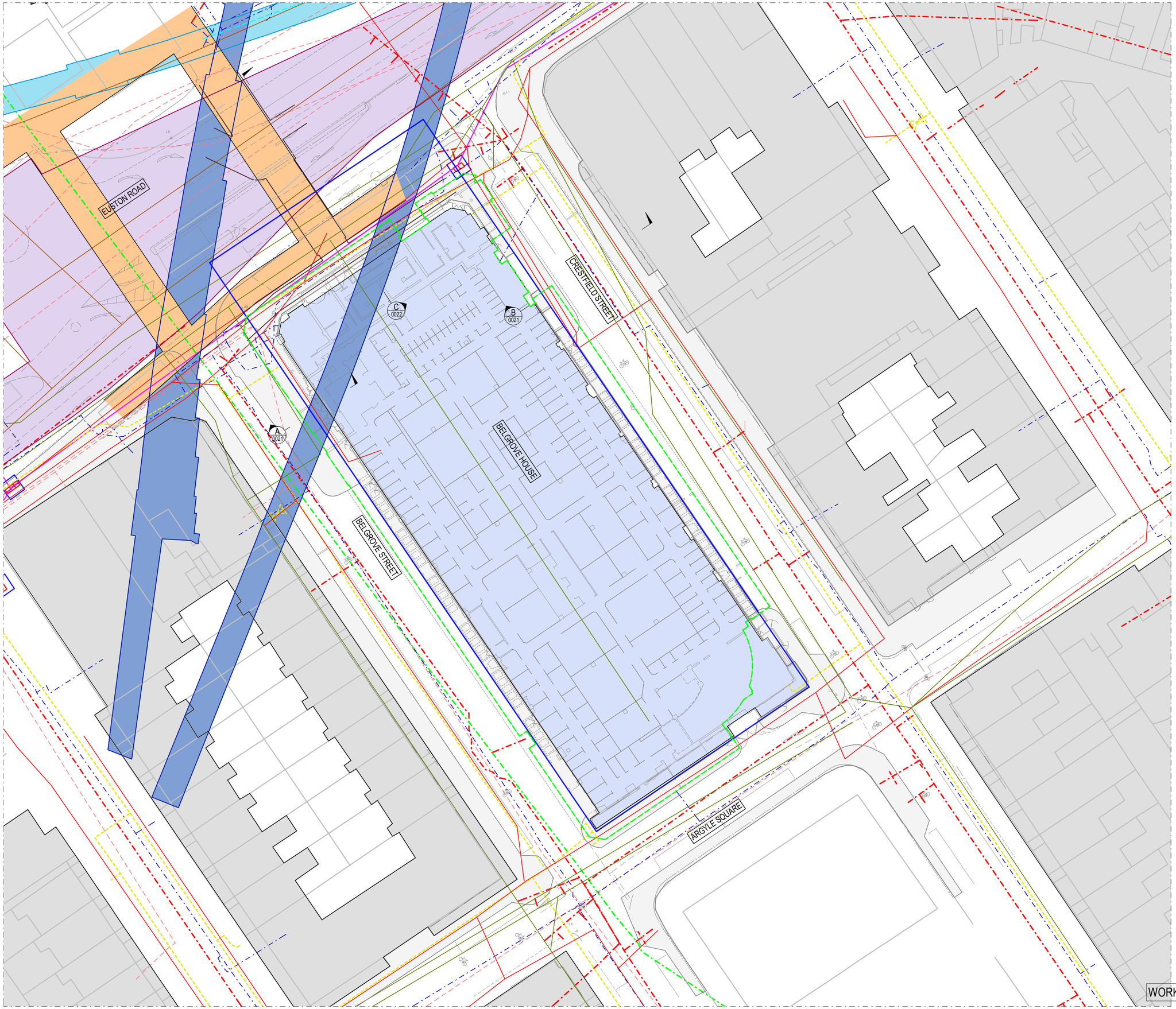
Appendix 10

Utility Damage Assessment



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SERVICES AND ENGINEERS DRAWINGS TOGETHER WITH RELEVANT SPECIFICATIONS.

