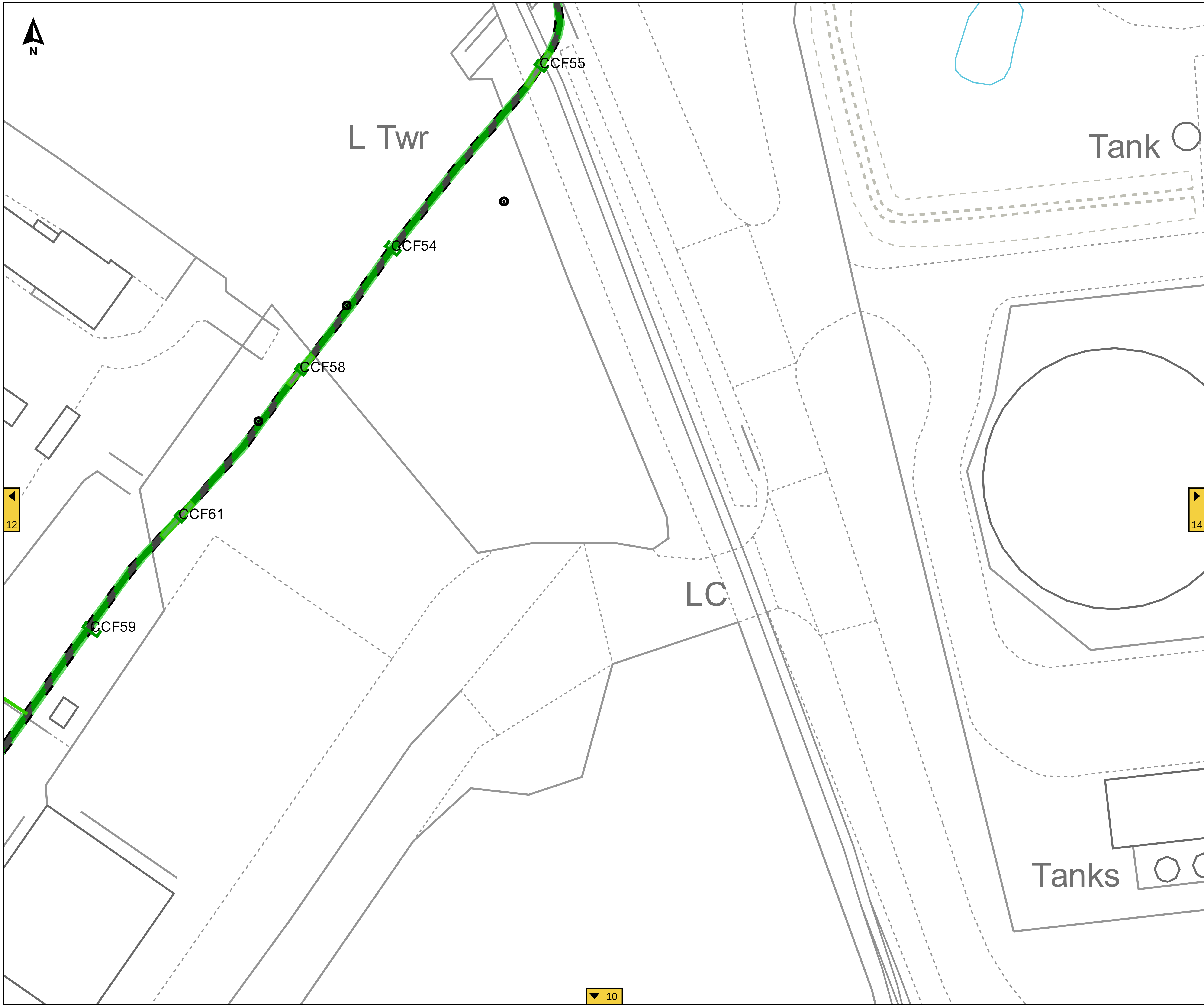
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520338 415484

Date : 27/09/2021

Produced For :
Mr Ben Evans

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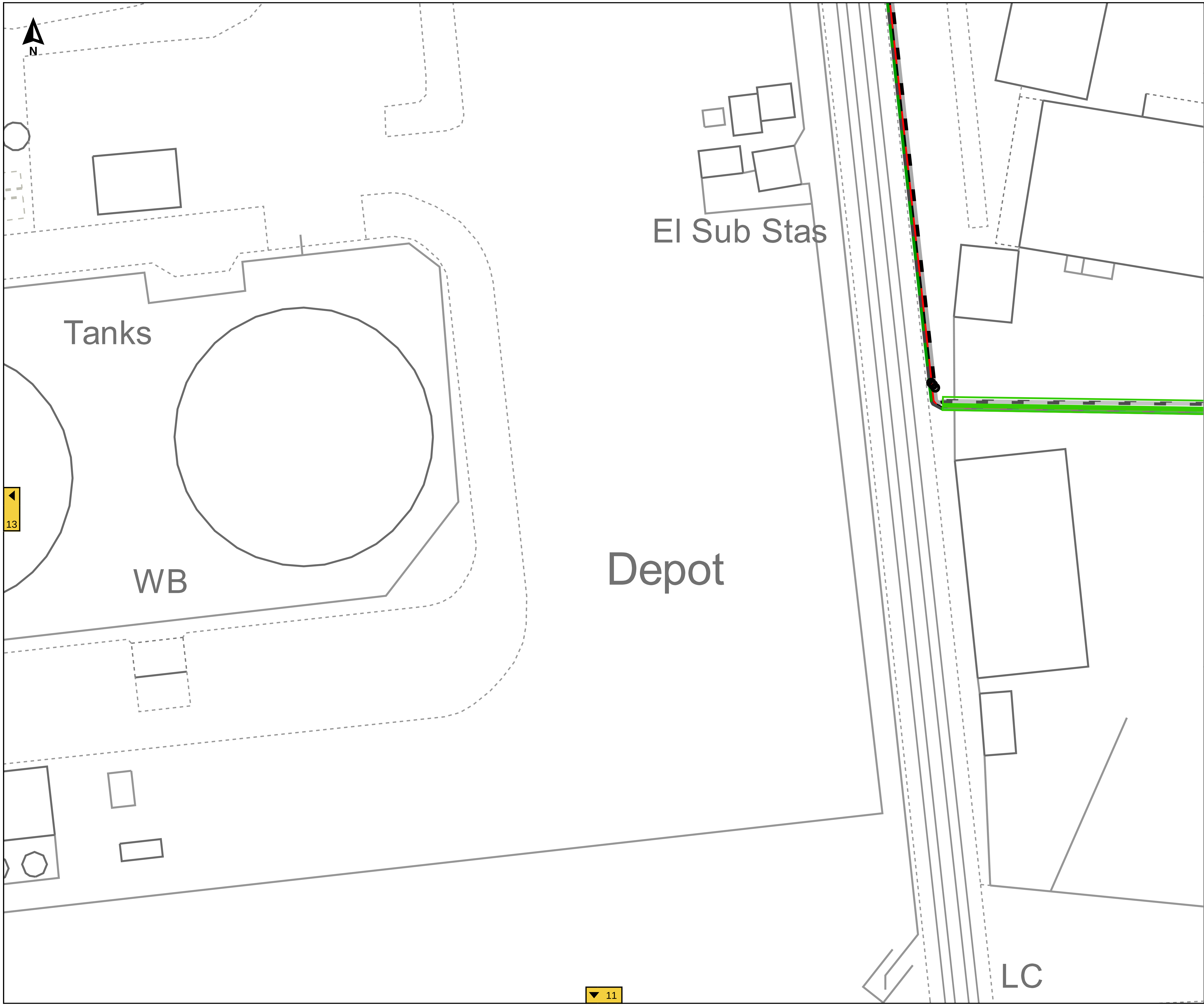
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641878

100245_6

Scale : 1:500

Grid Coordinates : 520505 415484

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 14 of 14 (14,14)

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Legend:

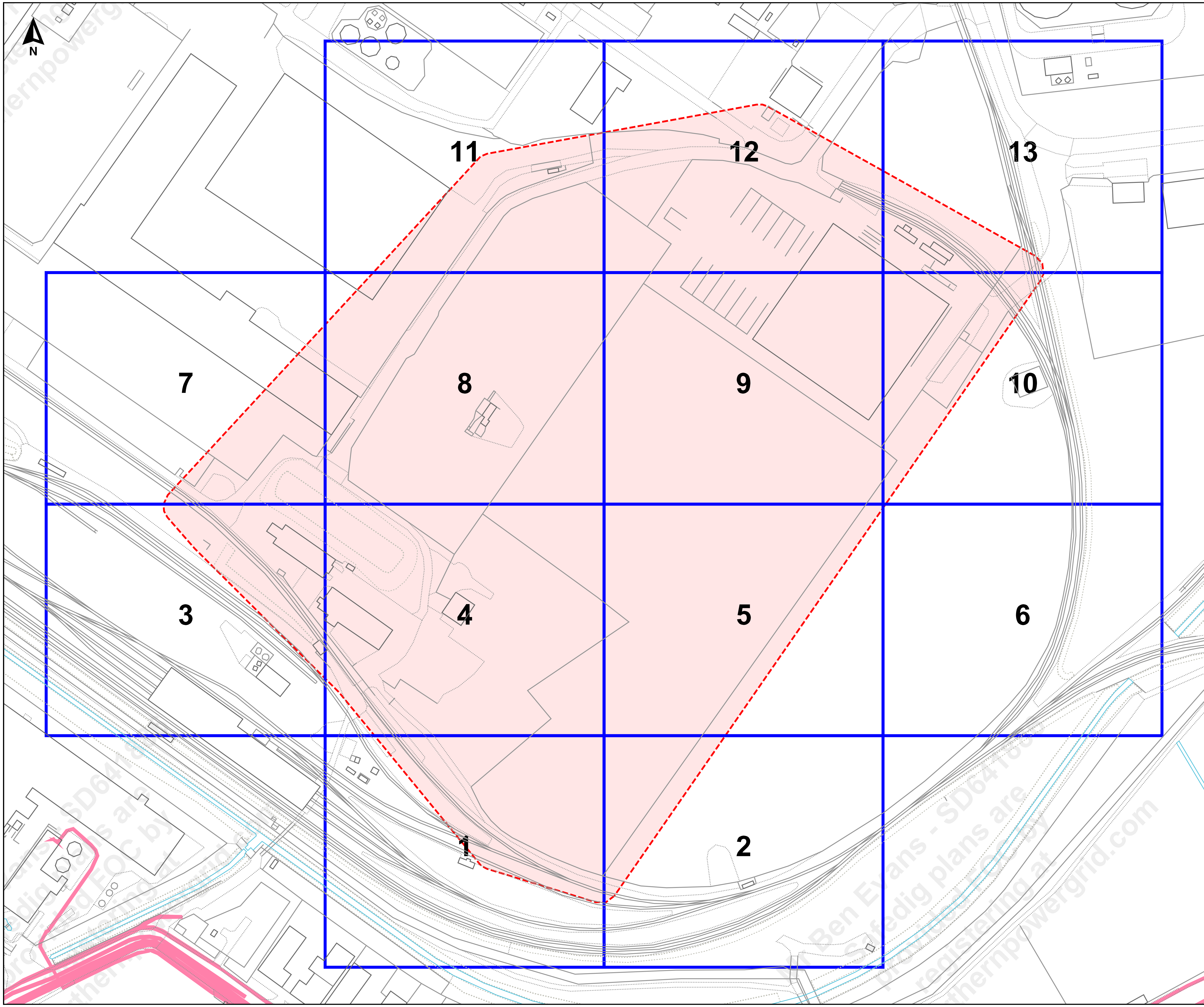
Underground Cables:

132kV	20kV
66kV	11kV
33kV	6kV
25kV	3kV
Left In Situ	Aux
LV Mains	LV Service
LV Service Assumed Route	
LV Service Logical Connection	
Duct Route	

Overhead Conductors:

132kV	20kV
66kV	11kV
33kV	6kV
25kV	3kV
LV Mains	Aux
LV Service	

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886
100245_7

Scale : 1:2100

Grid Coordinates : 520146 415179

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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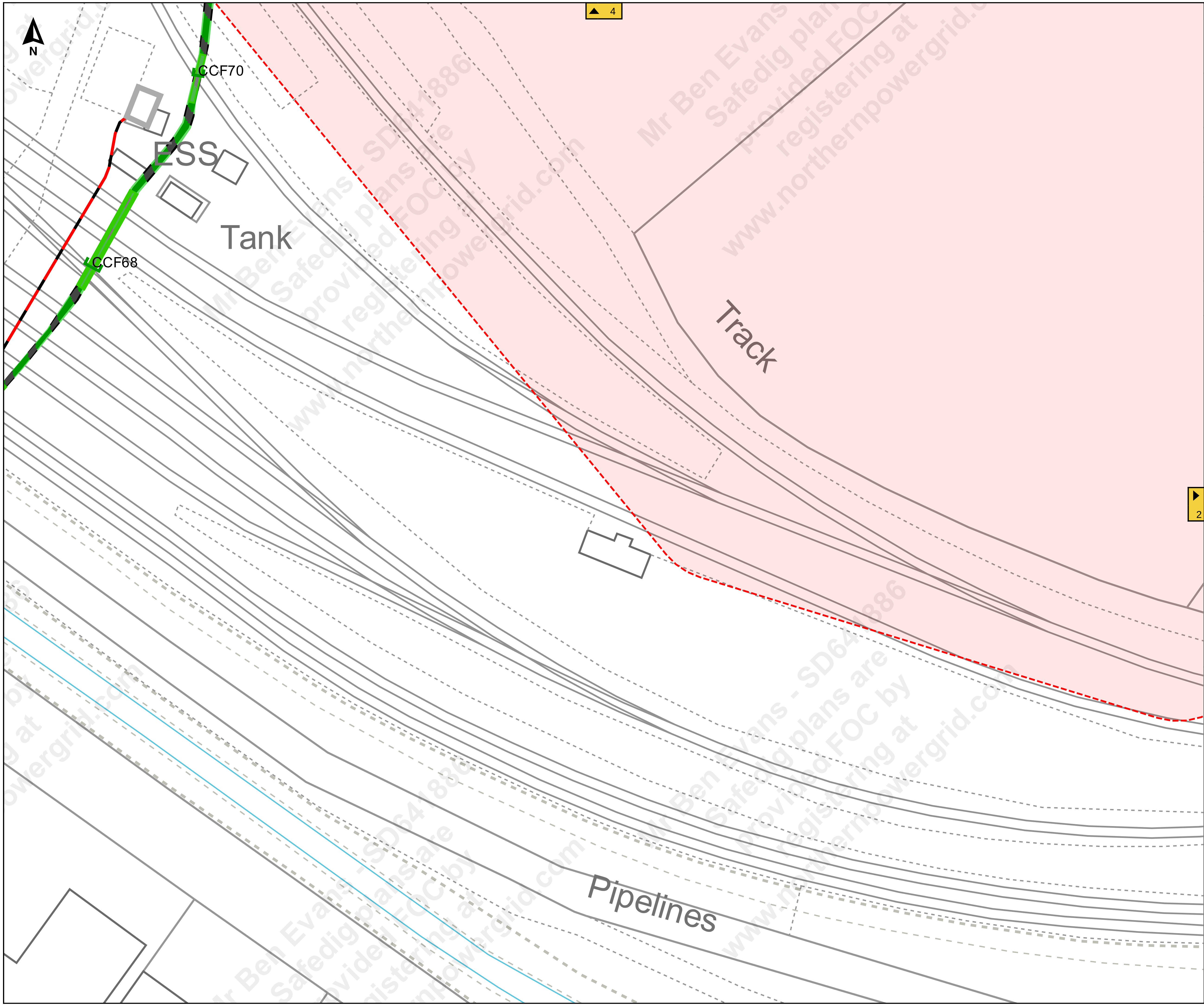
Legend:

Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520062 414971

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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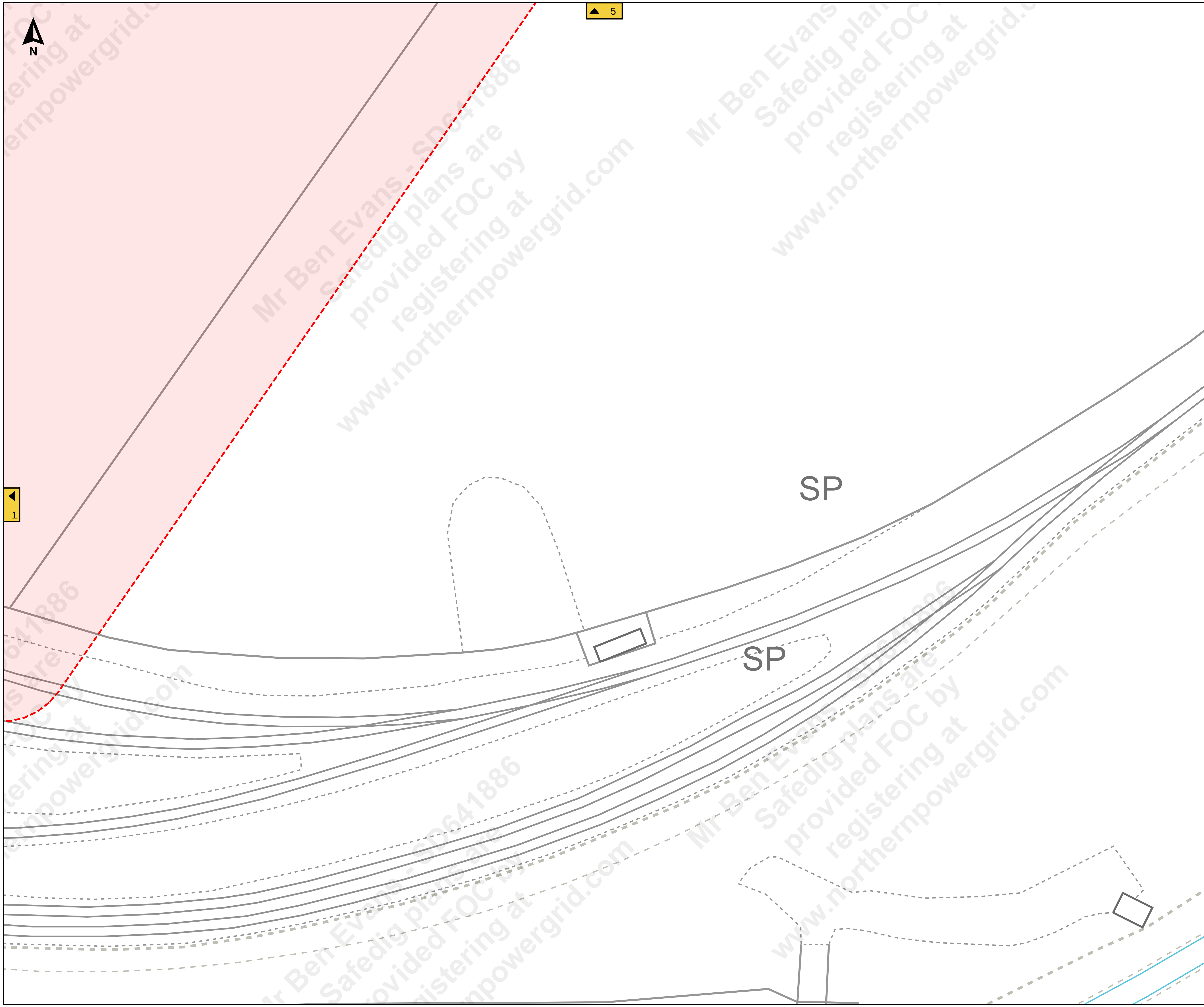
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520230 414971

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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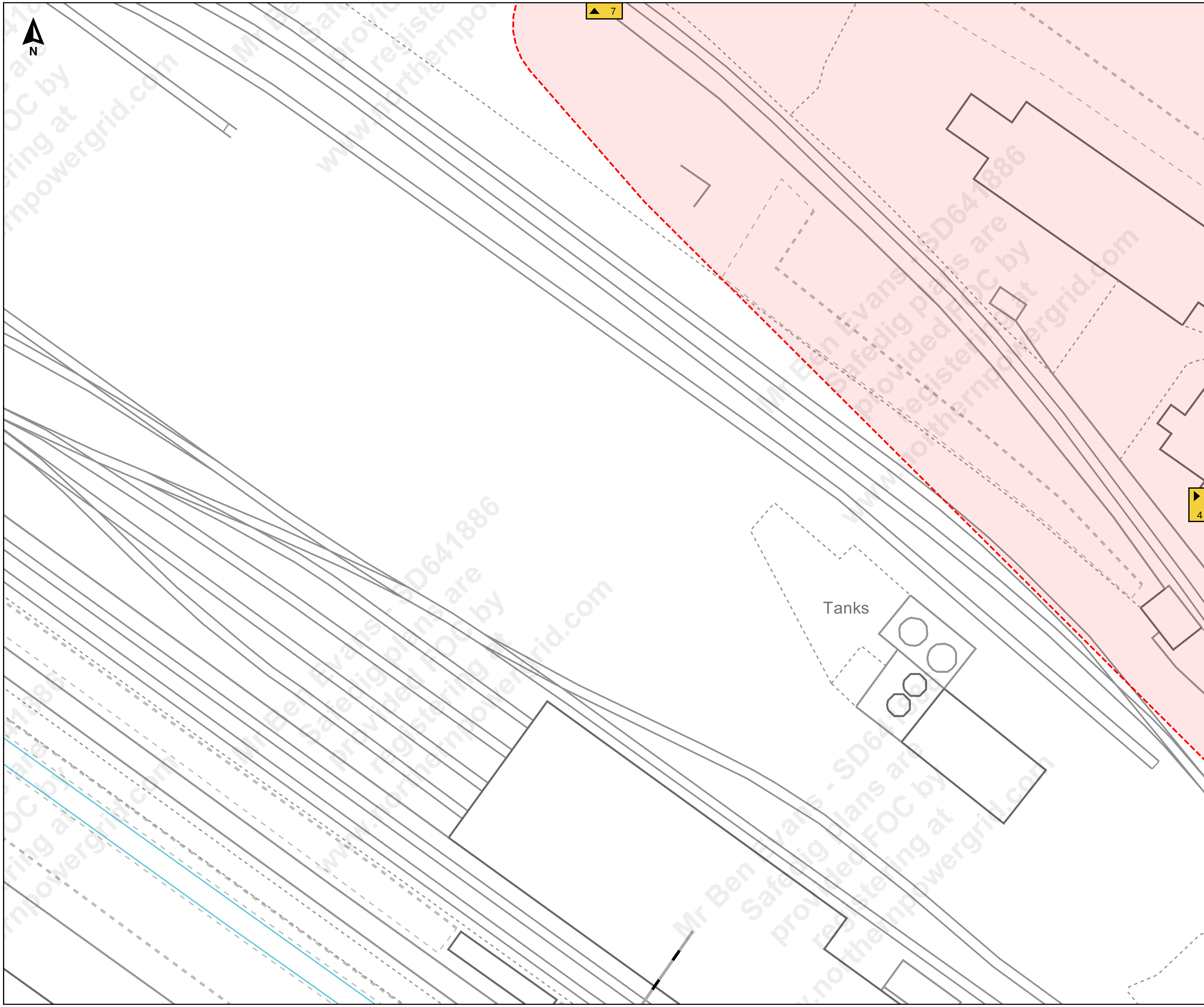
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 519895 415109

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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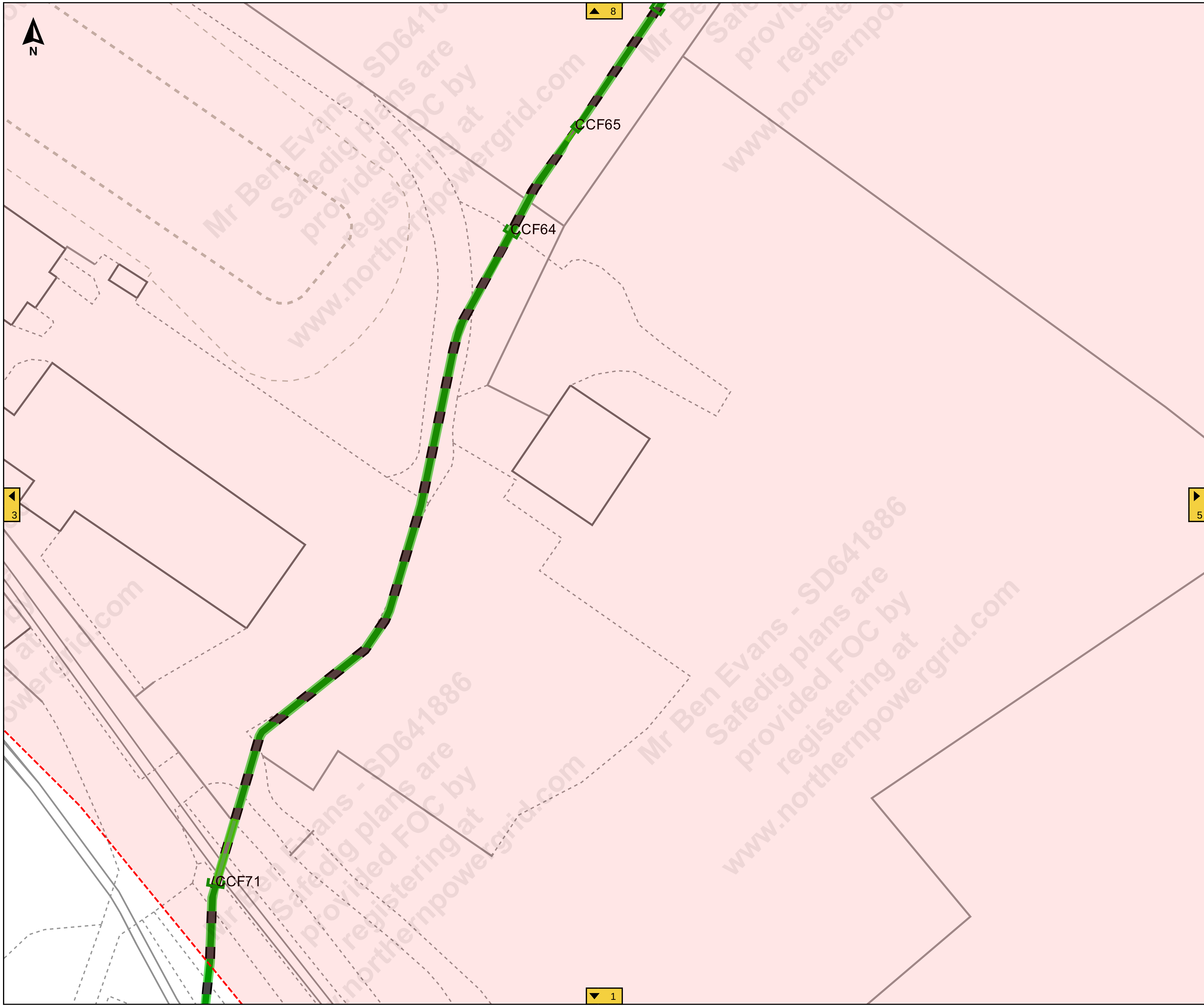
Legend:

Underground Cables:
132kV
66kV
33kV
25kV
Left In Situ
LV Mains
LV Service Assumed Route
LV Service Logical Connection
Duct Route
20kV
11kV
6kV
3kV
Aux
LV Service

Overhead Conductors:
132kV
66kV
33kV
25kV
LV Mains
LV Service
20kV
11kV
6kV
3kV
Aux

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886
100245_7

Scale : 1:500

Grid Coordinates : 520062 415109

Date : 27/09/2021

Produced For :
Mr Ben Evans

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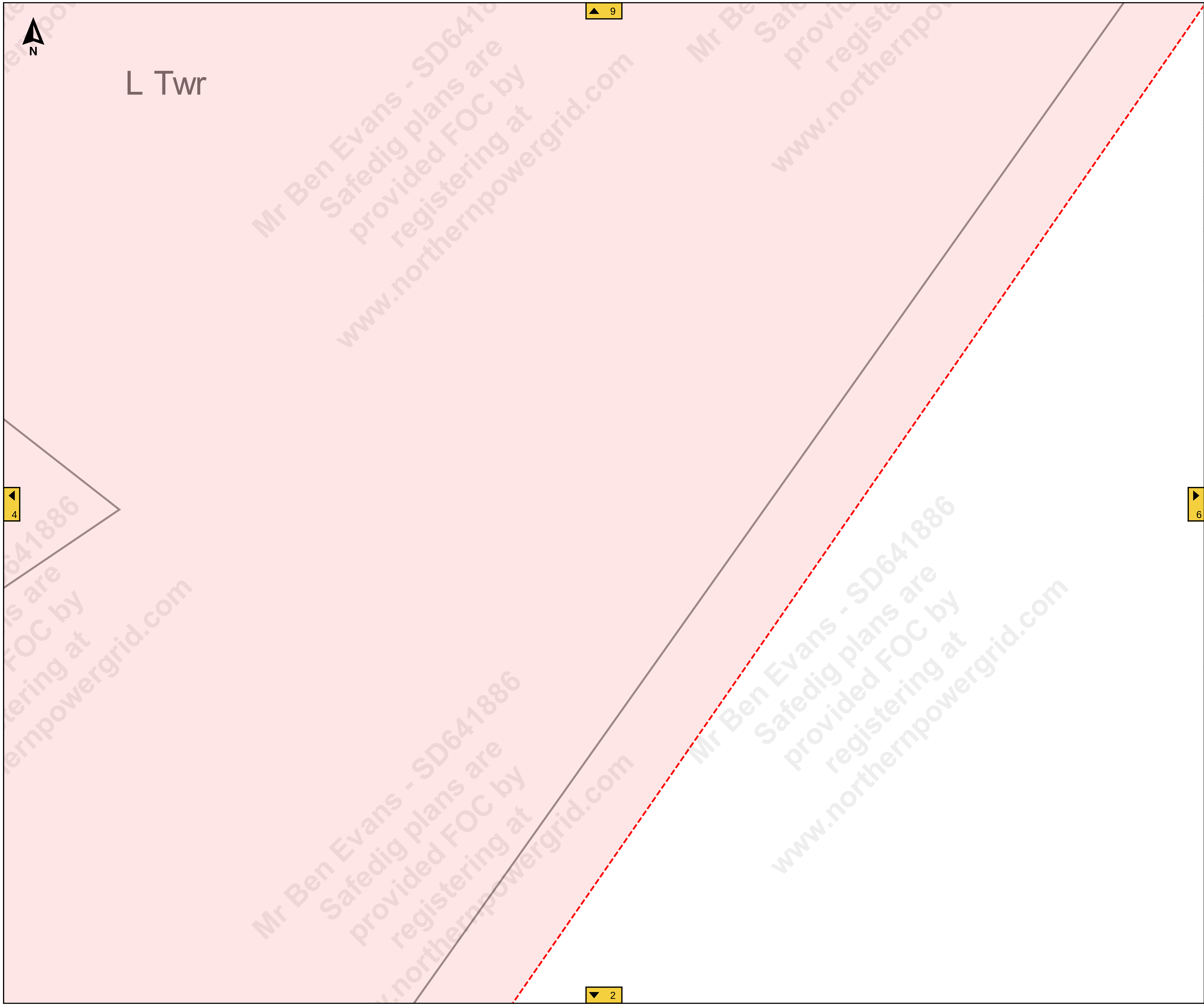
Legend:
Underground Cables:
132kV, 66kV, 33kV, 25kV, Left In Situ, LV Mains, 20kV, 11kV, 6kV, 3kV, Aux, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 66kV, 33kV, 25kV, LV Mains, LV Service, 20kV, 11kV, 6kV, 3kV, Aux

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520230 415109

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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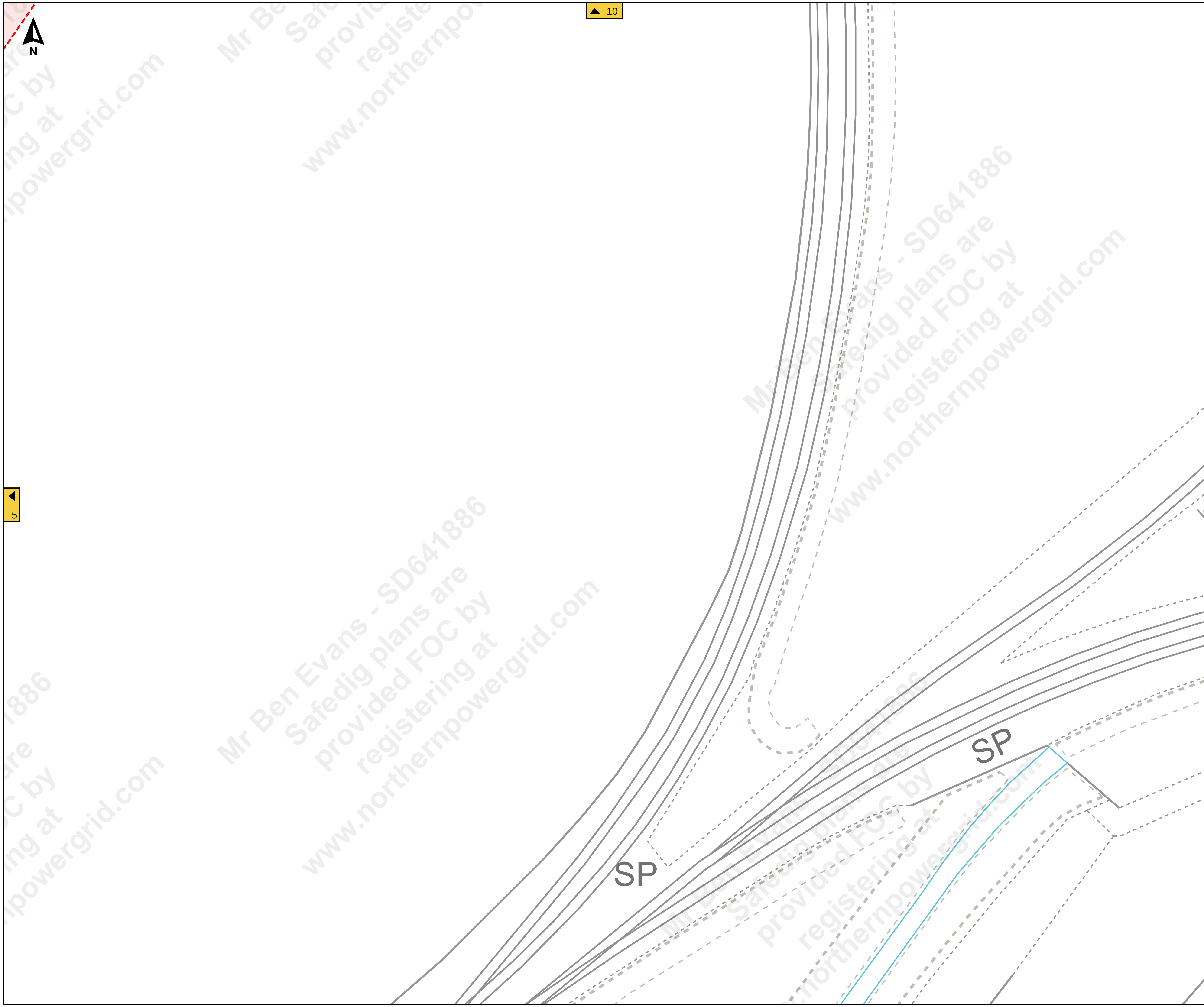
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886
100245_7

Scale : 1:500

Grid Coordinates : 520397 415109

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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Legend:

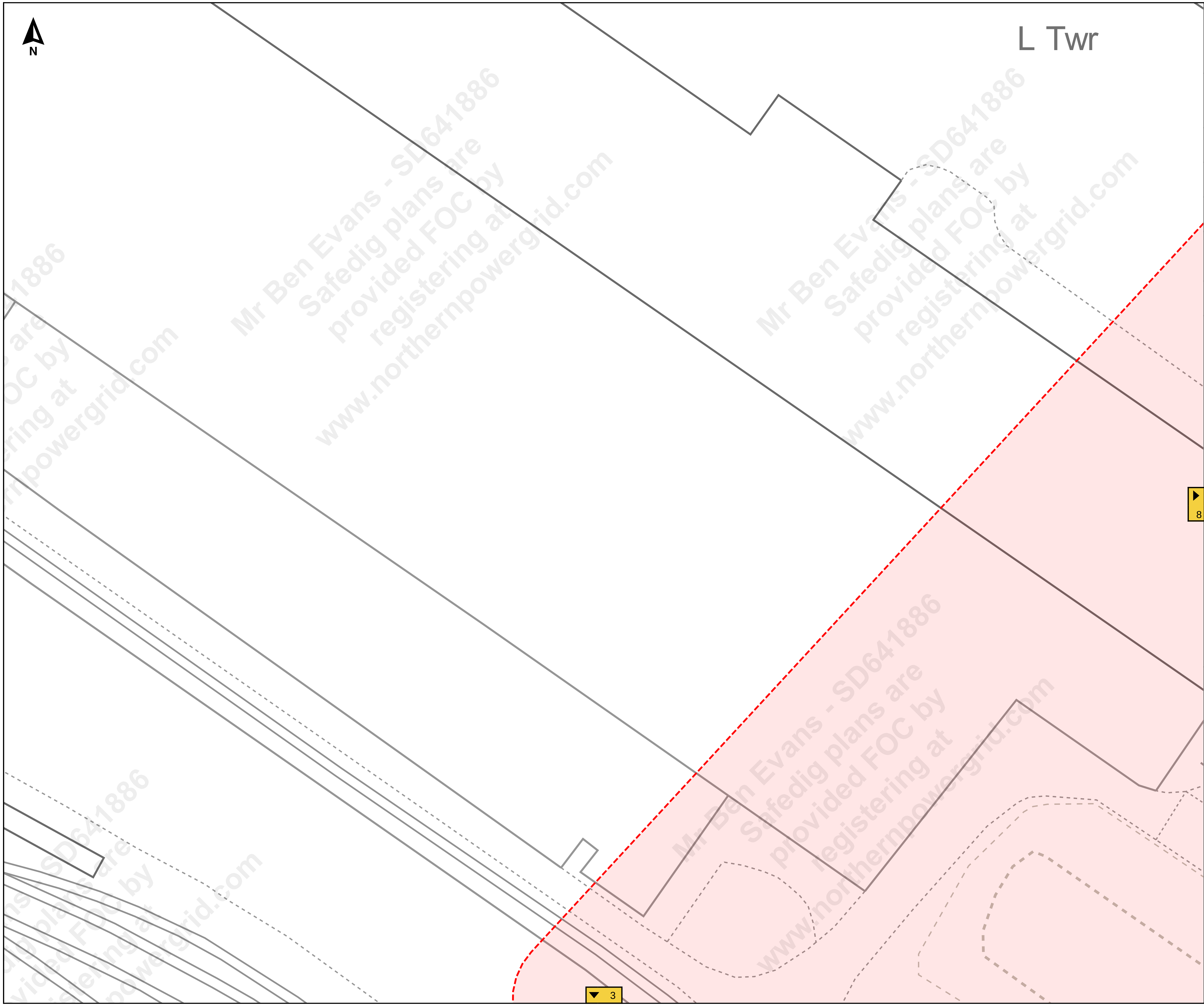
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 519895 415248

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 7 of 13 (7,13)

Terms and Conditions

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Legend:

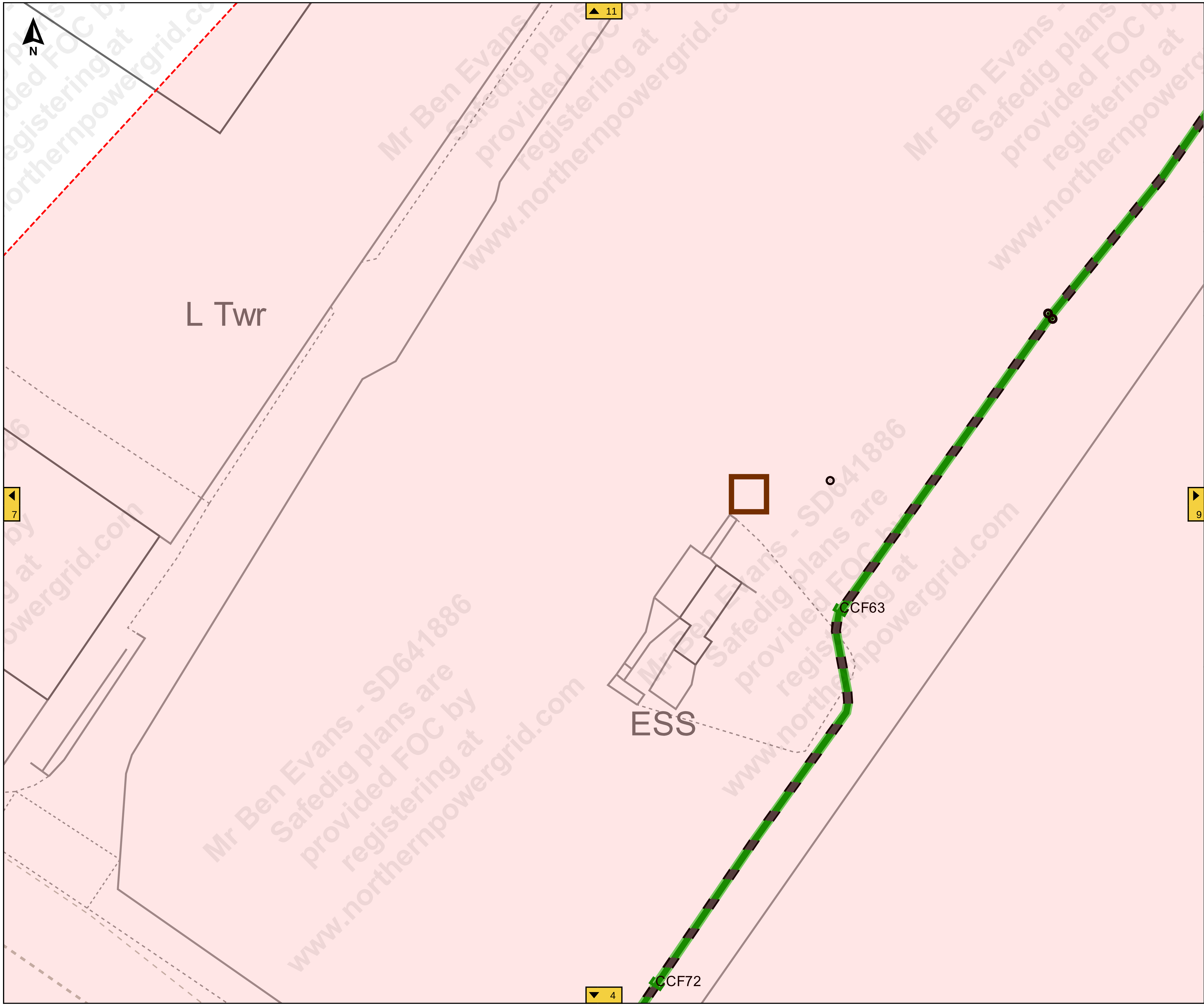
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520062 415248

Date : 27/09/2021

Produced For :
Mr Ben Evans

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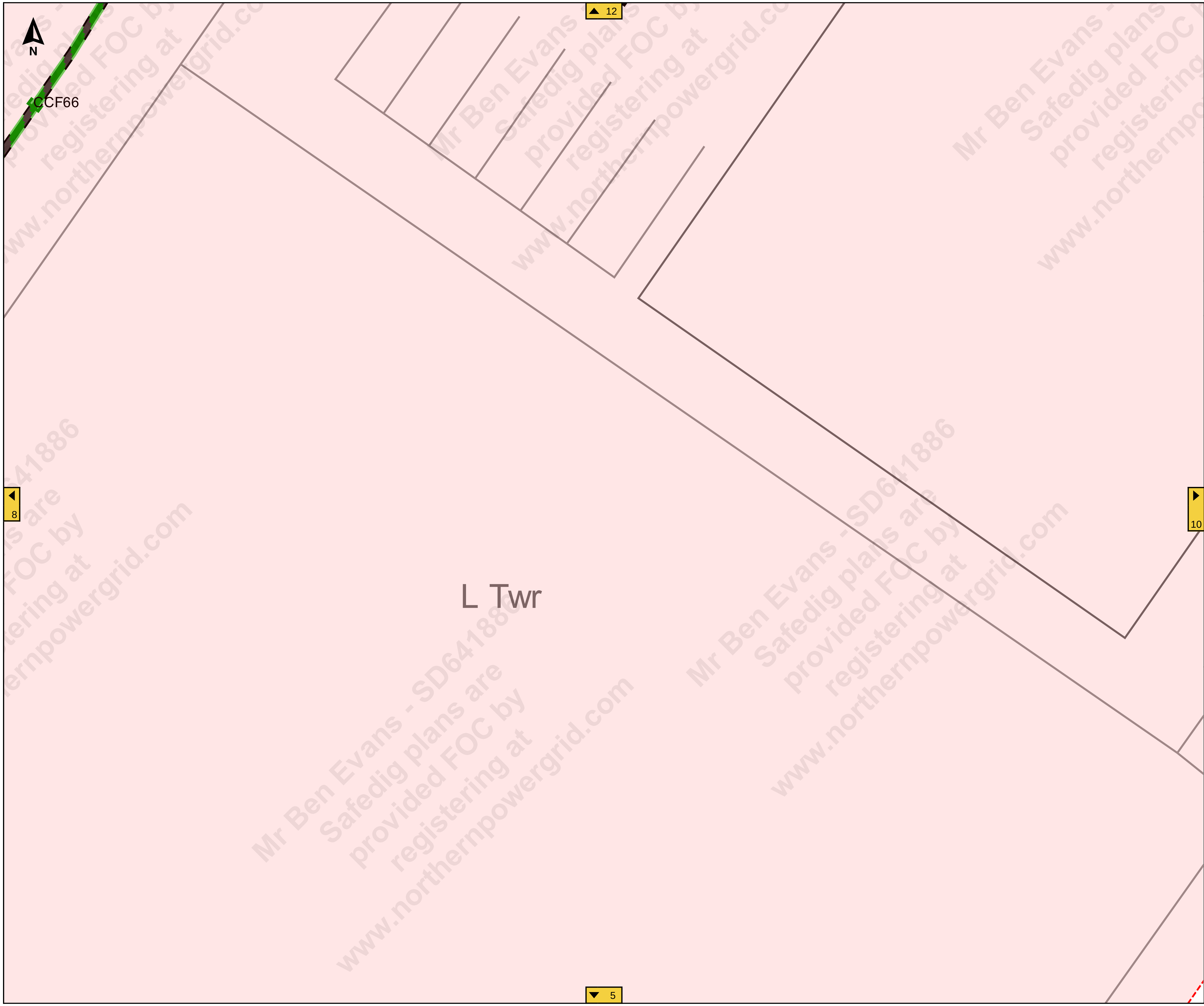
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520230 415248

Date : 27/09/2021

Produced For :
Mr Ben Evans

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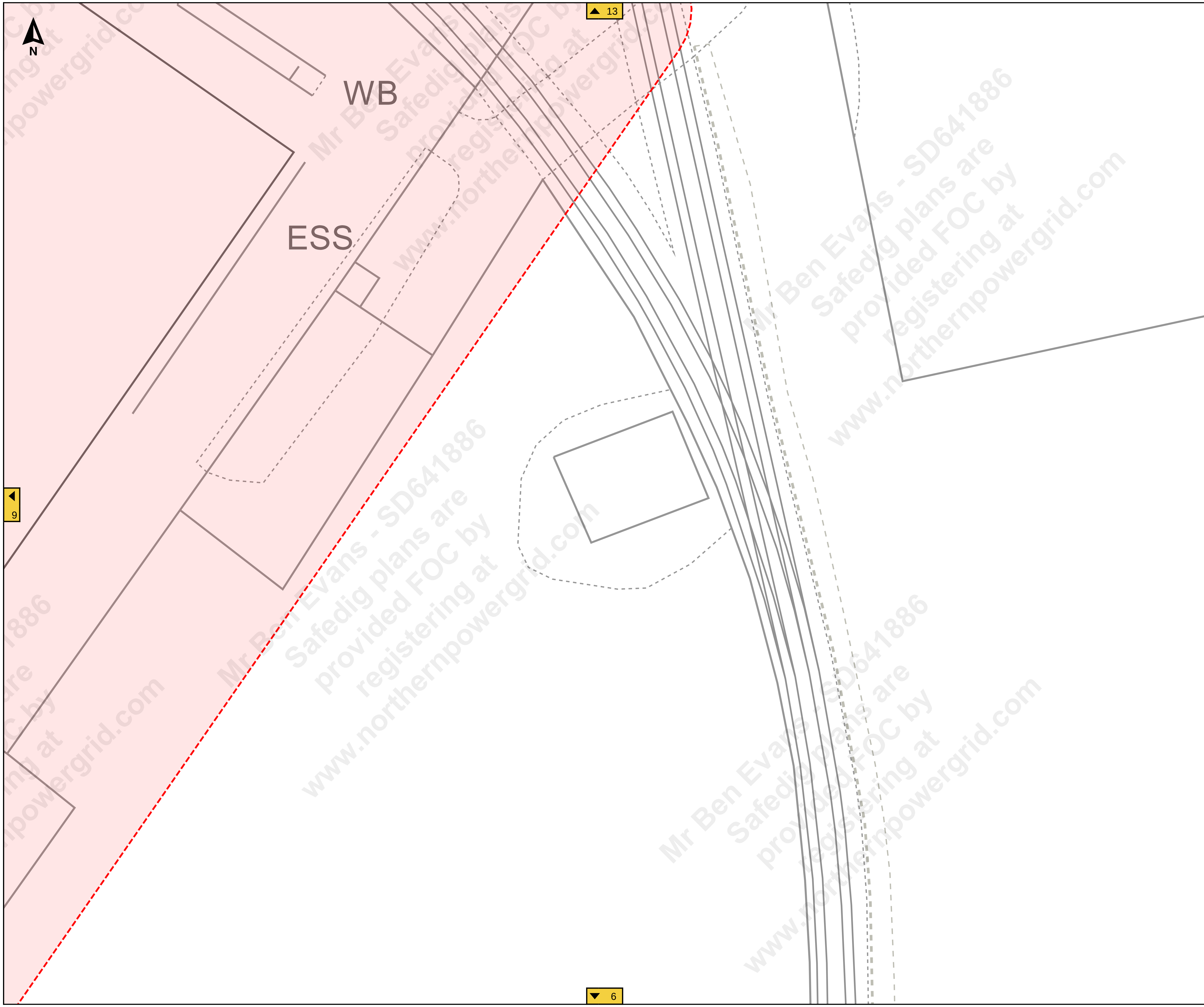
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520397 415248

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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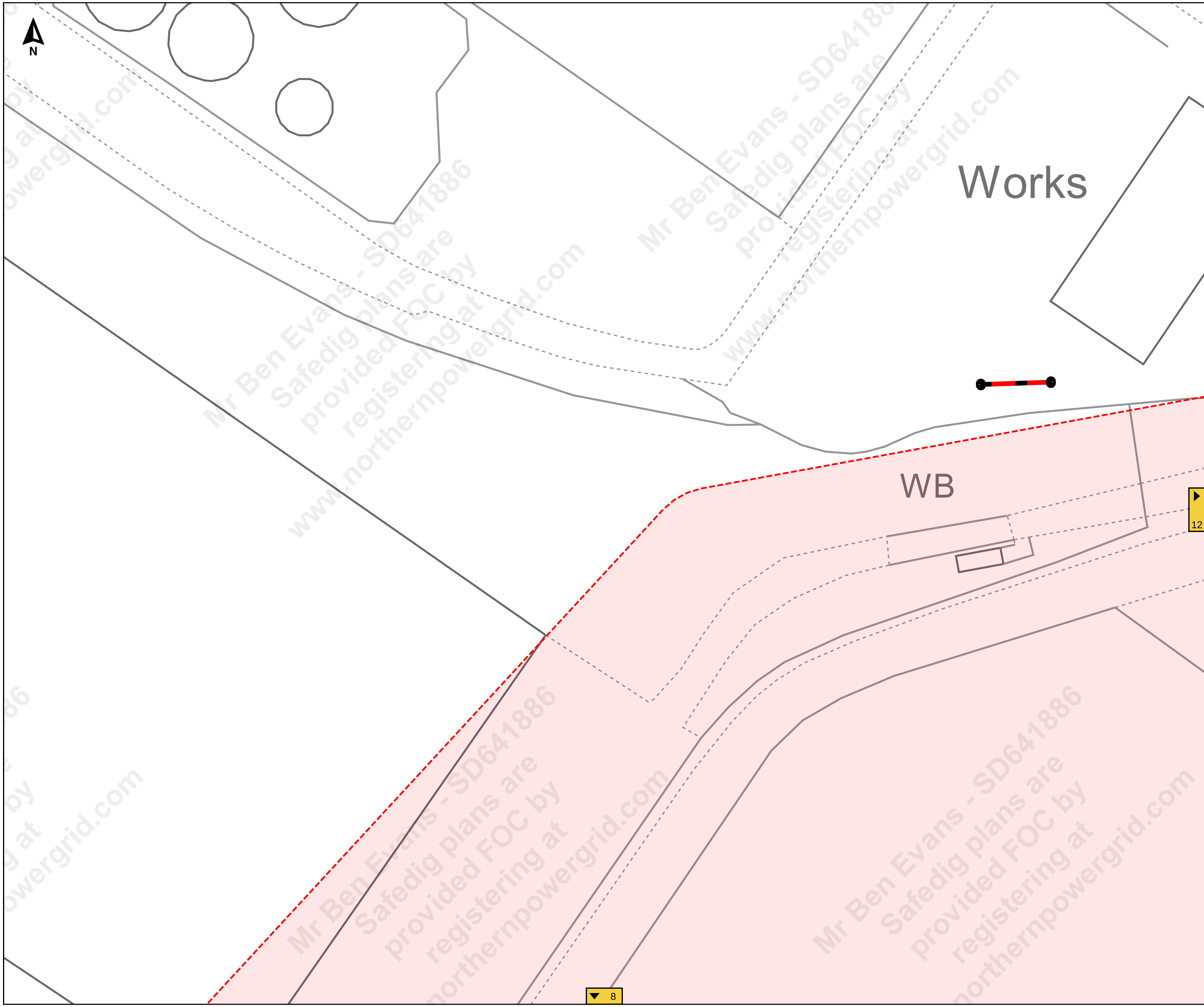
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520062 415386

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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Legend:

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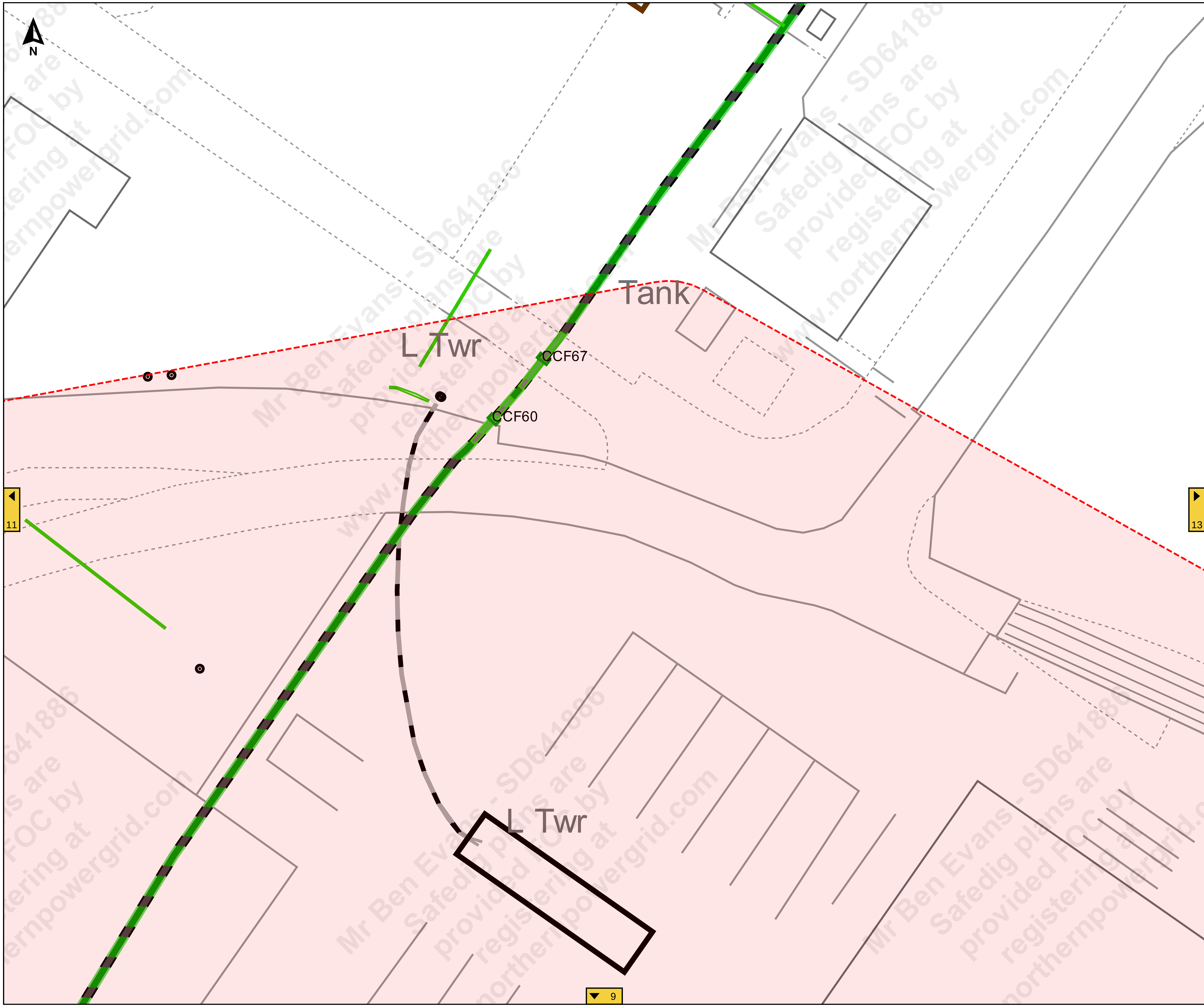
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886

100245_7

Scale : 1:500

Grid Coordinates : 520230 415386

Date : 27/09/2021

Produced For :
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Legend:

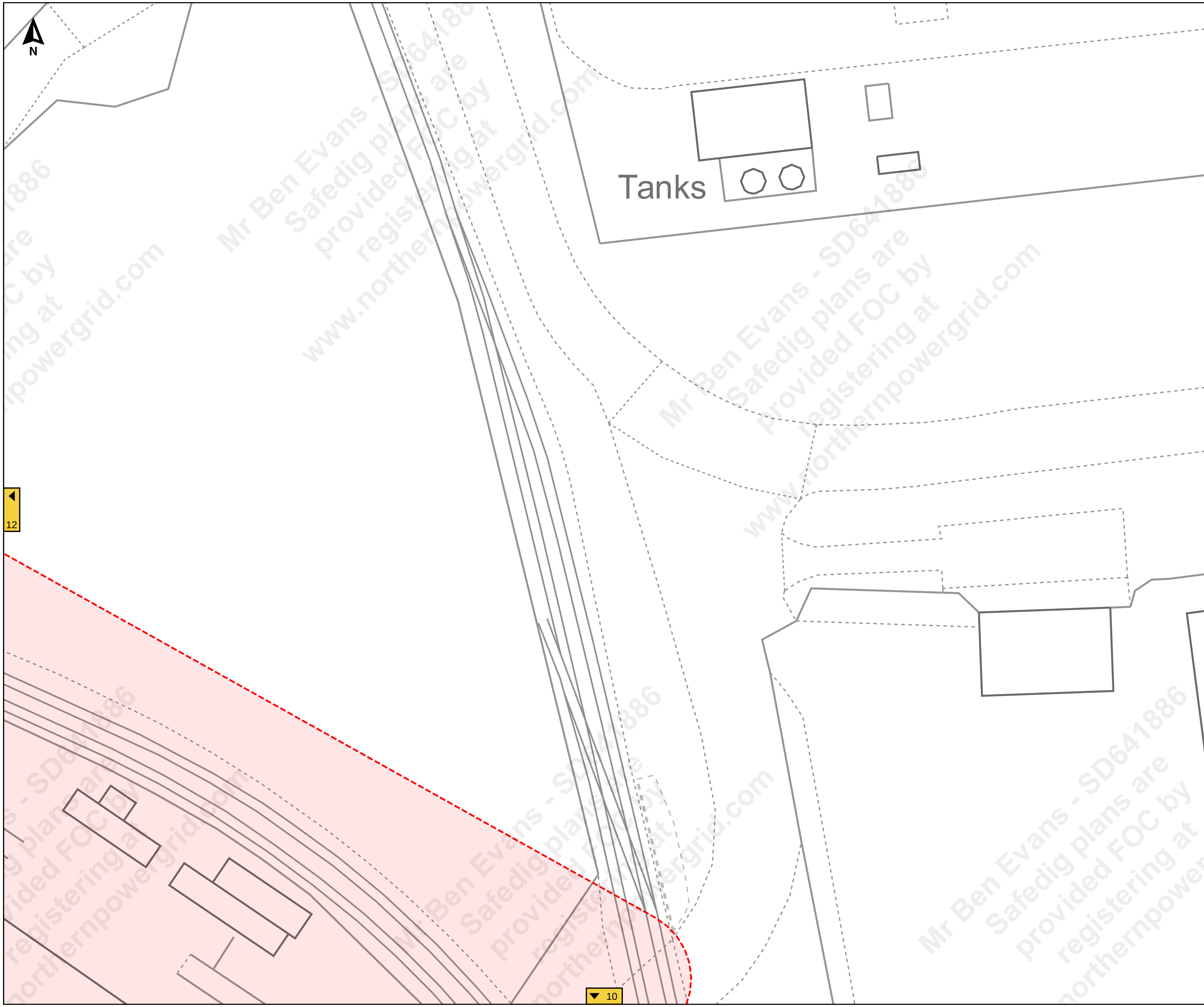
Underground Cables:

132kV	20kV
66kV	11kV
33kV	6kV
25kV	3kV
Left In Situ	Aux
LV Mains	LV Service
LV Service Assumed Route	
LV Service Logical Connection	
Duct Route	

Overhead Conductors:

132kV	20kV
66kV	11kV
33kV	6kV
25kV	3kV
LV Mains	Aux
LV Service	

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641886
100245_7

Scale : 1:500

Grid Coordinates : 520397 415386

Date : 27/09/2021

Produced For :
Mr Ben Evans

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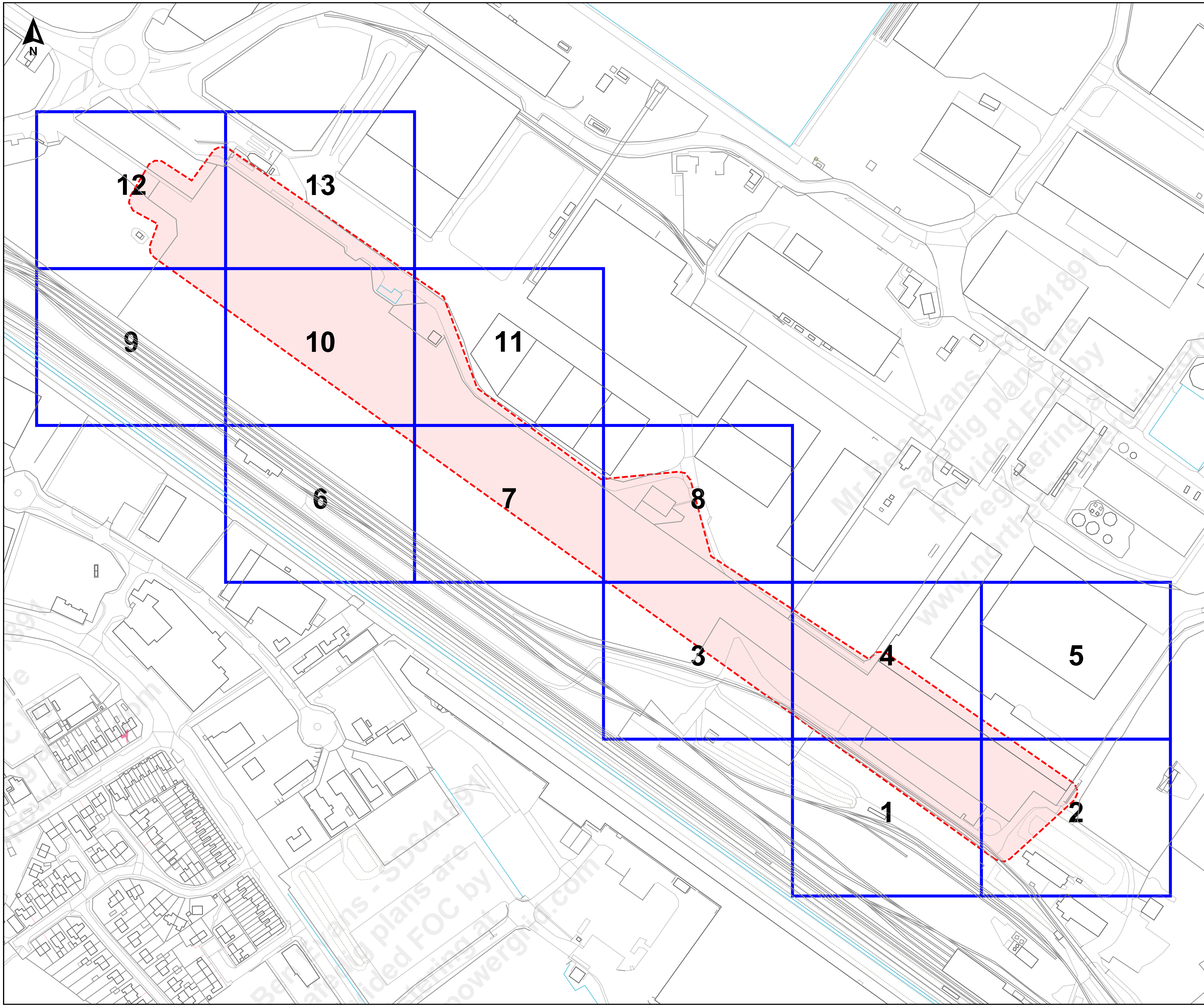
Legend:

