
Appendix A.2 – Environment Agency Correspondence

Ms Kirsty Thomas
Herrington Consulting Ltd.
Barham Business Park (Unit 6)
Elham Valley Road
Barham
Canterbury
CT4 6DQ

Our ref: KT/2020/127776/01-L01
Your ref: 2813/KT
Date: 13 January 2021

Dear Ms Thomas

ENVPAC/1/KSL/00360

Custom House, The Terrace, Gravesend, DA12 2DE

Thank you for consulting us on the above pre-application. We have reviewed the submitted pre-application letter, dated 4 December 2020. We would like to offer the following advice.

The application site lies partially within Flood Zone 3, which is considered to be 'High Risk'. Under the National Planning Policy Framework (NPPF) the development is classified as 'more vulnerable'.

As stated within your letter, a Flood Risk Assessment (FRA) will be required to be submitted alongside any planning application.

The Thames Estuary 2100 (TE2100) defence level at this location is 6.90 metres Above Ordnance Datum (AOD) for the epoch from 2040 to 2070 and 8.00m AOD for the epoch from 2070 to 2170. Please be aware that we are currently re-modelling the flood levels for the Thames Estuary as part of the 10 year review of the Thames Estuary 2100 Plan. However, the results from this study will not be available for a number of months.

The applicant will need to demonstrate how the site will be protected for the lifetime of the development. This should include demonstration that the existing defence crest level meets the requirement for 2040, as well as how the defences will be upgraded to achieve the defence level of 6.90m AOD by 2040 (if required) and 8.0m AOD by 2070. We are happy to discuss this further if you have any questions.

Page 17 of the submitted letter states that "the open space to the north of the outbuildings are constrained by the flood wall anchors which project back into the property." We note that an extension is proposed towards the north of the site and we would like to understand how close this would be to the anchors as it is currently unclear from the information provided at present.

We note from our records that there is a flood gate within this site. Please confirm if this is the case so we can provide further advice.

We would advise that finished floor levels should be situated to a minimum of 300mm above the 1 in 200 year plus climate change breach flood level for residential non-sleeping accommodation and a minimum of 600mm above the 1 in 200 year plus climate change breach flood level for sleeping accommodation. Due to the proximity of the site to the river we would also advise the applicant to consider the in-channel level as well as the breach level. The finished floor levels proposed on page 2 of the submitted letter follow the principles of the above guidance. However, the letter also states that “as the proposals comprise the conversion of existing buildings, which lie within a listed curtilage and are constrained by the existing ceiling height and need for accessible access, the opportunity to raise floors to the levels stated is severely limited.”

Firstly, we would ask the applicant to include the finished floor levels on any floor plans they submit so we can be clear what the finished floor levels will be across the site, on the ground and first floor. Secondly, if the current ground floor finished floor levels are already below the breach level then the applicant should look at options such as having accommodation split over two storeys. If the first floor was 600mm above the 1 in 200 year plus climate change breach flood level this would allow internal safe refuge for the occupants of the dwelling and could be considered. Please be aware that if a future planning application included any self-contained flats with finished floor levels entirely below the breach level we would raise an objection to this.

We are pleased with the recommendation to incorporate flood resilience into the design where possible. Information on flood resilience can be found on the following link http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf.

We are pleased with the recommendation that occupants register with the Environment Agency's flood warning service, 'FloodLine', so that they may prepare themselves in case of a flood event. This can be done by calling 0345 988 1188 to register.

The FRA should also consider safe dry access and egress. Please be aware that we do not normally comment on or approve the adequacy of flood emergency response procedures, as we do not carry out these roles during a flood. Our involvement with this development during an emergency will be limited to delivering flood warnings to occupants/users covered by our flood warning network. Any evacuation plan should provide suitable access and egress from the site and would need to be approved by the Local Planning Authority's Emergency Planning Department.

Landscaping close to the Thames should aim for a biodiversity net gain by providing ecologically beneficial landscaping such as native species, and flowering plants for pollinators.

If any flood defences require alteration or raising, we would need to see an improved interface between the river and the terrestrial environment. So where it is feasible to provide estuary edge habitats or other beneficial features we do require these for the benefit of the Thames.

The Estuary Edges website is available with ideas for how to improve habitats, and provide enhancements: <https://www.estuaryedges.co.uk/>

Please do not hesitate to contact us should you require any further information.

Yours sincerely

Ms Laura Edwards

Planning Advisor

Direct dial 02084749079

Direct email KSLPLANNING@environment-agency.gov.uk

Ms Kirsty Thomas
Herrington Consulting Ltd.
Barham Business Park (Unit 6)
Elham Valley Road
Barham
Canterbury
CT4 6DQ

Our ref: KT/2020/127776/02-L01
Your ref: 2813/KT
Date: 17 February 2021

Dear Ms Thomas

Custom House, The Terrace, Gravesend, DA12 2DE

We have reviewed the Herrington Consulting Limited letter dated 20 January 2021, and offer the following advice.

The application site lies partially within Flood Zone 3, which is 'High Risk'. Under the National Planning Policy Framework (NPPF) residential development is generally classified as 'More Vulnerable' but self-contained basement dwellings are classified as 'Highly Vulnerable'.

Flood Defence

The proposal is for a change of use to residential. This would increase the flood risk vulnerability of the development and significantly increase the dependence on the flood defence wall and the flood gate. The extent of any extensions or external building alterations is currently unclear.

Whether proposals include elements within 16 metres of the flood defence walls or not we expect the applicant to demonstrate how the site and its residents will be safe in flood risk terms for the development lifetime. The lifetime of residential development is taken to be 100-years. This should include how the defences will remain structurally sound and how they will be upgraded for climate change induced sea level rise in line with the Thames Estuary 2100 Plan.

This requires the applicant to either construct replacement flood defences with a 100-year design life, or provide a suitable structural survey, including intrusive investigation, to demonstrate that the residual life of any elements of the flood defences that are to be retained is in line with the 100-year development lifetime, along with a suitable scheme of remedial works where that is not the case.

Given the age of the existing flood wall, it appears less likely that the structure can be shown to have a remaining life of 100-years.

If the applicant chooses to undertake a river wall survey, including intrusive investigation, we would suggest that we are first consulted over the scope of the

Environment Agency

Orchard House Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH

Customer services line: 03708 506 506

Email: enquiries@environment-agency.gov.uk

www.gov.uk/environment-agency



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proposed survey to reduce the risk of abortive work.

The applicant also needs to demonstrate how the flood defence crest level will be raised to 8 metres Above Ordnance Datum in order to protect the site for its lifetime, taking account of sea level rise. That could be achieved by raising the defences now as part of the development, or proving how it can be raised, along with a robust funding strategy to undertake the needed defence raising.

The northern extent of the buildings abutting the eastern boundary are only about 4.5 metres from the visible part of the flood defence structure. That proximity may affect the ability to raise or renew the tidal defences.

We also expect applicants to show how a replacement flood defence could be formed with the development in place without needing to encroach towards the river, even when a new defence is formed as part of a development. This can be called a contingency or future proofing option. Again the extent of any northern building extension is currently uncertain.

Services in the northern part of the site could hinder future flood defence works. Please can you provide any details of existing and proposed services that are available.

It is important to prevent flood defence structures being compromised during construction work. Ground anchors running landward from their origin soon reach a depth where they are difficult to locate. This creates a legacy problem as the installation of deep foundations may risk damaging existing ground anchors. Where there is uncertainty over the location of ground anchors we need to take a precautionary approach. On page 13 of the letter dated 04 December 2020, it states that, *'The open space to the north of the outbuildings are constrained by the flood wall anchors which project back into the property.'* At present we have no information on the nature and depth of any foundations proposed for any building extensions. Please provide details of the location, nature and depth of any proposed new foundations and also the worst case location of all ground anchors, in terms of the potential for a clash.

Flood gates are weak points in the line of the flood defences. We therefore seek to have existing flood gates removed and replaced with a section of fixed flood defence wall wherever possible as part of re-developments. You have stated that the flood gate will be retained. Please provide information about what the flood gate will need to be opened for post development, and the ongoing arrangements for its management and operation.

Sleeping Accommodation

Although it may not be possible for each dwelling to have safe access and egress during the 1 in 200-year modelled breach flood levels factored for climate change, every dwelling must have all sleeping accommodation set no lower than 600mm above the 1 in 200 year plus climate change breach flood level. This is to provide its own temporary safe refuge and reduce the risk to people who are sleeping.

It is not clear how the above requirement can be met for the single story elements including the northern most part of the workshop building.

We would oppose any basement dwelling where there is any threshold or water entry level at or below the modelled breach flood level. We would also oppose the dwellings being dependent on flood doors or any other active / movable flood exclusion features. Please can you provide details and photos to show the presence or absence of pathways or openings into the buildings that could allow floodwater to enter below the modelled breach flood level.

Please can you also provide the revised floor plan drawings, with all post-development floor levels. We can then confirm if the proposals are acceptable.

The buildings that are proposed to be converted are historic and close to the tidal defences. In the unlikely but high consequence event of a failure of the tidal defences the buildings could be subjected to high water velocities and deep flood water. How does the applicant propose to establish whether the structures would remain intact and able to provide temporary safe refuge to residents in the event of a breach flood event at the site?

Flood Warning Service

Lastly, we wanted to highlight something in your previous letter, dated 4 December 2020, that we hadn't expanded on before. On page 3, you state that, *'The Thames catchment is also served by a well-established flood warning system, and it is expected that there could be at least 12 hours warning of conditions which may result in a failure of the defences.'*

Although we are we are pleased with the recommendation that occupants register with the Environment Agency's flood warning service, 'FloodLine', so that they may prepare themselves in case of a flood event. If a defence failure occurred near the site there could be little or zero warning. Therefore, we recommend that this statement is clarified within the subsequent Flood Risk Assessment.

Please do not hesitate to contact us should you require any further information.

Yours sincerely

Ms Laura Edwards
Planning Advisor

Direct dial 02084749079

Direct email KSLPLANNING@environment-agency.gov.uk

Ms Kirsty Thomas
Herrington Consulting Ltd.
Barham Business Park (Unit 6)
Elham Valley Road
Barham
Canterbury
CT4 6DQ

Our ref: KT/2020/127776/03-L01
Your ref: 2813/KT
Date: 30 April 2021

Dear Ms Thomas

Custom House, The Terrace, Gravesend, DA12 2DE

Thank you for consulting us on the scope of your investigation works. We have reviewed the email dated 9 April, and offer the following advice.

Flood Defences

As mentioned previously, we expect the applicant to demonstrate how the site and its residents will be safe in flood risk terms for the development lifetime. The lifetime of residential development is taken to be 100-years. This should include how the defences will remain structurally sound and how they will be upgraded for climate change induced sea level rise in line with the Thames Estuary 2100 Plan.

This requires the applicant to either construct replacement flood defences with a 100-year design life. Alternatively to provide a suitable structural survey, including intrusive investigation, to demonstrate that the residual life of any elements of the flood defences that are to be retained is in line with the 100-year development lifetime. Along with a suitable scheme of remedial works where that is not the case.

Given the age of the existing flood wall, it appears less likely that the structure can be shown to have a remaining life of 100-years.

The applicant also needs to demonstrate how the flood defence crest level will be raised to 8m Above Ordnance Datum in order to protect the site for its lifetime, taking account of sea level rise. That could be achieved by raising the defences now as part of the development, or proving how it can be raised in the future without undue cost and difficulty, along with a robust funding strategy to undertake the needed defence raising.

Where a flood defence or future defence raising is being designed the applicant needs to consider the reasonable worst case ground water levels.

The current investigation works proposed are not sufficient to provide a representative sample of the condition of the flood defences across the site.

We would advise that the scope of the investigation works is revised to include an increased number of investigation locations and consideration for the eastern section of flood defence.

In addition, we would advise that trial pits are undertaken at landward and riverward locations.

Please see attached our guidance for applying for a Flood Risk Activity Permit. It is likely that some of these works will require a Flood Risk Activity Permit. **Please could the applicant submit a method statement so that we can confirm exactly what the permitting requirements will be.** The method statement would also be beneficial so we can understand more about the nature of the investigation works proposed e.g. the depth of trial pits.

Please could the applicant confirm if they have undertaken a visual assessment of the flood defences at this location? If this has been undertaken and there is a summary report it would be useful for us to have sight of this. If this has yet to be done a visual assessment can be undertaken without a Flood Risk Activity Permit and could be useful to undertake in the interim to understand potential priority areas for further site investigations.

In addition to checking the sheet pile thickness on the defence to the west of the site we would also advise that you undertake anchor testing.

The applicant should also be aware there are some tide flaps running through the flood defence to the west of the site that will need to be considered with respect to climate change.

Aerial views shows that there is a concrete platform in front of the flood defence. The applicant will need to determine the interdependency between the flood defence and this concrete structure. **We would expect the applicant to undertake investigations to prove whether failure of the subordinate structure will impact the strength and stability of the flood defence.** Where the flood defence is found to be dependent on the subordinate structure, the subordinate structure must be treated as part of the overall flood defence in all related assessments.

Ground Anchors

As mentioned in previous correspondence, we would like to understand more about the ground anchors and services at this site. Our previous comments regarding these points for reference are below.

It is important to prevent flood defence structures being compromised during construction work. Ground anchors running landward from their origin soon reach a depth where they are difficult to locate. This creates a legacy problem as the installation of deep foundations may risk damaging existing ground anchors. Where

there is uncertainty over the location of ground anchors we need to take a precautionary approach. On page 13 of the letter dated 04/12/2020, it states that, *'The open space to the north of the outbuildings are constrained by the flood wall anchors which project back into the property.'* At present we have no information on the nature and depth of any foundations proposed for any building extensions. Please provide details of the location, nature and depth of any proposed new foundations and also the worst case location of all ground anchors, in terms of the potential for a clash.

Services in the northern part of the site could hinder future flood defence works. Please can you provide any details of existing and proposed services that are available.

Conclusion

Lastly, if the applicant revises the scope of their investigations we would appreciate being consulted. We will endeavour to provide as much advice as possible in regards to the scope of the investigation works but, ultimately the responsibility is with the applicant to ensure the site investigations will be sufficient to allow the applicant to robustly demonstrate the condition and remaining lifetime of the flood defences.

Please do not hesitate to contact us should you require any further information.

Yours sincerely

Ms Laura Edwards

Planning Advisor

Direct dial 02084749079

Direct email KSLPLANNING@environment-agency.gov.uk

Ms Kirsty Thomas
Herrington Consulting Ltd.
Barham Business Park (Unit 6)
Elham Valley Road
Barham
Canterbury
CT4 6DQ

Our ref: KT/2020/127776/04-L01
Your ref: 2813/KT
Date: 17 June 2021

Dear Ms Thomas

Custom House, the Terrace, Gravesend, DA12 2DE

Thank for the additional information. We have reviewed the submitted report ('Custom House River Wall Structural Inspection report, project reference: A7752, dated 26 May 2021, revision: P2). **The current investigation works proposed are not sufficient to provide representative sample of the condition of the flood defences across the site.**

Anchor Testing

Although trial pits to locate and inspect the anchor visually from the landward side of the flood defence has been detailed in the application, there is no proposal to undertake ground anchor testing. This is important to help determine the condition of the ground anchors. This could include, but is not limited to:

- An assessment of all anchor head assemblies.
- Identification of the lifted anchor strands and identification of the mechanism and precise location of failure.
- List off tests and determining a correlation of the anchor heads with strand failures or with other influences.

Inspection of Masonry

Section 5.6.4 of the inspection report recommends the removal of some bricks from the wall to check the core make-up. We require further clarification of the extent of the brick inspection namely:

- How many bricks will be removed.
- The location of the removed bricks.

The number and location of removed bricks should be sufficient to provide an understanding of the condition of the masonry across the full extent.

Existing and Proposed Services

We have not seen any information regarding existing and proposed services or any proposed method for determining the location of existing services within 16 metres of the flood defences. Services in the northern part of the site could hinder future flood defence works.

Environment Agency
Orchard House Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH
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Method of Compaction

Please provide further clarification of the proposed method of compaction. Appendix C provides a method statement for proposed activities which states that excavations will be backfilled, using the arisings, before being compacted with an excavator bucket. Any compaction should be to Highways specification or similar. Additionally, please confirm that no trial pits will be left open overnight.

Flood Risk Activity Permit

Please note that that all works, both permanent and temporary, within 16 metres of the Thames defences will require a Flood Risk Activity Permit.

Please do not hesitate to contact us should you require any further information.

Yours sincerely

Ms Laura Edwards

Planning Advisor

Direct dial 02084749079

Direct email KSLPLANNING@environment-agency.gov.uk

Ms Kirsty Thomas
Herrington Consulting Ltd.
Barham Business Park (Unit 6) Elham Valley
Road
Barham
Canterbury
CT4 6DQ

Our ref: KT/2020/127776/05-L01
Your ref: 2813/KT
Date: 28 July 2021

Dear Ms Thomas

The proposals for development are not fixed, however, it is intended that the Grade II Listed Customs House building and outbuildings will be converted to accommodate 29no. self-contained flats with associated parking, amenity and landscaping.

Custom House, The Terrace, Gravesend, DA12 2DE

Thank you for your previous response to our concerns. However, we still require clarification for the following points.

Inspection of Masonry

We are pleased to hear that a supervising engineer will be on site. We request plans are supplied to us that detail where bricks are moved, in addition to the final test results.

Existing and Proposed Services

Please can you clarify if the proposed services survey will be intrusive or desktop based. We would seek assurance that there is a clear working space for future flood defences.

Method of Compaction

Although it is understood that the make-up of the hard standing is not currently known, please can you confirm that compaction will be to a Highways specification or similar. Additionally, please clarify that no trenches are to be left open overnight.

Please note that that all works, both permanent and temporary, within 16 metres of the Thames defences will require a Flood Risk Activity Permit.

Please contact me should you wish to discuss the above.

Yours sincerely

Sophie Page

Mrs Sophie Page

Planning Specialist

Direct dial 020 8474 8030

Direct e-mail kslplanning@environment-agency.gov.uk

Elena Corchon
HERRINGTON CONSULTING
Barham Business Park (Unit 7)
Elham Valley Road
Barham
Canterbury
CT4 6DQ

Our ref: KT/2020/127776/07-L01
Your ref: 2813/KT
Date: 09 December 2021

Dear Elena Corchon

ENVPAC/1/KSL/00360 Updated FRA, Drainage Strategy and Structural Inspection Report of the flood defence. The proposals for development are not fixed, however, it is intended that the Grade II listed customs house building and outbuildings will be converted to accommodate 29no. Self-contained flats with associated parking, amenity and landscaping.

Custom House, The Terrace, Gravesend DA12 2DE

Thank you for consulting us with the above details. We have reviewed the revised Flood Risk Assessment (FRA) ('Flood Risk Assessment and Drainage Strategy for the Proposed Development at Custom House, The Terrace, Gravesend, Kent', by Herrington Consulting Limited, revision 4, revision dated 05/11/2021) and the 'River Wall intrusive Investigation Inspection Report' (Project No: A7752-01, by Consulting Engineers, revision: P5, revision dated: 05/11/2021). We **maintain our objection** to the proposal.

Residual Life of the Flood Defence Wall

Our principle concern is that the report and updated FRA fail to accurately assess the residual life of the flood defence especially when the impacts of climate change are considered. The report does not detail the works that will be undertaken to repair the flood defence or sufficiently respond to requirements for defence raising.

Page 3 of the referenced report states that 'the river wall is believed to have been constructed around the 1990's based on historic maps and record drawings'. We can confirm the defences here were constructed in the early 1980s – this is supported by the drawing dates and commission date of Customs House flood gate (1980) as the fixed defences were constructed at the same time.

An NRA Southern Region TTFD records investigation and site survey final report was written in 1995, which identifies defects at these defences. These include

Environment Agency
Orchard House Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH
Customer services line: 03708 506 506
Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency



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corrosion in the splash zone of the sheet piling, some bubbling and flaking where there is absence of protective coating and comments that the primary defences are generally showing their age. It is unlikely that these defects would be present had the defences been built in the 1990s.

- It is therefore more realistic for the assessment of the defences to be made on the basis they have been in-situ for 40 years.

Page 13 of the FRA report states that the 'the condition grade for the defences in this area is good'. It should be noted that this is true for the defence encased in brick wall but not the sheet piling in the west.

Section 4 of the report explores the residual life of the sheet pile based on existing examination of corrosion. Paragraphs 4.9 - 4.11 proposes a residual life expectancy of approximately 120 years based on a calculated corrosion rate. However, this does not take into account that the sheet pile will need to adequately resist forces applied to it and therefore would fail under load before it corrodes through completely. The steel sheet pile wall is likely to exceed a serviceability limit state before it reaches an ultimate limit state and failure. We do not consider this to be an acceptable means of examining residual design life.

- The applicant needs to demonstrate that the remaining thickness of the steel sheet piles will still be capable of adequately resisting the forces applied to it after 100 years of corrosion, including higher levels resulting from climate change.

The report has identified a number of defects in the flood wall.

- The report needs to confirm the works that will be carried out to rectify these.

Proposed Defence Raising

The piling capacity check calculations presented in Appendix E of the inspection report to demonstrate future raising options uses the nominal design thicknesses of the steel sheet piles as 15.7mm for the flange and 9.6mm for the web. This does not account for the actual thickness recorded in Appendix F of the inspection report.