2. DIMENSIONS ARE NOT TO BE SCALED FROM THIS DRAWING.

NOTE:

THE INFORMATION ON THIS DRAWING SHOULD NOT BE CONSIDERED TO BE EXHAUSTIVE AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND VERIFY ALL BURIED ON SITE

LEGEND:

- DENOTES BELGROVE HOUSE BUILDING
- DENOTES ADJACENT BUILDINGS
- DENOTES METROPOLITAN LINE TUNNEL
- DENOTES PICADILLY LINE TUNNEL
- DENOTES VICTORIA LINE TUNNEL
- DENOTES EXISTING PAVEMENT
- DENOTES KINGS CROSS ENTRANCE TUNNEL - BASED ON ARUP DRAWING **B_PLN_ARUP Report Plan Underground.dwg**
- TITLE EXTENTS
- OUTLINE BASEMENT

UTILITIES LEGEND:

- DENOTES GAS
- DENOTES THAMES WATER - WATER
- DENOTES THAMES WATER - SEWER
- DENOTES THAMES STORM - SEWER
- DENOTES BT CABLES
- DENOTES INSTALCOME CABLES
- DENOTES VERIZON CABLES
- DENOTES VIRGIN CABLES
- DENOTES VODAFONE CABLES

INFORMATION TRACKER:

FILE NAME/NUMBER: B_PLN_ARUP Report Plan Underground.dwg	
ORIGIN: ARUP	REVISION: 0
TITLE: B_PLN_ARUP Report Plan Underground	ISSUE DATE:-
FILE NAME/NUMBER: 12907A_07_P	
ORIGIN: GREENHATCH GROUP	REVISION: 0
TITLE: TOPOGRAPHICAL SURVEY	ISSUE DATE:-
FILE NAME/NUMBER: NNNN0000-DWG-CVL-SA00-5531780	
ORIGIN: LONDO UNDERGROUND	REVISION: 07
TITLE: KINGS CROSS TO KINGS CROSS DISUSED AND FARRINGDON PAGE 80	ISSUE DATE: 01/01/15
FILE NAME/NUMBER: TQ3082	
ORIGIN: NATIONAL GRID GAS PLC.	REVISION: -
TITLE: -	ISSUE DATE: 29/11/17
FILE NAME/NUMBER: ALS/ALS STNDARD/2017_3699113	
ORIGIN: THAMES WATER	REVISION: -
TITLE: ASSET LOCATION SEARCH SEWER/WATER MAP	ISSUE DATE: 28/11/17
FILE NAME/NUMBER: TQ3082NW	
ORIGIN: VERIZON	REVISION: D
TITLE: VERIZON CABLE MAP	ISSUE DATE: 17/10/06
FILE NAME/NUMBER: VM.192741	
ORIGIN: VIRGIN MEDIA	REVISION: -
TITLE: VIRGIN CABLE MAP	ISSUE DATE: 01/12/17
FILE NAME/NUMBER:	
ORIGIN: VODAFONE LIMITED	REVISION: -
TITLE: VODAFONE CABLE MAP	ISSUE DATE: 11/12/17
FILE NAME/NUMBER:	
ORIGIN: INSTALCOM	REVISION: -
TITLE: INSTALCOM CABLE MAP	ISSUE DATE:

REV	DATE	DESCRIPTION	BY	CHKD
P 1	18.10.2019	WORK IN PROGRESS	CS	PD

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ACCESS SELF STORAGE

CLIENT

BELGROVE HOUSE

PROJECT

SITE CONTRAINTS BELGROVE HOUSE PLAN

TITLE

CS	As indicated@A1	4259B- AKT- XX- XX- DR- S- 0020.dwg	
DRAWN	SCALE	CAD FILENAME	
JUN '19	PD	S0	WORK IN PROGRESS
DATE	CHECKED	SUITABILITY CODE	STATUS

