

Client: PP O'Connor

Task Number: AEC-30397-11

Project Title: Premier House

Task Title : Vibration Assessment and Movement Monitoring Report

Design Risk Category: Cat 1

Report Reference: 30397-11-PPO-PH-VA-REPORT R3

Reviewed By: Joshua Martin
BEng (Hons) IEng MICE



Document Revision History

Revision	Description	Author	Revision Date	Checked By
R0	Initial Issue	Richard Boyle	22-11-2021	Joshua Martin
R1	Further information on services	Richard Boyle	30-11-2021	Joshua Martin
R2	Addition of monitoring regime	Richard Boyle	15-12-2021	Joshua Martin
R3	Additional monitoring points	Richard Boyle	21-12-2021	Joshua Martin

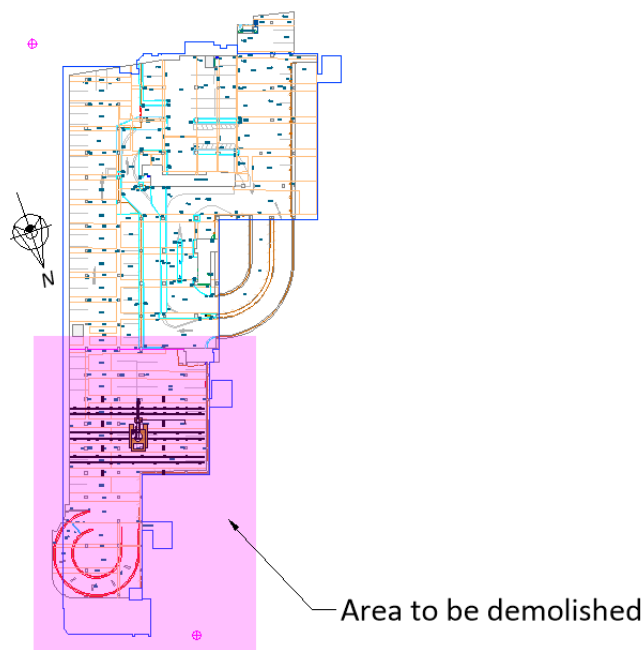
Premier House - Vibration Assessment and Movement Monitoring Report

Engineering Statement

Introduction

Premier house in Deansgate, Manchester, is to be partially demolished. As part of these works, mechanical demolition of the northern section of the building is to take place.

PP O'Connor Ltd. have instructed Andun Engineering Consultants Ltd. to assess the possible impact from vibration on adjacent services due to the demolition and to specify the required movement monitoring for the retaining walls along Deansgate (road) and Victoria bridge.



Service Location

The following services have been located in the vicinity of works that may be susceptible to vibration:

- A large sewage water service runs below the Deansgate approximately 8m away from the edge of the site;
- Below basement level -3 an overflow culvert runs along the north of the site. This culvert is partially in the sandstone layer and then backfilled with concrete;
- Below basement level -3 there are several gullies that run through the site below foundation slab level

The vibration on all of these services will be considered.

Overview on vibration

Vibration is most commonly defined as a cyclical pattern, where a motion is repeated about a fixed point over a specific interval of time (Mobley, 1999). In the case of ground vibration, this movement is measured in 3 separate orthogonal axes; Longitudinally, Vertically and Transversely. As velocity is considered to be the best indicator, most industry-standard limitations regarding human comfort and the resistance of structures to vibration are given in these units.

The results are shown as a peak particle velocity (PPV) expressed in millimetres per second (mm/s). The velocity readings are summed continuously when monitoring vibrations and the vector sum is recorded as the Peak Vector Sum (PVS). However, it is well known that people are more sensitive to vibration at low thresholds and often confuse the annoying aspect of lower velocity vibration with a perceived ability to do significant damage to a structure. A table of commonly accepted threshold values for structural damage is shown below.

Most commonly, vibrational assessments are undertaken to establish the potential damage or discomfort that could occur from vibration. However, the effects of vibration due to construction works are frequently overestimated.

Human response

It is generally accepted that the limit for the human threshold for ground vibration is a PPV of approximately 0.3mm/s, which in orders of magnitude is lower than that required to cause structural damage. The frequency of the vibration can also have a notable physiological effect which should be considered. There are, of course, several factors that may influence this, and the response will vary between people. However, the critical point is that sensitivity to vibration and the trigger for structural damage is invariably misunderstood.

Thus concerns will be raised by affected people regarding vibrations that are of no structural significance. However, it must be accepted that annoyance at ground-borne vibration is a real phenomenon that cannot be ignored. There are times when the acceptable level for vibration must be set at a level well below that which is structurally significant. This is particularly important if the works causing the vibration are to be carried out at unsocial hours. Thus trigger levels may need to vary during the day to reflect this sensitivity.

To put vibration levels in context, below is a list of common tasks and the level of vibration they produce:

Activity	Vibration (mm/s – Peak Particle Velocity(PPV)
Jumping	Up to 250
Hammering nail	Up to 100
Sliding door	Up to 10
Shutting door	Up to 30

This report will concentrate on the safe working limits in structures and not limit activities due to human response as works will be in a site environment.

Safe limits on vibration

The owner of the service assets, United Utilities, have indicated that the given limit of 5mm/s PPV for vibration is for guidance only and to avoid any discolouration of water. A literature review of PPV and the allowable limits set on it locally and internationally will be undertaken.

From a review of PPV limits recommended in BRE guidance note, Structural vibration damage, and Mining and blasting document on vibration limits, the following limits are given:

- City of New jersey - 48mm/s
- Crandell - "caution" 84mm/s
- Edwards Northwood - 114mm/s
- Duvall and Fogelson - 50mm/s
- Swedish standard - 70mm/s minimal damage, 110mm/s slight damage 160mm/s moderate damage 230mm/s serious damage
- Esteves (based on Swedish standards) found no structural damage below 50mm/s.
- German standards - DIN 4150-3:1999 -

Table 2: Guideline values of vibration velocity, for evaluating the effects of short-term vibration, DIN4150-3:1999

Line	Type of Structure	Vibration peak particle Velocity (mm/s)			
		Foundation Frequency			Plane of Floor of Uppermost Storey
		Less than 10 Hz	10 to 50 Hz	50 to 100* Hz	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

* For frequencies above 100Hz, at least the values specified in this column shall be applied

From the above limits, it can be seen that a higher limit may be suitable. We propose the below limits are utilised for the vibration on services.

Green	<10mm/s	No issues, continue demolition work in accordance with RAMS
Amber	10-20mm/s	Proceed with caution
Red	>20mm/s	Stop works and contact engineer.

Checks to be carried out

The following vibration assessment and monitoring regimes shall be undertaken:

- The large sewer will have a vibration assessment to avoid any damage to the pipes. From this assessment, suitable vibration monitoring limits will be given.
- The overflow culvert that runs below the basement -3 slab will have suitable vibration monitoring limits set until works to replace the culvert commence.

Calculation of vibration on services

The main cause of vibration will be from using hydraulic breakers on areas of concrete during the demolition works. The vibration caused by these breakers can be quantified by comparing them to the vibration caused by equivalent impact hammers during piling works. This comparison will utilise the energy per blow given in joules from the datasheet of a typical breaker to be used - HP 7000 ABF equivalent breakers can be used.

To convert from energy per blow to PPV, the conversion in TRL report 429, table 6 shall be used. The conversion takes into account the absolute distance from the point of impact to the services. As a conservative check, the impact will be taken at the same level as the services, but this will not be the case for much of the demolition works.

Table 6 Simple predictors for preliminary estimation of vibration from piling proposed by *Attewell and †BSI

	<i>Vibrodrivers</i>	<i>Impact hammers</i>
For a high level of confidence that predicted values will not be exceeded*	$v_{res} = 1.8 \left[\frac{\sqrt{W_c}}{x} \right]$	$v_{res} = 1.5 \left[\frac{\sqrt{W}}{x} \right]$
For more probable levels of vibration*	$v_{res} = 1.0 \left[\frac{\sqrt{W_c}}{x} \right]^{0.95}$	$v_{res} = 0.76 \left[\frac{\sqrt{W}}{x} \right]^{0.87}$
Vibration levels unlikely to be exceeded significantly in most cases†	$v_v = 1.0 \left[\frac{\sqrt{W_c}}{r} \right]$	$v_v = 0.75 \left[\frac{\sqrt{W}}{r} \right]$

v_{res} is the resultant ppv (mm/s); v_v is the vertical component ppv (mm/s); W is the nominal energy of the hammer (J); W_c is the nominal energy per cycle (J); x is the distance measured along the ground surface; r is the slope distance from the pile toe.

*Attewell (1995)

†BSI (1992b)

Results of calculations

The services are at an approximate distance of 8.0m away from the works and will be assumed to be on the same level. The analysis considers the breaker operations being carried out at the closest to the service location as worst case.

Energy per blow $E_1 := 10350\text{J}$

Horizontal distance $d_1 := 8.0\text{m}$

Vertical distance $d_2 := 0.0\text{m}$

For the use of the equation, unitless values are used.

$$W_1 := \frac{E_1}{J} = 10350$$

$$x_1 := \frac{d_1}{m} = 8 \qquad x_2 := \frac{d_2}{m} = 0$$

$$r_1 := \sqrt{x_1^2 + x_2^2} = 8$$

High Level of confidence that the predicted values will not be exceeded (Atwell 1995)

$$v_{\text{res.A}} := 1.5 \left(\frac{\sqrt{W_1}}{x_1} \right) \frac{\text{mm}}{\text{s}} = 19.08 \cdot \frac{\text{mm}}{\text{s}}$$

For more probable levels of vibration (Atwell 1995)

$$v_{\text{res.B}} := 0.76 \left(\frac{\sqrt{W_1}}{x_1} \right)^{0.87} \frac{\text{mm}}{\text{s}} = 6.94 \cdot \frac{\text{mm}}{\text{s}}$$

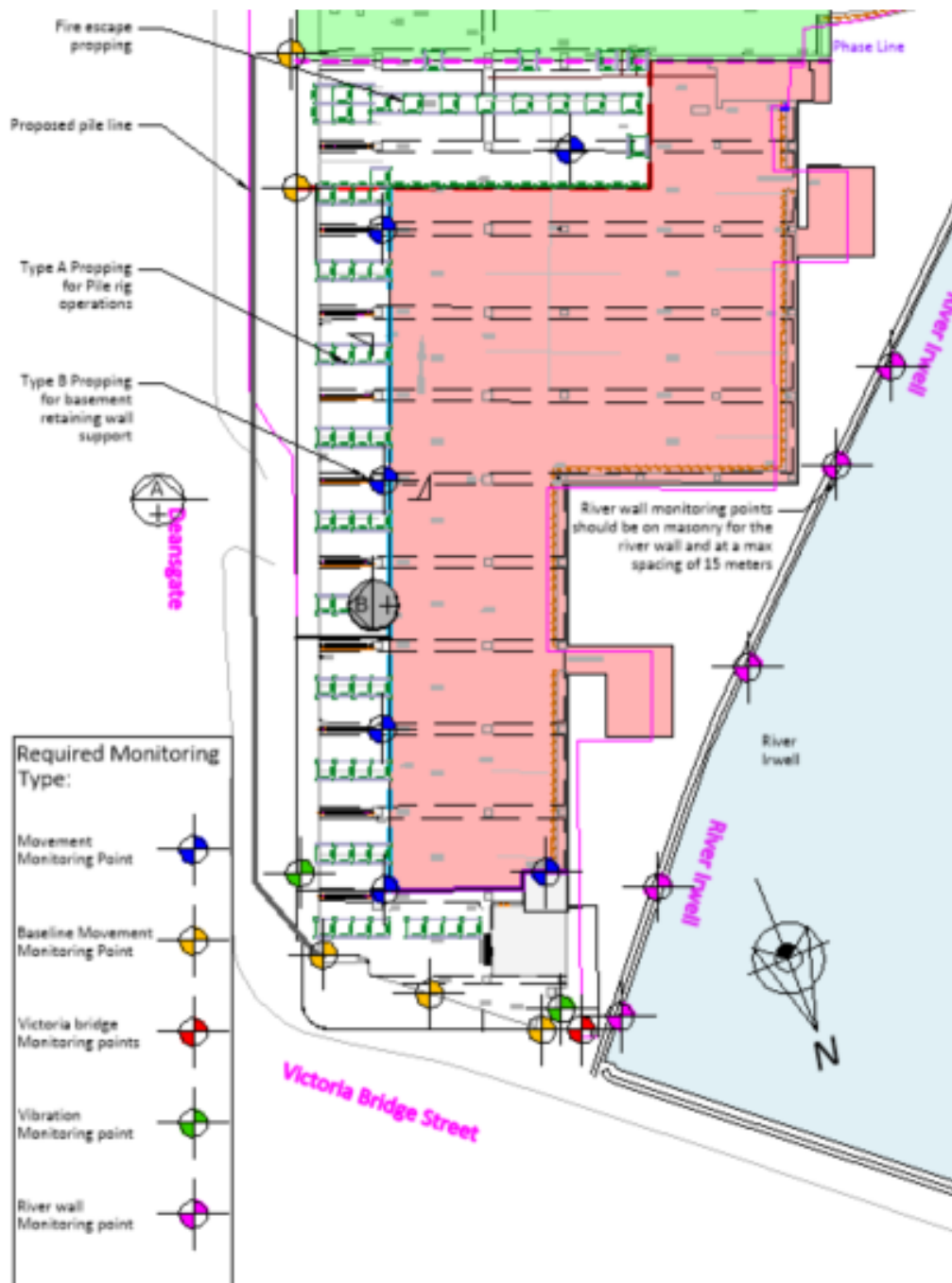
Vibration levels unlikely to be exceeded significantly in most cases (BSI 1992b)

$$v_{\text{res.C}} := 0.75 \left(\frac{\sqrt{W_1}}{r_1} \right) \frac{\text{mm}}{\text{s}} = 9.54 \cdot \frac{\text{mm}}{\text{s}}$$

From the previous calculations, we can see that the predicted vibrations fall within an acceptable limit. However, as the vibration is close to the set limits, live monitoring is recommended to ensure these limits are not exceeded during demolition. If the vibration limits are exceeded, AEC should be contacted for further guidance.