Underground Cables:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:3100

Grid Coordinates : 519574 415474

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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Legend:

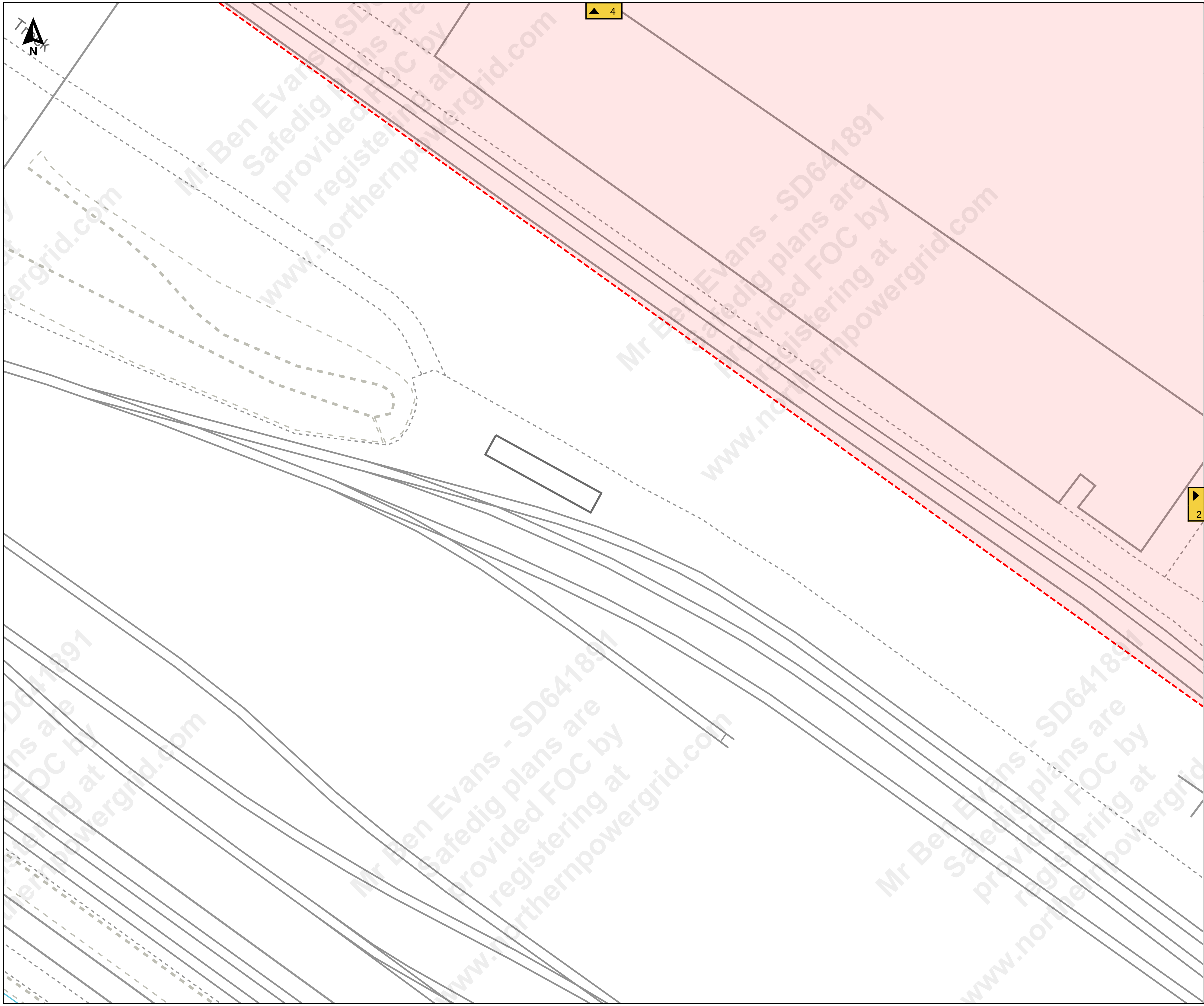
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519824 415196

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

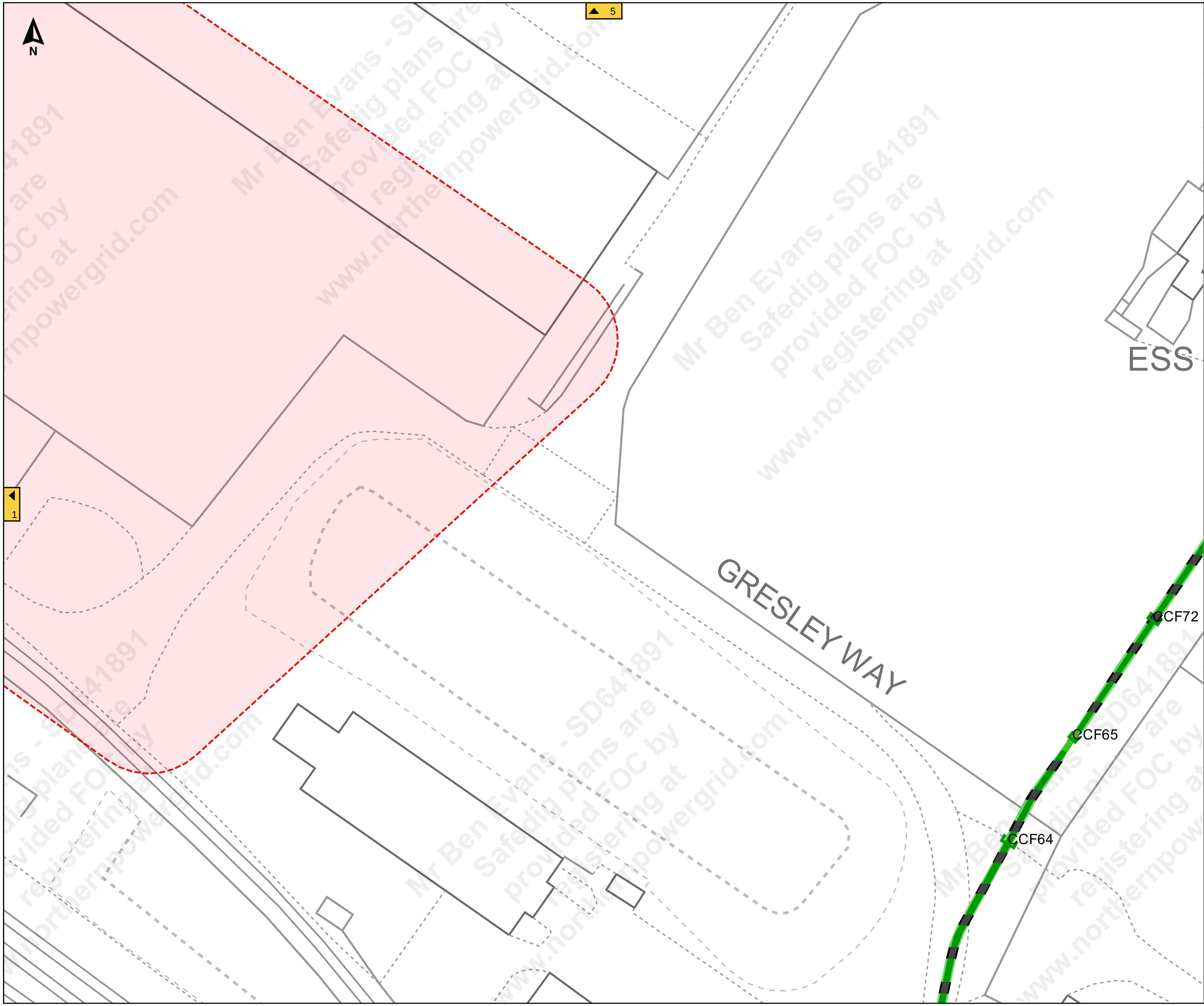
Underground Cables:

132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route

Overhead Conductors:

132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519991 415196

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 2 of 13 (2,13)

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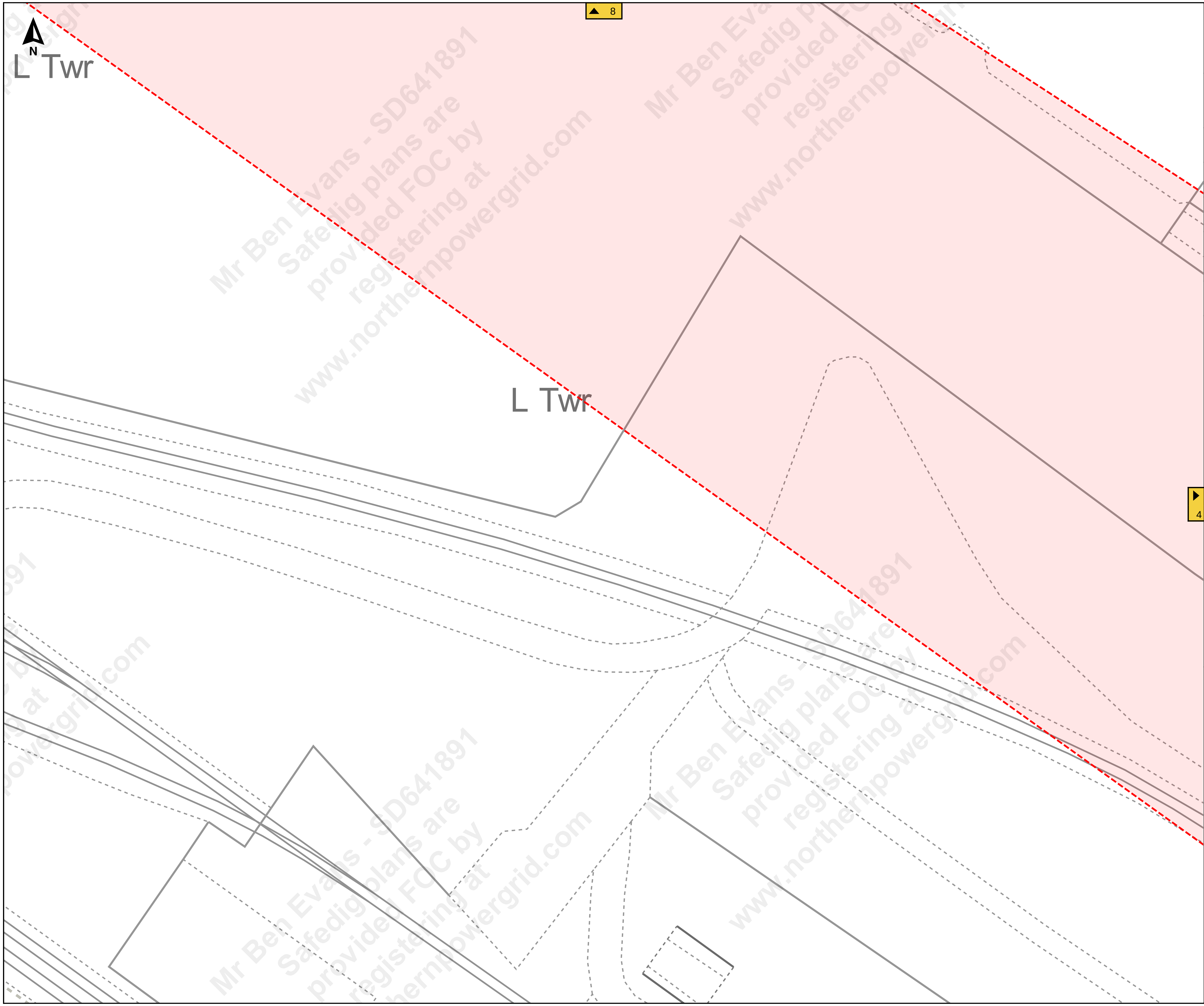
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519657 415335

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 3 of 13 (3,13)

Terms and Conditions

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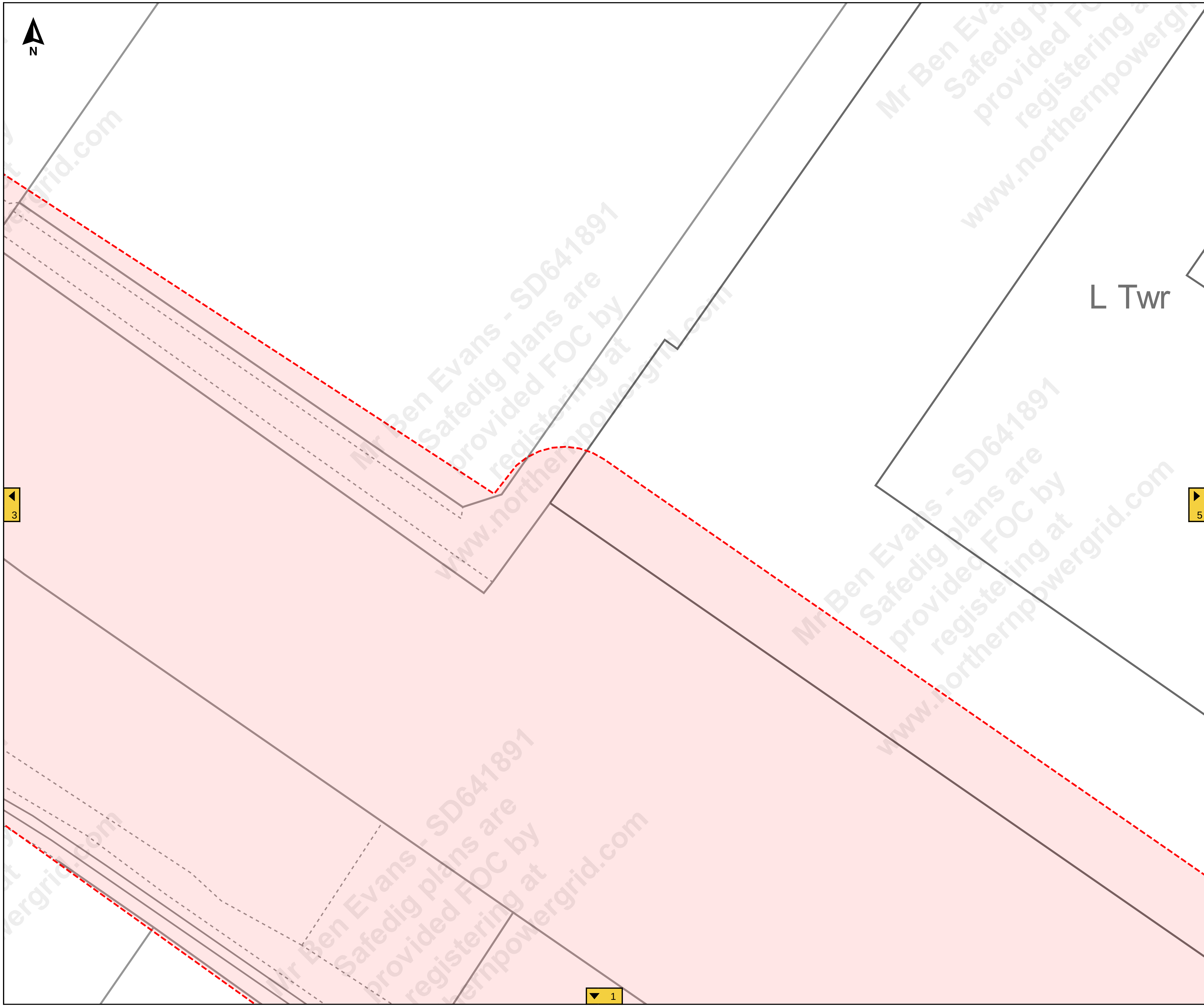
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519824 415335

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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Legend:

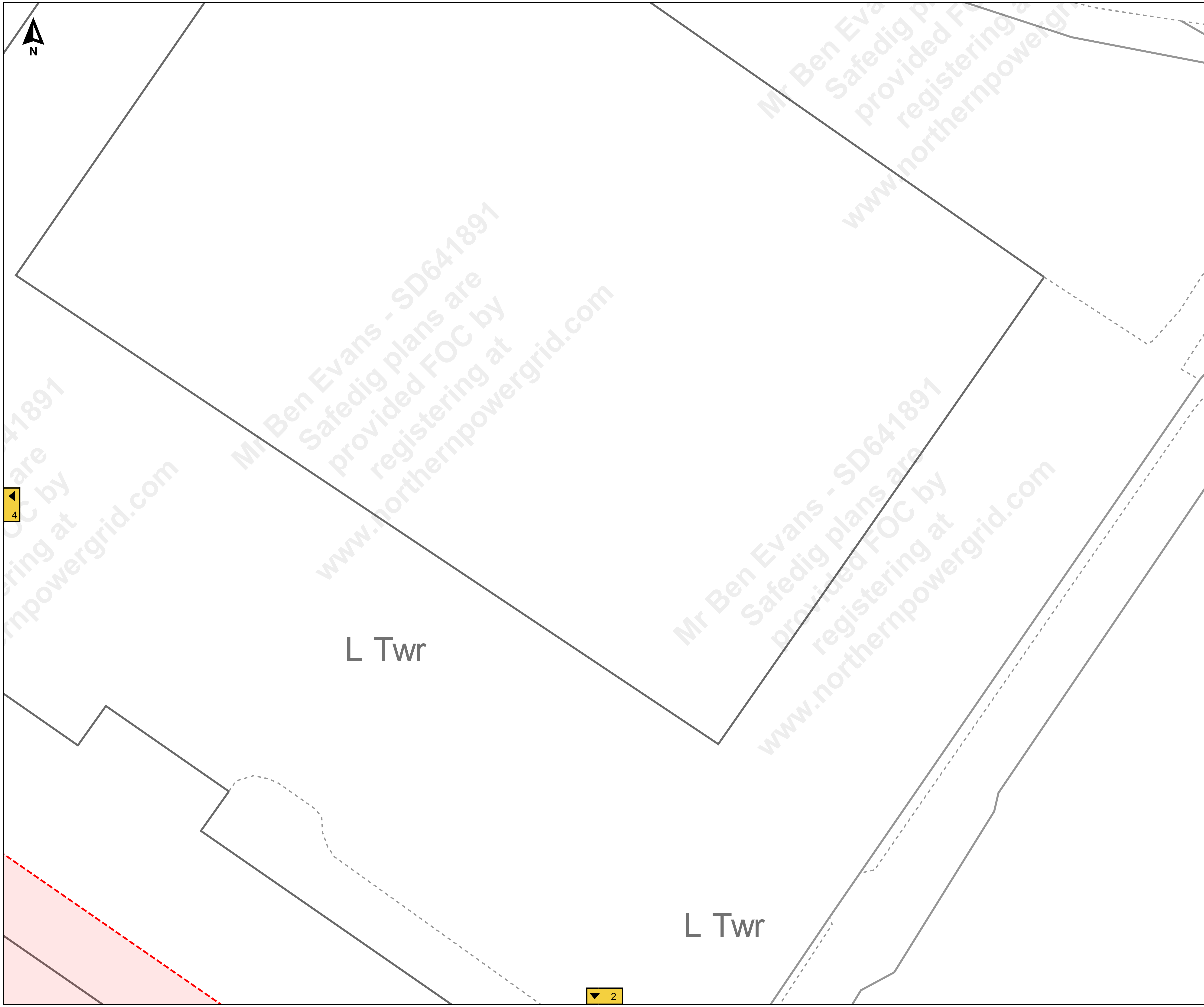
Underground Cables:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:

- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519991 415335

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

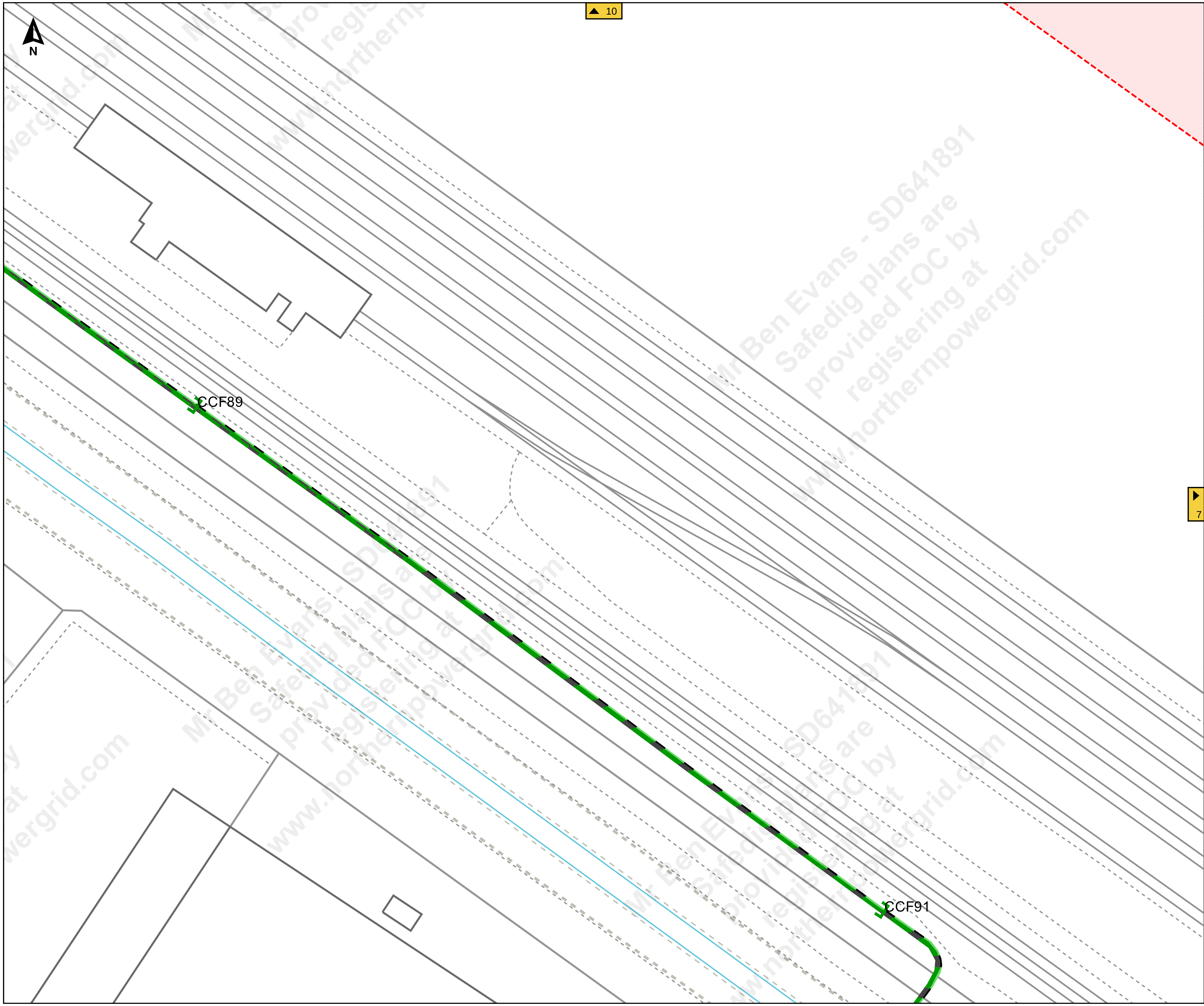
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891
100245_8

Scale : 1:500

Grid Coordinates : 519323 415474

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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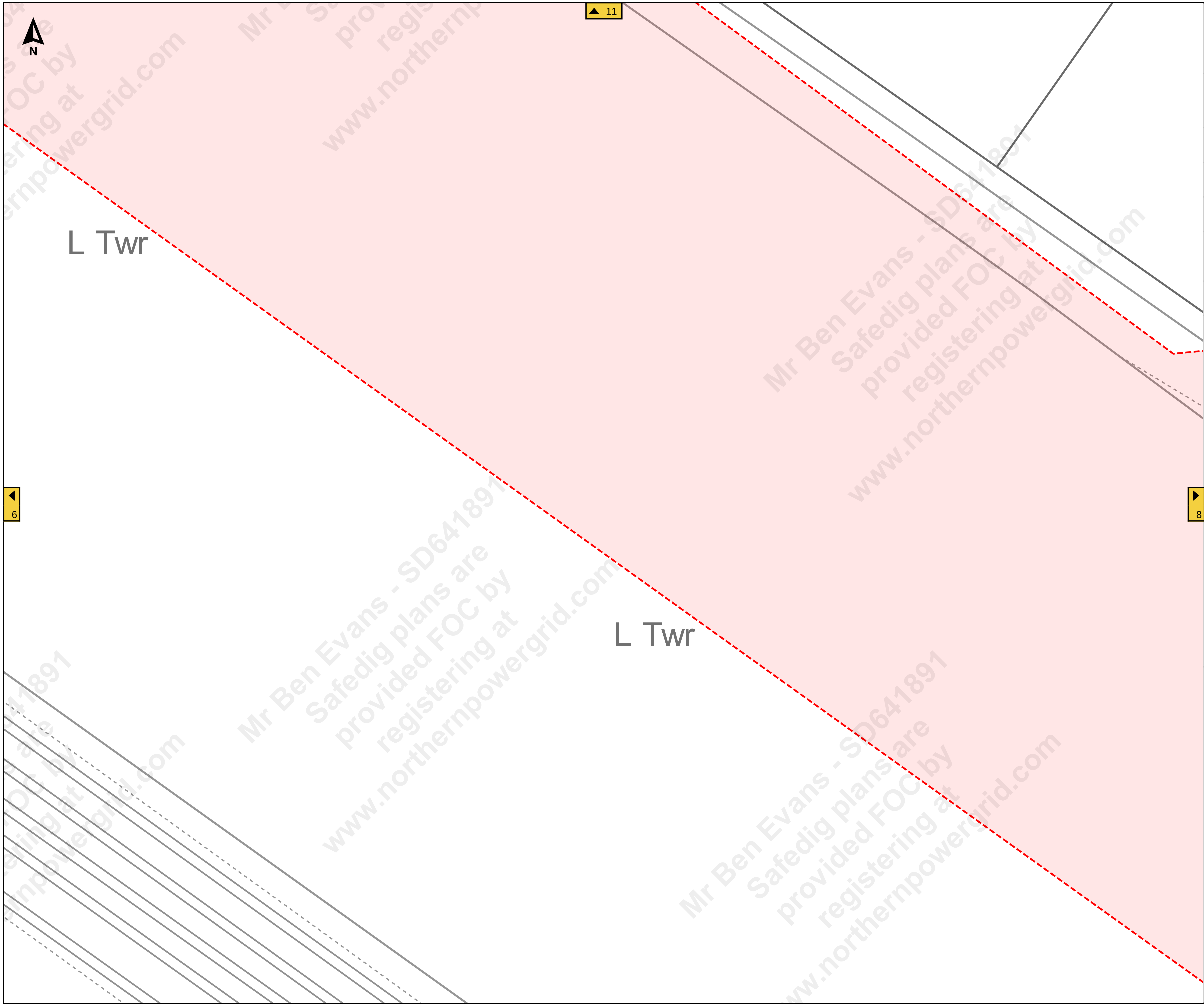
Legend:
Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519490 415474

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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Legend:

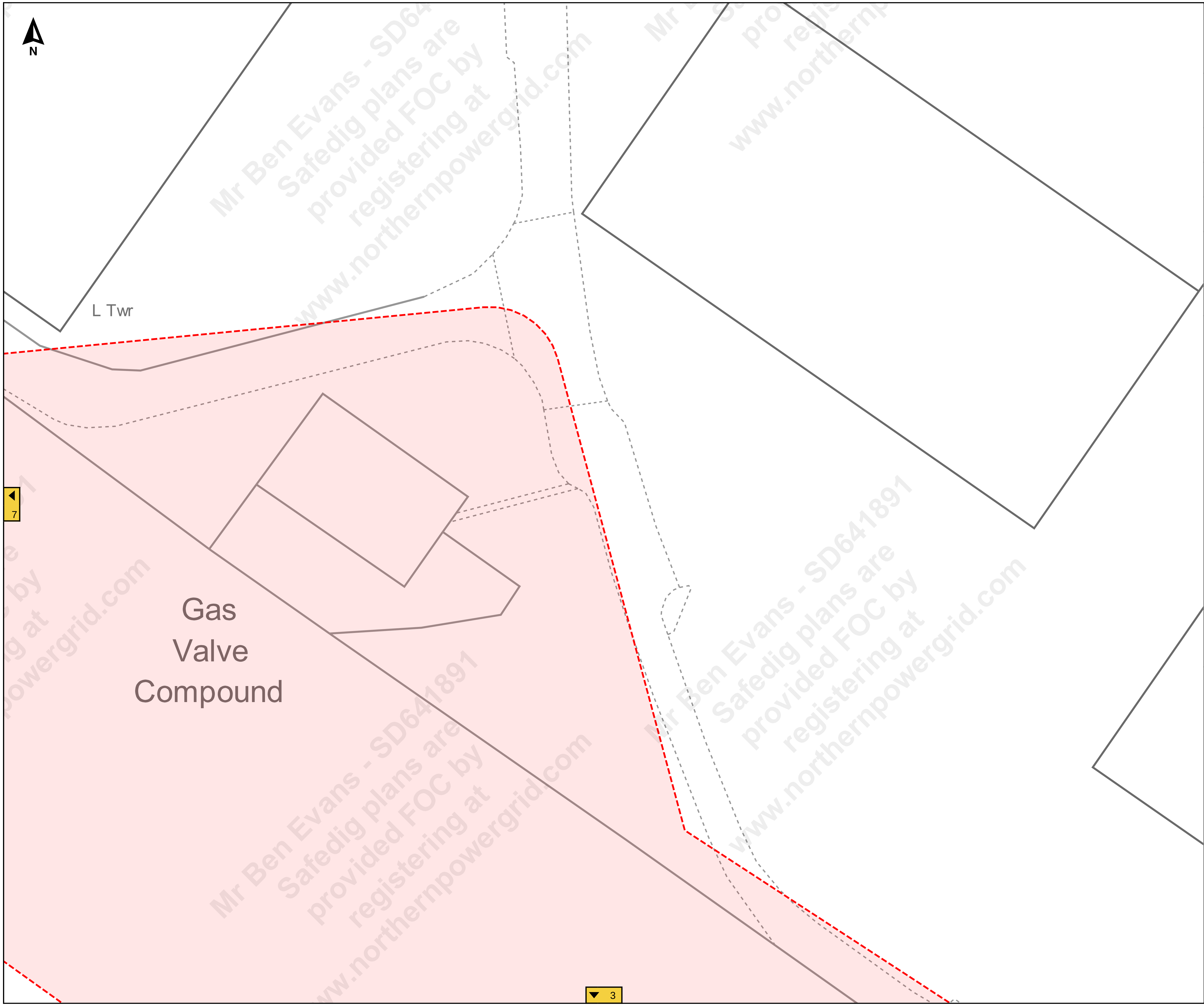
Underground Cables:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891
100245_8

Scale : 1:500

Grid Coordinates : 519657 415474

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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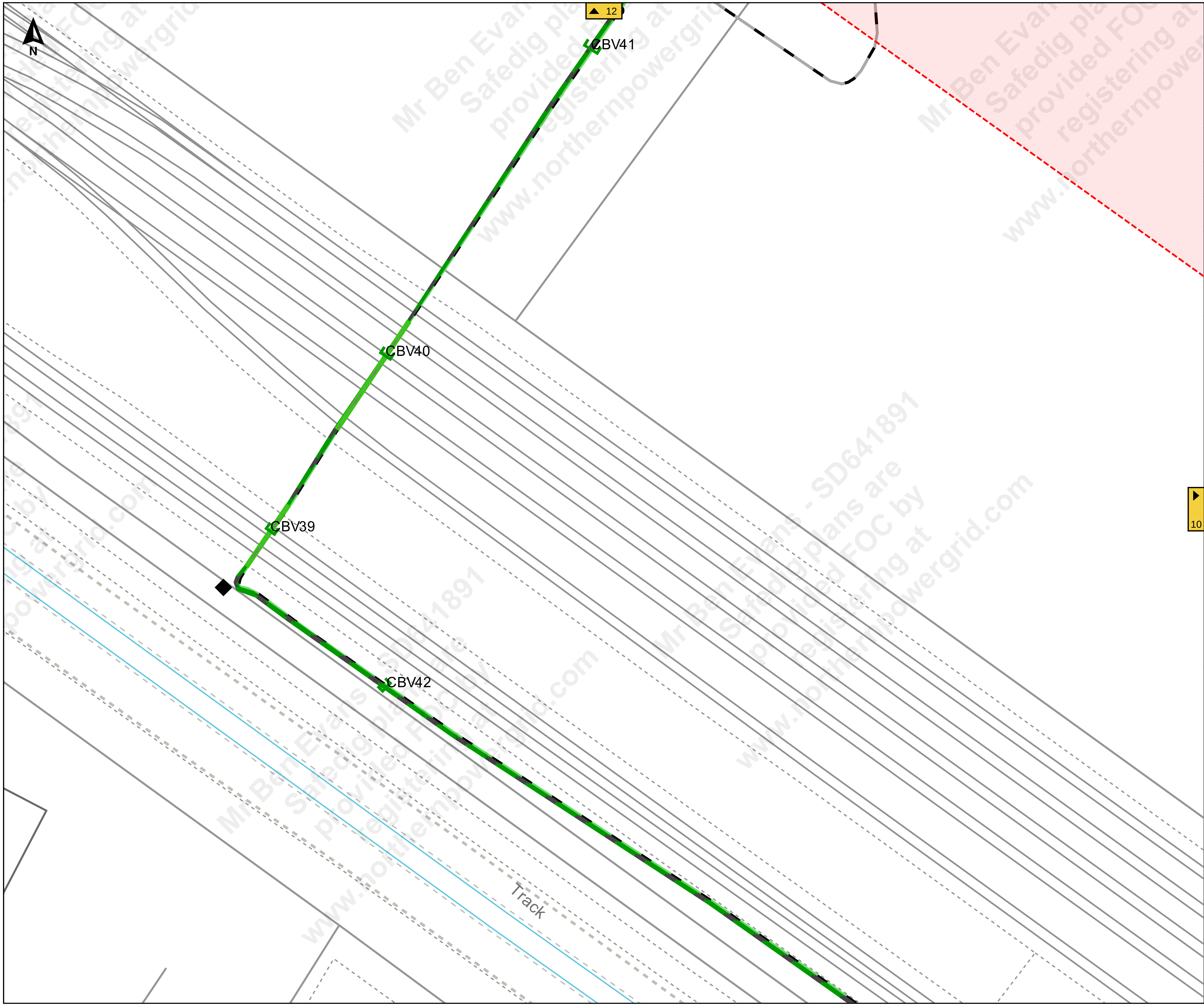
Legend:

Underground Cables:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- Left In Situ
- Aux
- LV Mains
- LV Service
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route

Overhead Conductors:
- 132kV
- 20kV
- 66kV
- 11kV
- 33kV
- 6kV
- 25kV
- 3kV
- LV Mains
- Aux
- LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519156 415612

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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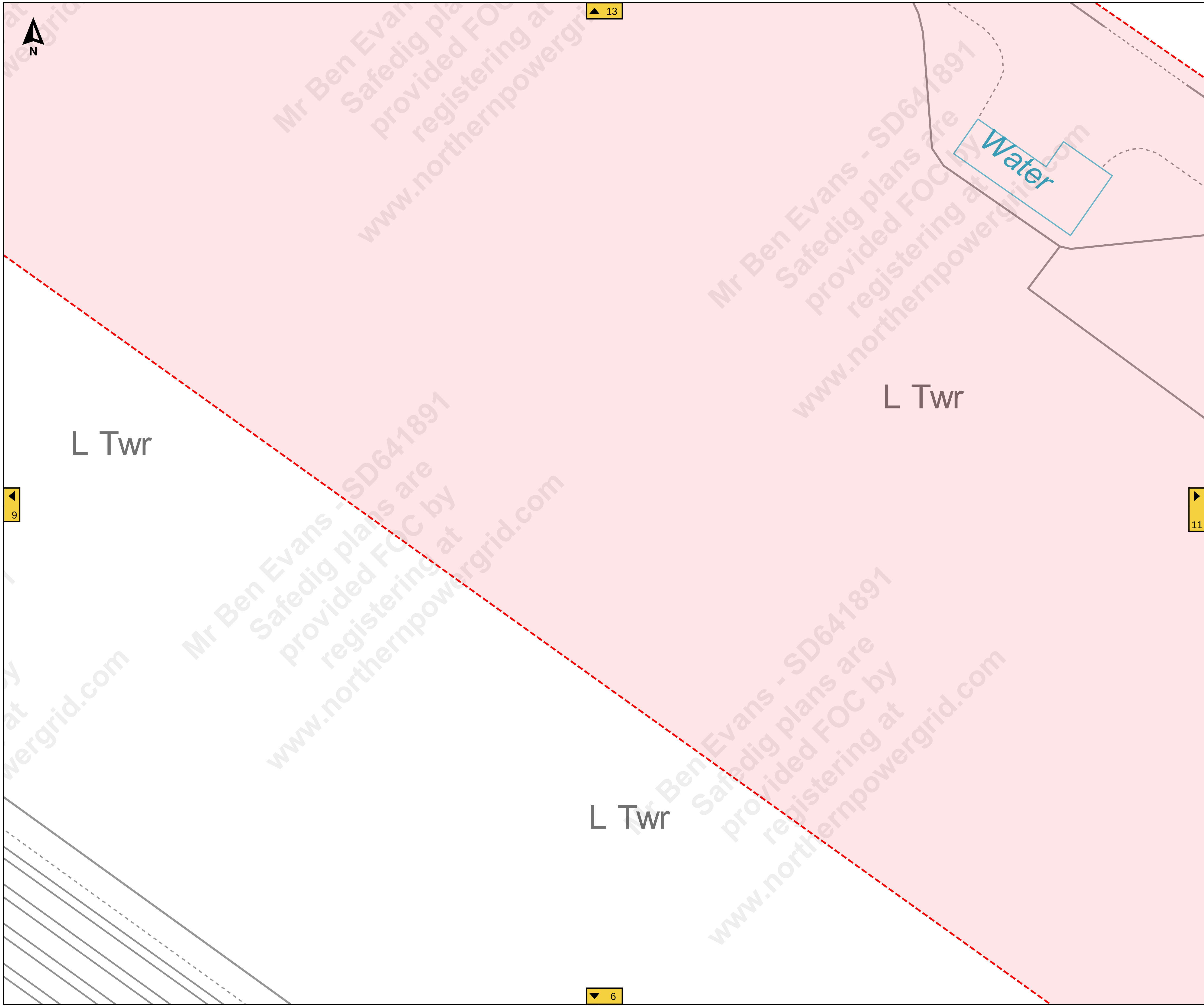
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519323 415612

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 10 of 13 (10,13)

Terms and Conditions

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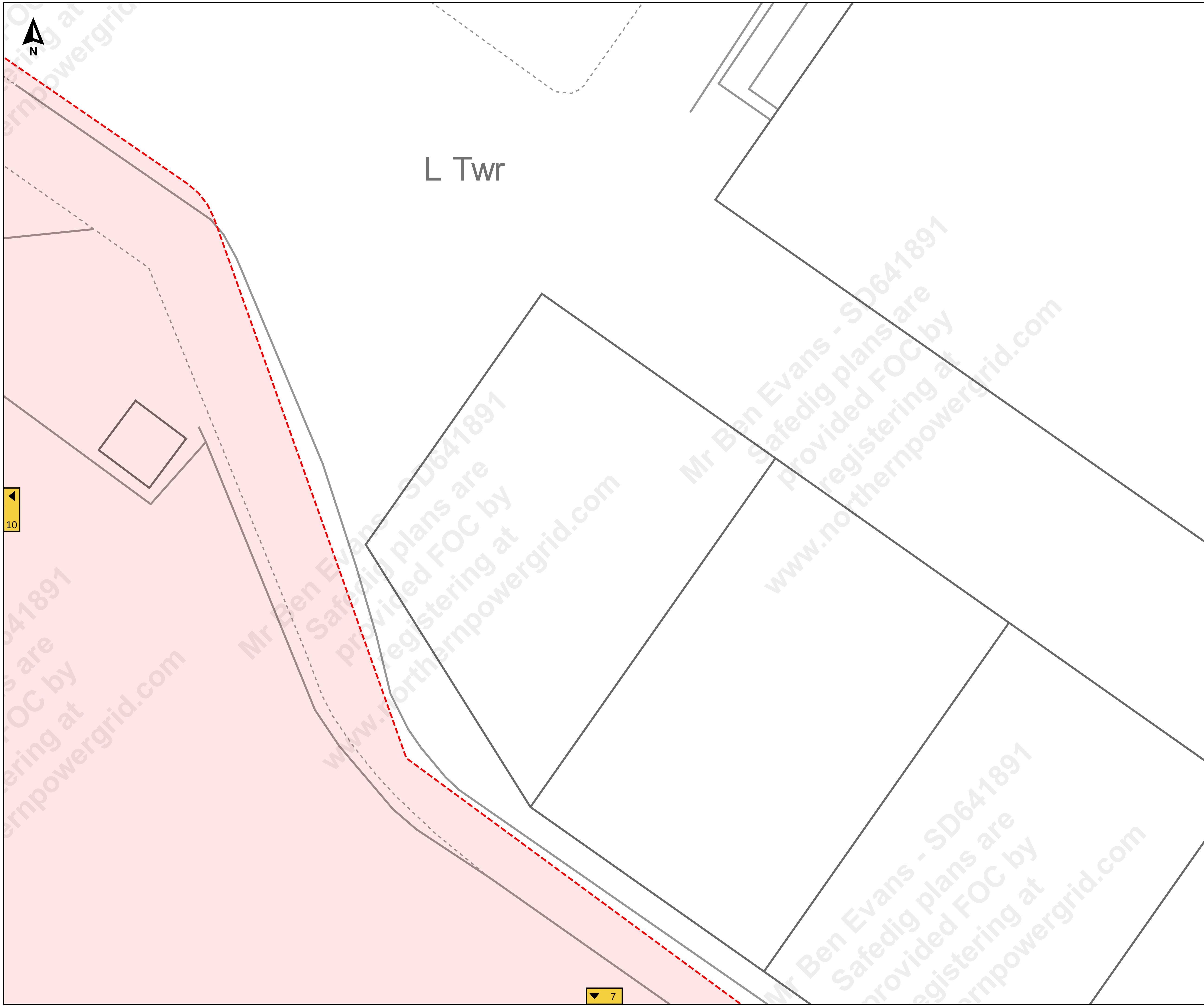
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891
100245_8

Scale : 1:500

Grid Coordinates : 519490 415612

Date : 27/09/2021

Produced For :
Mr Ben Evans

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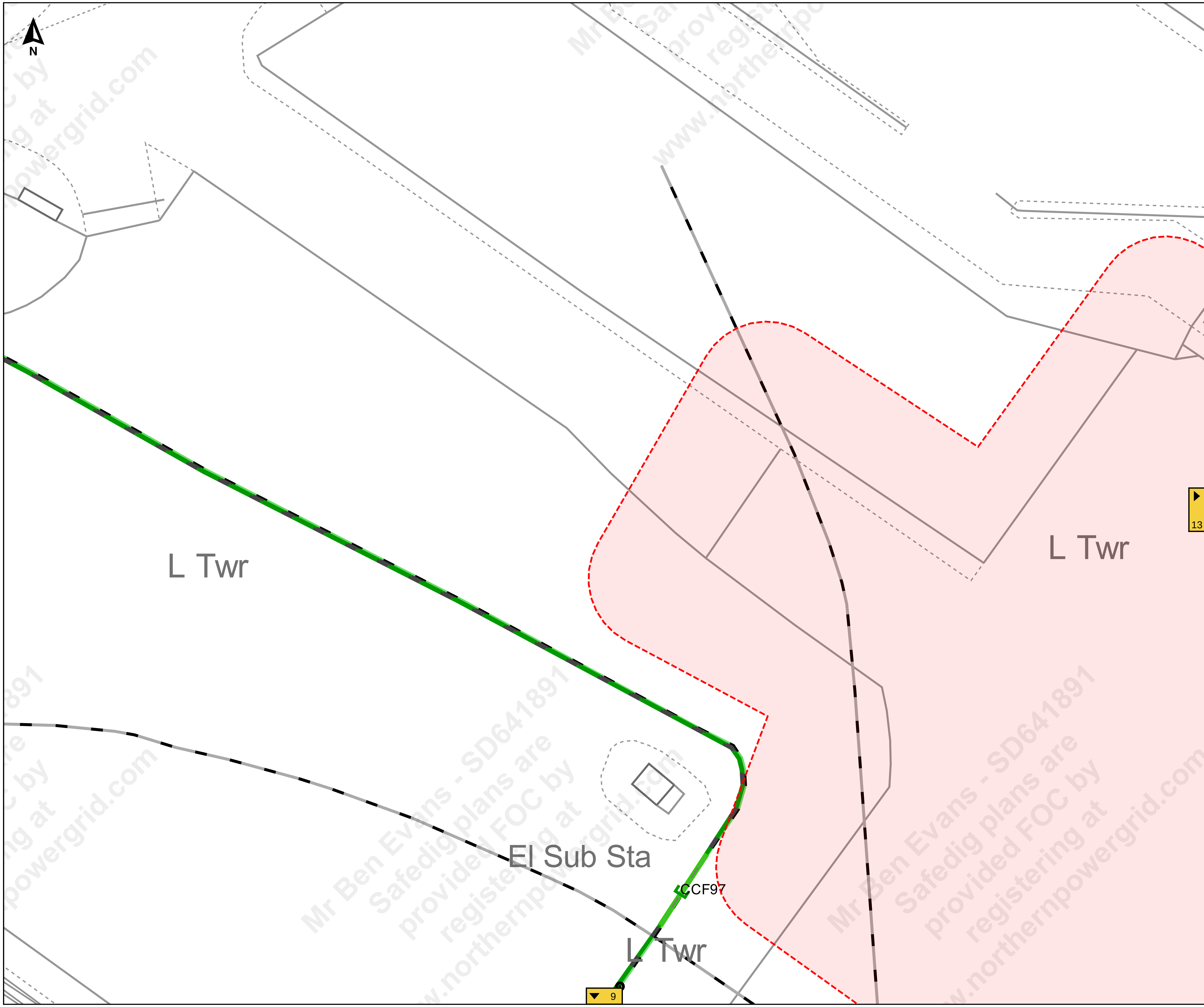
Legend:
Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route
Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891
100245_8

Scale : 1:500

Grid Coordinates : 519156 415751

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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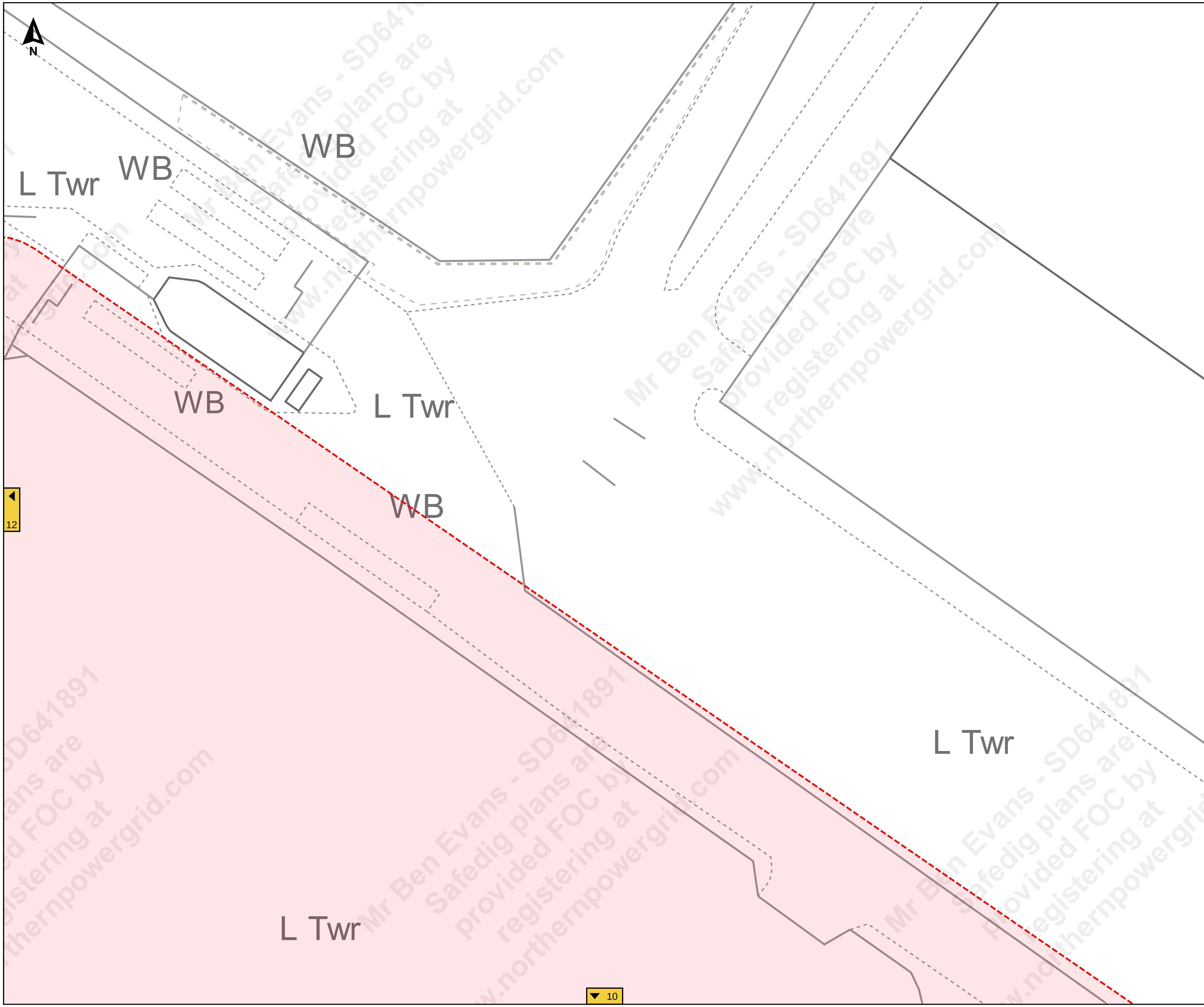
Legend:
Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641891

100245_8

Scale : 1:500

Grid Coordinates : 519323 415751

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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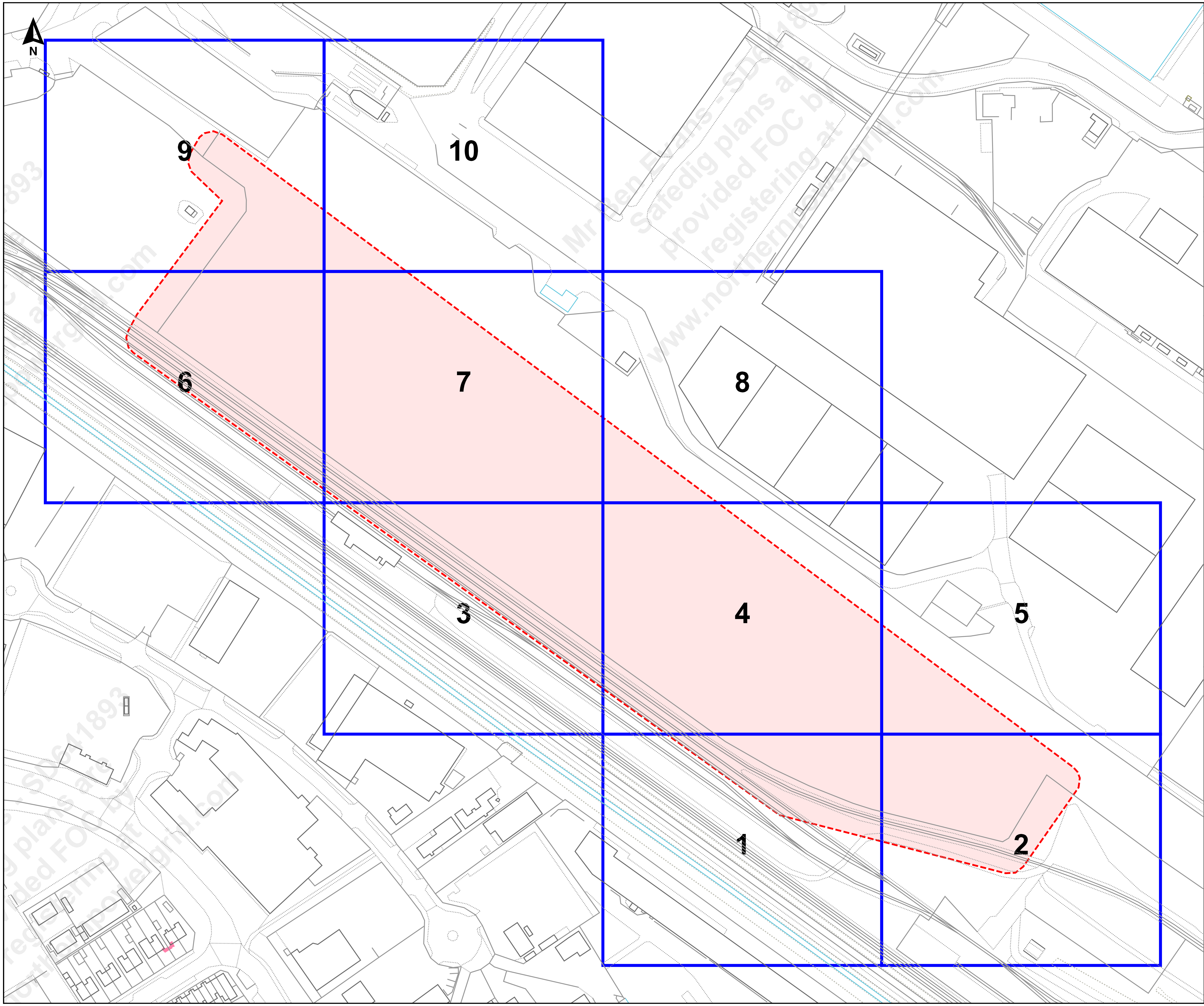
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893

100245_8

Scale : 1:2100

Grid Coordinates : 519411 415536

Date : 27/09/2021

Produced For :
Mr Ben Evans

Overview Page

Terms and Conditions

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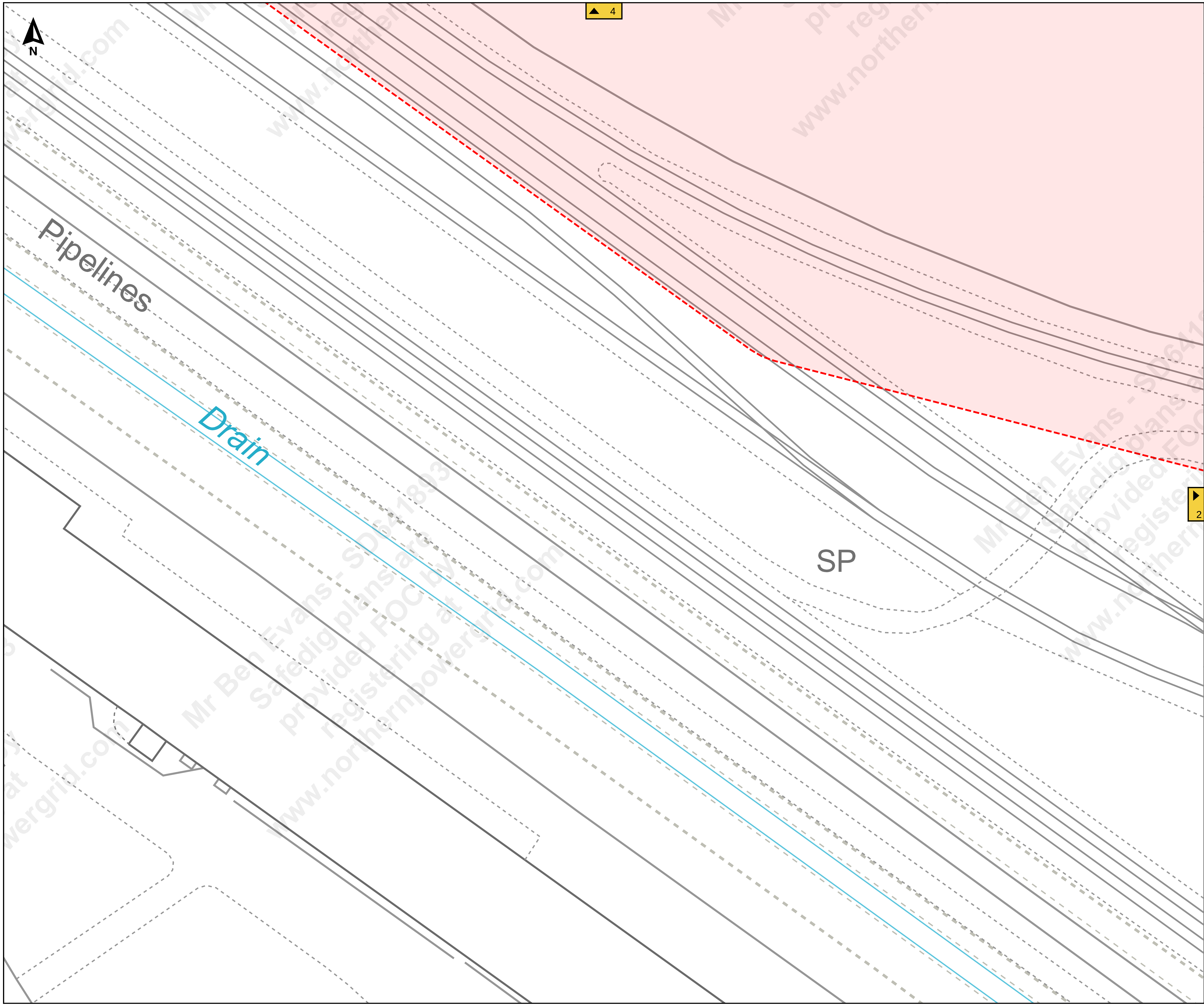
Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 20 40 60 80m



NORTHERN POWERGRID

Job Reference : SD641893

100245_8

Scale : 1:500

Grid Coordinates : 519494 415328

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 1 of 10 (1,10)

Terms and Conditions

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Legend:

Underground Cables:

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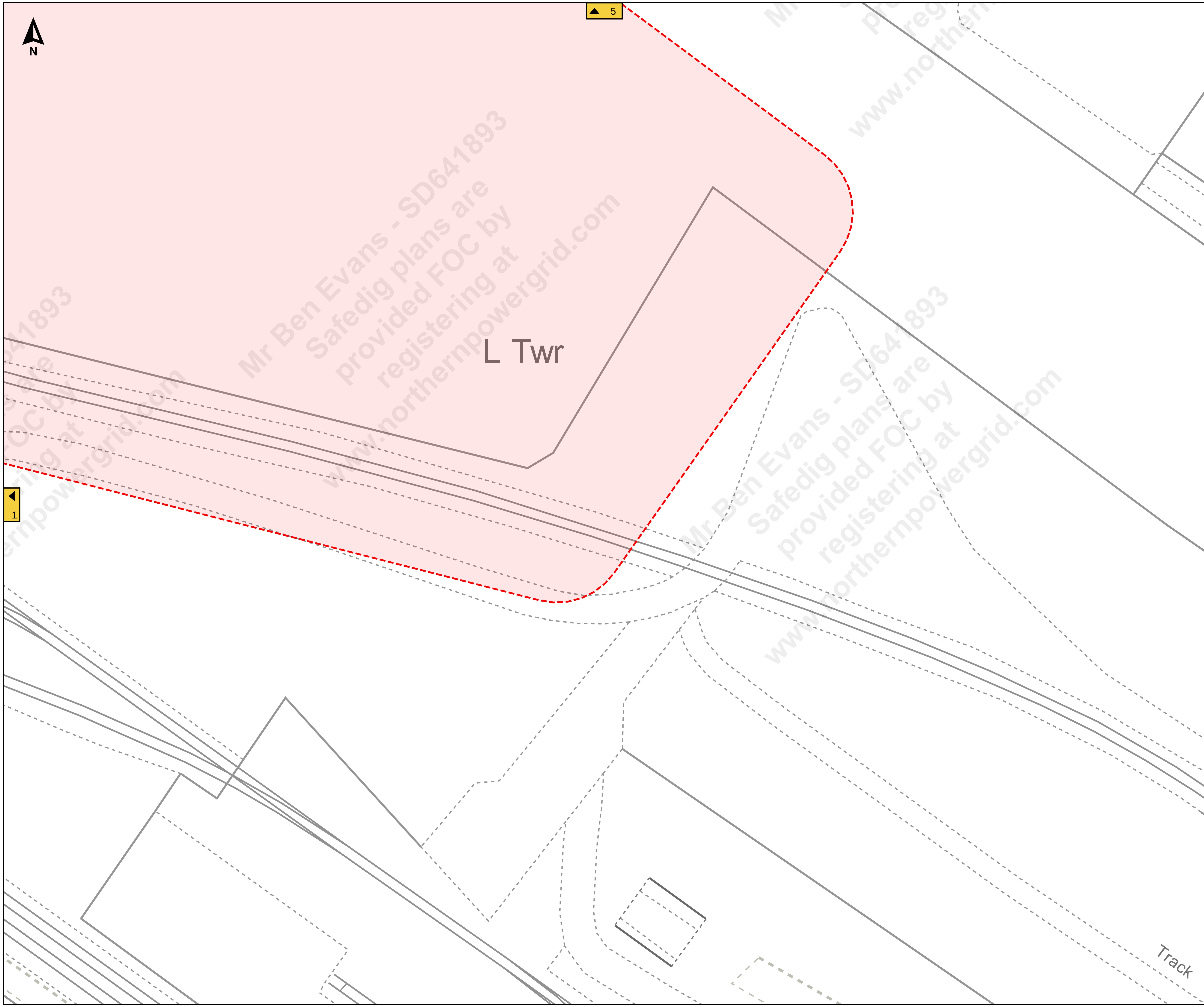
Overhead Conductors:

132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519661 415328

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

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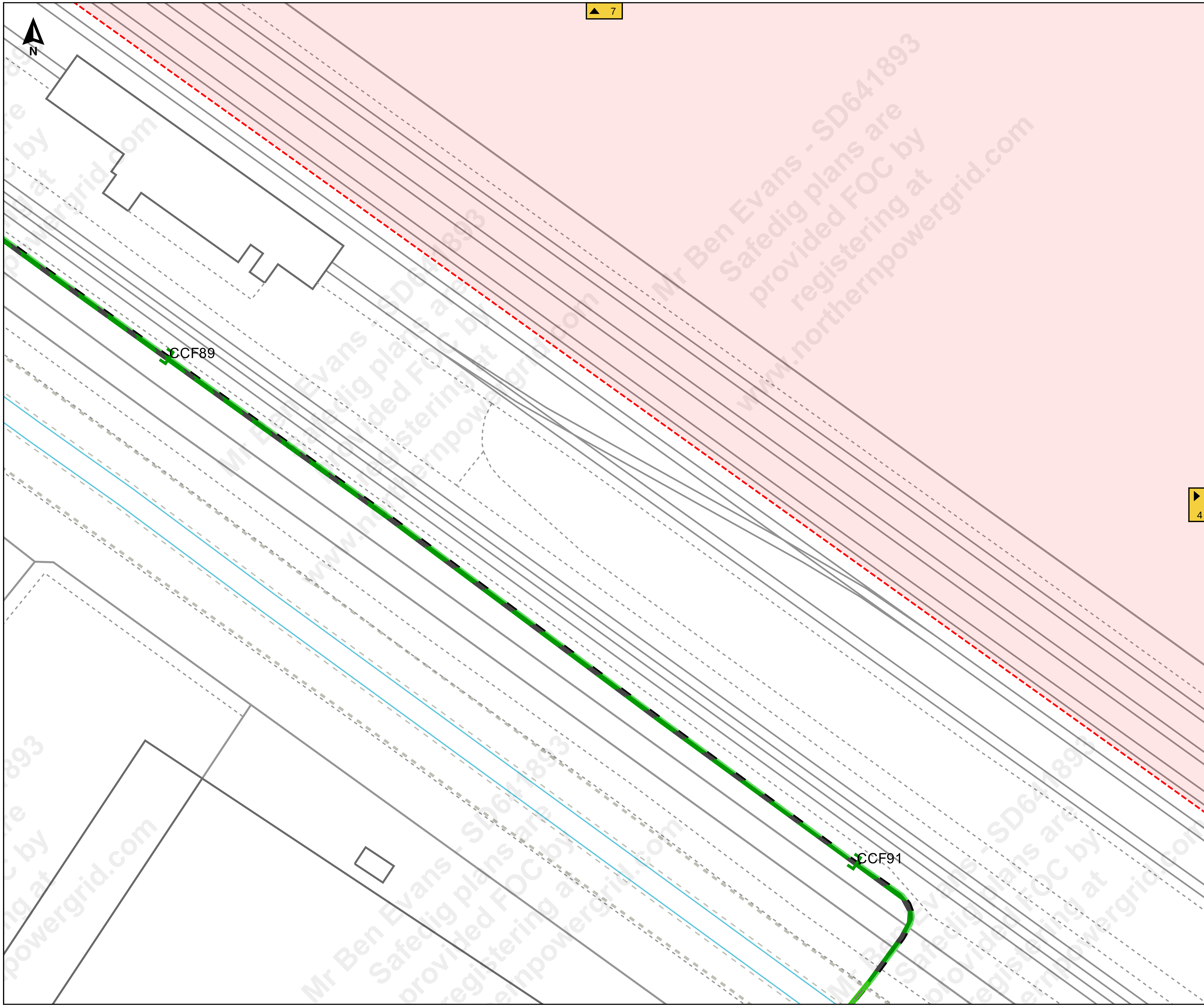
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519327 415467