4259B- AKT- XX- XX- DR- S- 0020 P 1

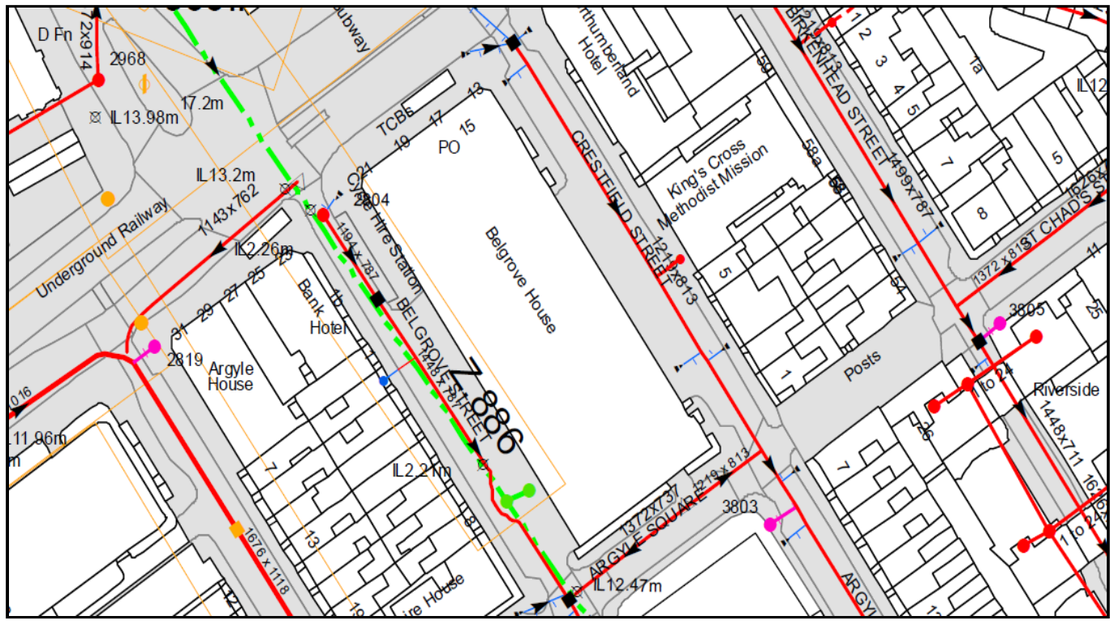
DRAWING No. REVISION

15/10/2019 11:20:27

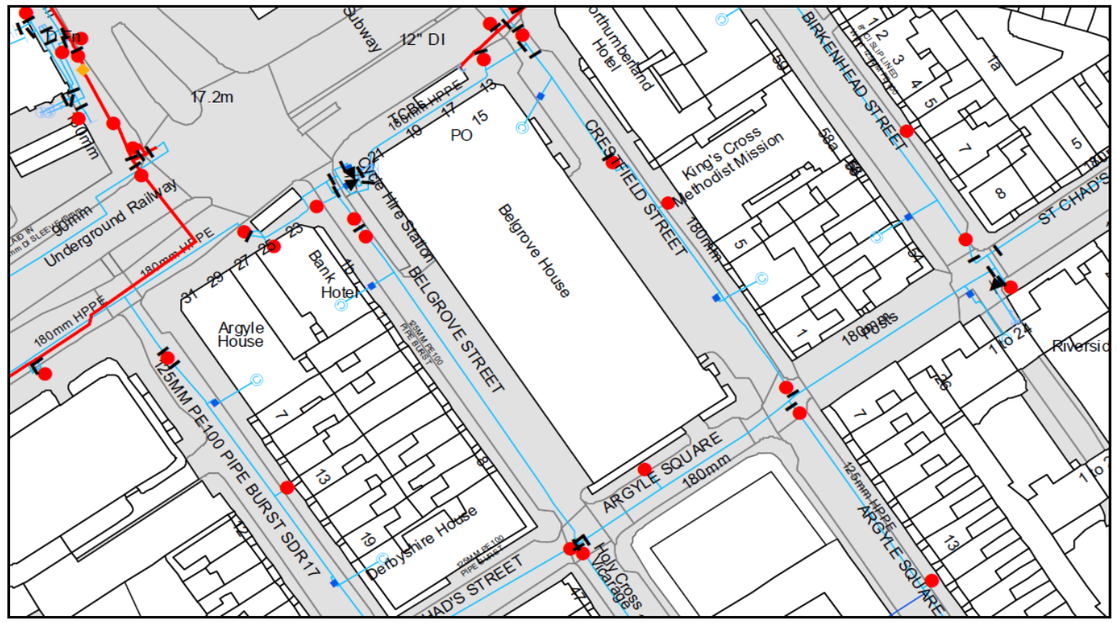