- The applicant needs to repeat the piling capacity check calculations for
 - i. The actual thicknesses recorded in Appendix F, and
 - ii. For the remaining thicknesses after 100 years of corruptions
- The report does not contain any consideration or demonstration of the space requirements to allow for future replacement of the structures or for the raising with the proposed development in place.
- The proposed raising options do not include for environmental enhancements.
- Where structures are being proposed to be built over the flood defence, the flood defence under this section must be raised to the necessary raising height now as the presence of this structure will make it more costly and logistically difficult to undertake the raising in the future.
- We require confirmation that the floodgate will be decommissioned as part of the development.

Interdependency of Hardstanding

Page 6 of the report states that the concrete/hardstanding area to the northeast has been confirmed independent from the flood wall as no connection was present between the two. However, this does not confirm that the flood wall is not relying on the concrete structure for ground support/stability.

- Please demonstrate that the main flood defence is not dependent on this structure in anyway to remove the need of an assessment of its condition.

Further Information Required

In addition to the information outlined above, we require further information with regards to the following points:

- A map detailing the location of the whaling beam.
- Plan view demonstrating the offset distance between the services from the landward side of the defence so that the remaining free space can be determined.
- Plan view of the offset distance from the landward side of the flood defence and the storage crates as shown in figure 8.1 of the FRA.
- Cross section view showing offset distance for any tree/vegetation planting from the defence and presenting the nature of the planting. Note. Discussion with our asset inspector has confirmed a minimum of 1.2m should be provided to allow access for inspection.
- Appendix D of the report includes trial pit record sheets. However, the values boxes are blank. Please send completed record sheets for the trial pits.

Funding

The submitted information does not detail a robust funding strategy for future defence raising from when the development is completed.

- Please explain how funds are to be raised and managed.

Our Position

The applicant must demonstrate that the site will be protected, by the flood defences, for the 100 year lifetime. The Thames Estuary 2100 Plan requires for the site's flood defence to be raised and maintained to a level of 6.90mAOD for the epoch between 2040 and 2070. Further defence raising would be required to meet a crest level of 8.00mAOD for the 2070 to 2170 epoch.

We have previously stated that the applicant must submit a proposal that meets *either* of the following requirements:

- Raise crest levels to a minimum of 6.90mAOD by 2040 and demonstrate how the defence can be raised to 8.00mAOD by 2070 including a robust funding strategy to undertake said defence raising.
- Provide a defence with a crest height of 8.00mAOD with a minimum design life of 100 years now.

We await further information from the applicant to confirm the residual life of the flood defence. However, our current assessment of the information is that although the recommended works to repoint and replace failed brickwork and apply protective coating to the sheet piles will help extend the residual life of the asset, it will unlikely

be sufficient to achieve 100 years without major remedial works within this timeframe. Consequently, we consider replacing and raising to 8.00mAOD to be the most appropriate proposal.

Yours sincerely

Sophie Page

Mrs Sophie Page
Planning Specialist

Direct dial 020 8474 8030

Direct e-mail kslplanning@environment-agency.gov.uk

Michael Keckes
Mile Property Group Ltd
27 Castle Street
Canterbury
CT1 2PX

Our ref: KT/2020/127776/08-L01
ENVPAC/1/KSL/00360
Your ref: 2813/KT
Date: 22 February 2022

Dear Michael

STRUCTURAL REPORT AND INTRUSIVE INSPECTION OF THE FLOOD DEFENCE. THE PROPOSALS FOR DEVELOPMENT ARE NOT FIXED, HOWEVER, IT IS INTENDED THAT THE GRADE II LISTED CUSTOMS HOUSE BUILDING AND OUTBUILDINGS WILL BE CONVERTED TO ACCOMMODATE 29NO. SELF-CONTAINED FLATS WITH ASSOCIATED PARKING, AMENITY AND LANDSCAPING.

CUSTOM HOUSE, THE TERRACE, GRAVESEND DA12 2DE

Thank you for sending the above reports for review. As discussed in our meeting of 10 February we require further detailed information and **maintain our objection** to the proposal. The revised Structural Inspection Report does not sufficiently or accurately assess the residual life of the site's Tidal Flood Defences or provide a detailed proposal for future raising/remedial works.

Removing our objection

The following points must be resolved:

- The condition and residual life of the Tidal Flood Defences must be accurately and sufficiently assessed. We have included further detail on what we require from a further revision of the report below.
- The proposal should include a detailed plan for how defence levels will be raised to meet 2070 requirements with a 100 year design life. Based on our assessment of the submitted information, the tidal defences do not have sufficient residual life to meet the 100 year requirement or to support the load from further raising to 8.00mAOD. Therefore, a new defence with a crest of no less than 8.00mAOD should be constructed as part of this development.
- If the applicant can demonstrate that raising to the 2070 levels is not possible as part of this development, then it must be demonstrated that the existing defence can meet the 100 year design life requirement with remedial works. A full proposal for the raising of the Tidal Defences to meet the 2040 levels must be included and these works will form part of the application. Additionally, a

full proposal for subsequent raising to 8.00mAOD would have to be submitted and approved by ourselves.

Please review the following specific requirements which have not been met in the revised Structural inspection Report:

Existing Flood Defence

- The calculations for the residual life of the existing flood defence only focus on the buried part of the sheet pile. Although this may be where the highest bending takes place, it does not mean the exposed section of sheet pile subject to more intense corrosion should not also be analysed. We require both sets of calculations for a holistic analysis of the residual life of the existing flood defence types on the site.
- A managed maintenance approach, involving regular interventions, is not desirable as it introduces a risk that the long term maintenance is not appropriately implemented throughout the lifetime of the development and a major intervention is consequently required. We need greater assurance that the flood defence will retain its condition throughout the lifetime of the development.
- No assessment of potential foreshore erosion and how this would affect the stability of the flood defence in the future.

Future Flood Defence

- The applicant is undertaking at least the 2040 defence raising, on the basis the existing defence is demonstrated to have a life of 100 years, also accounting for the performance of the defence with the proposed 2040 raising option – a revised report must detail which option will be chosen and demonstrate buildability.
- Many of the 2040 raising suggestions add load to the flood defence. It has not been demonstrated how the flood defence could take this additional load and how this would affect its performance in achieving an 100 year life without requiring a major intervention.
- Where the 2040 raising option employs space behind the flood defence (e.g. concrete upstand wall) we need to understand how much space will be taken up so this can be used in the assessment of space available behind the flood defence for the 2070 raising.
- Glass defences are more fragile and require greater maintenance requirements than conventional flood defences. We will only accept these short comings as a flood defence option where it has been justified to be the only option to mitigate any significant adverse impacts caused by flood defence raising. This is not the case at this site where multiple options have been proposed to be feasible.
- The 2040 and 2070 raising is being looked at completely separately – the 2070 raising proposal must account for any changes that have been made as part of the 2040 raise as this could impact the requirements for the 2070 raise.

- The report states that the embedment depth of the sheet pile walls is not known. In this case, all calculations must be done for the worst case scenario i.e. shortest pile depth known until the embedment depth is confirmed.
- We require information on how the 2070 raising will be achieved in the space provided from the landward extent of the flood defence to the first building line. As there are two proposals, this should be shown for the proposal that requires the largest amount of space behind the flood defence to be constructed. i.e. what plant will be required and what are its dimensions, how can this manoeuvre safely within the space provided from the land, does the space for construction adhere to CDM requirements.
- Note: the 1.2m offset to the flood defences previously discussed was purely appropriate for inspection requirements, not for maintenance. Space needs to be demonstrated for minor maintenance repairs and major renewal of the flood defence.
- Note: if the flood defence has to be replaced as part of the development due to it not being demonstrated to provide 100 years, we will still require space behind the flood defence for a contingency flood defence option, a demonstration of what this option could be and the space required to construct it.
- The full extent, purpose and condition of the whaling beams should be detailed.

Environment enhancements

- The current proposals are very separate to the flood defence – we need to see environmental enhancements that are incorporated within the flood defence design. For example, if the flood defence is being replaced we would expect the flood defence design to incorporate a tidal terrace, unless there is evidence that this would not be possible, in which case a different ecological enhancement would need to be installed. Further information on this can be found at Estuary Edges.

Contamination

- We require confirmation of whether the material in front of the flood defence is contaminated or not.
- The composition of the foreshore material could exacerbate the sheet pile corrosion greater than what has been accounted for.

Stairs

- The 'Proposed Site & Lower Ground Floor Plan EA Requirements Drawings' indicates that the stairs will remain in place over the flood defence. Note, if the stairs are removed/replaced we would require the necessary raising (2070) to be completed underneath the stairs to avoid undue cost and difficulty in the future.

Floodgate

- It has not been confirmed in the report how the floodgate will be decommissioned as part of the development, but the drawing suggests it would be sealed. This option is a temporary decommission and requires

ongoing maintenance to ensure the seals do not allow water through the flood defence. Also a floodgate only has a design life of 50 years. We would therefore request it is replaced by the proposed reinforced concrete wall and tie into the existing wall to ensure there is no weakness in the flood defence for the development lifetime.

Ship impact

- We require a consideration for ship impact to the Tidal Thames defences to be included with a revised report.

Please revise and submit reports as required and should you request another meeting with us, we request that documents and plans are received by us at least 2 weeks prior to any meeting taking place. This is to give ample time for review of the detailed information and to review our position.

Please contact me should you wish to discuss the above.

Yours sincerely

Sophie Page

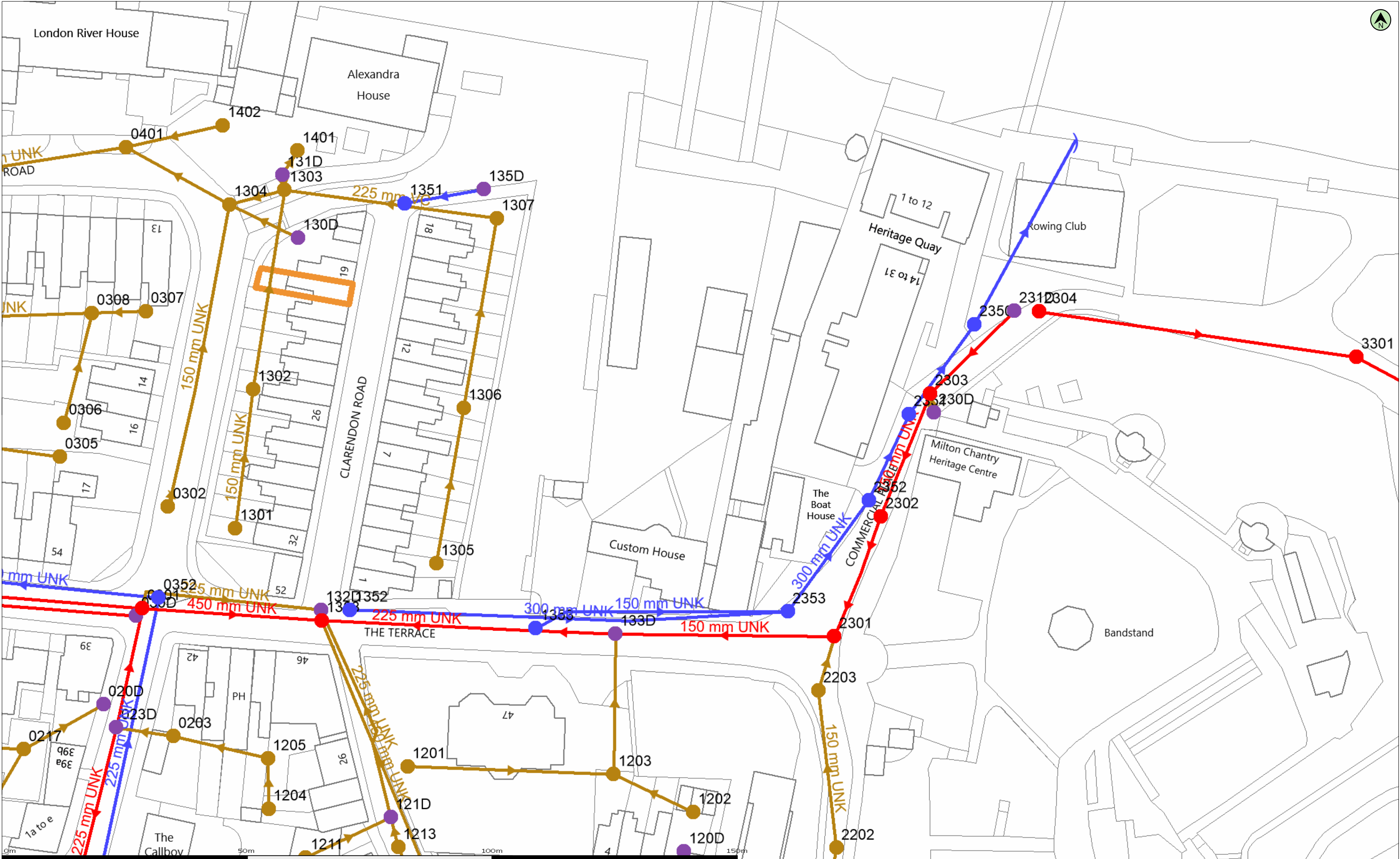
Mrs Sophie Page
Planning Specialist

Direct dial 020 8474 8030

Direct e-mail kslplanning@environment-agency.gov.uk

Cc Herringtons – Elena Corchon

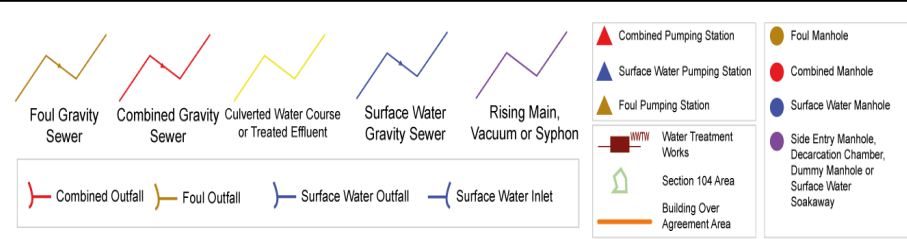
Appendix A.3 – Southern Water Asset Location Data



(c) Crown copyright and database rights 2020 Ordnance Survey 100031673 Date: 15/07/20 Scale: 1:500 Map Centre: 565198,174345 Data updated: 15/06/20 Our Ref: 416424 - 1 Wastewater Plan A2

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2020 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



flood@herringtonconsulting.co.uk	
2813/KB	



Appendix A.4 – Surface Water Management Calculations

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	45	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	200.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.048	4.00	7.600	1200	565172.609	174327.320	1.350
Tank A	0.016	4.00	6.700	1200	565188.702	174338.897	1.700
3	0.041	4.00	5.440	1200	565203.077	174333.000	1.425
4	0.018	4.00	5.300	1200	565206.000	174348.982	1.500
Tank B	0.043	4.00	5.600	1200	565191.160	174361.517	1.880
6	0.039	4.00	4.100	1200	565195.251	174395.400	0.525
Tank C	0.033	4.00	4.450	1200	565193.643	174382.921	1.300
7	0.013	4.00	4.800	1200	565209.001	174365.068	1.425
Tank D	0.024	4.00	4.450	1200	565204.235	174381.431	1.400
9	0.019	4.00	4.460	1200	565212.862	174386.006	1.425
10			4.100	1200	565212.825	174388.776	1.450
OUT			4.140	1200	565217.335	174408.352	1.557

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	Tank A	19.825	0.600	6.250	5.350	0.900	22.0	150	4.15	198.4
1.001	Tank A	Tank B	22.753	0.600	5.000	4.175	0.825	27.6	225	4.30	198.4
2.000	3	4	16.247	0.600	4.015	3.875	0.140	116.1	225	4.22	198.4
2.001	4	Tank B	19.426	0.600	3.800	3.720	0.080	242.8	300	4.55	198.4
1.002	Tank B	Tank C	21.548	0.600	3.720	3.552	0.168	128.3	225	4.86	198.4
3.000	6	Tank C	12.582	0.600	3.575	3.400	0.175	71.9	225	4.14	198.4
1.003	Tank C	Tank D	10.696	0.600	3.150	3.097	0.053	200.0	300	5.02	198.2
4.000	7	Tank D	17.043	0.600	3.375	3.091	0.284	60.0	225	4.17	198.4
1.004	Tank D	10	11.302	0.600	3.050	2.700	0.350	32.3	225	5.10	197.1
5.000	9	10	2.770	0.600	3.035	2.650	0.385	7.2	225	4.01	198.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.155	38.1	37.2	1.200	1.200	0.048	0.0	120	2.447
1.001	2.501	99.4	49.4	1.475	1.200	0.063	0.0	112	2.497
2.000	1.213	48.2	31.6	1.200	1.200	0.041	0.0	133	1.291
2.001	1.004	71.0	45.2	1.200	1.580	0.058	0.0	174	1.063
1.002	1.153	45.8	128.1	1.655	0.673	0.164	0.0	225	1.174
3.000	1.544	61.4	30.7	0.300	0.825	0.039	0.0	112	1.541
1.003	1.108	78.3	184.4	1.000	1.053	0.237	0.0	300	1.122
4.000	1.691	67.2	10.5	1.200	1.134	0.013	0.0	60	1.242
1.004	2.310	91.8	212.2	1.175	1.175	0.274	0.0	225	2.352
5.000	4.908	195.2	14.7	1.200	1.225	0.019	0.0	42	2.928

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.005	10	OUT	20.089	0.600	2.650	2.583	0.067	300.0	225	5.55	191.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.005	0.750	29.8	220.4	1.225	1.332	0.293	0.0	225	0.763

Pipeline Schedule

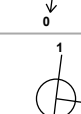
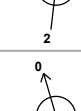
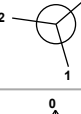
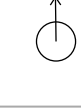
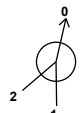
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	19.825	22.0	150	Circular	7.600	6.250	1.200	6.700	5.350	1.200
1.001	22.753	27.6	225	Circular	6.700	5.000	1.475	5.600	4.175	1.200
2.000	16.247	116.1	225	Circular	5.440	4.015	1.200	5.300	3.875	1.200
2.001	19.426	242.8	300	Circular	5.300	3.800	1.200	5.600	3.720	1.580
1.002	21.548	128.3	225	Circular	5.600	3.720	1.655	4.450	3.552	0.673
3.000	12.582	71.9	225	Circular	4.100	3.575	0.300	4.450	3.400	0.825
1.003	10.696	200.0	300	Circular	4.450	3.150	1.000	4.450	3.097	1.053
4.000	17.043	60.0	225	Circular	4.800	3.375	1.200	4.450	3.091	1.134
1.004	11.302	32.3	225	Circular	4.450	3.050	1.175	4.100	2.700	1.175
5.000	2.770	7.2	225	Circular	4.460	3.035	1.200	4.100	2.650	1.225
1.005	20.089	300.0	225	Circular	4.100	2.650	1.225	4.140	2.583	1.332

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	Tank A	1200	Manhole	Adoptable
1.001	Tank A	1200	Manhole	Adoptable	Tank B	1200	Manhole	Adoptable
2.000	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
2.001	4	1200	Manhole	Adoptable	Tank B	1200	Manhole	Adoptable
1.002	Tank B	1200	Manhole	Adoptable	Tank C	1200	Manhole	Adoptable
3.000	6	1200	Manhole	Adoptable	Tank C	1200	Manhole	Adoptable
1.003	Tank C	1200	Manhole	Adoptable	Tank D	1200	Manhole	Adoptable
4.000	7	1200	Manhole	Adoptable	Tank D	1200	Manhole	Adoptable
1.004	Tank D	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
5.000	9	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
1.005	10	1200	Manhole	Adoptable	OUT	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	565172.609	174327.320	7.600	1.350	1200				
						0	1.000	6.250	150
Tank A	565188.702	174338.897	6.700	1.700	1200		1	1.000	5.350
						0	1.001	5.000	225
3	565203.077	174333.000	5.440	1.425	1200				
						0	2.000	4.015	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
4	565206.000	174348.982	5.300	1.500	1200		1	2.000	3.875	225
Tank B	565191.160	174361.517	5.600	1.880	1200		1	2.001	3.800	300
							2	1.001	4.175	225
							0	1.002	3.720	225
6	565195.251	174395.400	4.100	0.525	1200		0	3.000	3.575	225
Tank C	565193.643	174382.921	4.450	1.300	1200		1	3.000	3.400	225
							2	1.002	3.552	225
							0	1.003	3.150	300
7	565209.001	174365.068	4.800	1.425	1200		0	4.000	3.375	225
Tank D	565204.235	174381.431	4.450	1.400	1200		1	4.000	3.091	225
							2	1.003	3.097	300
							0	1.004	3.050	225
9	565212.862	174386.006	4.460	1.425	1200		0	5.000	3.035	225
10	565212.825	174388.776	4.100	1.450	1200		1	5.000	2.650	225
							2	1.004	2.700	225
							0	1.005	2.650	225
OUT	565217.335	174408.352	4.140	1.557	1200		1	1.005	2.583	225

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	45	0	0
30	45	10	0
100	45	10	0

Node Tank A Online Orifice Control

Flap Valve	x	Invert Level (m)	5.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.020		

Node Tank B Online Orifice Control

Flap Valve	x	Invert Level (m)	3.720	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.030		

Node Tank D Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.050	Depth (m)	0.900
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	80	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	5.000	Number Required	1
Porosity	0.95	Pit Length (m)	10.000		

Node Tank A Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	5.000	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.95	Pit Length (m)	11.000		

Node Tank C Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.150	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	80	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	6.500	Number Required	1
Porosity	0.95	Pit Length (m)	18.000		

