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Preliminary Report on Metrolink Route and its Potential Effect on AerCap House

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Quality Assurance – Approval Status

This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

Issue	Date	Prepared by	Checked by	Approved by
1	03/03/2024	R.Osborne	R.Osborne	

Comments

Executive Summary

The Issue of concern to Hines is that although a submission was made to TII informing the structural form and geometry of the existing AerCap House, TII has ignored the information.

The elevation of the Metrolink Tunnel as it passes under AerCap House does not properly consider the existing AerCap House structure and, as a result, the damage that is going to be caused to AerCap House.

The Exclusion Zone, as defined in the "Draft Guidance Note For Developers" document dated May 2023 prepared by TII, results in the basement structure falling within the exclusion zone. The reduction of the Limits of Deviation has reduced the level of the exclusion zone, but it still encompasses the existing piles.

The EIAR prepared by Jacobs/IDOM does not correctly identify AerCap House and refers to Canada House, a building that previously occupied the site and was demolished prior to 2013. Therefore, all the assessments undertaken are inaccurate and do not properly consider the impact of the Metrolink Tunnel on AerCap House.

The level of damage AerCap House could reasonably accommodate is Negligible (cracks less than 0.1mm). Even at this level, there are still concerns that the Basement Waterproofing System is going to be compromised and require remedial works to an occupied building.

If the Metrolink Tunnel is to pass under or close to AerCap House, we require a detailed Phase 3 assessment using the correct building geometry and structural form to be completed and independently verified, ensuring the maximum damage caused to AerCap House is limited to 0.1mm cracking. The proposed tunnel elevation may require to be lowered more than the current LOD downwards, i.e. more than the 10.0m indicated in the Wider Effects Report submitted as part of the application, considering the proximity and sensitivity of AerCap House.

The major concern for Hines is physical damage to AerCap House, either through the Tunnel Boring Machine damaging the existing structure or the secondary effects caused by the Tunnel Boring Machine, such as subsidence/settlement of the ground damaging the integrity of the waterproofing system, structure and facades.

Based on the findings of this Report, we believe that the Metrolink Tunnel should either be:

1) rerouted around the substructure of AerCap House or,

2) the elevation of the Metrolink tunnel should be significantly lowered to a level that no damage will be caused to any part of AerCap House.

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Disclaimer

1. Introduction

1.1 Qualifications & Experience

I, Richard Osborne, Director of Waterman Moylan Consulting Engineers Limited, have prepared this Report based on a review of the documents and information provided. I have over 25 years of experience in the design, construction and management of an extensive range of building and civil engineering projects. I am a Chartered Engineer ("CEng"), a Fellow of the Association of Consulting Engineers ("FConsEI") and a Member of the Institution of Engineers of Ireland ("MIEI"). I hold a Bachelor's Honour Degree in Engineering ("BENG (Hons)") from Bradford University, England. I have been retained by Hines with respect to the impact of the MetroLink tunnel passing under the recently completed AerCap House.

1.2 Background

AerCap House is located at the corner of Earlsfort Terrace and St. Stephens Green. The purpose of this Report is to provide the Inspector and the Board with a high-level understanding of the impact of the proposed Metrolink route on the structure of AerCap House. The structure of AerCap House generally comprises an insitu concrete basement and insitu concrete columns supporting insitu concrete post-tensioned slabs. The façades to AerCap House comprise several bespoke systems that were developed specifically for the development.

Waterman Moylan has previously prepared the submission that was submitted to TII concerning the Route of the Metrolink. This submission highlights various potential issues that could cause damage to AerCap House, including vibration, noise, settlement and damage to the foundation and basement structure.

2. Findings

2.1 Metrolink Building Damage Assessment of AerCap House

The proximity of the proposed tunnel to the existing structure has not been correctly assessed or considered by the Jacob / IDOM team. I have reviewed the Building Damage Report ("the BDR") produced by Jacob/IDOM, which was included in Appendix A5.17 of the Environmental Impact Assessment Report ("the EIAR"), and I believe the building that has been assessed (reference AB-37 in the EIAR, table 5.4) incorrectly describes the property as a five-storey building and with no reference to a basement. This description does not correctly represent AerCap House, which is a six-storey building with a two-storey basement structure. The description describes one of the buildings on the site that was demolished (Canada House) prior to the construction of AerCap House.

The Building (AB-37) described in the BDR is a five-storey building. It is clearly incorrect and does not correspond with AerCap House, which has been constructed on this plot. The findings of the BDR concerning the Building Damage Categorisation are incorrect as the data used was not checked or verified. The empirical degree of damage thresholds in TII risk classification table in the BDR are for masonry structures and do not take account of the main characteristics of the AerCap building, including the basement waterproofing system and façade construction, which are referred to in more detail in the next section.

Therefore, the expected Category of Damage present by Jacob / IDOM cannot be relied upon, which, if followed, would result in damage to our Client's building.