WORK IN PROGRESS

BELGROVE HOUSE

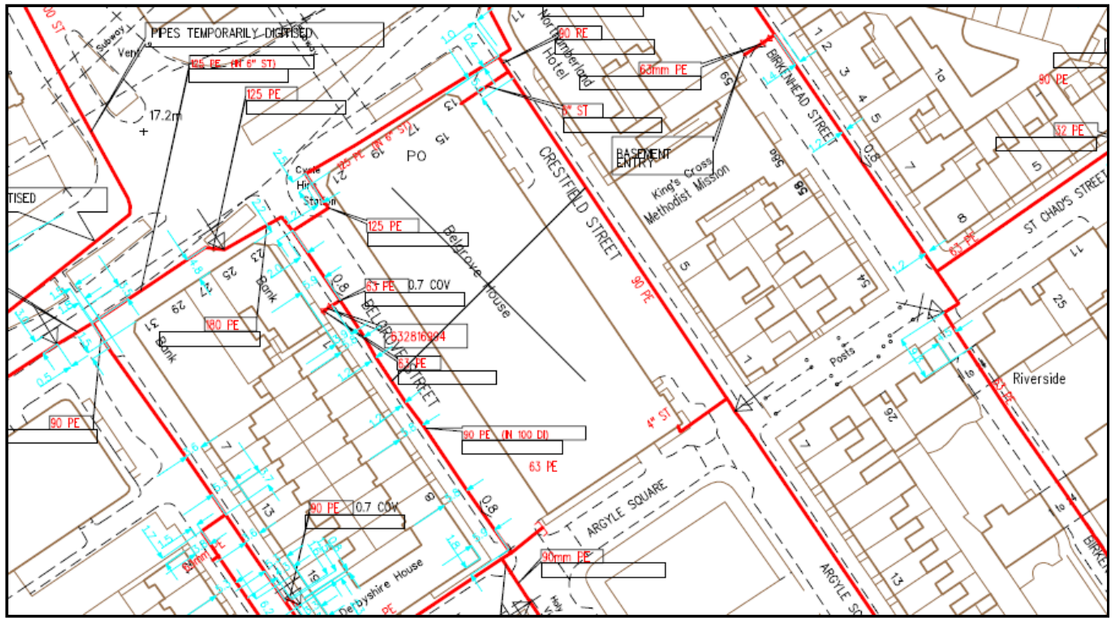
Extract of Thames Water Asset Location - Sewer Map