Date : 27/09/2021

Produced For :
Mr Ben Evans

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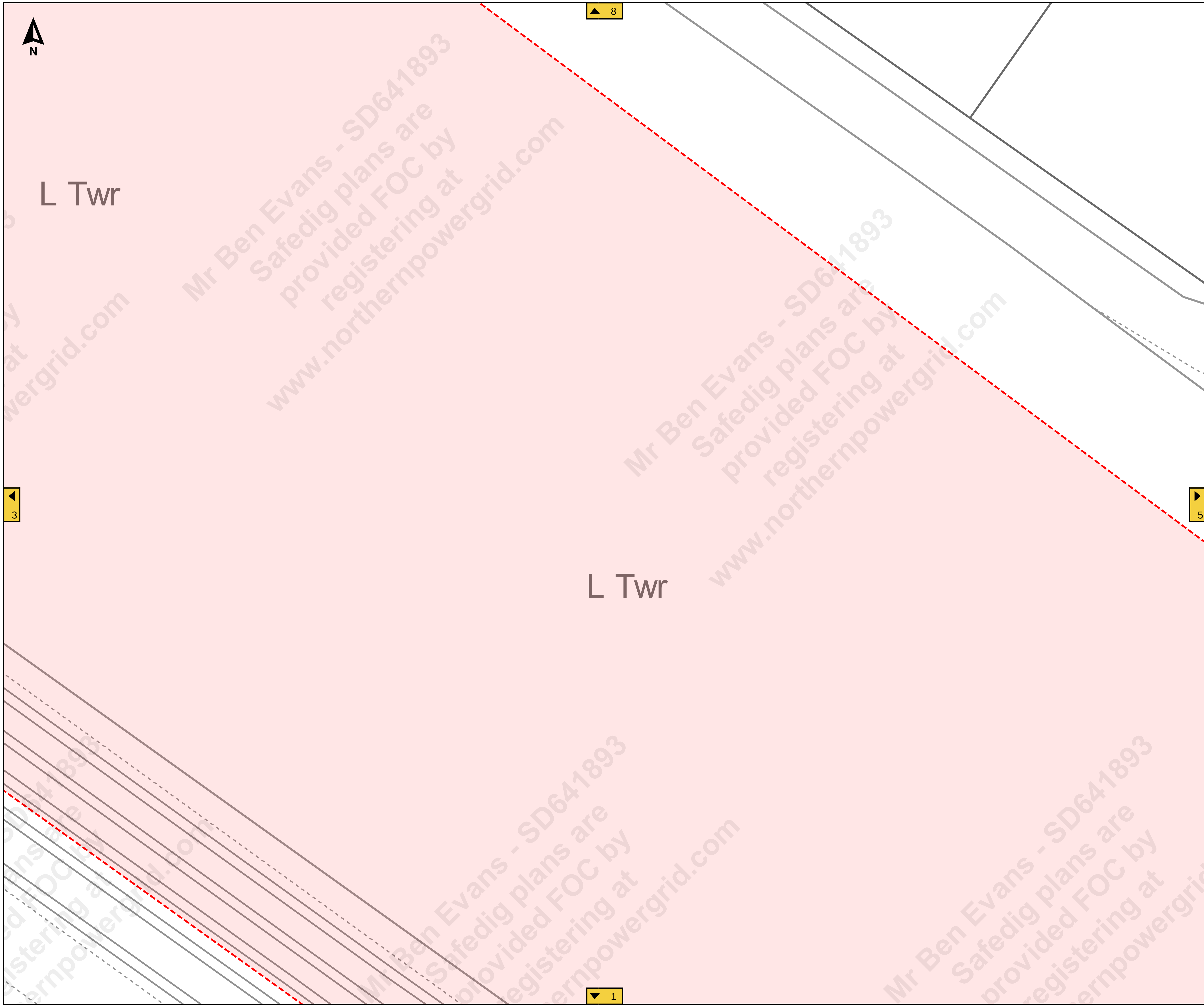
Legend:
Underground Cables:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
Left In Situ
Aux
LV Mains
LV Service
LV Service Assumed Route
LV Service Logical Connection
Duct Route
Overhead Conductors:
132kV
20kV
66kV
11kV
33kV
6kV
25kV
3kV
LV Mains
Aux
LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519494 415467

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 4 of 10 (4,10)

Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines". Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties. Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part. Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

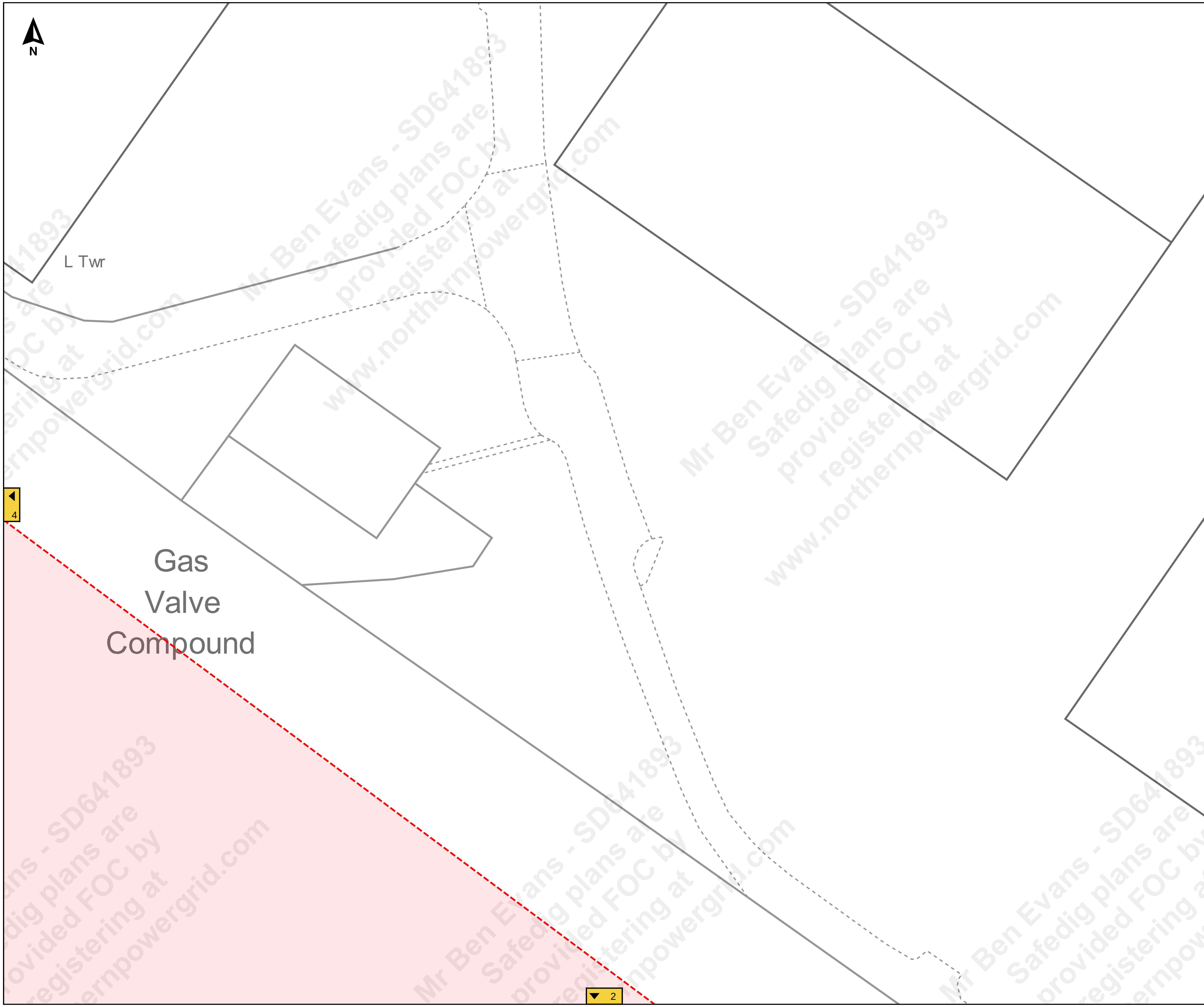
Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519661 415467

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 5 of 10 (5,10)

Terms and Conditions

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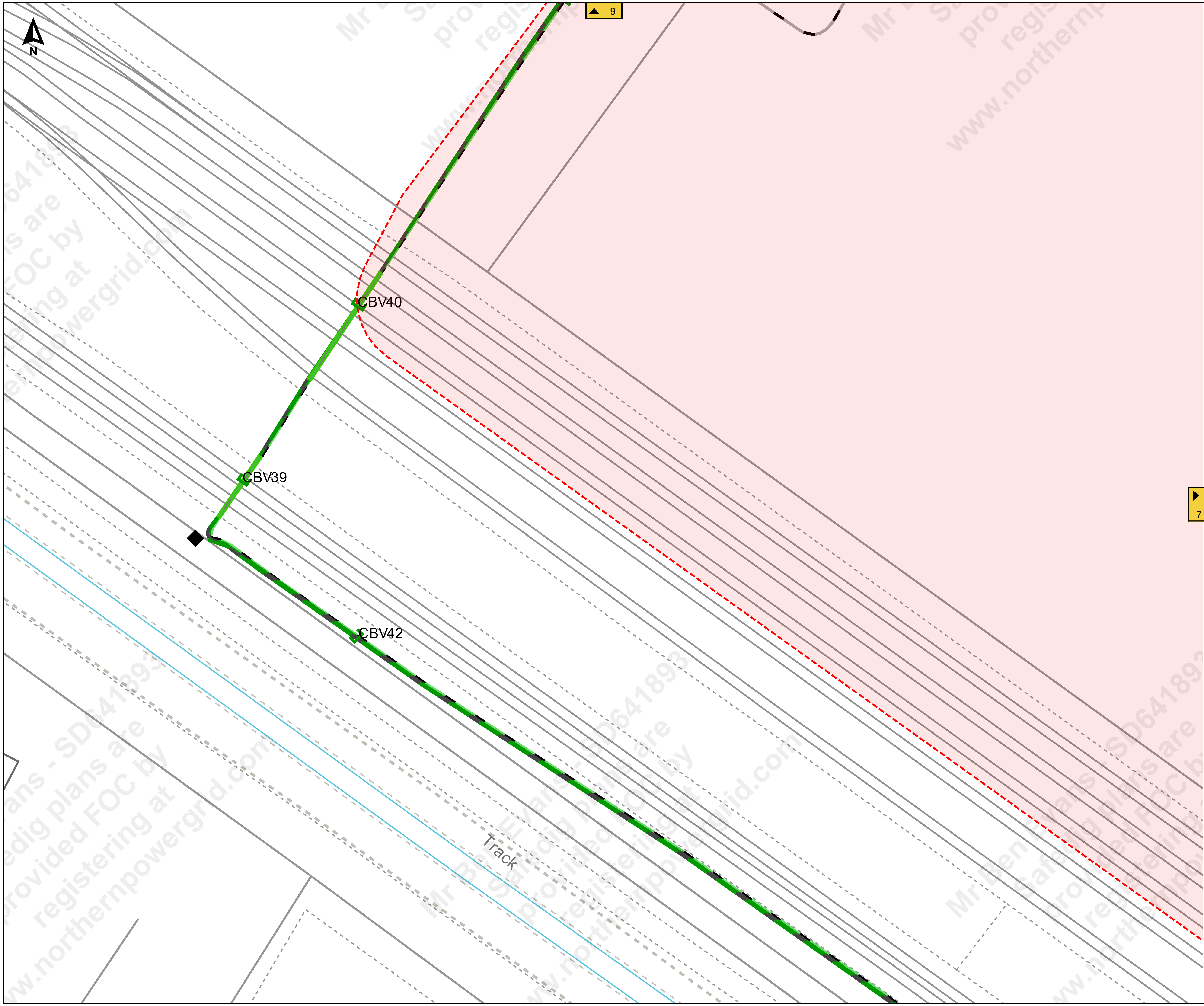
Legend:
Underground Cables:
132kV
66kV
33kV
25kV
Left In Situ
LV Mains
LV Service Assumed Route
LV Service Logical Connection
Duct Route
20kV
11kV
6kV
3kV
Aux
LV Service
Overhead Conductors:
132kV
66kV
33kV
25kV
LV Mains
LV Service
20kV
11kV
6kV
3kV
Aux

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893

100245_8

Scale : 1:500

Grid Coordinates : 519160 415605

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 6 of 10 (6,10)

Terms and Conditions

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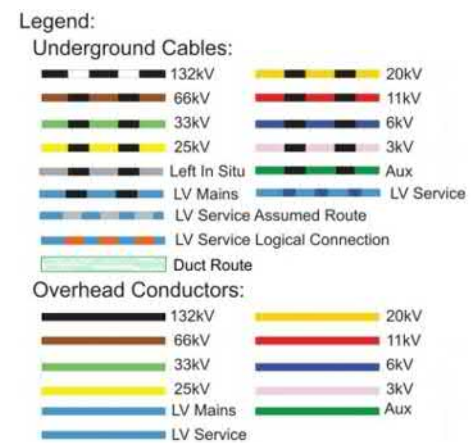

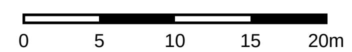

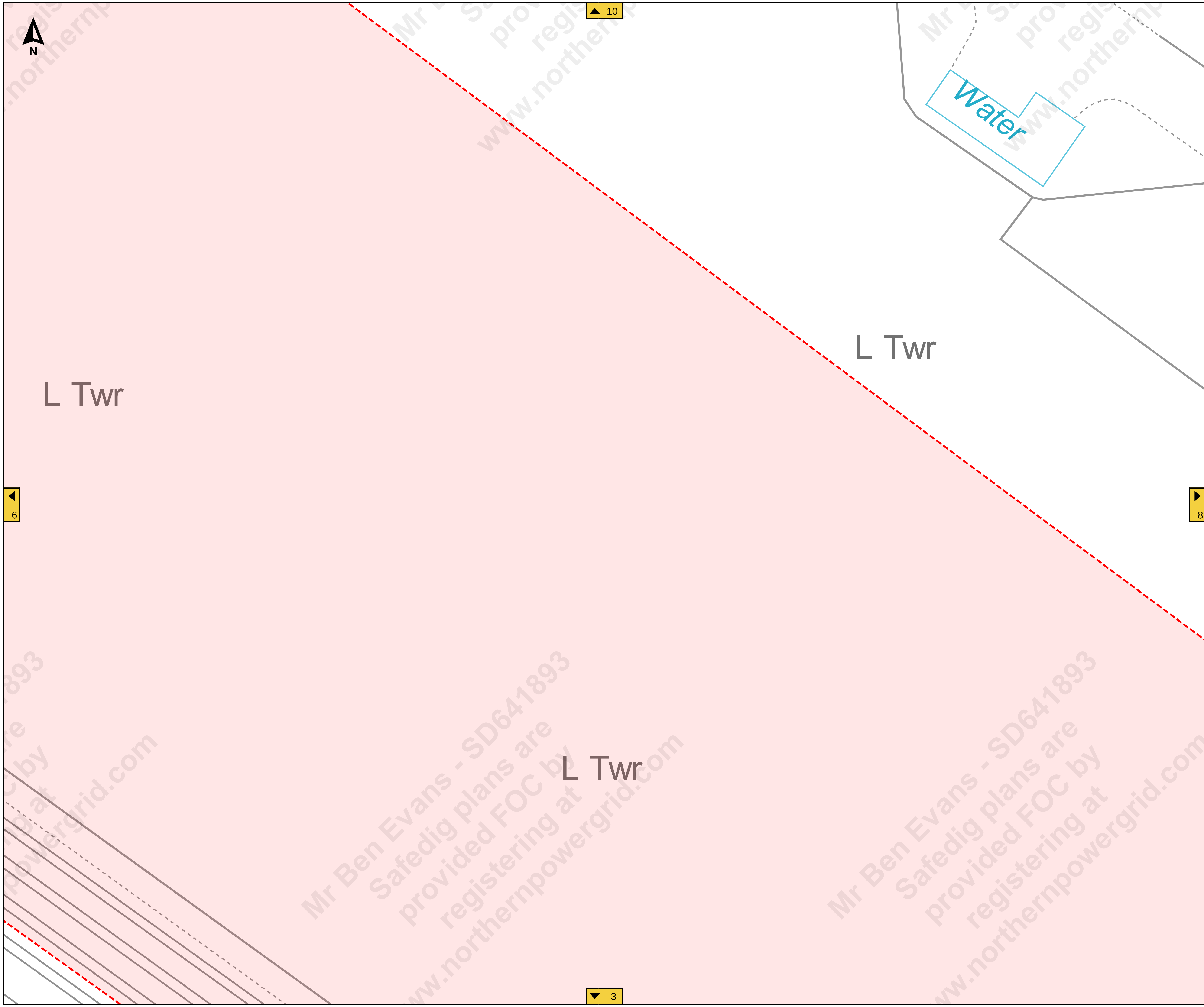

NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519327 415605

Date : 27/09/2021

Produced For :
Mr Ben Evans

Terms and Conditions

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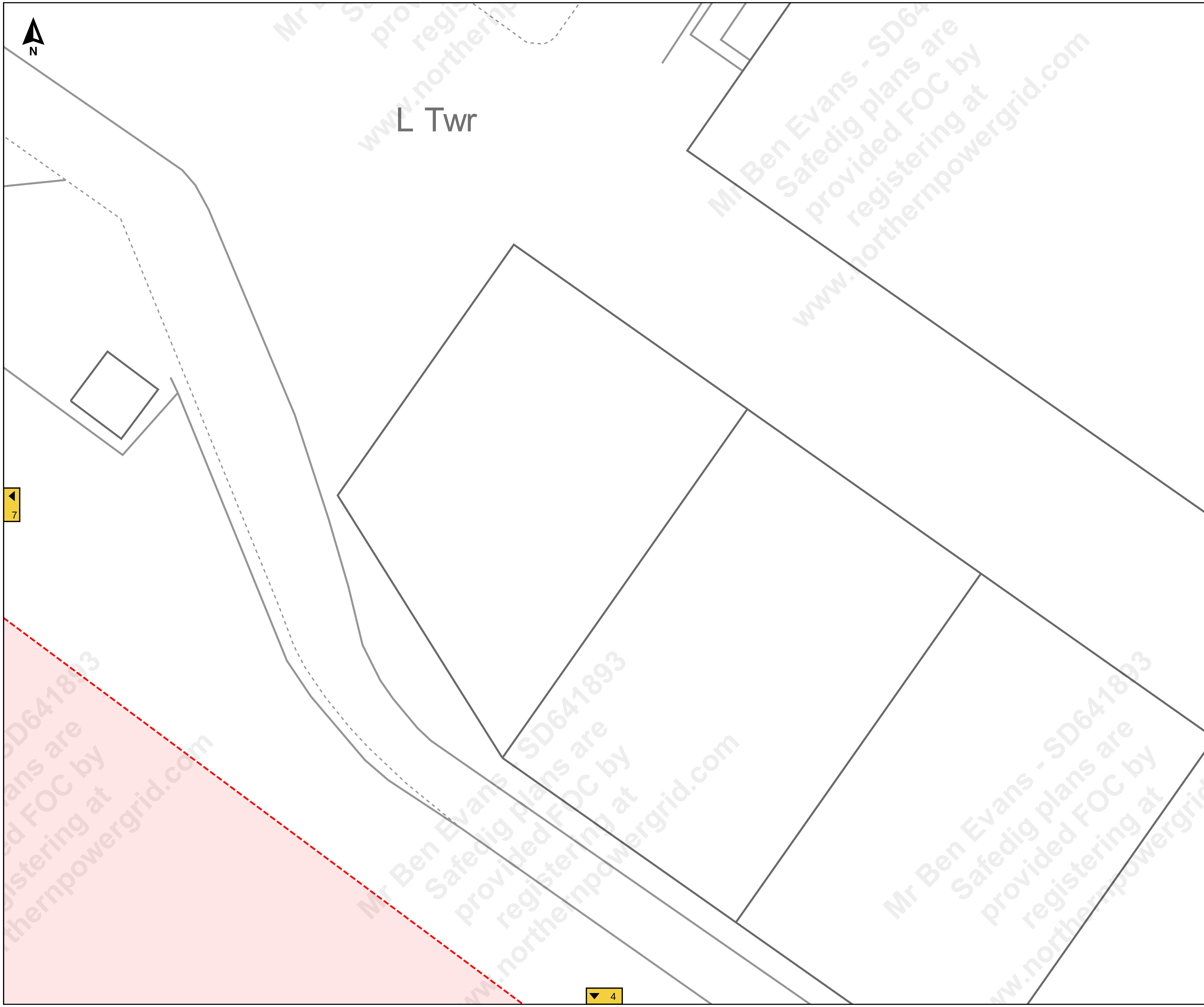
Legend:
Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route
Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519494 415605

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 8 of 10 (8,10)

Terms and Conditions

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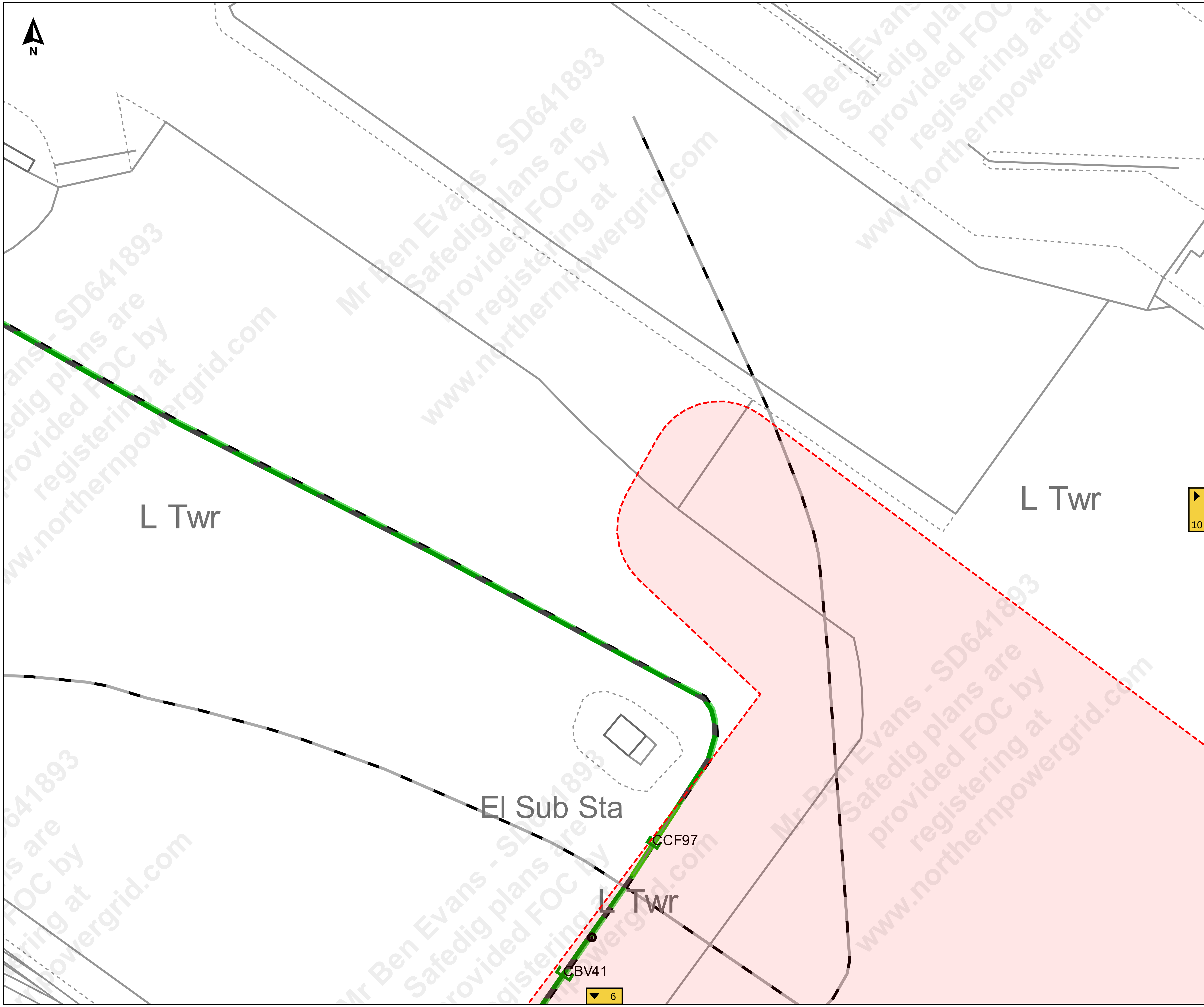
Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893

100245_8

Scale : 1:500

Grid Coordinates : 519160 415744

Date : 27/09/2021

Produced For :
Mr Ben Evans

Page 9 of 10 (9,10)

Terms and Conditions

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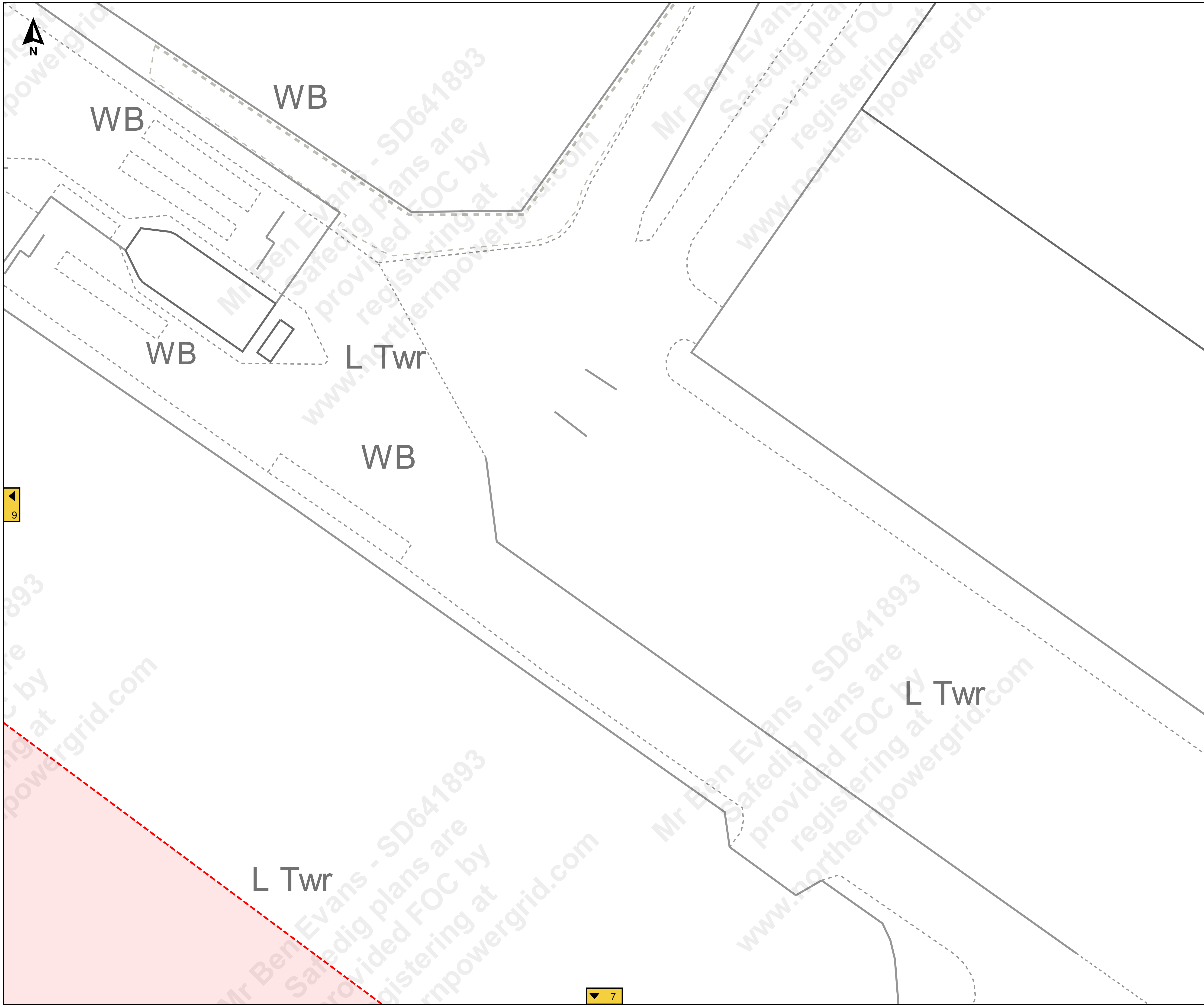
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m



NORTHERN POWERGRID

Job Reference : SD641893
100245_8

Scale : 1:500

Grid Coordinates : 519327 415744

Date : 27/09/2021

Produced For :
Mr Ben Evans

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Legend:

Underground Cables:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, Left In Situ, Aux, LV Mains, LV Service, LV Service Assumed Route, LV Service Logical Connection, Duct Route

Overhead Conductors:
132kV, 20kV, 66kV, 11kV, 33kV, 6kV, 25kV, 3kV, LV Mains, Aux, LV Service

0 5 10 15 20m

NORTHERN POWERGRID

Assume all Northern Powergrid assets are live, unless proved otherwise

Please establish the on-site position of Northern Powergrid assets prior to the commencement of site works

For specialist assistance or enquiries, please use one of the following options:

General enquiries- 0800 011 3332
- Option 1 -Electricity emergency or power cut
- Option 2- Electricity bill enquiries
- Option 3- New connection, disconnection, meter enquiry, increased load, service alteration
- Option 4- Request for Safedig Plans
- Option 5- Other general enquiries; including request for site visit, safe working heights

Public safety emergency line -(0800 151 3255)
- Reports of exposed underground cables, grounded overhead conductors etc.

Network connections or diversions - 0800 011 3433
- Maximum load enquiries, connection quotation

Wayleave enquiries- Northeast (0191 229 4604) or Yorkshire (01977 605 104)
- Queries relating to ownership of assets, wayleave agreements

If site works are to be performed more than 3 months after you have received safe dig plans from Northern Powergrid, it is advisable that you request a more up to date copy.

Call Centre Phone Numbers: If the area is located in: North East call 0800 668877, Yorkshire or North Lincs call 0800 375675.

Northern Powergrid Holdings Company
The position of our equipment is shown on the plan as accurately as possible, it may have changed since the plan was produced. Therefore the position of our equipment and those services which may not be shown should be established on site. Electricity cables not owned by Northern Powergrid Holdings Company may be laid in this area and may not be shown on this plan. Where private cables are shown, the information should not be regarded as accurate and should be used for guidance purposes only. In all cases, accurate information should be obtained from the owner of such cables prior to the commencement of work on site.

Reference should be made to HSE Guidance, HS(G)47 '*Avoiding Danger from Underground Services*' and GS6 '*Avoidance of Danger from Overhead Power Lines*'.

Legend:

Underground Cables:

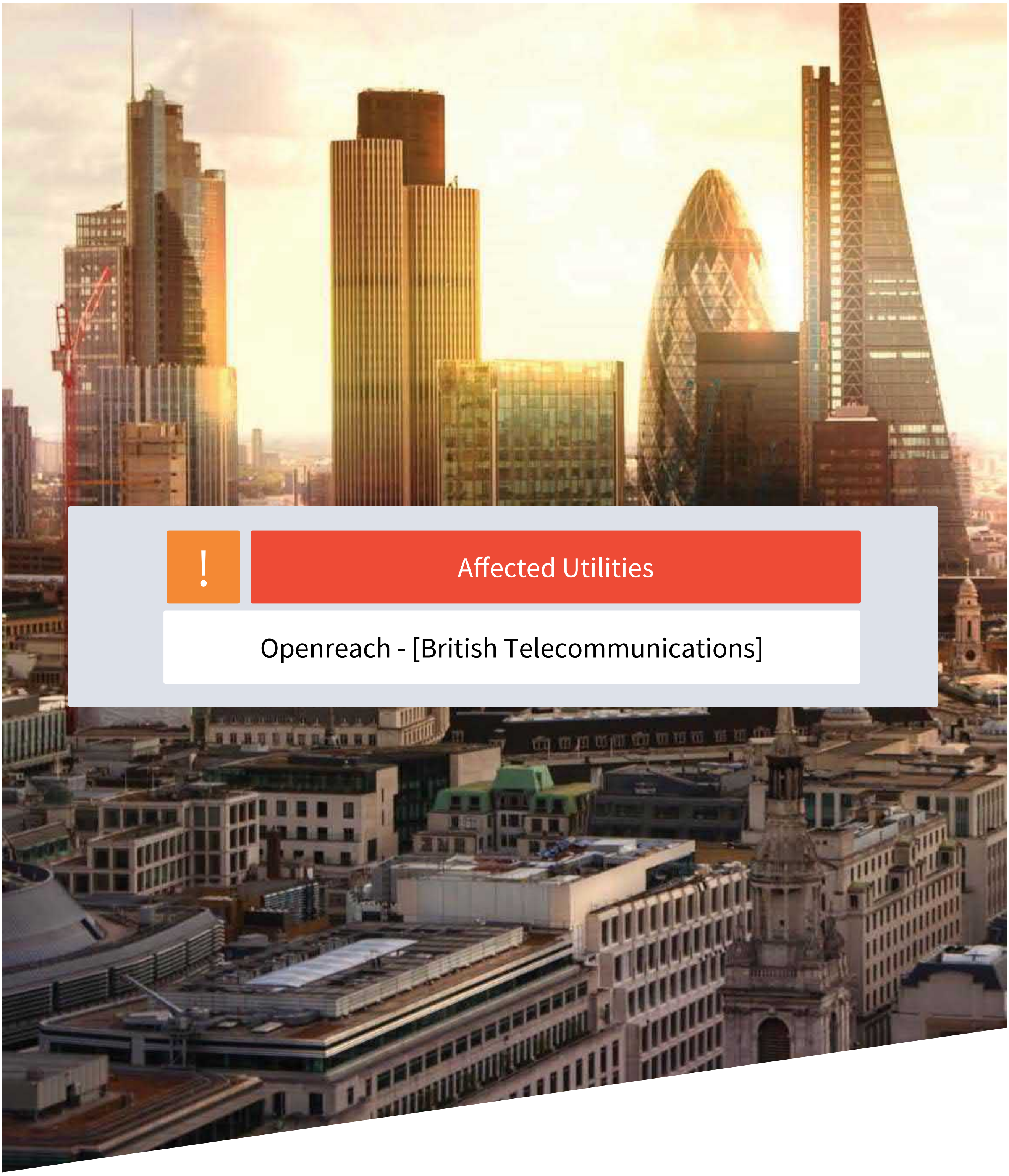
132kV	20kV	LV Mains
66kV	11kV	LV Service
33kV	6kV	LV Service Assumed Route
25kV	3kV	LV Service Logical Connection
Left In Situ	Aux	

Overhead Conductors:

132kV	20kV	LV Mains
66kV	11kV	LV Service
33kV	6kV	Aux
25kV	3kV	

Date Printed:

Scale: 1:



!

Affected Utilities

Openreach - [British Telecommunications]

Landmark®
INFORMATION

Our Ref: Ref shown on map

Date of issue: shown on map

email: nnhc@openreach.co.uk

Dear Customer,

NR & SW ACT 1991 – PROPOSED WORKS AT: ****SITE LOCATION****

Prior to commencement of work: For free onsite guidance and accurate up to date location of BT Apparatus please contact our Plant Protection Service by the following methods:-

Email the Click Before You Dig Team CBYD@openreach.co.uk
Visit the Click Before You Dig Website [redacted]

Thank you for your request of **/**/** describing the above proposals.

Enclosed are copies of our drawings marked up to show the approximate locations of BT apparatus in the immediate vicinity of your works. It is intended for general guidance only. No guarantee is given of its accuracy.

The drawings are valid for 90 days from the date of issue and should not be relied upon after this time period has expired.

When planning excavation work or other works near to BT apparatus, please be mindful our apparatus may exist at various depths and may deviate from the marked route.

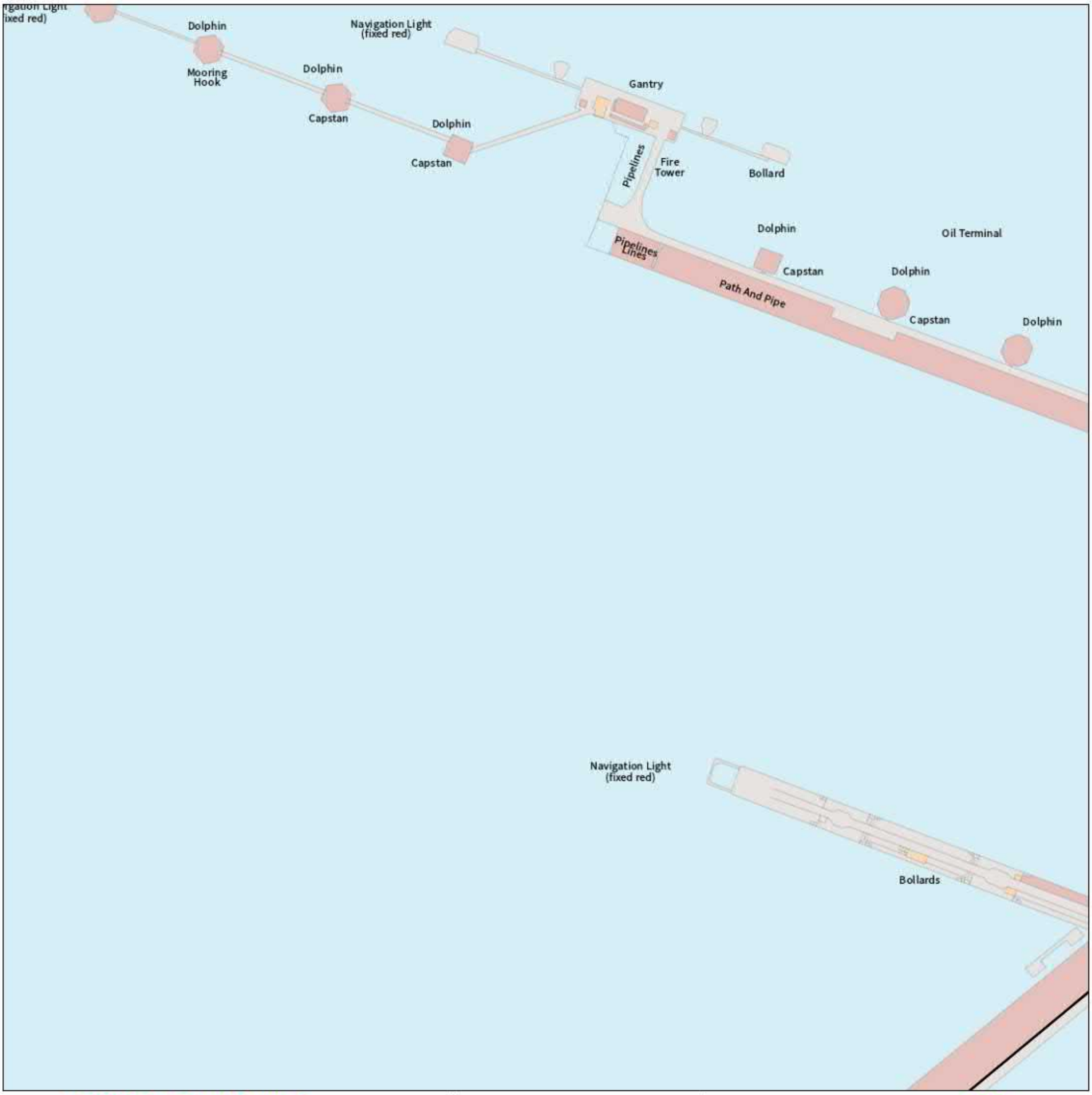
To avoid damage it is recommended that mechanical excavators or borers are not used within 600mm of BT apparatus. If scaffolding is erected, please ensure that our equipment is not enclosed, blocked, covered or otherwise obstructed by the scaffolding.

In the event of BT apparatus being in the area of your works we recommend that your plant/vehicle crossing is either resited, or apply for a budget estimate by submitting detailed plans to our Network Relocation Team at [redacted]

Yours faithfully,

Julie Cullum
NNHC & MBE Manager

Maps by email Plant Information Reply



IMPORTANT WARNING

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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

Accidents happen

If you do damage any Openreach equipment please let us know by calling 0800 023 2023 (opt 1 + opt 1) and we can get it fixed ASAP

KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

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

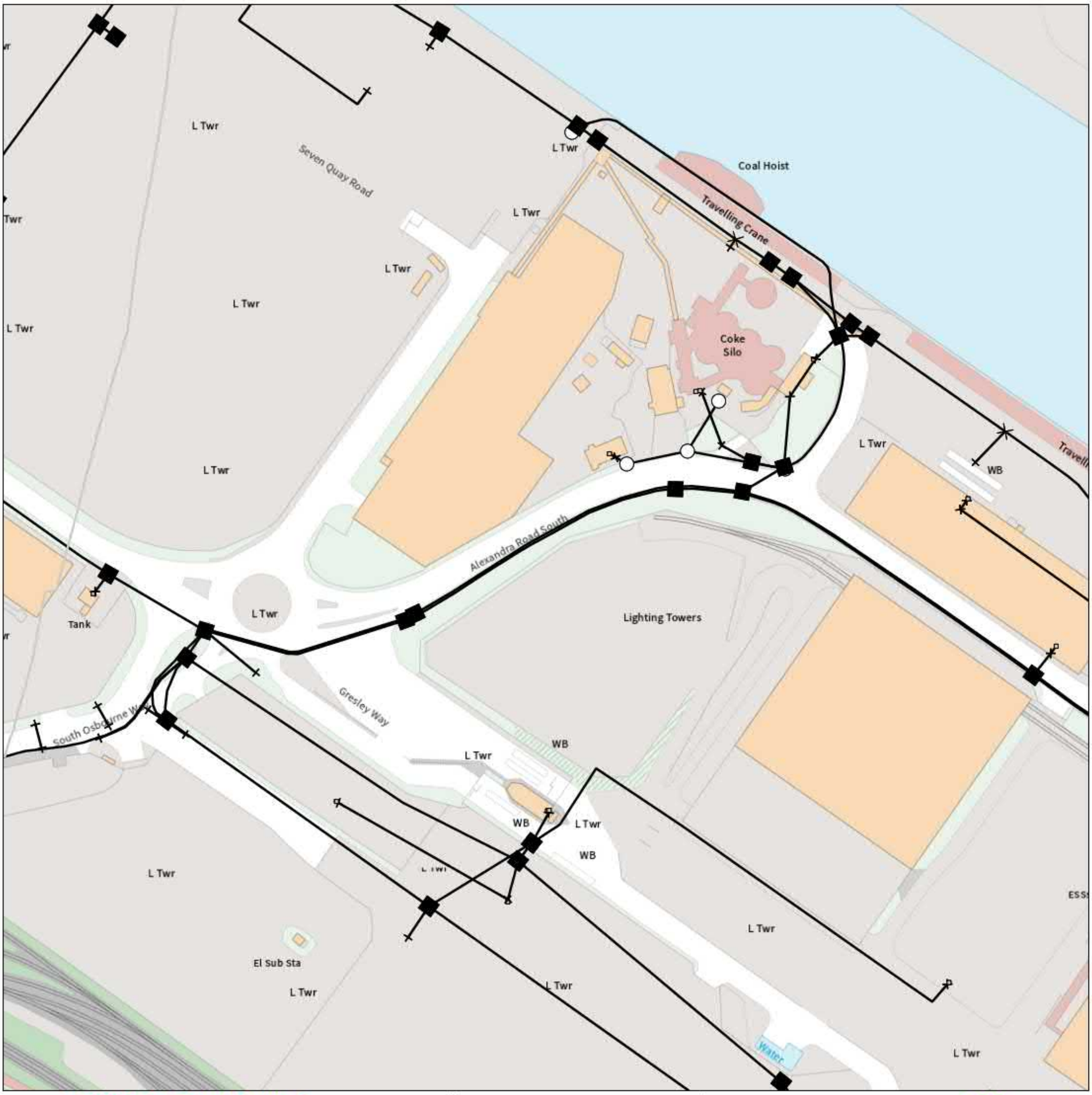
Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : WHC02239W
Map Reference : (centre) TA2113416356
Easting/Northing : (centre) 521134,416356
Issued : 27/09/2021 14:23:59

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS						
	Planned	*Live*	Change Of State	+	Hatchings	
PCP			Split Coupling	×	Built	
Pole			Duct Tee	▲	Planned	
Box			Building		Inferred	
Manhole			Kiosk	Ⓚ	Duct	
Cabinet						

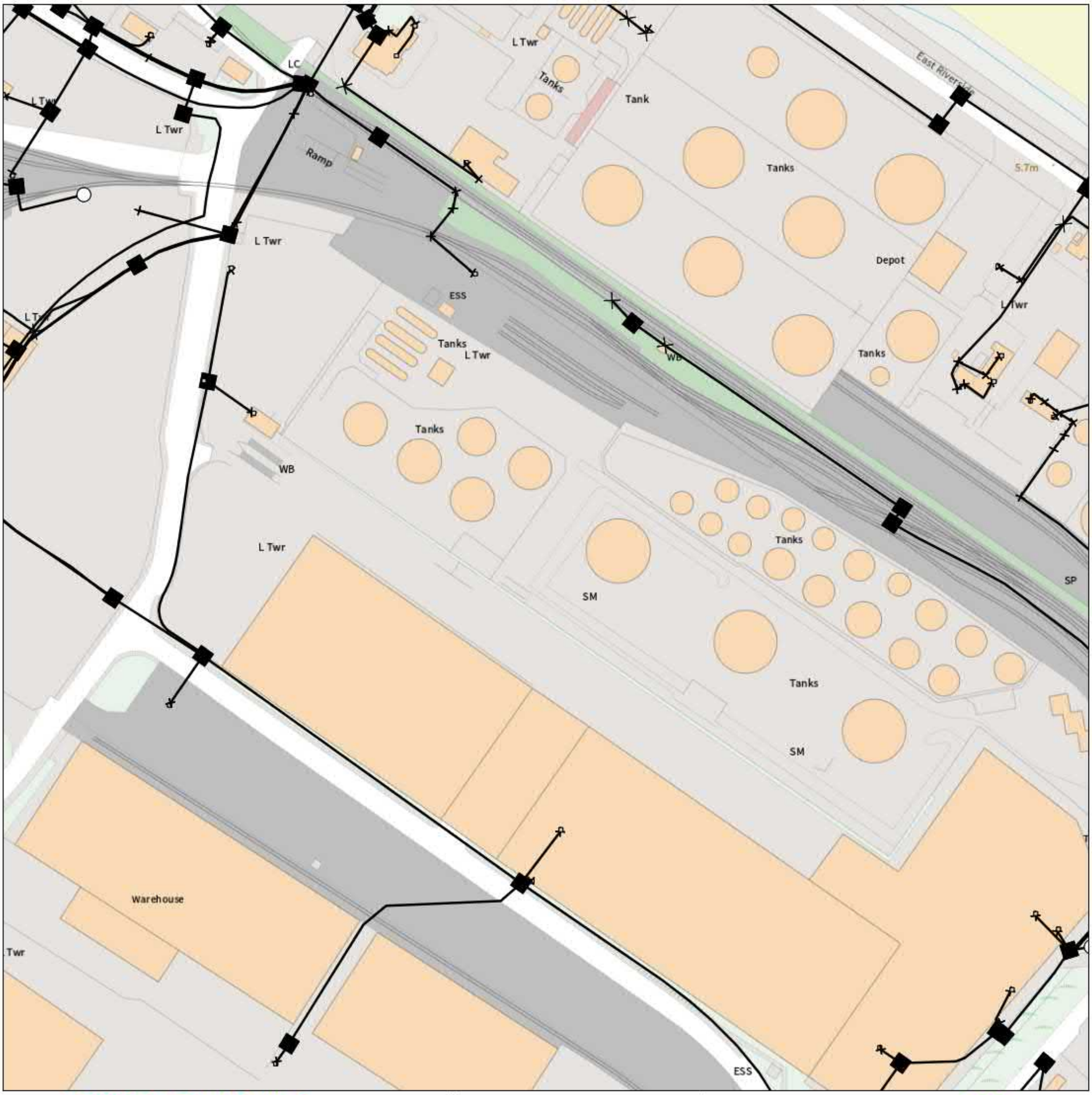
Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : EZP02231G
Map Reference : (centre) TA1927615891
Easting/Northing : (centre) 519276,415891
Issued : 27/09/2021 14:24:01

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS

	Planned	*Live*
PCP		
Pole		
Box		
Manhole		
Cabinet		

Change Of State	+	Hatchings	
Split Coupling	×	Built	
Duct Tee	▲	Planned	
Building		Inferred	
Kiosk	Ⓚ	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 : VSM02237B
Map Reference : (centre) TA2020515891
Easting/Northing : (centre) 520205,415891
Issued : 27/09/2021 14:24:06

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

Maps by email Plant Information Reply

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KEY TO BT SYMBOLS	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

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

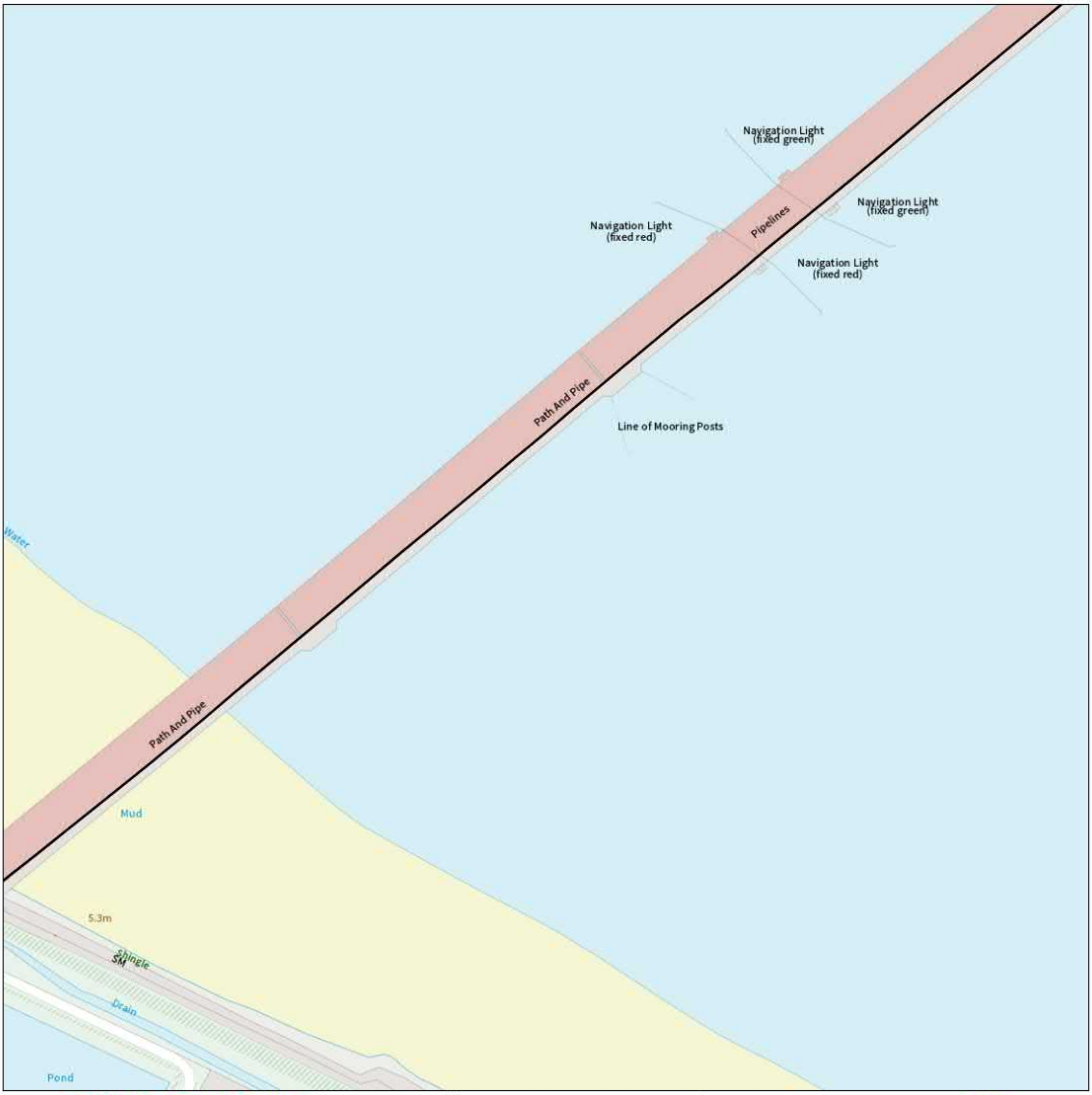
Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : EXG02231J
Map Reference : (centre) TA2067015891
Easting/Northing : (centre) 520670,415891
Issued : 27/09/2021 14:24:07

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS			Change Of State	+	Hatchings	
	Planned	*Live*	Split Coupling	×	Built	
PCP			Duct Tee	▲	Planned	
Pole			Building		Inferred	
Box			Kiosk	Ⓚ	Duct	
Manhole						
Cabinet						

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 : TKN02249L
Map Reference : (centre) TA2113415891
Easting/Northing : (centre) 521134,415891
Issued : 27/09/2021 14:24:09

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Maps by email Plant Information Reply

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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

Accidents happen

If you do damage any Openreach equipment please let us know by calling 0800 023 2023 (opt 1 + opt 1) and we can get it fixed ASAP

KEY TO BT SYMBOLS			Change Of State	+	Hatchings	
	Planned	Live	Split Coupling	×	Built	
PCP			Duct Tee	▲	Planned	
Pole			Building		Inferred	
Box			Kiosk	K	Duct	
Manhole						
Cabinet						

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 : NWQ02245X
Map Reference : (centre) TA1927615426
Easting/Northing : (centre) 519276,415426
Issued : 27/09/2021 14:24:22

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

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.

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KEY TO BT SYMBOLS

	Planned	Live				
PCP			Change Of State	+	Hatchings	
Pole			Split Coupling	×	Built	
Box			Duct Tee	▲	Planned	
Manhole			Building		Inferred	
Cabinet			Kiosk	Ⓚ	Duct	

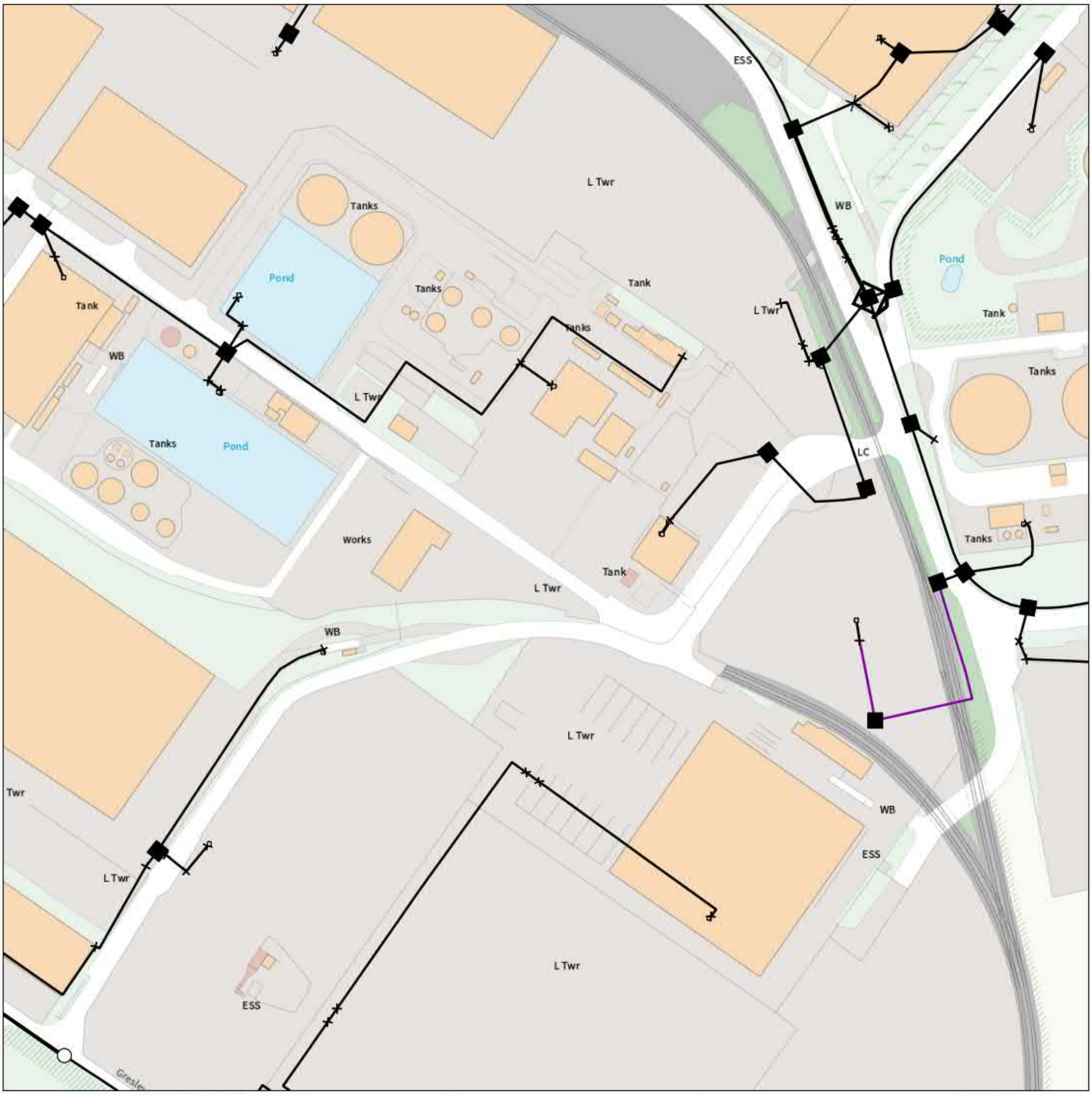
Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : OUG02244F
Map Reference : (centre) TA1974115426
Easting/Northing : (centre) 519741,415426
Issued : 27/09/2021 14:24:24

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS	Planned	Live				
			Change Of State	+	Hatchings	
			Split Coupling	×	Built	
PCP			Duct Tee	▲	Planned	
Pole			Building		Inferred	
Box			Kiosk	Ⓚ	Duct	
Manhole						
Cabinet						

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 : UHM02249A
Map Reference : (centre) TA2020515426
Easting/Northing : (centre) 520205,415426
Issued : 27/09/2021 14:24:26

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

Maps by email Plant Information Reply

IMPORTANT WARNING

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KEY TO BT SYMBOLS

	Planned	Live				
			Change Of State	+	Hatchings	
			Split Coupling	×	Built	
PCP			Duct Tee	▲	Planned	
Pole			Building		Inferred	
Box			Kiosk		Duct	
Manhole						
Cabinet						

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 : VYK02246U
Map Reference : (centre) TA2067015426
Easting/Northing : (centre) 520670,415426
Issued : 27/09/2021 14:24:29

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

Maps by email Plant Information Reply

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KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

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

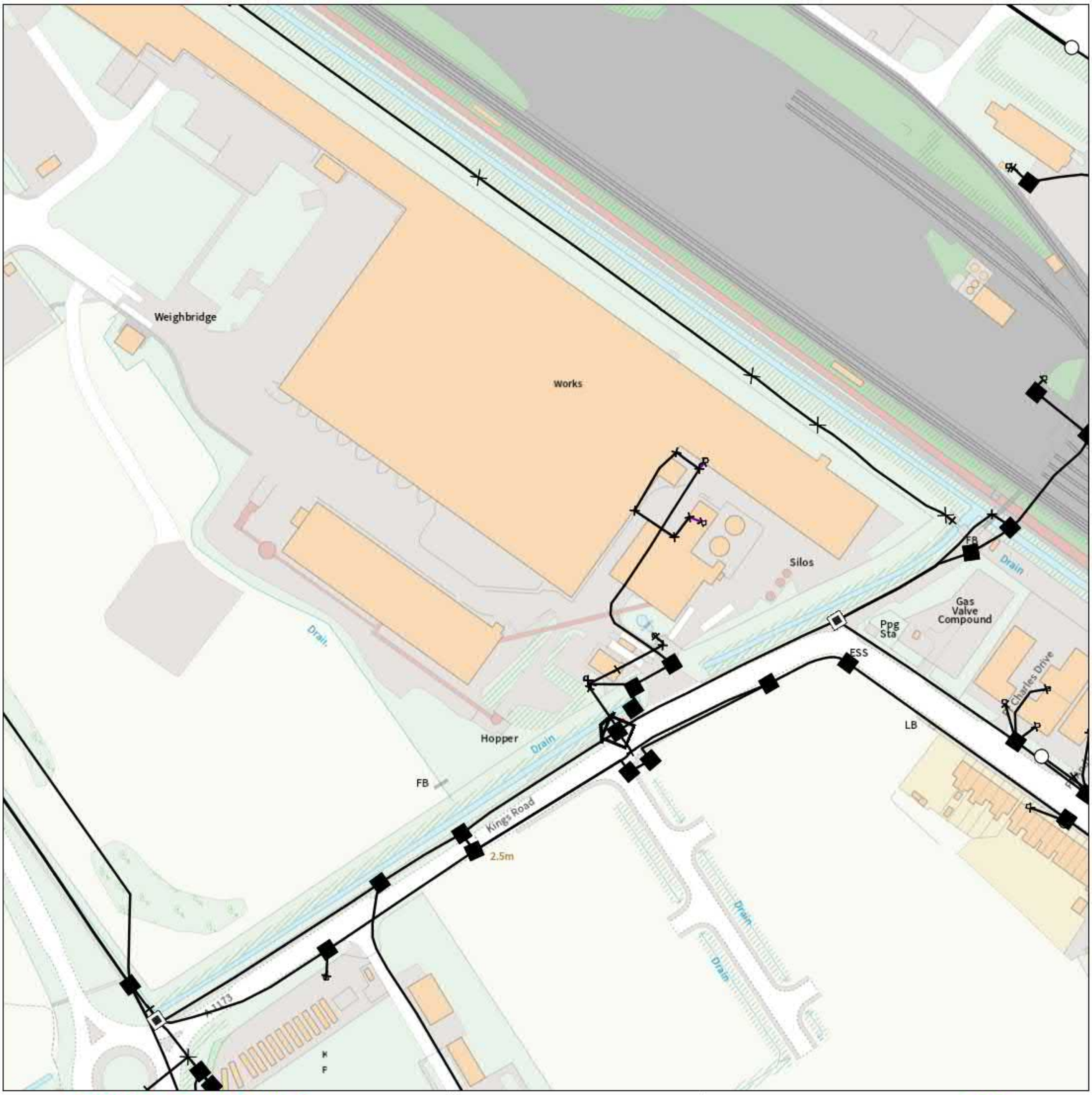
Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : MPU02241H
Map Reference : (centre) TA2113415426
Easting/Northing : (centre) 521134,415426
Issued : 27/09/2021 14:24:31

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

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

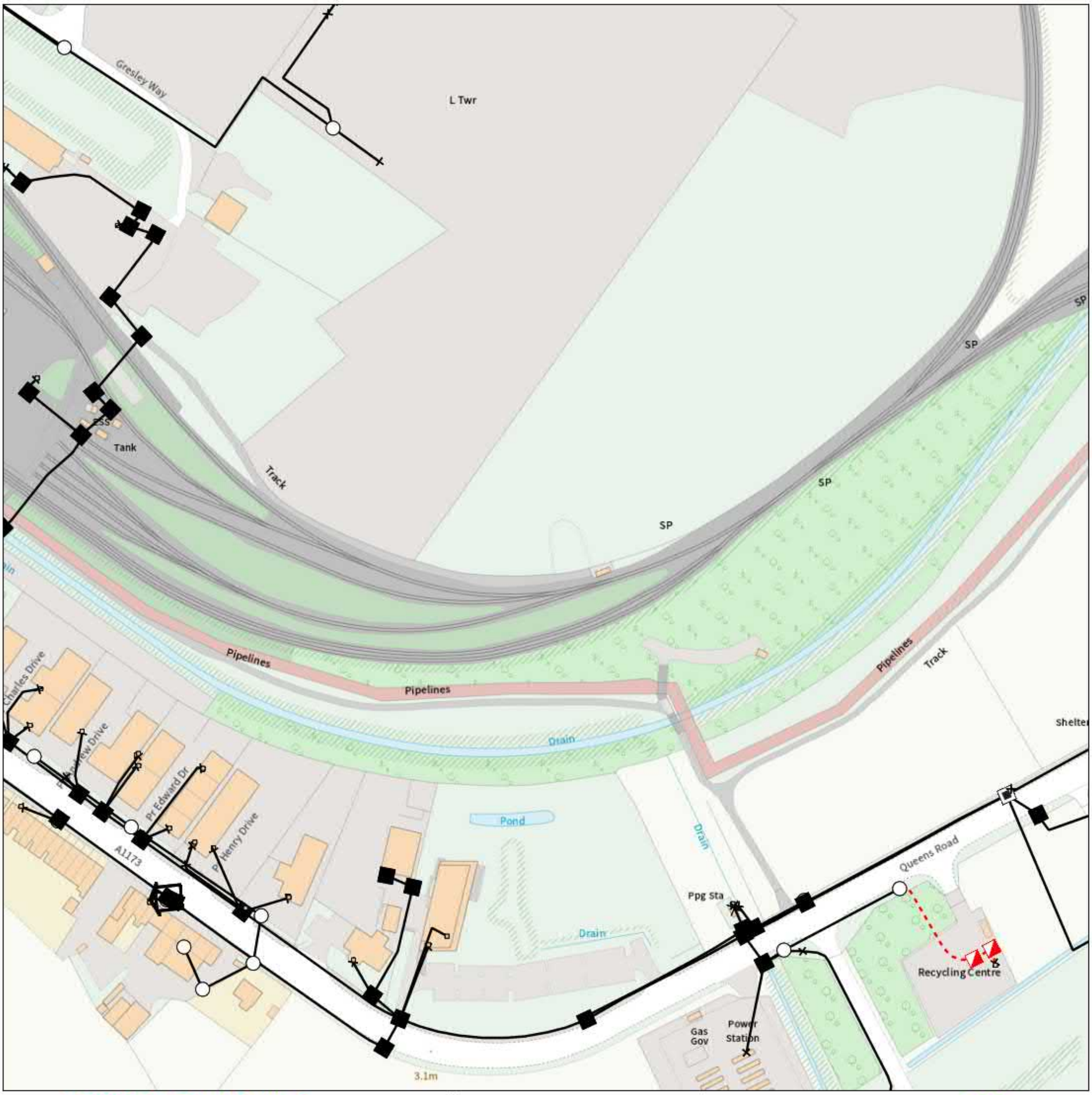
Other proposed plant is shown using dashed lines. BT Symbols not listed above may be disregarded. Existing BT Plant may not be recorded. Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : VYF02249Y
Map Reference : (centre) TA1974114962
Easting/Northing : (centre) 519741,414962
Issued : 27/09/2021 14:24:44

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

Change Of State	+
Split Coupling	×
Duct Tee	▲
Building	
Kiosk	Ⓚ

Hatchings	
Built	
Planned	
Inferred	
Duct	

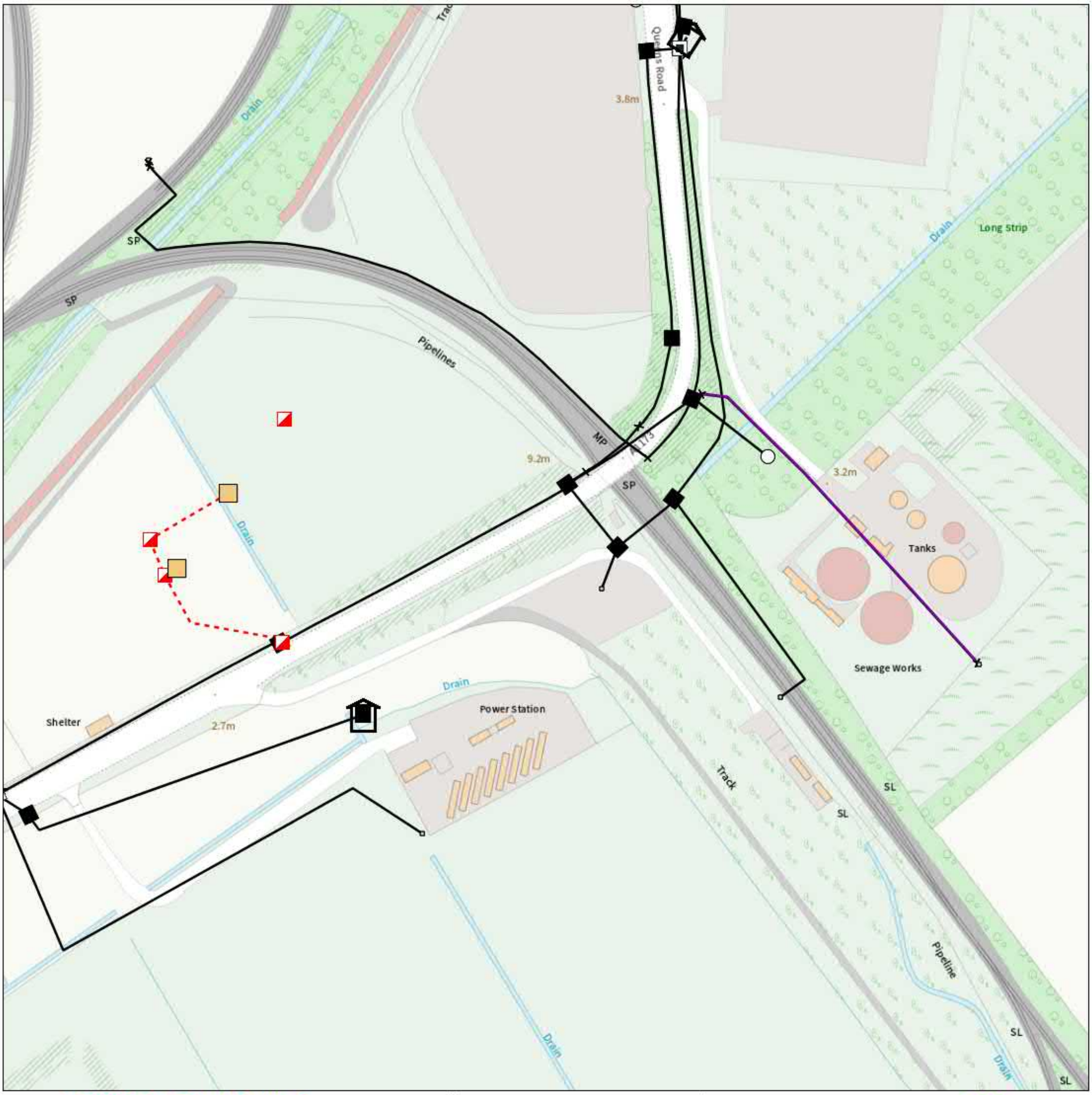
Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

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

BT Ref : QTN02241B
Map Reference : (centre) TA2020514962
Easting/Northing : (centre) 520205,414962
Issued : 27/09/2021 14:24:45

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

Maps by email Plant Information Reply



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KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

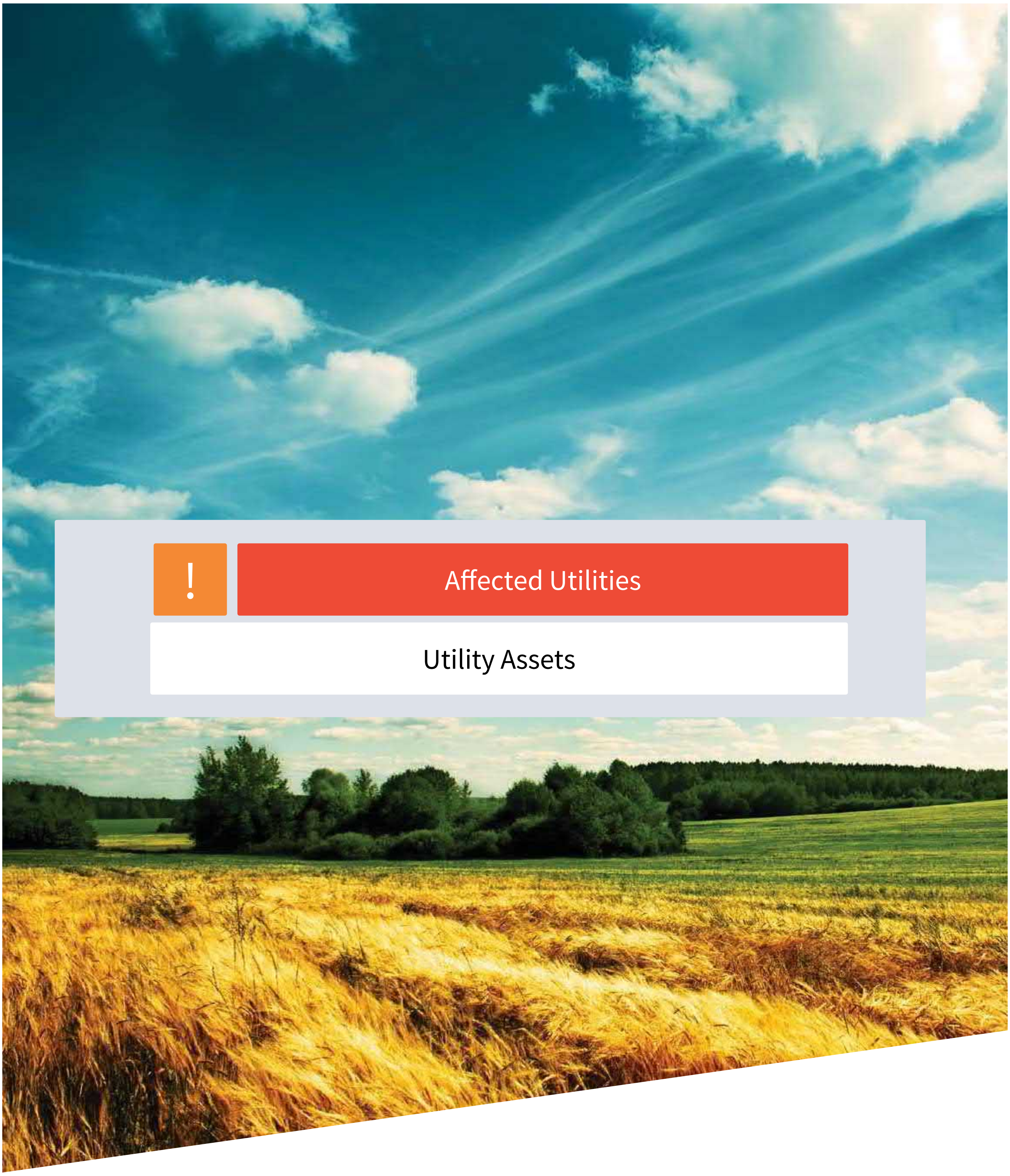
Change Of State	+	Hatchings	
Split Coupling	×	Built	
Duct Tee	▲	Planned	
Building		Inferred	
Kiosk	Ⓚ	Duct	

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 : LLH02246H
Map Reference : (centre) TA2067014962
Easting/Northing : (centre) 520670,414962
Issued : 27/09/2021 14:24:47

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



Affected Utilities

Utility Assets

Landmark INFORMATION

ADVISO Y NO ICE

S PPLI R UP ATE tility A se s

On 2 /09/2021 an enq iry wa sen to Utility Ass ts' pla t ecor departm nt As of the dat of iss e of th s Uti ities R port w have not rece ved a formal respo se fr m U ility Asse s in egard t ow ing any equipment on this site. Utility Assets have however adv sed he f llowing:

" hank yo for r cently c nt c ing Ut lity Ass ts p an record dep rtm nt. We wil check wheth r we have any plant pre ent at your site nd contact y u within 5 - 7 w rkin d ys O LY f we own any plant in the vicinity.

