

Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Our ref.: 23453-TW1

15TH August 2023

F.A.O. Umar Saber - Asset Protection Civil Engineer.

RE:- Cranwood House, 100 Woodside Avenue, Haringey, London N10 3JA.

Further to your e-mail dated 27th June 2023 regarding the above, and subsequent queries raised on 02nd August 2023, we wish to respond to the queries raised as follows; -

TWUL Comments on 27/06/2023

MWP Responses on 11/07/2023

TWUL Further comments on 02/08/2023

MWP Responses 14/08/2023

1. Have the pile setting out tolerance, pile verticality and asset survey error been considered in setting out the exclusion zone?

Response – Yes they have been included.

Given the piles will be constructed in close proximity to the sewer, any deviation in the assumed sewer alignment may result in direct clash between the piles and the sewer. It is noted that the survey for the 300mm sewer could not be completed due to blockage. Please clarify how you validate the line and level of the sewer adopted in the design and assessment. The pipe was obstructed but not blocked as sewage continues to flow through the pipe, the obstructions did not allow the camera to pass, but we have been informed that a Sond pipe locator could pass the obstructions. In any event it is unlikely given the pipe depth that the line would have deviated more than 300 to 400mm. The 1.5m wayleave is not related to the inaccuracy of the pipe but is the minimum width required to excavate to the pipe in the event that it requires repair or replacement.

2. Please state the minimum vertical and horizontal clearances between the proposed foundation and the extrados of asset on the cross-sections.

Response – These are included on the Cross-section drawings.

The requested information regarding vertical and horizontal clearances are not shown on the cross-sections. Only the exclusion zones are currently shown on the drawings. Please update the cross-sections.

The required information has been clarified on the drawings.

3. Please include a copy of CCTV survey report as an appendix.

Response - A copy will be sent by data transfer due to its size.

Noted (see further comment on Item 1 above)

Noted

4. It is important to review the repair and maintenance history of the clean water assets around the site (TBC by TWUL)

Response – We would expect Thames Water to have reviewed this information when reviewing the report. Please provide the required information for our review.

TBC by TWUL

Noted

5. Post condition survey for both 300mm sewer and the masonry tunnel will be required.

Response – Noted, an end of project survey will be carried out.

Noted

6. Vibration monitoring is required. Please provide the proposed monitoring plan (including trigger levels and action plans).

Response – CFA piling is considered vibrationless when used in Clays such as the London Clay likely to be encountered on this site. As there are no sands or gravels sleeving of the bore should not be required, therefore the vibration will be limited to that produced by the Piling Rig engine. We have been given the following advise from the Piling Contractor. “The PPV produced varies greatly between pile construction techniques. The least disruptive method of pile construction from a noise and vibration perspective is CFA piling, which produces less than 3mm/s PPV”. Due to the depth and horizontal distance of the TW Utility the vibration will be reduced by the soil taking the PPV of 3 at ground level and using a minimum distance to the utility of 3.35m the PPS at the utility would be 0.89 mm/s. This is below the require PPV of 2 mm/s outlined in the TW Guidance.

It is understood that those piles within the zone of influence will be sleeved and please confirm the predicted vibration level.

Also, earthworks will be undertaken around the masonry service tunnel and hence there is a need for vibration monitoring. It should be noted that compaction of the soil within the zone of influence of the masonry service tunnel should be undertaken by non-vibratory method.

Sleeving of the piles involves installing a “cardboard Sleeve” to reduce soil friction, this is achieved by either open boring of the top section and installing an oversized sleeve or stopping concrete filling and inserting the sleeve before completing the concrete filling, therefore there is no increase in vibration. We confirm that any compaction will be carried out using non vibratory equipment. We have indicated the location of vibration monitoring points and the associated trigger levels on drawing no. 0101- site constraints drawing. The trigger levels will be:

- 0 - 5 mm/s = Green – carry on.
- 6 - 7 mm/s = Amber – review & monitor.
- > 8 mm/s = Red – stop & review.

7. An Emergency Preparedness Plan (EPP) is required.

Response – This will be prepared by the contractor.

Section 4 – What are the amber and red trigger levels?