2.2 Metrolink Settlement Assessment at AerCap House

Jacob / IDOM drawing number ML1-JAI-EAI-ROUT_XX-DR-Y-21146, revision P02 dated 23 February 2024 (which appears to supersede ML1-JAI-EAI-ROUT_XX-DR-Y-21149 revision P02, which was included in Appendix C of the BDR), indicates the Jacob / IDOM engineers predict subsidence/settlement of up to 10mm under the footprint of AerCap House. This settlement was previously advised as 20mm in the original Rail Order submission. No explanation has been given for the reduction to a predicted 10 mm.

A copy of Jacob / IDOM, drawing number ML1-JAI-EAI-ROUT_XX-DR-Y-21146 Rev P02, has been included in Appendix A of this Report for ease of reference.

The magnitude of the subsidence/settlement under AerCap House is not uniform and varies from 0mm to 10mm. The maximum subsidence/settlement is experienced directly under one of the main stair cores, which provides stability to the building.

The settlement contours presented by Jacob / IDOM indicate that differential settlement/distortion of AerCap House is going to occur, resulting in the following damage:

- The basement uses a whitetank waterproofing system, which relies on the watertightness of the reinforced concrete basement floor slab and walls. Therefore, even minor cracking could lead to groundwater ingress;
- The internal reinforced concrete frame uses post-tensioned reinforced concrete floor slabs for large spans, which would be more sensitive to differential settlement than conventional RC slabs;

- The tunnel passes under one of the main structural cores for the building, and this incorporates a complex transfer structure at the first-floor level to accommodate a shift in the position of the core for the upper floors of the building;
- The building has a modern stone and glass façade, which would be more sensitive to distortion due to differential settlement along the perimeter secant pile wall than a masonry or blockwork structure.

AerCap House can not accommodate movement of this magnitude without damage to the structure, waterproofing and facades being caused.

2.3 Proposed Metrolink Tunnel Location

Following the publication of the Metrolink Rail Order, including the drawings, Waterman Moylan has reviewed the proposed alignment and level of the Metrolink tunnel under the footprint of AerCap House.

The proposed Route of the Metrolink tunnel passes under AerCap House, entering at the southern boundary and exiting at the northern boundary. The level of the proposed Metrolink rail varies between c. -13.180m AOD at the southern boundary and c. -13.200m AOD at the northern boundary. Based on the information in the Metrolink Rail Order, we understand the outside diameter of the tunnel to be 9.2m and that the cutting diameter of the proposed Tunnel Boring Machine ("TBM") is 9.53m. We note that the final diameter of the TBM is to be left to the discretion of the contractor and could be larger than currently presented by Jacobs/IDOM.

We have also included in Appendix B of this Report Jacobs/IDOM drawing number ML1-JAI-ARD-ROUT_XX-DR-Y-01018, which was included in the Metrolink Rail Order information pack and is titled "Metrolink - Alignment Long Section 18".

We have reviewed the "Draft Guidance Note For Developers" document dated May 2023, which was submitted at the beginning of the Oral Hearing. In section 2.1.4 Tunnels, Figure 11:Bored Tunnel Protection and Exclusions Zones is presented indicating the exclusion zone to the tunnel extending 5.0m above the top of the tunnel and 10.0m below the bottom of the tunnel. There is also a lateral exclusion zone, which is 15.0m on either side of the tunnel.

We note that DOC ML1-JAI-GEO-ROUT_XX-RP-Y-00034, dated 10 November 2023 and prepared by Jacob/IDOM, has also been submitted as part of the Oral Hearing. In this document the Level of Deviation ("LOD") upwards has been reduced from 5.0m to 1.0m.

We have added the relevant information Exclusion Zones, and Limits of Deviation to Jacobs/IDOMs drawing number ML1-JAI-ARD-ROUT_XX-DR-Y-01018 included in Appendix B of this Report. We have also indicated the location and volume of the substructure and superstructure of AerCap House.

Based on the overlay, it is clear that the substructure to the basement is located at the top of the exclusion zone as presented DOC ML1-JAI-GEO-ROUT_XX-RP-Y-00034.

A detailed Phase 3 assessment using the correct building geometry and structural form should be completed and independently verified, ensuring the maximum damage caused to AerCap House is limited to 0.1mm cracking. The proposed tunnel elevation may require to be lowered more than the current LOD downwards, i.e. more than the 10.0m indicated in the Wider Effects Report submitted as part of the application, considering the proximity and sensitivity of AerCap House.

The impact of implementing the LoDs, either upwards or downwards, on differential settlement and building damage (Ch.5 of EIAR) has not been assessed in the Wider Effects Report. Moreover, the likely significant **positive** impact of lowering the tunnel has not been considered in the EIAR.

2.4 Damage to AerCap House Substructure in the Exclusion Zone

We understand that AerCap House could not have been developed in its current form had the Metrolink Tunnel been previously constructed, as there are substructure elements required to extend into the exclusion zone, which could cause damage to the Metrolink Tunnel.

As the Metrolink Tunnel is a significant piece of infrastructure and has been designed to resist significant earth pressures, it is equally likely that such a significant piece of structure could cause damage to the existing substructure elements of AerCap House that are currently in place and providing support to AerCap House.