Movement monitoring

The current structure will be reduced to ground level and be partially demolished before permanent works are installed. The retaining basement walls currently support Deansgate (road), and the Victoria bridge road requires monitoring for movement during works.



The monitoring points will be in 4 categories:

Movement monitoring - The monitoring points should be at slab level on every floor: Ground floor, Basement 1, Basement 2, and Basement 3 levels. The monitoring points will be on the retained columns to make the monitoring more manageable. Monitoring should continue throughout demolition works.

Baseline monitoring points - The monitoring points are to be at the top, middle and bottom of the retaining walls. These points will be required to acquire a baseline for handover to the principal contractor.

Victoria bridge monitoring points - The monitoring points are to be at the top, middle and bottom of the retaining walls. Monitoring should continue throughout demolition works.

River wall monitoring points - The monitoring points should be on the masonry section of the River wall and at a maximum spacing of every 15 meters.

The limits for monitoring have been set in the Approval in Principal for Manchester Highways as prepared by BG&E REN-BGE-RT-S-RP-010 Rev B.

Green	<15mm	No issues, continue work in accordance with RAMS
Amber	15-25mm	Contact design engineer
Red	>30mm	Stop work immediately and contact design engineer

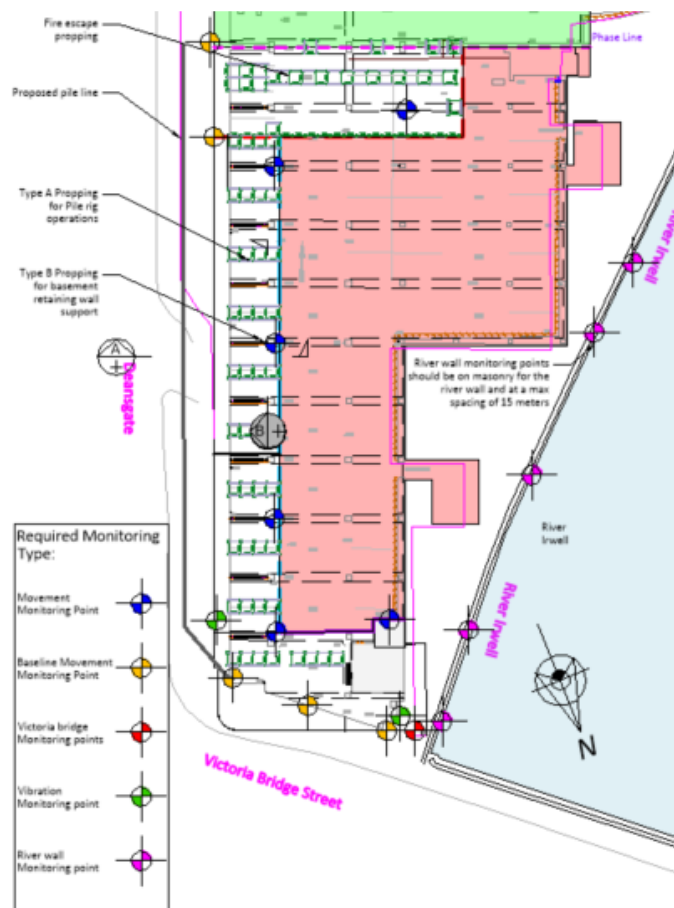
Summary for Vibration Monitoring

AEC has undertaken a preliminary vibration assessment for the demolition works at Premier House in Deansgate, Manchester. We recommend that vibration monitoring is undertaken throughout works and that works progress towards the services, i.e. start demolition works away from services and work towards the services. This will enable the project team to estimate the expected vibrations from plant activity directly adjacent to the services and evaluate the current methodology. Monitor points should be located directly over the services. Based on the literature review, we recommend the vibration limits shown below for both the overflow culvert and sewage water pipes. Contact AEC if vibration limits are expected to be exceeded or as per the table below.

Green	<10mm/s	No issues, continue demolition work in accordance with RAMS
Amber	10-20mm/s	Proceed with caution
Red	>20mm/s	Stop works and contact engineer.

Summary for Movement Monitoring

AEC has assessed the required movement monitoring and conclude that the monitoring highlighted below is suitable. The propping highlighted in drawings 30397-6-PPO-PH-RWP-DRW-01 should be installed before demolition work commences to mitigate movement. The movement should be monitored throughout the proposed works.



The monitoring point will have the movement monitoring requirement as highlighted in the table below;

Green	<15mm	No issues, continue work in accordance with RAMS
Amber	15-25mm	Contact design engineer
Red	>30mm	Stop work immediately and contract design engineer

Richard Boyle
BSc (Hons) GMICE
Date: 21/12/21



Enc.

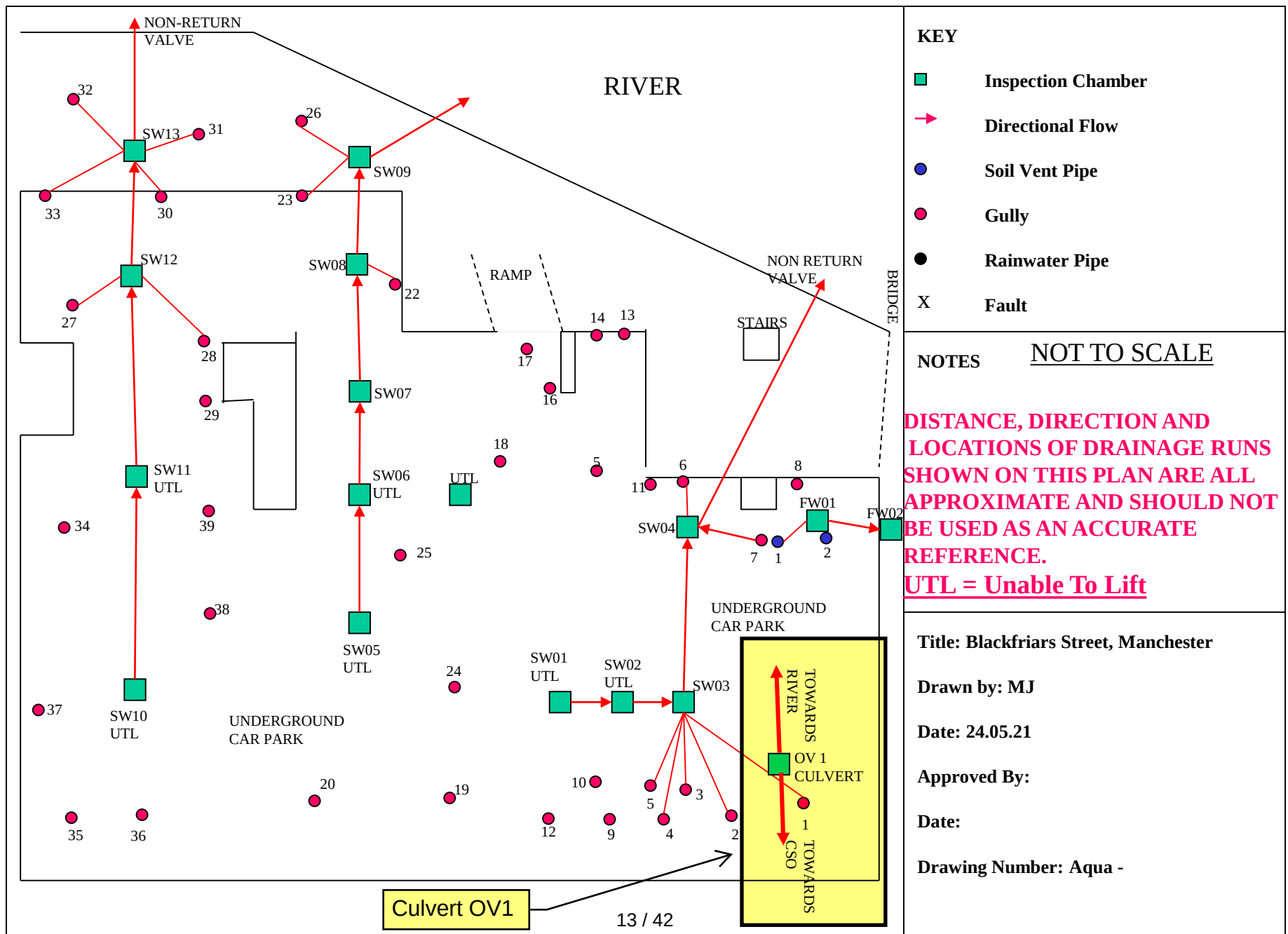
Proposed Sequence and Services Location

2021 07 08 - Northern Sewer Overrun - Proposed Staged Sequence Sketches - Rev A Issued.pdf

United Utilities Services Location

UU - 250037-19-02-2021-02-39-22.pdf

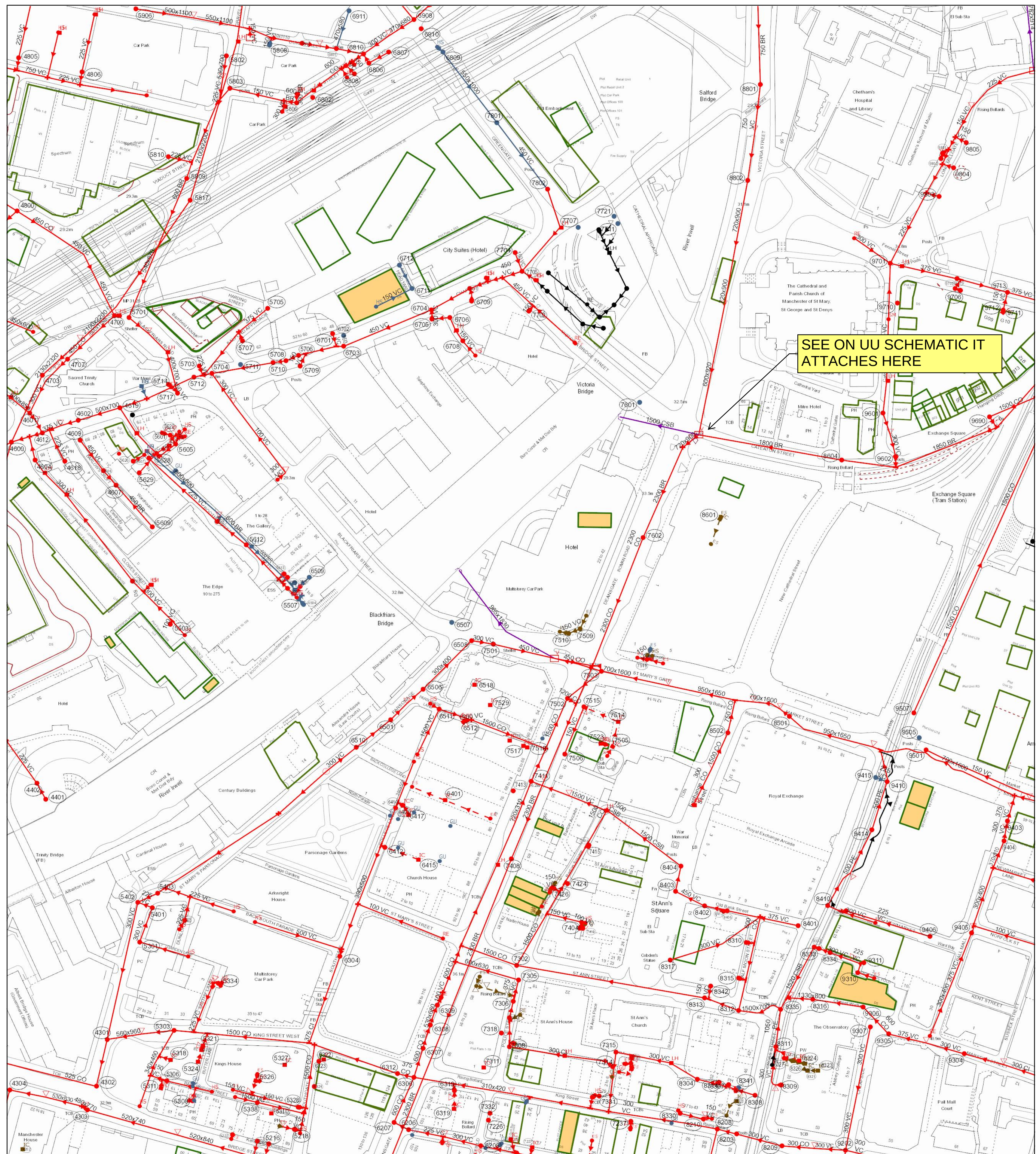
1 - LOCATION





We believe there is a bend in the pipe, as the outlet to the River Irwell is not aligned with the pipe surveyed.