If we do not reply, we do not have any apparatus in the area of your works. However, PLEASE TAKE CARE when excavating around electricity cables in the event that not all cables present may be accurately shown. We recommend you use detecting equipment to map the site before excavating and fully comply with HSG47. DO NOT assume that a cable is dead if you don't have a record of its presence. The cable must be treated as live unless PROVEN DEAD by the cable owner. In case of emergency please contact your local electricity distribution company.

This is an automated reply from our dedicated asset records email address. If you receive further correspondence from us it will be from asset.manager@utilityassets.co.uk *quoting a site reference number.*

Asset Manager - Utility Assets Ltd"

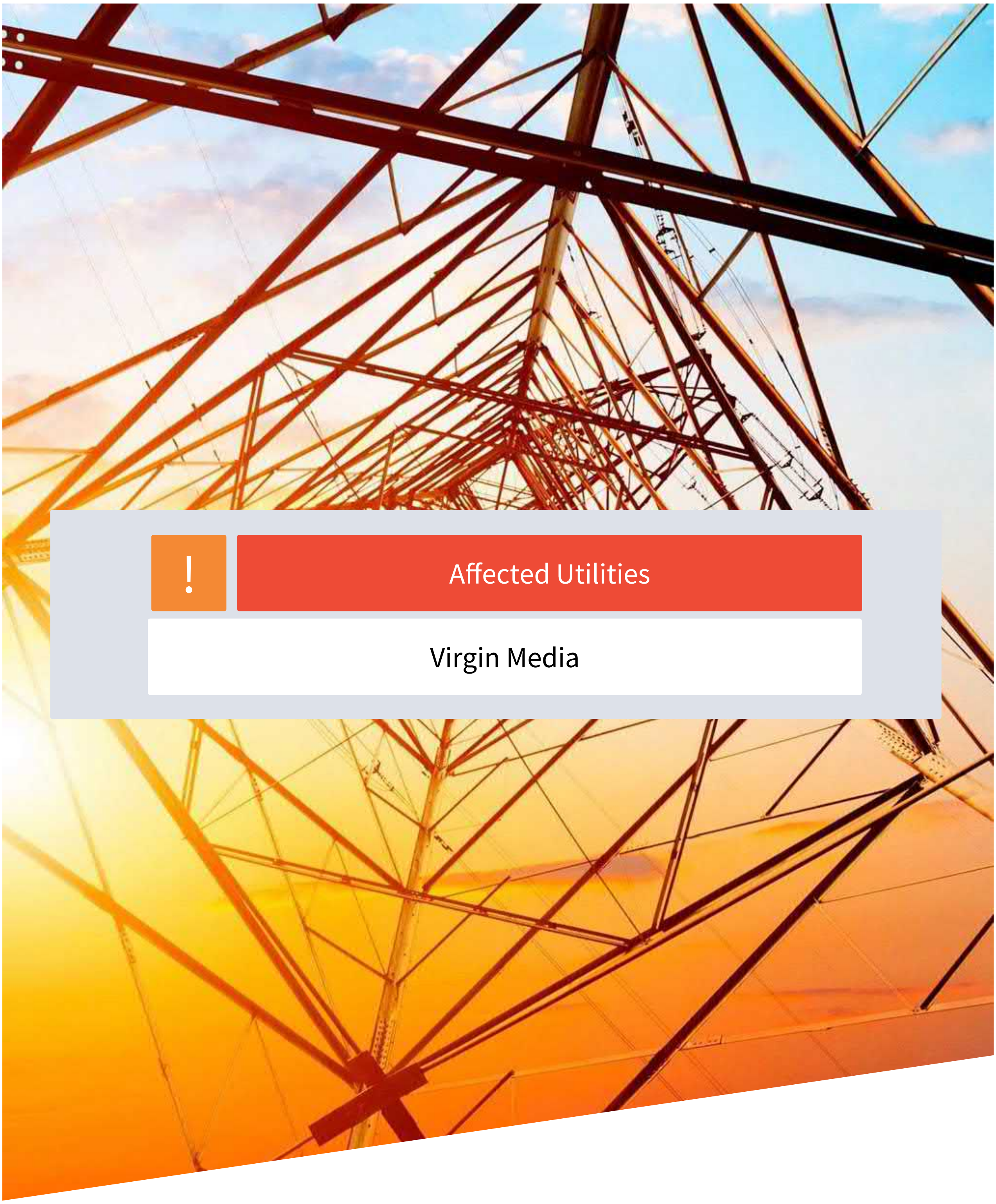
If a formal response is received within 3 months of the date of this search it will be forwarded onto you as per our usual service. However, without formal communication from Utility Assets it remains unconfirmed that your site will not be affected by their network. Utility Assets will not acknowledge receipt of this enquiry, or any subsequent chases, unless their network will be affected.

Terms and Conditions

Full Terms and Conditions can be found on the following URL:
http://www.landmarkinfo.co.uk/Terms/Show/515

Please note that Utilities Reports have a validity of 3 months from the date of purchase.

If you experience difficulties accessing our Terms and Conditions, please telephone our Customer Service Team on 0844 844 9966.



! Affected Utilities

Virgin Media

Landmark® INFORMATION


Marine Control Centre
Customs House
Dock Offices
Riverside House
Tank
Tanks
Depot
ESS
Triton House
El Sub Sta
WB
Warehouse
Path And Pipe
Track
0m
250m
500m
750m
Duct, Trench
Chamber / Pole
Cabinet
Virgin media

Duct, Trench

Chamber / Pole

Cabinet

Duct, Trench

Chamber / Pole

Cabinet

Not Affected Utilities

Landmark INFORMATION

Badwannache, Sanjana

From:	Plantenquiries <plantenquiries@catelecomuk.com>
Sent:	13 October 2021 17:43
To:	Utility Solutions GDC Requests
Subject:	RE: Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

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

CA TELECOM UK Limited

Please consider the environment before printing this email.

From: requests.utilitysolutions@atkinsglobal.com <requests.utilitysolutions@atkinsglobal.com>
Sent: 27 September 2021 05:13
Cc: requests.utilitysolutions@atkinsglobal.com
Subject: Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

We have checked CityFibre's website and in this instance your area is not affected.

From: plantenquiryservice@gtc-uk.co.uk
Sent: 27 September 2021 09:35
To: Utility Solutions GDC Requests
Subject: Saved/RPA GTC Plant Enquiry - Ref- 2064827
Attachments: 2064827.png

GTC Apparatus Not Found In Search Area

Our Plant Enquiry Service Ref: 2064827
Your Enquiry Ref: LM 100245/DoM

Dear Chrissy,

Thank you for your enquiry concerning apparatus in the vicinity of your proposed work. GTC can confirm that we have no apparatus in the vicinity but please note that other asset owners may have and ensure all utility owners have been consulted. For your records, the search area is shown in the attached map.

Please note our assets now include those owned and operated by:

- GTC Pipelines Limited
- Independent Pipelines Limited
- Quadrant Pipelines Limited
- Electricity Network Company Limited
- Independent Power Networks Limited
- Independent Water Networks Limited
- Open Fibre Networks Limited
- Independent Community Heating Limited

If you have any queries or require any further information please do not hesitate to contact us.

Your sincerely,

GTC Plant Enquiry Service.

GTC
Synergy House
Woolpit Business Park
Woolpit
Bury St Edmunds
Suffolk, IP30 9UP
Tel: 01359 240363
plant.enquiries@gtc-uk.co.uk

GTC Plant Enquiry. Our Ref 2064827, Your Ref LM 100245/DoM generated for AtkinsStatutory.Enquiries@atkinsglobal.com at 27/09/2021 05:04:40. This map shows the search area of your enquiry.

From: Plantenquiries <Plantenquiries@instalcom.co.uk>
Sent: 29 September 2021 16:45
To: Utility Solutions GDC Requests
Subject: Saved/RPA RE: E09-21- 6286 Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

Dear Sir or Madam,

Thank you for your plant enquiry below.

We can confirm that Lumen Technologies (formerly CenturyLink Communications UK Limited, Level 3, Global Crossing (U.K.) 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: [redacted]
Web: [redacted]

From: requests.utilitysolutions@atkinsglobal.com <requests.utilitysolutions@atkinsglobal.com>
Sent: 27 September 2021 05:13
Cc: requests.utilitysolutions@atkinsglobal.com
Subject: Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

Our Reference: 100245
Site Name: Site off Queens Road, Immingham
Works Description: Development Appraisal

We have checked KCOM Group s websi e a d n th s instan e yo r ar a s n t affected.

Landmark®
INFORMATION GROUP

e ha e check d Lincolnshi e Coun y Council s websi e a d n th s instan e yo r ar a s
n t affect d f r Streetlights.

nationalgrid

Linesearch before U dig

National Gas Emergency Number:
0800 111 999*

Gas Emergency Number:
0800 40 40 90*
*Available 24 hours, 7 days/week.
Calls may be recorded and monitored.
www.nationalgrid.com

Asset Protection
Gas Transmission
National Grid
Warwick
CV34 6DA
Email: assetprotection@nationalgrid.com

Our Ref: 23378509 LM 100245/DoM

Monday, 27 September 2021

Ben Evans
The Hub, 500 Park Avenue, Aztec West
Almondsbury
Bristol
BS32 4RZ

National Grid Gas – No Assets Affected Letter

Dear Sir/ Madam,

An assessment has been carried out with respect to National Grid Gas Transmission plc's apparatus and the proposed work location. Based on the location entered into the system for assessment the area has been found to not affect any of National Grid Gas Transmission plc's apparatus.

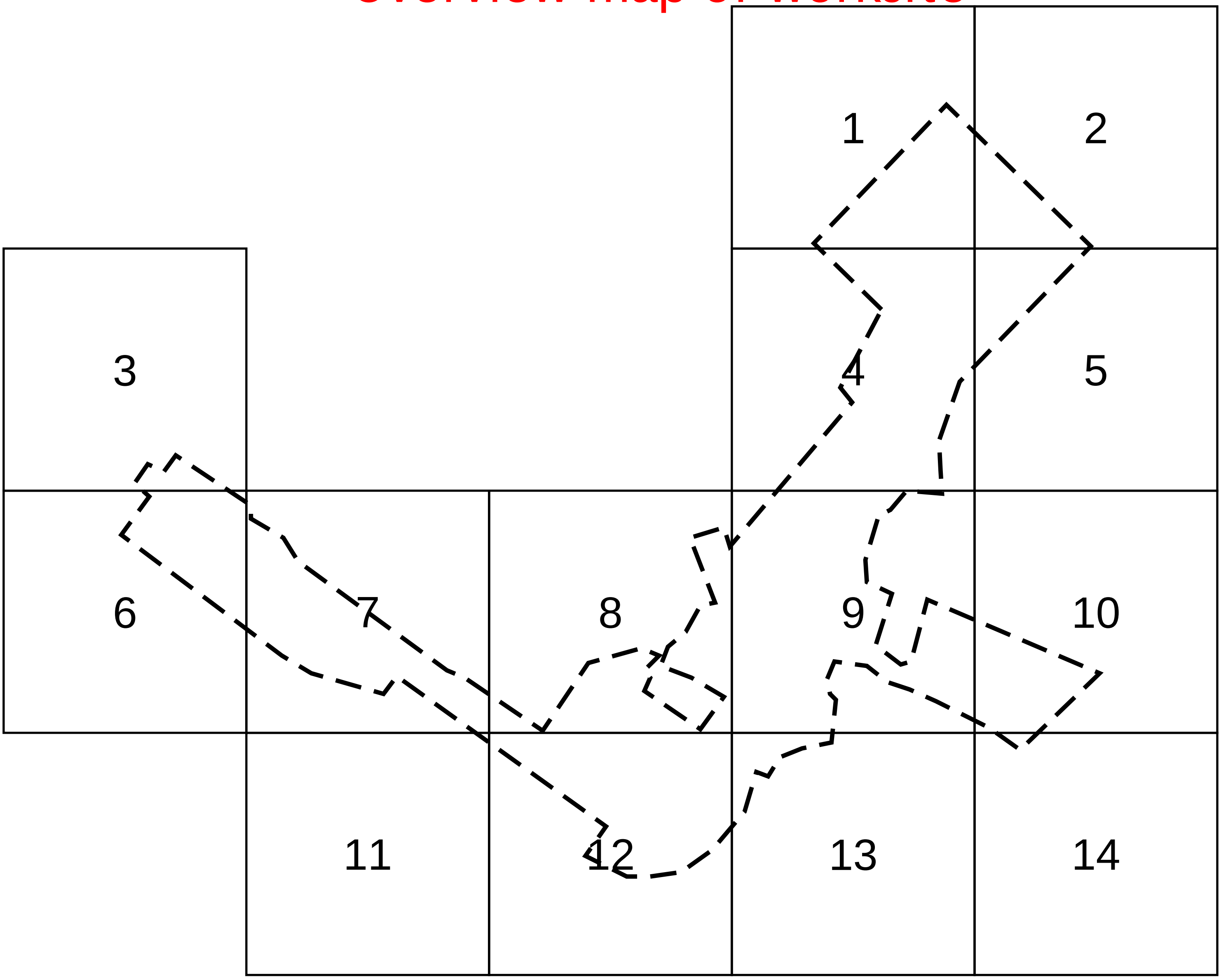
If you have any questions, or suspect for any reason that the above may be incorrect, please don't hesitate to contact us at assetprotection@nationalgrid.com, or call us on 01926 654844.

Please note this response and any attached map(s) are valid for 28 days

Yours sincerely

Asset Protection Team

Overview map of worksite



Warning: PDF designed for A4 colour print only with no page scaling

National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

AssetProtection@NationalGrid.com

Dig Sites Area: Line:

NHP Mains

Date Requested: 27/09/2021
Job Reference: 23378509
Site Location: 520645 415741
Requested by: Mr Ben Evans

Your Scheme/Reference: LM 100245/DoM

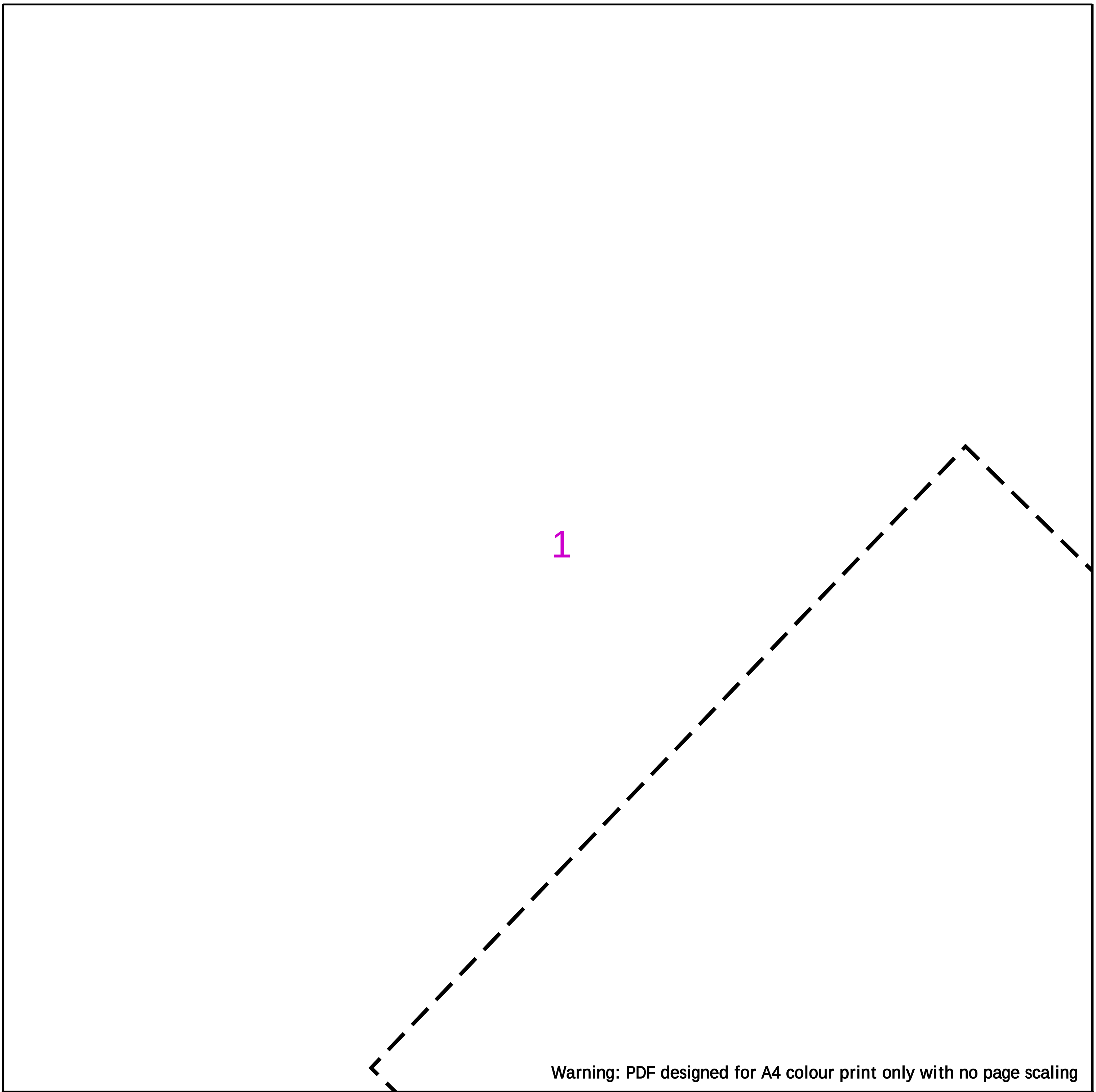
Scale: 1:12813 (When plotted at A4)

IMPORTANT NOTICES

This plan shows those pipes owned by National Grid 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 regards 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 National Grid 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.

National Grid Gas Emergency Number: 0800 40 40 90

Available 24 hours, 7 days/week. Calls may be recorded and monitored



Warning: PDF designed for A4 colour print only with no page scaling

100m

Dig Sites   Area: Line:

NHP Mains

National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

AssetProtection@NationalGrid.com

Date Requested: 27/09/2021
Job Reference: 23378509
Site Location: 520645 415741
Requested by: Mr Ben Evans

Your Scheme/Reference: LM 100245/DoM

Scale: 1:2500 (When plotted at A4)

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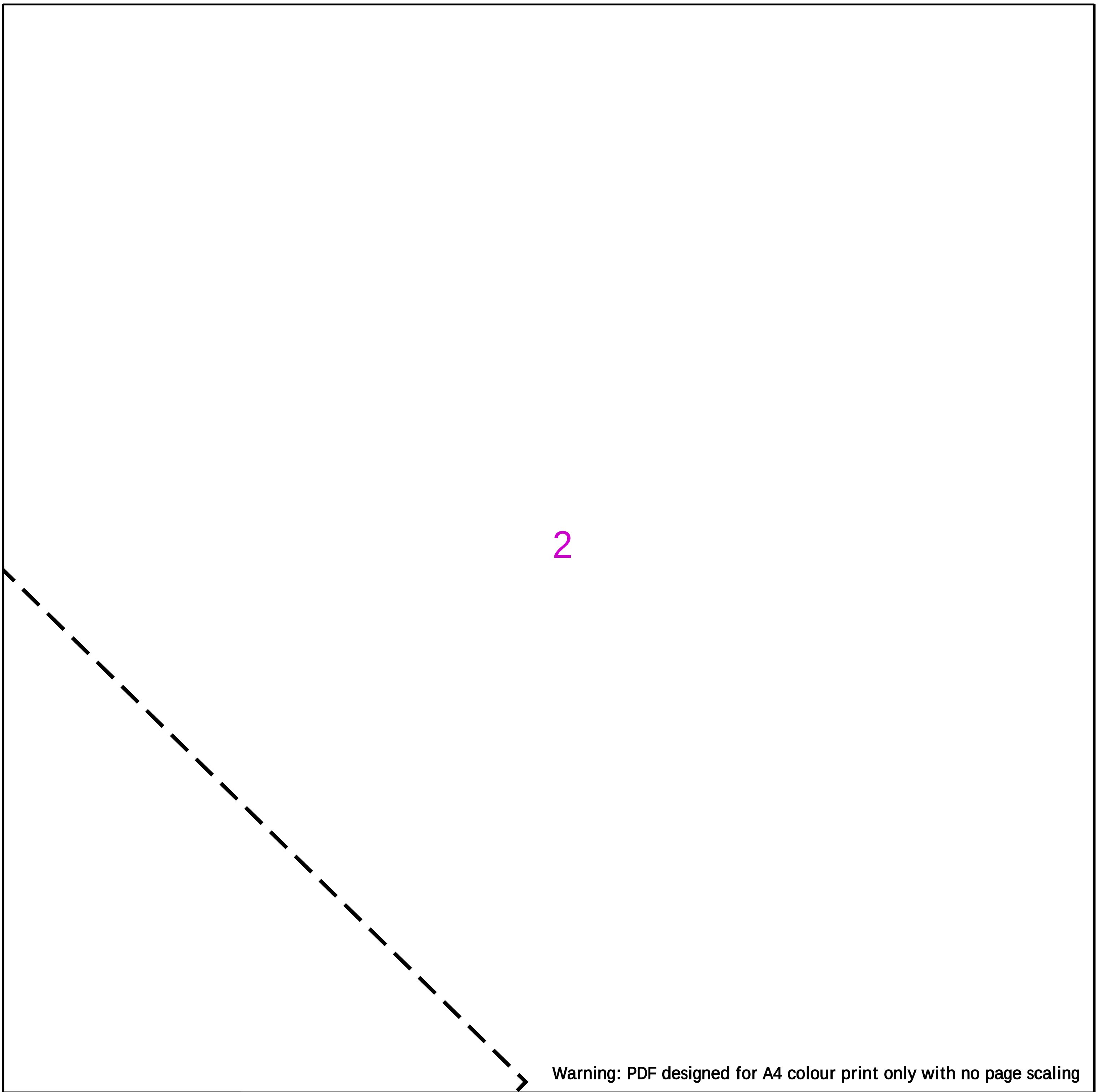
National Grid Gas Emergency Number: 0800 40 40 90
Available 24 hours, 7 days/week. Calls may be recorded and monitored



Warning: PDF designed for A4 colour print only with no page scaling

nationalgrid

100m

Dig Sites Area: Line:

NHP Mains

National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

AssetProtection@NationalGrid.com

Date Requested: 27/09/2021
Job Reference: 23378509
Site Location: 520645 415741
Requested by: Mr Ben Evans

Your Scheme/Reference: LM 100245/DoM

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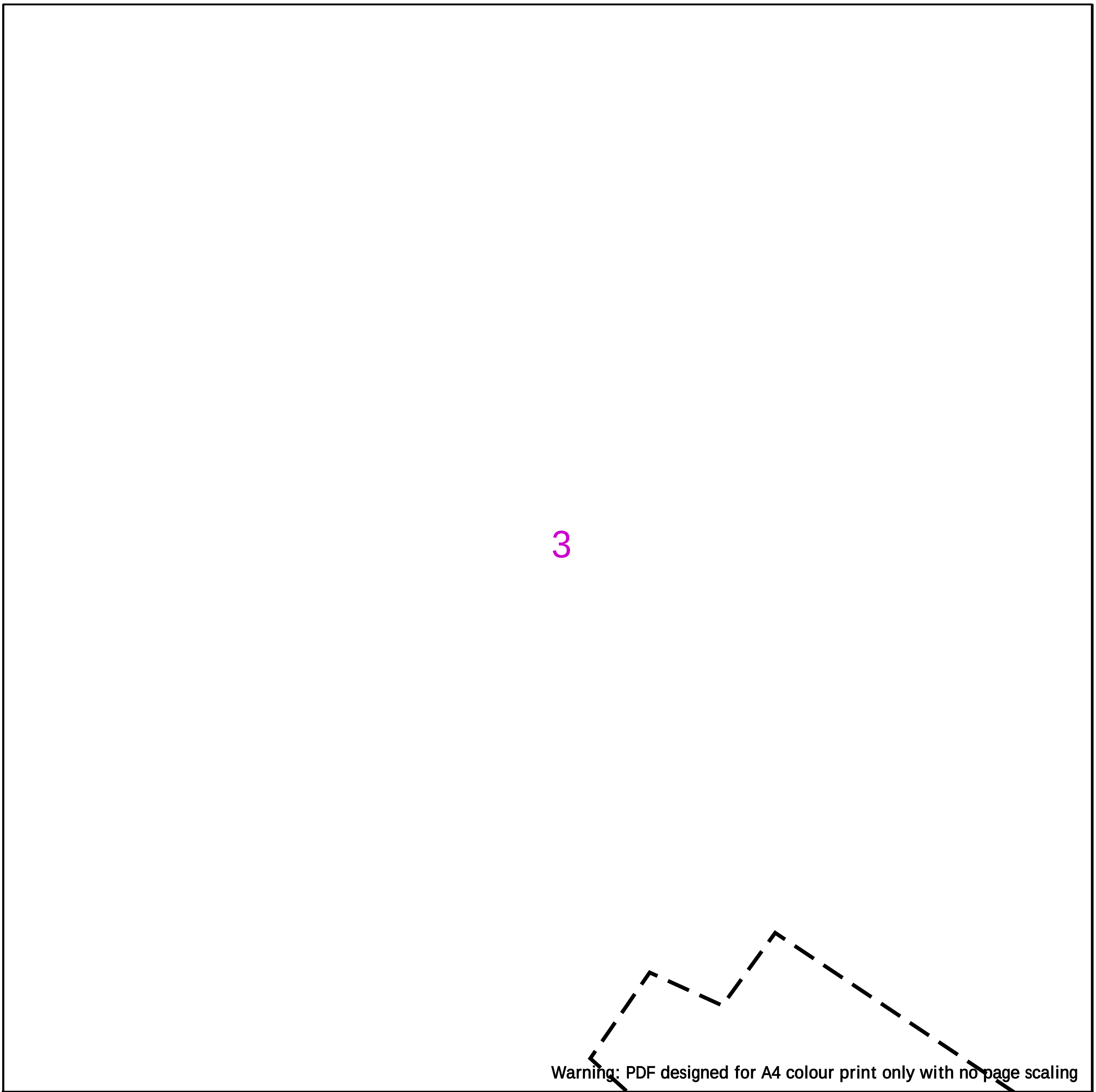

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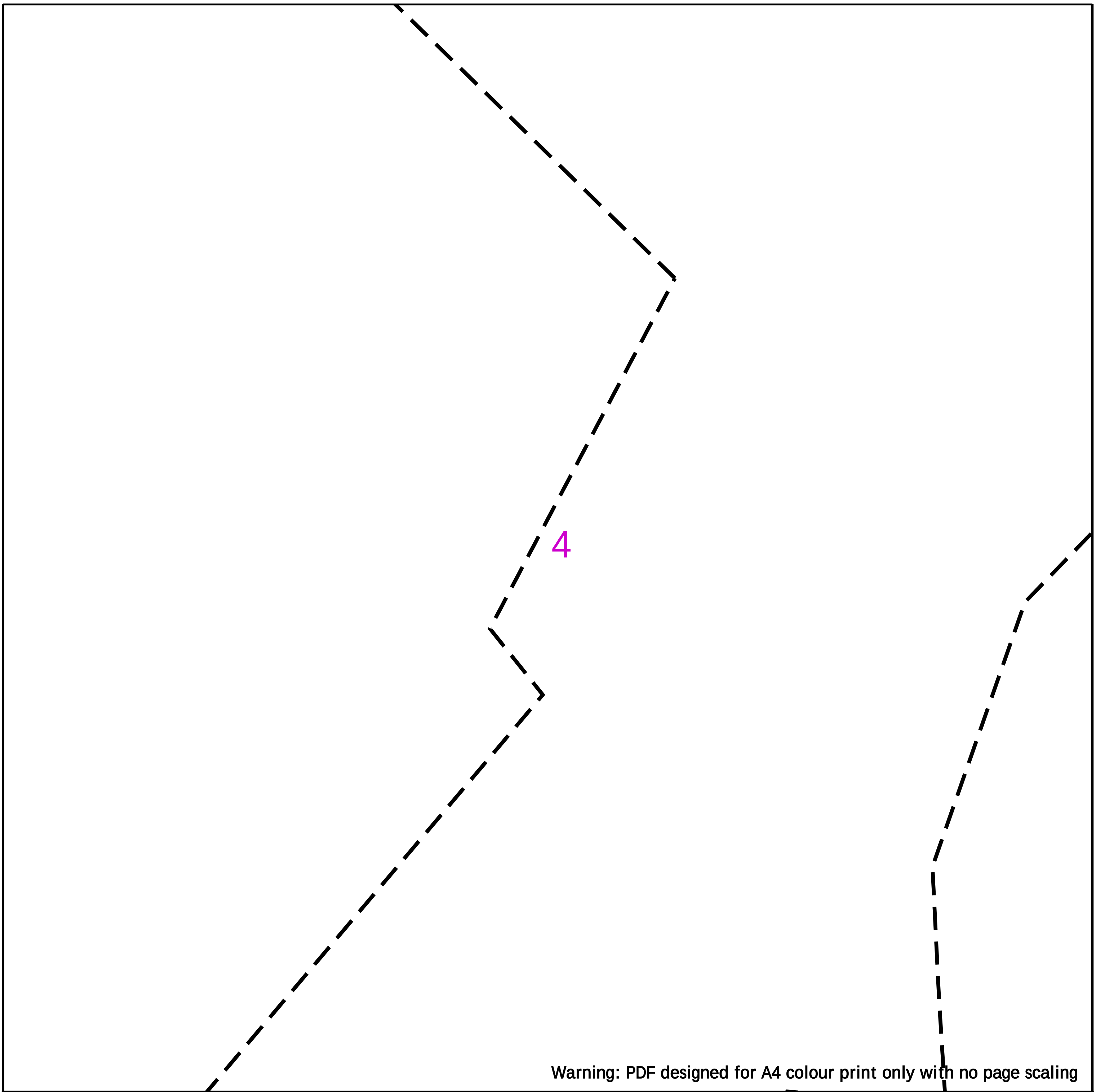

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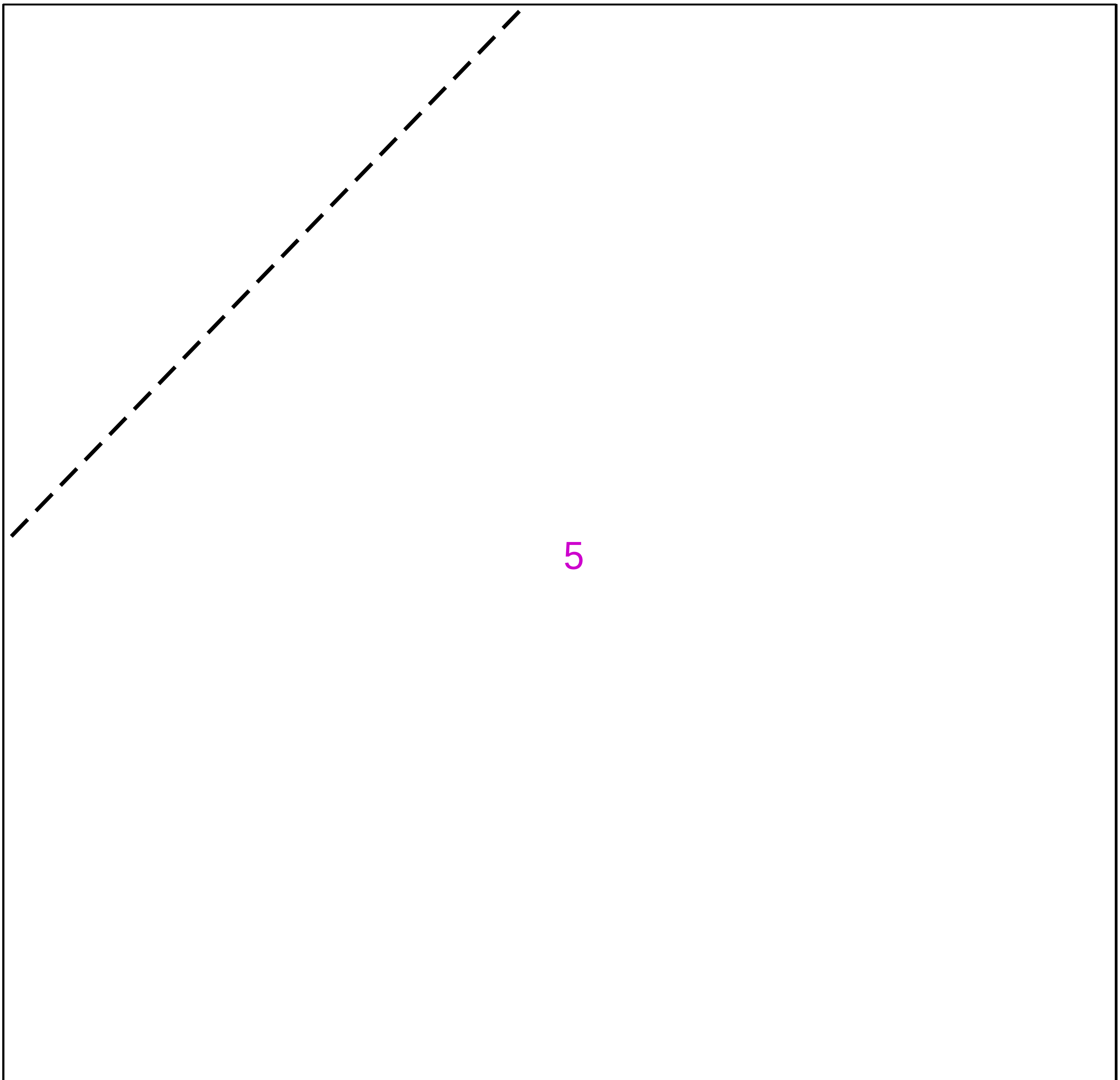

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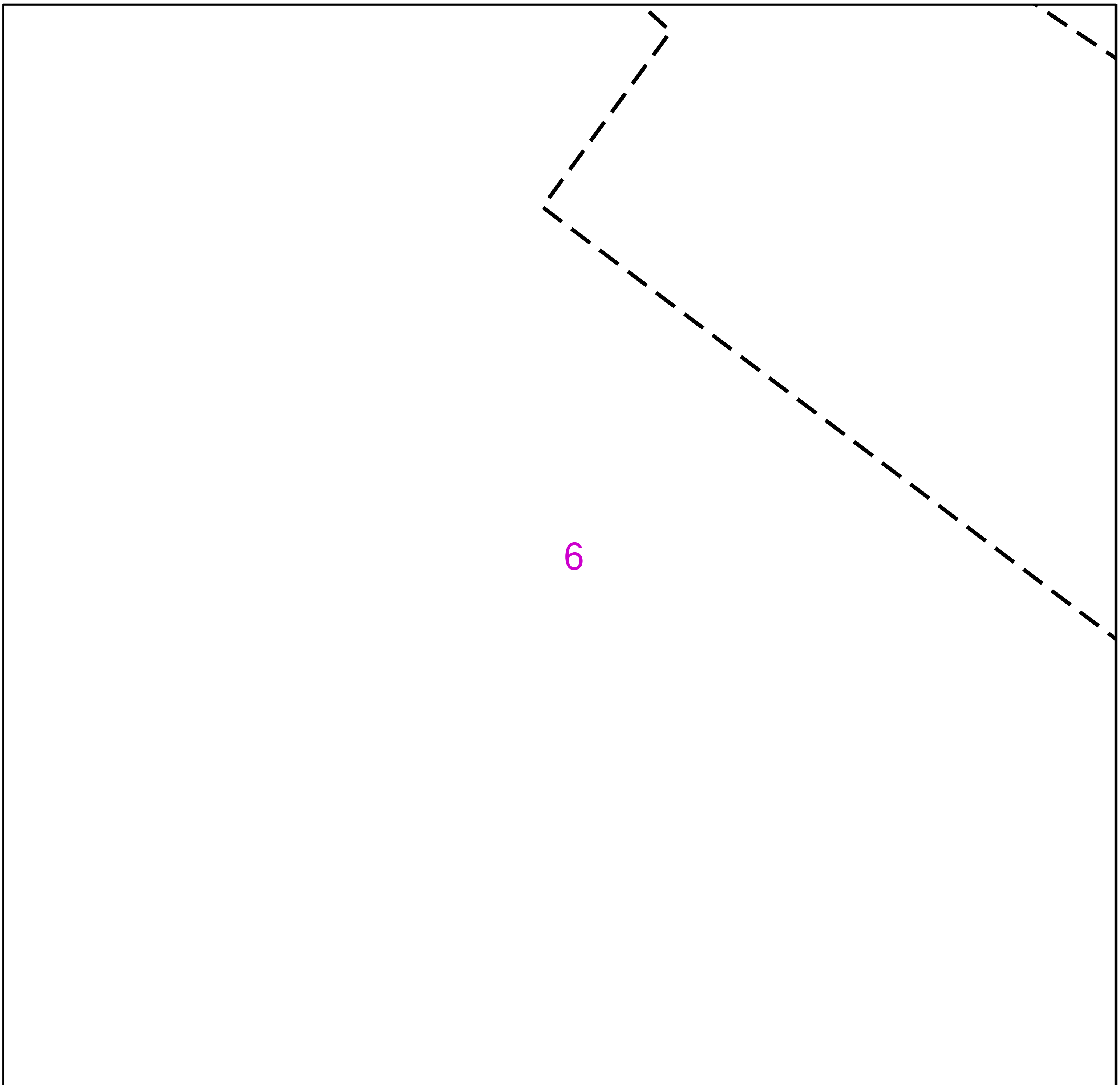

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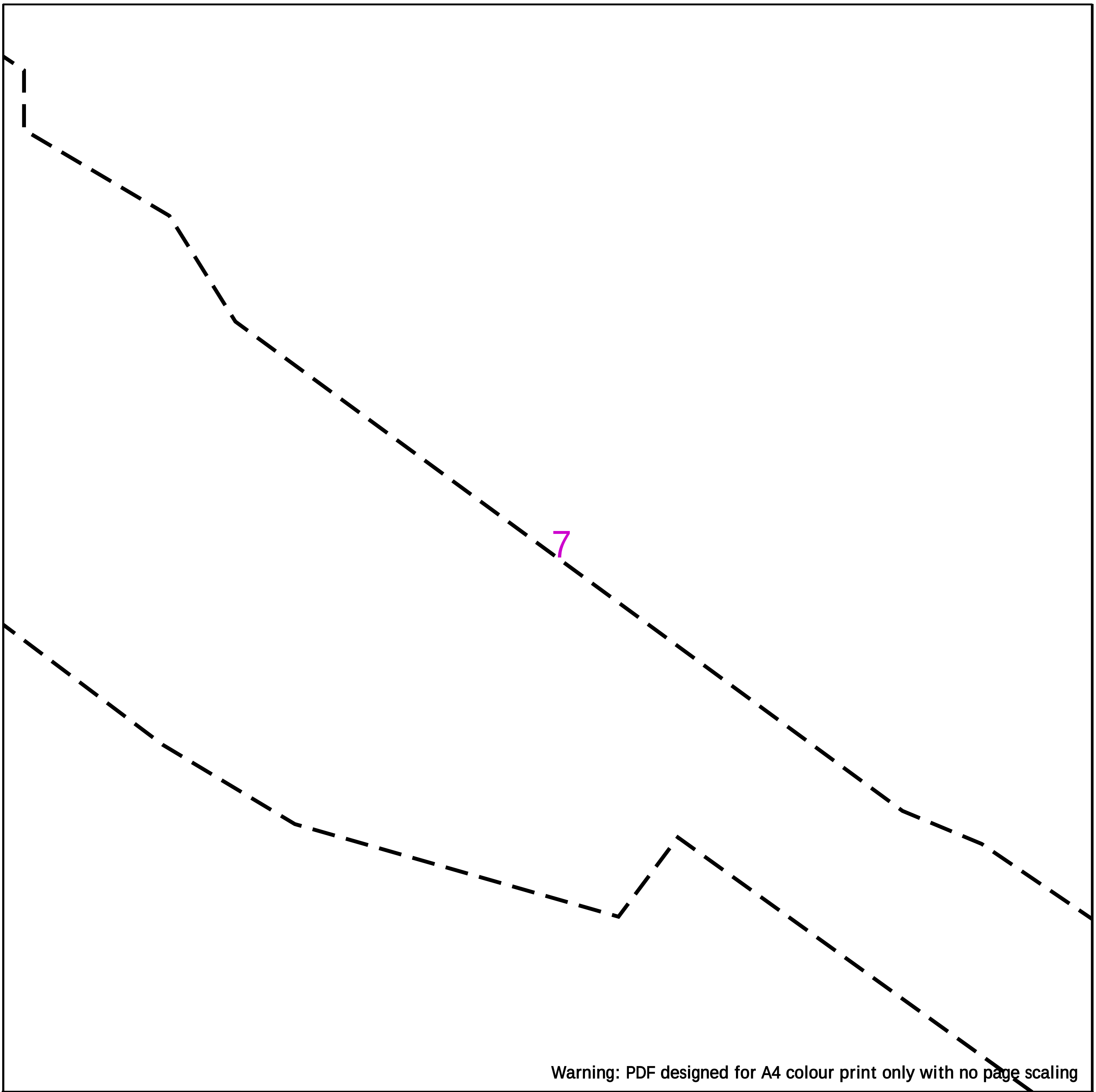

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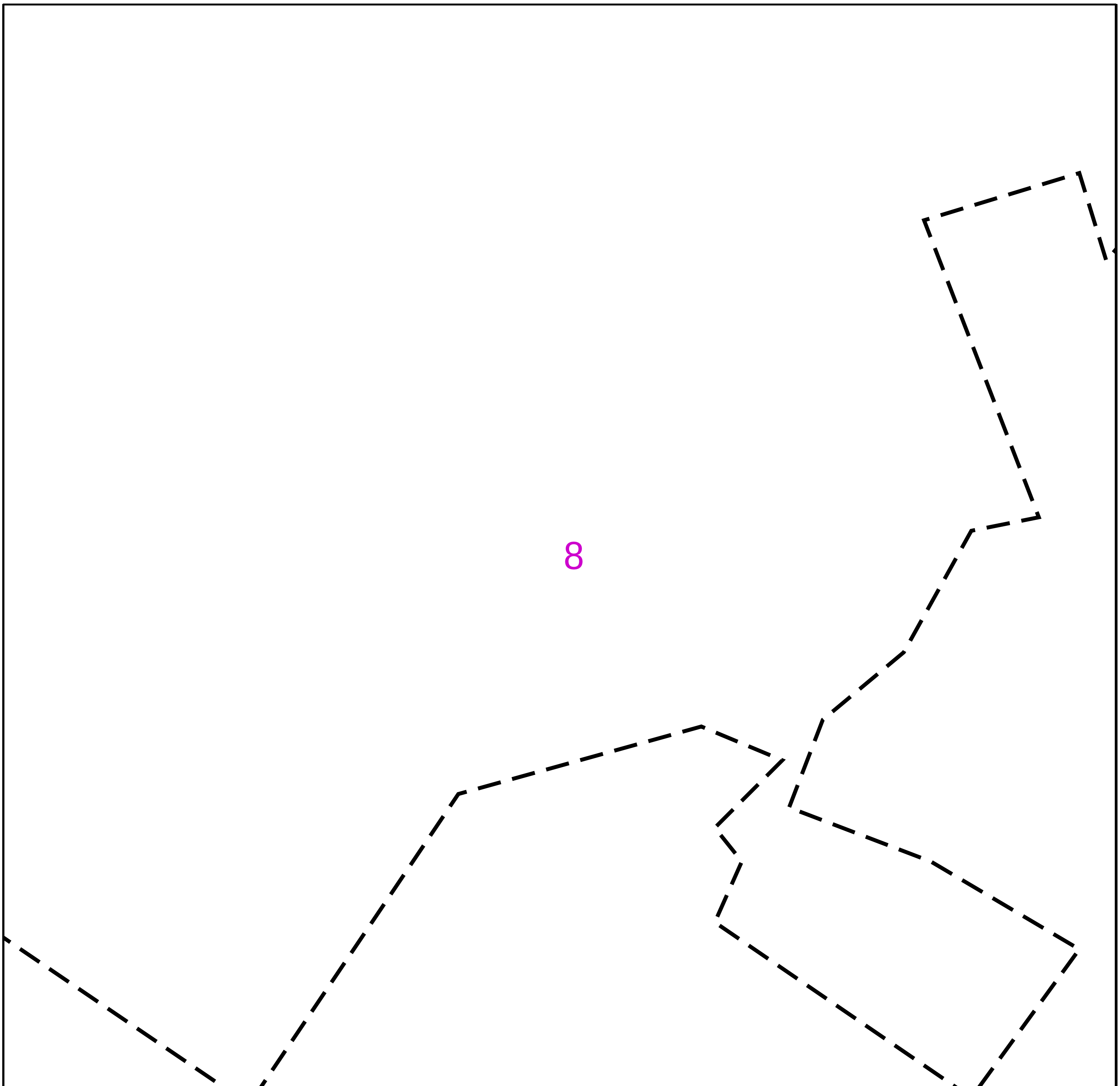

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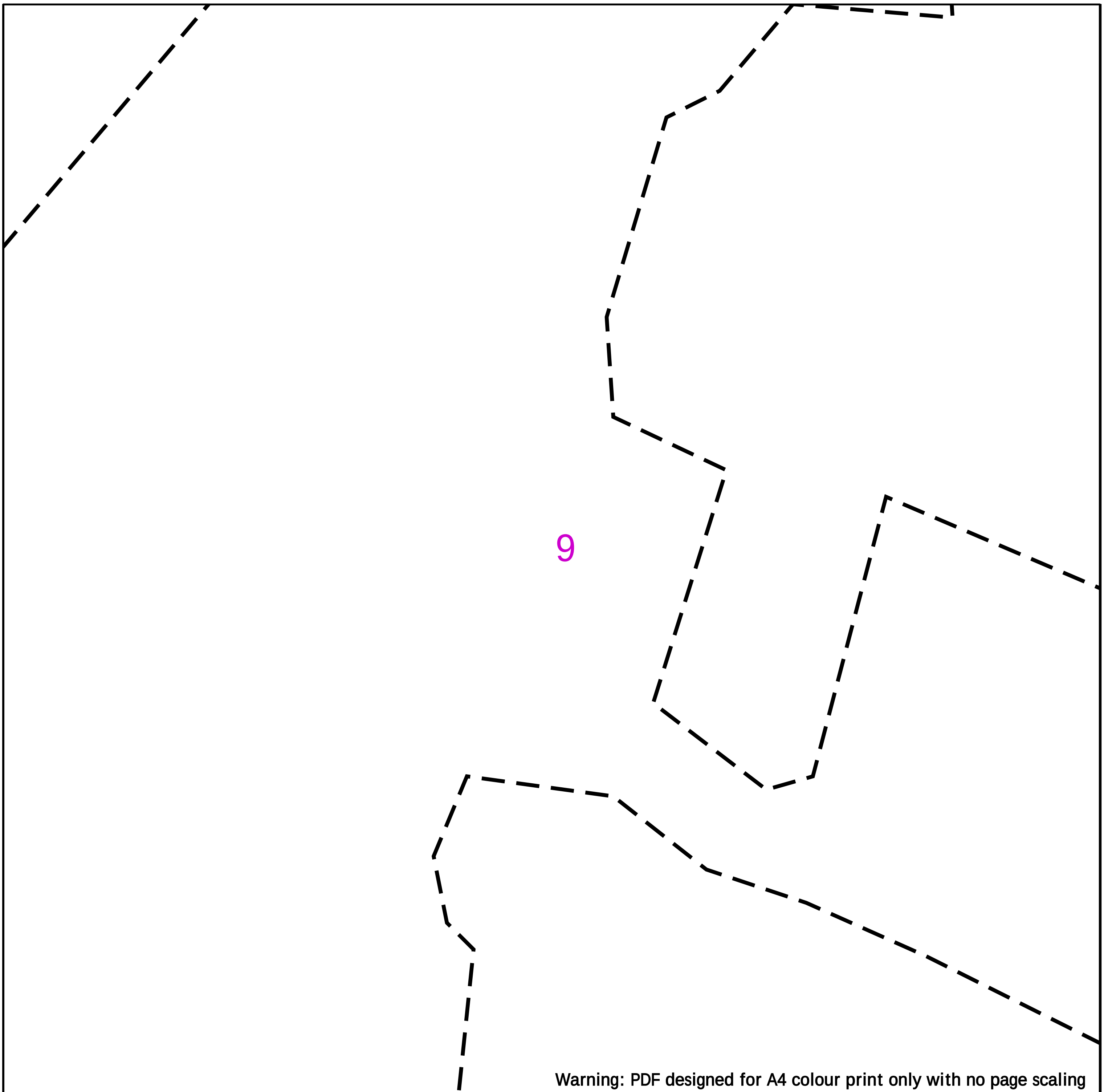

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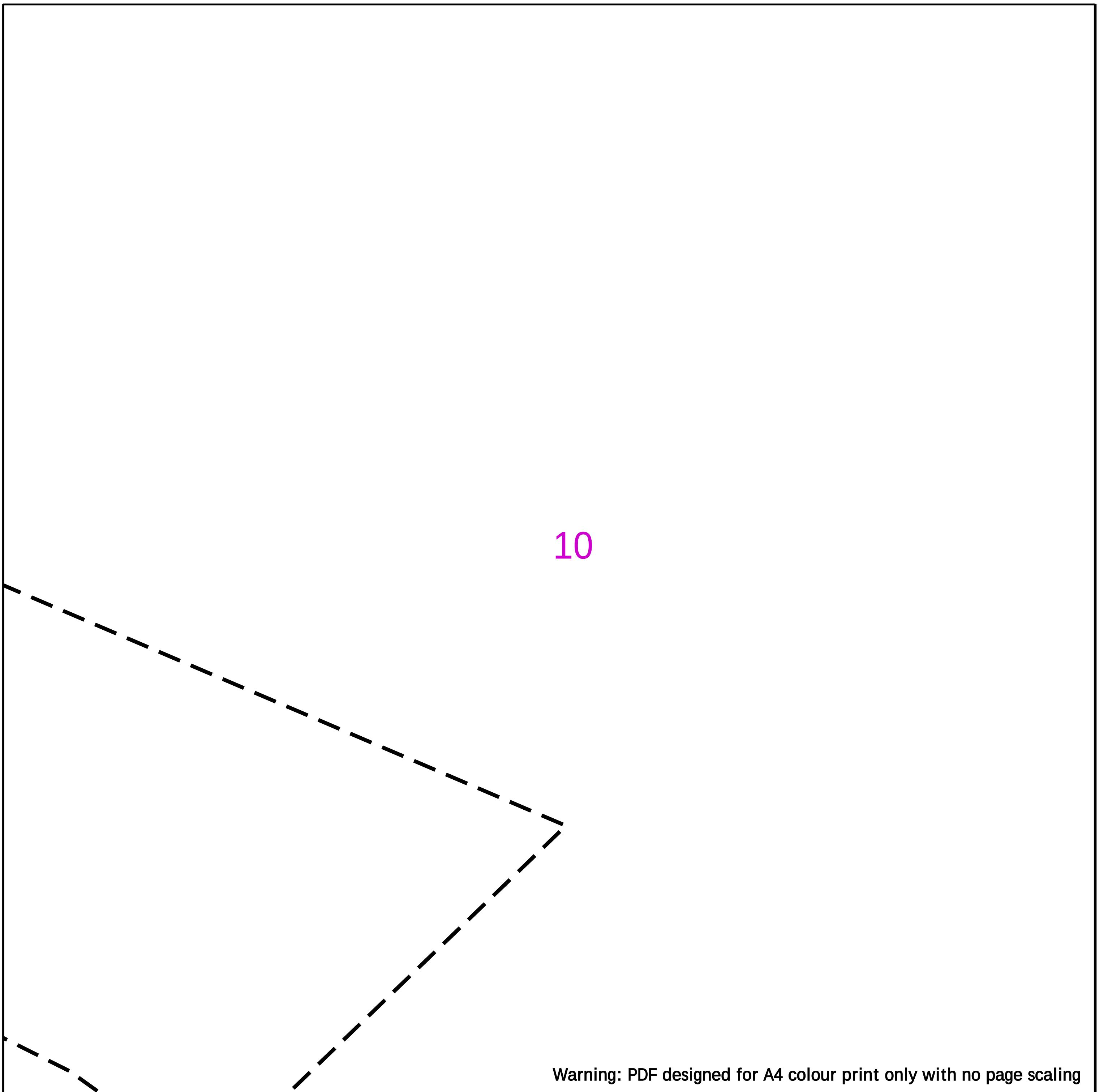

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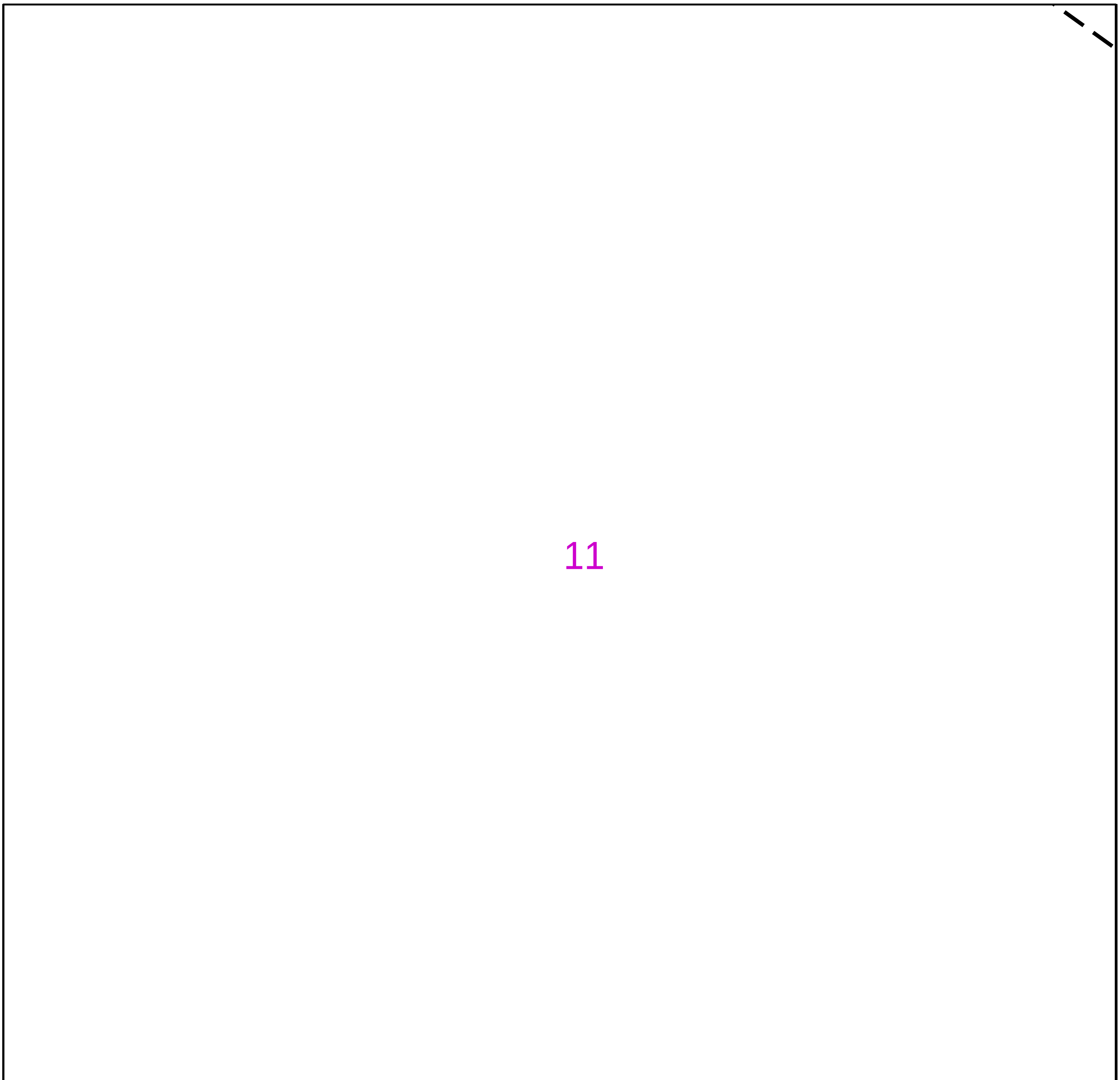