Node Tank B Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.720	Depth (m)	1.300
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	7.000	Number Required	1
Porosity	0.95	Pit Length (m)	10.000		

Results for 2 year +45% CC Critical Storm Duration. Lowest mass balance: 98.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.305	0.055	10.4	0.1016	0.0000	OK
360 minute winter	Tank A	288	5.301	0.301	2.2	12.9739	0.0000	SURCHARGED
15 minute summer	3	10	4.082	0.067	8.8	0.1147	0.0000	OK
360 minute winter	4	328	4.030	0.230	2.0	0.3134	0.0000	OK
360 minute winter	Tank B	328	4.030	0.310	3.7	21.0815	0.0000	SURCHARGED
15 minute winter	6	10	3.634	0.059	8.5	0.1551	0.0000	OK
360 minute winter	Tank C	376	3.418	0.268	3.6	30.2195	0.0000	OK
360 minute winter	7	376	3.418	0.043	0.5	0.0567	0.0000	OK
360 minute winter	Tank D	376	3.418	0.368	24.3	18.0171	0.0000	SURCHARGED
360 minute winter	9	376	3.418	0.383	0.7	0.5346	0.0000	SURCHARGED
360 minute winter	10	376	3.418	0.768	37.9	0.8684	0.0000	SURCHARGED
120 minute winter	OUT	240	5.633	3.050	8.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	Tank A	10.4	1.804	0.273	0.1143	
360 minute winter	Tank A	Orifice	Tank B	0.5				
15 minute summer	3	2.000	4	8.8	0.907	0.183	0.1576	
15 minute summer	4	2.001	Tank B	12.7	1.040	0.178	0.2981	
360 minute winter	Tank B	Orifice	Tank C	1.0				
15 minute winter	6	3.000	Tank C	8.5	1.061	0.138	0.1008	
360 minute winter	Tank C	1.003	Tank D	24.3	0.760	0.310	0.7317	
15 minute winter	7	4.000	Tank D	2.9	0.840	0.043	0.0891	
360 minute winter	Tank D	1.004	10	37.5	0.943	0.408	0.4495	
15 minute winter	9	5.000	10	4.1	1.110	0.021	0.0867	
240 minute winter	10	1.005	OUT	38.9	0.978	1.305	0.7990	51.5

Results for 30 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 98.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.367	0.117	33.1	0.2242	0.0000	OK
360 minute winter	Tank A	344	5.873	0.873	5.7	37.6708	0.0000	SURCHARGED
360 minute winter	3	352	4.611	0.596	3.6	1.0474	0.0000	SURCHARGED
360 minute winter	4	352	4.611	0.811	4.9	1.1263	0.0000	SURCHARGED
360 minute winter	Tank B	352	4.611	0.891	9.1	60.7371	0.0000	SURCHARGED
360 minute winter	6	360	3.801	0.226	3.5	0.6285	0.0000	FLOOD RISK
360 minute winter	Tank C	360	3.801	0.651	8.5	73.4781	0.0000	SURCHARGED
360 minute winter	7	360	3.801	0.426	1.2	0.5705	0.0000	SURCHARGED
360 minute winter	Tank D	360	3.801	0.751	34.7	36.8063	0.0000	SURCHARGED
360 minute winter	9	360	3.801	0.766	2.1	1.0896	0.0000	SURCHARGED
360 minute winter	10	360	3.801	1.151	50.3	1.3018	0.0000	FLOOD RISK
180 minute winter	OUT	240	5.633	3.050	47.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	Tank A	33.1	2.330	0.869	0.2814	
360 minute winter	Tank A	Orifice	Tank B	0.8				
15 minute summer	3	2.000	4	28.1	1.215	0.583	0.3868	
15 minute summer	4	2.001	Tank B	39.8	1.122	0.561	1.3489	
480 minute winter	Tank B	Orifice	Tank C	1.7				
15 minute summer	6	3.000	Tank C	27.2	1.428	0.443	0.2398	
360 minute winter	Tank C	1.003	Tank D	33.8	0.785	0.432	0.7532	
15 minute winter	7	4.000	Tank D	9.3	1.170	0.138	0.1691	
480 minute winter	Tank D	1.004	10	49.8	1.253	0.543	0.4495	
15 minute winter	9	5.000	10	13.1	1.138	0.067	0.0993	
480 minute winter	10	1.005	OUT	51.0	1.283	1.712	0.7990	151.9

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 98.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	6.639	0.389	43.4	0.7422	0.0000	SURCHARGED
360 minute winter	Tank A	344	6.544	1.544	7.8	52.2381	0.0000	FLOOD RISK
480 minute winter	3	464	5.012	0.997	4.0	1.7505	0.0000	SURCHARGED
480 minute winter	4	464	5.012	1.212	5.5	1.6821	0.0000	FLOOD RISK
480 minute winter	Tank B	464	5.012	1.292	10.2	88.0208	0.0000	SURCHARGED
360 minute winter	6	320	4.100	0.525	4.8	1.4590	4.6496	FLOOD
360 minute winter	Tank C	328	4.100	0.950	11.6	90.5837	0.0000	SURCHARGED
360 minute winter	7	328	4.101	0.726	1.7	0.9720	0.0000	SURCHARGED
360 minute winter	Tank D	328	4.100	1.050	36.6	44.3516	0.0000	SURCHARGED
360 minute winter	9	344	4.100	1.065	2.3	1.5143	0.0000	SURCHARGED
360 minute winter	10	320	4.100	1.450	52.8	1.6400	4.3457	FLOOD
480 minute summer	OUT	240	5.633	3.050	53.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	Tank A	39.6	2.319	1.040	0.3488	
360 minute winter	Tank A	Orifice	Tank B	1.0				
15 minute summer	3	2.000	4	36.8	1.269	0.763	0.5995	
15 minute summer	4	2.001	Tank B	50.4	1.115	0.711	1.3680	
480 minute winter	Tank B	Orifice	Tank C	2.1				
15 minute summer	6	3.000	Tank C	35.7	1.517	0.582	0.2961	
480 minute winter	Tank C	1.003	Tank D	36.8	0.899	0.470	0.7532	
15 minute winter	7	4.000	Tank D	12.2	1.243	0.182	0.2069	
600 minute winter	Tank D	1.004	10	55.3	1.391	0.602	0.4495	
15 minute winter	9	5.000	10	17.1	1.107	0.088	0.1023	
15 minute winter	10	1.005	OUT	56.7	1.431	1.904	0.7990	51.7

Appendix A.5 – Indicative Drainage Layout



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GENERAL NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
- ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, EUROPEAN NORMS, CODES OF PRACTICE AND BUILDING PRACTICE.
- ALL DIMENSIONS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
- ALL DRAINAGE SYSTEMS WILL NEED TO BE INSTALLED AND DESIGNED FOR SUITABLE LOADING REQUIREMENTS.
- THE CONTRACTOR SHALL OBTAIN PRIOR APPROVAL AND ALL NECESSARY LICENCES FROM THE THE HIGHWAY AUTHORITY AND/OR SEWERAGE UNDERTAKER BEFORE CARRYING OUT ANY WORKS.

KEY:

CL: XX.XX IL: XX.XX	EXISTING SURFACE WATER SEWER	EXISTING SURFACE WATER CHAMBER
CL: XX.XX IL: XX.XX	EXISTING GULLY	EXISTING GULLY
CL: XX.XX IL: XX.XX	SURFACE WATER DRAIN	SURFACE WATER MANHOLE
CL: XX.XX IL: XX.XX	SURFACE WATER MANHOLE	FLOW CONTROL DEVICE
CL: XX.XX IL: XX.XX	FLOW CONTROL DEVICE	GEOCELLULAR STORAGE

herrington

CONSULTING LIMITED

Unit 6-7 Barham Business Park
Elham Valley Road
Canterbury
Kent CT4 6DQ

Tel : 01227 833855
enquiries@herringtonconsulting.co.uk
www.herringtonconsulting.co.uk

London Office
Unit 52.11
Woolyard
52 Bermondsey Street
London
SE1 3UD

P7	Minor amendments	BW	SMB	07/10/22
P6	Minor amendments	EC	SMB	05/01/22
P5	Minor amendments	EC	SMB	22/12/21
P4	SWMS update following EA comments	EC	SMB	17/12/21
P3	SWMS update following EA comments	EC	SMB	03/11/21
Rev	Description	Author	Checked	Date

CLIENT

MILE PROPERTY GROUP

PROJECT

SWMS - The Terrace, Gravesend

SCALE	PROJ REF	ORIGINATOR	CHECKED BY
1:200	2813	BW	SMB

DWG REF

INDICATIVE DRAINAGE LAYOUT

DWG No.

HC-2813-501

Appendix A.6 – Maintenance Schedules

Operation and Maintenance Schedule – Geo-Cellular Storage System

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
	Remove debris and sediment from the catchment surface, wherever it presents a risk to the performance of the drainage system,	Monthly, or as required based on inspection frequencies.
	Remove sediment from pre-treatment structures (e.g. sediment traps) and from internal forebays	Annually or as required based on inspection frequencies
Remedial Actions	Repair; inlets, outlets, overflow pipes, and vent mechanisms	As required, based on inspections
	Replace tank or geotextile if significant damage is observed or geotextile is torn.	As required
Monitoring	Inspect and check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed.	Following installation, and annually hereafter
	Survey inside of tank, and at any sediment trap mechanisms, for sediment build-up and remove sediment if necessary. Use inspections to develop a regular maintenance and inspection procedure for sediment removal.	Every 5 years, or as required if inspections show high siltation rates.

General Operation and Maintenance Table for Geo-Cellular Storage Systems

Appendix A.7 – CCTV Survey



247 DRAINAGEUK LTD
 1 BLACHINGTON ROAD
 HOVE
 Tel: 01273 257 352
 Fax:
 Email: info@247drainageuk.com

Project-information

Project name :
Custom House

Project Number :

Contact :

Date :
15/10/2021

Client: **Mile Property Group**

Contact Name:

Department:

Road:

Town:

County:

Telephone:

Fax:

Mobile:

E-mail:

Site: **Custom House**

Contact Name:

Department:

Road: **The Terrace**

Town: **Gravesend**

County: **Kent, DA12 2BW**

Telephone:

Fax:

Mobile:

E-mail:

Contractor **247 DRAINAGEUK LTD**

Contact Name:

Department:

Road: **1 BLACHINGTON ROAD**

Town: **HOVE**

County:

Telephone: **01273 257 352**

Fax:

Mobile:

E-mail: **info@247drainageuk.com**

Defect Grade Description

Project Name :
Custom House

Project number :

Contact :

Date :
15/10/2021

1:

Brick: No Structural Defects
 Pipe: No Structural Defects

Acceptable Structural Condition

2:

Brick: Minor cracking, Surface mortar loss, Spalling slight, wear slight
 Pipe: Circumfrential crack, Moderate joint defects, Spalling slight, Wear slight

Minor collapse risk in short term but potential for further deterioration

3:

Brick: Total mortorloss without other defects, single brick displaced, Deformation up to 5%, Spalling medium, Wear medium
 Pipe: Fractures with deformation up tp 5%, Longitudinal cracking or mulitlpe cracking, Minor loss of level, More severe joint

! Collapse unlikely in near future but future deterioration likely !

4:

Brick: Total mortorloss with deformation greater than 10%, Deformation up to 10% and fractured, Displaced/hanging brickwork, Small number of missing bricks
 Pipe: Broken, Deformation up to 10% and broken,, Fractured with deformation 5 - 10%, Multipl

!! Collapse likely in foreseeable future !!

5:

Brick: Already Collapsed, Missing invert, Deformation over 10% and fractured, Displaced/hanging brickwork and deformation over 10%, Extensive missing bricks
 Pipe: Already collapsed, Deformation over 10% and broken, Extensive areas of fabric missin

!!! Collapsed or collapse imminent !!!

Place:



247 DRAINAGEUK LTD
 1 BLACHINGTON ROAD
 Street : HOVE
 Tel: 01273 257 352
 Fax:
 Email: info@247drainageuk.com

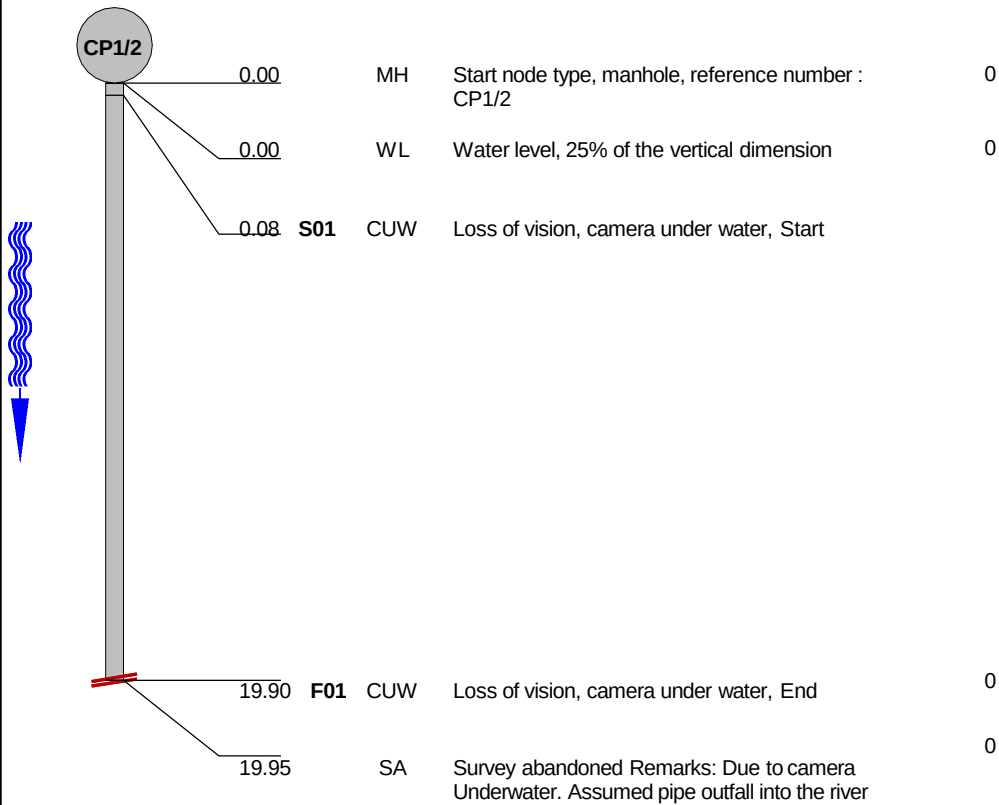
Inspection report

Date : 06/10/2021	Job number :	Weather : no rain or snow	Operator : JF PD	Section number : 1	PLR SUFFIX: X
Weather no rain or snow	Vehicle :	Camera : Push Rod	Preset :	Cleaned :	Operator : JF PD

Place : Road : Location Inspection	Gravesend Custom House, The Terrace Other (state in comments) CP1/2 (D/S) Outlet	Location details: Catchment: Tape number : Pipe Length	U/S MH : U/S Depth : D/S MH : D/S Depth :	CP1/2 3.2 Outlet
Direction Use: Year laid : Purpose : Total length :	Surface water Z Sample survey to determine asset condition 19.95 m	Pipe shape : Pipe size : Pipe material : Lining :	Circular 225 mm Vitrified clay	

Comment :

1:50 Position Code Observation Grade
Depth: 3.2



STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	0	0	0	1	0	0	0	0	1

Place:



247 DRAINAGEUK LTD
1 BLACHINGTON ROAD
HOVE
Tel: 01273 257 352
Fax:
Email: info@247drainageuk.com

ΣØ / Main sections and Site map

Project name :
Custom House

Project number :

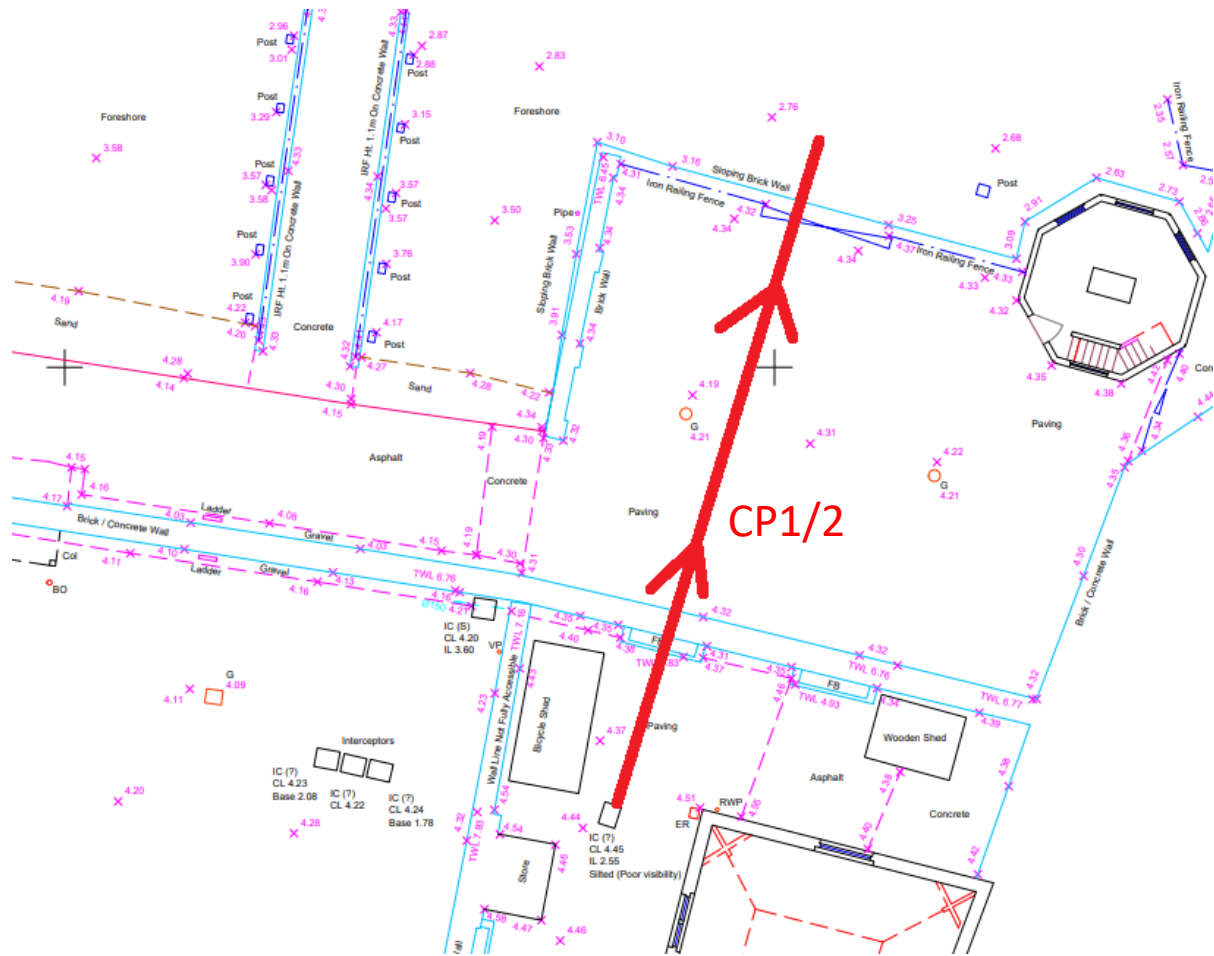
Contact :

Date :
15/10/2021

Nr.	US MH	DS MH	Date	Road	Tape No.	Material	m	(m)
1	CP1/2	Outlet	06/10/2021	Custom House, The Terrace		Vitrified clay	19.95	19.95

Pipe size: CIRCULAR 225

Site map showing approximate location of CP1/2



Place :



247 DRAINAGEUK LTD
 1 BLACHINGTON ROAD
 HOVE
 Tel: 01273 257 352
 Fax:
 Email: info@247drainageuk.com

Service / Operational Defects (SRM 4)

Project name :
Custom House

Project Number :

Contact :

Date :
15/10/2021

No.	PLR	Dir.	Use	Shape / Size	Date	Mat.	Total Length	Insp. Length	Peak HWG	Peak Score	Grade	Mean Score	Total Score
1	CP1/2X	D	S	C 225	06/10/2021	VC	19.95	19.95	-	0	1	0	0

Place :



247 DRAINAGEUK LTD
 1 BLACHINGTON ROAD
 HOVE
 Tel: 01273 257 352
 Fax:
 Email: info@247drainageuk.com

Structural Defects (SRM 4)

Project name :
Custom House

Project Number :

Contact :

Date :
15/10/2021

No.	PLR	Dir.	Use	Shape / Size	Date	Mat.	Total Length	Insp. Length	Peak HWG	Peak Score	Grade	Mean Score	Total Score
1	CP1/2X	D	S	C 225	06/10/2021	VC	19.95	19.95	-	0	1	0	0

Appendix A.8 – Meeting Minutes (20th October 2021)

Minutes



Meeting Date: Wednesday 20th October

Meeting Location: Microsoft Teams

Project: The Terrace, Gravesend

Attendance:

David Sankar (DS) – Environment Agency (EA)

Katie Boon (KB) – Environment Agency

Sophie Page (SP) – Environment Agency

Harry Washington-Smith (HWS) – Environment Agency

Michael Keckes (MK) – Mile Property Group (MPG)

Toby Vaughan (TV) – Herrington Consulting (HC)

Elena Corchon (EC) – Herrington Consulting

Introductions:

TV asks everyone to introduce themselves and provides a brief summary of the purpose of the meeting, which was to discuss the objection letter received from the EA on 18th August 2021 and to seek agreement in principle from the EA regarding the approach to be adopted.