The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Mat	Length	Grad
7334	29.58	CO	22.78	150	VC	2.02099			
8306	35.83	CO	31.04	600	VC	16.7035		1 in 186	
8802	30.85	BR	27.72	750	VC	71.9991			1 in 184
6709	26.74	CO	24.17	375	VC	22.3584			1 in 18
6911	29.34	BR	25.68	100	VC	22.19594			
8330	34.17	CO	31.1	150	VC	13.17195			
8628	29.27	CO	24.17	375	VC	6.334555			
7704	26.7	CO	24.72	150	VC	20.61553			
6312	35.69	CO	30.65	1500	VC	32.5925			
7404	36.54	CO	30.65	1500	VC	11.04455			
5709	27.23	CO	24.28	150	VC	48.70318			
8802	34.02	CO	31.52	150	VC	19.72096			
8309	35.85	CO	31.52	150	VC	7.615773			1 in 19
7115	35.85	CO	31.91	150	VC	2.230088			
6206	29.46	CO	28.22	150	VC	3.095899			
7510	35.66	CO	31.91	600	VC	28.14599			1 in 25
6801	29.48	CO	28.22	150	VC	8.942722			
8401	37.17	CO	28.79	375	VC	15.20768			1 in 204
5609	29.61	CO	28.79	375	VC	40.28788			
4800	29.92	CO	26.98	450	VC	30.4705			
5402	33.55	CO	28.24	300	VC	22.4722			1 in 88
7411	36.15	CO	25.52	1500	VC	17.87781			
7352	36.54	CO	0	1500	VC	19.69772			
7424	36.54	CO	0	1500	VC	107.2179			
4800	29.92	CO	27.47	450	VC	6.80988			
8310	35.85	CO	27.47	450	VC	12.04159			1 in 63
7326	26.65	CO	22.54	300	VC	4.474555			
6705	26.65	CO	22.54	300	VC	6.119659			
5328	37.8	CO	32.62	400	VC	2.87207			
4609	27.31	CO	0	450	VC	4.231385			1 in 58
9601	35.16	CO	27.65	375	VC	11.07758			
8410	38.23	CO	28.36	300	VC	21.45093			
8334	35.16	CO	27.65	375	VC	12.64911			1 in 107
7602	35.16	CO	27.65	375	VC	18.14339			
5707	28.24	CO	0	375	VC	6.37287			
7305	36.55	CO	36.44	600	VC	76.32169			
5307	36.74	CO	36.62	300	VC	5.985165			1 in 64
8806	28.38	CO	0	225	VC	36.40555			
9706	35.3	CO	0	150	VC	69.73816			
5222	33.01	CO	27.17	150	VC	5.83092			
4301	33.01	CO	27.17	150	VC	3.16278			
6703	26.85	CO	22.32	450	VC	2.498542			1 in 187
9713	36.85	CO	22.32	450	VC	26.65333			
8315	35.8	CO	31.34	375	VC	45.67192			
6207	35.8	CO	31.34	375	VC	4.180113			
7410	35.8	CO	31.34	375	VC	30.9151			1 in 67
8307	35.8	CO	31.34	375	VC	27.313			
5809	28.93	CO	23.64	600	VC	8.351408			
5809	28.93	CO	23.64	600	VC	6.139123			1 in 258
5812	27.09	CO	22.75	225	VC	41.23106			
9601	35.16	CO	27.65	375	VC	69.73816			
9406	36.23	CO	37.53	225	VC	1.412306			
8304	37.03	CO	33.07	300	VC	17.87811			
4401	36.23	CO	37.53	225	VC	10.01802			
4501	27.55	CO	21.78	800	VC	14.21267			1 in 776
4501	27.55	CO	21.78	800	VC	12.52996			
4501	27.55	CO	21.78	800	VC	54.32451			
5206	28.97	CO	22.5	225	VC	6.47294			
4512	28.97	CO	22.5	225	VC	56.1743			
5808	30.45	SW	31.57	150	VC	1.64278			1 in 187
8313	36.83	CO	31.57	1500	VC	20.51628			
5806	28.87	CO	23.86	600	VC	7.196777			
6306	35.83	CO	0	375	VC	1.80551			
7408	36.08	CO	24.1	2300	VC	19.26955			
4700	28.07	CO	24.6	600	VC	10.5462			
7802	26.6	CO	27.12	450	VC	1.412306			
5701	28.18	CO	23.28	600	VC	54.32451			
7802	26.6	CO	27.12	450	VC	12.52996			
7802	26.6	CO	27.12	450	VC	54.32451			
6808	28.46	CO	27.2	150	VC	6.47294			
8317	36.69	CO	31.57	150	VC	56.1743			
9406	36.23	CO	37.53	225	VC	1.64278			
9305	39.21	CO	31.37	600	VC	20.51628			1 in 187
5626	27.59	CO	0	150	VC	7.196777			
5714	36.85	CO	22.32	450	VC	1.80551			
4618	27.59	CO	0	225	VC	19.26955			
7801	27.03	SW	0	450	VC	46.4043			
5505	28.81	CO	23.18	225	VC	7.071068			
5301	33.38	CO	32.3	300	VC	20.24846			1 in 32
5806	31.54	CO	0	375	VC	32.38027			
7426	36.74	CO	28.36	450	VC	4.539997			
8209	36.67	CO	33.53	400	VC	14.31782			1 in 143
5817	28.86	CO	0	2100	VC	25.91794			
8402	36.68	CO	28.51	450	VC	99.53259			1 in 138
6410	36.68	CO	28.51	450	VC	17.88584			
5601	35.35	CO	26.37	300	VC	57.17316			
5501	35.35	CO	26.37	300	VC	5.747467			
5501	35.35	CO	26.37	300	VC	12.72792			
5501	35.35	CO	26.37	300	VC	10.18094			1 in 204
5502	26.94	CO	22.94	300	VC	86.17817			1 in 66
5507	26.56	SW	25.18	150	VC	5.070491			
6504	26.53	SW	25.18	150	VC	2.828427			
4302	32.79	CO	26.98	625	VC	4.101243			
7308	36.39	CO	30.99	375	VC	105.3846			1 in 254
5706	27.27	CO	22.27	450	VC	12.52996			
6809	27.61	SW	23.82	550	VC	16			
7333	36.85	CO	31.52	150	VC	7.071068			
8210	36.85	CO	31.52	150	VC	48.20366			
7705	26.85	CO	22.52	450	VC	1.585261			
6506	34.94	CO	28.18	300	VC	1.413899			
6508	34.1	CO	24.8	300	VC	11.59125			
9415	36.02	SW	35.66	225	VC	38.18377			1 in 11
9414	36.02	CO	32.15	500	VC	12.16553			1 in 243
7503	36.02	CO	32.15	500	VC	6.626892			1 in 35
4806	36.02	CO	32.15	500	VC	1.1835			
5509	26.85	CO	24.49	150	VC	27.83223			
8401	37.17	CO	28.79	375	VC	13.8147			
5303	33.64	CO	28.4	1500	VC	7.071068			1 in 68
4707	27.81	PVC	24.5	450	VC	5.83092			
6307	35.94	CO	30.93	600	VC	1.412306			
4608	27.21	BR	10.82015	0	VC	5.83092			
7502	36.25	CO	28.01	1200	VC	11.46175			
9310	27.25	CO	23.5	225	VC	6.954919			
6708	26.74	CO	28.2	150	VC	14.39183			
6510	26.72	CO	25.98	150	VC	7.28011			
6908	26.01	CO	24.37	370	VC	2.230088			
7306	36.62	CO	30.52	375	VC	4.24264			
9306	36.22	CO	31.24	600	VC	16.64332			
7307	36.46	CO	30.73	375	VC	12.36932			1 in 206
4303	33.01	CO	25.94	490	VC	28.3249			
5706	27.2	CO	22.28	450	VC	2.19544			
5202	36.78	CO	34.41	300	VC	1.414214			
6812	30.12	CO	28.78	560	VC	7.615773			1 in 46
7503	36.02	CO	32.15	500	VC	17.34546			1 in 38
9701	34.81	CO	28.63	375	VC	24.07744			
6810	28.35	CO	24.35	300	VC	37.92708			
7503	36.02	CO	32.15	500	VC	7.539593			
9403	40.08	CO	28.5	150	VC	6.954919			
5629	40.08	CO	28.5	150	VC	7.28011			
9405	40.08	CO	28.5	150	VC	14.39183			
7314	36.91	CO	32.86	225	VC	2.230088			
9803	34.6	CO	31.44	150	VC	5			
8308	35.97	CO	30.65	530	VC	6.324555			
6319	35.97	CO	30.65	530	VC	7.28011			
7315	36.56	CO	32.64	300	VC	3.759728			
8308	37.5	CO	33.58	300	VC	16.12452			
4604	26.84	CO	21.9	300	VC	16.76305			
5608	28.32	CO	24.31	225	VC	13.34166			
5701	27.35	CO	24.31	225	VC	2.230088			
5218	26.69	CO	22.4	450	VC	34.52355			1 in 891
9304	41.64	CO	36.67	300	VC	3.60745			
9304	41.64	CO	36.67	300	VC	52.73185			1 in 879
9304	41.64	CO	36.67	300	VC	5.325454			
9704	34.184	CO	36.67	300	VC	21.84033			
4605	31.33	CO	30.04	225	VC	7.071068			
9802	31.33	CO	30.04	225	VC	7.071068			
9802	31.33	CO	30.04	225	VC	7.071068			
9816	31.33	CO	30.04	225	VC	7.071068			
5712	37.8	CO	32.43	300	VC	9.8409	</		

2 - STAGED SKETCHES

Proposed Staging is as follows:

STEP 0)

CCTV survey of sewer (already undertaken)

STEP 1)

During Stage 1 demolition of the carpark we remove the existing L3 basement carpark slab on grade above the chamber and sewer.

Survey the exact location of sewer.

If necessary provide temporary pump to existing outlet.

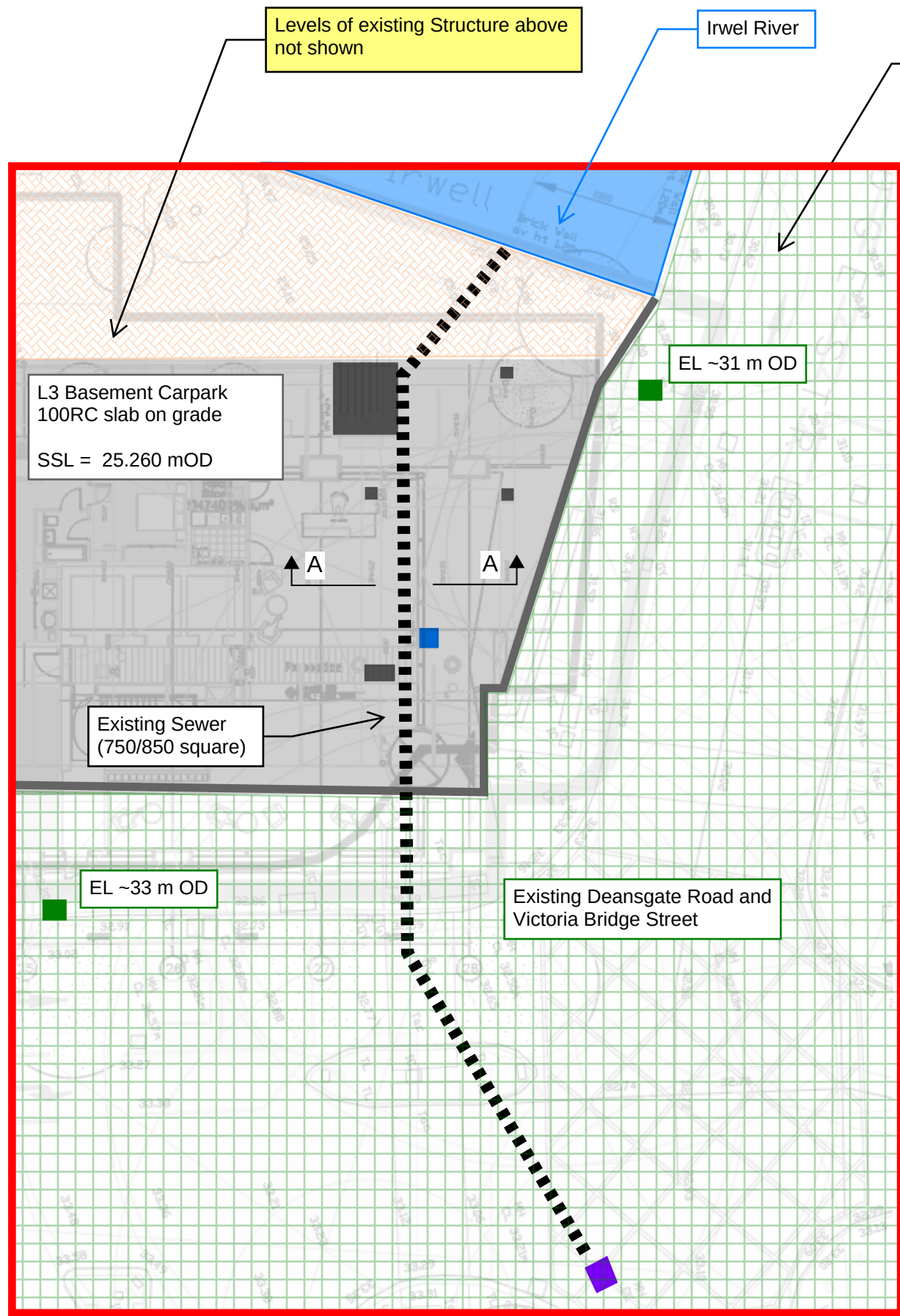
STEP 2)

Adjust Deansgate Road contiguous pile positions relative to the accurately surveyed location of sewer. Undertake contiguous piling works at Deansgate Road level. These piles will be close to the existing northern sewer overrun.