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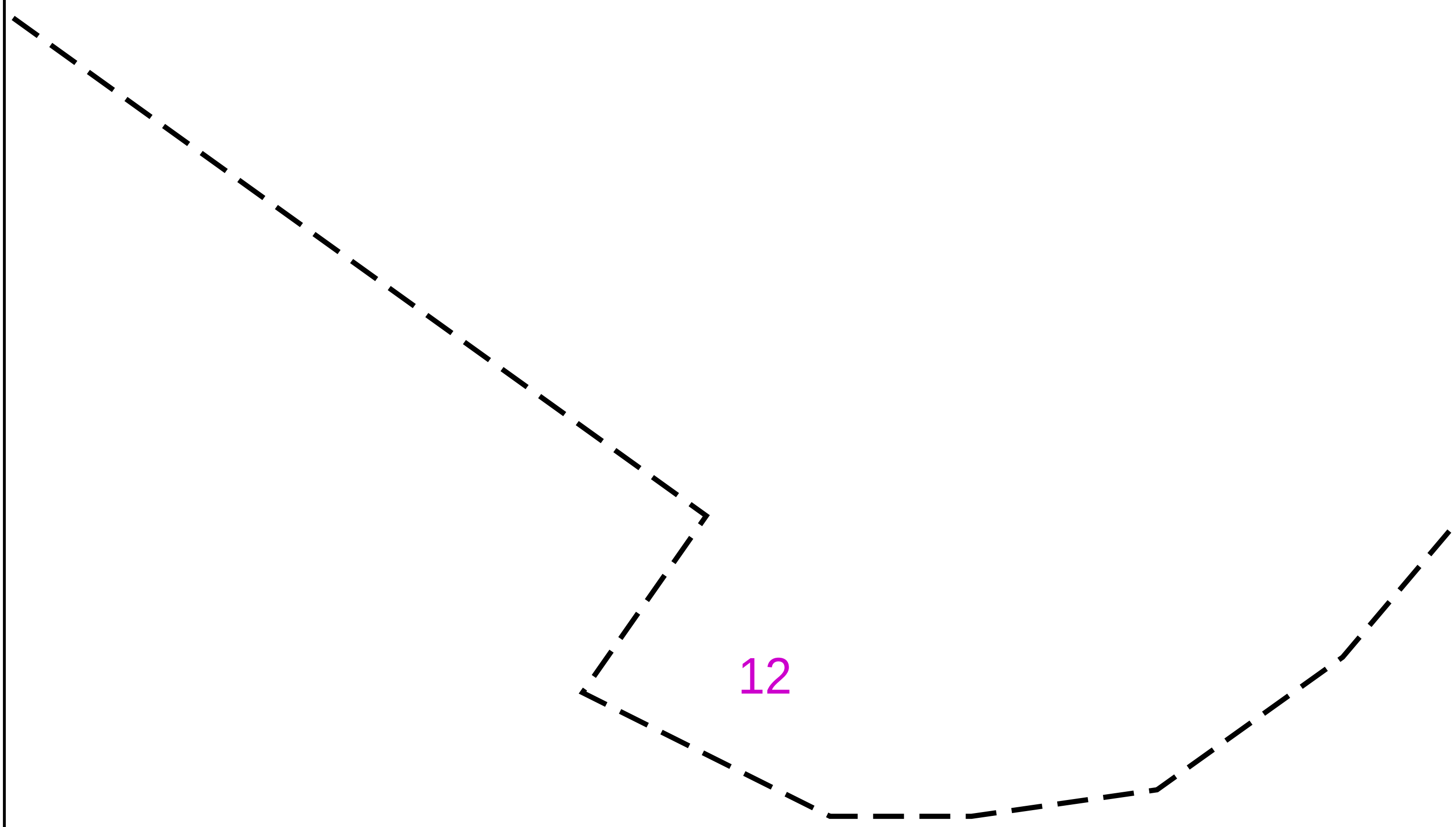

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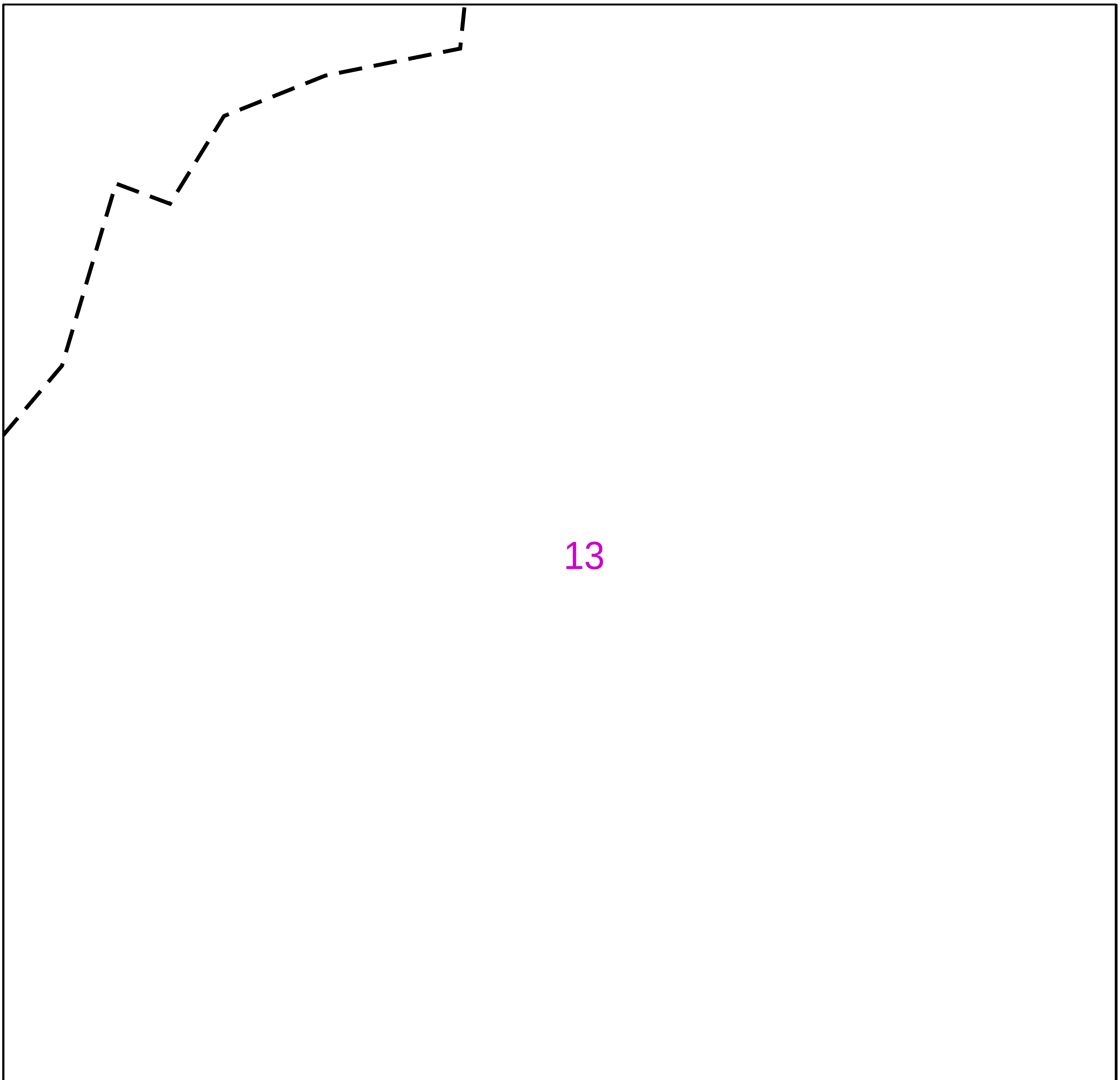

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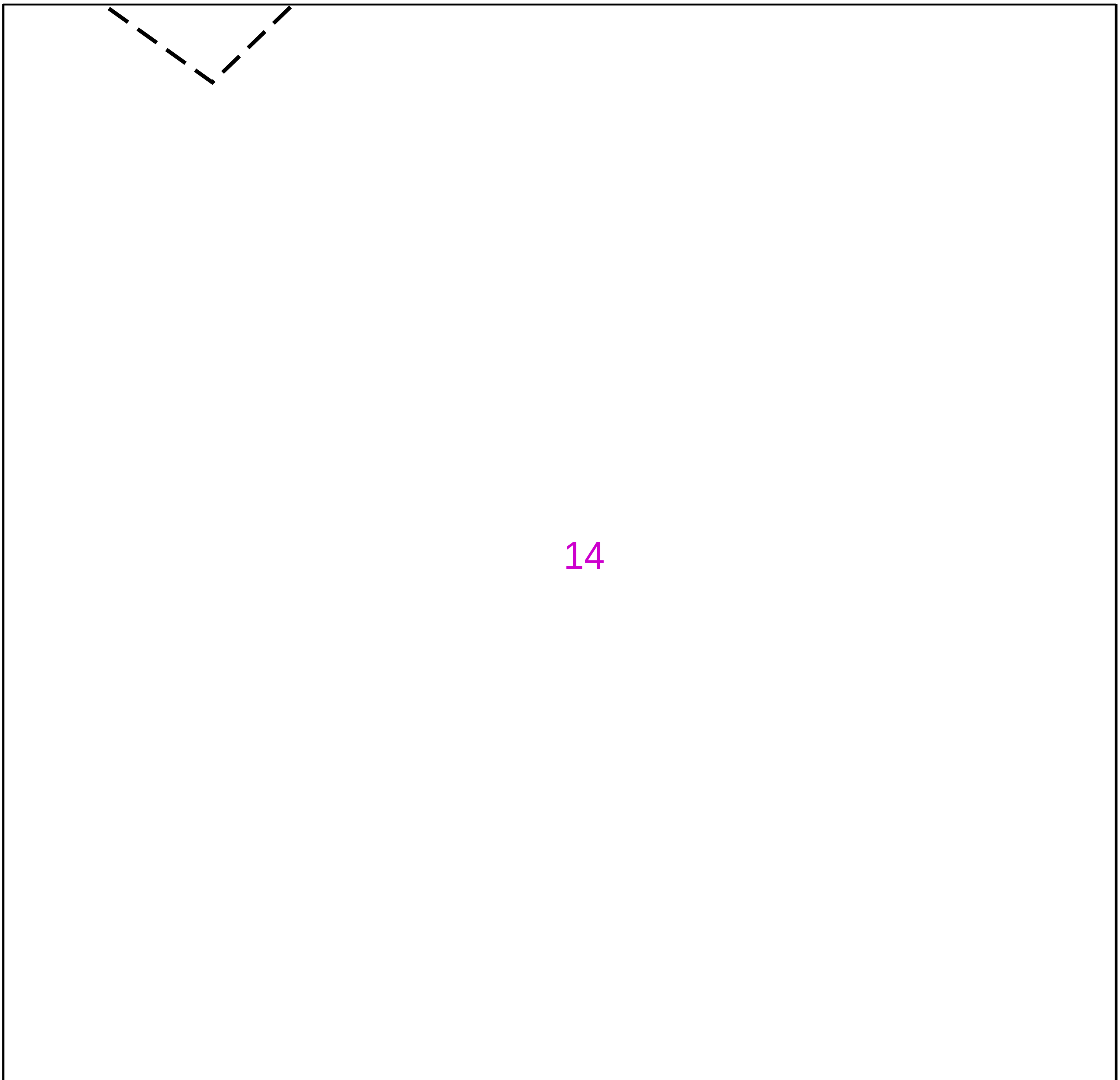

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ENQUIRY SUMMARY

Received Date
27/09/2021 5:15

Work Start Date
13/10/2021

Your Reference
LM 100245/DoM

Location
Centre Point: 520645 415741
X Extent:
Y Extent:
Postcode: DN402QQ

Map Options
Paper Size: A4
Orientation: PORTRAIT
Scale: 1:2500
Real World Extents: 2012m x 1588m

Enquirer Details
Organisation Name: Atkins - Utility Solutions
Contact Name: Ben Evans
Email Address: searches.utilitysolutions@atkinsglobal.com
Telephone: 01454662086
Address: The Hub, 500 Park Avenue, Aztec West, Almondsbury, Bristol, BS32 4RZ

Enquiry Type
Initial Enquiry

Activity Type
Utility Works

Work Types
Single excavations site (deeper than 1.5m)

Notes/Works Description (if supplied)

From: NRSWA <nrswa.nrswa@sky.uk>
Sent: 27 September 2021 22:07
To: Utility Solutions GDC Requests
Subject: Saved/RPA Plant Enquiry - 100245 - Site off Queens Road, Immingham - 13/10/2021

Thank you for your enquiry.

Please be advised that Sky Telecommunications Services Ltd will not be affected by your proposal.

Best endeavours have been made to ensure accuracy, however if you require further information, please contact us by email at [redacted]

Regards

NRSWA Department
Sky UK – Technology - Operations
nrswa@sky.uk +44 2070323234

From: requests.utilitysolutions@atkinsglobal.com <requests.utilitysolutions@atkinsglobal.com>
Sent: 27 September 2021 05:13
Cc: requests.utilitysolutions@atkinsglobal.com
Subject: [EXTERNAL] Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

Our Reference: 100245
Site Name: Site off Queens Road, Immingham
Works Description: Development Appraisal
Site Grid References: 520610 415720,521083 416229,519144 415638,520805 416488,520193 414952

To whom it may concern,

Please find enclosed a plant enquiry for your attention.

From:	UK OSP-Team <osp-team@uk.verizon.com>
Sent:	27 September 2021 12:29
To:	Utility Solutions GDC Requests
Cc:	UK OSP-Team
Subject:	Saved/RPA RE: [E] Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

Dear Sir/Madam

Verizon is a licensed Statutory Undertaker.

We have reviewed your plans and have determined that Verizon (Formally known as MCI WorldCom, MFS) has no apparatus in the areas concerned.

If you have any further queries please do not hesitate to get in touch.

Yours faithfully

Plant Protection Officer (GB) Email osp-team@uk.verizon.com

From: requests.utilitysolutions@atkinsglobal.com [mailto:requests.utilitysolutions@atkinsglobal.com]
Sent: 27 September 2021 05:13
Cc: requests.utilitysolutions@atkinsglobal.com
Subject: [E] Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

Our Reference: 100245
Site Name: Site off Queens Road, Immingham
Works Description: Development Appraisal
Site Grid References: 520610 415720,521083 416229,519144 415638,520805 416488,520193 414952

To whom it may concern,

Please find enclosed a plant enquiry for your attention.

We request plans showing the location of your company's affected plant in relation to the entire site area shown within the boundary on the attached map. Grid references and postcodes relative to the site boundary are provided on the attached map to help you locate the site.

Within your response please quote our reference number and the name of the site shown above. If you do not have any apparatus in this area, please could you send written confirmation to declare that

Badwannache, Sanjana

From:	Rajamohan, Ramkumar
Sent:	11 October 2021 23:23
To:	Utility Solutions GDC Requests
Subject:	RE: Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

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

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 (now re-named Vodafone Enterprise UK), Energis Communications Limited, Thus Group Holdings Limited and Your Communications Limited.

ATKINS working on behalf of Vodafone: Fixed

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 [redacted] 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: requests.utilitysolutions@atkinsglobal.com <requests.utilitysolutions@atkinsglobal.com>
Sent: 27 September 2021 09:43
Cc: Utility Solutions GDC Requests <requests.utilitysolutions@atkinsglobal.com>
Subject: Plant Enquiry - 100245 - Site off Queens Road, Immingham - Please respond by 13/10/2021

Our Reference: 100245
Site Name: Site off Queens Road, Immingham
Works Description: Development Appraisal
Site Grid References: 520610 415720,521083 416229,519144 415638,520805 416488,520193 414952

To whom it may concern,

Please find enclosed a plant enquiry for your attention.

We request plans showing the location of your company's affected plant in relation to the entire site area shown within the boundary on the attached map. Grid references and postcodes relative to the site boundary are provided on the attached map to help you locate the site.

Consumer Protection

Important Consumer Protection Information

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The Standards:

- Conveyancing Information Executive Members shall act in a professional and honest manner at all times in line with the Conveyancing Information Executive Standards and carry out the delivery of the Search with integrity and due care and skill.
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TPOs Contact Details:

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP

Tel: 01722 333306
Fax: 01722 332296
Website: [redacted]
Email [redacted]

Consumer Protection

Conveyancing Information Executive

The Property Ombudsman

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Tel: 01722 333306,
Email: [redacted]

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision.

Annex E - Detailed UXO Assessments

SAFELANE
GLOBAL

Detailed Unexploded Ordnance Risk Assessment

In Respect Of:
Associated British Ports

For:
Immingham Eastern Ro-Ro Terminal

Report Reference:
9048 RA

safelaneglobal.com

2020
Awarded to
SafeLane Global Limited

Distribution

Version	Format	Recipient	Author	Review	Authorisation	Date
1	PDF Copy	Associated British Ports	ED	RL	NB	29/10/2021

This Report has been produced in compliance with the Construction Industry Research and Information Association guidelines for the preparation of Detailed Unexploded Ordnance Risk Assessments in the management of UXO risks in the construction industry.

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VAT Registration No. GB 171 628 112

Executive Summary

The Site	
Address:	Immingham East Junction, Queens Road, Immingham, North East Lincolnshire, DN40 1QR
OS National Grid Reference:	TA 20391 15249
Site Description:	The site is located within the east of the Immingham Dock facility. The project site is irregular in shape, encompassing large areas of hard standing, several commercial buildings and peripheral dense vegetation. The northern part of the site extends northwards into the Humber port approaches.
Proposed Works	
Associated British Ports (ABP), the owner and operator of the Port of Immingham, is proposing to construct a new roll-on/roll-off (Ro-Ro) facility within the Port to service the embarkation and disembarkation of principally commercial and automotive traffic. The proposed development will involve marine works (an approach jetty, a linkspan with bankseat, floating pontoon, finger piers) within the Humber Estuary and landslide works (terminal, building and internal bridge construction) on existing statutory port estate.	
Risk Assessment	
Risk Assessment Methodology: In accordance with CIRIA guidelines this assessment has carried out research, analysed the evidence and considered the likelihood that the site has been contaminated with unexploded ordnance; that such items remained on site; the risk that they could be encountered during any intrusive works and the consequences that could result. Appropriate risk mitigation measures have been proposed.	
UXO Risk Rating	**MEDIUM from the following UXO types:** **German Air-Delivered HE bombs** **Anti-Aircraft Projectiles**
The full UXO Risk Assessment and a breakdown of the UXO Risk Level can be found in Section 11.	
Maximum Bomb Penetration Depth	It has been assessed that a 500kg bomb would have had an approximate maximum bomb penetration depth of between **8-10m** below WWII ground level. Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth. For information on bomb penetration in the marine section of the site, please see section 8.5.5.

Recommended Risk Mitigation			
Risk Level	**Environment**	**Planned Site Activity**	**Recommendations**
Medium	Land-based	Shallow Intrusive Works e.g. excavations	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Non-Intrusive (NI) Magnetometer Survey (Greenfield areas only) • Target Investigation (Required as a follow-on from NI magnetometer survey) • Search & Clear • Explosive Ordnance Disposal (EOD) Engineer Watching Brief (for brownfield areas unsuitable for NI magnetometer survey)
		Deep intrusive works (e.g. piling)	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Intrusive Magnetometer Survey of pile/borehole positions
	Marine based	Shallow Intrusive Works e.g. excavations	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Non-Intrusive Magnetometer UXO Survey • Non-Intrusive 3D Seismic Investigation from the 2m contour
		Deep intrusive works (e.g. piling)	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Seismic Investigation: Further Non-Intrusive Survey over exact locations to identify and mitigate risk and geological assessment for further risk management.
In making this assessment and recommending these risk mitigation measures, the proposed 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, SafeLane Global should be consulted to see if re-assessment of the risk or mitigation recommendations is necessary.			

Table of Contents

List of Annexes

Glossary of Terms

AAA	Anti-Aircraft Artillery
ARP	Air-raid Precautions
BDO	Bomb Disposal Officer
EOD	Explosive Ordnance Disposal (current term for “bomb” disposal)
HE	High Explosive
HG	Home Guard
IB	Incendiary Bomb
Kg	Kilogram
LM	Land Mine
LSA	Land Service Ammunition (includes grenades, mortars, etc.)
Luftwaffe	German Air Force
m bgl	Metres Below Ground Level
MoD	Ministry of Defence
OB	Oil Bomb
PM	Parachute Mine
RAF	Royal Air Force
SI	Site Investigation
SAA	Small Arms Ammunition (small calibre cartridges used in rifles & machine guns)
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	“Doodlebug” the first cruise type missile, used against London from June 1944. Also known as ‘Flying Bomb’
V-2	The first ballistic missile, used against London from September 1944
WWI	First World War (1914 -1918)
WWII	Second World War (1939 – 1945)

Detailed Unexploded Ordnance Risk Assessment

In Respect of

Immingham Eastern Ro-Ro Terminal

1 Introduction

AECOM, on behalf of Associated British Ports, has commissioned SafeLane Global to conduct a Detailed Unexploded Ordnance Risk Assessment of the Immingham Eastern Ro-Ro Terminal.

Unexploded Ordnance (UXO) presents a significant risk to construction projects in parts of the UK as a result of enemy actions during the two 20th Century World Wars and historic British and Allied military activity.

One of the legacies of this conflict is buried unexploded air-dropped bombs or anti-aircraft projectiles resulting from the failure of a proportion of the weapons to function as designed. It is commonly accepted that the failure rate of these munitions was approximately 10% and, depending on their shape, weight, velocity and ground conditions, many penetrated the ground and came to rest at depth.

In addition, it is estimated that over 20% of the UK landmass has been used by the military at some point and between 2006 and 2009, over 15,000 items of British / Allied ordnance (excluding small arms ammunition) were found on UK construction sites (CIRIA).

Intensive efforts were made during and after the war to locate and render safe all UXO but, unsurprisingly, not all were found and dealt with. This is evidenced by the regular, on-going discoveries of UXO during construction-related intrusive ground works.

As a result of a generally increased risk awareness amongst professionals involved in ground engineering works and proactive health and safety measures, the risk to life and limb from UXO has been minimised. However even the simple discovery of a suspected device during on-going works can cause considerable disruption to production and cause unwanted delays and expense.

Such risks can be more fully addressed by a better understanding of the site-specific risk and the implementation of appropriate risk mitigation measures.

2 Construction Industry Duties and Responsibilities

2.1 The UK Regulatory Environment

There is no legal requirement for the control and mitigation of UXO risk in the construction industry, but guidelines for good practice, information, and solutions with regards to UXO risk are detailed within CIRIA (C681): Unexploded Ordnance (UXO) A Guide for the Construction Industry.

These guidelines provide the construction industry with a set process for the management of risk associated with UXO, from preliminary risk assessment to implementation of site-specific risk mitigation strategies.

Specific legislation does however exist for health and safety, and is addressed under a number of regulatory instruments, as outlined below.

In practice, the regulations impose a responsibility on the construction industry to ensure that they discharge their obligations to protect those engaged in ground-intrusive operations (such as archaeology, site investigation, drilling, piling or excavations) from any reasonably foreseeable UXO risk.

2.2 The Health and Safety at Work Act, 1974

The Act places a duty of care on an employer to put in place safe systems of work to address, as far as is reasonably practicable, all risks (to employees and the general public) that are reasonably foreseeable.

2.3 Construction (Design and Management) Regulations 2015

CDM 2015 ensures that health and safety within the construction industry is continually improved:

- Works are sensibly planned and managed.
- Competent staff are engaged in the works.
- Risks are identified and managed.
- All parties cooperate and coordinate activities.
- Communication flows to those who require it.
- Workers are consulted and engaged about risks and how they are being managed.

In line with CDM 2015 legislation, SafeLane Global are able to assist parties in their discharge of CDM duties as follows:

- Assist Principal Designers with pre-construction information and risk assessments.
- Assist the Designer with the Designer's Risk Assessment.
- Issue UXO risks as have been identified and manage risks accordingly.
- Assist the Principal Contractor with the construction phase information, in particular risk assessments and mitigation strategies.
- Plan, manage and monitor survey and clearance works under SafeLane Global's control.

2.4 Other Legislation

Other relevant legislation includes the "Management of Health and Safety at Work Regulations 1999" and "The Corporate Manslaughter and Corporate Homicide Act 2007".

3 The Role of the Authorities and Commercial Contractors

3.1 The Authorities

The Police have the responsibilities for co-ordinating the emergency services in the case of an ordnance-related incident on a construction site. They will make an initial assessment (i.e. is there a risk that the find is ordnance or not?) and if they judge necessary impose a safety cordon and/or evacuation and call the military authorities (JSEODOC - Joint Services Explosive Ordnance Disposal Operations Centre) to arrange for investigation and/or disposal. In the absence of an EOD specialist on site many Police Officers will use the precautionary principle, impose cordon(s)/evacuation and await advice from the JSEODOC.

The priority given to the request by JSEODOC will depend on their judgement of the nature of the risk (ordnance, location, people and assets at risk) and the availability of resources. They will respond immediately or as resources are freed up. Depending on the on-site risk assessment the item of ordnance may be removed or demolished (by controlled explosion) in situ. In the latter case additional cordons and/or evacuations may be necessary.

Note, that the military authorities will only carry out further investigations or clearances in very high profile or high-risk situations. If there are regular ordnance finds on a site, the JSEODOC may not treat each occurrence as an emergency and will encourage the construction company to put in place alternative procedures (i.e. the appointment of a commercial contractor) to manage the situation and relieve pressure from the JSEOD disposal teams.

3.2 Commercial Contractors

In addition to pre-construction site surveys and follow-on clearance work, a commercial contractor is able to provide a reactive service on construction sites. The presence of a qualified EOD Engineer with ordnance recognition skills will avoid unnecessary call-outs to the authorities and the contractor will be able to arrange for the removal and disposal of low risk ordnance. If high risk ordnance is discovered actions will be co-ordinated with the authorities with the objective of causing the minimum possible disruption to site operations whilst putting immediate, safe and appropriate measures in place.

4 This Report

4.1 Aims and Objectives

The aim of this report is to examine the possibility of encountering any explosive ordnance during any intrusive works at the site. Risk mitigation measures will be recommended in line with the CIRIA C681 guidelines, to reduce the risk of initiating UXO, and the subsequent risk of harm / damage during the envisaged works to as low as reasonably practicable (ALARP).

4.2 Risk Assessment Methodology

The following issues will be addressed in the report:

- The likelihood that the site was contaminated with unexploded ordnance.

- The likelihood that unexploded ordnance remains on site.
- The likelihood that ordnance may be encountered during any intrusive works.
- The risk that ordnance may be initiated.
- The consequences of initiating or encountering ordnance.

Risk mitigation measures, appropriate to the assessed level of risk and site conditions, will be recommended.

4.3 Approach

In preparing this Unexploded Ordnance Risk assessment, SafeLane Global has considered general and, as far as possible, site-specific factors including:

- Evidence of German bombing and delivery of UXBs.
- Site history, occupancy and conditions during WWII.
- The legacy of Allied military activity.
- Details of any known EOD clearance activity.
- The extent of any post war redevelopment.
- Scope of the current proposed works.

4.4 Sources of Information

SafeLane Global has carried out detailed historical research for this Unexploded Ordnance Risk Assessment including accessing military records and archived material held in the public domain and in the MoD.

Material from the following sources has been consulted:

- The National Archives.
- Britain From Above
- Groundsure Limited.
- Relevant information supplied by the client.
- Available material from 33 Engineer Regiment (EOD) Archive.
- SafeLane Global's extensive archives built up over many years of research and hands-on Explosive Ordnance Disposal activities in the UK.
- Open sources such as published books, local historical records and the internet.

4.5 Reliability of Historical Records

4.5.1 General Considerations

This report is based upon research of historical evidence. Whilst every effort has been made to locate all relevant material SafeLane Global cannot be held responsible for any changes to the assessed level of risk or risk mitigation measures based on documentation or other information that may come to light at a later date.

The accuracy and comprehensiveness of wartime records is frequently difficult or impossible to verify. As a result, conclusions as to the exact location, quantity and nature of the ordnance risk can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence. SafeLane Global cannot be held responsible for inaccuracies or gaps in the available historical information.

4.5.2 Bombing Records

During WWII, considerable efforts were expended in recording enemy air raids. Air Raid Precautions (ARP) wardens were responsible for making records of bomb strikes either through direct observation or by post-raid surveys. However, their immediate priority was to deal with casualties and limit damage, so it is to be expected that records are often incomplete and sometimes contradictory. Record keeping in the early days of bombing was not comprehensive and details of bombing in the early part of the war were sometimes destroyed in subsequent attacks. Some reports may cover a single attack, others a period of months or the entire war.

Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are not always reliable; records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

5 The Site and Scope of Proposed Works

Site Address	Immingham East Junction, Queens Road, Immingham, North East Lincolnshire, DN40 1QR	
OS National Grid Reference	TA 20391 15249	
Site Description	The site is located within the east of the Immingham Dock facility. The project site is irregular in shape, encompassing large areas of hard standing, several commercial buildings and peripheral dense vegetation. The northern part of the site extends northwards into the Humber port approaches.	
Proposed Works	Associated British Ports (ABP), the owner and operator of the Port of Immingham, is proposing to construct a new roll-on/roll-off (Ro-Ro) facility within the Port to service the embarkation and disembarkation of principally commercial and automotive traffic. The proposed development will involve marine works (an approach jetty, a linkspan with bankseat, floating pontoon, finger piers) within the Humber Estuary and landslide works (terminal, building and internal bridge construction) on existing statutory port estate.	
References	**Site Location Maps**	**Annex A**
	Recent Aerial Photograph	**Annex B**

6 Ground Conditions

<table>
<tr><th colspan="2">Data Source</th><th>Description</th></tr>
<tr><td rowspan="4">British Geological Survey Borehole</td><td>Borehole Reference</td><td>TA21NW10</td></tr>
<tr><td>Location</td><td>On site (south)</td></tr>
<tr><td>Date</td><td>April 1946</td></tr>
<tr><td>Recorded Shallow Geology</td><td>• ~0.4m of "made up ground"
• ~3.4m of "soft brown warp"
• ~5.6m of "soft blue warp"
• ~0.6m of "peat"
• ~5.6m of "marl clay"
• ~7.8m of "chalk gravel"
• ~8.5m of "chalk"</td></tr>
<tr><td rowspan="2">British Geological Survey Mapping</td><td>Superficial Deposits</td><td>Tidal Flat Deposit – Clay & Silt (south of the site)
Beach & Tidal Flat Deposits (undifferentiated) – Clay, Silt & Sand (north of site)</td></tr>
<tr><td>Bedrock</td><td>Flamborough Chalk Formation - Chalk</td></tr>
<tr><td>Client Provided Data</td><td>Groundsure Enviro+Geo Insight, 2021[1]</td><td>Most of the land-based project site comprises made ground, with small exceptions. These other areas within the site comprise infilled ground, the first area located towards the northern extent, just south of the dock/Humber, the second area in the south-eastern extent.
Information regarding the material and date of origin for these infilled areas is not provided within this document.</td></tr>
</table>

[1] Groundsure Limited, Enviro + Geo Insight, 08/10/2021, Ref: Project_Sugar_60664611

7 Historical Mapping

7.1 Pre and Post-WWII OS Mapping

	Date	Observations	Reference	Source
Pre-WWII	1910-30	• The available coverage of the northern extent of the site is dated 1910, while the remainder of the site is covered by a 1930 map. As such, the conditions of the site will have undergone additional changes at its northern extent after the production of this map. • The north of the site is predominantly shown to be undeveloped, with its very northern extent encroaching into the water. • The south-west of the site is occupied by railway lines and sidings, with surrounding open ground and small associated structures. • The south-east of the site is bisected by a road with embankments. On the eastern side of this road, the site comprises open pasture and vegetated fields. Some small buildings are visible. • The remainder of the site is not shown to be occupied by any structures. However, it is possible that certain features such as railway lines have been omitted from this map. • The surrounding area is predominantly rural to the east and south, with *Immingham Dock* and its associated railway infrastructure located to the west.	Annex C-1	Landmark Maps
Post-WWII	1947-51	• Several cleared buildings are visible in the surrounding area, predominantly to the east of the site around the Dock facilities. • Evidence of clearance is often indicative of bomb damage on early post-WWII OS mapping. • The site does not appear to have undergone any significant changes, aside from the installation of a railway line parallel to the river front. • Several instances of development are evident in the surrounding area, the most significant of which to the west of the northern extent. • Aside from the aforementioned clearance and development, no futher significant changes appear to have occurred in the surrounding area.	Annex C-2	Landmark Maps

7.2 Immingham Dock Plan, c. 1912

A plan of Immingham Dock dated around 1912 was obtained.

Date	Observations	Reference	Source
c.1912	• This plan confirms that during WWI, the project site was occupied primarily by rail lines and sidings, along with associated structures within the rail infrastructure. • The northern parts of the site were mostly occupied by open ground, with the northernmost extent extending outwards into the Humber.	Annex D	Open Source

8 The Threat from Aerial Bombing

8.1 General Bombing History of Immingham

8.1.1 First World War

The UK suffered aerial bombardment during WWI, beginning with indiscriminate night raids by Zeppelin airships. However as British defensive measures became more effective and aircraft development progressed, the German military switched to daylight raids by fixed wing aircraft in June 1917.

The area surrounding Kingston upon Hull has bombed several times by Zeppelin airships between 1915 and 1918, including the Immingham area.

On 28th/29th July 1916, a Zeppelin crossed the estuary to Immingham before dropping 6x HE bombs on Stallingborough Marsh, near to Immingham Halt station. One of the bombs fell near the electric railway line. A 12-pdr gun at Immingham Halt reportedly fired 2 rounds into the fog, but without result. Bombs were also dropped on the Killingholme area.[2]

WWI bombs were generally smaller than those used in WWII and were dropped from a lower altitude, resulting 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. 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.

8.1.2 Second World War

At the start of WWII, the Luftwaffe planned to destroy key military installations, including RAF airfields and Royal Navy bases, during a series of daylight bombing raids, mainly in southern and eastern England; July to October 1940.

After the Battle of Britain these tactics were modified to include both economic and industrial sites across the entire country. Targets included dock facilities, railway infrastructure, power stations, weapon manufacturing plants, gas works, etc. In the autumn of 1940, as a result of aircraft losses, daylight raids were reduced in favour of attacking targets under the cover of darkness.

The Luftwaffe strategy became the destruction of civilian morale by the large scale "carpet bombing" of Britain's cities; London, Liverpool, Birmingham, etc. This initial nine-month Blitz period came to an end in May 1941 as the vast majority of Luftwaffe was diverted east to prepare for 'Operation Barbarossa'; the invasion of the Soviet Union. Sporadic attacks continued in the Humber region till the end of the war, however these comprised smaller formations of German aircraft.

During WWII, north-east Lincolnshire was predominantly agricultural in character and, aside from a number of RAF airfields, contained few potential Luftwaffe targets. However, Immingham Port and the associated rail infrastructure, coal yards and industry on and in close proximity to the site would have constituted a significant Luftwaffe bombing target. Similarly, the neighbouring seaport of Grimsby to the south-east and city of Hull to the north, which both contained large areas of dock and port infrastructure, were regularly attacked throughout the war - along with other major industrial

[2] http://www.iancastlezeppelin.co.uk/2829-jul-1916/4591795878

centres in the north of England. As a consequence, it is probable that the surrounding area was subjected to both targeted raids and 'tip and run' bombing incidents[3].

8.2 Generic Types of WWII German Air-delivered Ordnance

The nature and characteristics of the ordnance used by the Luftwaffe allows an informed assessment of the hazards posed by any unexploded items that may remain today.

- HE Bombs: In terms of weight of ordnance dropped, HE bombs were the most frequent weapon deployed. Most bombs were 50kg, 250kg or 500kg (overall weight, about half of which was the high explosive) though large bombs of up to 2,000kg were also used. HE bombs had the weight, velocity and shape to easily penetrate the ground intact if they failed to explode. Post-raid surveys would not always have spotted the entry hole or other indications that a bomb penetrated the ground and failed to explode, and contemporary ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. Unexploded HE bombs therefore present the greatest risk to present–day intrusive works.
- Blast Bombs/Parachute Mines: Blast bombs generally had a slow rate of descent and were extremely unlikely to have penetrated the ground. Non-retarded mines would have shattered on most ground types, if they had failed to explode. There have been extreme cases when these items have been found unexploded, but this was where the ground was either very soft or where standing water had reduced the impact. SafeLane Global does not consider there to be a significant risk from this type of munition on land.
- Large incendiary bombs: This type of bomb ranged in size from 36kg to 255kg and had a number of inflammable fill materials (including oil and white phosphorus), and a small explosive charge. They were designed to explode and burn close to the surface, but their shape and weight meant that they did have penetration capability. If they penetrated the ground, complete combustion did not always occur, and, in such cases, they remain a risk to intrusive works.
- 1kg Incendiary Bombs (IB): These bombs, which were jettisoned from air-dropped containers, were just over 30cm in size and therefore highly likely to go unnoticed. They had the potential to penetrate soft ground and left a very small entry hole. Furthermore, if bombs did not initiate and fell in water or dense vegetation or became mixed with rubble in bomb damaged areas, they could have remained hidden to this day. Some variants had explosive heads, and these present a risk of detonation during intrusive works, particularly due to their shape, which leads them to often be misidentified.
- Anti-personnel (AP) Bomblets: AP bombs 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.
- Specialist Bombs (smoke, flare, etc): These types do not contain high explosive and therefore a detonation consequence is unlikely. They were not designed to penetrate the ground.

Examples of the most commonly deployed German bombs are presented in the following figures.

[3] When German aircraft were not able to reach their intended target due to heavy anti-aircraft fire or fighter interception and jettisoned their bomb load indiscriminately.

SC50 (High Explosive)

Bomb Weight: 40-54kg (110-119lb)

Explosive Weight: c.25kg (55lb)

Fuze Type: Impact fuze / electro-mechanical time delay

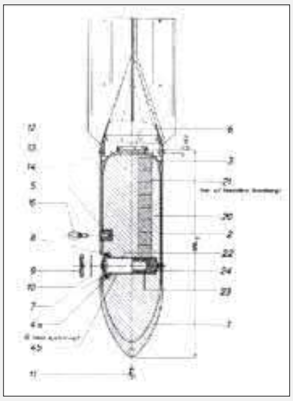
Body Dimensions: 1,090 x 280mm (22.9 x 11.0in)

Body Diameter: 200mm (7.87in)

Use: Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges, and buildings up to three-storeys.

Remarks: The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

50kg HE bomb, London Docklands

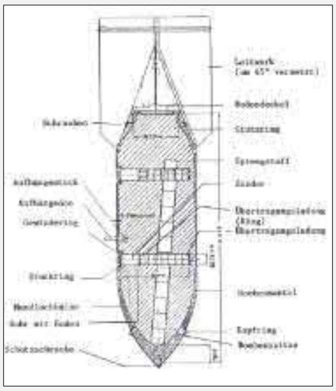


SC 50 JA (Güteklasse 1)

50kg HE bomb (minus tail section)

250kg HE bomb, Hawkinge

SC250 attached to undercarriage of Messerschmitt Bf109



SC 250 JA (Güteklasse 1)

SC250 (High Explosive)

Bomb Weight: 245-256kg (540-564lb)

Explosive Weight: c.125-130kg (276-287lb)

Fuze Type: Electrical impact fuze / mechanical time delay fuze

Body Dimensions: 1,640 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.

1kg Incendiary Bomb

Bomb Weight: 1.0 & 1.3kg (2.2 & 2.87lb)

Filling: 680gm (1.3lb) Thermite

Fuze Type: Impact Fuze

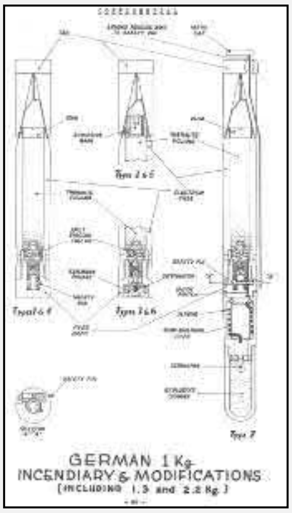
Body Dimensions: 350 x 50mm (13.8 x 1.97in)

Body Diameter: 50mm (1.97in)

Use: As incendiary – dropped in clusters against towns and industrial complexes.

Remarks: Jettisoned from air-dropped containers. Magnesium alloy case. Sometimes fitted with high explosive charge.

1. Ordinary scaffold pipe
2. 1kg incendiary bomb
3. Incendiary bomb recently found on site in UK



1kg German Incendiary Bomb next to a 30cm ruler

8.3 Second World War Bombing Statistics

The following table summarises the quantity of German bombs (excluding 1kg incendiaries and anti-personnel bombs) falling on the Rural District of Grimsby between 1940 and 1945.

Record of German Ordnance Dropped on the Rural District of Grimsby	
Area Acreage	39,647
High Explosive Bombs (all types)	204
Parachute Mines	6
Oil Bombs	-
Phosphorus Bombs	27
Fire Pots	17
Pilotless Missile (V1)	-
Long Range Rocket (V2)	-
Total	254
Items Per 1,000 Acres	**6.4**

Source: Home Office Statistics

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 incendiaries are not particularly significant in the risk they pose, they nevertheless are items of ordnance that were designed to cause damage and inflict injury and should not be overlooked in assessing the general risk to personnel and equipment. The anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. This table does not include UXO found during or after WWII.

8.4 Site Specific WWII Bombing Records

8.4.1 Secondary Source / Anecdotal Evidence

Anecdotal evidence of local bombing incidents was sought from publications and web resources. The following references to incidents on site or in the surrounding area were found.

Date	Weapon	Details
12/02/1940	250kg HE bomb	The merchant ship SS Kildare arrived in Immingham with a bomb wedged in the main deck. The bomb was subsequently defused. A similar incident reportedly occurred in the following June.[4]
February 1941	Not specified	In February, the main weight of attacks fell on the north of the county, Grimsby, Cleethorpes and the North Killingholme areas being raided most.[5]
22/03/1941	HE bombs	A Heinkel strayed over the Humber defences after becoming lost. It was hit by AA fire and then flew into a balloon cable. The aircraft jettisoned its bomb load at low level across the railway sidings at Immingham and crashed just beyond what is now Hawthorne Avenue.[6] This incident could have occurred within the project site's location.
22/03/1941	HE bombs	A further report taken from the same day notes that a Heinkel came under fire after entering the Humber estuary. It jettisoned its bombs on wasteland between Immingham Docks and the loco sheds, before crashing in a field beside the Immingham-Habrough Road.[7] This record confirms the events of the previous entry and could have resulted in bombs landing within the site boundary.
11/08/1942	Not specified	The Docks at Immingham were damaged.[8]

8.4.2 Bombing Decoy Sites

A national decoy authority headed by Colonel John Fisher Turner was set up in July 1940, and following earlier experiments in Glasgow and Sheffield, a system of urban lighting decoys was set up. These were known as "Civil" sites; Civil 'QL' for urban lighting simulation, and Civil 'QF' for dummy fires. "Q" - sites were equipped with assorted electrical and pyrotechnical apparatus to simulate the flare given from furnace doors, steel-making, railway marshalling yards, and light given off by inefficient blackout precautions.

Other sites simulated small fires started by incendiary bombs, with oil-storage area fire simulation being developed near large oil installations. A further variation on fire decoy sites was the "SF", or "Special Fires" sites. A larger, longer-burning type of fire was provided at these sites - known as

[4] https://www.rafmuseum.org.uk/blog/a-short-history-of-raf-bomb-disposal/
[5] Air Raids on Lincolnshire 1940-1945, County Constabulary Headquarters, Lincoln, 5th December 1945
[6] https://www.northlincsweb.net/RAFElshamWolds/html/22nd_march_1941_-_5-kg4-_eindhoven_-_heinkel_he_iii_p-4_-_2938_-.html
[7] Ramsey, (1988).
[8] Ramsey, (1990).

"Starfish" sites - to draw incendiary bombs, and hopefully as a consequence the full enemy payload, from falling on the larger conurbations and defence installations during heavy air raids. Decoy sites were effective in drawing the Luftwaffe's attacks away from legitimate airfields – in 1940 alone 'Q' and 'Starfish' sites received nearly 200 attacks.

Records show that one naval decoy site was located <3.5km to the south-east of the site, at Immingham Range. It was built as part of the "N-Series" of naval decoys to deflect enemy bombing from Royal Navy installations on the Humber estuary. This site operated as both a "Permanent Starfish" and "QL" decoy. The site is referenced as being in use during 1941 and 1942.[9]

In addition to this site, two bombing decoy sites were established further to the north-west of the site, to deflect attention away from the nearby airfields.

The presence of such installations indicates that it was anticipated that the region would receive Luftwaffe attention due to the strategically important targets situated nearby.

8.4.3 WWII-era RAF Aerial Photography

The following WWII-era aerial photography was reviewed for the site:

Date	4th May 1950
Source	Britain From Above
Image Type	Oblique
Image quality	High resolution, small scale, partial coverage
Observations	• The site appears mostly as shown on OS mapping, predominantly comprising vegetated open ground. • The south of the site encompasses part of the railway siding's infrastructure. • The northern extent of the site, located in the river, is not visible on this image. A second photograph was consulted (not annexed[10]), which confirms that this part of the site encroaches into the river. • Throughout the war, this area would have varied in water depth, at times comprising tidal mud / sediment. • No obvious signs of bomb damage are visible within the site boundary. However, the nature of the ground cover means evidence of bombing will not be easily observable. • Two gun battery sites are visible to the south and east.
Reference	**Annex E**

[9] https://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=f1bf76dc-6feb-4409-ae1e-ceb5092ea060&resourceID=19191
[10] https://www.britainfromabove.org.uk/en/image/EAW029090

8.4.4 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 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, nor 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.

SafeLane Global holds records of officially registered abandoned bombs at or near the site	✘
Additional Comments	n/a

8.5 UXB Ground Penetration

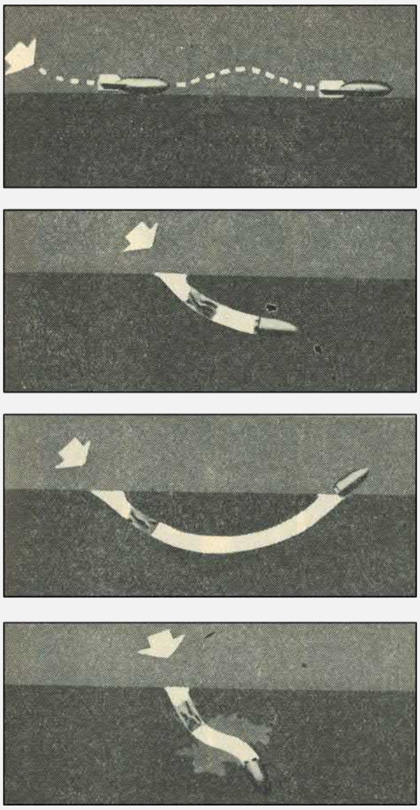
8.5.1 General Considerations

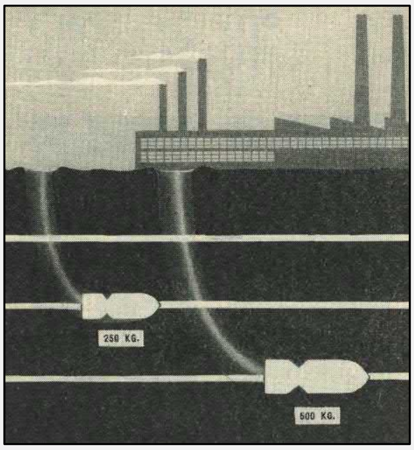
The actual penetration depth of aerial delivered bombs into the ground will have been determined by the mass and shape of the bomb, the velocity and angle of the bomb on impact (dependent on the height of release) and the nature of the ground and ground cover; the softer the ground, the greater the potential penetration. Peat, alluvium and soft clays are easier to penetrate than gravel and sand. Bombs are brought to rest or are commonly deflected by bedrock or large boulders.

8.5.2 The "j" Curve Effect

An air-dropped bomb released from normal bombing altitude (approx. 5,000m) on its curved trajectory can reach a terminal velocity of between 350-400 ms-1. In this case of high-level bombing, the angle of which the bomb enters the earth is approx. 15° from the perpendicular and its exact path is difficult to trace. The bomb is being driven by its kinetic energy can unless deflected, will continue its line of flight and can turn in an upwards curve towards the ground surface as it comes to rest. The upwards curve is caused by the transfer of energy as the bomb travels through the ground. The nose of the bomb travels slower than the rear of the bomb due to the drag/friction of it passing through the ground. The rear of the bomb, having more energy due to less drag/friction is travelling much quicker.

The location of the bomb is thus ''offset'' from the hole of entry. This ''offset'' from vertical is generally understood to be about one third of the penetration depth but can reach up to (and have been found at) 15m/50 ft from point of entry, dependent on ground conditions and the bomb's angle of impact. The figure below depicts the various paths of UXB through homogenous ground, showing how the J-curve effect can lead to a UXB coming to rest beneath undamaged buildings.





A UXB can come to rest beneath undamaged buildings due to the J-Curve effect if it lands in nearby soft ground.

Image source: Field Manual for Unexploded Bombs: Organisation and Operation For Disposal, United States War Department 1943

Left: Path of UXB in soft ground:

1. Ricochet resulting from low level attack: UXB stays perpendicular to ground and rests at surface.
2. Buried UXB with J-Curve: Bomb curves horizontally and rests perpendicular to surface.
3. UXB returning to surface due to J-Curve: Bomb points towards surface but may remain partially or completely below ground level.
4. UXB deflected by buried objects: Results in unpredictable path and unusual shift.

8.5.3 Second World War Bomb Penetration Studies

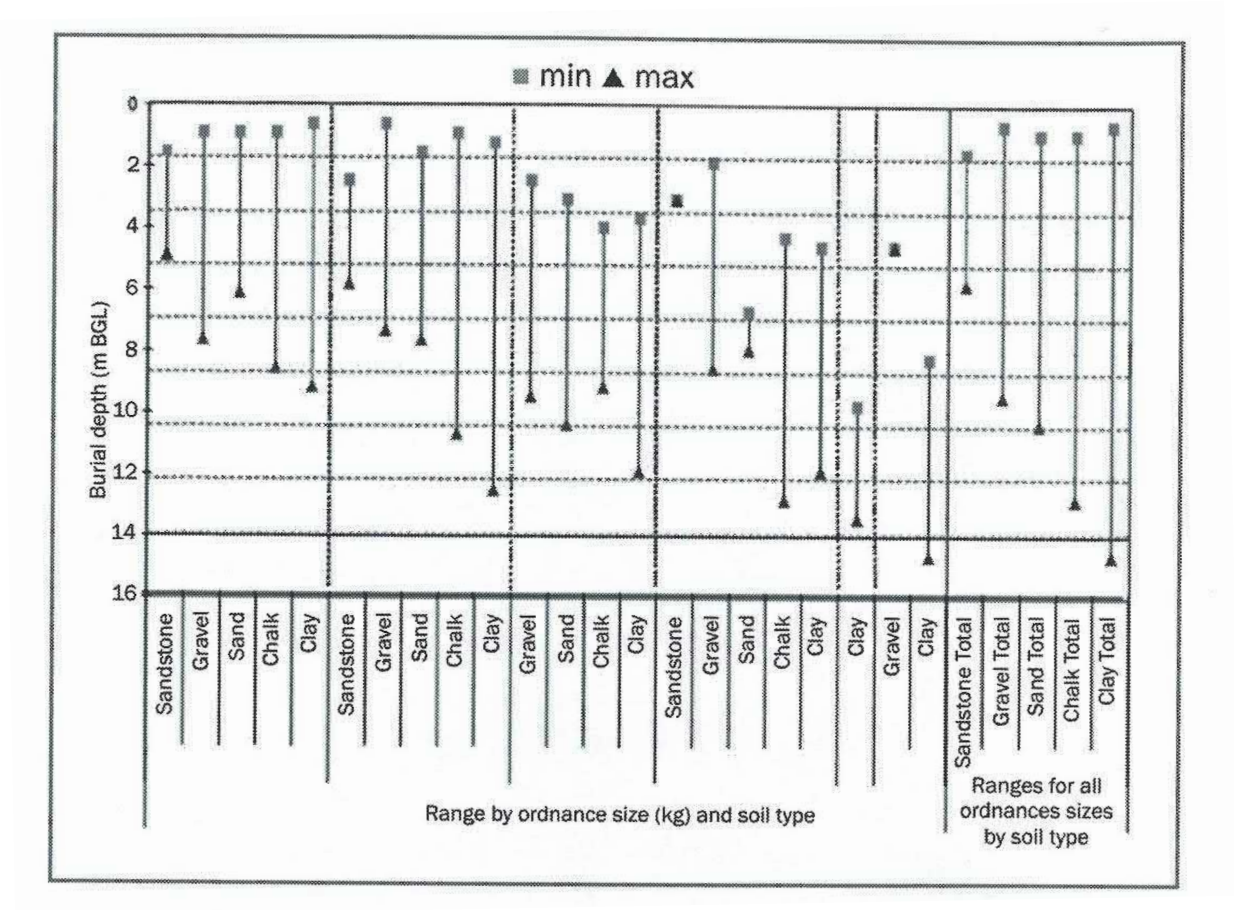
During WWII, the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by Bomb Disposal, mostly in the London area. They then came to conclusions as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

The median penetration of 430 x 50kg German bombs in London Clay was 4.6m and the maximum penetration observed for the SC50 bomb was 9m.

They concluded that the largest common German bomb, 500kg, had a likely penetration depth of 6m in sand or gravel but 8.7m in clay. The maximum observed depth for a 500kg bomb was 10.2m and for a 1,000kg bomb 12.7m. Theoretical calculations suggested that significantly greater penetration depths were probable.

8.5.4 CIRIA Bomb Penetration Depth Specifications

As stated within C681, the ground conditions at any individual site are likely to be highly variable and this results in a large range of burial depths for each different size bomb. The below chart shows the observed variation in burial depths of various sizes of air-delivered UXO for different ground conditions.



8.5.5 Site Specific Bomb Penetration Considerations

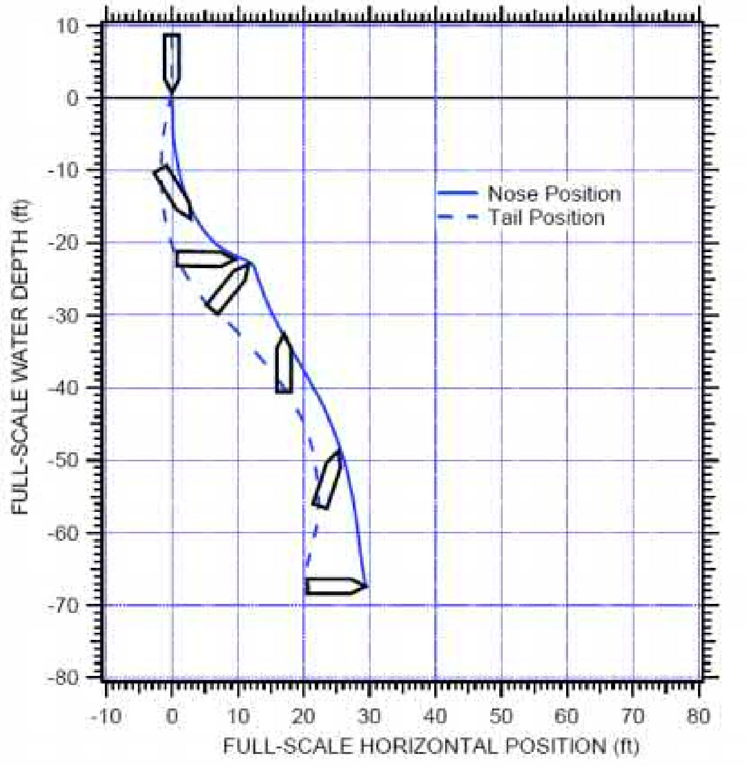
When considering an assessment of the bomb penetration at the site, the following parameters would be used:

- Geology – Tidal Flat Deposits (Clay & Silt – land) and Beach & Tidal Flat Deposits (Clay, Silt & Sand – marine), underlain by Flamborough Chalk Formation bedrock.
- Impact Angle and Velocity – 80-90° from horizontal and 267 metres per second.
- Bomb Mass and Configuration – The 500kg SC (General Purpose) HE bomb, without retarder units or armour piercing nose. This was the largest of the common bombs used against Britain.

Taking into account the above-mentioned factors it has been assessed that a 500kg bomb would have had an approximate maximum bomb penetration depth of between **8-10m** below WWII ground level. Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth.

Within any section of the site occupied by the river, the lowest possible water depth above the locations of the proposed works during WWII will also be considered.

For any part of the site located below the water mark of the lowest mean tide, calculating a maximum bomb penetration assessment is more problematic as the water column produces a decelerating effect that is not easily calculated.



Penetration into the riverbed by bombs with a standard tangent Ogive nosecone is not well predicted as the bomb will deviate from its original path. The velocity at which a bomb is travelling becomes irrelevant in water deeper than several metres because the water has such a decelerating effect that a bomb will essentially "float" down to the seabed, however not necessarily in a vertical orientation; see graph (left) - plotting the trajectory of an American MK-84 (925kg) HE bomb with no tail section into water at an entry velocity of 296m/s.[11]

By approximately 6m water depth the bomb has become fully horizontal and therefore has lost most of its ability to significantly penetrate the bed.

Note, that this 925kg bomb is approximately twice the weight of the 500kg bomb used above. This means that the bomb used in this American experiment struck the water with more force than the vast majority of those deployed over the UK during WWII.

Therefore, where the water depth above the study area exceeds approximately 4m, a 500kg UXB striking the water surface is unlikely to have had the required kinetic energy to achieve complete burial beneath the riverbed.

Further research confirms the following key features:

- Ignoring surface tension there will be an immediate loss of inertia due to rapid energy losses; sound, wave, splash, bubble formation and cavitation.
- The drag force rapidly decelerates the bomb. If there is sufficient water depth then acceleration will become 0m/s2 and the terminal velocity in water will be achieved; 11m/s.
- Once the terminal velocity in water is reached the bomb impacts the riverbed as a free-fall penetrator.

Analysis of the air-water-soil regime is complex and difficult to measure. The current model assumes that 5m of water column is required in order to achieve the terminal velocity of a German WWII HE UXB in water. Impacts at this speed will cause a riverbed sediment penetration of 2.3m, assuming a bearing capacity of 75kPa.[12]

[11] P. Gefken, Underwater Bomb Trajectory Prediction for Stand-off Assault (Mine/IED) Breaching Weapon Fuse Improvement (SOABWFI), 2006

[12] *Department of The US Army., TM 5-855-1 Fundamentals of Protective Design for Conventional Weapons, 1986*

8.6 Likelihood of Post-raid UXO Detection

Utilising the available historical bombing records as reviewed in Section 8.4, it is possible to make an assessment of the likelihood that evidence of UXO would have been noted on a site during the war and the incident dealt with or recorded at the time. Factors such as bombing density, frequency of access, ground cover, damage and failure rate have been taken into consideration.

8.6.1 Density of Bombing

Bombing density is an important consideration for assessing the possibility that UXBs remain in an area. A very high density of bombs will have increased the likelihood of errors in record keeping at the time, as civil defence personnel and emergency services may have been overwhelmed. A higher density of bombing also increases the number of UXBs actually occurring in a given area.

The type and specific location of recorded bomb strikes is also an important consideration. If a stick of bombs (one individual aircraft's bomb load) is plotted in line with a site or is shown to straddle a site, then this raises the possibility that an unrecorded UXB from the same stick struck that site.

8.6.2 Bomb Damage

In Blitzed cities / towns throughout Britain, bomb sites were often not cleared of rubble until after the war and mid-war repairs to buildings were only carried out on the most vital facilities (power stations, gas works, weapons factories etc.). However, if a building only sustained bomb damage to its upper floors, any subsequent UXB strike to the structure will still have caused obvious damage, at ground floor level, which would have been reported and dealt with at the time.

HE bomb strikes to open ground will have resulted in a large crater and local soil disturbance. Any subsequent UXB strike will not have resulted in an easily identifiable entry hole and as such is likely to have gone unnoticed amongst the disturbed ground.

In London and south-east England, the German V1 Flying Bomb and V2 Long Range Rocket campaigns caused widespread devastation. However, as these weapons began to be utilised after the final significant Luftwaffe air raids had occurred, any serious damage caused by such weapons does not necessarily indicate an increased risk of Luftwaffe freefall UXB contamination. However, it is quite possible that serious damage inflicted during the 1940-1944 campaigns by Luftwaffe freefall bombs could have been erased by a subsequent V Weapon strike.

8.6.3 Frequency of Access

A UXB strike at a site where human access was infrequent would have had a lower chance of being observed, reported and recorded compared to a site which was developed and subject to regular access. UXB strikes during night-time raids (when German planes could more easily evade anti-aircraft defences) are also more likely to have fallen unobserved than ones dropped during a daylight attack.

In frequently bombed cities / towns, ARP Wardens were tasked with carrying out searches for UXBs within recently bombed residential areas and schools. Similarly, many important home front facilities (factories, gas works, power stations, docks etc.) had their own dedicated ARP teams or Fire Watchers tasked with observing local air raids. Fire Watchers were mainly responsible for extinguishing 1kg incendiary bombs as well as reporting any UXB strikes. Anecdotal evidence however indicates that Fire Watchers did not always turn up for their shifts and therefore such UXB mitigating activities should not be assumed in the absence of site-specific evidence. Less important buildings sustaining bomb damage would have been abandoned until after the German bombing campaign in that area had ceased and repairs could be made, greatly decreasing the level of access to that site.

Schools closed due to the evacuation of children were often requisitioned by the Civil Defence authorities to be utilised as night time First Aid posts and reception centres (providing emergency accommodation for bombed out civilians). Therefore, an increased level of access is likely at these locations.

8.6.4 Ground Cover

The entry hole of a 50kg UXB (the most commonly deployed German HE bomb) could have been as little as 20cm in diameter. Wartime records also confirm that small German Incendiary Bombs, weighing just 1kg, were capable of significant penetration into soil, resulting in very small entry holes (5cm) or complete burial.

The quantity and type of ground cover present on a site during WWII would have had a significant effect, at ground level, on the visual evidence of buried UXO.

Evidence of UXO could be obscured in dense vegetation, soft ground, rubble, railway ballast or amongst stockpiled material (such as aggregate, coal or refuse heaps). A UXB strike to waterlogged ground or open water would have been immediately obscured from view beneath the waterline. Had such an incident occurred within a tidal mudflat or riverbank, the resulting entry hole will have remained only temporarily, before becoming in-filled by water and sediment. Any HE UXB strike to elevated risk ground cover could potentially have come to rest beneath neighbouring undamaged buildings or hard-standing due to the 'J-Curve' Effect.

UXB strikes to undamaged/superficially damaged buildings and hard-surfaced ground will still have caused substantial damage or an easily identifiable and persistent entry hole. Similarly, it is unlikely that an HE UXB entry hole on well-maintained / manicured lawns (tennis courts, bowling greens, golf course fairways / greens, gardens in affluent areas etc), would have been overlooked. Such incidents would have been reported and the UXB subsequently removed.

8.6.5 German Air-Delivered Ordnance Failure Rate

Based on empirical evidence, it is generally accepted that 10% of the German HE bombs dropped during WWII failed to explode as designed. This estimate is probably based on the statistics of wartime recovered UXBs and therefore will not have taken account of the unknown numbers of UXBs that were not recorded at the time and is probably an underestimate.

The reasons for failures include:

- Fuze or gaine malfunction due to manufacturing fault, sabotage (by forced labour) or faulty installation.
- Clockwork mechanism failure in delayed action bombs.
- Failure of the bomber aircraft to arm the bombs (charge the electrical condensers which supplied the energy to initiate the detonation sequence) due to human error or equipment defect.
- Jettison of the bomb before it was armed or from a very low altitude. Most likely if the bomber was under attack or crashing.

War Office Statistics document that a daily average of 84 bombs which failed to function were dropped on civilian targets in Great Britain between 21st September 1940 and 5th July 1941. 1 in 12 of these (probably mostly fitted with time delay fuzes) exploded sometime after they fell; the remainder were unintentional failures.

From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50kg and over (i.e. German bombs), 7,000 AAA shells and 300,000 beach mines. These operations resulted in the deaths of 394 officers and men. However, UXO is still regularly encountered across the UK.

Note, due to manufacturing fault or failure of the bomber crew to correctly arm their munitions, whole bomb loads often failed to detonate. Therefore, the presence of reported UXBs increases the likelihood of an additional unrecorded UXB in the vicinity.

8.6.6 Site Specific Analysis

The following table will place the site in context with these factors, in order to assess the likelihood of post-raid UXO detection within the project site.