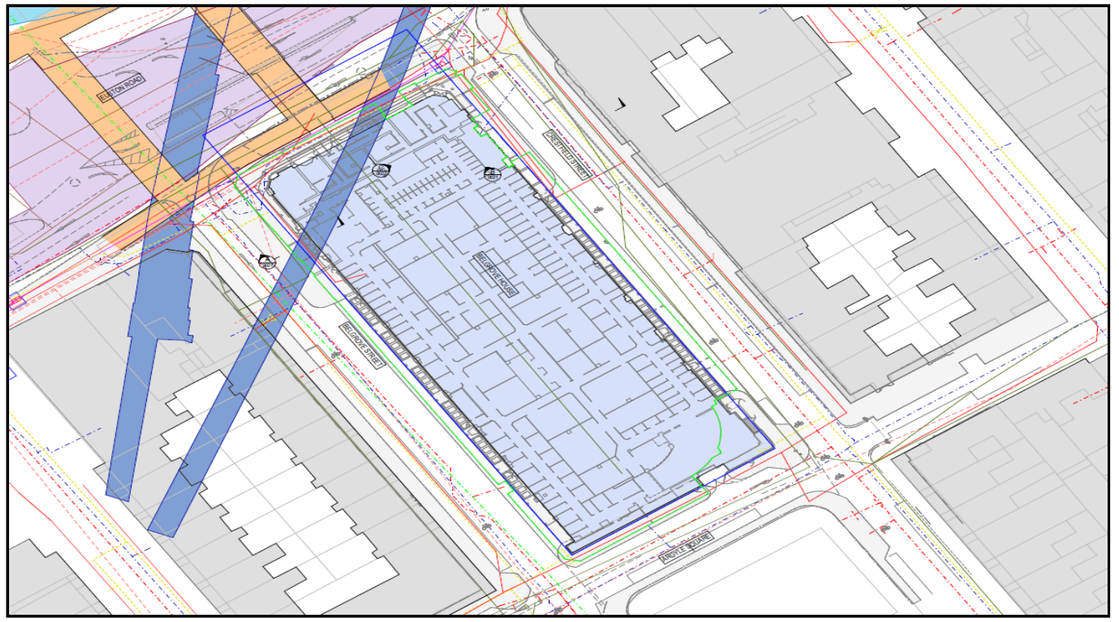
Extract of Thames Water Asset Location - Clean Water Map



Extract of Cadent Gas Asset Location



Extract of AKT map produced showing all services around the site



PROJECT	BELGROVE HOUSE				TITLE	UTILITY DAMAGE ASSESSMENT	
DATE	14/07/20	SCALE		CAD FILENAME	-	STATUS	FOR INFO
DRAWN	OH	CHECKED	MW	PROJECT No.	4259	DRAWING No.	REV 0

Thames Water & Cadent Gas Assets

The location of the Thames Water and Cadent Gas assets adjacent to the site are appended at the end of this document.

The figures below show the Thames Water sewers and mains, and Cadent Gas mains around the site as modelled in Oasys Xdisp in relationship to the basement layout. The geometry of the basement layout and assets have been slightly simplified for the purposes of this analysis.