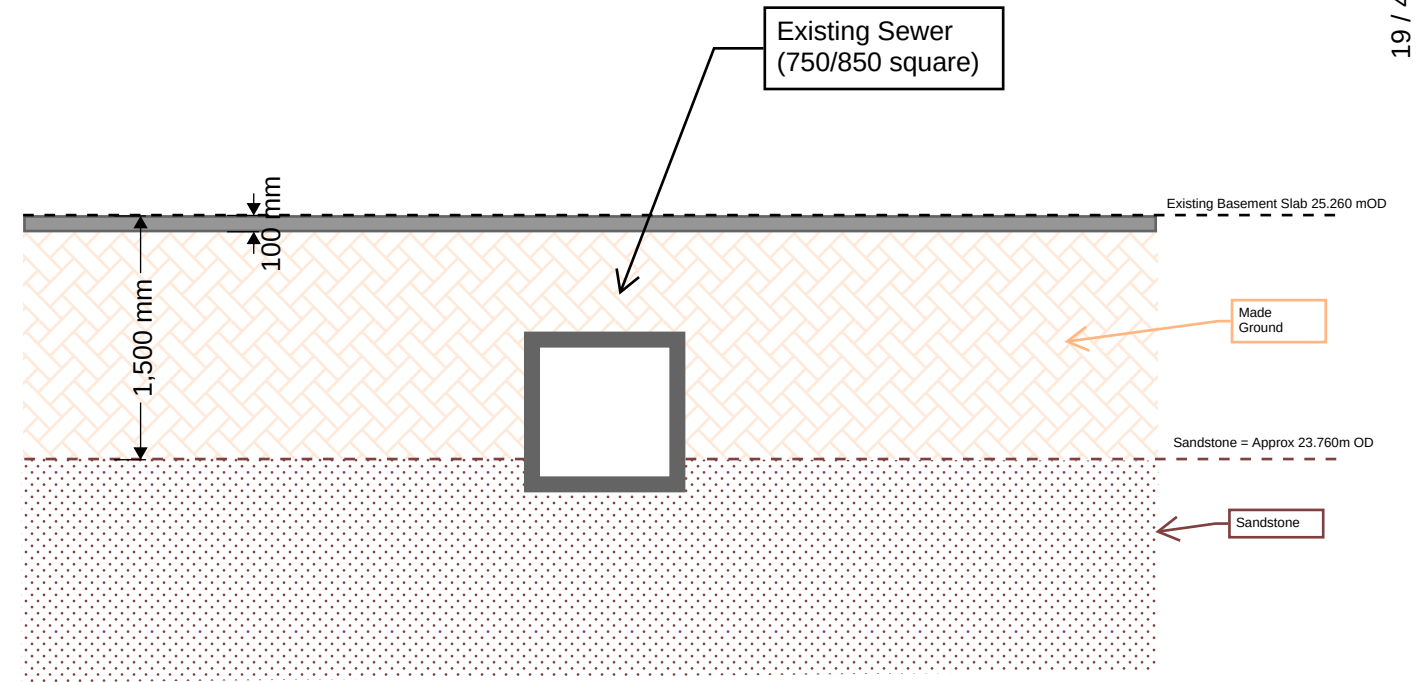
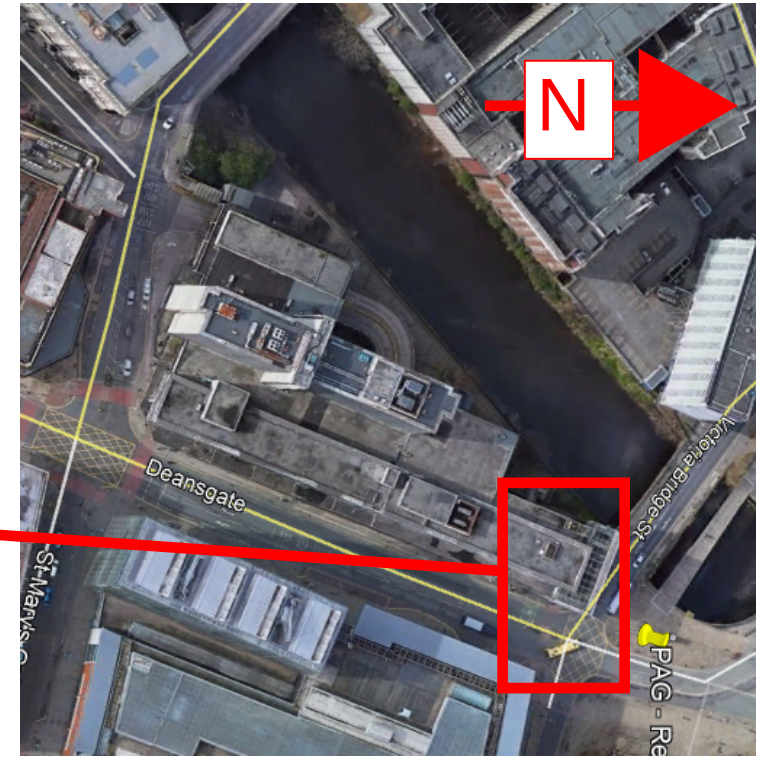
Re-inspect the sewer to ensure piling works have not caused further damage.

STEP 3)

During construction of the new residential tower foundations we demolish the sewer at the piling line and construct a new (RC Concrete) sewer under the new foundations from the piling line (site boundary along Deansgate road) to the existing outlet. Existing outlet position will not change.



PLAN

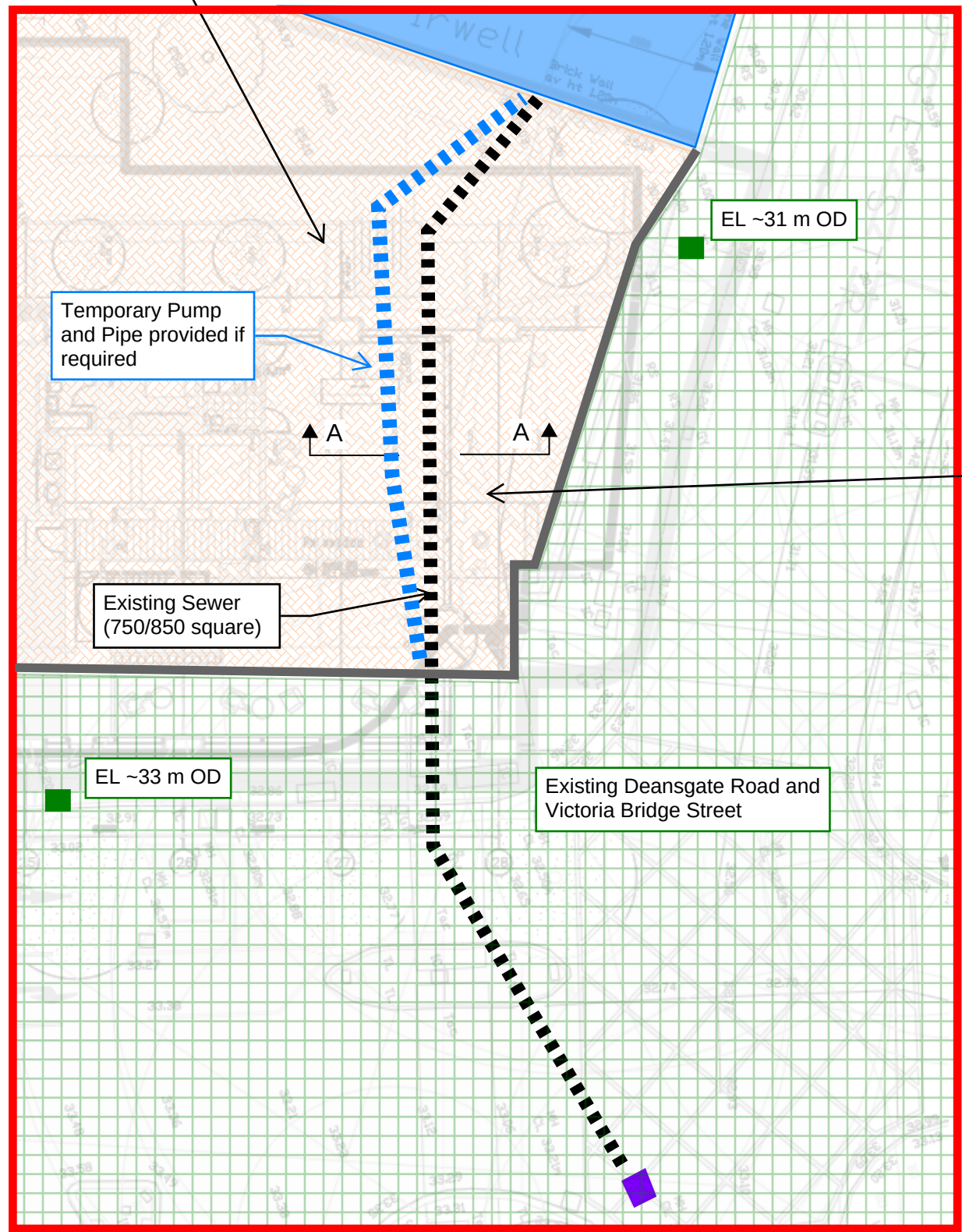


SECTION A-A

SKETCH ONLY

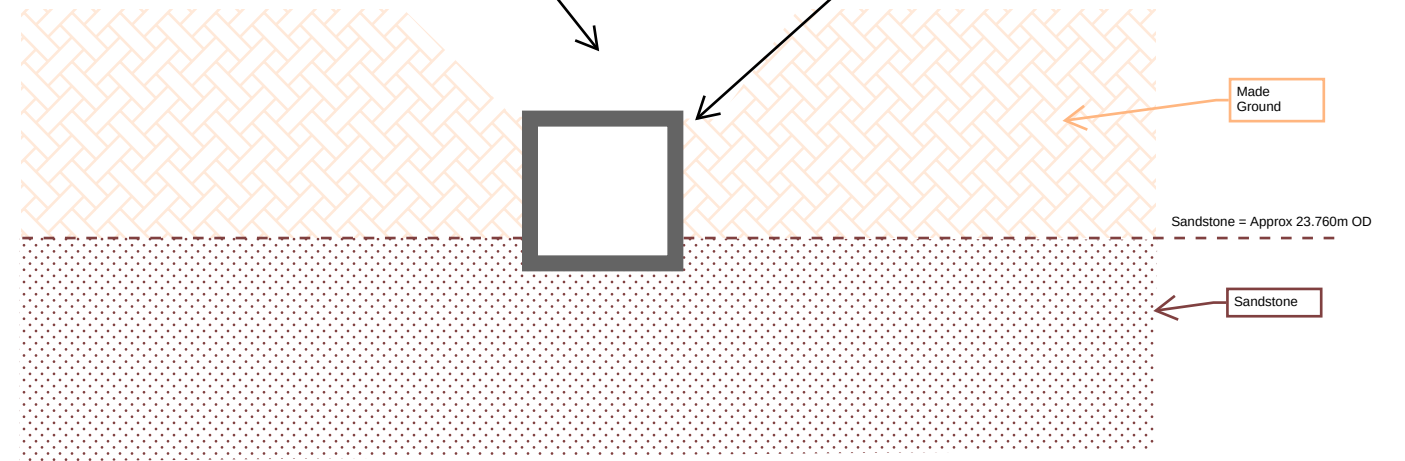
	DATE	PROJECT		
	SCALE	TITLE		
	GRID			
	PREPARED			
	SHEET	PROJECT No.	SKETCH No.	REV

Step 1A - Existing Structure is Demolished



PLAN

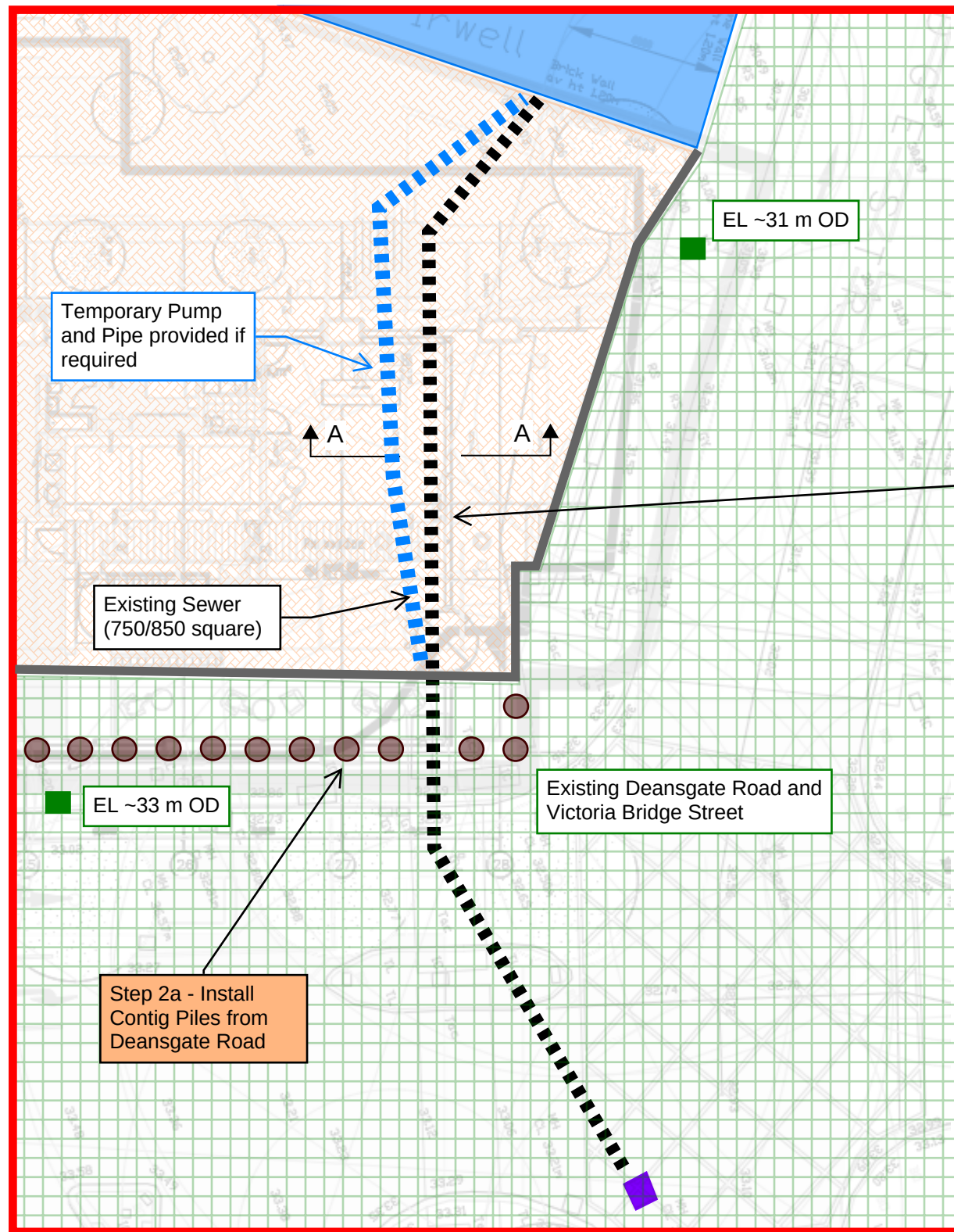
Step 1b - Existing sewer uncovered and exact position surveyed