Likelihood of Post Raid UXO Detection on Site			
Site-Specific Factors			Additional Comments
Density of Bombing Assessment	Based on wartime records or secondary source information, what was the bombing density over the site?	Low	The overall bombing density for Grimsby Rural District was low, however, the site's location within the dock and railway infrastructure, the localised bombing density is likely to be respectively higher.
	Was the site ever subjected to one or more large-scale (>100 tons of ordnance) night time Blitz raids?	✘	
	Were any HE bomb strikes recorded on site?	✓	Anecdotal evidence records bombing to the railway sidings and the dock areas. As such, it is likely that at least 1 HE bomb landed within the site boundary.
	How many HE, Parachute Mine, Oil Incendiary, Phosphorus Incendiary or Fire Pot bombs (large bombs) were recorded within a 300m radius of the site?	n/k	Precise and accurate site-specific bombing records are unavailable for the site. However, it is likely that multiple bombs over multiple raids had fallen within 300m of the site.
	Were any nearby sticks of large bombs recorded in line with the site?	✓	The aforementioned bombing incidents will have incorporated at least 1 stick of bombs in line with the site.
	Were any 1kg incendiary bomb showers recorded over the site?	✘	No records found
Bomb Damage Assessment	A comparison of the historical records confirms that buildings within the site boundary sustained serious bomb damage.	✘	The site contained only very few buildings, recording no evidence of significant damage. However, potential damage has been recorded to some of the surrounding buildings, and the dock was

			recorded to have sustained a level of bomb damage.
	Direct or indirect evidence of HE bomb craters in open ground (within the site boundary) has been found.	✘	
	Buildings on site were seriously damaged by a V1 and / or V2 strike.	✘	
	Buildings on site could have been seriously damaged prior to the nearby V1 or V2 strike?	n/a	
Frequency of Access Assessment	The site was situated in a densely populated urban area during WWII and therefore would have been accessed at the outbreak of WWII.	✘	A large proportion of the site comprised water, vegetated open ground and open pasture during WWII.
	The site was exclusively or partially developed during WWII.	✓	The south of the site contained railway lines and sidings.
	Buildings on site survived WWII intact and therefore likely remained inhabited or in use, suggesting these localities and their immediate environs were accessed throughout the war.	✓	No damage recorded to the small building in the south-east.
	The site was crossed by roads / pavements or footpaths which would have been regularly used / subject to daily footfall.	✘	The site was crossed by a number of railway lines which are likely to have been regularly used.
	The site was occupied by small residential back yards / gardens, likely to have been put to use for cultivation as a result of the government's Dig for Victory Campaign.	✘	
	The site was occupied by a school during WWII.	✘	
	Part of the site is likely to have been subject to post-raid searches for UXO.	✓	The railway lines are likely to have been checked for buckling or direct bomb damage, however the surrounding ballast or soft ground is not.
	Buildings on site sustained serious bomb damage and as a result were likely abandoned (along with any associated gardens / open ground) for the remainder of the war.	✘	
	The site was occupied by peripheral open ground / wasteland, with no apparent use, which may have been neglected.	✓	

	The site may have been occupied by recreational land / sports fields which may have only experienced seasonal access.	✗	
	The site was occupied by a graveyard which would have experienced limited access.	✗	
	The site was occupied by agricultural land, rural countryside or woodland which would not have been accessed in full, either regularly or frequently.	✓	
	The site was occupied by railway sidings which may not have been as regularly checked for buckling as mainline railway tracks.	✓	
	The site was occupied by soft railway embankments which are likely to have been neglected during the war.	✓	
Ground Cover Assessment	The site was partially or entirely abandoned, due to bomb damage, resulting in associated open ground likely becoming overgrown.	✗	
	The site was occupied by dense, inaccessible vegetation during WWII.	✓	A large proportion of the site was occupied by vegetated open ground, the densest of which was located in the south-eastern extent.
	The site may have been susceptible to waterlogged conditions during WWII.	✓	The open ground may have been susceptible to flooding or saturation.
	The site was occupied by (possibly) unmaintained grass field during WWII.	✓	
	The site was part occupied by a canal, river, dock basin, lake or reservoir during WWII.	✓	
	The site was occupied by tidal mud or marshland during WWII.	✓	
	The site was occupied by railway tracks crossing soft ground during WWII.	✓	
	The site was occupied by stockpiled material during WWII.	✓	Parts of the site are likely to have been used for stockpiling materials.
	The site was occupied by buildings, hard-standing or other manmade structures that did not sustain any degree of bomb damage.	✓	

	A comparison of the historical records confirms that buildings on site sustained inconsequential minor / moderate damage.	✗	
	The site was occupied by well-maintained, manicured lawn during WWII.	✗	
	Undamaged, developed parts of the site would have been vulnerable to the J-Curve Effect.	✓	
Bomb Failure Rate	Evidence has been found which suggests that the bomb failure rate in the vicinity of the site would have been different from the "approximately 10%" figure normally used.	✗	

9 The Threat from Allied Military Ordnance

The following potential historical and modern sources of UXO contamination on site or in the surrounding area have been considered:

Potential Source of Contamination on Site	
Army, Navy and RAF Bases / Installations	✓
Military Training Areas / Weapons Ranges	✓
Ordnance / Explosives Factories and Storage Depots	✗
Sites Requisitioned for Military Use	✓
Sites Used or Occupied by the Home Guard	✓
Military Fortifications and Coastal Defences	✓
Locations of Army Explosive Ordnance Clearance Tasks	✗
WWII Anti-Aircraft Batteries	✓
WWII Pipe Mined Locations and Beach Minefields	✗

The risk of contamination from Allied UXO on site is discussed below.

9.1 WWI Military Activity at Immingham

During WWI, Immingham was a submarine base for the British D-class submarines. As such, the port area was used extensively for WWI operations. Due to the port's importance, it was defended by anti-aircraft gun emplacements, and the area was targeted by the German air force.

Immingham was set up before WWI as a Balloon Station by the Royal Naval Air Service. Tethered kite balloons were trailed from convoy escort ships, taking observers aloft in a wicker basket to around 3000ft to watch for sea mines, torpedo tracks and submarines.

In addition to the primary ballooning role, some aircraft were based here, such as the 154 DFW Military Arrow Biplane. Limited numbers of airship operations were also conducted from Immingham during the war. On 1st April 1918, the RAF assumed command and was known as Number 8 Balloon Station until its closure.[13]

[13] https://imminghamheritage.co.uk/about/immingham-in-the-1900s/

9.2 WWII Military Activity at Immingham

9.2.1 Home Guard Activity

The Home Guard (HG) was a defence organisation of the British Army, operational between 1940 and 1944. It comprised 1.5 million local volunteers, otherwise ineligible for military service and acted as a secondary defence force in case of enemy invasion. The HG guarded the coastal areas of Britain and other important facilities such as airfields, factories and explosives stores. They were also active in county towns and cities.

Official records were rarely kept by the HG and therefore any present-day evidence is usually anecdotal. However, it is known that HG personnel often carried out training (including weapons training) in open countryside on the outskirts of cities / towns. Today, items of ordnance related to the HG are occasionally encountered by members of the public and the construction industry in the British countryside. This suggests a culture of ill-discipline regarding live ammunition within HG units.

HG personnel are known to have purposefully buried caches of ammunition and weapons in tactical positions, to be exhumed and used in case of invasion. Records of such caches were not rigorously kept, and some were therefore forgotten about. This is substantiated by several HG UXO finds over recent years. The below table shows just a handful of examples:[14]

Home Guard UXO Finds:	
	Unexploded Spigot Mortar Round, used by the Home Guard in WWII, found and disposed of in Hayle, Cornwall – January 2021
	24 x WWII grenades found buried in a field in Sibton, Suffolk – May 2019

[14] Various News Sources

	A cache of 80 phosphorous grenades buried by the Home Guard found in Eastbourne – September 2015
	Home Guard Phosphorous Grenades found buried beneath a bridge in Herne Bay – July 2015

9.2.2 Coastal Defence and Defensive Fortifications

The English coastline, particularly in the south and east, underwent a significant change with the introduction of anti-invasion fortifications and defences. The more easily accessible landing points were therefore designated for the highest level of defences.

Pivotal locations all across Britain were designated as Nodal Points, and defensive stop lines were installed across the country in preparation for an invasion.

Many of these locations were typically fortified with pillboxes, defence huts, trenches, weapons / ammunition caches. Pillboxes were small brick or concrete built structures, strategically placed to cover angles of likely attack and designed to provide a machine gun team with protection.

During the period when the threat of enemy invasion was high, such positions would have been manned by armed troops and therefore the likelihood of UXO contamination is locally higher at these places.

9.2.3 Soldier Accommodation

During WWII Army, Royal Marine and Home Guard detachments were temporarily accommodated at sites requisitioned by the military for training and / or defence purposes. Soldiers could face serious disciplinary action if found to have misplaced ammunition, therefore it was not uncommon historically for troops to hoard extra items of ammunition to make up for any lost during exercises. Once these surplus items became redundant, they were often buried or hidden.

This is substantiated by anecdotal evidence, for example, a grenade was found in an accommodation block drainpipe within the Rowcroft Barracks (Ashford, Kent). Also, whilst SafeLane Global carried out EOD clearance works at Church Crookham Barracks near Fleet, a search and clear dog team sent into a disused barracks building discovered a grenade. In 2003, SafeLane Global encountered a grenade hidden in the roofing of another disused barrack block at Colchester Garrison. Thus, such a scenario cannot be discounted.

9.2.4 Anti-Aircraft Gun Batteries

At the start of the war two types of AAA guns were deployed: Heavy Anti-Aircraft Artillery (HAA) and Light Anti-Aircraft Artillery (LAA). The LAA batteries were intended to engage fast low flying aircraft and were typically deployed around airfields or strategic installations. These batteries were mobile and could be moved to new positions with relative ease when required. With four guns per battery firing several rounds per minute, AA batteries could expel numerous shells in even the shortest engagements. Numerous unexploded AAA shells were recovered during and following WWII and are still occasionally encountered on sites today.

The maximum ceiling height of fire at that time was around 11,000m however, as the war progressed, improved variants of the 3.7" gun were introduced and, from 1942, large 5.25-inch weapons were brought into service. These had significantly improved ceiling heights of fire reaching over 18,000m.

When the supply of clockwork fuses from Switzerland was cut off, Britain was forced to make its own. After four years of war, the country still lacked the engineering skills to produce a reliable fuse. This resulted in a considerable number of AA projectiles exploding prematurely, killing the gunners or failing to explode at all and falling to the ground as UXBs. In January 1944, more people in London were killed by HAA shells than by German bombs.

9.3 Site-Specific Threat from Allied Military Ordnance

The following table identifies the potential threat to the site of contamination from British / Allied UXO.

Potential Source	Details
Nearest Home Guard Battalion to the site	7th Lindsey (Grimsby Rural) Battalion
Home Guard Activity on site	• No evidence of Home Guard activity on site has been found. • However, it is possible that Home Guard personnel may have been active in the general Immingham Dock area, for patrols, training, or manning the nearby defences. • As such, it cannot be entirely discounted that such activity may have occurred within the project site.
Defensive features within the vicinity	• WWI-era Pillbox (~1.3km south-east) • Coast Artillery Searchlight (~ 1.4km south-east) • Coast Battery (~1.4km south-east) • The 'G' Flight HQ was based in Grimsby and barrage balloons were based around Immingham (Skitter Road) and to the east of the Admiralty Oil Tanks near

	Immingham, Chase Hill Farm and Brickyard Lane. Also, floating barrage balloons were raised on vessels in the Humber, close to Sunk Island.[15]
Troop Accommodation on site	• Post-WWII aerial photography of the Immingham Docks identifies a WWII-era US Army Camp located approximately 250m to the west of the site. Troops will have been accommodated here during wartime, and as such it is likely that training exercises will have occurred in the surrounding area. • No evidence of soldier accommodation specifically within the project site boundary has been found.
Ordnance use, storage and disposal on site	• During both WWI and WWII, the general Immingham Dock area was home to military personnel. As such, the presence of armed navy and army personnel cannot be disregarded on site and in the surrounding area. • The presence of a nearby military camp indicates that training exercises may have occurred within or near to the project site. The unused, open ground adjacent to the camp itself may have presented an ideal location to conduct training exercises. However, although such a scenario cannot be discounted, no evidence of such activity has been found. • During WWII, it is likely that a range of ordnance and ammunition could have been stored near to the site, relating to the nearby military camp. While no plan of the military camp adjacent to the site has been located, it is likely that ammunition storage will have been located within the facility. No evidence of storage structures has been found within the project site boundary. • Anecdotal accounts suggest that faulty or surplus ordnance / ammunition on WWII military sites would often be burnt, buried or otherwise disposed of locally. In many cases, designated burning pits were located at peripheral open ground within with site perimeter. • It is possible that ordnance disposal could have occurred within the vicinity of the project site, as the open ground and peripheral locations within the north of the project site would have been ideal conditions to bury or burn unwanted munitions. • However, no evidence of such activity has been found. • Furthermore, the camp was located adjacent to the River Humber. Often, rivers, docks and other bodies of water near to military camps offered a quick and easy unofficial method of disposal to the military personnel. Hundreds of items of small arms and land service ammunition are found across Britain's waterways every year due to this very reason. As such, the possibility that surplus, faulty or unwanted items of ammunition may have been discarded into the marine section of the site during military occupation in the area. • Had such a scenario occurred along this part of the Humber, it is also possible that items could have then migrated with the river's current into or out of the site boundary itself.
Number of HAA batteries within 5km of the site	9

[15] https://nlahcentre.com/baloons-and-aa-sites-around-humber/

Threat to the site from unexploded AA shells	• HAA battery from WWI, armed with 2 x 1-pounder guns on travelling carriages in 1916, and a 12-pounder gun in 1917. This was located approx. 1.4km south of the site. • HAA Battery Number H21, located less than 300m east of the site. This was reportedly unarmed in 1941.[16] • HAA Battery Number H22, located on site. This battery was listed as unarmed in 1941.[17] • HAA Battery Humber L, a WWII HAA battery at Homestead Park (>1km west of the site). This was manned by 270 Battery of the 91st Royal Artillery Regiment.[18] • In addition to the aforementioned HAA batteries, 111 LAA Battery was based at Immingham.[19] These were at first manned by the army, but from circa 1942, they were manned by the Home Guard. • A photograph, dated circa 1940s, is presented in **Annex F**. This shows anti-aircraft gunnery training in Immingham. • Had an unexploded AA shell landed in the parts of the site occupied by the river, it would have been immediately obscured beneath the waterline. If it had landed within the tidal mud, it is unlikely to have resulted in a persistent entry hole, and would have been quickly infilled by the soft, mobile surrounding sediment. Following such a scenario, the item could easily have been left undiscovered. • Had an unexploded AA shell landed within the parts of the site occupied by unused, soft, open ground, ballast, or vegetation, it could have been left unnoticed. • However, had such an item landed directly onto railway tracks, undamaged buildings, or any other undamaged man-made structures, it could have caused significant damage which is more likely to have been noticed and dealt with at the time.

[16] https://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=41818b45-da86-42d2-bcf9-8811a890b3b2&resourceID=19191
[17] https://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=a94ce491-1067-44a1-ac1d-ce6d16bf71cd&resourceID=19191
[18] https://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=f74fe2de-27dd-4c0d-8adc-3c1cbe4caaf5&resourceID=19191
[19] https://nlahcentre.com/baloons-and-aa-sites-around-humber/

9.4 Generic Types of WWII British / Allied Unexploded Ordnance

9.4.1 Land Service Ammunition (LSA)

9.4.1.1 General

The term Land Service Ammunition covers all items of ordnance that are propelled, placed or thrown during land warfare. They may be filled or charged with explosives, smoke, incendiary or pyrotechnics. They can be broken into five main groups:

i. Mortars
ii. Grenades
iii. Projectiles
iv. Rockets
v. Landmines

Unexploded or partially unexploded Mortars and Grenades are among the most common items of UXO encountered in the UK. They are commonly encountered in areas used by the military for training and are often found discarded on or near historic military bases.

9.4.1.2 Mortars

A mortar bomb is a fin-stabilised munition, normally nose-fuzed and fitted with its own propelling charge (primary cartridge). Range is increased by adding extra propellant (augmenting charges). They are either HE or Carrier and generally identified by their tear-dropped shape (older variants however are parallel sided) and a finned 'spigot tube' screwed or welded to the rear end of the body housing the propellant charge.

A mortar relies on a striker hitting a detonator for explosion to occur. It is possible that the striker may already be in contact with the detonator and that only a slight increase in pressure would be required for initiation. Discarded augmenting charges are often encountered around mortar firing areas/bases.

Typical 2" High Explosive Mortar

Weight: 1.02kg (2.25lb)

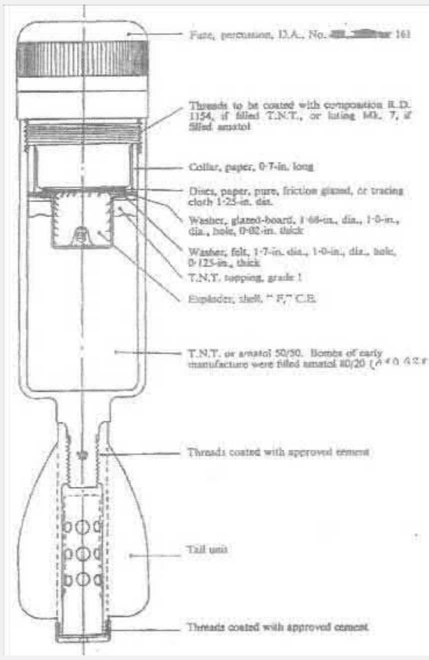
Type: High Explosive

Dimensions: 51 x 290mm (2in x 11.4in)

Filling: 200g RDX/TNT

Maximum Range: 457m (500yds)

Remarks: Fitted with an impact fuze which detonates the fuze booster charge (exploder) and, in turn, the high explosive charge. The main charge shatters the mortar bomb body, producing near optimum fragmentation and blast effect at the target.



Typical 3" Smoke Mortar

Type: Smoke

Dimensions: c.490 x 76mm (19.3in x 3in)

Filling: Typically white phosphorous

Maximum Range: 2515m (2,750yds)

Remarks: On impact, the fuze functions and initiates the bursting charge. The bursting charge ruptures the mortar bomb body and disperses the white phosphorous filler. The white phosphorous produces smoke upon exposure to the air.

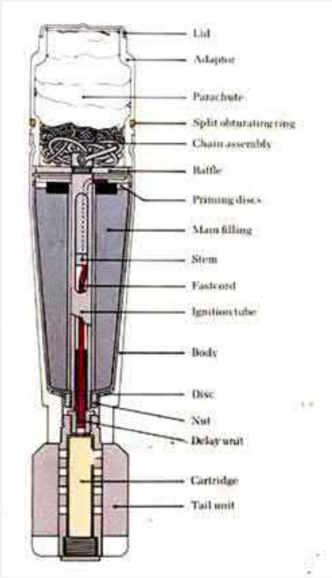
Typical 2" Illuminating Mortar

Type: Illuminating

Dimensions: 51 x 290mm

Filling: Various

Remarks: The expulsion charge ignites and ejects the candle assembly. A spring ejects the parachute from the tail cone. The parachute opens, slowing the descent of the burning candle which illuminates the target



9.4.1.3 Grenades

A grenade is a short-range weapon which may be thrown by hand, fired from the end of a rifle or projected/propelled from a special purpose grenade launcher. They are divided into two categories; HE and Carrier (generally smoke). As with mortars, a grenade striker may either be in contact with the detonator or still be retained by a spring under tension, and therefore shock may cause it to function. A grenade can have an explosive range of 15-20m. Common older variants have a classic 'pineapple' shape; modern grenades tend to be smooth-sided.

No. 36 "Mills" Grenade

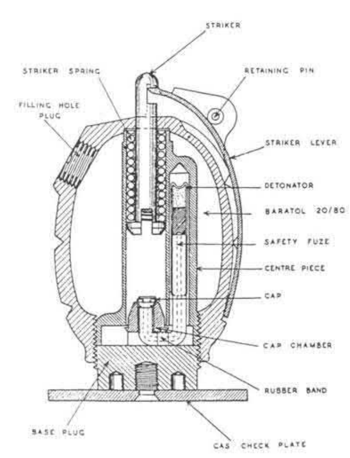
Weight: 0.7kg filled (1lb 6oz)

Type: Hand or discharger, fragmentation

Dimensions: 95 x 61mm (3.7 x 2.4in)

Filling: Alumatol, Amatol 2 or TNT

Remarks: 4 second hand-throwing fuze with approximate range of 30m



Grenade, .303 inch rifle, No. 36M, Mark I.

No. 69 Grenade

Weight: 0.38kg filled (0.8lb)

Type: Percussion / Blast

Date Introduced: December 1940

Remarks: Black Bakelite body. Blast rather than fragmentation type. After unscrewing the safety cap, a tape is held when throwing the grenade releasing the safety bolt in the throwing motion. Detection is problematic due to it's very low metal content.

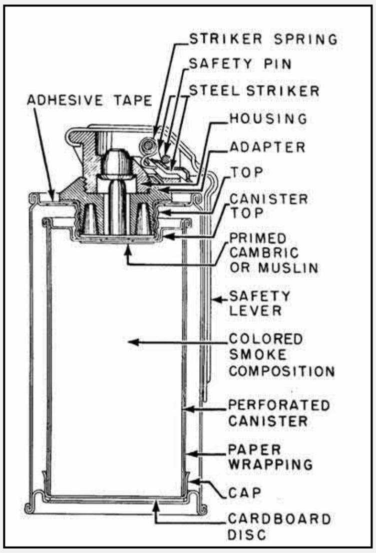
Typical Smoke Grenade

Dimensions: Approx. 65 x 115mm (2.5 x 4.5in)

Type: Smoke

Date Introduced: Current MoD issue

Remarks: Smoke grenades are used as ground-to-ground or ground-to-air signalling devices, target or landing zone marking devices, and screening devices for unit movement.

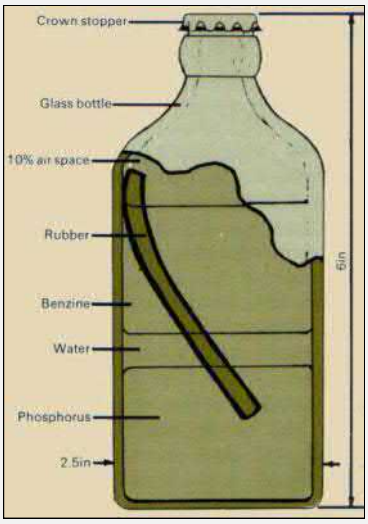


9.4.1.4 Examples of Home Guard Weapons

The following figures show examples of common ordnance used by the Home Guard for defensive purposes in WWII.

Self Igniting Phosphorous (SIP) Grenades

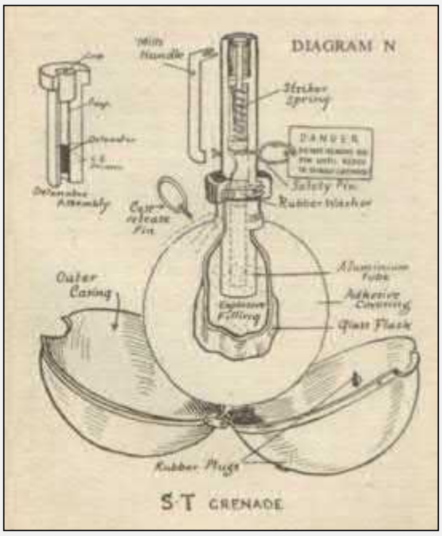
The grenade comprised a glass bottle with a total volume of approximately 1 pint. It was filled with White Phosphorous, benzene, a piece of rubber and water. Over time, the rubber dissolved to create a sticky fluid which would self-ignite when the bottle broke. Fired by hand or Northover Projector.

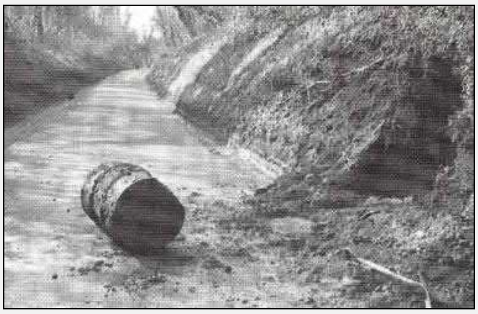


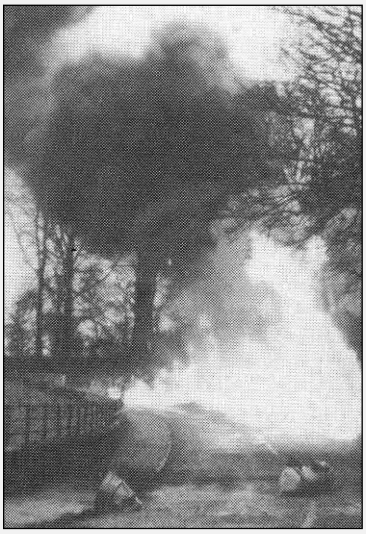
Sometimes called the "A & W" (Albright & Wilson) grenade.

No 74 Grenade (Sticky Bomb)

Designed as an anti-tank grenade and used by the Home Guard. The grenade consisted of a glass ball on the end of a Bakelite (plastic) handle. Inside the glass ball was an explosive filling whilst on the outside was a very sticky adhesive covering. Until used, this adhesive covering was encased in a metal outer casing.







Flame Fougasse Bomb

A Flame Fougasse was a weapon in which the projectile was a flammable liquid, typically a mixture of petrol and oil. It was usually constructed from a 40-gallon drum dug into the roadside and camouflaged. Ammonal provided the propellant charge which, when triggered, caused the weapon to shoot a flame 3m (10ft) wide and 27m (30 yards) long. Initially, a mixture of 40% petrol and 60% gas oi was used. This was later replaced by an adhesive gel of tar, lime and petrol known as 5B.

9.4.2 Small Arms Ammunition (SAA)

The most likely type of ordnance to be encountered on site are items of SAA (bullets), especially .303" ammunition which was the standard British and Commonwealth military cartridge from 1889 until the 1950s.

However even if an item such as this functioned, the explosion would not be contained within a barrel and detonation would only result in local overpressure and very minor fragmentation from the cartridge case.

Some LAA guns and RAF fighter cannons in use with British forces during WWII utilised the 20mm round. These bullets had a small fuse and a ~4gram HE or incendiary charge. Although small, this fill quantity still has the potential to cause serious injury.

20mm Hispano HEI Ammunition

Type: Live cannon round

Markings: Upper half of projectile painted "buff" colour, lower half is red

Cartridge Weight: 256g

Dimensions: Total cartridge / projectile length – 182mm

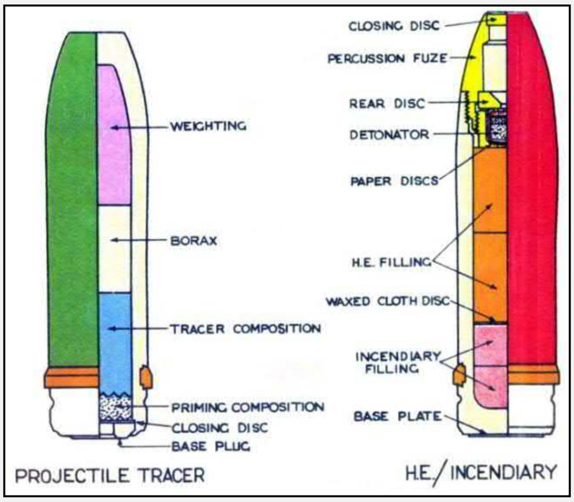
Fuzed: Contact fuze – No.253, No. 254 or No. 917

Filling: 108 grains of contact explosive + 68 grains of SR.379 incendiary composition

Threat: Explosives within unspent cartridge as well as the projectile

Deployment: Royal Navy, RAF and British Army Light Anti-Aircraft guns. Also RAF aircraft cannons.

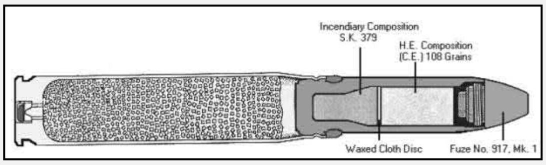
Remarks: Cartridges are belted or supplied loose in cartons

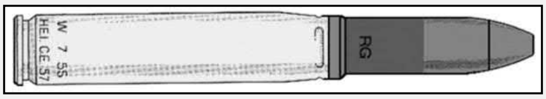


COLOUR IDENTIFICATION

BRITISH

NATURE OF SHELL	H.E.FILLING	COLOUR
H.E. TRACER	T.N.T.	
H.E	T.N.T.	
PROJ. PRACTICE		
PROJ. TRACER		
H.E. INCENDIARY	T.N.T.	
H.E.INCENDIARY TRACER	T.N.T.	





.303” Ammunition

Type: Rifle / machine gun round

Markings: Regular round – none. Tracer round – red primer

Bullet Weight: 150 – 180g

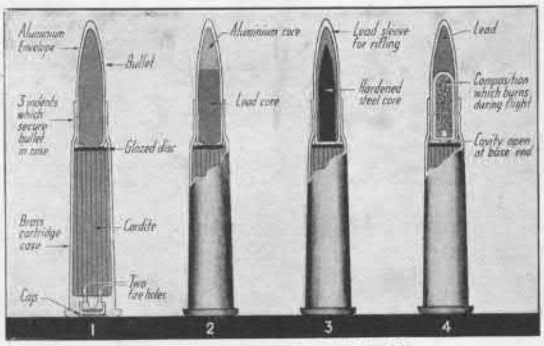
Dimensions: Total cartridge / projectile length – 182mm

Filling: Regular round – none. Tracer round – small incendiary fill

Threat: Explosive cordite within unspent cartridge

Deployment: Royal Navy, RAF and British Army Light Anti-Aircraft guns, machine guns and rifles. Standard British and Commonwealth military cartridge from 1889 until the end of the 1950s.

Remarks: Cartridges are belted or supplied loose in cartons



TYPES OF SMALL ARMS AMMUNITION

Fig. 1. *Four types of ammunition used by modern infantry. 1 and 2 are ball cartridges, 3 is an armour-piercing bullet, and 4 a tracer bullet which burns and makes its flight visible.*

9.4.3 Anti-Aircraft Shells

At the start of the war two types of AAA guns were deployed: Heavy Anti-Aircraft Artillery (HAA) using large calibre weapons such as the 3.7” QF (Quick Firing) gun and Light Anti-Aircraft Artillery (LAA) using smaller calibre weapons such as 40mm Bofors gun which could fire up to 120 x 40mm HE shells per minute to over 1,800m. During the early war period there was a severe shortage of AAA so older WWI 3” and modified naval 4.5” guns were also deployed.

These shells are frequently mistakenly identified as small German air-delivered bombs but are differentiated by the copper driving band found in front of the base. Although the larger unexploded projectiles could enter the ground, they did not have great penetration ability and are therefore likely to be found close to WWII ground level. With a HE fill and fragmentation hazard these items of UXO also present a significant risk if encountered.

The smaller 40mm projectiles are similar in appearance and effect to small arms ammunition and, although still dangerous, present a lower risk. Details of the most commonly deployed WWII AAA projectiles are shown below:

Gun type	Calibre	Shell Dimensions	Shell Weight	HE Fill Weight
3.7 Inch	94mm	94mm x 438mm	12.7kg	1.1kg
4.5 Inch	114mm	114mm x 578mm	24.7kg	1.7kg
40mm	40mm	40mm x 311mm	0.84kg	70g

3.7” Anti-Aircraft Projectile

Weight: 12.7kg (28lb)

Dimensions: 94 x 360mm (3.7 x 14.7in)

Carriage: Mobile and static versions

Rate of Fire: 10-20 rounds per minute

Ceiling: 9,000 – 18,000m (29,000-59,000ft)

Muzzle Velocity: 72m/s

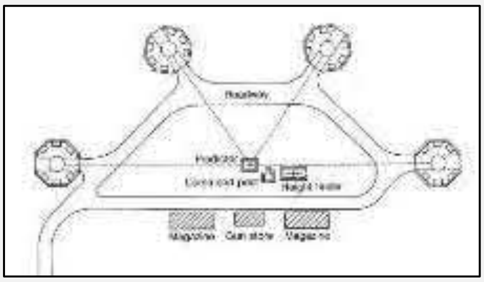
Remarks: 4.5” projectiles were also commonly utilised

Above: 3.7 inch AA Projectile, Minus Fuze.

Left: This AA shell was uncovered on a construction site in North London in February

Left: Layout plan for a typical HAA battery site.

Right: Hyde Park 1939 3.7” QF gun on mobile mounting



Home Guard soldiers load an anti-aircraft rocket at a 'Z' Battery.

Rocket Battery in action.

Rockets / Un-rotating Projectiles

Weight: (Overall) 24.5kg (54lb)

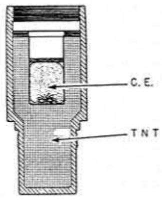
Warhead: 1.94kg (4.28lb)

Dimensions: 1930mm x 82.6mm (76 x 3.25in)

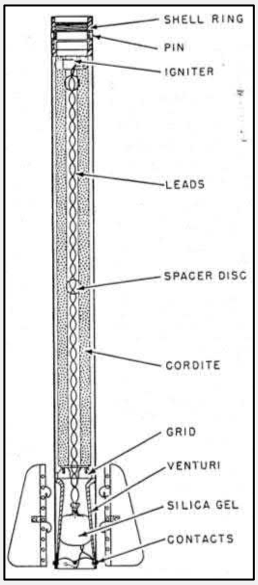
Carriage: Mobile – transported on trailers

Ceiling: 6770m (22,200ft)

Maximum Velocity: 457m/s



MK II HE Shell (3.5kg).



2" U.P AA Rocket.

40mm Bofors Gun Projectile

Weight: 0.86kg (1.96lb)

Dimensions: 40mm x 310mm (1.6in x 12.2in)

Rate of Fire: 120 rounds per minute

Ceiling: 7,000m (23,000ft)

Muzzle Velocity: 881m/s (2,890ft)

Remarks: Mobile batteries – normally few records of where these guns were located

40mm Bofors gun and crew at Stanmore in Middlesex, 28 June 1940.

Unexploded 40mm Bofors projectile

10 The Overall Unexploded Ordnance Risk Assessment Methodology

Taking into account the quality of the historical evidence, the assessment of the overall risk to any intrusive works from UXO must evaluate the following factors:

The likelihood that the site was contaminated with UXO (10.1)

↓

The likelihood that UXO remains on site (10.2)

↓

The likelihood that UXO could be encountered during site works (10.3)

↓

The risk that UXO could be initiated during site works (10.4)

↓

The consequences of encountering of initiating ordnance (10.5)

Each of these steps will be evaluated in the following sections in order to conclude the total risk from UXO to the proposed works to be undertaken within the project site.

10.1 The Likelihood that the Site was Contaminated with Unexploded Ordnance

10.1.1 General

The below is a generalised table of factors used to determine the likelihood that the site was contaminated with unexploded ordnance. Note that additional site-specific information can adjust UXO risk beyond these criteria:

Low Likelihood	Medium Likelihood	High Likelihood
German Air-Delivered Ordnance / Allied Anti-Aircraft Shells		
No evidence of bombing / bomb damage on site coupled with low local bombing density.	Moderate to High local bombing density or evidence of bombing / bomb damage on or close to the site.	High local bombing density or evidence of bombing /bomb damage on or adjacent to the site. Confirmed finds of WWII UXB.
Ground conditions that would prevent UXB penetration or lead to easily identifiable entry holes.	Ground conditions that allow for bomb penetration.	Ground conditions that would have immediately and completely obscured the existence of UXB.
Site was occupied and accessed fully throughout the bombing campaign.	Site located in an area that was infrequently observed or accessed, with a low likelihood that a UXB strike would have been noticed.	Site may be completely obscured from view or subject to very infrequent access.
British / Allied Ordnance		
No evidence of Allied military activity on or near the site. Or Military sites which have been cleared / redeveloped since their use Or Military-owned sites which have not been used for training with live munitions.	Clear evidence of military training activity on site involving live ammunition / munitions. Military sites which have not undergone clearance operations or redevelopment since use. Evidence of weapons storage on site.	Evidence of weapons testing or disposal on or adjacent to the site.
Developed areas that are unlikely to have been used for military exercises.	Open or unmaintained ground that may have been used for disposal or caching of munitions.	Evidence of UXO finds on or in the vicinity of the site.

The following sections assess the likelihood of contamination from German UXO and British / Allied UXO, based on the evidence discussed in the previous sections.

10.1.2 Likelihood of Contamination from German UXO

The following table discusses the overall likelihood of contamination from German UXO, based on the evidence discussed in Section 8.

Overview of the Potential Sources of German Air-Delivered UXO	
Bombing density	• Low regional bombing density, likely to be locally higher due to close proximity to Luftwaffe targets. • Several bombing raids over Immingham Docks. • Reports of bombs dropped on the railway sidings, potentially on site.
Bomb Damage	• No damage recorded to any buildings on site. • No evidence of bomb craters or ground disturbance on site. • Any evidence of bomb damage on site is likely to have been repaired or infilled before the 1950 aerial photograph was taken.
Ground Conditions	• The north of the site was occupied by a section of the River Humber. • Had a UXB fallen into this part of the site, it would have been immediately obscured beneath the waterline or soft tidal mud, and subsequently covered by the mobile sediment. • A large proportion of the site was occupied by soft open ground, some of which was densely vegetated and / or unmaintained. • The south of the site encompassed railway sidings across soft ground / ballast. • In these parts of the site, a UXB could have easily fallen unnoticed, with its entry hole obscured by the vegetation or unconsolidated material. • Note, the entry hole of an SC50 (the most commonly deployed German HE bomb) could be as little as 20cm in diameter and therefore easily obscured in such ground types. • Had a UXB landed directly onto any small buildings, structures or rail lines, it likely will have caused substantial damage and been noticed.
Frequency of Access	• Seasonal access to unmaintained or unoccupied land • Some heavily vegetated areas will have seen limited to no access at all. • Railway lines will have seen regular use, but the surrounding sidings and their ballast likely saw more limited maintaining works. • Northern extent of the site will have seen very limited access, especially to the riverbed / mud.

J-Curve Effect	• Had any UXB landed within the soft ground, ballast or tidal mud on site, it could have come to rest up to 15m away from its entry point, potentially beneath adjacent undamaged railway lines.
Other considerations	• Nearby naval decoy site • Bombing into the river could have resulted in UXBs migrating in or out of the site, in addition to potential burial under sediment.
Overall Likelihood of Contamination	Medium

10.1.3 Likelihood of Contamination from British / Allied UXO

The following table discusses the overall likelihood of contamination from British / Allied UXO, based on the evidence discussed in Section 9.

Overview of the Potential Sources of British / Allied UXO	
Land Service Ammunition / Small Arms Ammunition	• The surrounding Immingham Dock facility has been used extensively by the military during both WWI and WWII. • Several defensive positions, including barrage balloons, coastal batteries and pillboxes were located in the area during both WWI and WWII. • A US Army Camp was located in the vicinity of the project site during WWII. • As such, is cannot be discounted that the site, located at the periphery of the dock facilities, may have been used for training exercises, storage or disposal of munitions to an extent. • Although such a scenario cannot be entirely discounted, no specific evidence has been found of this activity type on site. • Furthermore, the camp was located adjacent to the River Humber. Often, rivers, docks and other bodies of water near to military camps offered a quick and easy unofficial method of disposal to the military personnel. Hundreds of items of small arms and land service ammunition are found across Britain's waterways every year due to this very reason. As such, the possibility that surplus, faulty or unwanted items of ammunition may have been discarded into the marine section of the site during military occupation in the area. • Had such a scenario occurred along this part of the Humber, it is also possible that items could have then migrated with the river's current into or out of the site boundary itself.
Anti-Aircraft Projectiles	• Anti-aircraft defences were present and engaged in the area during both WWI and WWII. • Nine HAA batteries were situated within a 5km radius of the site during WWII.

	• Had an unexploded AA shell landed in the parts of the site occupied by the river, it would have been immediately obscured beneath the waterline. If it had landed within the tidal mud, it is unlikely to have resulted in a persistent entry hole, and would have been quickly infilled by the soft, mobile surrounding sediment. Following such a scenario, the item could easily have been left undiscovered. • Had an unexploded AA shell landed within the parts of the site occupied by unused, soft, open ground, ballast, or vegetation, it could have been left unnoticed. • However, had such an item landed directly onto railway tracks, undamaged buildings, or any other undamaged man-made structures, it could have caused significant damage which is more likely to have been noticed and dealt with at the time.
Overall Likelihood of Contamination	Medium

10.2 The Likelihood that Unexploded Ordnance Remains on Site

10.2.1 General

The extent to which any ordnance clearance activities have taken place on site or extensive ground works have occurred is relevant since they may indicate previous ordnance contamination but also may have reduced the risk that ordnance remains undiscovered.

10.2.2 EOD Bomb Disposal and Clearance Tasks

SafeLane Global holds a number of official records of explosive ordnance disposal operations during and following WWII, obtained from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD), British Army.

Potential Source	Details
Records of Army EOD tasks having taken place on site or in the vicinity	None
Local ordnance finds	• May 2020: An undiscovered WWII bomb detonated in the Humber during dredging of Immingham's approaches. It was thought to be a small, very old device covered by silt and sand. Following this incident, a detailed survey of the area was reportedly carried out.[20] • May 2014: A WWII shell was found on the building site of the Tesco, Immingham (Kennedy Way).[21]

[20] https://www.hulldailymail.co.uk/news/hull-east-yorkshire-news/war-bomb-explodes-ve-day-4115384
[21] https://grimsby75.rssing.com/chan-4107517/all_p260.html

Local tasks undertaken by SafeLane Global	None

10.2.3 Post War Redevelopment

The nature of post-WWII ground works, redevelopment and construction has been considered. Significant structural redevelopment on site can, in some cases, provide a level of mitigation, particularly from shallow buried items. However, if a site has not undergone any extent of redevelopment, the likelihood of UXO remaining within its boundaries can remain.

The site has been redeveloped post-WWII	✗
Further Details	• OS mapping indicates that the site largely remained unchanged, while the surrounding area underwent significant redevelopment, until 1972-89. At this time, several of the railway sidings had been cleared. • The earliest available aerial photography indicates that between 2003 and the present day, the site has been subject to shallow ground works, with hardstanding laid across large portions of the project site area. • No records of large-scale, significant redevelopment on site have been found.

10.2.4 Wartime UXO in Britain's Waterways

Anecdotal and historical records give a strong indication that Britain's rivers, canals, lakes, ponds and other waterways have often presented a convenient location to easily and secretly dispose of unwanted items of UXO. This is illustrated by the significant number of items discovered in Britain's waterways ever year. A rise in the popularity of magnet fishing has presented an additional insight into the numbers of items that were dumped into these locations during and after wartime.

Furthermore, bodies of water in the UK were ideal for concealing airdropped UXBs. Often, WWII UXBs are found in rivers, docks, lakes etc, having been left unnoticed for all these years. Some lay on the bottom, but others were covered with sediment over time.

The following examples indicate the types of UXO that have recently been discovered across the UK. Note, these represent just a small number of the total items found:

Item(s) Discovered	Details
WWI-era Grenade 	July 2021 – Hand grenade found in the River Trent, near Wilford Toll Bridge, Nottingham.[22]
Unexploded Shell 	March 2021 – WWII mortar shell found by anglers in the River Avon, near Welford, Northamptonshire.[23]
WWII Mine 	December 2020 – WWII German submarine-laid, moored influence mine with 350kg of explosives found in the River Clyde.[24]

[22] https://www.bbc.co.uk/news/uk-england-nottinghamshire-57713711
[23] https://www.northamptonchron.co.uk/news/people/bomb-squad-blows-up-world-war-two-shell-found-in-northamptonshire-river-3181831
[24] https://www.glasgowtimes.co.uk/news/18915451.bomb-squad-called-river-clyde-ww2-mine-found-pristine-condition/

<table>
<tr><td>WWII-era Grenades
</td><td>December 2020 – 19 x grenades pulled out of the River Tame on the outskirts of Birmingham.[25]</td></tr>
<tr><td>WWII-era mortar
</td><td>July 2020 – WWII-era mortar found in the River Mole in Mickleham & Norbury in Dorking, Surrey.[26]</td></tr>
<tr><td>500kg German UXB

</td><td>In February 2018, SafeLane Global discovered an unexploded WWII bomb within King George V Dock, London. This resulted in the evacuation and closure of London City Airport.[27]</td></tr>
</table>

[25] https://www.independent.co.uk/news/uk/home-news/birmingham-river-grenades-found-bomb-disposal-b1777636.html
[26] https://metro.co.uk/2020/07/10/boy-6-finds-unexploded-world-war-two-bomb-magnet-fishing-12972444/
[27] https://www.safelaneglobal.com/en/case_studies/london-city-airport-bomb-clearance/

10.2.5 Site-Specific Analysis

The following table discusses the likelihood that UXO could remain on site, following any post-WWII activity.

Mitigating factors during post-WWII period	The available evidence suggests that the site has been subject only to shallow ground works since the end of WWII, inclusive of the removal of railway sidings, small buildings and vegetation. A large portion of the site has been laid to hardstanding. No records of dredging operations within the marine section of the site have been found.
Further comments	Within the footprints of the post-war redevelopment / ground works, the risk of shallow buried UXO (especially German 1kg incendiaries) remaining will have been partially mitigated since any such items could have been encountered and removed during soil stripping and levelling. Only within the volume of any post-war basement level bulk excavations and at the precise locations of any post-war pile foundations / boreholes, will the risk from deeper buried German HE UXBs have been completely mitigated. At any location on site where no bulk excavations have been carried out, the risk from deep buried UXO remains unmitigated to the maximum bomb penetration depth. Within any works taking place in the marine section of the site, there are three scenarios which could have resulted in explosive UXO remaining in the area of the proposed works: • *UXO remaining in situ* - whereby UXO remains on the seabed, in the exact location at which it was originally deposited. • *Storm Conditions* - During WWII it was observed that storms were capable of causing significant movement of objects, for example, tearing moored buoyant sea mines from their anchors. It is conceivable that any ordnance lying on the riverbed could have been moved into the study area. • *Migration* - Due to the mobile nature of some sub-marine environments, munitions can migrate across the riverbed with bottom currents, gravity flows and fishing activities. This is also the case with inshore wave action, resulting in a large quantity of munitions being washed up on beaches around the world, every year. Due to the extensive military action around the area, this is the most likely scenario for a range of difference items of ordnance, particularly SAA and LSA.

10.3 The Likelihood that Ordnance may be Encountered during the Works

The following table discusses the likelihood that UXO could be encountered on site during the proposed works.

At-Risk Scenarios	The most likely scenarios under which a 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. Since an air-dropped bomb may come to rest at any depth between just below ground level and its approximate penetration depth there is also a chance that such an item could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level. If the proposed works are due to be undertaken within post war fill material / made ground, the risk of encountering WWII UXBs is low. However, if works are to be undertaken below WWII ground level this risk is significantly higher.
Likelihood of UXO being encountered during the proposed works	The proposed works are expected to consist of construction works. As such, during shallow and deeper level works, there is a likelihood that UXO could be encountered. Additionally, within the tidal section of the site, empirical evidence has shown that UXO expended onto the riverbed can subsequently become buried. The factors governing seabed burial are; sedimentation rate, presence of gravity / density flows or mega ripples, sediment type, density of UXO and water currents. A combination of these factors could result in significant burial of both small and larger items of UXO within the site boundary. With regards to post contamination burial of UXO lying on the riverbed, there is currently no overall formula incorporating these factors due to the variance of critical influences which can affect whether or not various items of UXO become buried. SafeLane Global's previous experience in the marine environment has created the basis for the assumptions made here, however as this is not considered to be an 'exact science' it would be irresponsible to make definitive statements regarding precise burial depths of UXO within soft sediment environments. In shallow water environments, where surface water wave activity, tidal currents and storm conditions have a great effect on the riverbed, burial of UXO is much more likely. In some instances, regular water movements create scour features in the sediment, around a UXO item. Over a period of time the UXO could then roll into the scour mark and subsequently become partially or completely buried just below the surface. This inference has been made with reference to a research paper on Scour and Burial of Bottom Mines in the shallow marine environment[28].

[28] Douglas L. Inman & Scott A. Jenkins Scripps - Scour and Burial of Bottom Mines - Institution of Oceanography, 2007

10.4 The Risk that Ordnance may be Initiated

Items of ordnance do not become inert or lose their effectiveness with age. Time can indeed cause items to become more sensitive and less stable. This applies equally to items submerged in water or embedded in silts, clays or similar materials. The greatest risk occurs when an item of ordnance is struck or interfered with. This is likely to occur when mechanical equipment is used or when unqualified personnel pick up munitions.

10.4.1 Initiation of Unexploded Bombs

In the case of unexploded German bombs discovered within the construction site environment, there are a number of potential initiation mechanisms:

Direct Impact onto the main body of the bomb	Unless the fuze or fuze pocket is struck, there needs to be a significant impact to initiate a buried iron bomb.
Re-starting the clock timer in the fuze	Only a small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion has taken place within the fuze since the end of WWII that would prevent clockwork mechanisms from functioning, nevertheless it was reported that the fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did recommence.
Induction of a static charge, causing a current in an electric fuze	The majority of German WWII bombs employed electric fuzes. It is probable that significant corrosion has taken place within the fuze mechanism since the end of WWII such that the fuze circuit could not be activated.
Friction impact initiating the (shock-sensitive) fuze explosive	This is the most likely scenario resulting in the bomb detonating.

10.4.2 Activities that may Result in the Initiation of Unexploded Ordnance

Unexploded bombs do not spontaneously explode. All high explosive requires significant energy to create the conditions for detonation to occur. The risk that UXO could be initiated if encountered will depend on its condition, how it is found and the energy with which it is struck. However certain activities pose a greater risk than others.

Percussive piling or deep mechanical excavations	The most violent activity on most construction sites is percussive piling or deep mechanical excavations. If an item is struck with a significant enough impact, be it direct or through friction/vibration, it risks detonation.
Shallow excavation	Soil levelling and shallow excavation such as trial pits can pose a similar risk to deeper excavations, since UXO can be found at any depth between ground level and the maximum bomb penetration depth. In addition to risk of initiation by violent impact or vibration, detonation can also occur if discovered items are mishandled by unqualified personnel. This is particularly common when onsite personnel are not trained in the recognition of ordnance.
Non-intrusive works	In the case of non-intrusive planned works, little risk is posed by items of UXO that are buried beneath the ground. However, risk can arise from unburied munitions, particularly items of ordnance discarded in periphery areas of military sites. These items are frequently discovered by onsite personnel and remain live and liable to activate if mishandled.

10.5 The Consequences of Encountering or Initiating Ordnance

Clearly the consequences of an inadvertent detonation of UXO during construction operations would be catastrophic with a serious risk to life, damage to plant and a total site shutdown during follow-up investigations.

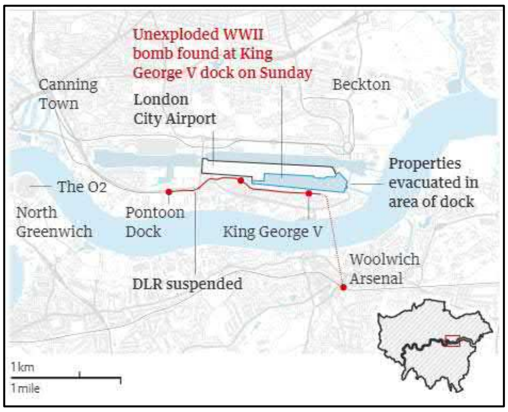
Since the risk of initiating ordnance is significantly reduced if appropriate mitigation measures are undertaken, the most important consequence of the discovery of ordnance will be economic. This would be particularly so in the case of high-profile locations and could involve the evacuation of the public.

The unexpected discovery of ordnance may require the closing of the site for any time between a few hours and a week with a potentially significant cost in lost time. Note also that the suspected find of ordnance, if handled solely through the authorities, may also involve loss of production since the first action of the Police in most cases will be to isolate the locale whilst awaiting military assistance, even if this turns out to have been unnecessary.

The following tables review a number of finds over recent years both in the UK and overseas that have seen large-scale disruptions, damage and injury/death:

UXB Incidents where intrusive works have caused detonation, resulting in death, injury and damage to plant	
 RESCUE workers search for survivors after a Second World War bomb exploded at a building site in Berlin, killing three people and injuring at least eight others. A fire brigade spokesman said he feared the final death toll could be higher. One worker was still missing, believed to be trapped under a machine. "We've **Blown up by history** found human remains 100 metres away but we can't tell if they belong to the dead already found," the spokesman said. The blast, set off by drilling work on Frankfurter Allee, one of east Berlin's busiest avenues, trapped workers under building machinery and sent huge chunks of concrete tumbling through the air. A large office block was being built on the site of the explosion which sent shoppers scrambling for shelter and paralysed dense afternoon traffic. One eyewitness said: "There was a bang, then silence, and then it started raining stones and dirt." Dozens of cars within a 250-metre radius were wrecked and the top two floors of a nearby apartment block caved in. Radio reports claimed that the total number of injured stood at 14.	A WWII bomb killed 3 and injured 8 in Berlin - 1944
	WWII bomb killed 3 in Goettingen, Germany – 2010.
	Excavator operator killed by WWII bomb in Euskirchen, Germany – 2014. A WWII bomb exploded at a construction site near a west German town, killing a man and injuring 8 others. The explosion occurred with a digger accidently struck the device during excavation works.

	A highway construction worker in Germany accidentally struck a WWII bomb, killing himself and wrecking several passing cars – 2006.
	Destroyed piling rig and dump truck after detonation of WWII UXB in Austria – 2006.
	WWII bomb injures 17 at construction site in Hattingen, Germany – 2008.
	A buried WWII-era bomb exploded during construction works in Bandar Malaysia, Kuala Lumpur – 2017.

<table>
<tr><th colspan="2">UXB Incidents in the UK, resulting in delays, site shutdowns, evacuations, and disruptions</th></tr>
<tr><td>


</td><td>
London City Airport shut: Flights cancelled after WWII bomb found in River Thames dock.
London City Airport was closed after the discovery of a 250kg WWII German bomb, affecting tens of thousands of passengers. All flights into and out of the airport were stopped after the device was found by SafeLane Global in the nearby King George V dock. A 700ft exclusion zone was put in place and people living nearby were evacuated.
</td></tr>
<tr><td>

</td><td>
Unexploded WWII bomb found in Birmingham, causing a construction site to be evacuated.
</td></tr>
<tr><td>


</td><td>
A WWII UXB was found near to the Aston Expressway, leading to the evacuation of around 200 residents and a 500m cordon.
Following the discovery, the weapon was safely detonated by the Army. However, although the M6 was reopened after the blast, the key Aston Expressway stayed shut until 6pm, extending traffic disruption. All nearby rail services and other roads were also disrupted.
</td></tr>
<tr><td>


</td><td>
Up to 1000 homes were evacuated and a 300m exclusion zone was put in place following the discovery of a WWII UXB in Lansdown Road, Bath. The 500lb bomb was found just a meter beneath a playground at the former Royal High Junior School.
</td></tr>
</table>

11 SafeLane Global's Risk Assessment

The Risk Assessment made by SafeLane Global for the site is based upon the likelihood that the site was contaminated, the risk of the contaminant item remaining, and the likelihood of, and potential consequences, should the item be struck during the proposed works. The following section discusses the risk that each ordnance type presents to the scope of works for the project site.

11.1 Conclusions

Taking into consideration the findings of this study, SafeLane Global considers the UXO risk at the site to be **Medium**.

Type of Ordnance	Likelihood of Contamination	Likelihood of UXO remaining	Likelihood of encounter	Potential Consequence	Overall Risk level
German High Explosive Bombs	Medium	Medium	Medium	Severe	**Medium**
German 1kg Incendiary Bombs	Low	Low	Low	Severe	**Low**
Allied Anti-Aircraft Shells	Medium	Medium	Medium	Minor	**Medium**
British / Allied Small Arms	Medium	Low	Low	Not Significant	**Low**
Land Service Ammunition	Medium	Low	Low	Moderate	**Low**

12 Proposed Risk Mitigation Strategy

SafeLane Global recommends the following minimum risk mitigation measures be deployed to support the proposed ground works at the site.

12.1 Summary

Based on the findings of the report, the following mitigation measures have been recommended for the proposed works on the site. Further detail on each method is presented in **Section 12.2.**

Risk Level	Environment	Planned Site Activity	Recommendations
Medium	Land-based	Shallow Intrusive Works e.g. excavations	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Non-Intrusive (NI) Magnetometer Survey (Greenfield areas only) • Target Investigation (Required as a follow-on from NI magnetometer survey) • Search & Clear • Explosive Ordnance Disposal (EOD) Engineer Watching Brief (for brownfield areas unsuitable for NI magnetometer survey)
		Deep intrusive works (e.g. piling)	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Intrusive Magnetometer Survey of pile/borehole positions
	Marine based	Shallow Intrusive Works e.g. excavations	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Non-Intrusive Magnetometer UXO Survey • Non-Intrusive 3D Seismic Investigation from the 2m contour
		Deep intrusive works (e.g. piling)	• UXO Safety & Awareness Briefing (Toolbox Brief, TBB) • Site Specific Safety Instructions (SSSIs) Training Course • Seismic Investigation: Further Non-Intrusive Survey over exact locations to identify and mitigate risk and geological assessment for further risk management.

12.2 Additional Notes

Risk Mitigation Measures – Further Detail	
Site Specific Explosive Ordnance Safety and Awareness Briefings (UXO Toolbox Briefing) to all personnel conducting intrusive works	These briefings are intended to make site operatives aware of the nature of explosive ordnance that may be encountered on their project site. • Delivered by a specialist Explosive Ordnance Disposal Engineer. • Provides information on the site-specific explosive ordnance risk • Basic ordnance identification. • What to do in the event of an encounter with a suspicious object. Provide UXO response procedures.
Site Specific Safety Instruction (SSSI)	For longer term projects that require Explosive Ordnance Safety and Awareness Briefings as part of the Explosive Ordnance Risk Mitigation measures for the project, SSSIs can be provided to allow nominated site representatives to deliver these briefings after initial training. • 2/3-hour presentation and training course. • Delivered by a fully qualified senior EOD Engineer. • Suitable for Project Site Manager HSE representative and supervisors. • Includes briefing pack. This provides a cost-effective solution to ensure that the Explosive Ordnance Safety and Awareness Briefings can be delivered effectively and efficiently to the required standard.
Explosive Ordnance Disposal (EOD) Engineer On-Site Support	In areas where the risk posed by the potential presence of explosive ordnance is low or where the conditions are not suitable for pro-active survey, EOD On-Site Support can provide a reactive response to any suspicious object that may be encountered during open excavation works. The presence of the EOD Engineer (sometimes referred to as 'high risk dig wardens') on-site in support of shallow intrusive work allows for a direct monitoring of works using visual recognition and instrumentation and provides an immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by ground workers. SafeLane Global EOD personnel on-site also have the additional benefit of providing Explosive Ordnance Safety and Awareness briefings (UXO TBB) to any staff that have not received them earlier and can advise staff of the need to modify working practices to take account of the ordnance threat. The EOD Engineer will also aid potential incident management which would involve liaison with the local authorities and police should ordnance that presents an explosive hazard be identified. • Specialist Explosive Ordnance Disposal Engineer. • Maintains a watching brief over all excavations. • Provides safety and awareness briefings to construction personnel as required.

	• Provides immediate identification of any suspicious item that is encountered. • Identifies whether any UXO item is live or inert. • Provides liaison assistance with the relevant authorities when dealing with any live UXO. Avoids on site delays which can be caused by the incorrect identification of a suspect item being potential UXO.
Explosive Ordnance Disposal (EOD) Engineer to support site investigation works	For cost effective Explosive Ordnance Risk Mitigation for site investigation work, the EOD Engineer can survey ahead of trial pits, monitor excavations when the ground conditions are not suitable for a pro-active survey and conduct intrusive surveys for borehole and window sample locations working in conjunction with the site investigation team. The On-Site Support will also provide a reactive response to any suspicious object that may be encountered during open excavation works. SafeLane Global EOD personnel on-site also have the additional benefit of providing Explosive Ordnance Safety and Awareness briefings to any staff that have not received them earlier and can advise staff of the need to modify working practices to take account of the ordnance threat. The EOD Engineer will also aid potential Incident Management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard. • Specialist Explosive Ordnance Disposal Engineer. • Maintains a watching brief over all trial pit excavations. • Provides safety and awareness briefings to construction personnel as required. • Works in conjunction with the drilling team to survey all borehole and window sample locations in real-time using a staged drilling and magnetometer survey procedure. • Provides immediate identification of any suspicious item that is encountered. • Identifies whether any UXO item is live or inert. • Provides liaison assistance with the relevant authorities when dealing with any live UXO. • Avoids on site delays which can be caused by the incorrect identification of a suspect item being potential UXO. *Technical Information* 1. In optimum ground conditions each survey using the borehole technique will have a 1 metre look ahead capability. 2. Any steel casing used for borehole surveys will need to be retracted by 3 metres to allow the magnetometer survey to be conducted. Non-ferrous pipe will be required to support the borehole during the survey minimum diameter 60mm (to be supplied by the client).
Search & Clear	Where a non-intrusive magnetometer survey is not possible (e.g. wooded areas) SafeLane Global can deploy a two-man Explosive Ordnance Disposal Engineer team using handheld magnetometer equipment who will proactively survey either in search lanes or boxes, investigating each reading with the support of

	an operated excavator. The survey is suited to detecting suspicious ferro-magnetic buried objects that may be munitions and/or explosive ordnance related. All SafeLane Global personnel involved with the Search and Clearance Works will be former military personnel who have gained formal NATO Military Explosive Ordnance Disposal Qualifications, having completed training at the Defence Explosive Ordnance Disposal School (DEODS) Chattenden, Kent or similar establishment throughout their military service. The client will be responsible for: • Demarcating the areas to be searched. • Providing services clearance and permit to dig. • Providing operated excavator to access deeper targets if required (SafeLane Global can provide this service at additional cost). • Providing coordinates of positions where debris have been identified (if information required in report). • Providing storage for recovered debris. Output will depend upon terrain and contamination (number of readings to be investigated).
Non-Intrusive Magnetometer Survey and Target Investigation (greenfield land only)	**Non-Intrusive Survey** This survey type is designed for use on magnetically 'clean' land commonly referred to as 'greenfield'. Brownfield land is often described as that which has had previous industrial or commercial use. In this context it specifically encompasses sites with are underlain by 'made ground' which may contain metallic contamination. Non-intrusive magnetometry or electromagnetic equipment which is used in the search for buried UXO relies upon the detection of small changes between clear ground and that containing UXO. The technique operates very successfully in environments where there is minimal ground contamination from other sources such as fired bricks, reinforced concrete, discarded scrap metal and buried services. There are also man-made ambient effects on magnetic and electromagnetic non-intrusive survey systems which include moving plant vehicles, power cables, electric trains etc. Non-Intrusive survey is carried out using either total-field or gradiometer magnetometry, dependent upon site conditions. Data is recorded and then interpreted using advanced AGSPRoc software in order to map magnetic fields and model discrete magnetic anomalies (variations in the Earth's magnetic field caused by ferro-magnetic objects electrical fields or geology). The location of such anomalies is determined, and mathematical modelling used to estimate their mass and depth. The survey will also locate any buried services with a magnetic signature and indicate any areas of gross magnetic "contamination" which may indicate the presence of unknown obstructions. Additionally, the survey can provide information on archaeological features. The system can detect the magnetic field from a 50kg WWII air-dropped bomb at a depth of 4m and smaller items such as Land Service Ammunition to depths of up to 1.5m in ground with a low ambient magnetic field. In the case of soft geology, it should be noted that a 50kg high explosive bomb may be buried greater than 4 metres below ground level and therefore may not be detected by the survey. In this instance intrusive surveys may be required.

	The non-intrusive survey system will be deployed utilising the pedestrian survey frame. The output for the pedestrian frame is estimated at up to 2Ha per day. *Technical information:* • Client to clearly demarcate area to be surveyed prior to start and highlight any known services/underground obstructions. • Ground must be level, free of obstacles / obstructions and clear of undergrowth. Height of any crops should be no more than 400mm and where crops are present SafeLane Global would require written approval from the landowner or client to walk over the site area. • When working adjacent to existing infrastructure the survey may be ineffective due to the ferro magnetic interference caused by passing vehicles and the presence of underground buried services. A site visit may be recommended prior to commencement. • Note: the survey will be ineffective on Brownfield sites due to the magnetic nature of building rubble, which typically masks the weaker magnetic signatures of buried objects. If parts of the site are contaminated, then alternative risk mitigation measures may need to be considered. **Target Investigation** If a buried anomaly is detected that cannot be discounted as a potential UXO / UXB then the object will need to be investigated to positively identify the item. The process will include; • Specialist two-man Explosive Ordnance Disposal Team. • Combination of manual and mechanical excavation techniques. • Excavator shafting, shoring and dewatering equipment can be provided by SafeLane Global if required. • Excavation techniques will be defined and agreed prior to the commence. **A factual report with clearance certificate will be issued on completion of the investigation.**
Intrusive Magnetometer Survey of all pile locations down to the maximum bomb penetration depth	SafeLane Global can deploy a range of intrusive magnetometry techniques to clear ahead of all the pile locations. The appropriate technique is governed 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. A site meeting would be required between SafeLane Global and the client to determine the methodology suitable for this site. Target investigation or avoidance will be recommended as appropriate.
Marine: **Non-Intrusive Magnetometer and Side Scan UXO Survey**	A Magnetometer and high-resolution Side Scan Survey should be conducted over the proposed works area to identify any ferrous anomalies (potential UXO), This will also identify areas clear of ferrous anomalies that may be used for the placement of piled foundations. The Side Scan Survey also allows for the identification of non-ferrous surface obstructions which may hamper the proposed works, to aid planning and design.

Marine: **Intrusive Magnetometer Survey - Down-hole Vallon Probing ahead of Marine Boreholes**	A down-hole Vallon magnetometer is lowered to the riverbed first to scan a radius for ferrous anomalies. Provided the riverbed is clear, boreholing is conducted to 1m. Nonferrous sleeving must be used with the Vallon lowered down the sleeve to clear the next metre ahead of the borehole. This sequence is repeated until bomb penetration depth is reached, then boreholing can continue unrestricted. Sleeving would be expected to extend from the JU Barge deck to riverbed to ensure drill bit relocates the borehole each time it is withdrawn.
Marine: **Barge-Mounted Intrusive Magnetometer Survey**	Magnetometer surveys of discrete pile locations are accomplished by the use of a TFG drill rig mounted on a jack up barge with a moon pool over each pile position. Where the use of a moon pool is not feasible due to the proximity of the pile location to other structures, a gantry can be constructed over the side of the barge to allow for drilling and safe access to the rig. A TFG survey can then be conducted to depth to prove whether a position is clear of ferrous anomalies.
Marine: **Seismic Investigation: Further Non-Intrusive Survey over exact locations to identify and mitigate risk (as an alternative to above two measures).**	This method will enable the gathering of detailed target information on individual targets giving the ability to produce true 3D seismic volumes of the upper tens of metres of sediment and imaging buried structures and objects with 3D decametric resolution allowing accurate UXO risk decision making to be made. This process is quick and requires no intrusive works unless an item of UXO is identified. In addition, this process would provide details of any other obstructions that may affect piling operations. In recent projects, SafeLane has reduced potential obstructions affecting piling works from an anticipated 10% to 0.01%.