Objection 1: Raising of Tidal Defences

TV summaries first EA objection. TV states that the intrusive flood defence condition survey has now been completed and report drafted. The report concludes that the residual life of the defences is 100yr + and that there are options available to raise the flood wall in line with the 2040 - 2070, and following that 2070 - 2115, requirements.

MK confirms works were completed a few weeks ago and draft report is finished. Will be issued once it has been signed off. Reiterated that the conclusions of the report are that the existing structure has residual life 100yr+ subject to some remedial works. MK also noted that the three options for raising the wall are included within the survey report.

HWS asked if anchor testing was carried out. MK confirmed that there are no anchors within the development site. The only anchor noted is outside the ownership (on Port of London Authority land) as specified in the report, and therefore anchor testing will not be required. MK asked if EA require any further information. KB stated that the EA would need to review the survey report before confirming if the EA require any further information.

TV asked when the defence wall had to be raised to meet the required levels for the 2040-2070 epoch. KB answered that the wall would have to be raised by the year 2040 (i.e. at 6.9m AODN by 2040) and it would need to be demonstrated how this would be done. KB also mentioned that the 2070 – 2115 requirements (8m AODN) would need to be achieved in the future. TV asked if the 10 year review of the TE2100 would have any implications on the site, as it was mentioned in the initial pre-app. KB and HWS confirmed the report was due for issue in 2022, but

Herrington Consulting Limited

Canterbury Office: Unit 6 & 7, Barham Business Park, Elham Valley Road, Barham, Canterbury, Kent, CT4 6DQ

London Office: Unit 52.11, Woolyard, 52 Bermondsey Street, London, SE1 3UD

www.herringtonconsulting.co.uk

wouldn't affect the required defence levels. KB stated the report may affect when the 2040 defence levels are required to be in place, but not currently known for certain.

KB asked if MK is looking to implement the raising now or in the future. MK confirmed that the works would be carried out in the future. KB stated that the EA requests such information to ensure that there is sufficient space for defences to be upgraded. MK reiterated that the options are in the report to be reviewed, they are not detailed design but happy for a condition to be placed that this is carried out in the future. MK mentioned that a fund would likely be in place for future leaseholder/freeholders to contribute to the works. MK stated that the main points of the objection were the residual life was sufficient and the wall could be raised, these concerns are answered in the report. EA to review report.

MK clarifies that MPG will send the survey report and asks if, as long as the two points (residual life and raising) are answered, the EA will be happy with that and will require further design as a condition. KB responded that the EA will need to look at it to ensure that it is buildable and have enough space. EA to confirm following review of report.

KB states will also need to make sure there is enough working space without having to reroute any services. MK confirmed that a mixture of desktop and intrusive service investigations had been carried out and the services are shown in the survey report. HWS will need to look at the report before confirming if anything else is required.

Objection 2: Proximity to Thames Tidal Defences

EC provided details of the redesigned drainage system. The originally proposed single storage tank directly adjacent to the defences has been replaced by a series of smaller tanks, at least 10m from the wall. EC asked if this is acceptable to the EA. KB & HWS responded that they will respond after seeing the survey report, and the proposals to raise the wall.

EC confirmed that an existing outfall had been located on site, had been cleaned and surveyed and was considered suitable to utilise. KB agreed that using the existing outfall would be the preferred option, provided it has adequate capacity.

EC asked what information the EA require for the access steps over the defences to be acceptable. MK added that the flood gate would be decommissioned and therefore access will be required over the wall. MK also added that the steps would be removed to allow the defence to be raised in the future and reinstated after the works are completed. MK asked, considering the above, would this be acceptable, and what would be required to be submitted. KB confirmed that steps are present elsewhere and are preferable to a flood gate. KB suggested that as long as the steps do not obscure the defences (to prevent inspection) and are removable, should be acceptable in principle, although further information would be required. MK stated that MPG will provide details of the steps and confirmation that they will be movable to allow raising.

MK confirmed that the survey report concludes the riverside hardstanding structure is independent of the flood wall. MK clarified that the works to the hardstanding are not intrusive, and it is simply envisaged to clean and undertake remedial works to this area.

EC asked the EAs requirements in relation to parking and vegetation adjacent to the defences. KB stated that parking is generally fine as it's a flat space and the EA can still access defences, but will need to review a landscaping plan to comment on vegetation.

TV asked if the private garden in the northeast corner of the site adjacent to the defences is acceptable, provided the EA has access to the gardens for inspection of the wall. KB said that looking at layout, the EA won't allow hedges that close to the wall as they will prevent visual inspection, ideally these should be offset. In regard to the garden, KB stated that it would be acceptable provided that the residents are aware that if they do any works on the garden they will require a permit. MK responded that a clause will be included stating the EA will have access to specific areas for inspection and maintenance of the wall and permits will be required for works in that area.

MK asks what offset would be required for the proposals to be accepted. KB will check and come back as they will need to have enough space to work on the wall. KB mentioned that it is preferable for any planting to be movable (i.e. potted) and that will be acceptable providing at least 1m easement is in place. This applies around the whole wall.

MK asked if the cycle storage in the north west corner is acceptable if there is 1m easement from wall. KB confirmed that is ok, so long as no permanent structure is erected. MK asked how often inspections are carried out. KB responded it would likely be twice yearly in this location.

Any other business:

HWS asked if any works are proposed to the two piers. MK explained that these are under the ownership of the previous site owner still and not in MPG control.

Meeting ends.

Actions

MK to provide finalised defence condition survey report, details of steps, landscaping plan and CCTV survey.

HC to provide updated drainage strategy showing relocated storage tanks and use of existing outfall.

EA to review documentation when received and confirm if any further information required.

Following EA acceptance, MK to provide information to the planning officer.

Appendix A.9 – CTP Consulting Engineers Flood Defence Report



Project Name: Custom House River Wall

Remedial Works Report

Date: May 2022

Project Number: A7752

Contents

Document Status and Signatures

- 1.0 Introduction
- 2.0 Existing Steel sheet piled wall in tidal zone
- 3.0 Existing steel sheet piled wall encased in concrete & masonry
- 4.0 Existing flood gate & stairs

Appendices:

Appendix A – Drawings of remedial works

Appendix B – Soil testing results

Appendix C – Further ultrasonic thickness readings

Appendix D – Knights Brown Construction methodology

Appendix E – Construction plant data sheets

Document Status and Signatures

Document Status		
Document Reference: A7752-02		
Issue Date	Version	Rev
27 May 2022	First Draft Issue	P1
21 June 2022	Comments incorporated	P2
23 June 2022	Comments incorporated	P3

File location: \\neptune\main\Jobs\A7750-A7999\A7752\4 - Reports and Specifications

Signed on behalf of CTP	
	
Prepared by:	Robert Byrneham - BEng (Hons) MSc CEng MICE
	
Reviewed by:	Neil Casey – BEng CEng MStructE

1.0 Introduction

- 1.1 This supplementary report has been prepared following Environment Agency comments received in letter reference KT/2020/127776/08-L01ENVPAC/1/KSL/00360 dated February 2022.
- 1.2 This report goes into detail on the different existing wall types and how the remedial works can be carried out to ensure the structure lasts 100 years and can be raised. This should provide justification to enable the Environment Agency to remove their objection to the development planning permission.
- 1.3 This report should be read in conjunction with CTP inspection report reference A7752-01, which detailed the existing condition of the structure, the remedial works options and conclusions presented in A7752-01 are superseded by the proposals contained within this report (A7752-02).

2.0 Existing Steel sheet piled wall in tidal zone

- 2.1 The length of wall at the north west of the development site, comprises of cantilever steel sheet piling, with a reinforced concrete capping beam. Photograph 1.0 shows the existing wall clouded in yellow.



Photograph 1.0 - The length of existing exposed steel sheet piled wall

- 2.2 It has been confirmed by the Environment Agency that a managed maintenance approach (periodically maintaining the existing sheet piled wall) to extend the serviceable life of the structure would not be acceptable.
- 2.3 This length of wall is to instead be replaced. A new steel cantilever sheet piled wall with reinforced concrete capping beam is to be constructed behind the existing wall, within the Clients ownership. The new defence will be designed with a minimum of 100-year design life, built to the 2070 raising level of 8.0m AOD. This will be constructed as part of the development. Section C-C shown on Appendix A shows further details and also confirms the worst-case space available for inspection post development.

- 2.4 The proposed extent of this replacement wall is indicated on A7752-100, the details of the wall interface between new and existing will be provided during the detailed design of this wall. A 90-degree return will be provided at each end of the new sheet piled wall, to enable connection into the existing wall. Buildability is also demonstrated in Appendix D.
- 2.5 Ecological enhancements are included as part of the development proposal. The creation new planted terraces along the foreshore. The new sheet piled wall will incorporate biodiverse features, details of which will be provided during the detailed design stage.
- 2.6 Ship impact will be considered for the new tidal section of the defence during detailed design.
- 3.0 Existing steel sheet piled wall encased in concrete & masonry**
- 3.1 The length steel sheet piling encased in concrete and clad in masonry, with a reinforced concrete capping beam, is indicated below on Photograph 2.0.



Photograph 2.0 - Existing steel sheet piled wall, encased in concrete and clad in masonry

- 3.2 The as built drawings of the structure have been obtained from the Environment Agency, these confirm the embedment depth of the sheet piled walls. This information has been used to analyse the existing structure under the worst 8.0m AOD condition. The existing wall has been calculated as being capable of withstanding the additional loadings from both the 2040 & 2070 increases to the wall height.
- 3.3 The initial raising of 6.9m AOD is to be carried out as part of the development by increasing the height of the existing reinforced concrete capping beam to 6.90m AOD. This will be done by drilling and fixing dowel bars into the existing capping beam, to create a key, and formwork shuttering around the existing capping beam, fixing new reinforcement and pouring concrete to create the higher capping beam. These works carried out as part of the development. With reinforcement designs provided during detailed design.
- 3.4 The 2070 raising works are to be carried out in the future, using a reinforced concrete upstand, to increase the wall height to 8m AOD. The flood wall is to be designed for the accidental flooding scenario; the combination of accidental actions is to be incorporated into the design in accordance with Eurocode design standards.
- 3.5 Both of these raising proposals, do not require any additional space behind the existing wall. Refer to drawings A7752-110 & 120 and sections A-A & B0B within Appendix A. The special requirements have been verified using the as built drawings. No additional space for additional support is necessary.
- 3.6 It is proposed to extend the life of the existing structure. To ensure the service life is extended to a minimum of 100 years it is proposed to provide a new concrete cover protection to the buried sheet piling, to protect the sheet piling from additional corrosion at the point of maximum bending moment. 2.5 metres down the steel sheet piles will have shear studs welded to them and then concrete poured to provide cover to the steel. The concrete protection will be designed to withstand the exposure condition of continual wetting and drying of seawater chlorides (concrete to be C35/45 class XS3).
- 3.7 The calculation of the structure considers the additional load on the structure and the expected life of the structure. The calculation considers both raisings (2040 & 2070).
- The 2040 & 2070 raisings are compatible with one another and are not looked at independently. The dowel bars will provide an adequate key into the existing structure.

- The as built drawings confirm the toe levels of the existing sheet piles.
 - The drawing plan in Appendix A shows space for plant access, contractors' temporary compound, and working access to carry out the 2070 raising
 - Access for the worst case inspection and maintenance requirements is provided as part of the post development plan. Refer to the drawing sections in Appendix A.
 - There is sufficient access behind the proposed wall for construction to both the replacement section of wall and the raising of the walls, refer to Appendix A
 - The extent and purpose of the wailing beams is shown on the as built drawings provided by the Environment Agency.
- 3.8 Drawings have been produced for the existing pre development and also the post development site plan, showing the construction access and temporary works access requirements, it also demonstrates the manoeuvrability of the plant, refer to Appendix A.
- 3.9 The method statement included in Appendix D demonstrates buildability, prepared by Knights Brown a local construction Contractor with vast experience in marine construction projects. The methodology and plant requirements for the new exposed sheet piled wall & the raising of the existing concrete capping beam wall is detailed.

4.0 Existing flood gate & stairs

4.1 The existing floodgate and staircase is indicated on photograph 3.0 below.



Photograph 3.0 Flood gate and stair location

4.2 Following the feedback received, the floodgate will be replaced with a new reinforced concrete wall. This will be tied into the surrounding structure, designed for a minimum of 100-year design life. Refer to the drawing in Appendix A for the marked-up plan, along with the buildability statement contained in Appendix D.

4.3 The stairs will be removed as part of the development

5.0 Contamination

- 5.1 Soil sampling and laboratory testing has been undertaken on the foreshore the results data is contained in Appendix B. The proposed measures of replacing the northern section of wall, and concrete encasement to the remainder of the wall mean that any the classification of the soil becomes irrelevant to the structure, as it is to be designed out, for both scenarios.

6.0 Corrosion

- 6.1 Additional corrosion readings have been obtained on site. A new sketch in Appendix C has been prepared to present this information
- 6.2 A new concrete cover to the sheet piling will be installed below ground to provide enhanced protection, this will negate the risk of corrosion rates worsening.

7.0 Buildability

- 7.1 The method statement included in Appendix D demonstrates the proposals buildability, prepared by Knights Brown a local construction Contractor with extensive marine experience. The methodology and plant requirements for the new exposed sheet piled wall & the raising of the existing concrete capping beam. The detailed plant data sheets are included in Appendix E. It shows that the mobile crane to lift in the sheet piling equipment is capable of manoeuvring on the site both pre and post development, and demonstrates there is enough storage area on site to prevent adversely surcharging the structures. The Contractor has demonstrated in the Appendix E that the works could be undertaken.

Appendix A – Drawings of remedial works

New Sheet piled wall to be constructed
500mm from existing steel sheet piled wall

Proposed Plant

Concrete Truck 6 Cubic meter

Overall width - excluding mirrors 2542mm
Overall width - including mirrors 3101mm
Overall length - 8235mm

6 Wheeled Arctic

Overall width - excluding mirrors 2500mm
Overall width - including mirrors 3050mm
Overall length - 8230mm

AC70- City Crane

Overall length 9963mm
Overall width 2550mm

WP150 Silent Piler

Length 2394mm
Width 1140mm

Project Datum
All levels and coordinates are related to the Ordnance Survey national grid by means of GPS using the Latic Smartnet RTK network. One survey control point has been fixed using GPS and then the survey orientated to an additional GPS points. No scale factor has been applied therefore only the fixed GPS point is a true Ordnance Survey position.

Topographical Survey Legend		
BEB Bellsh Beacon	FH Fire Hydrant	RL Ridge Level
BH Borehole	FL Flood Light	RS Road Sign
BS Bench Level	FP Flag Pole	RTW Retaining Wall
Bd Brack	GB Grit Box	RTW Rain Water Pipe
BP Brack Pillar	GL Gas Inspection Cover	SEG Sewer Entry Gully
BRW Brack Wall	GM Gas Meter	SS Structural Slab Level
BW Block Wall	GV Gas Valve	STN Survey Station
CBF Chain Link Fence	IC Inspection Cover	STW Stone Wall
CL Cover Level	IC (IC/Combined/F/5u/S/5) Storm	SV Stop Valve(V)/Water(G)/Gas
CLF Chain Link Fence	IC (IC/Combined/F/5u/S/5) Storm	SV Stop Valve(V)/Water(G)/Gas
Conc Concrete	IL Invert Level	TAC Tackling
COP Concrete Paving Fence	JB Junction Box	TCS Telephone Call Box
CPO Concrete Post	LP Lamp Post	TEP Telegraph & Electric Pole
CPS Concrete Paving Slab	MB Multi Rooted Tree	THL Threshold Level
CRW Concrete Retaining Wall	MS Service Marker	TIC Telecom Inspection Cover
CW Concrete Wall	MSF Metal Railing Fence	TM Ticket Machine
DC Drainage Channel	NP Name Plate	TL Traffic Light
DIL Disinfectant	OB Cont Board Fence	TLR Traffic Light Control Box
DP Down Pipe	PB Post Box	TP Telegraph Pole
DPC Damp Proof Course	PF Post & Chain Fence	TTL Top Of Wall Level
EIC Electric Inspection Cover	PM Parking Meter	UTL Unable To Lift
ER Earth Road	PWF Paved Footway	WIC Water Inspection Cover
EP Electric Pole	PRF Post & Rail Fence	WM Water Meter
FR Flow Bed	PWF Post & Wire Fence	WMF Wire Mesh Fence
FTL Finished Floor Level	RE Roofing Eave	WTL Water Level
		VP Vent Pipe

Tree Species		
AC Asar	FR Fruit	LN London Plane
AL Alder	HA Hawthorn	LO Locust
AS Ash	HB Hornbeam	MA Maple
BE Beech	HC Horse Chestnut	MG Magnolia
CE Cedar	HY Holly	CA Oak
CH Cherry	HZ Hazel	PI Pine
CY Cypress	LA Larch	PO Poplar
DE Dead	LB Laburnum	RD Rowan
EL Elm	LI Lime	SB Silver Birch
		SC Sweet Chestnut
		SP Spruce
		ST Sycamore
		U Underside
		WA Walnut
		WB Whitebeam
		WI Willow
		YV Yew

Line Types	
Steps / Ramps	Building Face
Top / Bottom of Banking	Drop Kerb
Bushes / Vegetation	Kerb
Change of Surface	Wall / Structure
Detail	Single Gate
Overhead Structure	Double Gate
Telecom Overhead	Banking
Telecom & Power Overhead	Survey Station
Power Overhead	

All levels and dimensions are quoted in metres. Tree heights are quoted based on an estimation taken from the ground and have not been accurately confirmed.
Whilst every effort is made to identify tree species and sizes, no responsibility can be taken for the accuracy of this information and an Arborologist should be consulted for confirmation.
Eave levels are taken at the bottom of the lowest roof tile.
It is recommended that all invert levels and pipe sizes be checked prior to construction.
Drawing correct at time of survey and to scale.
Any setting out works should be undertaken using Omega Geomatics Ltd survey control only.

Measured Building Survey Legend	
ACL Arch Center Level / Height above floor	ASL Arch Spring Level / Height above floor
CH Window Cill to Window Head Dimension	CLG Ceiling Level / Height above floor
DLH Door Head Level	F.C Floor to Window Cill Dimension
FL Floor Level	RU Ramp Up
RU Ramp Up	SCLG Suspended / False Ceiling Level / Height above floor
SL Slab Level	TH Threshold Height above floor
SU Skirting Up	THL Threshold Level
TH Threshold Height above floor	TWL Top of Wall Level
THL Threshold Level	USB Underside of Beam Level / Height to underside above floor
TWL Top of Wall Level	USJ Underside of Joist Level / Height to underside above floor
USB Underside of Beam Level / Height to underside above floor	WACL Window Arch Center Level
USJ Underside of Joist Level / Height to underside above floor	WASL Window Arch Spring Level
WACL Window Arch Center Level	WCL Window Head Level
WASL Window Arch Spring Level	WHL Window Head Level
WCL Window Head Level	WHL Window Head Level

Sloping Roof	Building Line / Wall Line
Sloped Ceiling (Points up)	Detail
Arched / Vaulted Ceiling	Roof
	Overhead Detail
	Partitions
	Glazing

All building measurements are taken to existing finishes or faces which are constant and represent an average face or wall line. All levels and dimensions are quoted in metres.
All window head and window cill levels are internal measurements.
Ceiling height measurements are taken to a point which best represents the general room height.