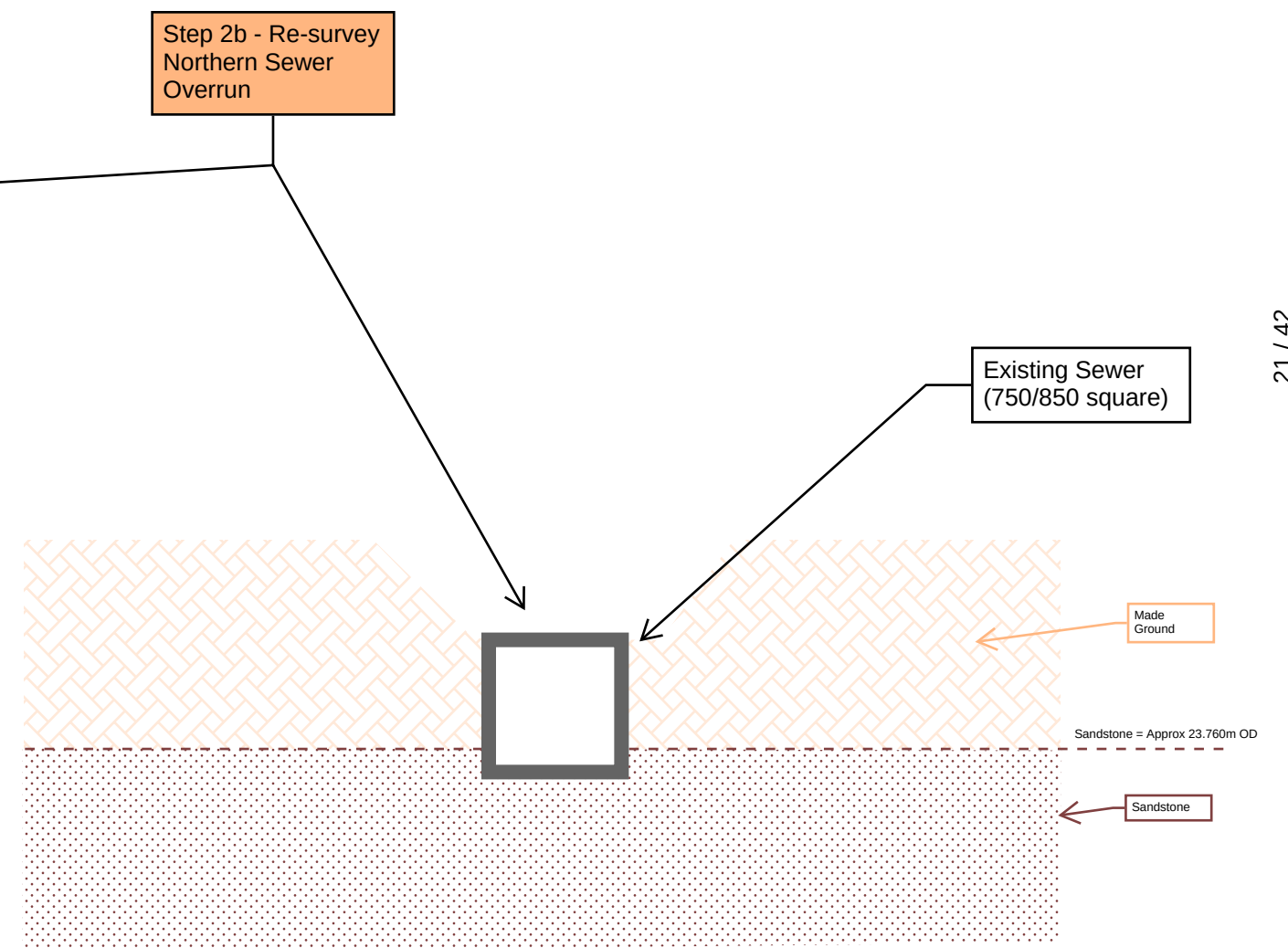
SECTION A-A

SKETCH ONLY

BG &E	DATE	PROJECT		
	SCALE	TITLE		
	GRID			
	PREPARED			
	SHEET	PROJECT No.	SKETCH No.	REV



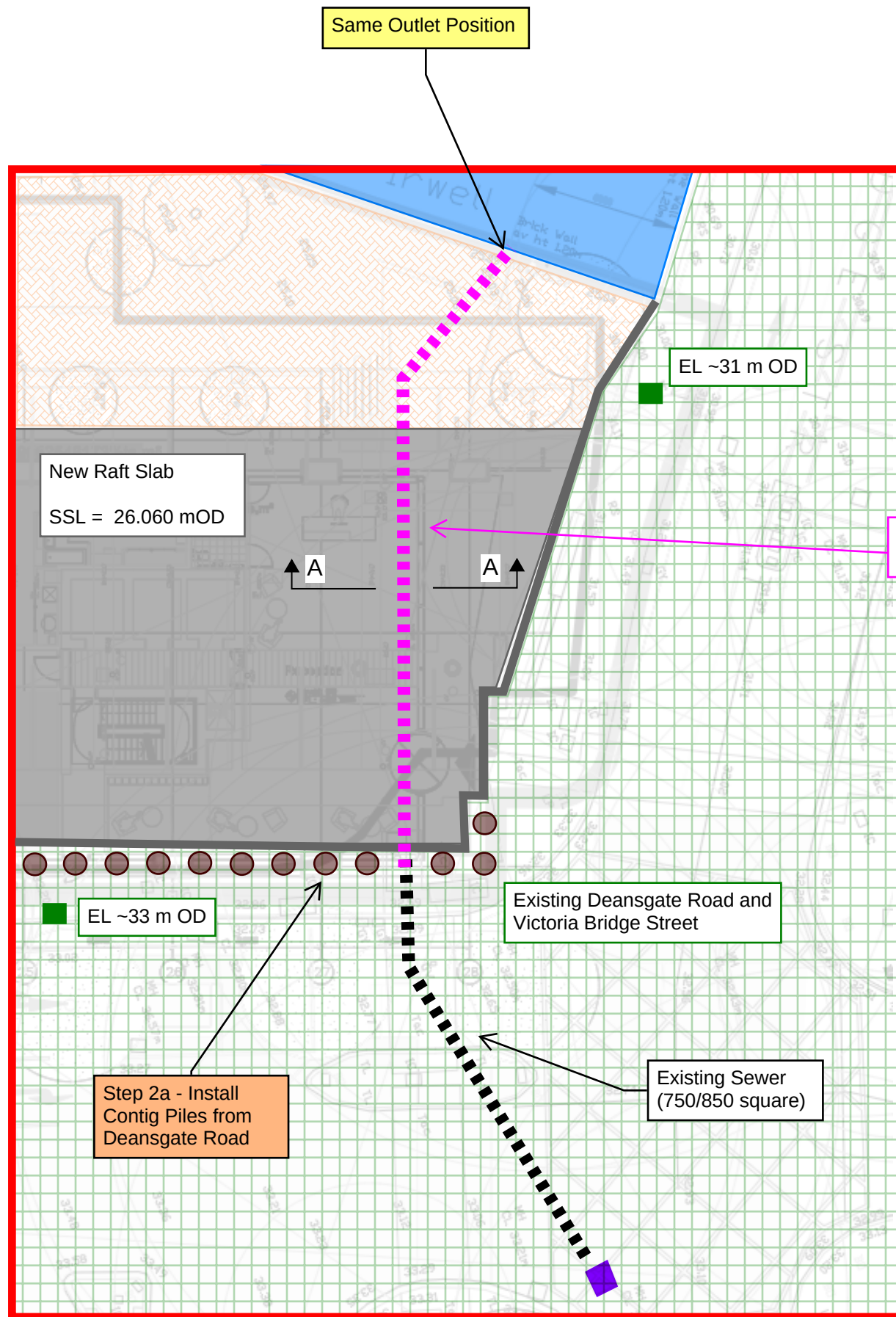
PLAN



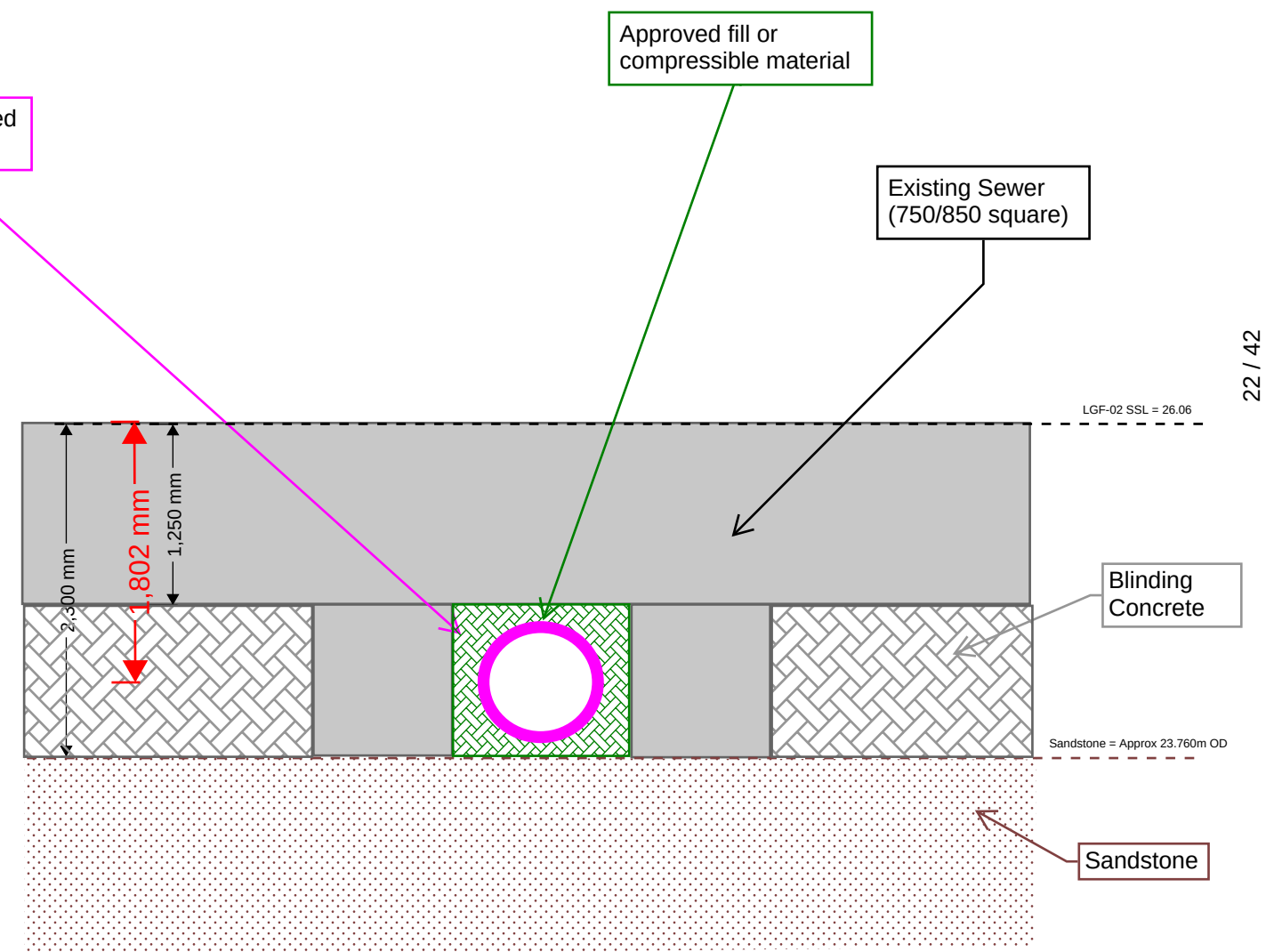
SECTION A-A

SKETCH ONLY

	DATE	PROJECT		
	SCALE	TITLE		
	GRID			
	PREPARED			
SHEET	PROJECT No.	SKETCH No.		REV



PLAN



SECTION A-A

SKETCH ONLY

	DATE	PROJECT		
	SCALE	TITLE		
	GRID			
	PREPARED			
SHEET	PROJECT No.	SKETCH No.		REV

3 - CCTV SURVEY



AquaSPEED

DRAIN SERVICES LLP

Registered Office: 171 Smallbrook Lane,
Leigh, Lancs., WN7 5PZ.
Fax: 01942 891977

Sale: 0161-976 5550 • Atherton: 01942 894878 • Bolton: 01204 366031 • Wigan: 01942 886722

**DRAIN CLEANING • EXCAVATION WORK • 24 HOUR CALL OUT • FAST EFFICIENT SERVICE
HIGH PRESSURE CLEANING • COLOUR CCTV SURVEYS • ELECTRONIC SONAR DRAIN TRACING**

PROPERTY ALLIANCE GROUP LTD
ALLIANCE HOUSE
UNIT 14 WESTPOINT ENTERPRISE PARK
CLARENCE AVENUE
TRAFFORD PARK
M17 1QS

11TH JUNE 2021

OUR REF: NH/MJ

RE: RENAISSANCE HOTEL, BLACKFRIARS STREET, MANCHESTER, M3 2EQ

CCTV SURVEY

Following the CCTV survey carried out of the culvert drain on 10.06.21, the findings are as follows:

Survey 1, overflow 1 to river 850mm pipe – on lifting this manhole we did encounter a foul smell. The sound of fast flowing water could be heard from the upstream section [from Deansgate]. This could possibly be from the CSO [**combined sewer overflow**] in Deansgate itself.