Bibliography

The key sources consulted during this assessment are listed below;

i. Bates, H, E., *Flying Bombs over England*, (Frogletts Publications Ltd. 1994).

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iii. Fegan, T., *The Baby Killers': German Air raids on Britain in the First World War*, (Leo Cooper Ltd. 2002).

iv. Fleischer, W., *German Air-Dropped Weapons to 1945*, (Midland Publishing. 2004).

v. Jappy, M. J., *Danger UXB: The Remarkable Story of the Disposal of Unexploded Bombs during the Second World War*, (Channel 4 Books, 2001).

vi. Price, A., *Blitz on Britain, The Bomber Attacks on the United Kingdom 1939 – 1945*, (Purnell Book Services Ltd. 1977).

vii. Ramsey, W., *The Blitz Then and Now, Volume 1*, (Battle of Britain Prints International Limited. 1987).

viii. Ramsey, W., *The Blitz Then and Now, Volume 2*, (Battle of Britain Prints International Limited. 1988).

ix. Ramsey, W., *The Blitz Then and Now, Volume 3*, (Battle of Britain Prints International Limited. 1990).

x. Whiting, C., *Britain Under Fire: The Bombing of Britain's* Cities 1940-1945, (Pen & Sword Books Ltd. 1999).

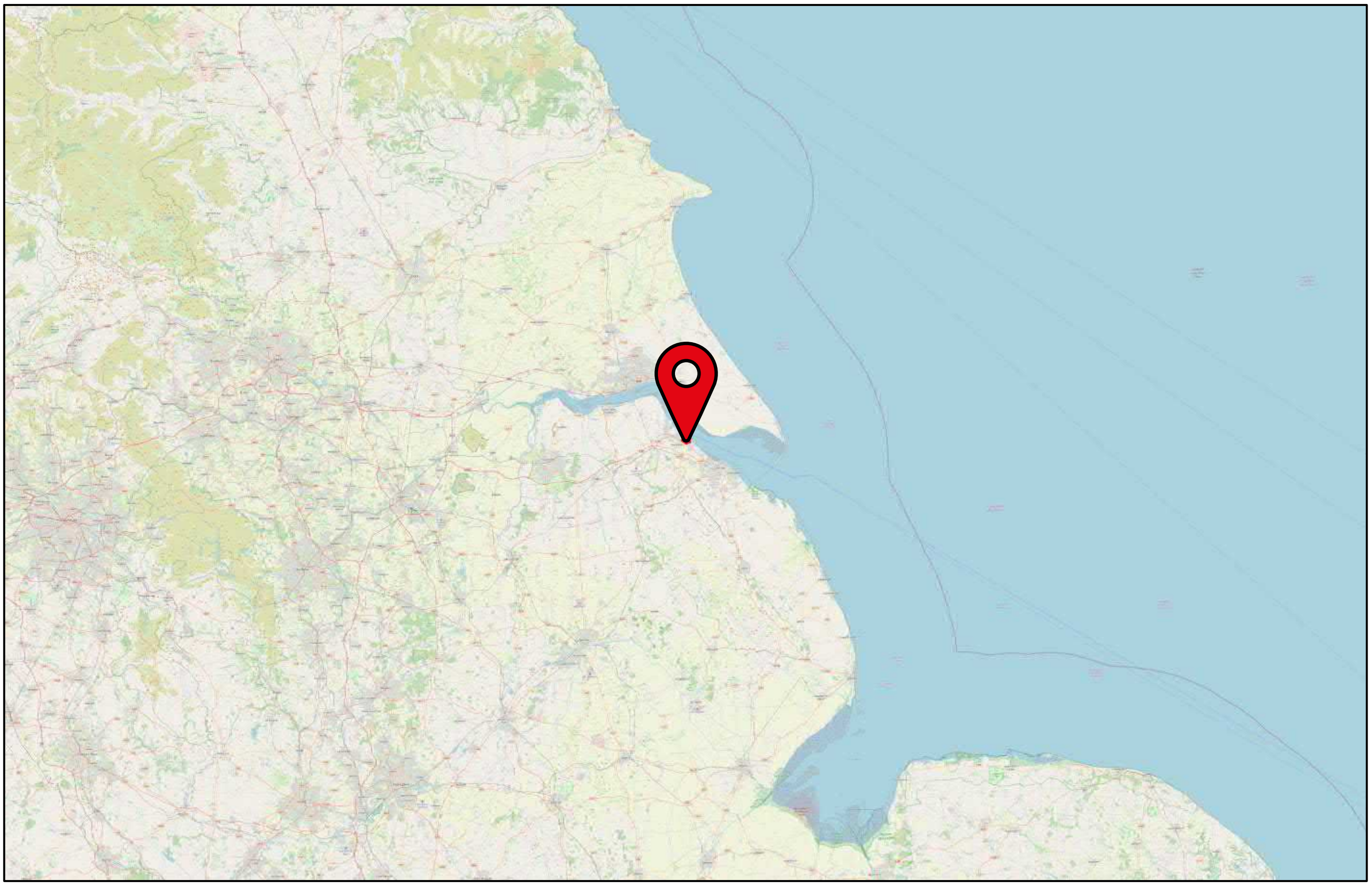
SAFELANE GLOBAL

Site Location Maps

Annex

A

9048 RA



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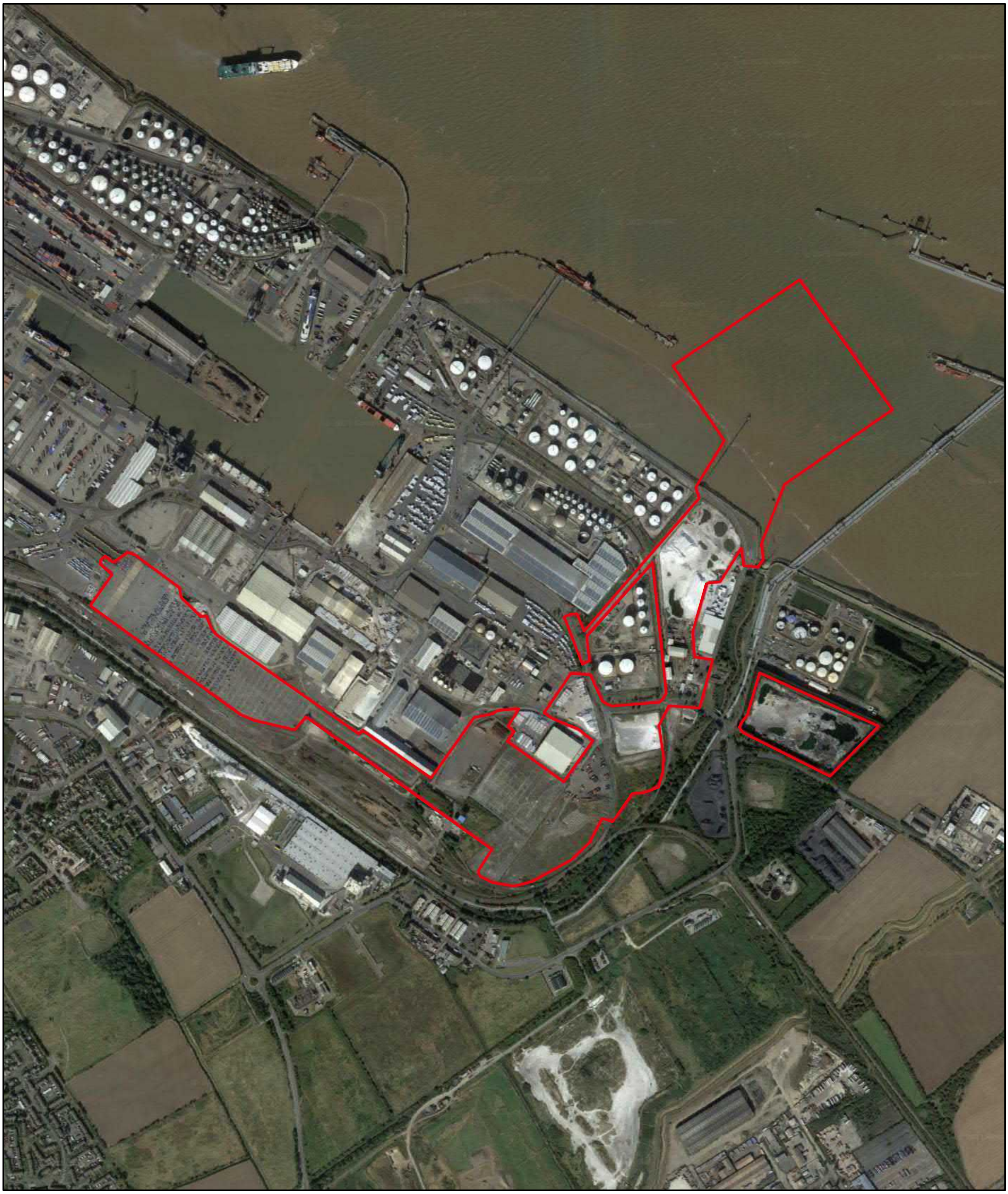
SAFELANE® GLOBAL

Recent Aerial Photograph

Annex
B
9048 RA

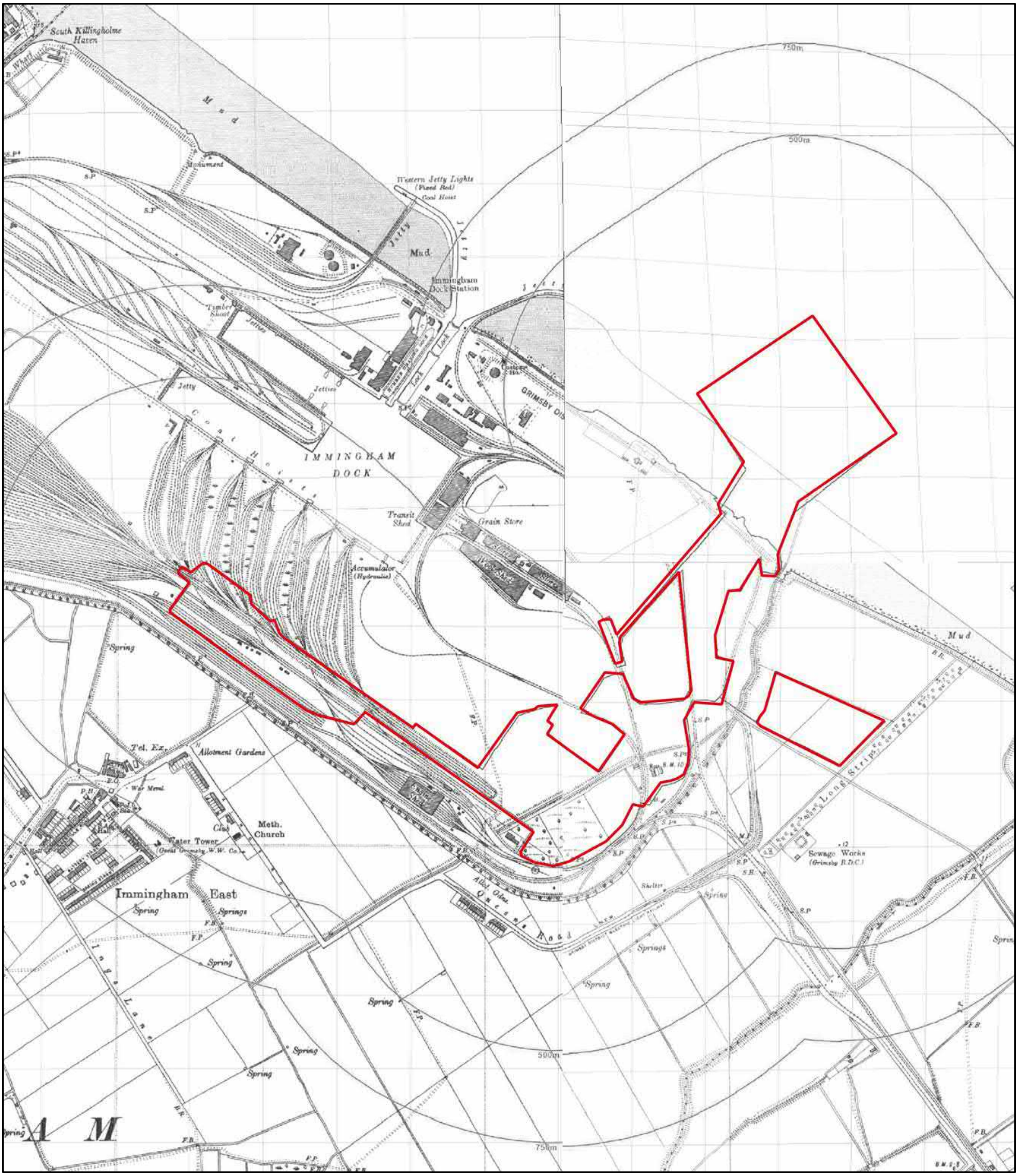
N



Approximate site boundary

Google Earth™ Mapping Services

N



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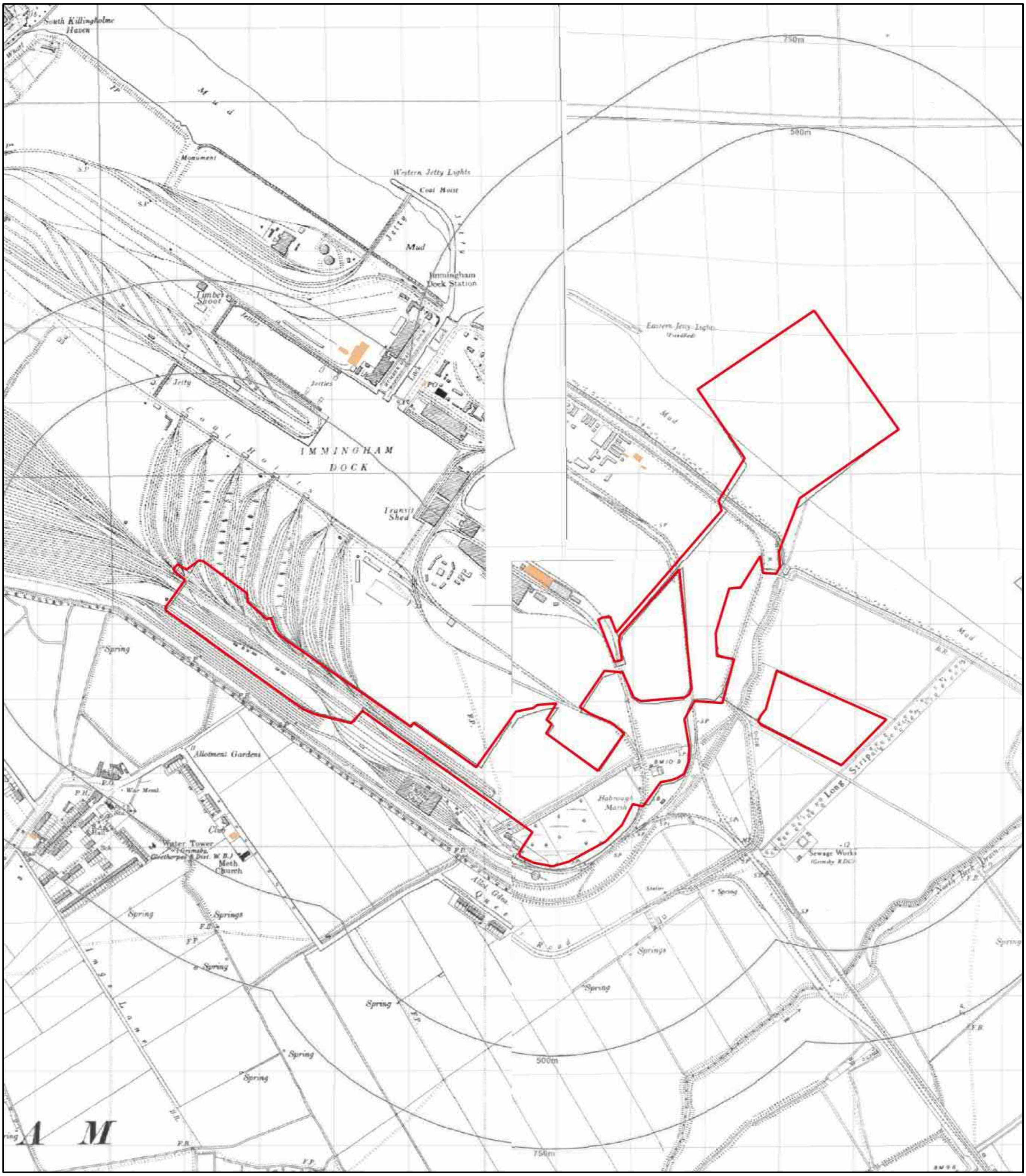

Approximate site boundary
Clearance

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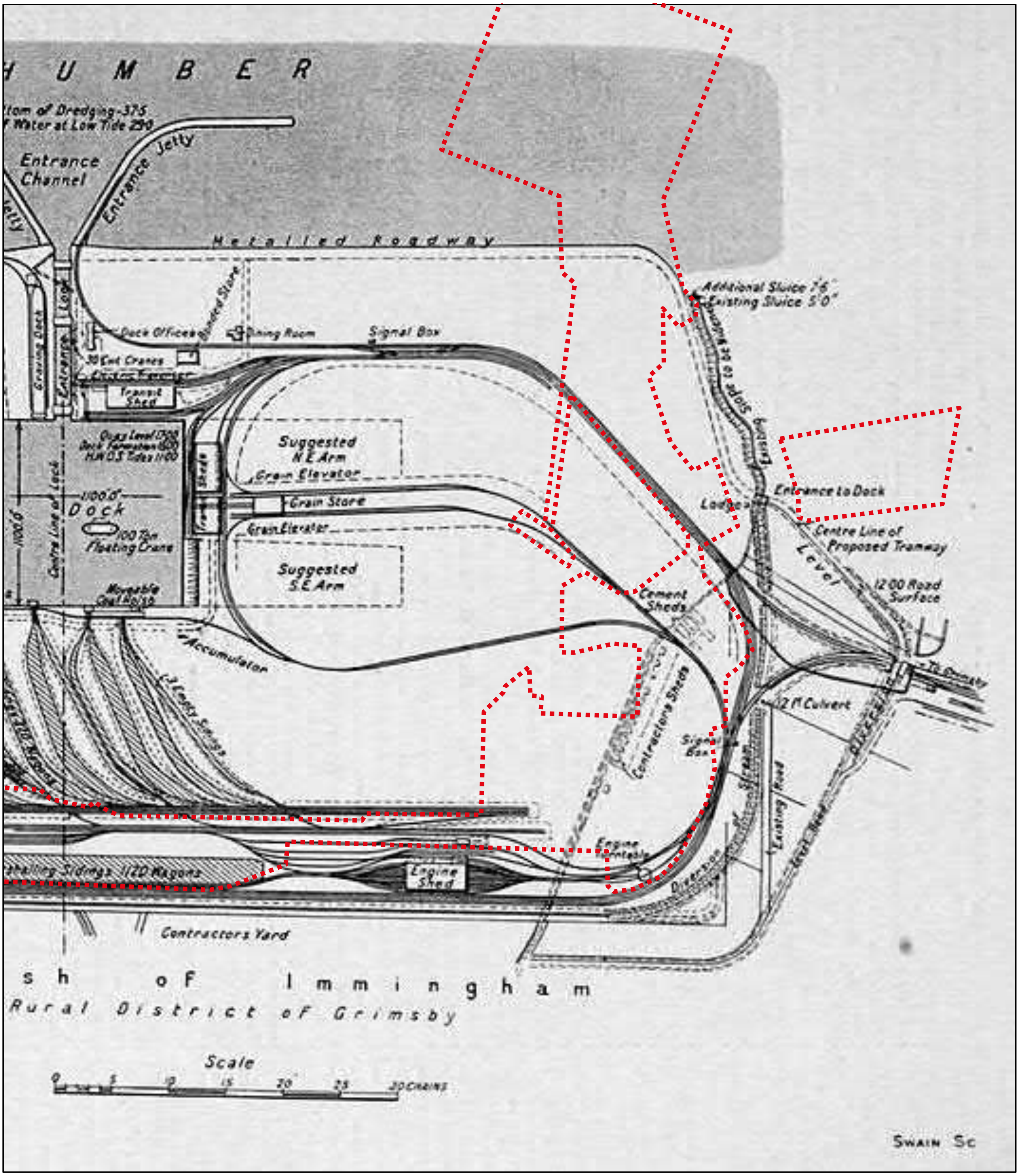
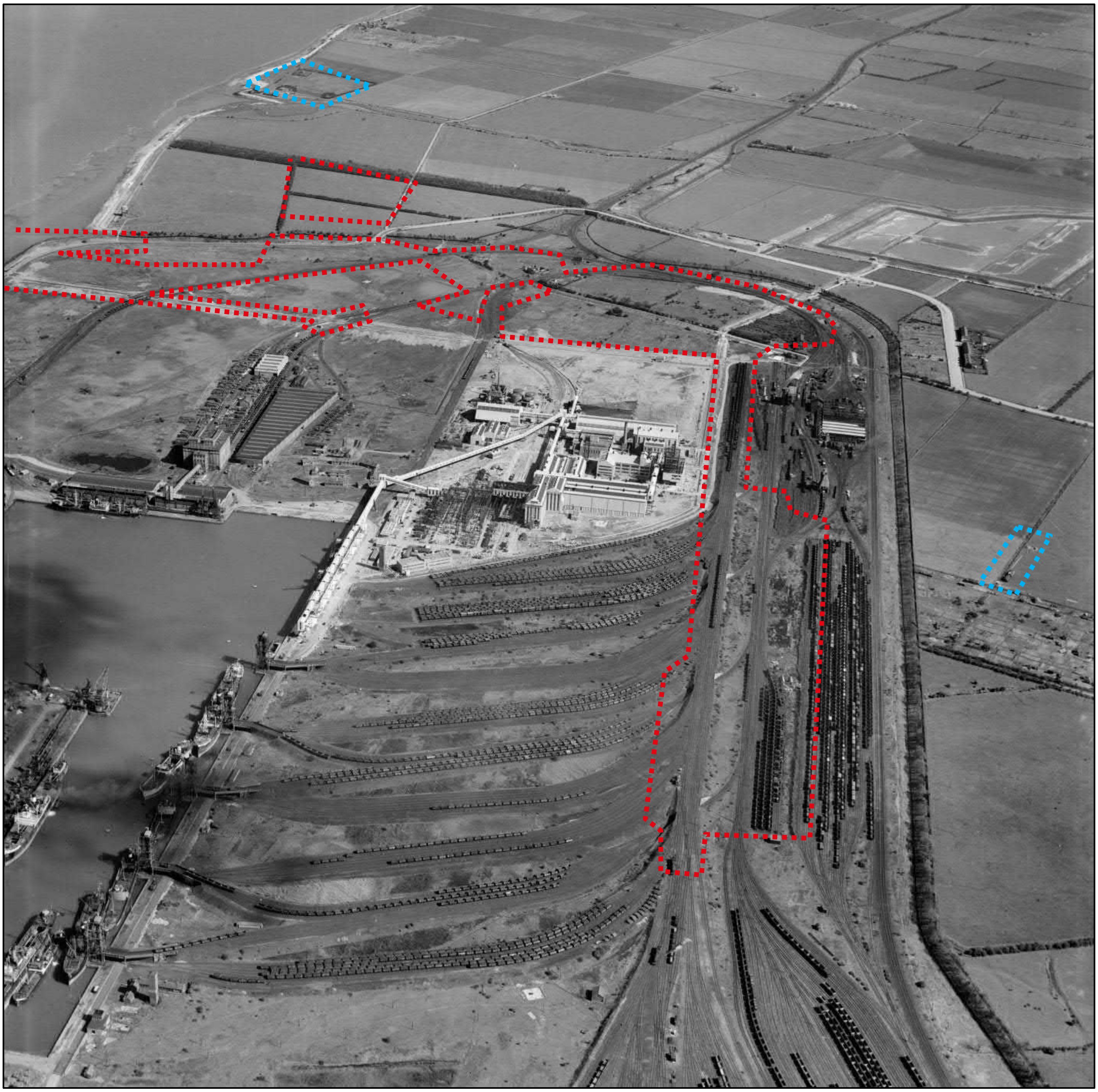


Approximate site boundary

WWII-era RAF Aerial Photography – 4th May 1950

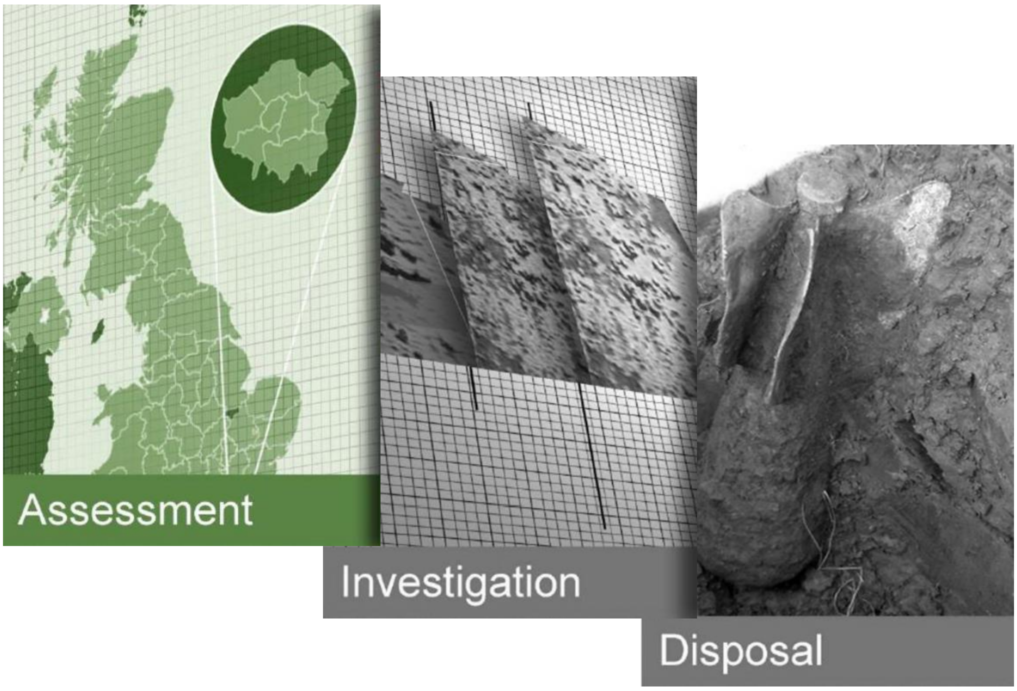
N



Approximate site boundary
Gun battery site

Britain From Above

Anti-aircraft gunnery training, c.1940s



Port of Immingham - UXO Desk Study & Risk Assessment

Drafted by Matthew Eatough
Checked by Abi Newton
Authorised by Stefan Lang

Document Title	**UXO Desk Study & Risk Assessment**
Document Ref.	**P11479-22-R1**
Revision	**A**
Project Location	**Port of Immingham**
Client	**Associated British Ports**
Date	**29th July 2022**

UXO DESK STUDY & RISK ASSESSMENT

EXECUTIVE SUMMARY

Key findings: No significant sources of Unexploded Ordnance (UXO) hazard have been identified. The potential for UXO to migrate onto the Site due to marine processes cannot be discounted.

Key actions: UXO awareness briefing for staff involved in dredging. Explosive Ordnance Clearance (EOC) Engineer attendance aboard the dredger may be prudent.

UXO Hazard Assessment

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

Given this, it is considered that the Site has a low UXO hazard level, as shown in the following Figure, reproduced as Figure 6 in the main report.

The UXO hazard zone plan of the Site is also given in the accompanying P11479-22-R1-MAP01-A.

It should be noted that the possibility of smaller, lighter items of UXO migrating onto the Site cannot be totally discounted, this forms part of the low background risk of encountering UXO on any similar site in the UK.

UXO hazard zone plan of the Site

Source: OpenStreetMap *Not to Scale*

Legend	Very Low		Low		Moderate	
	High		Very High		Site boundary	

The main findings of the report are summarised below.

- During World War One (WWI) the Admiralty established a naval base at Immingham Dock, approximately 0.3km west of the Site. It was used primarily for home defence. An associated Royal Naval Air Station (RNAS) kite balloon base was also established at Immingham, on land adjacent to the Site.
- During World War Two (WWII) Immingham Dock became the Royal Navy's (RN) Headquarters (HQ) for the Humber. The dock was also home to a small fleet of torpedo boats and minesweepers. The base was decommissioned post-WWII.
- Records indicate that several Anti-Aircraft (AA) and anti-invasion defences were established in the vicinity of the Site. These were removed post-WWII.
- During WWII the main strategic targets in the vicinity of the Site included Immingham Dock, RN establishments, transport infrastructure, and military camps and depots.
- No records have been found indicating that the Site was bombed during WWII. Records indicate that the nearest High Explosive (HE) bomb fell approximately 0.4km west-northwest of the Site.
- No records of military activity on the Site post-WWII have been found.

Data Confidence Level

The findings of this report were based on good corroborative evidence of the military activity and bombing on the Site.

Proposed Works

It is understood that works on the Site are associated with the development of a new roll-on/roll-off (Ro-Ro) facility at the Port of Immingham. This includes the construction of a new four-berth Ro-Ro jetty, along with accompanying terminal buildings and storage areas within existing port infrastructure.

Works on the Site include dredging to depths of 9m below ground level (bgl). The jetty will be constructed using driven piles up to 1m in diameter. These will be penetrating approximately 25m bgl into the riverbed.

Risk Assessment

The Table below, reproduced as Table 4 in the main report, provides a UXO risk assessment for the proposed works on the Site.

Further details on the methodology for the risk assessment are provided in Section 8.2 of the main report.

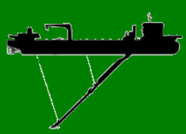
UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Dredging	1	1	1	1	5	5	Low
	Shallow Excavations	1	1	1	1	5	5	Low
	Deep Excavations	1	1	1	1	5	5	Low
	Boreholes/Piling	1	1	1	1	5	5	Low
Other UXO	Dredging	1	1	1	1	5	5	Low
	Shallow Excavations	1	1	1	1	4	4	Low
	Deep Excavations	1	1	1	1	4	4	Low
	Boreholes/Piling	1	1	1	1	3	3	Low
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)								
Shallow Excavations defined as <1.0m below ground level (bgl.)								

Risk Mitigation Plan

The Table below, reproduced as Table 5 in the main report, summarises the UXO risk for proposed works on the Site and recommended actions.

Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Dredging		**UXO awareness briefing** – It is recommended that those involved in dredging operations are provided with a formal UXO awareness briefing so that they take appropriate action in the event of a suspect find. Procedures for an Emergency Response Plan (ERP) in the event of a UXO find should also be established. **EOC Engineer** – If additional comfort is required, an Explosive Ordnance Clearance (EOC) Engineer can be present aboard the dredger during operations.
Excavations		**Proceed with works** – if additional comfort is required to address the residual UXO hazard, a formal UXO awareness briefing can be provided.
Boreholes/Piling		**Proceed with works**

In summary, it is recommended that staff involved in dredging operations are provided with a formal awareness briefing so that they take appropriate action in the event of a suspect find. For additional comfort, an EOC Engineer can be present aboard the dredger and take appropriate action in the event of a suspect item being encountered.

What Do I Do Next?

If you wish to proceed with UXO risk mitigation, Zetica would be happy to assist. Just contact us via phone (01993 886682) or email (uxo@zetica.com) and we can provide a proposal with options and prices.

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

CONTENTS

Figures, Plates & Tables

Accompanying GIS Data

P11479-22-R1-MAP01-A (UXO Desk Study)

ABBREVIATIONS

AA	Anti-Aircraft
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BDU	Bomb Disposal Unit
CMD	Conventional Munitions Disposal
DEMS	Defensive Equipped Merchant Ships
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FFE	Free From Explosives
HAA	Heavy Anti-Aircraft
HE	High Explosive
HMT	His Majesty's Trawler
HMS	His Majesty's Ship
HSE	Health and Safety Executive
HQ	Headquarters
IB	Incendiary Bomb
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
JSEODOC	Joint Services EOD Operations Centre
LAA	Light Anti-Aircraft
LG	Lewis Gun
MoD	Ministry of Defence
OB	Oil Bomb
PM	Parachute Mine
PUCA	Pick Up and Carry Away
RAF	Royal Air Force
RNAS	Royal Naval Air Station
RN	Royal Navy
Ro-Ro	Roll-on/Roll-off
TEP	Time Expired Pyrotechnics
UP	Unrotated Projectile
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
WWI	World War One
WWII	World War Two

UXO DESK STUDY & RISK ASSESSMENT

Please read: Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Boxed paragraphs in a dark green text with a green background are paragraphs providing general information and, where appropriate, links to online resources giving further detail. These are all available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

1 INTRODUCTION

1.1 Project Outline

Zetica Ltd was commissioned by Associated British Ports to carry out a detailed Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 89.2 hectares (ha) at the Port of Immingham in Lincolnshire ('the Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry' and C754 'Assessment and Management of Unexploded Ordnance (UXO) Risk in the Marine Environment'.

Where appropriate, this hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance.
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be recorded and therefore there cannot be any guarantee that all UXO hazards affecting the Site have been identified in this report.

1.2 Sources of Information

Zetica Ltd researched the military history of the Site and its surrounding area using a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

1.2.1 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

1.2.2 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on Zetica's website (http://zeticauxo.com/downloads-and-resources/risk-maps/)

1.2.3 Ministry of Defence and Government Records

Government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Department of Communities and Local Government (DCLG) records of abandoned bombs.

1.2.4 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, the US National Archives & Records Administration (NARA), the Imperial War Museum (IWM), Historic England and the Defence of Britain Project.

The British Geological Survey (BGS) was consulted for borehole information.

1.2.5 Local Authority Records

Information was obtained from the North East Lincolnshire Archives.

1.2.6 Local Record Offices and Libraries

The Immingham Museum & Heritage Centre and Grimsby Library were consulted for records.

1.2.7 Local Historical and Other Groups

Local history groups and archaeological bodies were consulted, including the Lincolnshire Historic Environment Record (HER).

1.3 Data Confidence Level

In general, there is a high level of confidence in the researched information sources used for this report. Exceptions to this are specifically detailed in the text of the report.

2 THE SITE

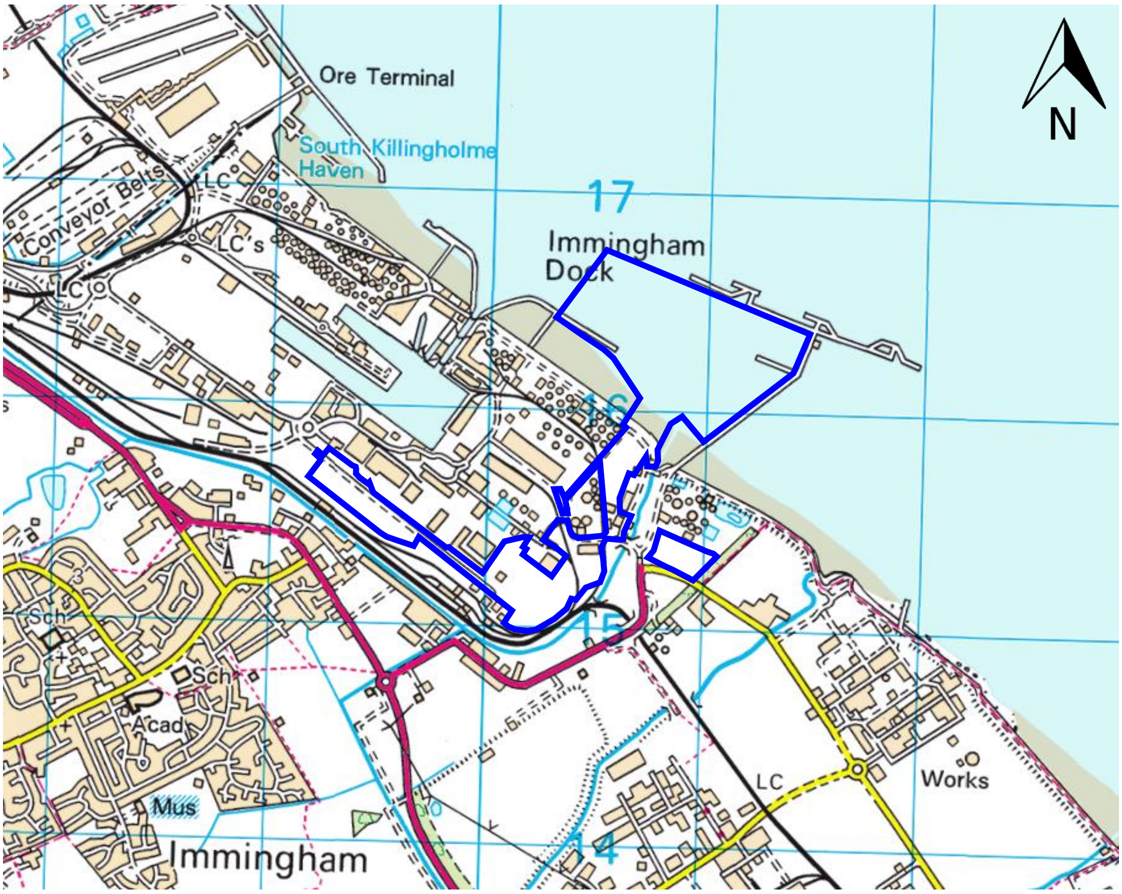
2.1 Site Location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) TA 203156. It is located at the Port of Immingham, approximately 1.2km east-northeast of central Immingham.

The Site comprises hardstanding, multiple commercial and industrial premises, and an area encompassing the Humber Estuary. It is bounded to the north by the Humber Estuary, to the east by open ground, industrial premises and the Humber Estuary, to the south by open ground and railway marshalling yards, and to the west by commercial and industrial premises.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

Figure 1 Site location map



Source: © Crown Copyright 2022. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site boundary

Plate 1 Recent aerial photograph of the Site

Source: Google Earth *Not to Scale*

Legend	Site boundary

3 MILITARY ACTIVITY

The following sections outline the recorded military activity in the vicinity of the Site. The potential UXO hazard from World War One (WWI) and World War Two (WWII) bombing is detailed in Section 4.

Each sub-section provides hyperlinks to further information on potential sources of UXO hazard. These are also available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

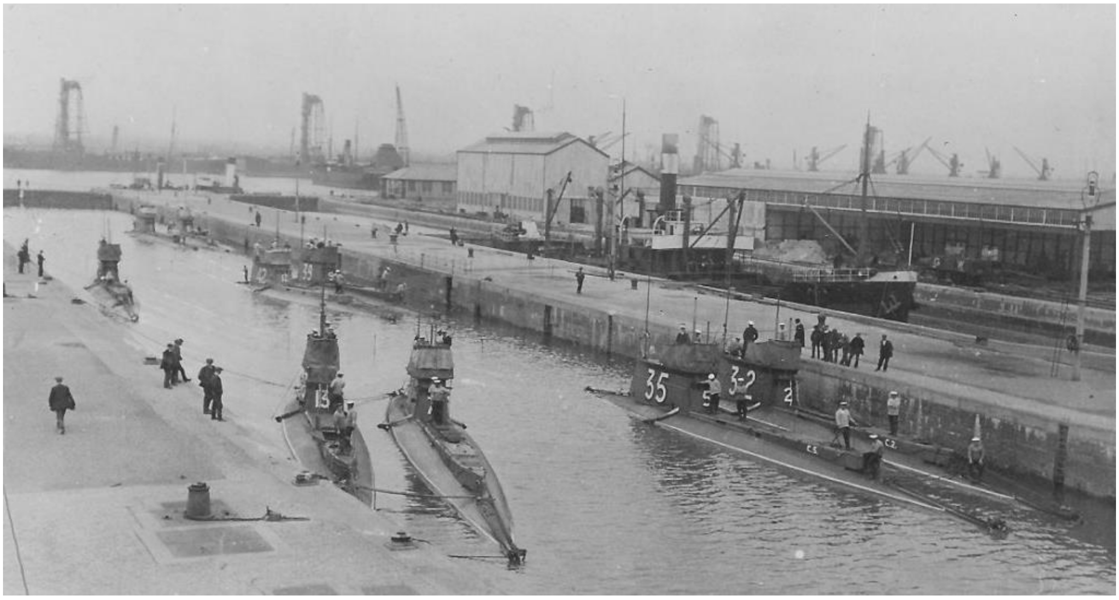
3.1 Immingham Dock

During WWI, a naval base was established at Immingham Dock, approximately 0.2km west of the Site. Established in August 1914, the base was designated as the Headquarters (HQ) of the 7th Destroyer Flotilla. This comprised a main force of 11No. torpedo boat destroyers.

The dock was also home to a small fleet of British C-class and D-class submarines, belonging to the 2nd, 3rd and 6th Submarine Flotillas. As a sub-command of the Admiral of Patrols, the flotillas stationed at Immingham were tasked with coastal defence, and were used to combat enemy U-boat action in the North Sea.

Plate 2 is a photograph of Immingham Dock, dating from circa 1916. This shows several Royal Navy (RN) C-class submarines moored at Immingham's entrance lock, approximately 0.3km west of the Site.

Plate 2 Photograph of Immingham Dock, c. 1916



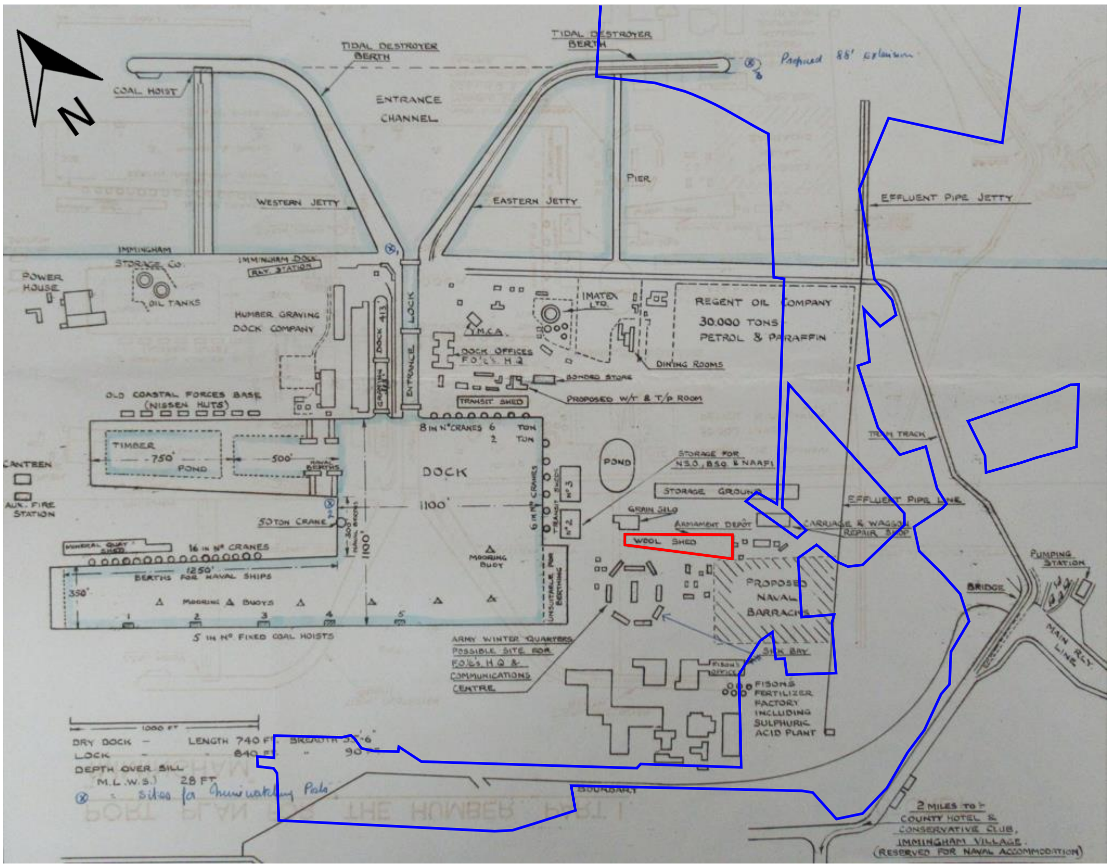
Source: Immingham Museum

At the end of WWI, the naval facilities at Immingham Dock were briefly amalgamated under the command of His Majesty's Ships (HMS) Pembroke VII and VIII. In 1921 the base was decommissioned.

At the outbreak of WWII, Immingham Dock was re-established as a naval base, and was designated as the RN's HQ for the Humber. Records indicate that the base was home to a small fleet of torpedo boats, minelayers and minesweepers. These were tasked primarily with coastal defence and convoy protection duties.

Figure 2 is a plan of Immingham Dock, dating from circa 1944. This indicates that the wool transit shed (TA 201157) approximately 0.1km west of the Site, was used as an armament depot.

Figure 2 Plan of Immingham Dock, c. 1944



Source: The National Archives *Not to Scale*

Legend	Site boundary	Armament depot

At the end of WWII, the naval base was decommissioned, and all facilities returned to commercial use.

Potential UXO Hazard

It should be noted that RN activities at Immingham Docks were poorly documented.

Whilst it is considered to be unlikely, the potential that ordnance was disposed or scattered by RN personnel on the Site, cannot be entirely discounted.

Details on UXO migration in the marine environment are presented in Section 5.

3.2 Defences

For further information on military defences, and the potential UXO hazards associated with them, follow the links below:

- Anti-Aircraft Guns
- Anti-Invasion Defences
- Barrage Balloons
- Bombing Decoys
- Home Guard
- Mined Locations

- Mortar & Gun Emplacements
- Pillboxes

The nearest military defences to the Site are described below.

3.2.1 Anti-Aircraft Guns

During WWI there were 4No. Anti-Aircraft (AA) batteries within 10km of the Site. The nearest was located at Immingham (TA 187142), within approximately 1km of the Site. This was armed with 2No. 1-pounder (pdr) guns in 1916, and an additional 12-pdr 12-hundredweight (cwt) gun in 1917. Records indicate that these armaments were situated on travelling carriages, which were likely moved around as operational requirements dictated.

During WWII there were 19No. Heavy AA (HAA) batteries within 10km of the Site. The nearest was located at Long Strip, Immingham (TA 210155), approximately 0.1km east-northeast of the Site. Its armament is unknown.

During WWII Immingham Dock was defended by multiple Light AA (LAA) gun emplacements, located in the immediate vicinity of the Site.

These initially comprised 24No. Lewis Guns (LG), with an additional 4No. 40mm Bofors guns listed in May 1943. They were manned by units of 309th Battery, 39th Regiment LAA. All LAA gun emplacements at Immingham were removed at the end of WWII.

The nearest recorded WWII AA shell incident to the Site is described below.

20th May 1942

2No. AA shells fell on Immingham Dock (TA 202162), approximately 0.2km west of the Site.

Potential UXO Hazard

Given the number of HAA and LAA gun batteries in the surrounding area during WWII, the potential for an Unexploded AA (UXAA) shell to have fallen on the Site unnoticed cannot be totally discounted.

Ammunition stores associated with HAA and LAA gun batteries were typically removed when the positions were dismantled at the end of WWII, although the possibility of local munitions disposal around defended positions cannot be totally discounted.

3.2.2 Pillboxes

During WWII, several pillboxes were established in the vicinity of the Site, forming part of the region’s anti-invasion defences. The nearest was located near the foreshore of Immingham Dock (TA 207158), on the Site.

Records indicate that this was a Lincolnshire style 3-bay pillbox (FW3/23). It was manned by units of the Home Guard (see Section 3.2.3). It was removed post-WWII.

Potential UXO Hazard

Pillboxes often had associated munitions caches which may have stored Small Arms Ammunition (SAA), in addition to close combat munitions such as grenades and mortars.

These caches were typically removed at the end of WWII, although the possibility of local munitions disposal around defended positions cannot be totally discounted.

Pillboxes are not considered to provide a significant source of UXO hazard to the Site.

3.2.3 Home Guard

During WWII, the 7th Lindsey (Grimsby Rural) Battalion of the Home Guard operated in the vicinity of the Site. The Home Guard was responsible for patrolling local transport links and strategic targets such as Immingham Docks, as well as manning regional anti-invasion defences later in the war.

Potential UXO Hazard

It should be noted that records of Home Guard activities were rarely kept, and training activities were usually unofficial or unsanctioned.

Storage and disposal of munitions by the Home Guard was poorly documented and surplus supplies were often buried or dumped in ad-hoc locations.

Home Guard activities are not considered to provide a significant source of UXO hazard to the Site.

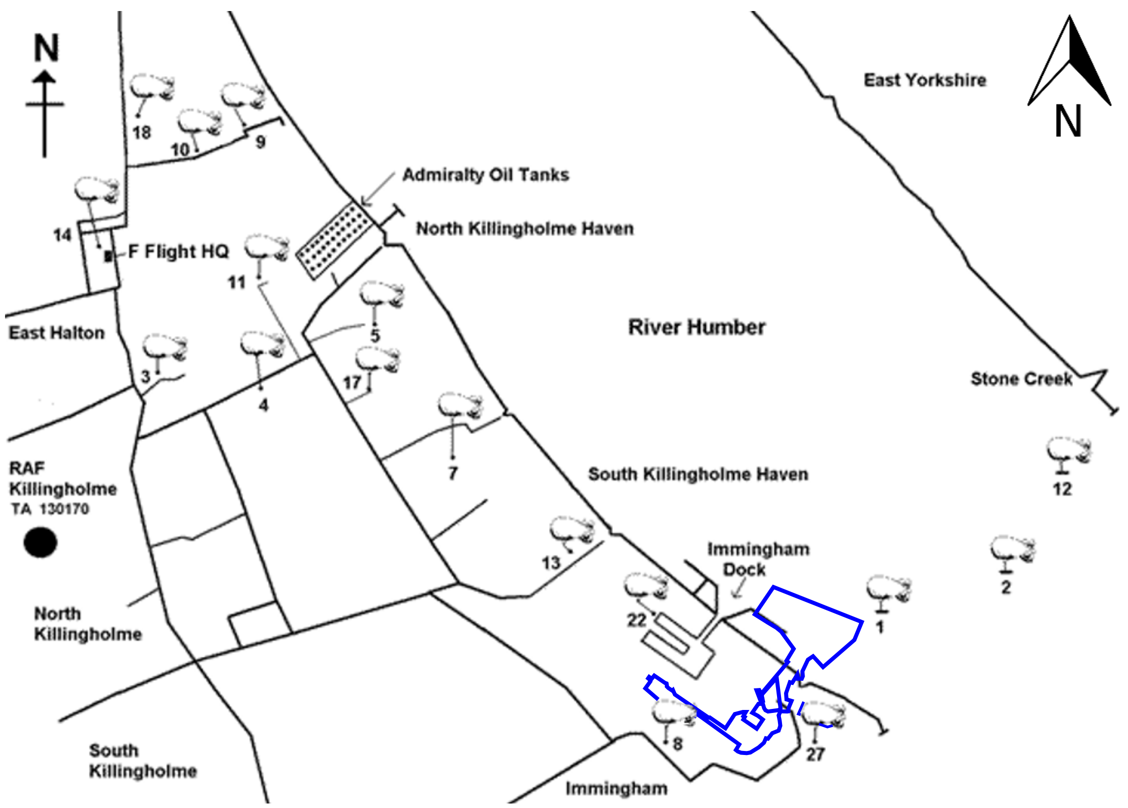
3.2.4 Barrage Balloons

Barrage balloons were widely used in Britain's defence against the Luftwaffe. Given the strategic importance of Immingham, Kingston-upon-Hull, and the RN facilities on the Humber, extensive barrage balloon defences were established in the vicinity of the Site during WWII.

Records indicate that the nearest barrage balloon anchorage (No. 27) was located at Long Strip, Immingham (TA 208152), on land adjacent to the Site. This has also been identified in Plate 4 (see Section 4.2). It was operated by units of 'F' Flight, No. 942 (East Riding) Balloon Squadron.

Figure 3 is a map of the barrage balloon defences in the vicinity of the Site during WWII.

Figure 3 Map of barrage balloon defences in the vicinity of the Site during WWII



Source: Bacon *Not to Scale*

Legend	Site boundary

In August 1944, when the threat of enemy air raids in the area had receded, No. 942 Squadron was disbanded and the barrage balloon anchorages in the region were abandoned.

Barrage balloons are not considered to provide a source of UXO hazard to the Site.

3.2.5 Bombing Decoys

The nearest recorded bombing decoy was located at Immingham Range (TA 234136), approximately 2.9km east-southeast of the Site.

Bombing decoys are not considered to provide a source of UXO hazard to the Site.

3.3 Military Airfields

For further information on military airfields, and the potential UXO hazards associated with them, follow the link below:

- Military Airfields

No records of any military airfields on the Site have been found. The nearest is described below.

3.3.1 RNAS Immingham

During WWI, Royal Naval Air Station (RNAS) Immingham was established at the southeast corner of Immingham Dock (TA 197155), on land adjacent to the Site. The base was used as a kite balloon station for RN convoy's operating out of Immingham Dock.

Records indicate that the base comprised 2No. main balloons, which were operated from 2No. canvas balloon sheds. The station was serviced by a small technical area, which contained an armoury. This is highlighted on Figure 4, a plan of RNAS Immingham, dating from circa 1918.

Figure 4 Plan of RNAS Immingham, c. 1918

Source: The National Archives *Not to Scale*

Legend		
	Site boundary (blue)	Station boundary (purple)
	Balloon sheds (green)	Technical area (red)

In April 1918, the station was acquired by the newly formed Royal Air Force (RAF), becoming No. 8 Balloon Base. It was decommissioned in 1919, and all associated facilities were subsequently removed.

RNAS Immingham is not considered to provide a source of UXO hazard to the Site.

3.4 Aircraft Crashes

For further information on military aircraft crashes, and the potential UXO hazards associated with them, follow the link below:

- Aircraft Crashes

No records of any aircraft crashes on or in close proximity to the Site have been found.

3.5 Explosives Factories, Munitions Depots and Disposal Areas

For further information on explosives factories, munitions depots and disposal areas, and the potential UXO hazards associated with them, follow the links below:

- Explosives Factories
- Munitions Depots
- Munitions Disposal Areas

No records of any explosives factories, munitions depots or munitions disposal areas on the Site have been found. The nearest is described below.

3.5.1 Immingham Depot

In the spring of 1917, a salvage depot was established at Immingham (TA 196164), within approximately 0.3km west of the Site. This was tasked with the sorting and salvage of used material from the western front, primarily fired brass cartridge cases.

Various types of shells and boxes were sorted and categorised at the depot, before being transported inland for repair and rectification. By the end of the war, the depot had sorted 3,314,690No. cartridge cases for salvage.

Immingham Dock was also used for the storage and distribution of various naval munitions, primarily sea mines and torpedoes. Records indicate that over 130,000No. tons of sea mines were stored and distributed from Immingham during WWI. It is considered likely that the wool transit shed (TA 201157), approximately 0.1km west of the Site, was used for these purposes.

Immingham Depot closed at the end of WWI, and all facilities were returned to commercial use.

Immingham Depot is not considered to provide a source of UXO hazard to the Site.

3.6 Firing Ranges and Military Training Areas

For further information on firing ranges and military training areas, and the potential UXO hazards associated with them, follow the links below:

- Artillery Ranges
- Bombing Ranges
- Military Training Areas
- Small Arms Ranges

No records of any firing ranges or military training areas on or in close proximity to the Site have been found.

3.7 Other Military Establishments

Other than those identified above, no other military establishments have been identified on or in close proximity to the Site.

4 BOMBING

4.1 WWI Bombing

For further information on WWI bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.1. Alternatively, use the following link.

- WWI Bombing

No records have been found indicating that the Site was bombed during WWI. The nearest recorded incident is described below.

29th July 1916

Zeppelin L24 dropped 6No. High Explosive (HE) bombs on Stallingborough Marsh, near Immingham Halt Station, within approximately 0.6km east-southeast of the Site.

WWI bombing is not considered to provide a source of UXO hazard to the Site.

4.2 WWII Bombing

For further information on WWII bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.2. Alternatively, use the following link.

- WWII Bombing

No records have been found indicating that the Site was bombed during WWII. Details of WWII bombing in the vicinity of the Site are provided in the following sections.

4.2.1 Bombing in Humberside & Immingham

From prior to the declaration of war in 1939, Britain was subjected to reconnaissance flights by the Luftwaffe who were building up a photographic record of potential targets. As early as 1937, German aircraft were flying up the Humber Estuary to photograph docks and factories.

Some areas of Humberside were heavily bombed during WWII, particularly Kingston-upon-Hull and Grimsby. The Humber Estuary was a major navigational aid for German bombers heading inland, and air activity in the region was particularly intensive.

Bombing raids in the region began in the summer of 1940 and continued until the end of WWII. Some smaller targets in the region were specifically targeted, including the Admiralty Fuel Depot at Killingholme (TA 180177) approximately 2.2km northwest of the Site.

Despite being a major strategic target, the Port of Immingham escaped significant bombing during WWII. Luftwaffe attacks in the immediate vicinity of the Site were primarily contained to ‘tip and run’ bombing raids.

It should be noted that although rural areas were bombed less heavily than urban districts, Air Raid Precaution (ARP) records may also under-represent the number and frequency with which bombs fell in rural areas.

4.2.2 Strategic Targets

The Site was located in an area which contained numerous potential strategic targets, including Immingham Docks, RN establishments, transport infrastructure, and military camps and depots.

Plate 3 is a Luftwaffe target photograph of the Port of Immingham, dated the 3rd September 1940.

This shows Immingham Dock (GB 45 27), encroaching on the Site, and Immingham Dock Granary (GB 56 26), approximately 0.2km west of the Site.

AA guns and searchlight batteries are marked as ‘Flak’ and ‘Scheinw’ respectively.

Possible bomb cratering has also been identified (marked ‘a’).

Plate 3 Luftwaffe target photograph of the Port of Immingham, 3rd September 1940

Source: NARA *Not to Scale*

Legend	Site boundary

4.2.3 Bombing Densities and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site (highlighted by bold text) and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal or Metropolitan Boroughs (MB) and County Boroughs (CB). WWII bomb density levels are defined below:

<5 bombs per 405ha is a Very Low regional bombing density.

5-15 bombs per 405ha is Low.

15-50 bombs per 405ha is Moderate.

50-250 bombs per 405ha is High.

>250 bombs per 405ha is Very High.

Table 1 Bombing statistics

Area	Bombs Recorded				
	High Explosive	Parachute Mines	Other	Total	Bombs per 405ha (1000 acres)
Grimsby RD	**204**	**6**	**0**	**210**	**5.3**
Cleethorpes MB	69	2	0	71	33.2
Grimsby CB	131	0	0	131	24.0
Glanford Brigg RD	663	12	1	676	4.9
Caistor RD	195	1	0	196	1.6

Note that Table 1 excludes the figures for Incendiary Bombs (IBs). Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

Details of the nearest recorded bombing incidents to the Site are given in the following section.

20th June 1940

1No. HE bomb fell on the marshalling yards at Immingham Dock, within approximately 0.8km west of the Site. This was recorded as an Unexploded Bomb (UXB).

20th August 1940

1No. HE bomb fell on the southwest corner of Immingham Dock, within approximately 0.3km west of the Site.

25th August 1940

1No. HE bomb fell on railway sidings near the power house, Immingham Dock, approximately 0.7km west of the Site.

23rd March 1941

12No. HE bombs fell on waste ground on the southwest corner of Immingham Dock, west of the coal hoists, approximately within 0.3km west-northwest of the Site.

30th May 1942

Several IBs fell on Immingham Village, within approximately 1km southwest of the Site.

11th August 1942

Several IBs fell on and near the marshalling yards at Immingham Dock, on and in close proximity to the Site.

18th August 1943

2No. IBs fell on the Humber Graving Dock, Immingham, approximately 0.5km west of the Site.

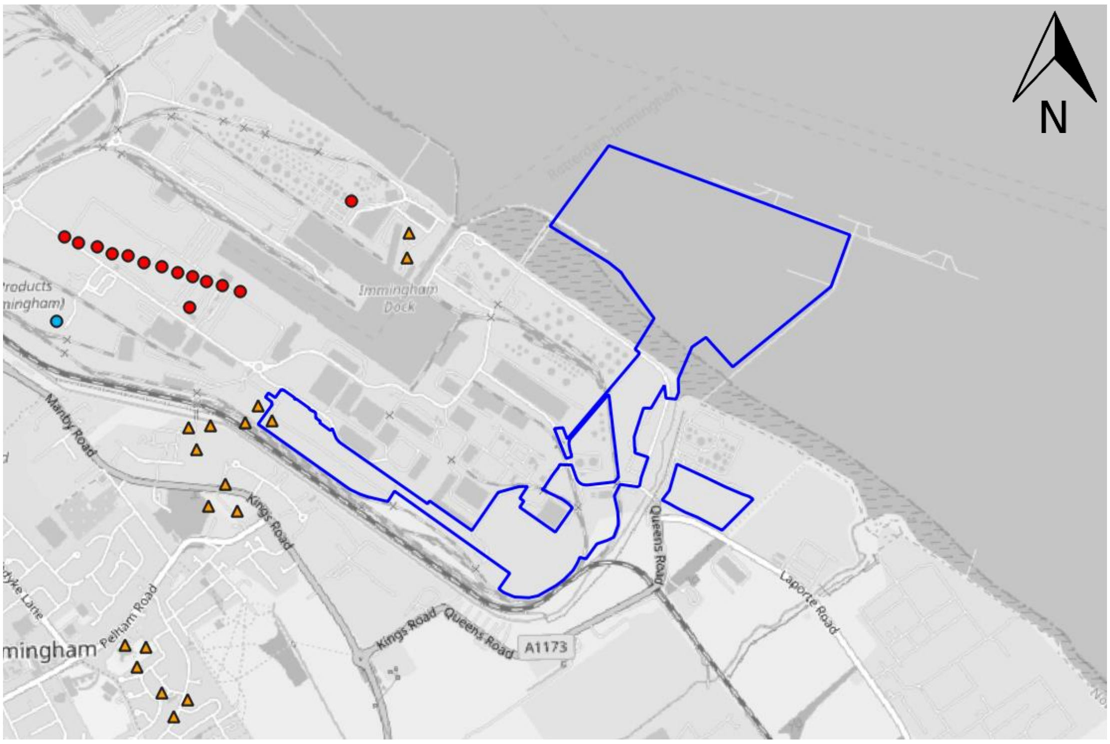
It should be noted that during WWII, many UXB were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXB were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Figure 5 is a map showing the approximate location of recorded bomb impacts in the immediate vicinity of the Site. IBs shown are indicative of larger numbers of similar devices that fell within the given area.

The map has been compiled from a number of different sources, including air raid incident reports, historical aerial photographs and bomb census maps.

The bomb map is also given in the accompanying P11479-22-R1-MAP01-A.

Figure 5 Compiled bomb impact map for the vicinity of the Site



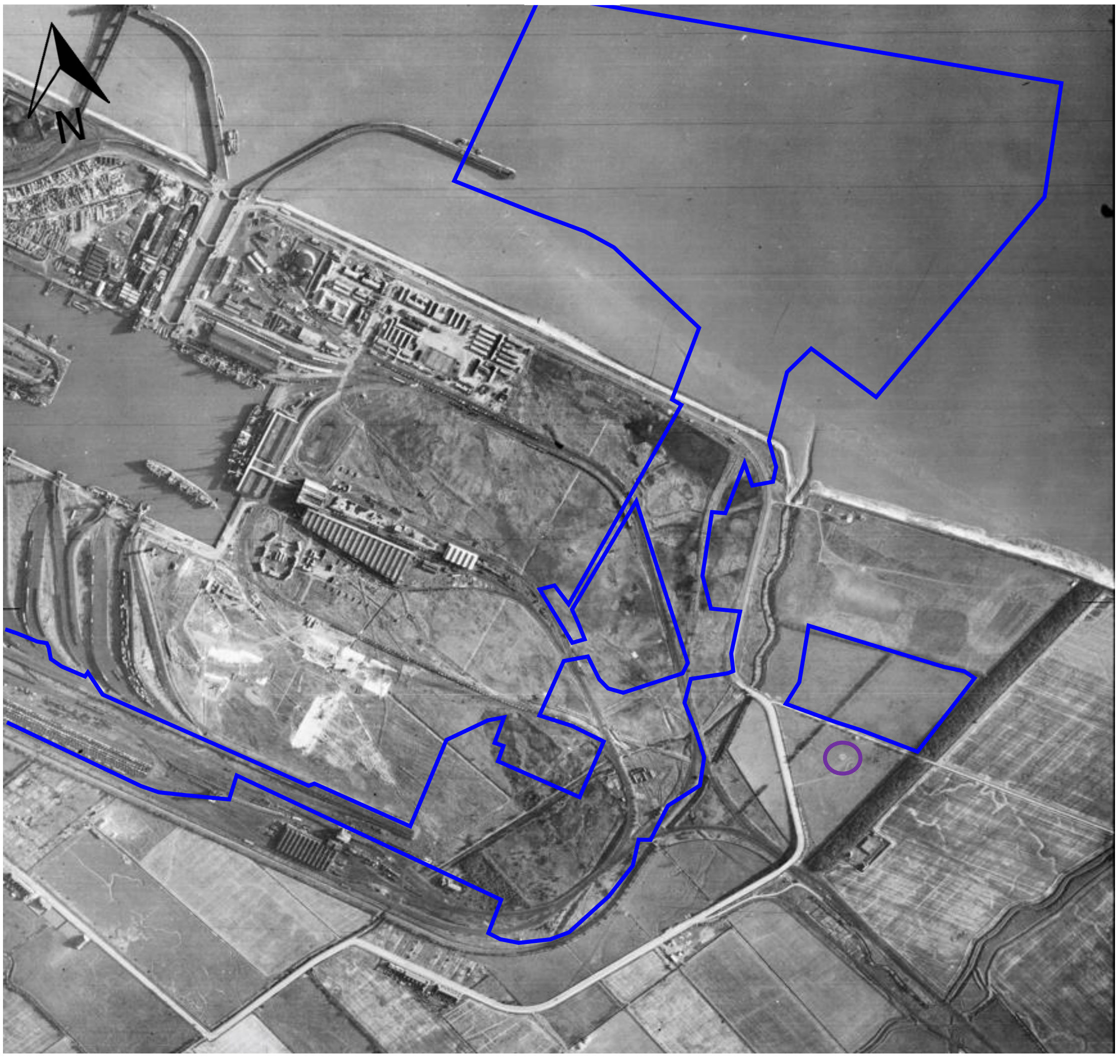
Source: OpenStreetMap *Not to Scale*

Legend	Site boundary	HE bomb	UXB	IBs

Plate 4 is an aerial photograph dated the 29th April 1947. No bomb damage or cratering has been identified on or in close proximity to the Site.