Section 4 – Additional vibration monitors are expected along the sewer and the masonry service tunnel.

As per 6 above.

Section 6 – Post condition survey is required for the masonry service tunnel.

Noted

8. Page 11 – The C760 method is for the calculation of ground movement due to wall installation (i.e. a row of piles) and hence it is not appropriate to be used for assessing single pile installation effect. The 'wall depth' relates to 'total length of pile' and not the excavation depth to the bottom of the TWUL asset.

Response – The process of excavating CFA piles means that no soil is removed until the concrete is injected. As a result the bore is supported during the entire process, it is correct that the data from CIRIA Report C760 relates to Contiguous piled walls however the advice provided by New et al refers the reader to C760 as a guide. An alternative reference is the graph of "Shaft sinking induced settlement" produced by National Grid/London Power Tunnels which suggests that for shafts of 6.5m diameter or less the Settlement/Excavation Depth varies from 0.03% at $d/H = 0$ and reduces to zero at d/H of 1.0. In reality given the method of construction and the pile diameter coupled with the distance from the pipe soil arching is likely to override and expansion or contraction from the pile bore, research by Poulos et al indicates that any expansion or contraction from the boring operation from a single pile does not last for long after the piling operation has been completed and the pore filled with concrete. Bearing the above in mind we have taken what we consider a conservative approach and believe we have overestimated the actual impact on the Asset.

Noted

9. Page 11 – It is important to note that a gradient (slope) assessment approach is fundamentally flawed when assessing continuous linear structures (e.g. pipes). It is because it is the axial and flexural strain (curvature) which causes damage to the utilities. Gradient (slope) does not have any relations to these parameters.

Response – The purpose of determining the gradient slope (bearing in mind this is horizontal not vertical) is to assess possible joint rotation. The slope determined is equivalent to a potential rotation of 0.05° which is well below the maximum of 1.0° recommended for a pipe of this diameter.

It is important to note that flexural displacement (i.e. resultant of vertical and lateral displacements) is used to calculate curvature and associated changes in strain and joint rotation. Your calculated joint rotation only considers $\frac{1}{2}$ of the total joint rotation. Also, the change in strain has to be considered.

Doubling the rotation would bring the rotation to 0.1° . We have assessed the transverses strain as per the formula of Choy and New provided below. This indicates that the transverse strain is within the limits set by Thames Water.

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		23453	
		PROJECT	
		Cranwood House	
SUBJECT	Pressure on Buried Pipelines	DATE	CHECKED
		14/08/2023	TM
REFERENCE	DESIGN CALCULATIONS		OUTPUT
These calculations are based on the recommendations of Choy and New			
Pipe Diameter (m)	Pipe Depth (m)	Soil Density (kPa)	Increased Pressure (kPa)
0.3	5.4	19	6
Increased Moment on Pipe run (M)	= $[w(1-K_0)r/8]$	$W = 2\sigma_v r$	
	= $\sigma_v r^2(1-K_0)/4$		
M/I	= $2Ee/t$	$E = \sigma_v/\epsilon$	$I = t^3/12$
E = Youngs Modulus GPa	= 7	t = pipe thickness	Ko
		= 0.02	0.6
		Pipe Radius	
		= 0.150	
Transverse Crushing strain	= $[\sigma_v r^2(1-K_0)/4]/8IE$		
	= $3\sigma_v r^2(1-K_0)/2Et^2$		
		28.93	
Limits on Increase in Axial strain			
	Pipe Diameter	Tension	Compression
Vitrified Clay	<125	80	400
	>125	80	400
Concrete (unreinforced)	<225	20	400
	225 – 750	40	400
	>750	60	400