This line is in poor condition & appears to have had a repair carried out at some time in the past, as there is evidence of shuttering supports & also plywood on the top of the drain, possibly to support a concrete repair.

Survey 2, overflow 1 to CSO 750mm pipe – we can only assume this drain is coming from the CSO in Deansgate, due to the foul smell & noise of rushing water. We would be unable to high pressure water jet this drain, due to an obstruction of concrete / heavy silt, & the downstream line leads directly into the River Irwell [this could result in major pollution]. We are uncertain where the upstream section of this drain comes from. We can only assume it is from the CSO in Deansgate.

If you require any further information regarding the above, or have any queries, please do not hesitate to contact our office.

Drainage Report



Prepared For
PROPERTY ALLIANCE GROUP

Site
**RENAISSANCE HOTEL
BLACKFRIARS STREET
MANCHESTER**



AQUASPEED DRAIN SERVICES
Surveyor: SHANE HOLMES
INFO@AQUASPEED.CO.UK
01942 886722

Total Defects for Project



Total DRB Grades for Project





RENAISSANCE HOTEL - CCTV Survey Report : 10/06/21

Name :	AQUASPEED DRAIN SERVICES
Contact :	
Location :	171 SMALLBROOKE LANE
Town :	LEIGH
Region :	LANCASHIRE
Postcode :	WN7 5PZ
Email :	INFO@AQUASPEED.CO.UK
Contact Number :	01942 886722
Surveyor :	SHANE HOLMES
Valid Certification No :	EUSR579459

Client Information

Name :	PROPERTY ALLIANCE GROUP
Contact :	EMILY
Location :	
Town :	
Region :	
Postcode :	
Tel :	
Mobile :	
Email :	
Fax :	

Site Information

Name :	RENAISSANCE HOTEL
Contact :	EMILY
Location :	BLACKFRIARS STREET
Town :	MANCHESTER
Region :	
Postcode :	
Tel :	
Mobile :	
Email :	
Fax :	

Total Defects for Project



Total DRB Grades for Project



Report interpretation.

Overview:

Each section of the drainage system is allocated a score indicating areas that require attention. These areas are detailed in the Overview section on the following page and also at the bottom right of the first few pages. We use colour coding as an indicator of severity. Additional information concerning rehabilitation options/recommendations is included in the Overview page, which can also be used as an, "at a glance" indication of system condition. More in depth information for each section, including images can be found later in the report. Grade indicators are as follows:

Grade A: Drain is serviceable no recommendations required

Grade B: There is an issue that might require remedial works

Grade C: There is a defect that requires remedial works, the drain is not serviceable.

Observations:

Each section of drainage reported on (manhole to manhole for example), contains detailed information about that drain and any observations made concerning condition are detailed below the header section. The observations are colour coded and given a severity score, with more significant defects being given a higher score, using a scale from 1 to 5 as detailed below:

Severity 1 to 2: These defects may require remedial monitoring

Severity 3: These defects probably require some form of remedial works

Severity 4 to 5: Defects that will require remedial repair or replacement

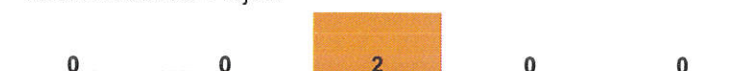
General:

The information provided is relevant at the time of survey. The coding system in this report is based on the Manual of Sewer Condition Classification, 5th edition (MSCC5) domestic codes (BS EN 13508-1:2003). This is the official standard for the water industry.

The severity system is based on significant experience in general practice and the 1-5 grades represent the severity of individual defects: 5 representing a more serious defect.

Please feel free to contact us for further explanation or pricing for remedial works required.

Total Defects for Project



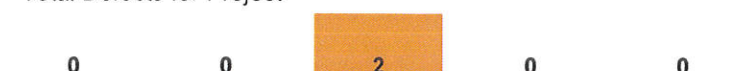
Total DRB Grades for Project



Overview

Section: 1 From: OV 1 To: RIVER	ON LIFTING THIS MANHOLE WE DID GET A FOUL SMELL COMING THROUGH IT,AND ALSO YOU CAN HERE THE SOUND OF FAST FLOWING WATER FROM UP STREAM WHICH FROM DEANS GATE THIS COULD POSSIBLY COME FROM THE CSO IN DEANS GATE ITSELF.THE LINE IS IN POOR CONDITION AND HAS HAD A REPAIR AT SOME TIME IN ITS LIFE WITH THE EVIDENCE OF THE SHUTTERING SUPPORTS AND THE PLY WOOD ON THE ROOF OF THE DRAIN POSSIBLY TO SUPPORT A CONCRETE REPAIR.	DRB Grade: B Pipe Size: 850 Material: Other (Record in remarks) Use: Other
Section: 2 From: OV1 To: CSO	WE CAN ONLY ASHUME TIS DRAIN IS COMING FROM THE CSO IN DEANS GATE DUE TO THE FOUL SMELL AND THE NOISE OF RUSHING WATER,WE WOULD NOT BE ABLE TO HIGH PRESSURE WATER JET THIS LINE TO IS THE OBSTRUCTION IS CONCRETE OR HEAVEY SILT DUE TO THE DOWN STREAM LEADING DIRECTLY INTO THE RIVER IRWELL WHICH COULD CAUSE MAJOR POLLUTING AS WE ARE UNSURE WEAR THE UP STREAM OF THIS DRAIN COMES FROM WE CAN ONLY SUMISE IT IS FROM THE CSO (COMBINED SEWER OVERFLOW) IN DEANS GATE.	DRB Grade: B Pipe Size: 750 Material: Other (Record in remarks) Use: Other

Total Defects for Project



Total DRB Grades for Project



Site: BLACKFRIARS STREET, MANCHESTER

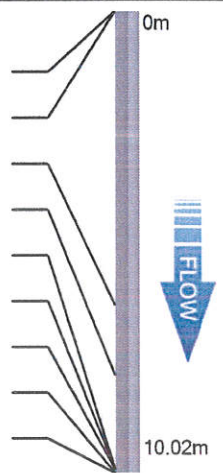
Section 1

Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
EMILY	BLACKFRIARS STREET	MANCHESTER		SHANE HOLMES	10/06/2021
Start Node Ref:	OV 1	Finish Node Ref:	RIVER	Direction:	D
Start Node Depth:	1.88	Finish Node Depth:	0.00	Use:	Z
Start Node Coordinate:		Finish Node Coordinate:		Material:	Z
				Cleaned	N

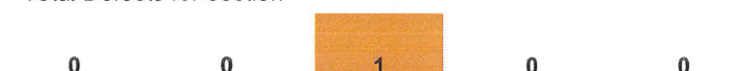
Node Type	Cover Condition	Benching Condition	1/2 Channel Condition	Node Condition Remarks
MH	Inadequate X	Missing X	Missing X	

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	General Remarks
A				D	N	10.02	STONE

Position	Code	Description	CD	Pic	Video Ref	
00.00m	MH	Start node type, manhole		0_0		
00.00m	WL	Water level 0%			0:00:00	
06.38m	REM	General remark		0_2	0:00:52	
07.90m	REM	S1 General remark	S1	0_3	0:01:28	
09.95m	MC	Material of drain/sewer changes		0_4	0:01:56	
09.95m	REM	General remark		0_5	0:02:19	
09.95m	OB	Other obstacles 20%			0:03:13	
10.02m	REM	F1 General remark	F1	0_-3	0:01:28	
10.02m	SA	Survey abandoned				



Total Defects for section



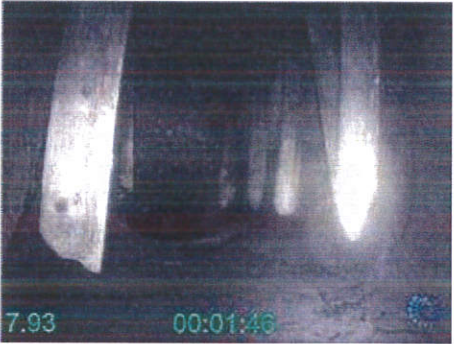
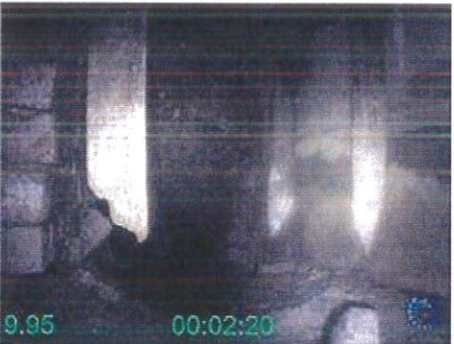
DRB Grade for Section

B



Descriptive Report with Remarks and Observation Images

Section 1

Pos	Video Ref	Code	Description	Image
00.00m		MH	Start node type, manhole OV 1	Image Provided - Ref: 0_0  6.38 00:01:02
00.00m	0:00:00	WL	Water level: 0% Height/Diameter	
06.38m	0:00:52	REM	General remark ply wood shuttering on the roof of the drain	Image Provided - Ref: 0_2  7.93 00:01:46
07.90m	0:01:28	S1 REM	General remark 7.9m - 10.02m support for shuttering	Image Provided - Ref: 0_3  9.95 00:02:20

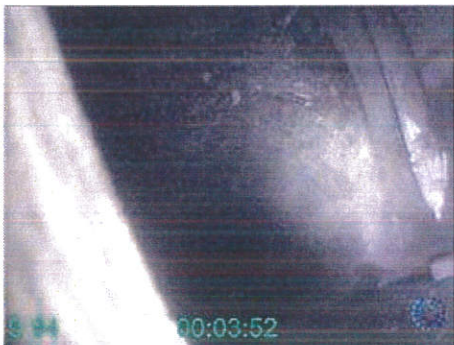
Total Defects for section



DRB Grade for Section

B



Pos	Video Ref	Code	Description	Image
09.95m	0:01:56	MCBR	Material of pipe changes to Brick	Image Provided - Ref: 0_4 
09.95m	0:02:19	REM	General remark bricks missing	Image Provided - Ref: 0_5 
09.95m	0:03:13	OB	Other obstacles: 20% Cross sectional area loss - Severity 3 support for shuttering will not let the camera past the brick drain can be seen in the distance	
10.02m	0:01:28	F1 REM	General remark Defect End support for shuttering	
10.02m		SA	Survey abandoned UNABLE TO PASS SUPPORT BEAM FOR SHUTTERING	

Total Defects for section



DRB Grade for Section





Site: BLACKFRIARS STREET, MANCHESTER

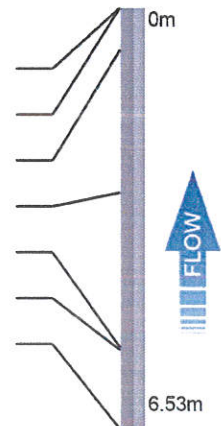
Section 2

Client: EMILY	Location (Street Name): BLACKFRIARS STREET	City/Town/Village MANCHESTER	Cust Job Ref.	Surveyors Name: SHANE HOLMES	Date: 10/06/2021
Start Node Ref: OV1	Finish Node Ref: CSO	Direction: U	Height/Dia: 750	Start Node Depth: 1.88	Finish Node Depth: 0.00
Start Node Coordinate:	Finish Node Coordinate:	Use: Z	Shape: R	Material: Z	Cleaned N

Node Type	Cover Condition	Benching Condition	1/2 Channel Condition	Node Condition Remarks
MH	Inadequate	Missing	Missing	THIS MANHOLE IS OFFSET TO THE DRAIN

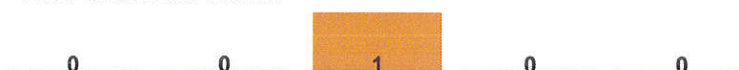
Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	General Remarks
A				D	N	6.53	STONE