Revision	Amendments	Date	Rev'd	Chk'd
Created by	SP	11/05/2022		STRUCT

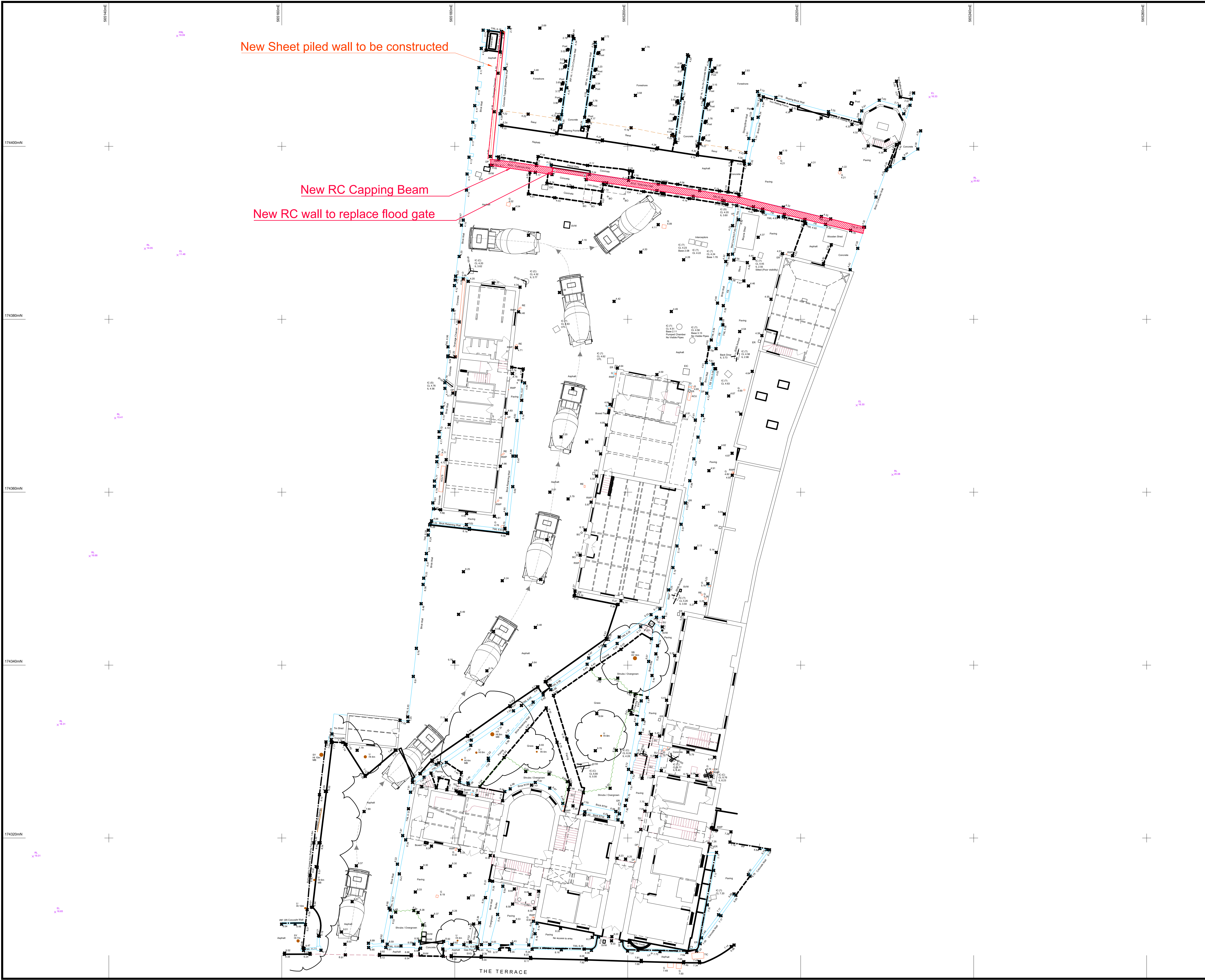


Suffolk House 154 High Street
Sevenoaks Kent TN13 1XE UK
UK: +44 (0)1732 740195
www.cti-lp.com

Project Title:
Customs House

Drawing Title:
North Wall replacement to 8.0m AOD

Drawing Number:
A7752-100
Scale:
1:200 @A1
Unless Noted Otherwise
Revision



Project Datum

All levels and coordinates are related to the Ordnance Survey national grid by means of GPS using the Latic Smartnet RTK network. One survey control point has been fixed using GPS and then the survey orientated to an additional GPS point. No scale factor has been applied therefore only the fixed GPS point is a true Ordnance Survey position.

Topographical Survey Legend

BEB Bellisha Beacon	FH Fire Hydrant	RL Ridge Level
BH Borehole	FL Flood Light	RS Road Sign
BS Bench Level	FP Flag Pole	RTW Retaining Wall
BO Boulder	GB Gas Box	RTW Rain Water Pipe
BP Brick Pillar	GC Gas Casing	SEG Silt Entry Gully
BRW Brick Wall	GM Gas Meter	SS Structural Slab Level
BU Bush	GV Gas Valve	STN Survey Station
BW Block Wall	HT Height (m feature)	STW Stone Wall
CB Chain Link Fence	IC Inspection Cover	SV Stop Valve (Water/Gas)
CL Cover Level	IC (C) Combined (F/Su/S) Stop Valve	SV Stop Valve (Water/Gas)
CL Chain Link Fence	IL Invert Level	SV Stop Valve (Water/Gas)
Conc Concrete	JB Junction Box	TAC Tactile Paving
CP Concrete Paving	LP Lamp Post	TCS Telephone Call Box
CPO Concrete Post	MB Multi Rooted Tree	TEP Telegraph & Electric Pole
CPS Concrete Paving Slab	MC Service Marker	TEL Threshold Level
CRW Concrete Retaining Wall	MP Metal Paving Fence	TIC Telecom Inspection Cover
CW Concrete Wall	NP Name Plate	TM Ticket Machine
DC Drainage Channel	OB Open Board Fence	TL Traffic Light
DIL Disinfectant	OB Open Board Fence	TL Traffic Light Control Box
DP Down Pipe	OB Open Board Fence	TP Telegraph Pole
DPC Damp Proof Course	OB Open Board Fence	TP Top of Wall Level
EIC Electric Inspection Cover	OB Open Board Fence	UTL Unable To Lift
ER Earth Road	OB Open Board Fence	WIC Water Inspection Cover
EP Electric Pole	OB Open Board Fence	WM Water Meter
ES Earth Road	OB Open Board Fence	WMF Wire Mesh Fence
FL Flow Bed	OB Open Board Fence	WTL Water Level
RE Road	OB Open Board Fence	VP Vent Pipe

Tree Species

AC Ascar	FR Fruit	LN London Plane	SC Sweet Chestnut
AL Alder	HA Hawthorn	LO Locust	SP Spruce
AS Ash	HB Hornbeam	MA Maple	ST Stump
BE Beech	HC Horse Chestnut	MG Magnolia	SY Sycamore
CE Cedar	HY Holly	OA Oak	U Underside
CH Cherry	HZ Hazel	PI Pine	WA Walnut
CY Cypress	LA Larch	PO Poplar	WB Whitebeam
DE Dead	LB Laburnum	RO Rowan	WI Willow
EL Elm	LI Lime	SB Silver Birch	YE Yew

Line Types

Steps / Ramps	Building Face
Top / Bottom of Banking	Drop Kerb
Bushes / Vegetation	Kerb
Change of Surface	Wall / Structure
Detail	Single Gate
Overhead Structure	Double Gate
Telecom Overhead	Banking
Telecom & Power Overhead	Survey Station
Power Overhead	

All levels and dimensions are quoted in metres. Tree heights and canopy spreads are surveyed as a mean size and shown to scale. Tree heights are quoted based on an estimation taken from the ground and have not been accurately confirmed.

Whilst every effort is made to identify tree species and sizes, no responsibility can be taken for the accuracy of this information and an Arborologist should be consulted for confirmation.

Leave levels are taken at the bottom of the lowest roof tile.

It is recommended that all invert levels and pipe sizes be checked prior to construction.

Drawing correct at time of survey and to scale.

Any setting out works should be undertaken using Omega Geomatics Ltd survey control only.

Measured Building Survey Legend

ACL Arch Level / Height above floor	ASL Arch Spring Level / Height above floor
CH Window Cill to Window Head Dimension	CLG Ceiling Level / Height above floor
DLH Door Head Level	F.C Floor to Window Cill Dimension
FL Floor Level	R.U Ramp Up
SCLG Suspended / False Ceiling Level / Height above floor	SL Sill Level
SU Skips Up	TH Threshold Height above floor
THL Threshold Level	TWL Top of Wall Level
USB Underside of Beam Level / Height to underside above floor	USJ Underside of Joist Level / Height to underside above floor
WACL Window Arch Center Level	WASL Window Arch Spring Level
WCL Window Cill Level	WHL Window Head Level

Proposed Plant

6 Cubic meter Concrete Truck

Overall width - excluding mirrors 2542mm
Overall width - including mirrors 3101mm
Overall length - 8235mm

6 Wheeler Arctic

Overall width - excluding mirrors 2500mm
Overall width - including mirrors 3050mm
Overall length - 8230mm

Revision

Revision	Amendments	Date	Rev'd	Chk'd
SP		11/05/2022		STRUCT

Project Title:

Customs House

Drawing Title:

2040 Raising to 6.9m AOD

Drawing Number:

A7752-110

Scale:

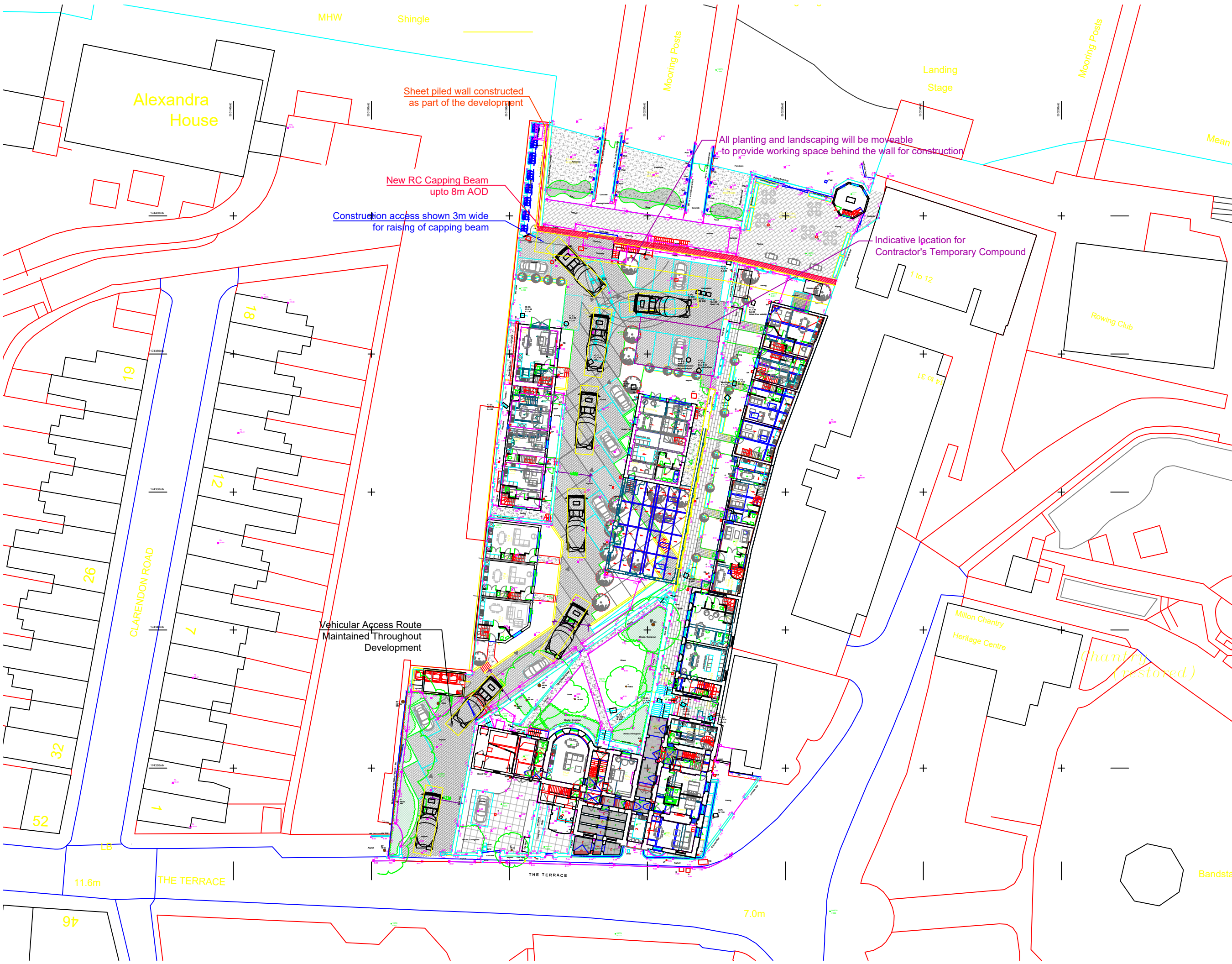
1:200 @A1

Unless Noted Otherwise

Revision



Suffolk House 154 High Street
Sevenoaks Kent TN13 1XE UK
UK: +44 (0)1732 740195
www.ctp-lp.com



Project Datum

All levels and coordinates are related to the Ordnance Survey national grid by means of GPS using the Leica SmartNet RTK network. One survey control point has been fixed using GPS and then the survey orientated to an additional GPS points. No scale factor has been applied therefore only the fixed GPS point is a true Ordnance Survey position.

Topographical Survey Legend

BEB Bellsh Beacon	PH Fire Hydrant	RL Ridge Level
BH Bench	PL Flood Light	RS Road Sign
BL Bell Level	RT Retaining Wall	RWP Rain Water Pipe
BO Bollard	G Gully	SS Side Entry Gully
BP Brick Paving	GC Gas Inspection Cover	SI Sign
BPav Brick Paving	GP Gas Pipe	STN Survey Station
BW Brick Wall	GV Gas Valve	STW Stone Wall
CBF Close Board Fence	H Height (in meters)	SU Step Up
CL Cover Level	IC Inspection Cover	SV Stop Valve/Water/Gas
CLF Chain Link Fence	IC(C) Combined Foul/Sewer	SVF Soil Vent Pipe
COC Concrete	IB Junction Box	TAC Traffic Paving
CPF Concrete Paving Fence	LB Lamp Post	TCL Telephone Call Box
CPD Concrete Paving	MB Mail Box	TLC Telegraph & Electric Pole
CRW Concrete Retaining Wall	MS Manhole	TLC Teleson Inspection Cover
CW Concrete Wall	MP Meter Point	TL Traffic Light
DC Drainage Channel	NP Name Plate	TLCB Traffic Light Control Box
DLS Discharge	OP Open Board Fence	TP Telegraph Pole
DP Down Pipe	PS Post Box	TPF Top of Wall Level
DPC Damp Proof Course	PFC Post & Coat Fence	UTL Unstable To Lift
EIC Electric Inspection Cover	PMF Parking Meter	WIC Water Inspection Cover
EL Eave Level	PMP Post & Rail Fence	WM Water Meter
EP Electric Pole	PS Post & Wire Level	WMB Wire Mesh Fence
FB Bath Room	PPF Post & Wire Fence	WVL Water Level
FB Power Box	RF Roofing Tye	WV Vent Pipe
FL Finished Floor Level		

Tree Species

AC Acer	FR Fruit	LN London Plane	SC Sweet Chestnut
AL Alder	LO Locust	SP Spruce	ST Stump
AS Ash	MA Hornbeam	MA Maple	ST Stump
BE Beech	MC Horse Chestnut	MD Magnolia	SV Sycamore
CE Cedar	HY Holly	OA Oak	U Underplotted
CH Cherry	HZ Hazel	PI Pine	W Willow
CY Cypress	LA Larch	PO Poplar	WB Whitebeam
DE Dead	LB Laburnum	RD Rowan	WV Willow
EL Elm	LI Lime	SB Silver Birch	YE Yew

Line Types

Steep / Ramp	Fence
Top / Bottom of Banking	Building Face
Change of Surface	Drop Mark
Change of Surface	Keel
Detail	Mail / Structure
Overhead Structure	Single Gate
Overhead Structure	Double Gate
Telecom & Power Overhead	Banking
Power Overhead	Survey Station

All levels and dimensions are quoted in metres. Tree griffs and canopy spreads are surveyed as a mean size and shown to scale. Tree heights are quoted based on an estimation taken from the ground and have not been accurately confirmed.

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Eave levels are taken at the bottom of the lowest roof tile.

It is recommended that all invert levels and pipe sizes be checked prior to construction.

Drawing correct at time of survey and to scale.

Any setting out works should be undertaken using Omega Geomatics Ltd survey control only.

Measured Building Survey Legend

ACL Arch Center Level / Height above floor	SL Slab Level
ASL Arch Spring Level / Height above floor	SCG Suspended / False Ceiling Level / Height above floor
C-H Window Cill to Window Head Dimension	SI Step Up
CLG Ceiling Level / Height above floor	TH Threshold Level
CH Door Head Height above floor	THL Threshold Height above floor
DHL Door Head Level	US Underside Level / Height above floor
FL Floor Level	USB Underside of Beam Level / Height to underside above floor
SCG Suspended / False Ceiling Level / Height above floor	USU Underside of Joist Level / Height to underside above floor
SI Slab Level	WACL Window Arch Center Level
SH Step Up	WALL Window Arch Spring Level
TH Threshold Level	WCL Window Cill Level
THL Threshold Height above floor	WHL Window Head Level

Proposed Plant

Concrete Truck 6 Cubic meter

Overall width - excluding mirrors 2542mm
Overall width - including mirrors 3101mm
Overall length - 8235mm

6 Wheeled Arctic

Overall width - excluding mirrors 2500mm
Overall width - including mirrors 3050mm
Overall length - 8230mm

AC70. City Crane

Overall length 9963mm
Overall width 2550mm

Building Line / Wall Line

Shaping Roof	Detail
Shaped Ceiling (Points up)	Shops
Arched / Vaulted Ceiling	Overhead Detail
	Partitions
	Glazing

All building measurements are taken to existing finishes or faces which are constant and represent an average face or wall line. All levels and dimensions are quoted in metres.

All window head and window cill levels are internal measurements.

Ceiling height measurements are taken to a point which best represents the general room height.

Revision

Revision	Amendments	Date	Rev'd	Chkd
SP		11/05/2022		STRUCT

Project Title:

Customs House

Drawing Title:

2070 Raising to 8.0m AOD

Drawing Number:

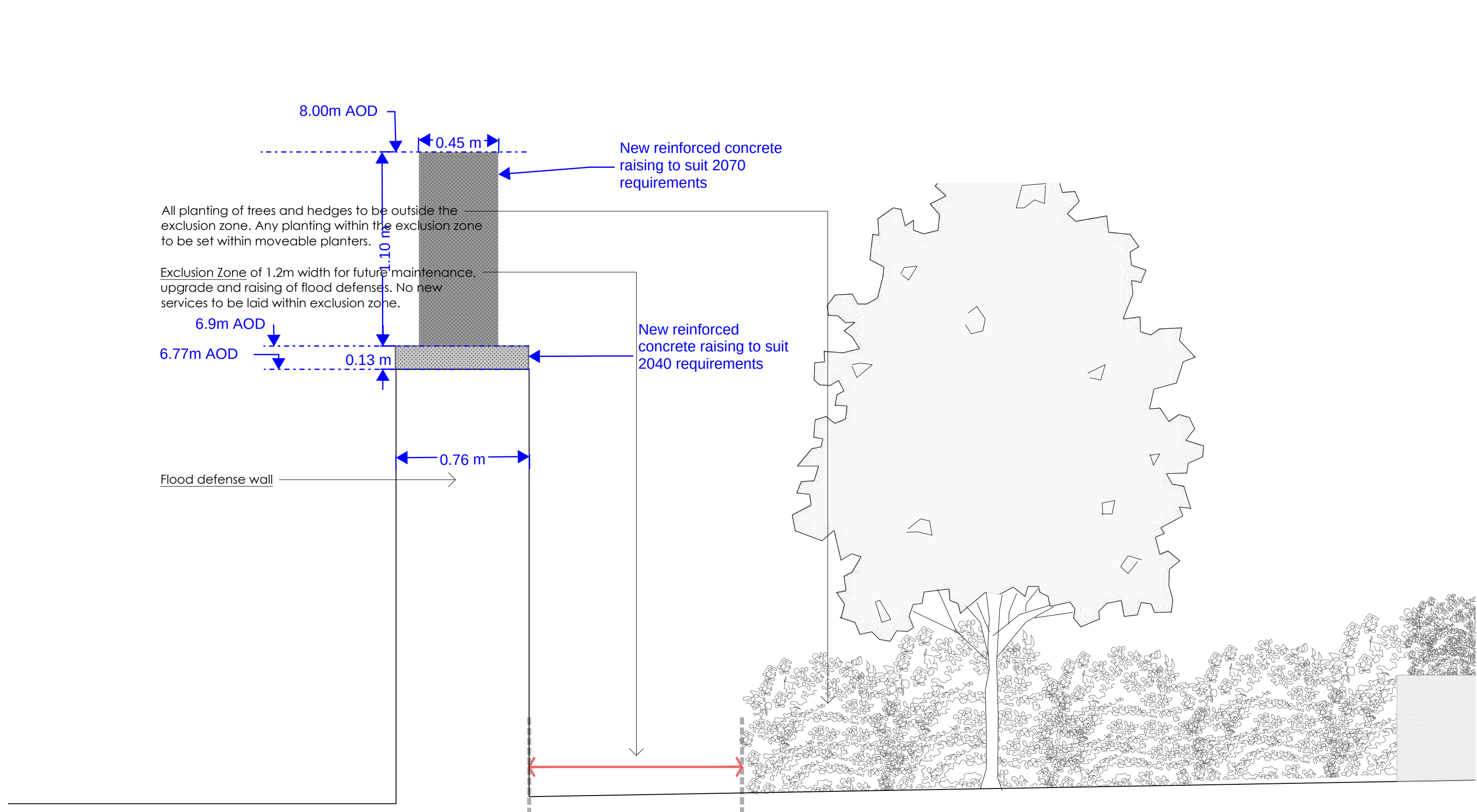
A7752-120

Scale:

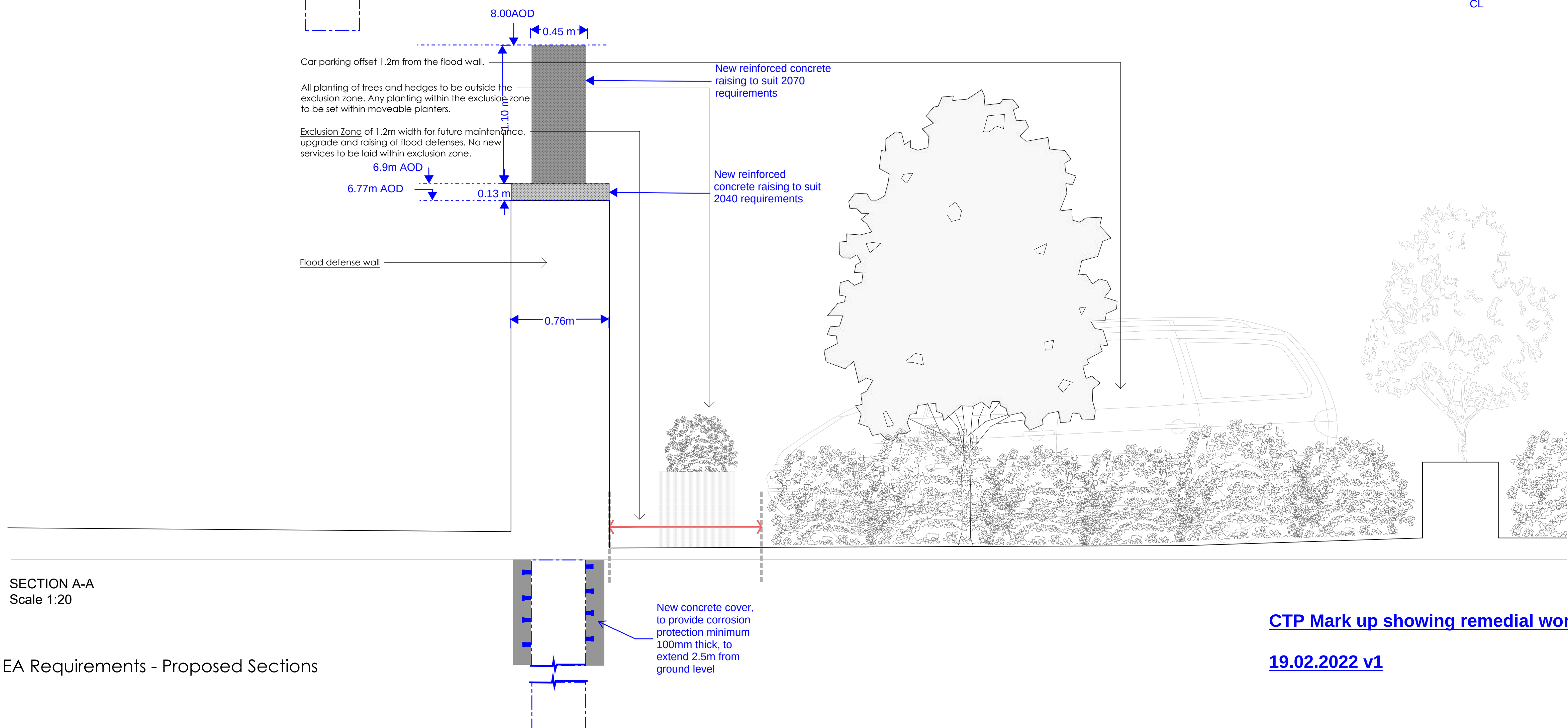
1:500 @A3
Unless Noted Otherwise

ctip consulting engineers international

Suffolk House 154 High Street
Sevenoaks Kent TN13 1XE UK
UK: +44 (0)1732 740195
www.ctip-llp.com

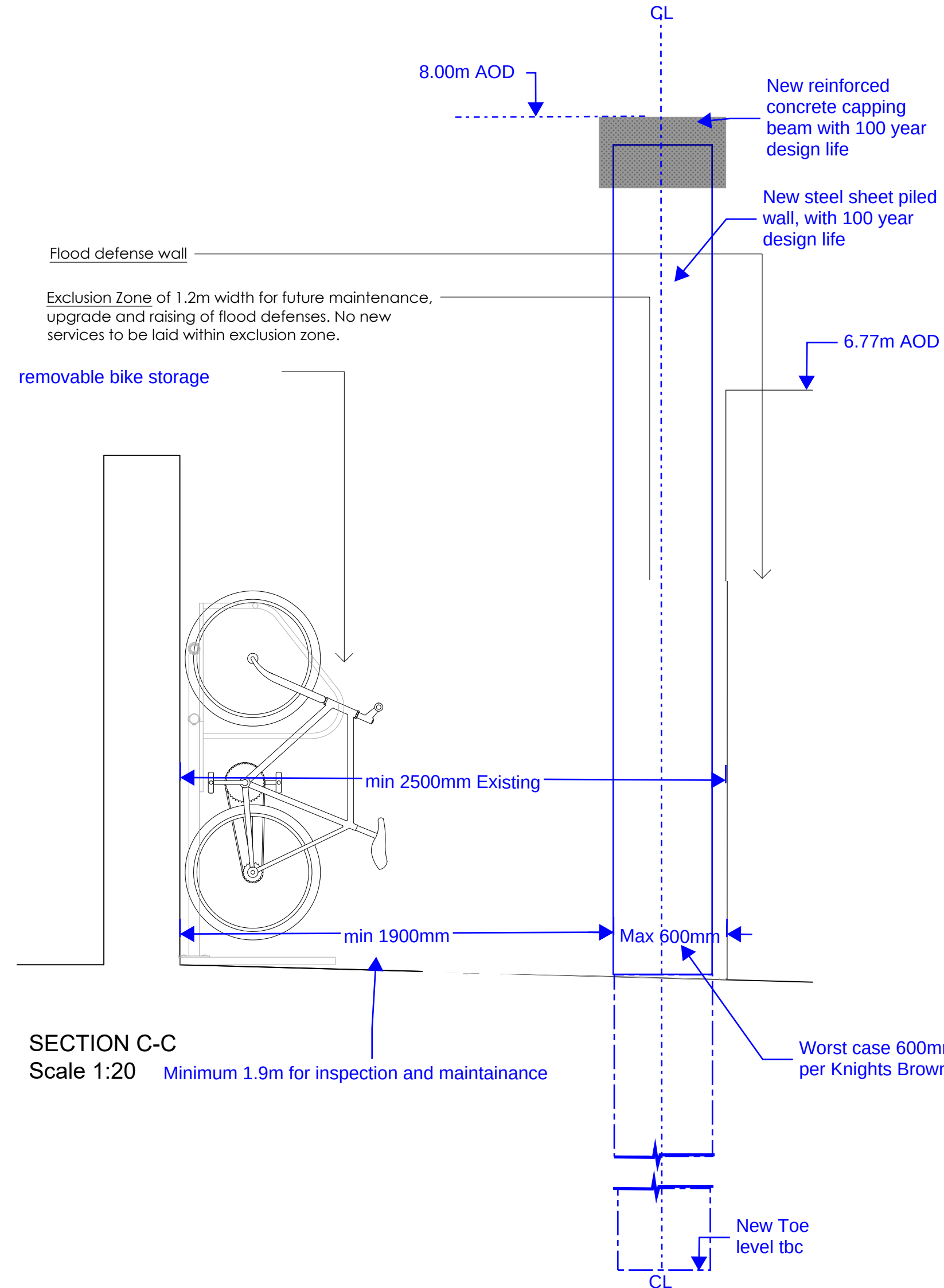


SECTION B-B
Scale 1:20

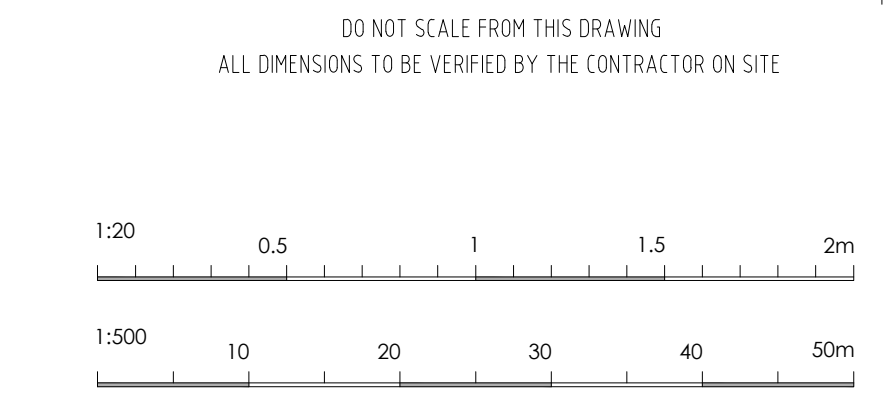


SECTION A-A
Scale 1:20

EA Requirements - Proposed Sections



SECTION C-C
Scale 1:20
Minimum 1.9m for inspection and maintenance



LEGEND
Scale 1:500

CTP Mark up showing remedial works to river walls

19.02.2022 v1

REV	DESCRIPTION	DATE	BY	CHKD
TURNER JACKSON+DAY ASSOCIATES Radio House Thanet Way, Whitstable Kent CT15 3DX t: 01227 261453 e: enquiries@tjda.co.uk www.turner-jacksonday.co.uk client details Mile Property Group Ltd project details Custom House The Terrace, Gravesend, DA12 2DE drawing title Proposed Site Sections EA REQUIREMENTS date Jan '22 scale 1:20@A1 drawn by AR checked by project no. 1735 drawing no. 036 revision -				

Appendix B – Soil testing results



Jake Wade

Lustre Consulting Ltd
Suite 1
Second Floor North
The Fitted Rigging House
The Historic Dockyard
Chatham, Kent
ME4 4TZ

t: 01634 757 705

e: info@lustreconsulting.com

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 22-52253

Project / Site name: Custom House

Samples received on: 14/04/2022

Your job number: 4353

**Samples instructed on/
Analysis started on:** 14/04/2022

Your order number:

Analysis completed by: 26/04/2022

Report Issue Number: 1

Report issued on: 26/04/2022

Samples Analysed: 12 soil samples

Signed:

Joanna Wawrzeczko
Joanna Wawrzeczko
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

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

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

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

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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241559	2241560	2241561	2241562	2241563
Sample Reference				TP1	TP1	TP1	TP1	TP3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	1.00	1.30	0.30
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	40	< 0.1	< 0.1	44
Moisture Content	%	0.01	NONE	7.4	13	27	15	5.2
Total mass of sample received	kg	0.001	NONE	0.8	0.8	0.8	1	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JSW	JSW	JSW	JSW	JSW

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.2	9.4	8.4	8.4	9.2
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	210	99	410	130	170
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.11	0.05	0.2	0.065	0.087
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	107	49.6	204	65.3	87.3
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.5	1.5	3.7	1	0.2

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	3.4	1	0.6	0.98	0.4
Acenaphthene	mg/kg	0.05	MCERTS	0.98	< 0.05	< 0.05	0.26	0.33
Fluorene	mg/kg	0.05	MCERTS	3.1	0.24	< 0.05	0.6	0.23
Phenanthrene	mg/kg	0.05	MCERTS	45	3.5	5.6	11	1.8
Anthracene	mg/kg	0.05	MCERTS	7.2	1.1	0.91	2.4	0.45
Fluoranthene	mg/kg	0.05	MCERTS	80	12	21	31	6
Pyrene	mg/kg	0.05	MCERTS	66	9.6	17	27	5.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	39	8.1	9.2	16	2.9
Chrysene	mg/kg	0.05	MCERTS	24	6.9	7.8	13	2.5
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	32	8.7	13	20	3.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	19	2.4	3.6	4.4	1.2
Benzo(a)pyrene	mg/kg	0.05	MCERTS	32	6.1	9	14	2.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	16	4.4	5.2	6.5	1.6
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	4.4	1.2	1.4	2	0.43
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	18	4.5	5.9	7.7	1.9

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	391	69.7	99.1	156	31.1
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Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241559	2241560	2241561	2241562	2241563
Sample Reference				TP1	TP1	TP1	TP1	TP3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	1.00	1.30	0.30
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	27	19	78	39	7.2
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	1.5	3.9	0.9	0.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	NONE	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	22	31	15	8.4
Copper (aqua regia extractable)	mg/kg	1	MCERTS	110	95	480	69	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	5200	1900	1500	1300	220
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.8	1.6	3.7	5.1	0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	23	54	14	7.1
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	440	190	660	230	52

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH,CU,1D,AL}	mg/kg	1	MCERTS	2	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH,CU,1D,AL}	mg/kg	2	MCERTS	8.7	< 2.0	< 2.0	9	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	36	11	< 8.0	16	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	530	57	27	38	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) _{EH,CU+HS,1D,AL}	mg/kg	10	MCERTS	580	68	32	63	< 10

TPH-CWG - Aromatic >EC5 - EC7 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH,CU,1D,AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH,CU,1D,AR}	mg/kg	2	MCERTS	14	3	2.5	14	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	180	53	42	110	14
TPH-CWG - Aromatic >EC21 - EC35 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	470	140	83	200	38
TPH-CWG - Aromatic (EC5 - EC35) _{EH,CU+HS,1D,AR}	mg/kg	10	MCERTS	660	200	130	330	52

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241559	2241560	2241561	2241562	2241563
Sample Reference				TP1	TP1	TP1	TP1	TP3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	1.00	1.30	0.30
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Lab Sample Number				2241559	2241560	2241561	2241562	2241563
Sample Reference				TP1	TP1	TP1	TP1	TP3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.70	1.00	1.30	0.30
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

VOCs TICs

VOCs TICs Compound Name		N/A	NONE	ND	ND	ND	ND	ND
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U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241564	2241565	2241566	2241567	2241568
Sample Reference				TP3	TP3	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.70	1.00	0.30	0.50
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	41	59	< 0.1
Moisture Content	%	0.01	NONE	5.1	29	14	5	13
Total mass of sample received	kg	0.001	NONE	0.5	0.8	0.8	0.8	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JSW	JSW	JSW	JSW	JSW

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	7.7	9.3	10.1	10.2
Total Cyanide	mg/kg	1	MCERTS	< 1.0	3.3	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	150	770	510	160	340
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.075	0.39	0.25	0.078	0.17
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	74.9	386	253	77.6	169
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	< 0.1	6.4	1.7	0.7	0.6

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	5	0.92	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.41	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.82	0.4	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.3	14	4.7	0.98	1.9
Anthracene	mg/kg	0.05	MCERTS	0.2	4.1	1.5	0.27	0.56
Fluoranthene	mg/kg	0.05	MCERTS	3.3	48	10	3.3	6.9
Pyrene	mg/kg	0.05	MCERTS	2.9	35	7.6	3.1	6.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.5	26	6.5	1.7	3.3
Chrysene	mg/kg	0.05	MCERTS	2	27	5.1	1.7	3
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	2.3	24	5.4	2.5	4.2
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.77	11	2.2	0.71	1.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.8	19	4.3	1.8	3.4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.1	14	2.9	1.2	1.9
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.27	3.9	0.81	0.31	0.57
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1	14	2.9	1.3	2.3

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	18.5	247	55.4	18.8	35.9
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Project / Site name: Custom House

Lab Sample Number				2241564	2241565	2241566	2241567	2241568
Sample Reference				TP3	TP3	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.70	1.00	0.30	0.50
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	35	2.2	15	13	18
Boron (water soluble)	mg/kg	0.2	MCERTS	0.2	5	2.4	1.7	2.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	NONE	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	2.7	21	22	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	270	9.3	55	48	58
Lead (aqua regia extractable)	mg/kg	1	MCERTS	1000	62	870	330	390
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.1	< 0.3	1.1	0.6	0.7
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	45	2	18	16	21
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	410	16	170	140	160

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH,CU,1D,AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH,CU,1D,AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	< 8.0	13	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	< 8.0	72	35	67	21
TPH-CWG - Aliphatic (EC5 - EC35) _{EH,CU+HS,1D,AL}	mg/kg	10	MCERTS	< 10	84	41	72	21

TPH-CWG - Aromatic >EC5 - EC7 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH,CU,1D,AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH,CU,1D,AR}	mg/kg	2	MCERTS	< 2.0	14	4.5	3.1	2.3
TPH-CWG - Aromatic >EC16 - EC21 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	12	200	35	18	21
TPH-CWG - Aromatic >EC21 - EC35 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	27	390	110	110	71
TPH-CWG - Aromatic (EC5 - EC35) _{EH,CU+HS,1D,AR}	mg/kg	10	MCERTS	40	610	150	130	94

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Lab Sample Number				2241564	2241565	2241566	2241567	2241568
Sample Reference				TP3	TP3	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.70	1.00	0.30	0.50
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241564	2241565	2241566	2241567	2241568
Sample Reference				TP3	TP3	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.70	1.00	0.30	0.50
Date Sampled				13/04/2022	13/04/2022	13/04/2022	13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
1,2,3-Trichlorobenzene				µg/kg	1	ISO 17025	< 1.0	< 1.0

VOCs TICs

VOCs TICs Compound Name		N/A	NONE	ND	ND	ND	ND	ND
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U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241569	2241570
Sample Reference				TP4	TP4
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	1.20
Date Sampled				13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	22
Total mass of sample received	kg	0.001	NONE	1.2	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JSW	JSW

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.6	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	420	590
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.21	0.29
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	208	293
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.4	2.6

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	1.7	0.96
Acenaphthene	mg/kg	0.05	MCERTS	0.75	< 0.05
Fluorene	mg/kg	0.05	MCERTS	1.1	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	14	7.5
Anthracene	mg/kg	0.05	MCERTS	3.6	1.2
Fluoranthene	mg/kg	0.05	MCERTS	28	24
Pyrene	mg/kg	0.05	MCERTS	20	20
Benzo(a)anthracene	mg/kg	0.05	MCERTS	14	11
Chrysene	mg/kg	0.05	MCERTS	15	10
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	13	16
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	5.4	4.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	9.9	12
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	6.9	7
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	2	1.9
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	7	8.5

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	142	126
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Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241569	2241570
Sample Reference				TP4	TP4
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	1.20
Date Sampled				13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Heavy Metals / Metalloids					
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	29	45
Boron (water soluble)	mg/kg	0.2	MCERTS	2.5	3.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	NONE	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	36	33
Copper (aqua regia extractable)	mg/kg	1	MCERTS	120	230
Lead (aqua regia extractable)	mg/kg	1	MCERTS	3400	5400
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.8	2.4
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	43
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	300	570

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	4.5
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	3.2	10
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	16	36
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	76	120
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	MCERTS	95	170

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	9.4	12
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	87	83
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	190	190
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	MCERTS	280	280

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241569	2241570
Sample Reference				TP4	TP4
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	1.20
Date Sampled				13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
VOCs					
Chloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	< 1.0

Analytical Report Number: 22-52253
Project / Site name: Custom House

Lab Sample Number				2241569	2241570
Sample Reference				TP4	TP4
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	1.20
Date Sampled				13/04/2022	13/04/2022
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	< 1.0

VOCs TICs

VOCs TICs Compound Name		N/A	NONE	ND	ND
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U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-52253

Project / Site name: Custom House

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2241559	TP1	None Supplied	0.3	Brown sandy loam with gravel and vegetation.
2241560	TP1	None Supplied	0.7	Brown sandy loam with stones and brick.
2241561	TP1	None Supplied	1	Brown clay and sand with gravel.
2241562	TP1	None Supplied	1.3	Brown sandy loam with gravel and vegetation.
2241563	TP3	None Supplied	0.3	Light brown sand with stones.
2241564	TP3	None Supplied	0.5	Light brown sand.
2241565	TP3	None Supplied	0.7	Brown sandy loam with gravel.
2241566	TP3	None Supplied	1	Brown sandy clay with gravel and stones.
2241567	TP4	None Supplied	0.3	Brown sandy loam with stones and brick.
2241568	TP4	None Supplied	0.5	Brown sandy loam with gravel.
2241569	TP4	None Supplied	1	Brown sandy loam with gravel and brick.
2241570	TP4	None Supplied	1.2	Brown clay and loam with gravel.