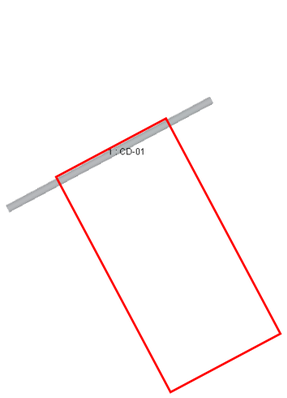


Figure 1 - Cadent Gas assets - Xdisp view

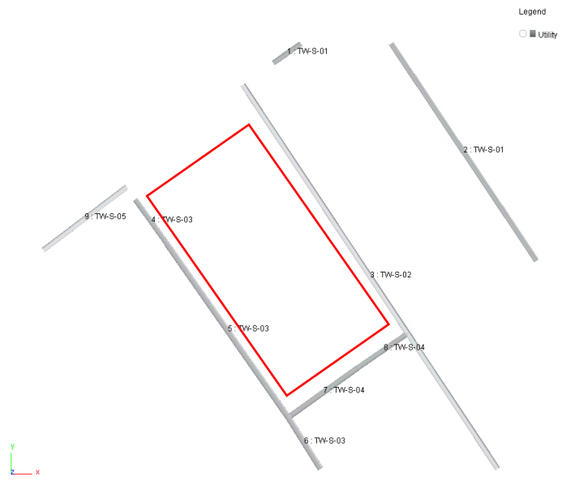


Figure 2 - Thames Water sewers - Xdisp view

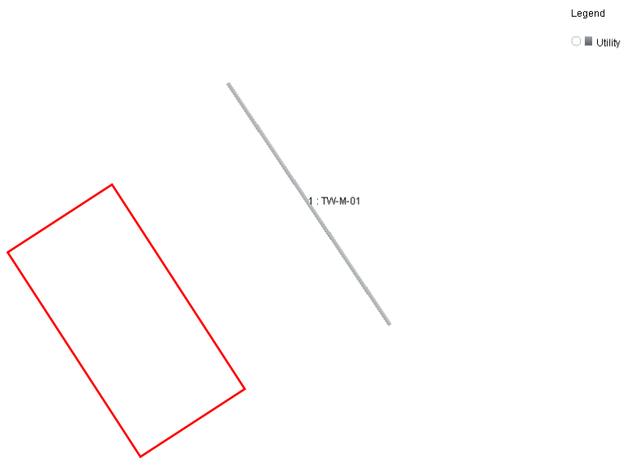


Figure 3 - Thames Water distribution and trunk mains - Xdisp view

The properties of the assets used in the analysis are presented in the table below. The properties were assigned in line with some local archive search data. Where some properties were not clear, these have been assumed, i.e. some material and lining thickness values.

The analysis should be updated if further data, i.e. future CCTV condition surveys or communication with the asset owners, prove these assumptions not to be valid.

Asset Reference	Material	Diameter (mm)	Assumed Lining Thickness (mm)
TW-S-01.1	Brick	1219 x 813	300
TW-S-01.2	Brick	1219 x 813	300
TW-S-02	Brick	1219 x 813	300
TW-S-03.1	Brick	1194 x 787	300
TW-S-03.2	Brick	1397 x 762	300
TW-S-03.3	Brick	1397 x 762	300
TW-S-04.1	Brick	1372 x 737	300
TW-S-04.2	Brick	1219 x 813	300
TW-S-05	Brick	1143 x 762	300
TW-M-01	Steel	406	20
CD-01	Cast Iron	610	60

Table 1 - Thames Water distribution and trunk mains - Xdisp view

The acceptance criteria for each asset have been assumed based on previous experience in dealing with Thames Water and Cadent Gas assets and are summarised in the tables below.

In AKT's experience no assessment is required for PE gas mains. However, the results for this kind of assets have been included for reference.

Table 1 - Assessment Criteria for Existing Thames Water Pipeline and Sewer Assets

PIPE TYPE	Diameter (mm)	Allowable Increase in Strain (□□)		Rotation (deg.)
		Tension	Compression	
Brick Sewer (red / yellow / blue brick)	N/A	500	25% of the allowable stress	N/A
Cast Iron Lead-yarn joints	N/A	100	1200	0.1
Ductile Iron (Lead-yarn gasket joints)	N/A	500	700	0.5
Ductile Iron (Rubber gasket joints)	N/A	500	700	2.0
Steel	N/A	450	450	1.5
Vitrified Clay	<125	80	400	0.5
	>125	80	400	See Table 2
Concrete (unreinforced)	<225	20	400	0.5
	225 – 750	40	400	See Table 2
	>750	60	400	

Table 2 - Maximum Rotation for Vitrified Clay and Concrete Pipes

Diameter (mm)	Rotation (deg.)
< 375	2.0
375 – 750	1.0
750 – 1400	0.5
> 1400	0.3

Figure 4 - Thames Water limitng criteria (extract from Thames Water - Guidance on piling, heavy loads, excavations, tunnelling and dewatering)

Thames Water Asset Type	Pullout		Rotation	Axial Strain		Flexural Strain	
	Axial	Flexural		Tensile	Compressive	Tensile	Compressive
Masonry	1	1	1	1	1	2	1
Cast Iron	0.2	1	1	0.2	0.2	1	1

Table 2 - Thames Water reduction factors

Cadent Gas Asset Type	Pullout	Rotation	Allowable Strain	
			Tension	Compression
	(mm)	(°)	(mm)	(mm)
Cast Iron Gas Main	1.5	0.45	150	1200