Position	Code	Description	CD	Pic	Video Ref
00.00m	MH	Start node type, manhole			
00.00m	WL	Water level 0%			0:00:00
00.65m	LLQ	Line of drain/sewer deviates left [quarter]			0:00:12
02.86m	REM	General remark	1_3		0:00:33
05.26m	SC	Dimension of drain/sewer changes : 0mm	1_4		0:01:24
05.30m	OB	Other obstacles 20%			0:01:24
06.53m	SA	Survey abandoned			



Total Defects for section

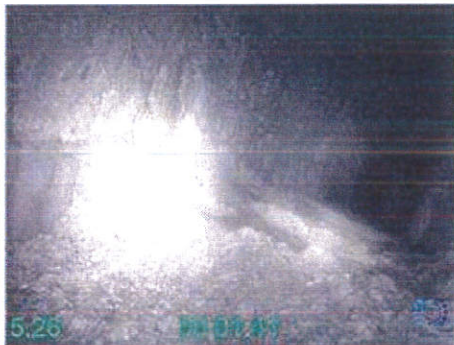
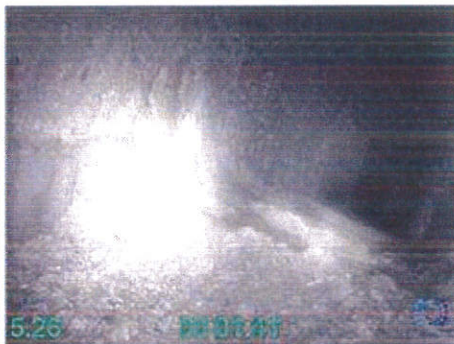
DRB Grade for Section





Descriptive Report with Remarks and Observation Images

Section 2

Pos	Video Ref	Code	Description	Image
00.00m		MH	Start node type, manhole OV1	
00.00m	0:00:00	WL	Water level: 0% Height/Diameter	
00.65m	0:00:12	LLQ	Line of drain/sewer deviates left [quarter]	
02.86m	0:00:33	REM	General remark TOP OF DRAIN IS A FLAT TOP AT THIS POIN	Image Provided - Ref: 1_3 
05.26m	0:01:24	SC	Dimension of drain/sewer changes: 0mm Diameter	Image Provided - Ref: 1_4 
05.30m	0:01:24	OB	Other obstacles: 20% Cross sectional area loss - Severity 3 POSSIBLE CONCRETE IN THE INVERT 20%	
06.53m		SA	Survey abandoned UNABLE TO PASS OBSTRUCTION	

Total Defects for section



DRB Grade for Section

B

A guide to defects and other observations in drainage systems

More detailed information can be found in the National Standard (BS EN 13508-1:2003) and in the Manual of Sewer Condition Classification (MSCC) 5th Edition, written by the Water Research Centre (WRc).

Use	
Code	Description
C	Combined
F	Foul
S	Surface Water
T	Trade Effluent
W	Culverted Watercourse
Z	Other

Common Materials	
Code	Description
VC	Vitrified Clay
PVC	Polyvinyl Chloride
CO	Concrete
CI	Cast Iron
PF	Pitch Fibre
PE	Polyethylene
DI	Ductile Iron

Start Node	Description	Finish Node
MH	Manhole	MHF
IC	Inspection Chamber	ICF
GY	Gulley	GYF
RE	Rodding Eye	REF
SK	Soakaway	SKF
BN	Buchan Trap	BNF
BR	Major Connection without Ref	BRF
CP	Catch Pit	CPF
OC	Other Special Chamber	OCF
OF	Outfall	OFF
OS	Oil Separator	OSF
WR	Major Connection without mh	WRF
LH	Lamphole	LHF

Code	Observation	Description	Attributes
B	Broken	Pieces pipe have visibly moved	Defined by clock references. Associated with deformity in rigid pipe 
CC CL CM CR	Cracks	Cracks are break lines that are not visibly open	Defined by clock reference position/s. Longitudinal and radiating cracks attract only one clock reference 
CN	Connection	Lateral pipe has been connected after original construction	Described by clock reference position and diameter 

Total Defects for section



DRB Grade for Section





CX(I)	Defective Connection (Intruding)	Defective by intrusion or damage due to factors including: cracks, fractures, obstruction, position etc	Described by clock reference position and diameter (+ % intrusion)	
CU	Loss of Vision	Lens of camera is obscured by debris, water etc. Operator is unable to see drain clearly	"W" can be added if loss of vision is due to water	
D	Deformed	Pipe has lost its structure	Described by percentage loss of height or width. Recorded in 5% increments	
DEE	Deposits Encrustation	Eg. Attached scale deposits evident	Described by clock referenced position and percentage loss of cross-sectional area (5% increments)	
DEG	Deposits Grease	Attached grease deposits evident	Described by clock referenced position and percentage loss of cross-sectional area (5% increments)	
DER DES	Deposits Coarse/Fine	Settled deposits on the invert of the pipe.	Described by percentage loss of height or diameter. Recorded in 5% increments.	
FC FL FM FR	Fractures	Fractures are visibly open. Pieces of pipe have not moved	Defined by clock reference position/s. Longitudinal and radiating fractures attract only one clock reference	
H	Holes	Section of pipe fabric is missing	Defined by clock reference location. Normally two clock references	
I	Infiltration	Water is infiltrating the pipe, normally via a joint but could be via another defect	Can be described in Remarks using terms such as Seeper, Dripper and Runner	
JDL	Joint Displaced Large	Pipe has moved at joint, perpendicular to axis of pipe	More than 1.5 times the pipe wall thickness must be visible	

Total Defects for section



DRB Grade for Section





JDM	Joint Displaced Medium	Pipe has moved at joint, perpendicular to axis of pipe	Between 1 and 1.5 times the pipe wall thickness must be visible	
JN	Junction	Lateral pipe was installed at construction	Described by clock reference position and diameter	
JX	Defective Junction	Lateral pipe was installed at construction but is defective in some way	Joint can be defective due to factors including: cracks, fractures, obstruction, position etc	
LD LU LL LR	Line Deviation	LD = Line Down, LU = Line Up, LL = Line Left, LR = Line Right. Not related to CIPP lining.	Additional modifiers are added: Q = Quarter (22.5), H = Half (45), F = Full (90). In degrees.	
LC	Lining Changes	If the drain is lined, the lining material has changed	Position of lining material change	
MC	Material Change	The pipe material has changed	Position of change is noted. Type of material change can be defined	
OB	Obstruction/Obstacle	An obstruction or obstacle is affecting the flow through the pipe	Described in percentage loss of cross-sectional area	
OJL	Open Joint Large	Pipe has moved at joint, along the axis of pipe	More than 1.5 times the pipe wall thickness must be visible	
OJM	Open Joint Medium	Pipe has moved at joint, along the axis of pipe	Between 1 and 1.5 times the pipe wall thickness must be visible	
PC	Pipe Length Changes	Length of individual pipe changes	New length described at this position	

Total Defects for section

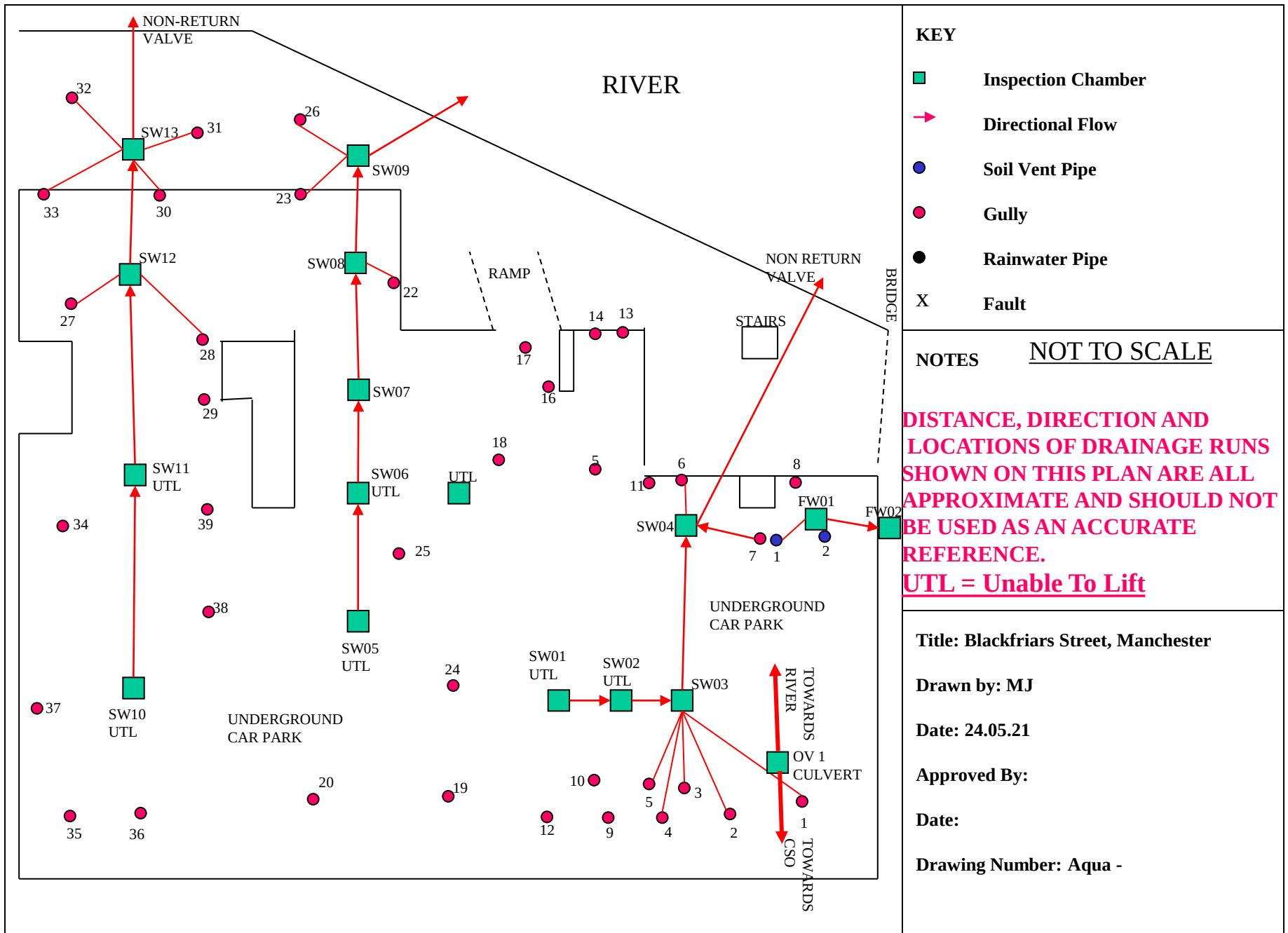


DRB Grade for Section





R	Roots	Evidence of root ingress	Roots will normally infiltrate via bad joints, cracks, fractures, breaks etc	
REM	Remark	General remark	Used for additional information	
S	Surface Damage	This might include corrosion, spalling and chemical attack	Position only. Additional information can be added in Remarks	
SA	Survey Abandoned	Used when a survey cannot continue for any reason	The reason for abandoning a survey should be noted in the remarks area	
SC	Shape Changes	Dimension of drain changes	Diameter dimension change recorded. Second dimension is recorded for no circular pipe changes	
SR	Sealing Ring	Sealing ring intrudes into pipe at joint	Described by clock reference position	
V	Vermin	Evidence of Vermin in pipe	Can also be used for evidence within manhole etc	
WL	Water Level	Used to record changes in water level. Always shown at the beginning of every survey, if dry noted as 00.	Described by percentage of height or diameter. Recorded in 5% increments	
XP	Collapsed	Drain is suffering from complete loss of structural integrity. Always followed by SA - Survey Abandoned	Percentage loss of cross-sectional area is recorded. Other related structural defects are not recorded	



warren chan

40
peter street,
Manchester,
M2 5GP

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: C1405
Our Ref: UUPS-ORD-250037
Date: 19/02/2021**

Dear Sirs

Location: FLAT 101 1 DEANSGATE, MANCHESTER, M3 1AZ

I acknowledge with thanks your request dated 11/02/2021 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