Analytical Report Number : 22-52253

Project / Site name: Custom House

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Tentatively identified compounds (VOC) in soil	Determination of volatile organic compounds total ion count in soil by headspace GC-MS followed by a full library scan.	In-house method based on USEPA8260	L073-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

Analytical Report Number : 22-52253

Project / Site name: Custom House

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

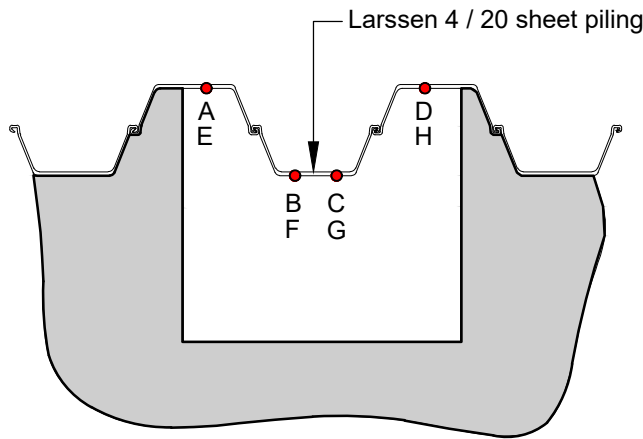
Appendix C – Further ultrasonic thickness readings



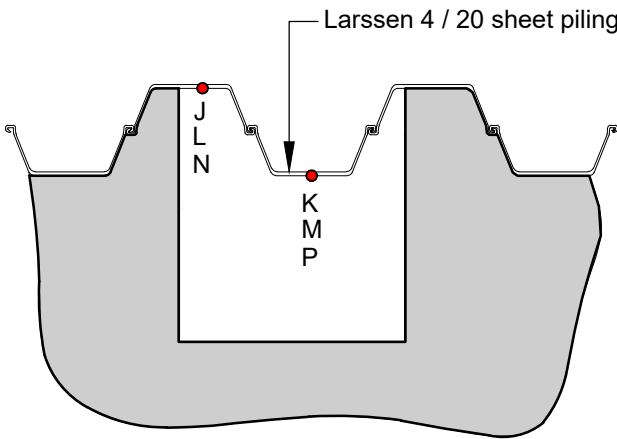
TP1 Photo



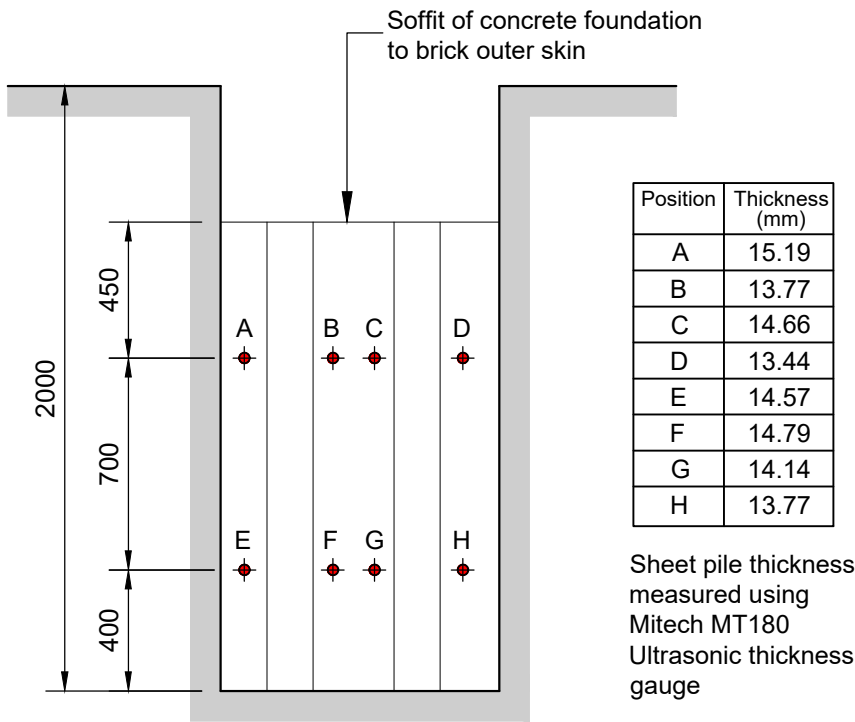
TP2 Photo



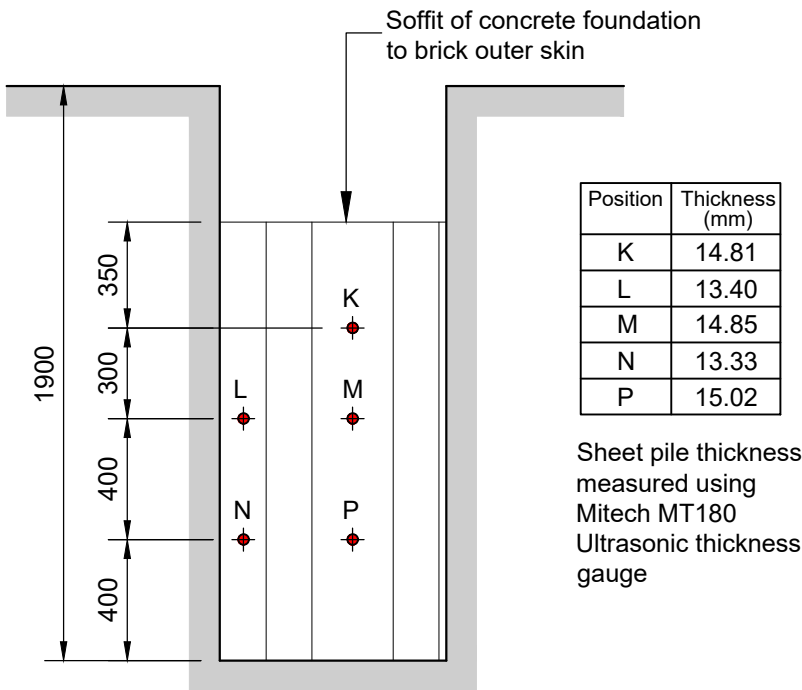
PLAN ON TRIAL PIT 1 (TP1)
Scale 1:25



PLAN ON TRIAL PIT 2 (TP2)
Scale 1:25



ELEVATION ON TRIAL PIT 1
Scale 1:25



ELEVATION ON TRIAL PIT 2
Scale 1:25

NOTES

- DO NOT SCALE THIS DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN MILLIMETRES (mm) UNLESS NOTED OTHERWISE.
- This drawing is to be read in conjunction with all relevant Architect's, Engineer's and Specialist's drawings and their respective Specifications.
- All work to comply with the relevant British Standards, Codes of Practice and the Building Regulations.
- Any discrepancies between all working drawings, specifications and schedules of all disciplines to be immediately notified to CTP for clarification/correction prior to construction of relevant structure.



PART PLAN SHOWING TRIAL PIT LOCATIONS
nts



Suffolk House 154 High Street
Sevenoaks Kent TN13 1XE UK
UK: +44 (0)1732 740195
www.ctp-llp.com

CUSTOM HOUSE RIVER WALL
GRAVESEND, KENT.

TRIAL PITS TP1 & TP2

P1 Issued for Information			RB		
Revision	Amendments		Date	Rev'd	Chk'd
Created by:	Date created:		Discipline:		
PB	14.04.2022		STRUCT		
Drawing Number:			Scale		
A7752-SK100			1:25 @A3		
			Unless Noted Otherwise		
			Revision		
			- P1		

The below corrosion analysis to buried portion of sheet piled walls is presented. This looks at the corrosion rates calculated from the site measurements. A 100 year analysis, and 48 year analysis are both carried out to check the section capacity of the raised sheet piled wall

Table A - 100 year analysis to 2122 with no remedial works

Location	Reading (mm)	start (mm)	Loss (mm)	% loss	Actual Rate of corrosion over 39 years (mm/year)	Loss of section over 100 years	residual pile thickness (mm)	residual % of thickness after 100 years	section modulus remaining after 100 years	2174 section modulus required
A	15.19	15.7	0.51	3.2	0.013	1.31	13.88	88.4	2135	not ok
B	13.77	15.7	1.93	12.3	0.049	4.95	8.82	56.2	1356	not ok
C	14.66	15.7	1.04	6.6	0.027	2.67	11.99	76.4	1844	not ok
D	13.44	15.7	2.26	14.4	0.058	5.79	7.65	48.7	1175	not ok
E	14.57	15.7	1.13	7.2	0.029	2.90	11.67	74.3	1795	not ok
F	14.79	15.7	0.91	5.8	0.023	2.33	12.46	79.3	1915	not ok
G	14.14	15.7	1.56	9.9	0.040	4.00	10.14	64.6	1559	not ok
H	13.77	15.7	1.93	12.3	0.049	4.95	8.82	56.2	1356	not ok
K	14.81	15.7	0.89	5.7	0.023	2.28	12.53	79.8	1926	not ok
L	13.4	15.7	2.3	14.6	0.059	5.90	7.50	47.8	1154	not ok
M	14.85	15.7	0.85	5.4	0.022	2.18	12.67	80.7	1948	not ok
N	13.33	15.7	2.37	15.1	0.061	6.08	7.25	46.2	1115	not ok
P	15.02	15.7	0.68	4.3	0.017	1.74	13.28	84.6	2041	not ok
Average	14.29	15.7	1.41	9.0	0.0362	3.62	10.67	67.94	1640	

Table B - 48 year analysis to 2070 with no remedial works

Location	Reading (mm)	start (mm)	Loss (mm)	% loss	Actual Rate of corrosion over 39 years (mm/year)	Loss of section over next 48 years	residual pile thickness (mm)	residual % of thickness after 48 years	section modulus remaining after 48 years	approx 1500 section modulus required
A	15.19	15.7	0.51	3.2	0.013	0.63	14.56	92.8	2239	ok
B	13.77	15.7	1.93	12.3	0.049	2.38	11.39	72.6	1752	ok
C	14.66	15.7	1.04	6.6	0.027	1.28	13.38	85.2	2057	ok
D	13.44	15.7	2.26	14.4	0.058	2.78	10.66	67.9	1639	ok
E	14.57	15.7	1.13	7.2	0.029	1.39	13.18	83.9	2026	ok
F	14.79	15.7	0.91	5.8	0.023	1.12	13.67	87.1	2102	ok
G	14.14	15.7	1.56	9.9	0.040	1.92	12.22	77.8	1879	ok
H	13.77	15.7	1.93	12.3	0.049	2.38	11.39	72.6	1752	ok
K	14.81	15.7	0.89	5.7	0.023	1.10	13.71	87.4	2109	ok
L	13.4	15.7	2.3	14.6	0.059	2.83	10.57	67.3	1625	ok
M	14.85	15.7	0.85	5.4	0.022	1.05	13.80	87.9	2122	ok
N	13.33	15.7	2.37	15.1	0.061	2.92	10.41	66.3	1601	ok
P	15.02	15.7	0.68	4.3	0.017	0.84	14.18	90.3	2181	ok
Average	14.29	15.7	1.41	9.0	0.0362	1.74	12.55	79.93	1930	

Table C - Analysis of 100 years, after concrete encasement carried out within 1 year.

Location	Reading (mm)	start (mm)	Loss (mm)	% loss	Actual Rate of corrosion over 39 years (mm/year)	Loss of section over next 1 year	residual pile thickness (mm)	residual % of thickness after 100 years	section modulus remaining after 100 years	2174 section modulus required
A	15.19	15.7	0.51	3.2	0.013	0.01	15.19	96.8	3802	ok
B	13.77	15.7	1.93	12.3	0.049	0.05	13.77	87.7	3584	ok
C	14.66	15.7	1.04	6.6	0.027	0.03	14.66	93.4	3721	ok
D	13.44	15.7	2.26	14.4	0.058	0.06	13.44	85.6	3533	ok
E	14.57	15.7	1.13	7.2	0.029	0.03	14.57	92.8	3707	ok
F	14.79	15.7	0.91	5.8	0.023	0.02	14.79	94.2	3741	ok
G	14.14	15.7	1.56	9.9	0.040	0.04	14.14	90.1	3641	ok
H	13.77	15.7	1.93	12.3	0.049	0.05	13.77	87.7	3584	ok
K	14.81	15.7	0.89	5.7	0.023	0.02	14.81	94.3	3744	ok
L	13.4	15.7	2.3	14.6	0.059	0.06	13.4	85.4	3527	ok
M	14.85	15.7	0.85	5.4	0.022	0.02	14.85	94.6	3750	ok
N	13.33	15.7	2.37	15.1	0.061	0.06	13.33	84.9	3516	ok
P	15.02	15.7	0.68	4.3	0.017	0.02	15.02	95.7	3776	ok
Average	14.29	15.7	1.41	9.0	0.0362	0.04	14.29	91.00	3663.51	ok

The above table concludes the additional section modulus of the pile.

The concrete and shear studs create a composite steel & concrete section, the section modulus therefore increases

Table D - Table of sheet pile section properties

Section	Dimensions				A	G _{sp}	G _w	I _y	W _{el,y}	S _y	W _{pl,y}
	w	h	t _f	t _w							
	mm	mm	mm	mm							
4A	400	381	15.7	9.4	236	74	185.1	45 160	2 371	-	-
4/20	508	381	15.7	9.4	218	86.8	170.9	45 924	2 414	-	-

Appendix D – Knights Brown Construction methodology

Delivery Methodology:

Contract Number:	-
Site:	Custom House, Gravesend, DA12 2DE
Method Statement No:	-
Task / Activity:	Proposed River Wall Defence

	Prepared by:	Reviewed by: (where applicable)	Approved by: (where applicable)
Name:	Sam Smith	Frank Fealey	
Position:	Graduate Engineer	Head of Pre-Construction and Business Development Manager	
Date:	06/04/2022	12/04/2022	

Records of Amendments to Method Statement.

Issue:	Date:	Details of Amendments:	Amended by:	Comment / response required by (Date)

Note: Following amendment the Method Statement shall be re-briefed with a record maintained.

Ref:	Item:	Comments:
1	Describe what the task is and what it is to achieve.	- Installation of a new North South sheet pile wall behind the existing piled wall on the West side of the site to conform to the 2070 requirement of 8.00 AOD. - On completion of the sheet pile installation, return connections to either end will be made achieving a water seal. - Once the seal is achieved the existing sheet pile wall will be removed, and the new wall with the revised protection level of 8.00 AOD will act as the replacement flood wall. The capping beam detail will be added as required, possibly in a later phase. - Installation of a new reinforced concrete wall to reflect the existing construction will be installed as a replacement for the existing floodgate which is to be removed in this phase. - Extend the remaining East West reinforced concrete flood walls capping beam to suit the 2040 flood requirement level of 6.9 AOD. - Prior to the 2070 flood level requirement the existing East West flood wall modified in this activity will need further enhancements to meet the 8.00 AOD requirement. This can be done using similar equipment to that already identified with this methodology.
2	Program for the work. Timing of the work including date, start and finish times if applicable, and duration.	TBC. Will be driven by receipt of the necessary marine licenses.

Ref:	Item:	Comments:
3	Work area clearly identified with references to drawings, sketches, grids, elevations. Where exactly on site is the task to be undertaken.	All works to be carried out within the existing site constraints where the site compound will be established, which will be segregated from the public, with the only access route via the main gate. The compound will be utilised for the delivery and safe storage of plant, welfare units, pavement protection and Heras fence panels to produce a safe worksite for operatives, and enable sufficient access for the works, as well as protecting the public. Signage will be used on the main entrance gate, making members of the public aware of the works. 
4	Supervisory and monitoring arrangements. Who will be supervising the task?	All tasks to be supervised by a member of the site team: Project Manager: TBC Site Engineer/Manager: TBC General Foreman: TBC
5	Schedule of plant to be used. List the plant and equipment required to undertake the task.	• Hiab lorry crane (for delivery and collection of welfare units /plant/machinery) • AC 70T Mobile Crane • WP150 U Silent Piler with power pack and water pump • Welding equipment • Small tools. • Concrete Placement Equipment. • Heras/pedestrian fencing All plant and tools will be managed in accordance with PUWER regulations and manufacturers guide notes. Will be inspected weekly and before use.
6	Sequence of task. Describe how the task is to be undertaken, (if applicable break it down into individual steps).	Pre setup: • Site inductions to be completed and full PPE to be issued and worn by all • All necessary permits to be in place • Each morning prior to commencement of works, all operatives will sign on to the daily briefing. This will cover the scope of the tasks at hand, any issues, safety precautions, the weather, and any changes and/or relevant information. • The team will be briefed on the control measures as detailed in the environmental plan which includes the following activities: Refuelling and COSHH storage arrangements, working next to a water course, ground water discharge, dust management, lighting arrangements, emergency spill and incident procedures, vibration management, noise management, and concrete wastewater management.

Ref:	Item:	Comments:
		Covid-19: • Covid-19 will be managed as detailed in the company procedure and current government advice and the workers will be briefed on the requirements. • When signing into site all persons will check off the COVID symptom checklist, so that they are aware of the symptoms, and they confirm that they do not have any symptoms of Covid Initial preparation of work site: • Delivery and safe set up of site welfare units (green area in image below) • Erect Heras fencing around works area and relevant signage. • Access and egress for emergency vehicles must be always maintained through main gate • All delivery vehicles are to be directed to required location and if reversing must be directed by a banksman • All Heras fencing will be full height, double clipped, and installed and maintained as per the manufacturer's details. 

Ref:	Item:	Comments:
		<u>Sequence of Works.</u> All permanent works design will be undertaken by the Client engineer. <u>Sheet pile wall (highlighted in blue):</u> - To meet the 2070 requirement (8.00 AOD) a new sheet pile wall is to be installed behind the existing sheet pile wall seen in the sketch. Exact location to be confirmed by the permanent works engineer. Expected to be between 400 – 600mm behind. - All services will firstly be disconnected and relocated, and the existing generator is to be removed. - A silent piler rig (WP150 U Silent Piler) will be used due to the lack of access, seen in the photograph to the right. - Due to the rig requiring a stable seating/pressing environment to apply sufficient reaction forces, a reaction frame must first be assembled. - A 70t crane will then set up in the courtyard with sufficient outrigger mats, in the purple area highlighted in the sketches. - The crane will be used to lift the piling rig into position and once set up it will then be used to lift the new sheet piles up and over the existing wall to feed the piling rig. - The silent piling rig has the capability to self-move from pile to pile without crane assistance, as the installation procedure advances. - Once all piles have been installed to correct level, the piling rig will be lifted out by the crane and taken away from site. - Closure details will be provided by the permanent works engineer and installed to provide a water seal between the new and remaining walls. - Once this has been installed and approved the existing sheet pile wall will be removed by flame cutting techniques into manageable sizes and removed utilising the site craneage and disposed of via a registered waste site.  

Ref:	Item:	Comments:
		<u>Reinforced concrete wall:</u> - The existing steel floodgate, together with its access and operational equipment, is to be removed (seen highlighted in orange). Then replaced with a new reinforced concrete wall which is to be constructed to the same height as the adjoining wall. - Prior to the removal of the existing floodgate a temporary flood defence barrier will be installed to prevent potential water ingress whilst the concrete wall is constructed. - Sufficient footings will then be excavated, as detailed by the permanent works engineer. - Steel bars will be doveled into both sides of the existing wall. - Steel reinforcement will be installed between the walls. - Shuttering will be erected on both sides of the wall, to the full height. - Concrete will then be mass poured into the shutters. - Sufficient time will be allowed for curing before the shutters are struck.  <u>Reinforced concrete capping beam:</u> - A new reinforced concrete capping beam is to be constructed along the full length of the existing river wall as part of the development, raising the height to the 2040 requirement of 6.9mAOD (seen highlighted in yellow). - Reinforcement will be doveled into the existing capping beam. - Shutters will be erected to the correct height. - Concrete will be poured into the shutters, forming the new capping beam. - Sufficient time will be allowed for curing before the shutters are struck.  Notes: - The full width of the access road within the courtyard will be always maintained. - Soft landscaping will be completed after the main body of works. Allowing for possible future developments as none of which will present a permanent obstacle. - All services along the river wall to be removed and relocated prior to works Fire Arrangements: - The site fire plan will be produced and displayed on site notice boards and in the office. - Suitable fire extinguishers will be set up in strategic locations within the site compound, high risk material locations and with high-risk site operations. - Fire extinguishers will be suitable for the material at risk and will be checked weekly and serviced if necessary. - The fire alarm will be an air horn and 999 must be called.

Ref:	Item:	Comments:
		The site emergency meeting point will be set up and displayed in the site fire plan and briefed to all operatives in their induction.
7	Reference to occupational health standards: COSHH, manual handling, noise exposure. Does the task introduce risks to occupational health, for example; Manual handling (detail on a Manual Handling Risk Assessment). Using substances hazardous to health (if a COSHH Assessment is not available obtain a MSDS and undertake an assessment and record on COSHH Assessment). Noise/vibration (determine or measure levels and undertake Risk Assessment, record on Vibration Register).	- Manual handling will be avoided where possible. - All plant to be regularly inspected to minimise excessive noise. - A silent piler rig will be used, which minimise's noise and vibrations. - Noise and vibrations to be monitored throughout the duration of the project. - All Plant will be managed in accordance with PUWER & LOLER regulation and company procedures. - All plant will be maintained and used in accordance with the manufacturer's instructions. - Defective or damaged plant will be removed from service and repaired or replaced. - All plant will have a copy of their declaration of conformity (if less than 12 months old) or certificate of thorough examination - All plant must be refuelled at a designated refuelling point where necessary and will be briefed to plant operators in the site induction. - All items of plant will have drip trays and plant nappies when not in use to prevent oil/fuel spills next to a water course. - Plant and equipment will be inspected daily and maintained in accordance with the manufacturer's guidance. - If a fuel or oil leak is noticed, the item of plant or equipment will be taken out of use and the oil/fuel will be contained. - Activities involving the use of handheld vibrating tools will be risk assessed to see if they can be avoided. - Low vibration tools will be used, and these will be well maintained, and an assessment of exposure will be carried out to ensure that the limit values are not exceeded. Compulsory for all personnel to wear minimum PPE requirements of: - High visibility clothing - Hard hat - Protective footwear - Eye protection - Gloves (Hearing protection and wet weather gear to be worn when required) - Any delivery drivers exiting their cab must wear full PPE on site. - All COSHH materials will be kept in the stores. - COSHH assessments will be completed for all COSHH materials/substances. All COSHH assessments will be briefed to the operatives along with the relevant RAMS. - All operatives will be briefed on the site spill procedure. - Any small items of plant will be refuelled on a drip tray with absorbent pad. - At the end of use or end of shift all COSHH materials will be return to a COSHH store. - Diesel will be stored in a double banded bowser, and a designated plant refuelling area will be set up with signs and barriers placed to demarcate its location.