Table 3 - Cadent Gas limiting criteria

Cadent Gas Asset Type	Reduction Factors						
	Pullout		Rotation	Axial Strain		Flexural Strain	
	Axial	Flexural		Tensile	Compressive	Tensile	Compressive
Cast Iron Gas Main	0.4	1	1	0.4	0.4	0.4	0.4

Table 4 - Cadent Gas reduction factors

PROJECT	Belgrove House	TITLE	Preliminary Thames Water & Cadent Gas GMA
DATE	08/12/2020	SCALE	NTS
CAD FILENAME	-	STATUS	-
DRAWN	OH	CHECKED	MW
PROJECT No.	4259	DRAWING No.	-
REV	R06A		

Ground Conditions

The following ground conditions have been assumed based on historical boreholes. If the ground conditions on site are found significantly variable than presented below, the analysis shall be re-taken. No groundwater was found within the historical boreholes and the preliminary SI.

Stratum	Top Level (mOD)	Thickness (m)	Cu (kN/m²)	Eu (kN/m²)	E' (kN/m²)
Made Ground	17	5.5	-	-	5000
London Clay	12	16	75+10z	Eu=425Cu	E'=0.8Eu
Lambeth Group	-4	17	100+11z	Eu=650Cu	E'=0.8Eu
Thanet Sand	-21	-	-	-	300000

Table 5 - Summary of assumed ground conditions

Results

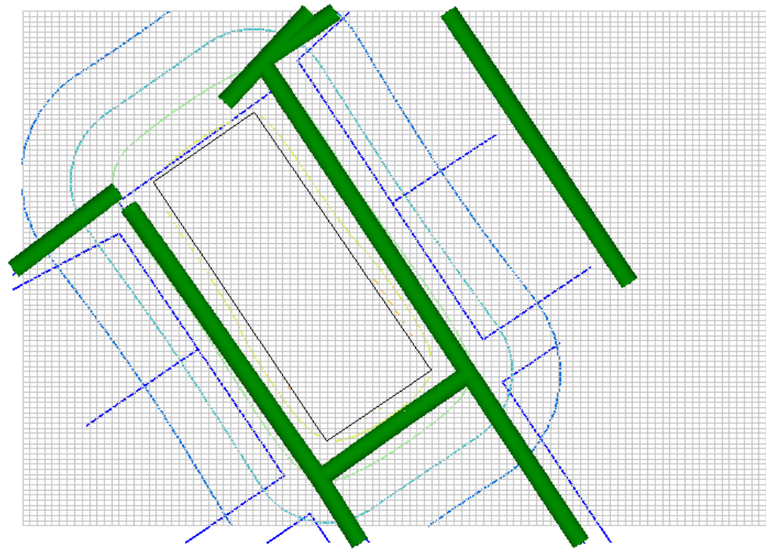
A preliminary Ground Movement Assessment (GMA) has been carried out with Oasys Pdisp and Xdisp software for two stages, the first stage modelled is the installation and excavation of the basement and the second is the loading of the new building loads.

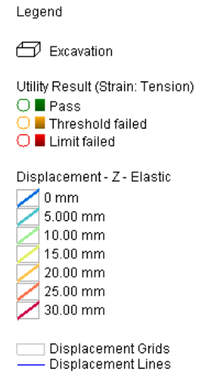
The excavation and loading stages were carried out in Pdisp using the Boussinesq method. Movements due to wall installation have been estimated with the use of the ground movement curves provided in CIRIA C760. Excavation induced movements were estimated in accordance with the CIRIA C760 ground movement data for excavation in front of high-stiffness wall in stiff Clay.

The results in terms of ground movement plots at surface level are presented below as well as a summary of the estimated maximum movement, strain, rotation, pullout and curvature values for both stages assessed. A summary of the long term drained results can be seen in Table 6.

Vertical movement is considered to be positive when downwards (compression) and negative when upwards (heave). Positive horizontal movement is movement towards the excavation.