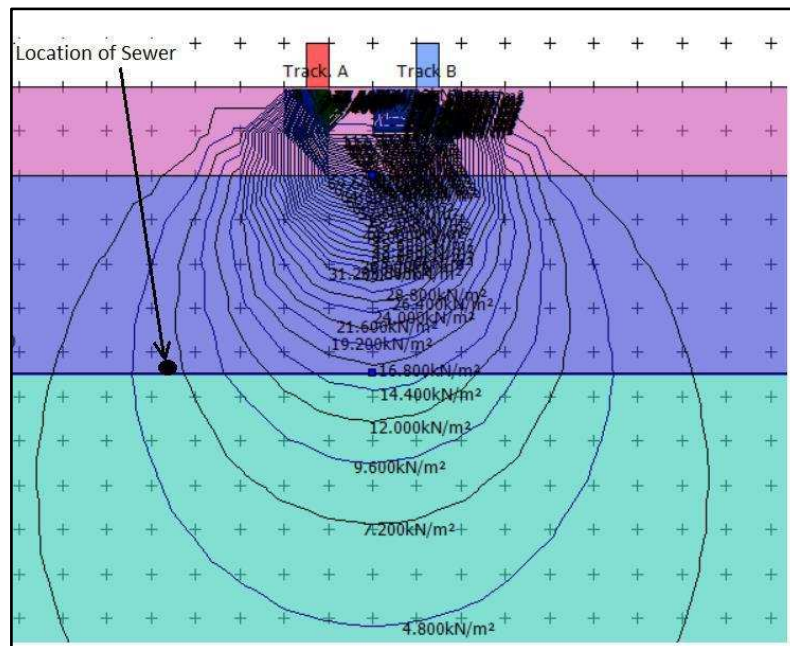
10. Page 12 – Klemm 709 piling rig is to be used for the piling works (see piling RAMS). For the size of this piling rig, a track bearing pressure of 240kPa is unexpectedly high. Please explain how you calculate the maximum track bearing pressure and provide the datasheet for the piling rig.

Response – While the intention is to use a Klemm 709 rig it is not unusual for the piling contractor to change rigs depending on what is available when the works commences. The loading of 240 kN/m² for the track is the loading imposed during auger withdrawal when the weight of the soil is included and is based on a rig capable of singing piles up to 600mm diameter piles. Using this approach guards against accidental loading in the event that a bigger rig is used and not notified to MWP.

Noted

11. Page 12 – Depending on the spacing between the two tracks, the increase in pressure on the asset can be greater than your current prediction. Please review your calculation based on the actual spacing between the tracks.

Response – The piling rig will always be placed at 90 degrees to the line of the pipe to maintain it outside of the exclusion zone, therefore the spacing of the tracks has less impact on the result. As a conservative estimate we have modelled the tracks parallel to the pipe (although this would require the pile to be 3.0m from the pipe rather than 1.5m), this analysis presented in the Figure below suggests that the loading is between 4.8 and 7.2kPa (approximately 6kPa) which is only a marginal increase on the 5.45 kPa calculated. Bearing in mind the response to item 10 above we do not consider this warranted the additional calculation.



Noted

12. Based on the maximum predicted increase in pressure on the asset, please undertake crushing assessment (e.g. see Choy & New (2002) for the calculation of transverse (crushing) strain for pipe).

Response- A crushing assessment in accordance with BSEN 1295 was undertaken – see Figure 13. The percentage increase in vertical load is 6.5% (as a maximum) as the strain is related to loading the increase in strain due to the additional load will also be 6.5% approximately and below the guidance provide by TW.

Below is an extract from the Choy & New (2022) paper regarding crushing assessment. The vertical stress is based on the predicted maximum increase in vertical stress (relative to the existing stress level) at the pipe. Please confirm the associated increase in the transverse bending strain and compare it with the tensile strain limit for the VC pipe.

See above

displacement can cause leakage. Assuming the pipeline is rigid and the joint is free to accommodate axial movement, the joint pullout will not be more than the differential ground movement between mid-points of adjacent pipes (see Attewell et al. (1986)).

For an optimally aligned spigot and socket connection, a pullout limit of 3mm can be considered for cast iron pipes as a joint leakage criterion for assessment purposes.

For non-flexible joints (e.g. bolted flanges), the pipelines should be considered as continuous linear structures with a check that the connections are not overstressed.