Barrage balloon anchorage No. 27 has been identified adjacent to the Site (see Section 3.2.4).

Plate 4 Aerial photograph, 29th April 1947



Source: Historic England *Not to Scale*

Legend	Site boundary	Barrage balloon anchorage

Potential UXO Hazard

No records have been found indicating that the Site was bombed and no bomb damage or cratering has been identified on the Site on historical aerial photography.

WWII bombing is not considered to provide a source of UXO hazard to the Site.

4.2.4 Geology and Bomb Penetration Depths

It is important to consider the geological materials present at the time that a bomb was dropped in order to establish its maximum penetration depth.

British Geological Survey (BGS) 1:50,000 Sheet 81 Patrington (Solid & Drift) and BGS borehole records from on and near the Site were consulted to get an indicative overview of the Site geology.

The geology of the landward part of the Site is understood to consist of Made Ground, over Tidal Flat Deposits of clay and silt, overlying the Flamborough Chalk Formation.

Table 2 provides an estimate of average maximum bomb penetration depths for the landward part of the Site assuming WWII ground conditions of 1.5m of Made Ground (modelled as gravel), over 12m of clay and silt, overlying more than 20m of weak rock.

Table 2 Estimated average maximum bomb penetration depths (landward part of the Site)

Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	4.0m
	250kg	8.0m
	500kg	15.0m

The geology of the marine part of the Site is understood to consist of water, over Beach and Tidal Flat Deposits of clay and silt, overlying the Burnham Chalk Formation.

Table 3 provides an estimate of average maximum bomb penetration depths for the marine part of the Site assuming a water column of 7m (modelled as soft clay), over 35m of clay and silt, overlying more than 20m of weak rock.

Table 3 Estimated average maximum bomb penetration depths (marine part of the Site)

Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	7.0m
	250kg	11.0m
	500kg	18.5m

Vertical or near vertical deployment of ordnance to the Humber Estuary bed is unlikely due to deflection of UXB at the water surface and the initial aerial trajectory of air-delivered ordnance.

As ordnance passes through a water column, it loses its' air-water interface impact velocity, and hence momentum, due to hydrodynamic drag during its' submarine trajectory. Initial impact energy is dissipated exponentially as the ordnance travels through the denser water media. At a critical depth, the ordnance loses enough forward momentum to assume a low angle 'glide' path downwards.

It penetrates with less impact velocity and momentum.

For parts of the Site located in deeper water penetration depths are likely to be less than the theoretical ones given in Table 3.

These calculations can be refined on receipt of Site-specific information.

The estimated bomb penetration depths given in Tables 2 and 3 are from the WWII ground level and are based on the following assumptions:

a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).

b) A strike angle of 10 to 15 degrees to the vertical.

c) That the bomb is stable, both in flight and on penetration.

d) That no retarding units are fitted to the bomb.

e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10° and 15° to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

The average offset is one third of the penetration depth, i.e. an offset of 2m may be expected for a 50kg bomb in dry silts and clays. If hard standings or Made Ground were present during WWII, bomb penetration depths would have been significantly reduced but offset distances may have been up to four times greater.

5 UXO IN THE MARINE ENVIRONMENT

Both wartime and peace time military and naval activities provide numerous sources of UXO within the marine environment. The principal sources of UXO hazards are from ordnance disposal at sea, WWII aerial laid mines, mines laid as beach defences, crashed aircraft and wrecks containing ordnance.

Clearance certification for UXO within a marine environment may be valid only for a limited period as storms, tides and general current movement can cause UXO to migrate into an area that may have been cleared of UXO only hours before. This also makes it very difficult to accurately predict where UXO may be found.

UXO is most likely to be concentrated on and immediately around the principal sources of the UXO hazard. These are typically ordnance disposal sites at sea, WWII mines, marine ranges and wrecks containing ordnance.

Potential sources of UXO hazard in the marine environment in the vicinity of the Site are described below.

5.1 Immingham Dock

During WWI and WWII Immingham Dock, within approximately 0.2km west of the Site, was used as a naval base by the RN. Further information is given in Section 3.1.

The possibility of ammunition and other ordnance spillage into the marine environment during rearmament of naval vessels at moorings cannot be entirely discounted. Such spillage may include, for example, small arms and machine gun ammunition and pyrotechnic marker devices.

5.2 AA Defences

Immingham and the Humber Estuary had extensive AA defences during WWII (see Section 3.2.1).

These are likely to have contributed UXAA shells to the marine environment in the vicinity of the Site.

Given the number of HAA and LAA batteries and the strength of currents in the Humber area, it is considered that the potential for shells to migrate along the riverbed cannot be totally discounted.

5.3 Coastal Defences

No records of coastal batteries on or in close proximity to the Site have been found.

The nearest was coastal battery during WWI was Stallingborough Fort (TA 222148), approximately 1.6km east-southeast of the Site. Established in February 1916, it was equipped with 2No. 6-inch (”) breech-loading Mk. VII guns. This formed part of the Humber estuary's coastal defence system. In 1919 the guns were removed. The fort was abandoned in 1926.

During WWII Stallingborough Fort was reused and fitted with 2No. 4.7” quick-firing guns. 2No. searchlights for close defence were also installed. By 1945 it had become disused.

During WWI a supplementary coastal battery was established at Sunk Island (TA 249175), approximately 3.5km northeast of the Site. This was built between 1914 and 1915. Records indicate it comprised 2No. 6” breech-loading Mk. VII guns, along with command post, quarters, magazine and accompanying searchlights. In 1919 the guns were removed. The battery was abandoned in 1926.

In the summer of 1940 Sunk Island Battery was reused and fitted with 2No. 4.7” quick-firing guns and 2No. searchlights for close defence. By the end of WWII it had become disused.

No records have been found to indicate that the coastal batteries in the region conducted practice firing, but it is likely that some form of training was undertaken. The possibility that these contributed shells to the surrounding marine environment, in vicinity of the Site, cannot be entirely discounted.

5.4 Marine Ranges

No records of marine ranges or coastal batteries on or in close proximity to the Site have been found.

The nearest marine range to the Site was Grimsby Merchant Navy Range (TA 314079), approximately 12.8km southeast of the Site. Grimsby Merchant Navy Range was used for the training of Defensive Equipped Merchant Ships (DEMS), using 12-pdr guns, 20mm Oerlikon cannons, machine guns, and Unrotated Projectiles (UP).

Given the presence of marine ranges in the vicinity of the Site, the potential for UXO to migrate onto the Site, whilst unlikely, cannot be totally discounted.

5.5 Marine Mines

During WWI and WWII, major defensive and offensive minefields were established in the Humber estuary, within approximately 3km of the Site.

Given the importance of Immingham and the Humber Estuary, waters in the vicinity of the Site would have been regularly swept for mines. Despite this sweeping, a very real threat from mines remained throughout the war and at least 22No. minesweepers were lost during the conflict.

No records have been found of vessels striking magnetic mines and sinking in the vicinity of the Site post-WWII.

Marine mines are not considered to provide a source of UXO hazard to the Site with the possible, albeit very unlikely, exception of buoyant marine mines migrating onto the Site.

5.6 Wrecks Containing UXO

No records have been found indicating that any wrecks are located on the Site.

There are records of more than 50No. wrecks in the mouth of the Humber estuary and approaches. The nearest wrecks possibly containing UXO are detailed below.

9th October 1940

The minesweeper His Majesty's Trawler (HMT) *Sea King* (Wreck 8827) sank, after hitting a mine, approximately 9.5km east-southeast of the Site.

20th March 1941

HMT *Gloaming* (Wreck 8946) sank, following the accidental detonation of an acoustic mine by the minesweeper HMS *DW Fitzgerald*, approximately 5.7km southeast of the Site.

Wrecks are not considered to provide a direct source of UXO hazard to the Site, although they may contribute UXO to the marine environment in the vicinity of the Site. This will mainly comprise Small Arms Ammunition (SAA) and AA shells.

5.7 UXO Migration in the Marine and Estuarine Environment

There are several identified potential sources of UXO hazard in the marine and estuarine environment in the vicinity of the Site.

The factors controlling UXO migration in the marine and estuarine environment surrounding the Site are discussed below.

Tidal and Fluvial Currents

The Humber Estuary in the vicinity of the Site has a mean tidal range between approximately 3.2m (neap) and 6.4m (spring). Tidal streams move on both the flood and ebb between approximately 9 knots (neap) and 27 knots (spring). The flow regime fronting Immingham is generally rectilinear, with flows aligned approximately east-southeast on the ebb to west-northwest on the flood. Peak flows above 1.8 m/s are recorded during the ebb tide, with slightly slower flows on the flood phase of the tide.

Wave Action

The wave climate across the Site is generally protected from large waves approaching from the North Sea by a combination of sheltering effects (from Spurn Head, the various banks and channels within the outer parts of the Humber Estuary, and by the local jetties at Immingham).

The wave regime at the Site is dominated by waves approaching from the northwest and the southeast (coincident with the longest fetch lengths at the site). Waves with Hs of above 0.7 m are observed from both of these main approach directions, with a peak Hs value during the deployment of 0.84 m.

The prevailing wave action and tidal streams dominate the nearshore sediment transport and littoral drift in the estuary which may influence UXO migration (see below).

Sediment Pathways

The Humber Estuary is part of the coastal accreting zone cell 2 between Flamborough Head and The Wash. The Humber Estuary has a macro tidal range, fast flows and a high background suspended sediment content. This means the bed of the estuary is very dynamic in its morphology, both in the short term and on longer time scales, particularly in areas where there are no constraints, either geological or man-made.

It is estimated that 2.22 million m^3 of sediment is transported into the estuary from the sea each year, in addition to 0.3 million m^3 brought in by the river.

Over 1,500 tonnes of sediment are carried in with every tide. Approximately 6 million tonnes (dry solid weight) of sediment enter the estuary each year, most of it either as background material from the North Sea or from the rapid erosion of the Holderness coast. Less than 3% of the sediment is from river input.

Qualitative and quantitative source contribution estimates show that 98% of the coarse fraction (up to 250mm diameter) is derived from marine sources.

Much of the marine material returns to the North Sea on the subsequent tide but some remains in the estuary, moving upstream along the shoreline and either accumulating there or entering the deeper channels and being carried back towards the sea.

A review of historical bathymetric charts extending both up and down estuary of the proposed development shows that in the 1930s, the channel up estuary was considerably deeper than present day, with depths of the order of -16 m CD centred about 1 km from the shoreline. The channel has consistently in-filled until about 1990, resulting in a depth of around -7 mCD. During the last 15 years, depths have been relatively stable, although variations between -6 m and 7 mCD have occurred.

Approximately 3 million tonnes of sediment are dredged each year from the docks, port approaches and the main shipping channel. All dredged material is returned to the estuary, generally close to the point from which it was removed. No dredging is recorded as having taken place on the Site.

UXO Migration

Given the tidal currents and sediment movement patterns in the River Humber, it is considered that larger UXO (such as air-dropped bombs), too heavy for the tides and near shore currents to move, are unlikely to be transported onto the Site but rather would be exposed by scour around them and then be left proud of the sediments.

In such cases, the UXO are unlikely to move from source unless disturbed by dredging activities and exposed.

Buoyant and semi-buoyant UXO (as may be the case with some marine mines), smaller, lighter items of UXO (such as small or medium calibre shells), and UXO with neutral buoyancy could move by saltation or roll as bed load particles during ebb or flood tides, or high wave energy storm conditions.

Such conditions may, rarely, provide a pathway for UXO migration onto the Site.

The potential migration of fluvial or marine UXO onto the Site forms part of the low background risk of encountering UXO on any similar site in the UK, as demonstrated by a recent find at Immingham (see Section 6.2).

6 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27th February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% of UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear. Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

6.1 Abandoned Bombs

For further information on abandoned bombs, and the potential UXO hazard associated with them, follow the link below:

- Abandoned Bombs

No records have been found indicating that any officially abandoned bombs are located on the Site.

6.2 EOC Tasks

Records held by Zetica Ltd show that the following post-WWII EOC task has taken place in the vicinity of the Site.

8th May 2020

1No. a small WWII-era bomb was discovered in the Humber Estuary during dredging off the approaches to Immingham, within approximately 1km from the Site. It was destroyed in situ.

7 UXO HAZARD ASSESSMENT

7.1 UXO Hazard Level

The definitions for the levels of UXO hazard are provided below.

Definitions of UXO Hazard Level for a Site	
Hazard Level	**Definition**
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present or that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

Given this, it is considered that the Site has a low UXO hazard level, as shown in Figure 6.

The UXO hazard zone plan of the Site is also given in the accompanying P11479-22-R1-MAP01-A.

It should be noted that the possibility of smaller, lighter items of UXO migrating onto the Site cannot be totally discounted, this forms part of the low background risk of encountering UXO on any similar site in the UK.

Figure 6 UXO hazard zone plan of the Site

Source: OpenStreetMap *Not to Scale*

Legend	Very Low		Low		Moderate	
	High		Very High		Site boundary	

8 UXO RISK ASSESSMENT

8.1 Proposed Works

It is understood that works on the Site are associated with the development of a new Ro-Ro facility at the Port of Immingham. This includes the construction of a new four-berth Ro-Ro jetty, along with accompanying terminal buildings and storage areas within existing port infrastructure.

Works on the Site include dredging to depths of 9m bgl. The jetty will be constructed using driven piles up to 1m in diameter. These will be penetrating approximately 25m bgl into the riverbed.

8.2 Risk Assessment Methodology

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	LIKELIHOOD of Encounter and Detonation	Rating
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0
P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.		

The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix

		SEVERITY (S)					
LIKELIHOOD (P)		5	4	3	2	1	0
	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

8.3 UXO Risk Level

The UXO risk assessment for proposed works on the Site is given in Table 4.

Table 4 UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Dredging	1	1	1	1	5	5	Low
	Shallow Excavations	1	1	1	1	5	5	Low
	Deep Excavations	1	1	1	1	5	5	Low
	Boreholes/Piling	1	1	1	1	5	5	Low
Other UXO	Dredging	1	1	1	1	5	5	Low
	Shallow Excavations	1	1	1	1	4	4	Low
	Deep Excavations	1	1	1	1	4	4	Low
	Boreholes/Piling	1	1	1	1	3	3	Low
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)								
Shallow Excavations defined as <1.0m below ground level (bgl.)								

9 RISK MITIGATION PLAN

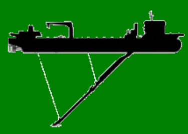
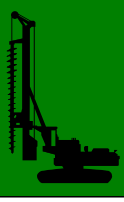
Key findings: No significant sources of Unexploded Ordnance (UXO) hazard have been identified. The potential for UXO to migrate onto the Site due to marine processes cannot be discounted.

Key actions: UXO awareness briefing for staff involved in dredging. Explosive Ordnance Clearance (EOC) Engineer attendance aboard the dredger may be prudent.

9.1 UXO Risk Summary

Table 5 summarises the UXO risk for proposed works on the Site and recommended actions.

Table 5 Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Dredging		**UXO awareness briefing** – It is recommended that those involved in dredging operations are provided with a formal UXO awareness briefing so that they take appropriate action in the event of a suspect find. Procedures for an Emergency Response Plan (ERP) in the event of a UXO find should also be established. **EOC Engineer**– If additional comfort is required, an Explosive Ordnance Clearance (EOC) Engineer can be present aboard the dredger during operations.
Excavations		**Proceed with works** – if additional comfort is required to address the residual UXO hazard, a formal UXO awareness briefing can be provided.
Boreholes/Piling		**Proceed with works**

In summary, it is recommended that staff involved in dredging operations are provided with a formal awareness briefing so that they take appropriate action in the event of a suspect find. For additional comfort, an EOC Engineer can be present aboard the dredger and take appropriate action in the event of a suspect item being encountered.

9.2 Risk Mitigation Techniques

9.2.1 UXO Awareness Briefing

Typically ~1hour in duration, these briefings will be expected to provide site workers with:-

- Background to the potential UXO hazards that could be encountered.
- Awareness of how the UXO hazard could present a risk.
- Knowledge of what to do in the event that a suspect item is encountered.

The briefing is to be provided along with back-up materials such as UXO awareness posters, emergency contact numbers and other background information to assist site workers in becoming familiar with what potential UXO can look like.

The materials can also be used by key staff to pass on the relevant points of the induction to others who visit or work on the Site.

By providing the UXO awareness briefing, it ensures that in the unlikely event that UXO is encountered:-

- All site staff take appropriate action.
- A support mechanism and points of contact are established.
- The likelihood of harm to people or property is reduced.
- Significant delays to site work are prevented.

9.2.2 Emergency Response Plan

A site-specific emergency response plan (ERP) should be formulated and included as part of the UXO briefing materials.

The ERP should clearly outline the actions to take in the event of a potential UXO find, in agreement with the local port authority and other stakeholders.

The ERP should be discussed with operatives during any UXO awareness briefing to ensure that they understand the appropriate protocol in the event of UXO encounter, which can then be cascaded out to others involved in the scheme.

The information provided should be in line with CIRIA C754 guidance and the 2010 Guidance Note published by the Crown Estate, 'Dealing with munitions in marine sediments' (https://zeticauxo.com/wp-content/uploads/2016/07/Dealing-with-munitions-in-marine-sediments.pdf)

9.2.3 EOC Engineer Attendance

If additional comfort is required, an EOC Engineer can attend site and be present aboard the dredger during operations.

In the event that a suspect item is brought aboard during dredging, the EOC Engineer will be able to quickly identify whether it is UXO-related. This will prevent delays and allow the appropriate measures to be put in place for the disposal of hazardous UXO.

All EOC operatives should have competencies and experience in line with guidance provided by the Institute of Explosives Engineers (https://zeticauxo.com/wp-content/uploads/2016/07/Guidance-Notes-for-Commercial-EOD-in-GB.pdf)

9.3 What Do I Do Next?

If you wish to proceed with UXO risk mitigation, Zetica would be happy to assist. Just contact us via phone (01993 886682) or email (uxo@zetica.com) and we can provide a proposal with options and prices.

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

APPENDICES

Appendix 1 Anticipated Ordnance Types

The probability of encountering UXO on the Site is considered to be low. As with any similar site in the UK, there is always a background risk of finding ordnance and potential types to be encountered are detailed below. For a more comprehensive set of ordnance data sheets, see http://zeticauxo.com/downloads-and-resources/ordnance-data-sheets/.

Information Data Sheet

Category Small Arms Ammunition
Type Various

Description: Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

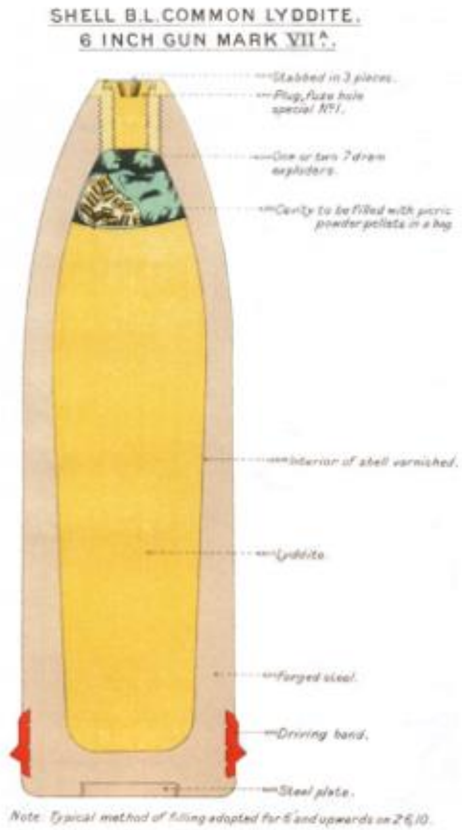
Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance.

SAA is often associated with discarded ammunition boxes around firing practice ranges and training areas and is often found scattered across former military airfields as a result of aircraft crashes and localised disposal.

Information Data Sheet

Category Shell (British)

Type 6-inch Naval Shell



Weight 122lbs (55.59 kg) **Firing Mechanism** Percussion fuse

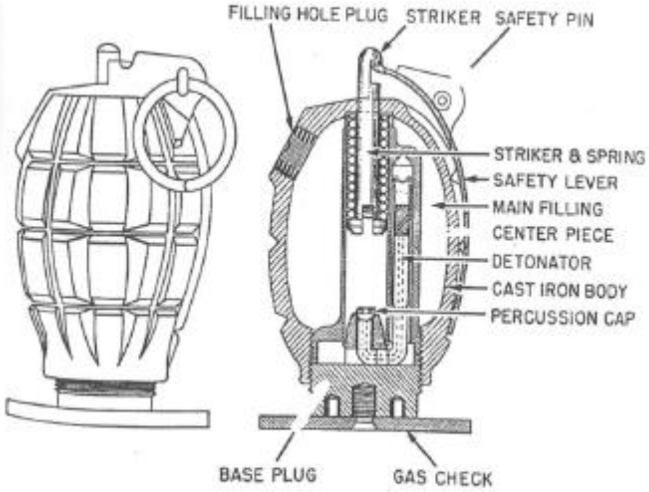
Description Tapered cylindrical shell.

Function The BL 6-inch gun Mark VII (and the related Mk VIII) was a British naval gun dating from 1899, which was mounted on a heavy travelling carriage in 1915 for British Army service to become one of the main heavy field guns in the First World War, and also served as one of the main coast defence guns throughout the British Empire until the 1950s.

Information Data Sheet

Category Grenades (British)

Type No. 36 Hand Grenade ('Mills Bomb')



Variants	-	**Dimensions**	101.6mm x 61mm (4" x 2.4")
Weight	2 lbs	**Delay**	4 seconds
Filling	Baratol	**Material**	Cast Iron

Description Lemon-shaped, cast-iron body filled with high explosive. Three holes in the body; one in the base for priming, one near the top for filling; one on the top holding striker.

Function Used as a defence against enemy personnel.

Information Data Sheet

Category Grenades (British)
Type No. 76 Self-Igniting Phosphorus Grenade

Variants -

Dimensions 152.4mm x 63.5mm (6" x 2.5")

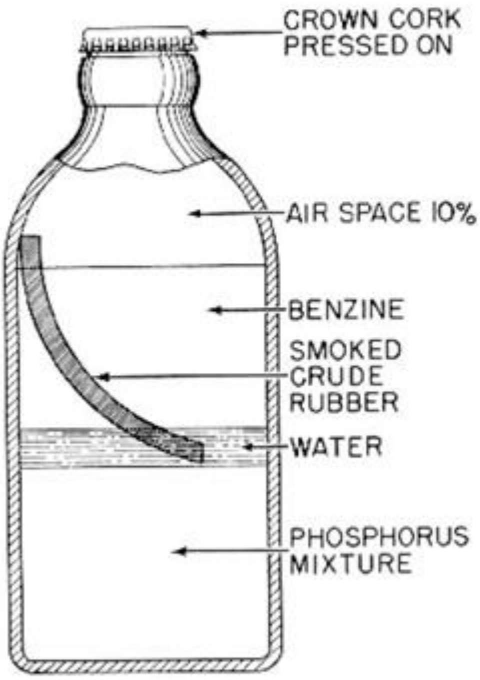
Weight 1lb

Fuze Self-igniting upon breakage

Material Glass

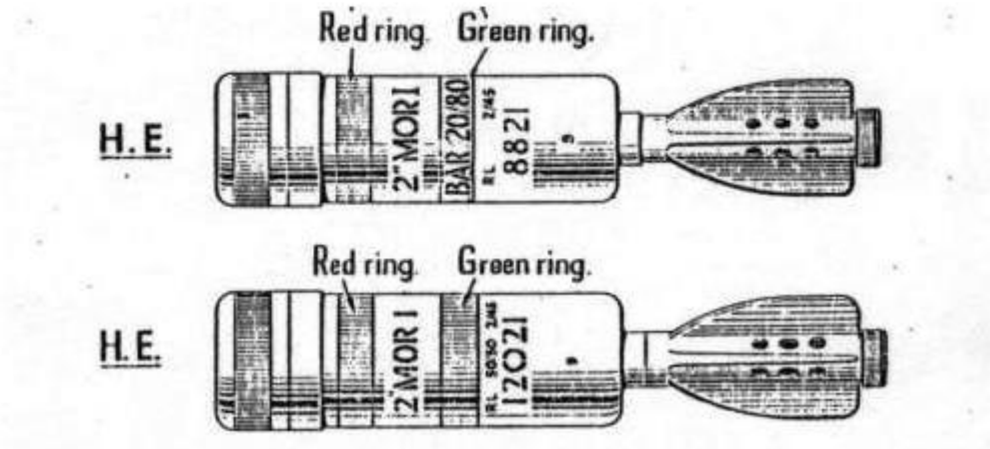
Description Glass bottle filled with white phosphorus, benzene, water and crude rubber.

Function Introduced as an emergency anti-tank measure for the Home Guard early in WWII. Intended to ignite the engine compartment of advancing tanks.



Information Data Sheet

Category Mortar (British)
Type 2-Inch Mortar Bomb



Variants	14	**Length**	11.4" x 2"
Weight	2.5lbs	**Firing Mechanism**	Trip (small trigger)
Calibre	50.8mm (2.0 inches)	**Rate of Fire**	8 rounds per minute

Description Pear-shaped steel body with 6 or 8 vanes. Originally painted buff yellow or dark grey. Filled with c TNT, granular TNT or powdered Amatol. Also smoke, illumination and practice versions.

Function Small enough to be carried by one man, with a range limited to 500 yards, the 2" mortar was usec an anti-personnel role.

Information Data Sheet

Category Marine Mines

Description

Marine mines have been used in some form since at least the 17th century, when gunpowder-filled kegs were deployed as a primitive naval weapon. Designs gradually improved until the 19th century when marine mines became widely used for coastal defence.

During WWI, approximately 128,000No. mines were laid in the sea around the coast of the UK. At the beginning of WWII, the Admiralty ordered the laying of further extensive minefields around the coast of England. This included both defensive mines on beaches in order to prevent enemy landings, as well as approximately 100,000No. marine mines laid at sea to destroy enemy ships. Some of these were buoyant and others were deployed by anchoring them to the seabed.

By WWII, marine mines typically carried 100 to 500lbs (50 to 250kg) of explosive. The initiating mechanisms in these mines have often deteriorated but the explosive charges will not have significantly altered unless the mine has split and the explosives have migrated and dispersed in the marine environment.

German aircraft also dropped thousands of magnetic mines into shipping lanes and estuaries. Many of these were removed by British minesweepers, although outside the major shipping lanes the requirement for disposal would have been reduced.

Left: Recovered British marine mine. Right: German marine mine at sea during WWII

Hazard

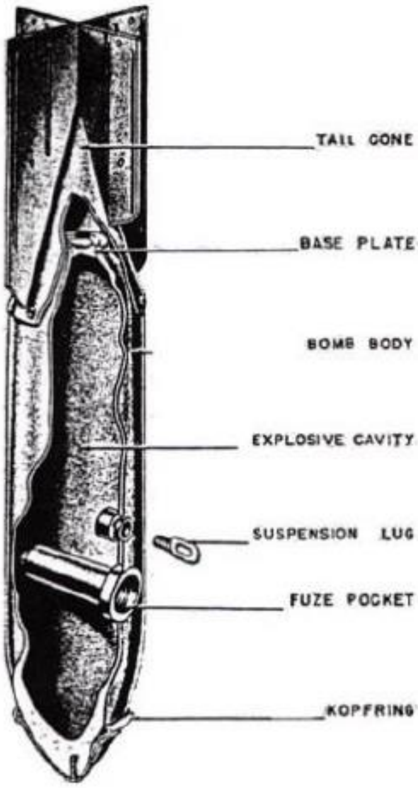
It is generally accepted that less than 30% of the total number of marine mines laid during WWII were recovered due to migration from their initial locations in tidal currents. The recovery rate for anchored submerged mines is likely to be higher but accurate records regarding the clearance of these minefields is not readily available.

As a result there is a possibility that some remain in the marine environment and a mine can be washed up on a beach or found drifting in the water around any part of the UK's coastline.

Information Data Sheet

Category Bomb (Luftwaffe)
Type Sprengbombe-Cylindrisch (SC) 50kg

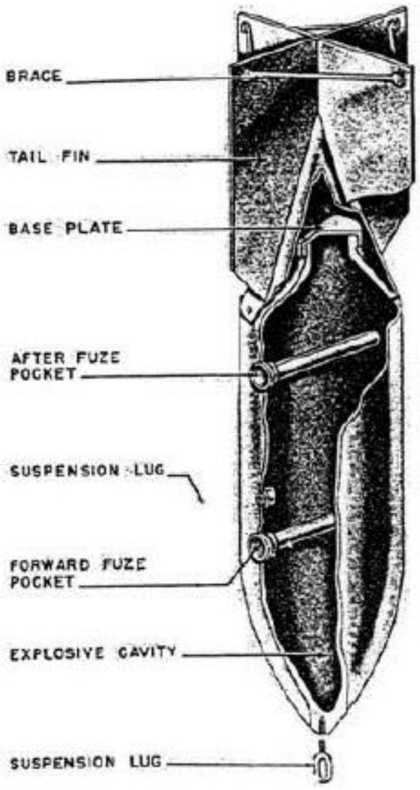
Variants	8
Body Dimensions	762 x 200mm (30" x 7.9")
Weight	55kg (122lbs)
Charge Weight	25kg (54lbs)
Fuze	Single electric impact fuze. Some have short time delay
Composition	Sheet steel
Description	Thick nose welded to a steel body. Nose may be attached to Kopfring (a triangular section steel ring) or spike. Suspension bolt in eye/body and sheet metal tail attached to body with rivets/screws. Originally painted green-grey with a yellow stripe on the tail. Cast TNT, Amatol or Trialen filling.
Function	Designed to maximise shock waves through air, water and earth and for general demolition. Used against easily damageable targets, including roads, aircraft hangars, rolling stock and small buildings. Spike bombs/ 'Stabo' (SC 50 with spikes attached to nose) were used against rail lines and country roads, with Kopfring used against naval targets.



Information Data Sheet

Category Bomb
Type Sprengbombe-Cylindrisch (SC) 250kg

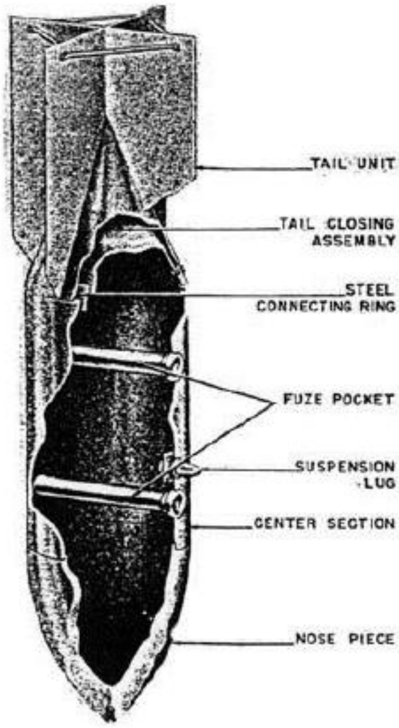
Variants	8
Body Dimensions	1194mm x 368mm (47" x 14.5")
Weight	249-264 kg (548-582lbs)
Charge Weight	130-145 kg (287-320lbs)
Fuze	Electric impact fuze/electric clockwork time fuse & electric anti-disturbance fuze
Composition	Sheet steel with stays
Description	Thick nose welded to steel body. Nose may be attached to Kopfring (triangular section steel ring) or spike. Sheet metal tail attached to body with rivets/ screws. Suspension eye bolt in the nose/body. Originally painted green-grey with a yellow stripe on the tail. TNT; amatol; TNT and aluminium powder, naphthalene, ammonium nitrate and wax/ wood meal filling.
Function	Designed to maximise shock waves through air, water and earth and general demolition. Used against railway installations, large buildings, ammunition depots and below-ground installations (to 8m). Spike bombs/ 'Stabo' (SC 50 with spikes attached to nose) used against rail lines and country roads.



Information Data Sheet

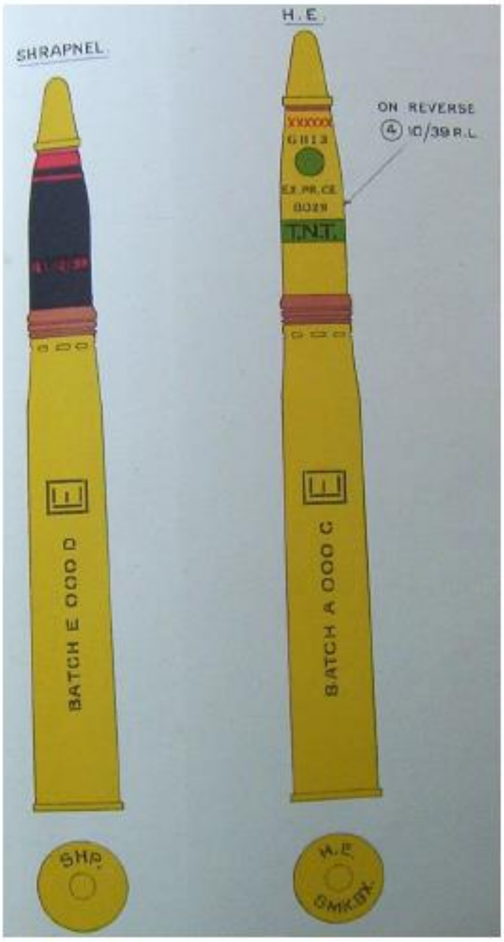
Category Bomb
Type Sprengbombe-Cylindrisch (SC) 500kg

Variants	-
Body Dimensions	1414–1486mm x 470mm (55.7-58.5" x 18.5")
Weight	500kg (1,100lbs)
Charge Weight	220kg (484lbs)
Fuze	Electric impact fuze/electric clockwork time fuse & electric anti-disturbance fuze.
Composition	Sheet steel with stays or drum
Description	Thick nose welded to steel body. Nose may be attached to Kopfring (triangular section steel ring). Tail either steel sheet or drum-shaped. Suspension band. Originally painted green-grey/ buff (some later versions sky blue) with yellow stripe on tail. Filled with amatol, TNT or trialen.
Function	Designed to maximise shock waves through air, water and earth and for general demolition. Used against railway property, large buildings, shipping and below-ground installations.



Information Data Sheet

Category Projectile
Type 3.7" Anti-Aircraft Shell



Variants 6

Body Dimensions 94mm x 360mm (3.7 x 14.7")

Weight 12.7kg (28lb)

Fuze Mechanical time fuze

Composition Cast steel

Description Brass cartridge case. Square-based shell with tapered nose, filled with Amatol, TNT or RDX/TNT. MK6 had forward centring bands and a wider driving band.

Function Used as a defence against enemy aircraft, fired from fixed batteries and mobile mountings. Could fire approximately 20 rounds per minute with a maximum ceiling of 41,000ft and horizontal range of 20,600 yards.

Information Data Sheet

Category Projectile
Type 4.5" Shell (Mark II – Anti-Aircraft)

Variants -

Body Dimensions 114mm x 566mm (4.5" x 21.9")

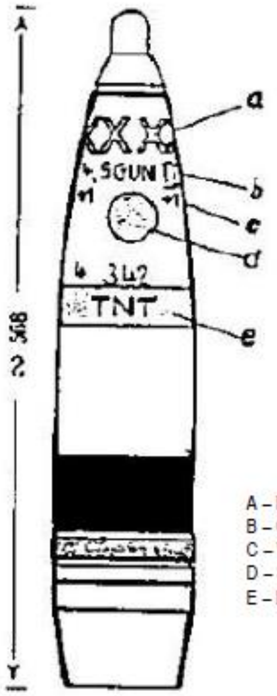
Weight 24.9kg (55lb)

Fuze Mechanical time fuze

Composition Cast steel

Description Square-based, tapered-nosed shell filled with TNT or Amatol. Steel casing, rotating band of either copper or gilding metal located 3.5" in front of the base end with single groove.

Function Used as field artillery and adapted for use in anti-aircraft defence from fixed batteries. Rate of fire of 8 rounds per minute, maximum ceiling of 44,000ft and horizontal range of 22,800 yards.



A – Missile Identification
B – Gun and Bullet Type
C – Weight
D – Smoke pot
E – Explosives Ring

Appendix 2 Sources of UXO Hazard

The sections below provide background information on the potential sources of UXO hazard (albeit low) affecting the Site. For a more comprehensive set of UXO information sheets, see http://zeticauxo.com/downloads-and-resources/uxo-information-sheets/.

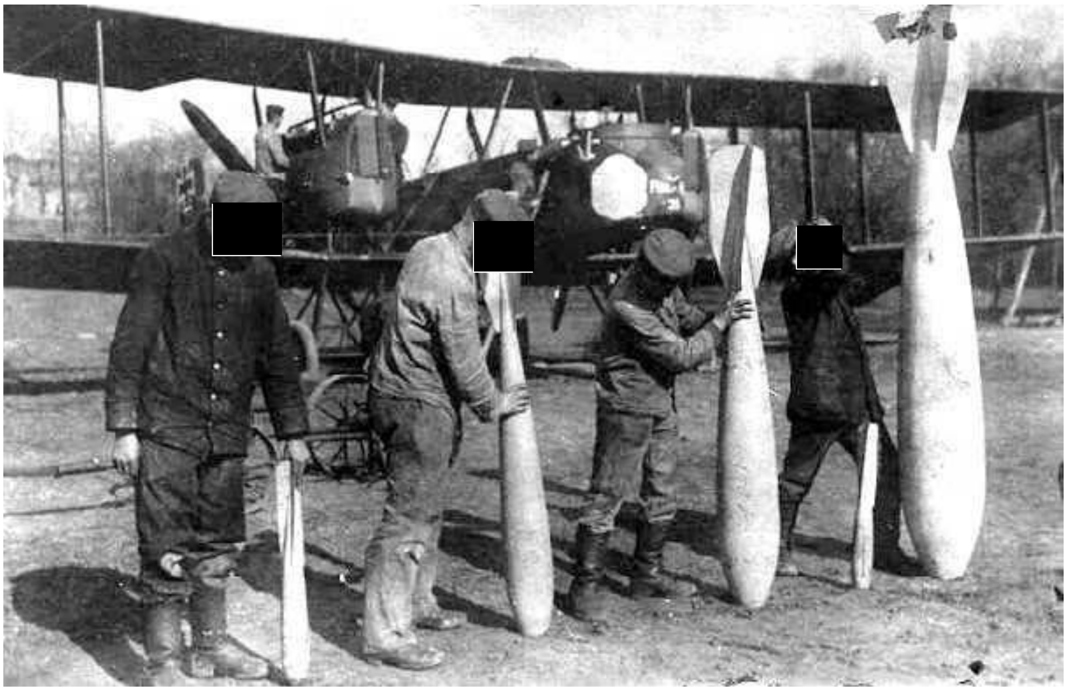
Appendix 2.1 WWI Bombing

It is not generally realised that during World War One (WWI) significant bombing took place across some areas of the UK. An estimated 9,000No. German bombs were dropped on Britain during the course of 51No. airship and 52No. aircraft raids. It was the first time that strategic aerial bombardment had been used. More than 1,400No. people were killed during these raids.

Most air raids were carried out on London and Southeast England. Areas along the East Coast were also targeted regularly due to their proximity to the European continent. Bombing raids further inland were rare and West England and Wales were out of reach for German aircraft of the time.

Aerial bombing during WWI initially relied on visual aiming, with bombsights not developed until later in the war. The inaccuracy inherent in this method meant that bombs often fell some way from their intended targets.

The first recorded raid against England occurred on the 21st December 1914 when 2No. high explosive bombs fell near the Admiralty Pier at Dover. Zeppelin raids intensified during 1915 and 1916, with aircraft raids becoming more frequent after 1917. The last raid of WWI took place on the 19th May 1918, when 38 Gotha and 3 Giant aircraft bombed London and surrounding districts, dropping a total of more than 2,500lbs of bombs.



The potential of coming across an Unexploded Bomb (UXB) from WWI is far less likely than a WWII UXB given the lower bombing densities during raids in the Great War.

Some areas which were subjected to sustained bombing raids, such as parts of London and coastal towns, recorded a higher number of UXB. In these areas, where there has been no significant development for the last century, the potential of a UXB remaining from WWI cannot be totally discounted.

Appendix 2.2 WWII Bombing

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, harbours, industrial premises, power stations and airfields. In addition to London, industrial cities and ports, including Birmingham, Coventry, Southampton, Liverpool, Hull and Glasgow, were heavily targeted, as well as seaside towns such as Eastbourne and cathedral cities such as Canterbury.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied Incendiary Bombs (IBs) to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact. PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration.

Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

In 1944, the Germans introduced new weapons; the V1, a 'flying bomb' and guided missile, and the V2, a ballistic missile rocket that travelled at such speed that no one could see or hear its approach. London was the main target for these attacks.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any Unexploded Bombs (UXB) or other UXO. In more rural areas, fewer bombing raids occurred. It is known that Air Raid Precaution (ARP) records under-represent the number and frequency of bombs falling in rural and coastal areas. Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid anti-aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural and coastal areas often went unrecorded or entered as 'fell in open country' or 'fell in the sea'. The Luftwaffe are thought to have dropped approximately 75,000 tons of bombs on Britain throughout the Second World War and an estimated 11% of all bombs dropped during the war failed to detonate.

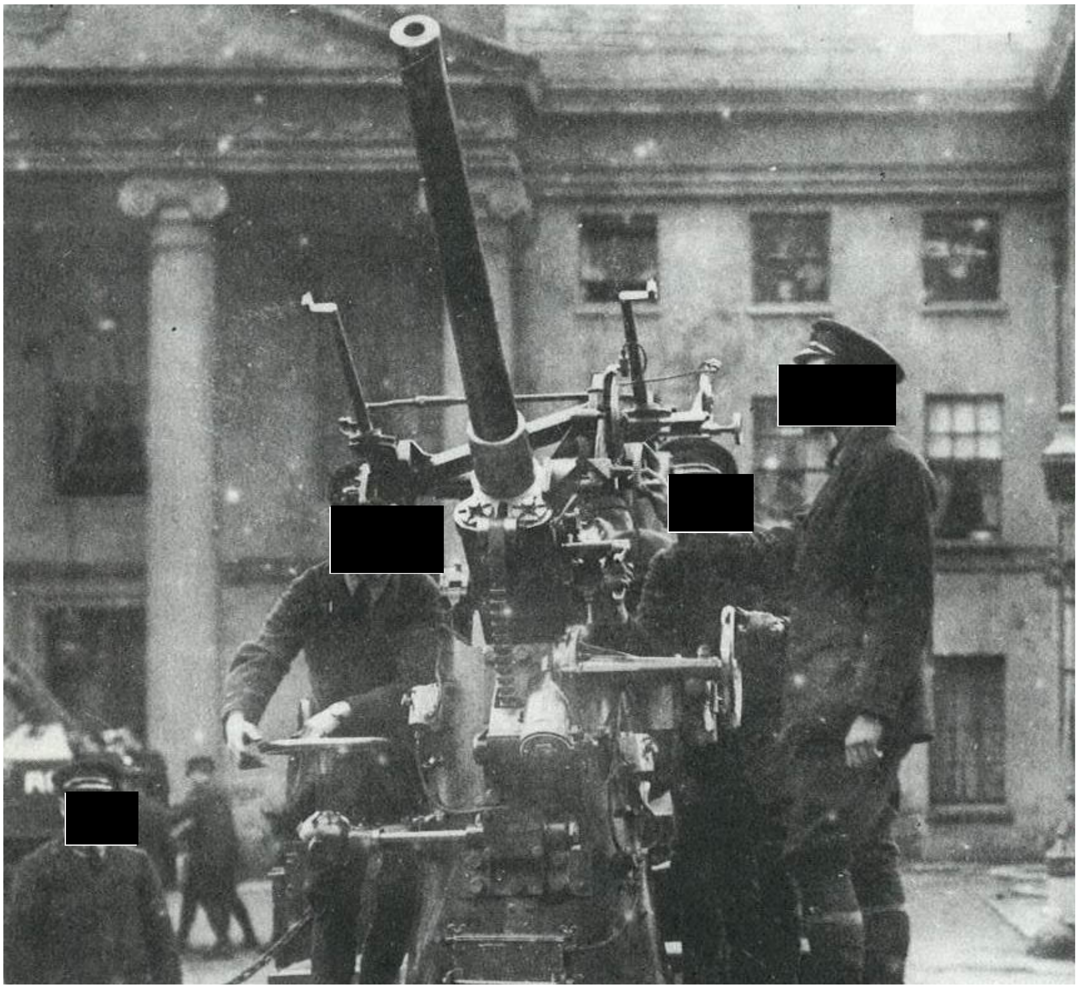
The potential for a UXB hazard to exist on a site depends on a variety of factors. Were there strategic targets in the surrounding area? Was the site bombed? Could a UXB impact have been missed? Even in rural areas, the potential for UXB cannot be totally discounted and therefore it is essential that detailed local bombing records are obtained when assessing the UXB hazard on any site.

Appendix 2.3 Anti-Aircraft Guns

As aerial bombardment first began during WWI, Anti-Aircraft (AA) gun batteries were established were gradually established throughout much of England to counter German bombing raids. By June 1916, there were approximately 271No. AA guns and 258No. searchlight installations defending London alone.

Common AA defences during WWI included 3-inch, 75 millimetre, 6-pounder and 1-pounder guns. Many of these guns were mobile, being mounted on lorry chassis. They were driven about following the course of an airship and fired from any area of open land.

During WWI, Unexploded AA (UXAA) shells, could land up to 13km from the firing point, although more typically fell within 10km.



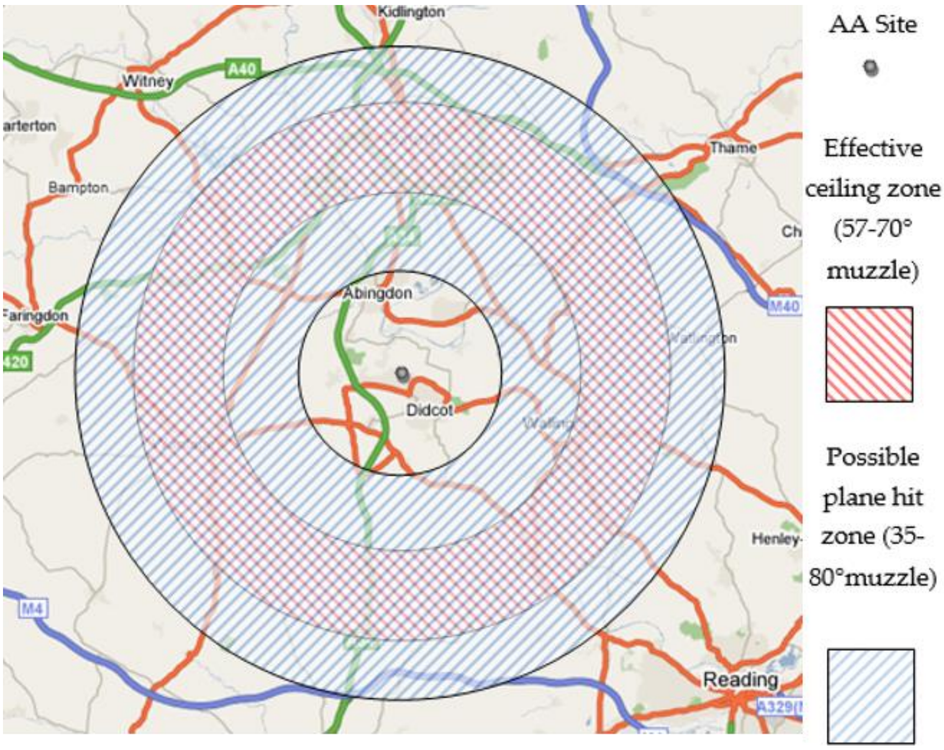
AA gun batteries were used extensively during WWII to counter the threat posed by enemy aircraft. In many instances, AA shells caused damage to Allied territory and in some areas caused significant numbers of civilian fatalities.

During WWII, AA shells could land up to 27km from the firing point, although more typically fell within 15km. These could be distributed over a wide area.

3No. types of AA batteries existed:

- **Heavy Anti-Aircraft (HAA)** batteries of large guns (typically 3.7", 4.5" and 5.25" calibre) designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- **Light Anti-Aircraft (LAA)** weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields. They typically fired 40mm shells and machine gun ammunition.
- **Rocket batteries (ZAA)** firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were typically permanent emplacements.

Unexploded AA (UXAA) shells were a common occurrence during WWII. As the figure below demonstrates, shells were unlikely to fall in the immediate vicinity of a gun battery but in the surrounding area. This would be dependent upon the angle of fire and the flight height of the attacking aircraft.



AA batteries were deliberately targeted by the Luftwaffe and therefore areas surrounding a gun battery may have a greater risk of UXB being present.

Munitions stores were also established around AA batteries. These stored the shells for the batteries and small arms ammunition for troops manning the position. Such stores were typically removed at the end of WWII, although some disposal may have occurred in the immediate vicinity of the gun battery.

Appendix 2.4 Barrage Balloons

Balloon barrages were flown in many British towns and cities to protect against air raids and defend key targets such as industrial areas, harbours and ports. Their presence deterred low flying aircraft, making it more difficult for bombs to reach their intended targets; enemy raiders were forced to fly higher and thus bombed targets with far less accuracy. The wires holding the balloons up also served as a form of defence, cutting into the planes.

By the middle of 1940, there were 1,400 balloons, a third of these over the London area. Many of the barrage balloons contributed to 'Operation Pegasus', the Free Barrage Balloon (FBB) operation, in which untethered balloons armed with explosive charges and aerial mines were allowed to drift towards enemy aircraft. Although their use increased as WWII progressed, the success of the balloons was limited as they also posed a significant threat to British aircraft.

Barrage balloon positions were associated with small caches of munitions, often comprising small arms and minor explosive charges. Most of these were removed at the end of WWII and, in general, these anti-aircraft defences are not considered to provide a significant source of UXO hazard.

Some barrage balloon positions were also targeted by Luftwaffe bombers and therefore there may be a heightened UXB risk in these areas.

Appendix 2.6 UXO in the Marine Environment

Both wartime and peace time military and naval activities provide numerous sources of UXO within the marine environment. In addition to coastal and offshore artillery and bombing ranges, the principal sources of marine UXO hazards are from ordnance disposal at sea; aerial or ship laid mines, depth charges and torpedoes; projectiles, shells and bombs left in battle conflict zones; mines laid as beach defences; crashed aircraft and wrecks containing ordnance.

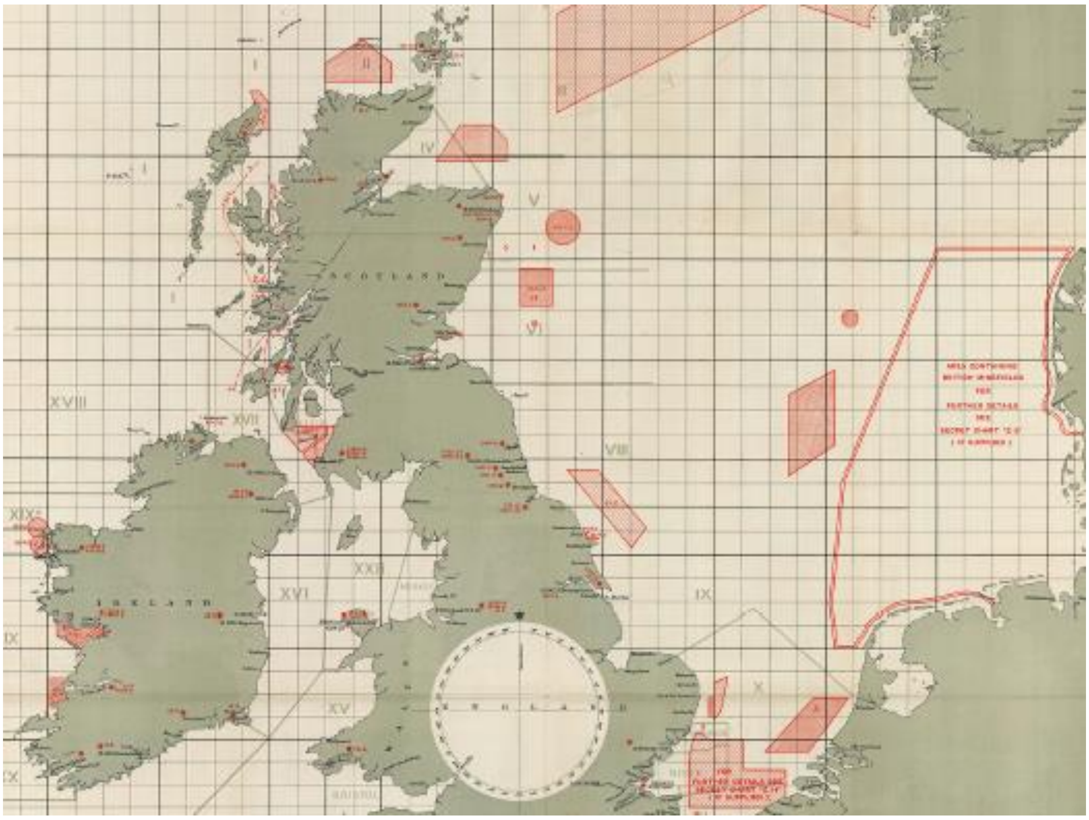
Clearance certification for UXO within a marine environment may be valid only for a limited period as storms, tides and general current movements can cause UXO to migrate into an area that may have been cleared of UXO only hours before. This also makes it very difficult to accurately predict where UXO may be found.

UXO is most likely to be concentrated on and immediately around the principal sources of the UXO hazard but, given sufficiently high energy events over long time periods, migration from source can never be entirely discounted.

Appendix 2.7 Marine Mines and Minefields

During WWI, approximately 128,000No. mines were laid in the sea around the coast of the UK.

At the beginning of WWII the Admiralty ordered the laying of further extensive minefields around the coast of England. This included both defensive mines on beaches in order to prevent enemy landings, as well as approximately 100,000No. marine mines laid at sea to destroy enemy ships.



Buoyant mines, designed to drift free, float or sit just below the surface, were the most commonly deployed marine mines. They were typically moored, or tethered to the seabed with an anchor or wire.

After deployment, cables or anchor systems designed to keep the mine at predetermined depths often failed, allowing previously moored mines to be moved from their original locations by currents. They could also be moved by later fishing activity such as trawling.

Generally spherical in shape, the mines were comprised of 2No. hemispheres connected with a cylindrical mid-section.

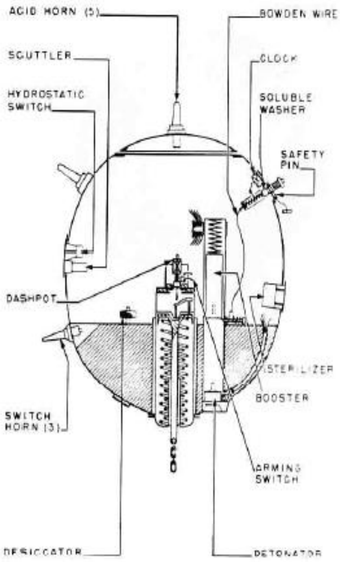
Marine mines typically carried 100 to 500lbs (50 to 250kg) of explosive. They were detonated by contact (being struck) or by influence (a vessel interfering with the mine’s electromagnetic field).

Marine mines deployed during WWI were mostly activated by contact mechanisms, those during WWII were activated by either contact or influence mechanisms, or a combination of both.

German ground mines (Luftmine) were air-deployed naval mines which were also modified for deployment from submarines and surface craft. Although primarily designed to lie on the seabed, many were also moored or buoyant. Designed as an anti-shipping weapon, the WWII Luftmine was also often used on land based targets.

Luftmines typically comprised a cylindrical body with a hemispherical nose and tapered tail, with charges weighing between 675lbs and 1,500lbs (305 to 680kg).

Some German marine mines were composed of aluminium or manganese steel depending on the variant, whereas British mines were typically made of steel



It is generally accepted that less than 30% of the total number of marine mines laid during WWII were recovered due to migration from their initial locations in tidal currents. The recovery rate for anchored submerged mines is likely to be higher but accurate records regarding the clearance of these minefields is not readily available.

As a result there is a possibility that some remain in the marine environment and a mine can be washed up on a beach or found drifting in the water around any part of the UK's coastline.

Air-dropped German mines that did not detonate may remain unexploded in coastal areas around the UK, in addition to in lakes and reservoirs, and rivers.

Appendix 2.7 Munitions Disposal at Sea

Both chemical and conventional munitions have been extensively dumped at sea since WWI.

In a few cases, the location and types of munitions are well known. In many cases the locations and types are not well known due to insufficient record keeping, dumping of material intentionally or unintentionally outside agreed official dumping areas and, to some extent, the movement of dumped munitions to areas outside the disposal points.

A comprehensive list of dumped conventional or chemical weapons material does not exist, and the composition of munitions in many dumping incidents is unknown.

The materials that have been dumped around the UK are mostly captured German, British, and American munitions, the vast majority being conventional weapons which were excess to requirements at the end of WWI or WWII.

During WWI, many munitions were dumped indiscriminately before vessels returned to shore. Between 1944 and the 1970s, large scale disposal of excess munitions in the marine environment took place in both specified and unspecified locations.

For example, between July and October 1945, 14,000 tons of 5” artillery shells, loaded with phosgene, are recorded as being dumped in the Beaufort's Dyke trench off the coast of Scotland. Between 1945 and 1948, 135,000 tons of both conventional and chemical munitions were dumped there, and between 1949 and the late 1950s, approximately 20,000 tons/year were disposed of in the trench.

During ‘Operation Sandcastle’ (1954-1956) merchant ships with cargoes of Tabun were recorded as being scuttled in Beaufort's Dyke and the Irish Sea. By the early 1970s, approximately 3,000 tons/year of, mostly defuzed, conventional munitions were being disposed of. The last recorded dump at Beaufort's Dyke took place in 1976, when crews performed an emergency dump of a small number of 40mm shells.

The Scottish MoD estimates that Beaufort's Dyke currently contains nearly 2 million tons of conventional munitions, 120,000 tons of mustard and phosgene gas, 25,000 tons of nerve gas, 330 tons of arsenic compounds and 1,890 tons of waste gases.

Some evidence indicates that following corrosion certain types of munitions are able to float and that these can wash ashore if disturbed. There are records indicating that, following pipe laying disturbance in the 1990s, explosives and case material from Beaufort’s Dyke were encountered on beaches. Spontaneous explosions have also been recorded in the region of the Beaufort’s Dyke dumping ground by BGS seismic equipment.

The potential UXO hazard from offshore munitions disposal sites is elevated for deep sea fishermen or those involved with offshore construction projects such as pipe laying, dredging and wind farms.

Appendix 3 Recent UXO Finds

UXO finds in the UK are a regular occurrence, although they almost never result in an accidental detonation.

It is still important to note that explosives rarely lose effectiveness with age. In some instances, mechanisms such as fuzes and gaines can become more sensitive and more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of an accidental UXO detonation are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved. Such occurrences are largely restricted to current theatres of war and overseas minefields, with occasional events in mainland Europe.

Zetica, and other commercial EOD companies, uncover and make safe thousands of items of UXO each year, though details are rarely made public knowledge.

Publicly-recorded discoveries do also occur regularly, as demonstrated by the list of recent significant UXO finds in the UK below. To keep up to date with the latest UXO finds, visit http://zeticauxo.com/news/.

On the 3rd February 2020, a 500kg German UXB was found on a building site in Soho, London. It was removed by an EOD team.

On the 18th April 2020, a 500lb British UXB was discovered by a farmer near Drayton in Oxfordshire. The area had been used as an RAF practice bombing range during WWII and after an in-situ disposal was completed the item was found to have contained no explosives.

On the 4th May 2020, a UXB was discovered by builders at Kings Hill on the former RAF West Malling airfield, the fourth found since 2017. It was destroyed in a controlled explosion.

On the 1st December 2020, a research vessel discovered an unexploded marine mine containing 350kg of explosives in Wemyss Bay in the Firth of Clyde. RN divers investigated the item and destroyed it.

On the 4th February, 2No. anti-tank mines were discovered on Slapton Sands in Devon. They had been uncovered by recent storms and were destroyed.

On the 26th February 2021, a 1,000kg German "Hermann" UXB was discovered by builders at Exeter University campus (see plate below). It was investigated and detonated in-situ following the evacuation of nearby properties and University halls of residence.

On the 29th March 2021, 1No. 250lb UXB was discovered on the seabed near Hinkley Point C harbour, Bristol. A maritime exclusion was imposed while the item was investigated and then destroyed in a controlled explosion.

On the 10th May 2021, 1No. Anti-Aircraft shell dating from WWII was found by a member of the public in Horsham, Surrey. It was destroyed in-situ by a bomb disposal unit.

On the 17th May 2021, 1No. Sea Wolf missile was brought onboard a fishing vessel near Brixham in Devon. A Royal Navy EOC team destroyed the missile in a controlled explosion.

On the 1st June 2021, a cache of approximaetly 100No. hand grenades dating from WWII were found in a Nottinghamshire forest, a possible relic from nearby wartime camps. They were destroyed.

On the 23rd July 2021, 1No. 18lb artillery shell dating from WWI was discovered in a private garden in Bloxham, Oxfordshire. It was transported to a nearby field where it was destroyed in a controlled explosion.

On the 24th July 2021, 1No. 500lb British UXB was uncovered during construction works in Goole, East Yorkshire. Reports indicated that the UXB had been jettisoned by a Lancaster bomber aircraft prior to crashing nearby in WWII. The item was investigated and destroyed.

On the 18th August 2021, 1No. UXB was found by construction workers on a Site in Earl Sterndale, Derbyshire. Upon inspection the UXB was deemed to be dangerous and a controlled detonation was undertaken.

On the 10th September 2021, EOD teams destroyed 25No. mortars which had been washed up onto beaches around Nairn and Ardersier in Morayshire. These beaches had been used during WWII for training prior to the D-Day landings in Normandy.

On the 18th October, 1No. 18.5lb artillery shell was discovered during the clearing-out of a farmyard barn near Aberfeldy in Perthshire. The shell dated from WWI and was removed.

On the 12th November 2021, 1No. unexploded artillery shell was found on a housing development site in Wrexham, Wales. It was detroyed in controled explosion.

On the 15th December 2021, approximately 200No. artillery shells were discovered at a construction site located within the former Royal Ordnance Factory at Swynnerton in Staffordshire. The shells were removed and destroyed.

On the 15th December 2021, 1No. apparent UXB was snagged by a fishing trawler off the Norfolk Coast and then detonated, causing significant damage to the vessel. Upon further investigation, it was concluded that the UXB had been dropped in the water during WWII.

On the 2nd January 2022, 1No. heavily deteriorated 105mm artillery shell was discovered by dogwalkers on a beach in Cumbria. This may have originated on one of the several offshore ranges which have been operational along the nearby coastline since WWII.

Between the 24th and 27th January 2022, 5No. empty artillery shells were uncovered at a construction site in Manchester. These were likely linked to a shell-production factory which had been active on the site during WWII.

On the 17th February 2022, 1No. WWI-era Mk1 Mills hand grenade was found in the River Frome in Dorset by magnet fishermen. This was the third grenade to be pulled from the same stretch of the river over the past year. It was inspected by local police and destroyed.

Appendix 4 Glossary and Definitions

Abandoned Explosive Ordnance (AXO)	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Close Combat Munitions	Items of ordnance thrown, propelled or placed during land warfare, to include grenades, mortars, projectiles, rockets and land mines.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
Explosive	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.
Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.

Explosive Substances and Articles (ESA)

Explosive substances are solid or liquid substances (or a mixture of substances), which are either:

- capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.
- designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction.

Explosive article is an article containing one or more explosive substances.

Fuze

A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.

Gaine

Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.

Geophysical survey

A geophysical survey is essentially a range of methods that can be used to detect objects or identify ground conditions without the need for intrusive methods (such as excavation or drilling). This is particularly suited to ordnance as disturbance of ordnance items is to be avoided where ever possible.

Gold line

This is the estimated limit of blast damage from an explosive storage magazine. It usually means that development within this zone is restricted.

High Explosive

Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).

Munition

Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:-

- inert - contain no explosives whatsoever.
- live - contain explosives and have not been fired.
- blind - have fired but failed to function as intended.

Primary Explosive	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.
Propellants	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
Pyrotechnic	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Small Arms Ammunition (SAA)	SAA includes projectiles around 12mm or less in calibre and no longer than approximately 100mm. They are fired from a variety of weapons, including rifles, pistols, shotguns and machine guns.
Unexploded Anti-Aircraft (UXAA) Shell	UXAA shells are army ordnance commonly containing HE, though they can also contain pyrotechnic compounds that produce smoke. Most commonly, these were 3.7” and 4.5” HE shells, although they ranged from 2” to 5.25” calibre.
Unexploded Bomb (UXB)	UXB is a common term for unexploded air-dropped munitions.
Unexploded Ordnance (UXO)	UXO is explosive ordnance that has been either primed, fuzed, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.

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