Ref:	Item:	Comments:
		Any COSHH incidents will be reported and dealt with in accordance with company procedure and site requirements In the event of a spill: STOP: work immediately and prevent any more material spilling. If the pollutant is flammable eliminate any sources of ignition e.g., switch off plant. If the pollutant is silt, stop the activity which is causing silt generation CONTAIN: the spillage immediately using bunds of earth or sand, drip tray or spill kit contents as appropriate NOTIFY: Immediately report incident to the site manager/foreman, who will then report to the environmental representative (or project manager in their absence). Emergency procedures will be included on the site poster boards.
8	PERMITS TO WORK REQUIRED Does the task require additional controls using a Permit to Work? Permit to Dig Hot Work Permit Confined Space Entry Permit	A permit to lift will be required for all lifting operations in accordance with the company procedure, site lifting plan and LOLER Regulations. Any works that present a fire risk such as welding, cutting lances or disc cutting of metals requires a hot works permit. Any breaking of ground will require a permit to dig which will be issued in accordance with breaking ground method statement and company procedures. If using a ladder for access, a ladder permit is required.
9	QUALITY CONTROLS While undertaking the task detail any Quality Controls required i.e.: Records of Concrete Cube tests.	Engineering equipment will be checked, recorded weekly and certification of calibration will be kept in the site engineering file.
10	ENVIRONMENTAL CONTROLS Environmental controls that need to be put in place to safeguard the Environment: Ground Contamination Water Pollution- Protection of Species/Habitat Statutory Nuisances- noise/dust Waste Materials- Site Waste Management plan etc.	Waste should only be removed to an authorised facility under waste transfer note/consignment note and following receipt and check of waste carrier license and disposal/exemption permits. It is the intention to limit the production of non-recyclables wastes and their consequent removal from site as far as is reasonably practicable. Construction materials and wastes will be safely stored so that items do not blow across site and potentially into the river. - Spill kits will be located on site, in plant and by refueling points. These will be replenished as necessary. - Due to the proximity to a water course, extra care must be taken when refueling and using plant/machinery. - In the presence of marine wildlife, works will be temporarily paused and the relevant environmental agency and wildlife personnel will be contacted.

Ref:	Item:	Comments:
11	First Aid and Emergency Arrangements. In addition to the general site first aid and emergency arrangements are any additional first aid or emergency requirements required for the task.	First Aider to be always on site. - First Aiders: TBC First aid kit & eye wash kit will be available in site welfare. Local A&E Department: Darent Valley Hospital, Emergency Department, Darenth Wood Rd, Dartford, DA2 8DA Hospital route will be displayed on site notice board.
12	Control for the safety of third parties While undertaking the task detail any controls that are to be put in place to safeguard others affected by the work.	The site compound itself is not accessible by the public and supervision will ensure no members of the public enter the works areas via the main gate. Sign posting will be erected where necessary, to ensure the local public are made aware of the works within the site.
13	Details of temporary services required. List any temporary services required to undertake the task.	Temporary sea defense barrier to be installed once the existing floodgate is removed.
14	Are any lifting operations to be undertaken?	• Permits to lift required. • Lift to be supervised by KB staff to reduce risk of operatives and any members of the public from being injured. • Plant and equipment used for lifting must be maintained and managed in accordance with PUWER regulations.
15	Arrangements for dealing with waste.	Any waste material to be recorded in accordance with the waste management strategy and disposed of accordingly.
16	Attachments.	

Ref:	Item:	Comments:
17	Additional Information	The site will be left secure, and all plant and tools safely locked away at the end of each shift, a review will be carried out weekly to assess the security on site. All deliveries will be recorded. The project manager/site manager and the site engineer are to monitor the day to day works and ensure that the works are being carried out in accordance with the method statement. The site engineer or other suitable person is to provide a weekly tour of the works for the visiting client project manager or his representative In addition to this, the programme will be monitored on site to ensure the works stay on programme and release the site to follow on trades as quickly as possible. Works will be inspected in accordance with the approved ITP Future Works to raise the crest level to 8AOD (Before year 2070) Find attached below a plan indicating the expected work areas for a return visit after the development is complete to extend the walls to meet the 2070 requirement, using the same method as for the Reinforced concrete capping beam raising described in section 5 above as well as using the same equipment. The full width of the access road within the courtyard will be always maintained. Soft landscaping will be completed after the main body of works, none of which will present a permanent obstacle to complete the 2070 raising.

Ref:	Item:	Comments:
		Future Works Access Plan Proposed Working Area for Installation Plant Proposed Compound Maintained Access Route

The signatories confirm that this Method Statement and attached Risk Assessments / COSHH Assessments have been briefed to understood and the task shall be undertaken as described.

Method Statement Number: -

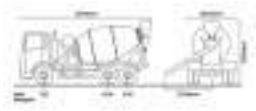
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Position:

Appendix E – Construction plant data sheets

Truck information

6m³ Truckmixer



Length = 8.7m

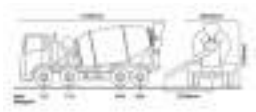
Height = 3.75m

Width = 2.55m

Chute = 2.75m

A fully loaded 6m³ truck will weigh approximately 26 tonnes, depending on the type of concrete.

8m³ Truckmixer



Length = 9.15m

Height = 3.75m

Width = 2.55m

Chute = 2.75m

A fully loaded 8m³ truck will weigh approximately 32 tonnes, depending on the type of concrete.

We understand that our 6m³ and 8m³ trucks aren't always suitable for deliveries requiring small volume orders or with restricted access. Which is why Hanson Concrete offers a mini mix operation under the brand Supamix. This is a dedicated small contract delivery service for Hanson Premix customers available from Supamix plants based across the North East, Yorkshire and Cumbria.

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Necessary



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Accept all

WP150 Silent Piler System



Description:

The WP-150 is specific plant designed to reduce the level of noise, vibration and risk during the installation of sheet piles.

With the option of pre-augering the ground prior to the installation work commencing, and water jetting during the installation process, the "Silent Piler" is capable of negotiating through a wide variety of soil conditions.

Benefits:

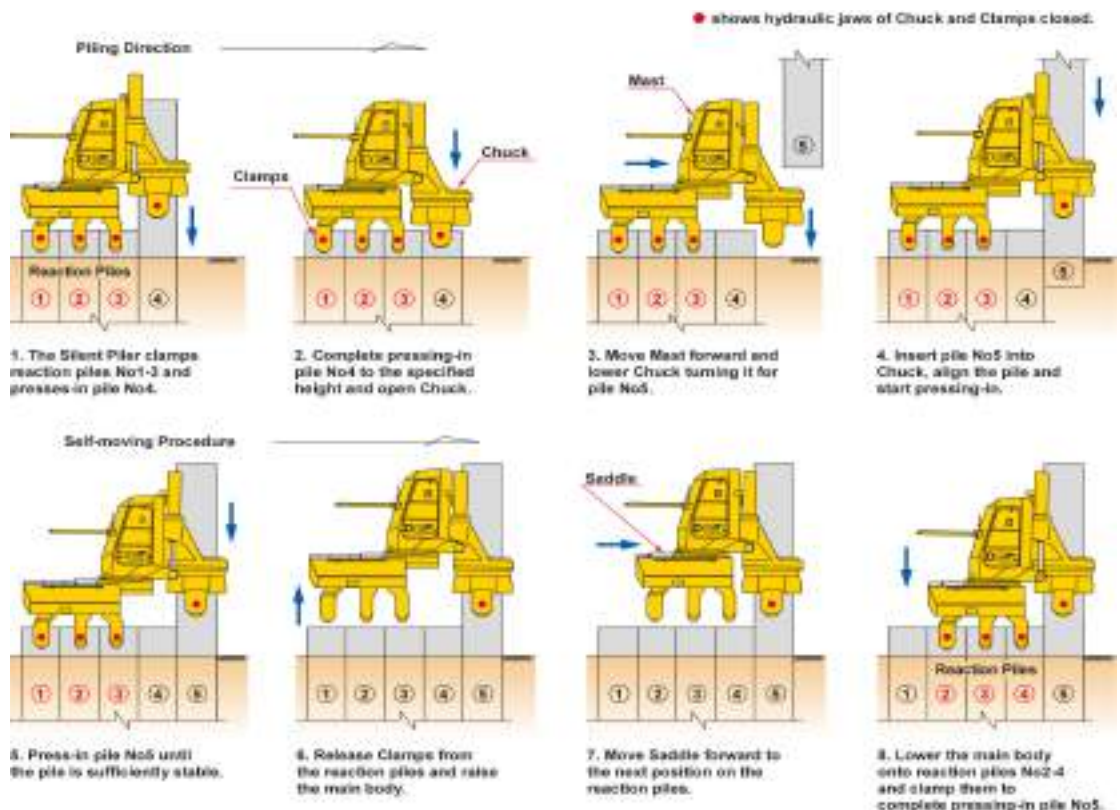
The benefits of the WP-150 are numerous. As well as the reduction in noise and vibration due to the piler's ability to *push* piles into the ground, the piler's capability to work close to the ground without the need of trestles and wailings greatly reduces the risk of injury. Additionally the piler's capacity to move itself along the top of the first piles installed reduces the need for craneage and brings the total cost of construction down.



Sheet Piling, Construction
& Professional Design
Services

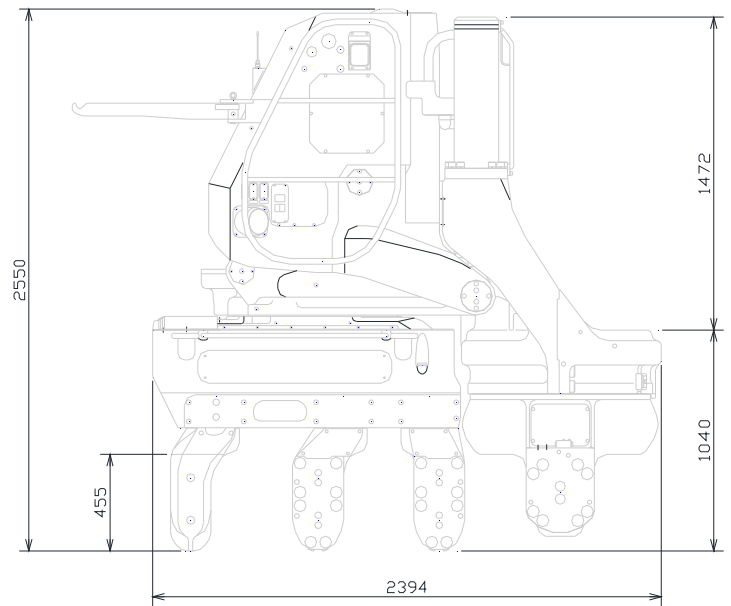
Unit 7,
The Oaks Business Village
Revenge Road,
Lordswood,
Kent,
ME5 8LF

TEL: 01622 794460
FAX: 01634 863016
Enquiries@berryrange.com
www.berryrange.com

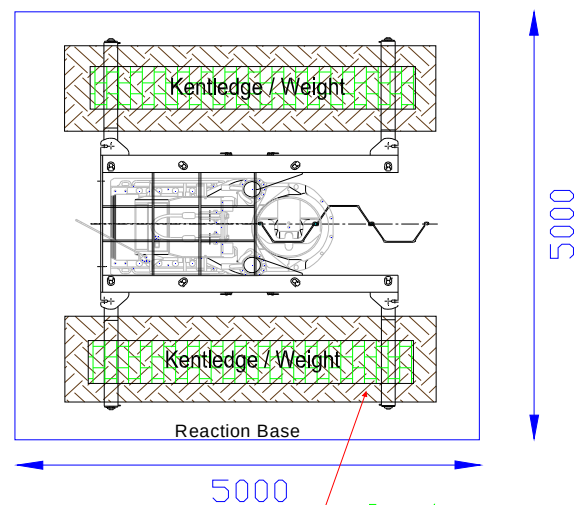
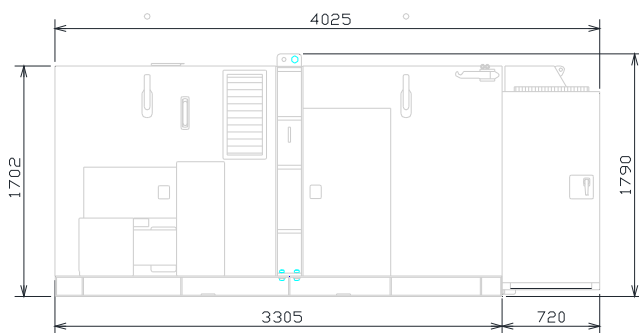
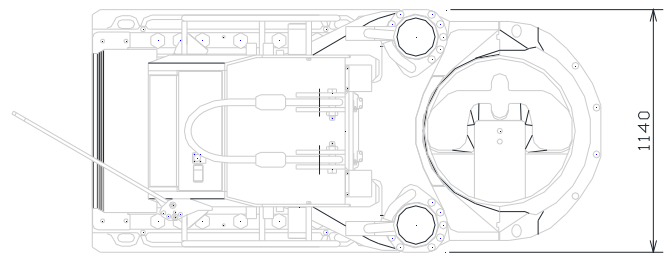


WP150 Silent Piler System

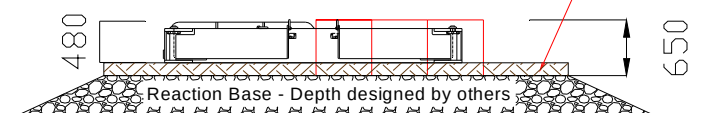
STILL WORKER	WP-150
MAX. Pressing-In Force	1,500kN
MAX. Drawing-out Force	1,600kN
Stroke	800mm
Pressing-in Speed	1.8-23.0 m/min
Drawing-out Speed	1.9-18.0 m/min
Tilting Device	± 5 degrees
Mast Rotation	180 degrees
Applicable sheet piles	U Profile 400mm, 500mm, 600mm
Operation System	Wireless radio-control and Cable remote-control
Moving System	Self-moving
Weight	9,500kg



HYDRAULIC POWER UNIT	TE-200
Power	Diesel Engine 4-cycle, Water-Cooled Direct Injection Turbo
Output Rating	147.1kw/1,800min ⁻¹
Pump	Variable-Capacity Pump
Pressure Rating	40MPa max.
Fuel Oil tank	350 Litres
Hydraulic Oil tank	550 Litres
Weight	5300kg



Reaction Stand	WP-150	WP-100
Dimension	Length 3,200mm Width 1,900mm Height 475mm	Length 3,200mm Width 1,900mm Height 475mm
Weight	1,700kg	1,400kg





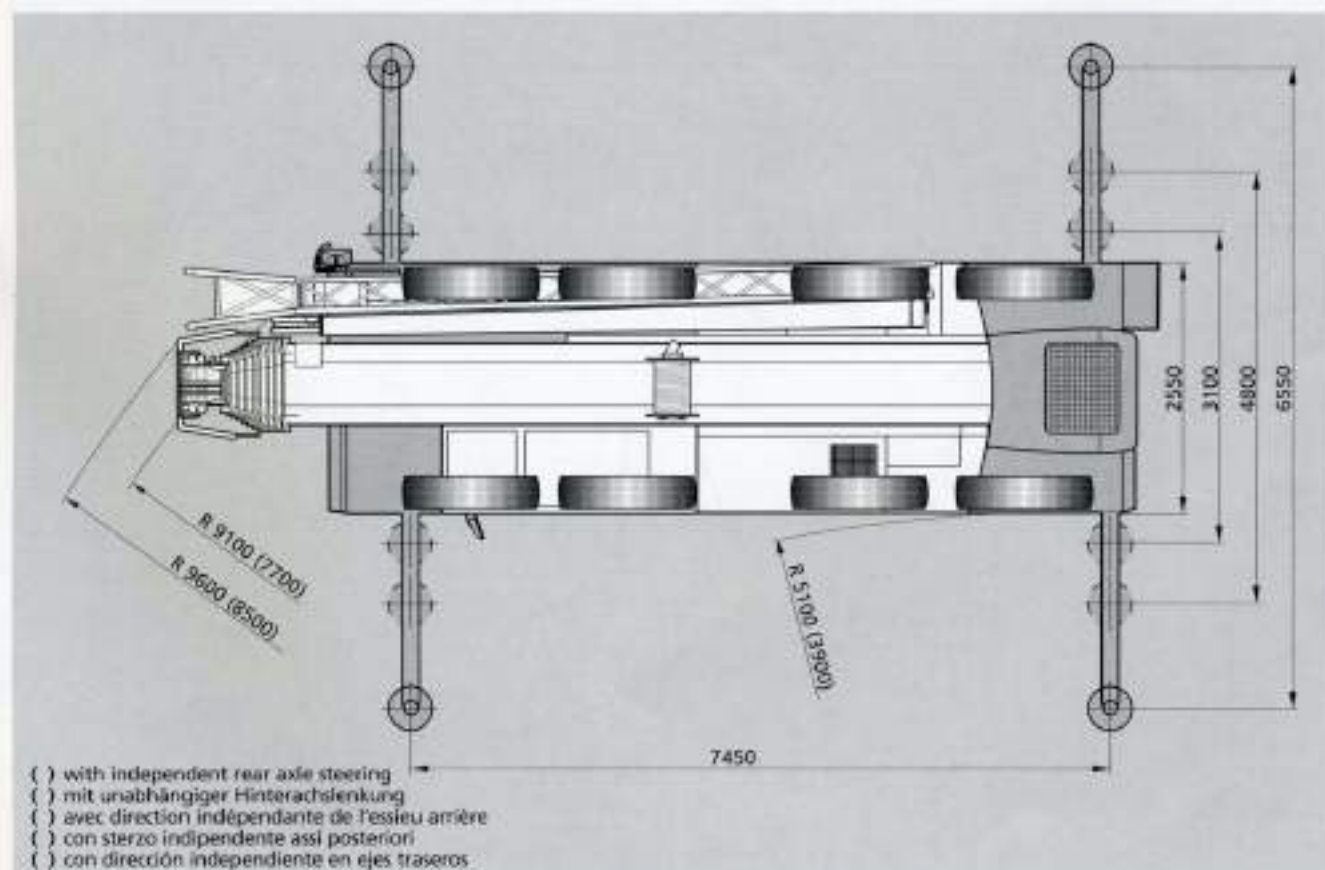
TEREX | DEMAG

AC70CITY

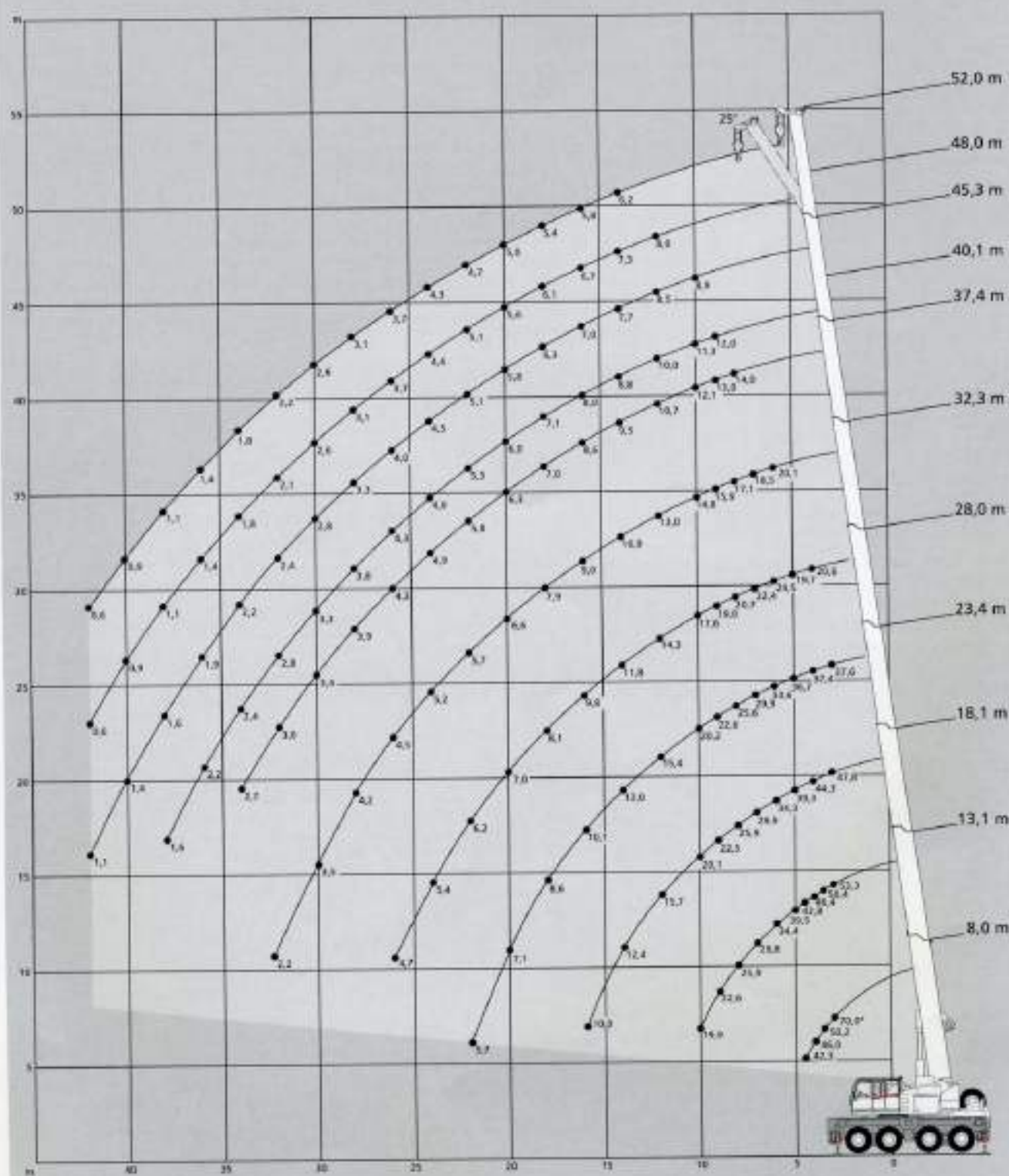


70t





**Working ranges main boom · Arbeitsbereiche Hauptausleger ·
Portées flèche principale · Campo di lavoro braccio base ·
Rangos de trabajo de pluma principal**



* over front · nach vorne · sur l'avant · sul davanti · hacia delante

✕ Runner for workshop applications · Montagespitze für Hallen-
einsätze · Potence pour utilisation en atelier ·
Runner per lavori all'interno · Runner para trabajos en interiores