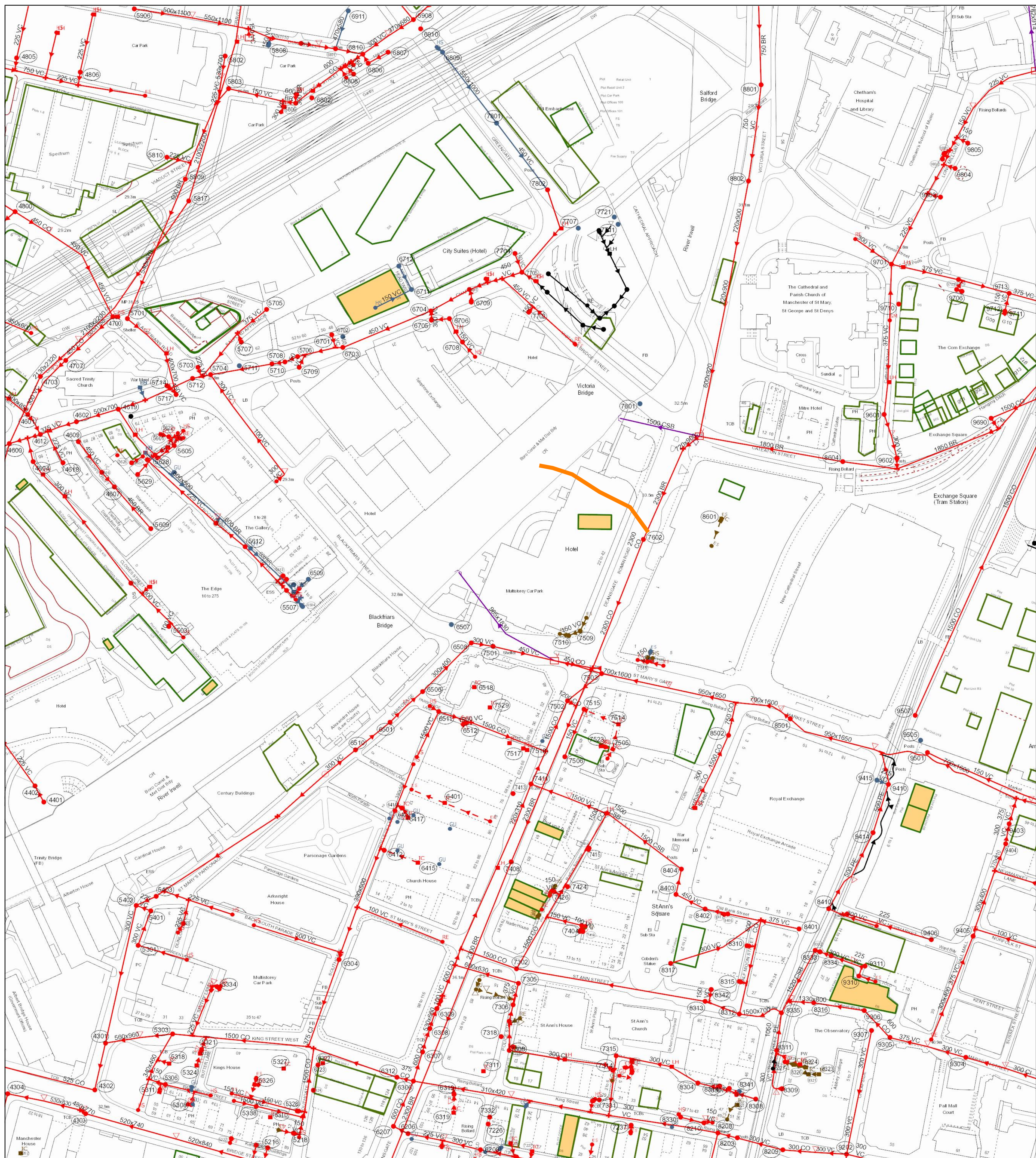
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



Refno	Cover	Func	Invert	Size x	Size y	Shape	Mat	Length	Grad
7334	8801	29.58	CO	22.78	750	VC	2.02999	26.1725	1 in 186
8306	35.83	CO	31.04	600	VC	16.76305	1 in 186	1 in 4	
8802	30.85	BR	27.72	750	VC	71.9991	22.3584	20.61553	
6709	26.74	CO	24.17	375	VC	13.17195	6.324555	13.17195	
6911	29.34	BR	22.58	470	BR	22.584	11.04455	19.72096	
8330	34.17	CO	31.1	100	VC	13.17195	6.324555	13.17195	
8628	29.27	CO	24.17	375	VC	20.61553	32.9269	48.70318	
7704	26.7	CO	24.72	150	VC	11.04455	19.72096	7.615773	1 in 19
6312	35.69	CO	30.65	1500	VC	2.230988	10.99886	17.81811	1 in 88
7404	26.74	CO	24.17	375	VC	10.99886	17.81811	15.97272	1 in 25
5709	27.23	CO	24.28	150	VC	4.836473	15.29706	40.28788	1 in 204
9802	34.02	CO	31.52	150	VC	30.4795	22.4722	17.81811	1 in 88
8309	35.66	CO	31.91	600	VC	8.94272	10.99886	10.99886	
7151	26.74	CO	24.17	375	VC	15.29706	40.28788	15.29706	
6206	35.66	CO	31.91	600	VC	8.94272	10.99886	10.99886	
7510	26.74	CO	24.17	375	VC	4.836473	15.29706	40.28788	
6801	29.48	BR	28.22	150	VC	15.29706	40.28788	15.29706	
8401	37.17	CO	28.79	375	VC	40.28788	15.29706	15.29706	
9609	29.61	BR	24	450	VC	30.4795	22.4722	17.81811	
4800	29.92	CO	26.98	450	VC	22.4722	17.81811	15.29706	
5402	33.56	VC	28.24	300	VC	17.81811	15.29706	15.29706	
7411	36.15	VC	25.52	1500	VC	19.69772	10.99886	10.99886	
7352	36.54	CO	0	1500	VC	10.99886	17.81811	15.29706	
7424	33.56	VC	28.24	300	VC	17.81811	15.29706	15.29706	
4800	29.92	CO	27.47	450	VC	12.04159	1 in 63	1 in 63	
8310	35.66	CO	31.91	600	VC	4.474555	6.119659	2.87207	
7356	26.65	CO	22.54	300	VC	4.231385	11.07758	21.45093	1 in 58
6207	37.8	CO	32.62	400	VC	11.07758	21.45093	12.64911	1 in 1
4609	27.31	CO	0	450	VC	18.14339	6.37287	16.73169	1 in 107
9601	35.16	CO	27.65	375	VC	12.64911	16.73169	38.58165	
8410	38.23	CO	28.36	300	VC	38.58165	16.73169	38.58165	
8334	38.23	CO	28.36	300	VC	38.58165	16.73169	38.58165	
7602	28.97	CO	25.58	150	VC	6.40555	10.99886	10.99886	
5707	28.24	CO	0	375	VC	6.40555	10.99886	10.99886	
7356	35.55	BR	36.44	600	VC	6.40555	10.99886	10.99886	
9307	38.74	CO	36.62	300	VC	6.40555	10.99886	10.99886	
8806	28.38	CO	0	225	VC	5.83952	12.64911	12.64911	
9706	35.3	CO	0	150	VC	3.16278	2.498542	26.65333	1 in 167
5222	33.01	CO	27.17	150	VC	26.65333	25.58752	45.97192	1 in 1279
6703	26.85	CO	22.32	450	VC	45.97192	4.180113	30.9151	1 in 67
9713	35.8	CO	31.34	375	VC	30.9151	27.313	3.514048	1 in 258
6207	35.66	CO	31.53	600	VC	27.313	8.139123	41.23106	1 in 117
7410	35.66	CO	31.53	600	VC	8.139123	41.23106	10.99886	
5809	28.93	CO	23.64	600	VC	10.99886	17.81811	15.29706	
6207	35.66	CO	31.53	600	VC	10.99886	17.81811	15.29706	
5612	27.09	CO	22.75	225	VC	20.61553	32.9269	48.70318	
9603	35.66	CO	31.53	600	VC	48.69943	10.99886	10.99886	
9406	36.23	CO	37.53	225	VC	48.69943	10.99886	10.99886	
8304	37.03	CO	33.07	300	VC	10.20953	6.40555	10.99886	
4401	28.97	CO	25.58	150	VC	6.40555	10.99886	10.99886	
4601	27.55	CO	21.78	800	VC	6.40555	10.99886	10.99886	
6712	28.97	VC	25.58	150	VC	14.74462	8.828272	7.28011	
5206	28.97	VC	25.58	150	VC	7.28011	14.74462	4.123106	
4612	28.97	VC	25.58	150	VC	4.123106	10.99886	10.99886	
5808	30.45	SW	23.57	150	VC	10.99886	17.81811	15.29706	
8313	36.83	CO	31.53	600	VC	10.99886	17.81811	15.29706	
5806	28.87	CO	23.18	225	VC	10.99886	17.81811	15.29706	
6306	35.83	CO	0	375	VC	9.219544	17.81811	15.29706	
7408	36.08	BR	24.1	2300	VC	17.81811	15.29706	15.29706	
4700	28.07	CO	24.6	600	VC	17.81811	15.29706	15.29706	
6703	26.85	CO	22.32	450	VC	10.01802	54.34251	12.52996	1 in 9
7822	26.6	CO	27.12	450	VC	54.34251	12.52996	12.52996	
5701	28.18	CO	23.28	660	VC	14.21267	12.52996	12.52996	
6703	26.85	CO	22.32	450	VC	12.52996	14.21267	12.52996	
7822	26.6	CO	27.12	450	VC	12.52996	14.21267	12.52996	
6808	28.46	CO	27.2	150	VC	6.47294	16.73169	16.73169	
8317	36.69	CO	31.53	600	VC	16.73169	16.73169	16.73169	
8406	36.69	CO	31.53	600	VC	16.73169	16.73169	16.73169	
9305	39.21	CO	31.37	150	VC	20.51628	1.642787	20.51628	
5626	27.59	CO	0	150	VC	7.196777	1.642787	1.642787	
5714	35.66	CO	31.53	600	VC	1.642787	1.642787	1.642787	
4618	27.59	CO	0	225	VC	1.642787	1.642787	1.642787	
7801	27.03	SW	0	450	VC	46.4043	1.642787	1.642787	
5505	28.81	CO	23.18	225	VC	7.071068	1.642787	1.642787	
5301	33.38	CO	32.3	300	VC	20.24846	1.642787	1.642787	
5806	31.54	BR	0	300	VC	32.36027	1.642787	1.642787	
7426	36.74	CO	28.36	450	VC	4.539997	1.642787	1.642787	
8209	36.67	CO	33.53	400	VC	14.31782	1.642787	1.642787	
5817	28.86	CO	0	2100	VC	25.91794	1.642787	1.642787	
8402	36.68	CO	28.51	450	VC	99.63259	1.642787	1.642787	
6410	36.68	CO	28.51	450	VC	17.88584	1.642787	1.642787	
5601	35.35	CO	26.37	300	VC	57.17316	1.642787	1.642787	
6501	35.35	CO	26.37	300	VC	5.747467	1.642787	1.642787	
5502	26.94	CO	22.94	300	VC	12.72792	1.642787	1.642787	
5608	27.78	CO	22.94	300	VC	10.19094	1.642787	1.642787	
5507	26.56	SW	25.18	150	VC	86.17817	1.642787	1.642787	
6504	28.53	SW	26.18	150	VC	5.070491	1.642787	1.642787	
4302	32.79	CO	26.98	625	VC	2.828427	1.642787	1.642787	
7308	36.39	CO	30.99	375	VC	4.101243	1.642787	1.642787	
5706	27.27	CO	22.27	450	VC	10.9346	1.642787	1.642787	
6809	27.61	SW	23.82	550	VC	16	1 in 67	1 in 226	
7333	33.61	SW	23.82	550	VC	7.071068	1.642787	1.642787	
8210	26.85	CO	22.52	450	VC	49.20366	1.642787	1.642787	
7705	26.85	CO	22.52	450	VC	1.5852611	1.642787	1.642787	
6506	34.94	CO	28.18	300	VC	1.413899	1.642787	1.642787	
6508	34.1	CO	24.8	300	VC	1.59125	1.642787	1.642787	
9415	36.02	SW	35.66	225	VC	38.15377	1.642787	1.642787	
9414	36.02	CO	32.15	500	VC	12.16553	1 in 243	1 in 243	
7503	36.02	CO	32.15	500	VC	6.626892	1 in 35	1 in 35	
4806	36.02	CO	32.15	500	VC	27.83223	1 in 58	1 in 58	
5509	26.85	CO	24.49	150	VC	13.0147	9.66	7.071068	
8401	37.17	CO	28.79	375	VC	7.071068	9.66	7.071068	
5303	33.64	CO	28.4	1500	VC	5.83952	1 in 49	1 in 49	
4707	27.81	PVC	24.5	450	VC	12.86265	1 in 44	1 in 44	
6307	35.94	CO	30.93	600	VC	18.10777	1 in 56	1 in 56	
4608	27.21	BR	10.62015	0	VC	6.48281	7.28011	7.28011	
7502	36.25	CO	28.01	1200	VC	7.28011	7.28011	7.28011	
9603	35.66	CO	31.53	600	VC	11.40175	7.28011	7.28011	
9310	27.25	CO	23.5	225	VC	14.39183	7.28011	7.28011	
6708	26.74	CO	26.2	150	VC	7.28011	14.39183	14.39183	
6510	26.72	CO	25.98	150	VC	7.28011	14.39183	14.39183	
6908	26.01	CO	24.37	370	VC	4.24264	1 in 17	1 in 17	
7306	36.62	CO	30.52	375	VC	16.64332	1 in 206	1 in 206	
9306	36.62	CO	30.52	375	VC	12.36932	1 in 189	1 in 189	
9306	36.62	CO	30.52	375	VC	28.3249	1 in 49	1 in 49	
4303	33.01	CO	25.94	490	VC	2.21544	1 in 49	1 in 49	
5706	27.2	CO	22.28	450	VC	1.414214	1 in 46	1 in 46	
9202	36.78	CO	34.41	300	VC	7.615773	1 in 38	1 in 38	
6812	30.12	CO	26.78	560	VC	8.97503	1 in 46	1 in 46	
7503	36.02	CO	30.52	375	VC	24.07741	1 in 36	1 in 36	
9701	34.81	CO	28.63	375	VC	37.52708	1 in 36	1 in 36	
6810	28.35	CO	24.35	300	VC	7.53953	1 in 36	1 in 36	
7503	36.02	CO	30.52	375	VC	6.954919	1 in 36	1 in 36	
9403	40.08	CO	28.5	150	VC	7.28011	14.39183	14.39183	
5629	40.08	CO	28.5	150	VC	7.28011	14.39183	14.39183	
9405	40.4	CO	35.98	225	VC	2.230988	1 in 79	1 in 79	
7314	36.91	CO	32.86	225	VC	5	1 in 79	1 in 79	
9803	34.6	CO	31.44	150	VC				



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