6.7 Transverse (crushing) strain for pipe

The problem with large diameter pipe subject to load from concentrated sources from above is crushing. This can result in longitudinal cracking (see Figure 15) which

is usually developed at the quarter points of the pipe wall. The maximum transverse bending strain (ϵ_t) at the quarter points of the pipe wall is given by New (2019) as:

$$\epsilon_t = 3 \sigma_v r^2 (1 - K_0) / 2 E t^2$$

where

σ_v is the vertical stress at the pipe axis level. This can be estimated by Boussinesq-based analyses.

K_0 is the ratio of horizontal to vertical ground stress.

r is the mean radius of the pipe.

E is the Young's modulus of the pipe (typically 80GPa for cast iron pipe).

t is the pipe wall thickness.

6.8 Transverse strain for masonry sewer

For assessment purposes, it is conservative to assume that masonry has negligible tensile strength and each part of the outer circumference of the masonry sewer moves with the ground (full bond). The transverse sewer

13. Figures 12 & 14 – Please correct the unit for pressure.

Response – Noted

Noted

14. Page 14 – Please provide datasheet for the proposed crane and explain how you calculate the maximum pad pressure.

Response – No information is available for the mobile crane however as a practice we limit the bearing stress under the mats to 125 kN/m² to avoid damage to new or existing services which may fall within the zone of the mats and the load is based on this practice.

Noted

15. Page 14 – Please state the crane exclusion zones for both sewer and tunnel on the drawing/plan.

Response – The exclusion zone will be applied to the crane as per the piling rig.

Noted

16. Please provide an impact assessment for the following stages:

- a. Demolition

Response – This work has been completed.

Noted and please confirm the impact on the assets is negligible.

We confirm that there has been negligible impact on the Thames Water assets during demolition.

- b. Excavation (including ground beam, pile caps, soil ... etc)

Response – Due to the depth of the asset there will be no impact.

Please confirm regrading of existing ground surface level does not have an impact on the masonry service tunnel.

Please assess the impact associated with the temporary removal of soil above the masonry service tunnel (as shown on Section 4). Is the shaded area for the temporary soil removal, correct? If yes, how can you support the 2m vertical excavation?

The area adjacent to the tunnel will be landscaped, the ground will be graded to a slope and landscaped with imported clean soil to build up the ground as indicated in the cross section.

- c. Loading (Note: Although there will be no direct loading onto the sewer and tunnel, there will be ground movement associated with the new building loads. The potential ground movement could be calculated using the equivalent raft method and the Boussinesq approach).

Response – The building in the vicinity of the TW assets consists of isolated piles or small groups of piles supporting a single pile cap, the equivalent raft method is not appropriate in this situation. The TW Asset is outside the zone of influence of any settlement, therefore there is no impact to assess.

What is the predicted settlement for those piles within the zone of influence?

The settlement of the piles will be between 4 to 6mm, however for the piles adjacent to the sewer which are sleeved this settlement will occur below the sleeved section of pipe.

17. A detailed impact assessment is required if an asset falls within the 1mm ground movement contour. Please see attached note regarding 'Impact Assessment for TWUL assets'.

Response – Noted, this has been carried out were considered appropriate.

As pointed out above, there is a need to consider further for the masonry service tunnel.

The service tunnel is outside the building envelopes and there will be little or impact on the tunnel, bearing in mind that this tunnel extends a considerable distance and id impacted by heavily trafficked roads which do not appear to have had any adverse impact. Brick tunnels work in compression and generally are less impacted by additional loading than pipes, in this site some areas of the tunnel may have additional loading however it is a relatively low increase and unlikely to result in any damage to the structure. Vibration monitoring is proposed and this will be monitored to determine the PPV is within the limits as set out on MWP drawing 0101- site constraints.

18. Any other TWUL clean and waste-water assets around the site which fall within the 1mm ground movement contour will have to be assessed.

Response – There are no assets outside the site which fall within this category.

Noted

We hope the above has satisfactorily addressed the queries raised for the proposed works at Cranwood House, 100 Woodside Avenue, Haringey, London N10 3JA.

Should you have any queries please do not hesitate to contact the undersigned.

Kind Regards,



Tim Moynihan BSc MSc CEng MIEI P. Geol Euro Geol
Director
For Malachy Walsh and Partners