Short Term Analysis (Undrained)

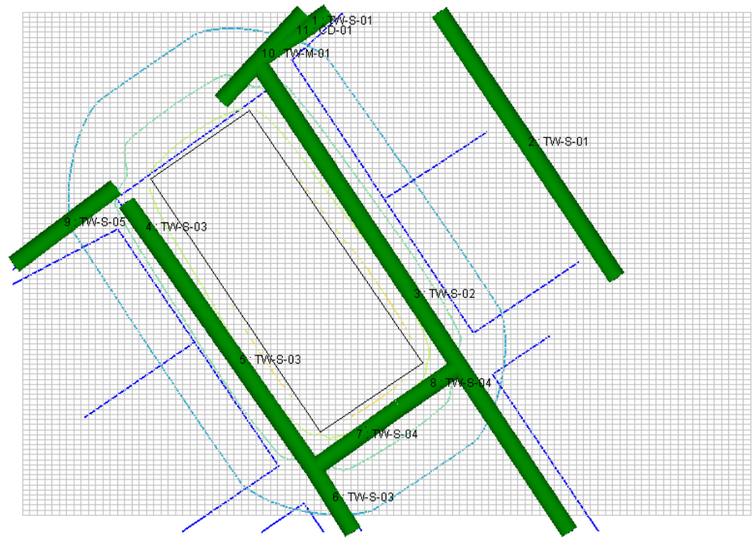


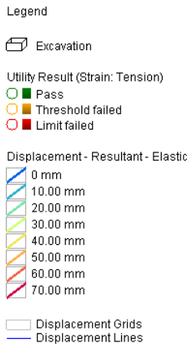


The Utility Assessment for Belgrove House is based on the following sequence:
1. Installation & Excavation of the basement.
2. Loading with the new building loads

As presented on the contour plots most of the assets are within the 0 and 10mm settlement contour.

Long Term Analysis (Drained)





PROJECT	Belgrove House	TITLE	Preliminary Thames Water & Cadent Gas GMA		
DATE	08/12/2020	SCALE	NTS	CAD FILENAME	-
STATUS	-				
DRAWN	OH	CHECKED	MW	PROJECT No.	4259
DRAWING No.	-	REV	R06A		

Asset	Material	Internal diameter (mm)	Maximum tensile strain	Maximum allowed tensile strain	Maximum compression strain	Maximum allowed compression strain	Maximum rotation (deg)	Maximum allowed rotation (deg)	Maximum pullout (mm)	Maximum allowed pullout (mm)
TW-S-0.1.1	Brick	1219 x 813	7.4	500	3.7	-	-	-	-	-
TW-S-0.1.2	Brick	1219 x 813	0.05	500	0.02	-	-	-	-	-
TW-S-02	Brick	1219 x 813	43	500	22	-	-	-	-	-
TW-S-0.3.1	Brick	1194 x 787	18	500	9.1	-	-	-	-	-
TW-S-0.3.2	Brick	1397 x 762	48	500	24	-	-	-	-	-
TW-S-0.3.3	Brick	1397 x 762	49	500	25	-	-	-	-	-
TW-S-0.4.1	Brick	1372 x 737	62	500	31	-	-	-	-	-
TW-S-0.4.2	Brick	1219 x 813	66	500	33	-	-	-	-	-
TW-S-05	Brick	1143 x 762	52	500	26	-	-	-	-	-
TW-M-0.1	Steel	406	1.2	450	1.2	450	<0.01	1.5	0.043	25
CD-01	Cast Iron	610	3.0	100	3.0	1200	<0.01	0.1	0.015	3

Table 6 - Summary of the Utility Damage Assessment results

Results

The table above shows the results of the Utility Damage Assessment carried out for Belgrove House, only the long term drained is shown as this represents the worst case scenario for the stages assessed.

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PROJECT **Belgrove House** | TITLE **Preliminary Thames Water & Cadent Gas GMA**

DATE 08/12/2020 | SCALE NTS | CAD FILENAME - | STATUS -

DRAWN OH | CHECKED MW | PROJECT No. 4259 | DRAWING No. - | REV R06A