2.5 Mitigation Measures to Protect AerCap House

Based on our findings, we believe that :

a) The Route of the Metrolink Tunnel should be diverted to avoid clashing with the existing substructure of AerCap House and damaging the existing building or

b) The elevation of the Metrolink Tunnel should be lowered to the extent necessary to ensure that no damage will be caused to any part of AerCap House.

3. Metrolink Responses to Previous Submission

Below, we have set out our original points raised in our submission dated 13 January 2023 to TII response to the Metrolink Rail Order, followed by TII's Response and further commentary on TII response.

Observation (Waterman Moylan) 1: *The route selection including horizontal alignment, vertical alignment and depth of MetroLink below ground in the area between Chainage 18+600 and Chainage 18+700 should be reviewed by NTA / TII to satisfy themselves and to ensure that (a) MetroLink does not cause structural damage to the foundation system supporting our Client's building which comprises a mixture of CFA piles (some extending 12.5m below ground level) and pads foundations which are founded on the competent rock. (b) MetroLink does not cause structural damage to our Client's building at the basement level. The basement structure forms the waterproof envelope to our Clients building and any damage would result in the ingress of water into the basement. (c) MetroLink does not cause damage to the bespoke cladding; glazing and fragile finishes of our Client's building. (d) MetroLink provides the necessary vertical and/or horizontal clearance between the existing basements and the tunnels.*

TII Response 1: *" TII are satisfied that the approach adopted to date for assessment of building damage follows an industry standard approach undertaken on tunnelling and underground projects around the world including on the Channel Tunnel Rail Link and Crossrail in London, the Dublin Port Tunnel and currently on High Speed 2 in England, and therefore that further assessment does not need to be delivered prior to the Route being consented. The purpose of the Stage 1 and Stage 2a assessments has been to provide/ensure confidence that the Works will not induce unacceptable damage to buildings/structures along the Route. The primary objective has been to confirm that the structural integrity of each building/structure will not be compromised by the Works.*

EIAR Appendix A 5.17, Building Damage Report, covers the assessed impacts of construction generated ground movements and settlement on property. Table 5-4 of this Report shows that the building (AB-37) has been assessed as falling within the "Negligible damage" category currently, an explanation for which can be found in Table 4-4 of the aforementioned Report. According to this Table, the Negligible damage category refers to hairline cracks. TII would also like to confirm that the assessment has additionally taken into account the presence of the basement as noted.

Despite the low predicted impact of the tunnelling works on your building, it will progress to a subsequent Phase 3 assessment due to the piled foundations and basement structures noted.

The Phase 3 assessment will take account of final design and construction methodology details. For the Phase 3 assessment, each building will be subject to detailed assessment on an individual basis. A detailed survey will be carried out as part of the Phase 3 assessment to provide the necessary additional information to inform this detailed analysis of how the individual elements of the building would be affected by the predicted ground movements. The method and extent of the detailed analysis will be determined on a case-by case basis and may include a more sophisticated semi-empirical or a detailed soil-structure interaction using finite element modelling methods. It is likely that the Phase 3 assessment will yield further improvement to the damage category determined by the Phase 2b assessment. The results of this refined assessment typically show that earlier assessments are conservative and over estimate the likely impact of construction generated ground movements.

Ancillary features in each building/structure, which themselves do not contribute to the structural integrity of the building/structure, are considered in the subsequent Phase 3 assessment. The Designer/Contractor is responsible to further investigate the sensitivities of each building/structure to identify those elements within the building/structure curtilage that may not contribute to the structural integrity of the building/structure itself, but will most likely in themselves be sensitive to the excavation and construction processes. In each instance, engaging with the building/structure owner (or their delegated representative) the Designer/Contractor will be responsible for identifying further mitigations if mitigation measures are required. These mitigations might relate directly to the excavation and construction processes (at source measures), or they might relate to a direct protection of the non-structural elements for which damage related concern remain.

If, based on the detailed Phase-3 assessment, the impacts are deemed to be unacceptable to items such as building cladding or basement waterproofing (or any other ancillary features) further mitigation measures would then be assessed and implemented. For example enhanced control the TBM slurry pressure in this zone would further reduce face loss and hence impacts. Additionally, there is the ability to increase the separation of the tunnel from your basement structures within the limits of deviation and rail design constraints. Lowering the tunnel alignment would further reduce the settlement but for your building this is unlikely to be needed as it is already in the Negligible damage category.

During the Phase-3 assessment, TII will reduce the impacts from those conservatively stated to date such that any unacceptable impacts are negated. This process has been used successfully across major projects elsewhere with buildings of similar cladding and basement detailing."

Waterman Moylan Response 1: TII refer to the EIAR Appendix A 5.17, Building Damage Report and confirms that the building has been assessed as falling within the "Negligible damage". This response is deficient for the following reasons:

1. The building that has been assessed (reference AB-37 in the EIAR) incorrectly describes the property as a four-storey building with no reference to a basement. This description does not correctly represent AerCap House, which is a six-storey building with a two-storey basement structure. The description describes one of the buildings on the site that was demolished (Canada House) prior to the construction of AerCap House. Therefore, any assessment that has been completed can not be relied upon.
2. TII recommends a Phase 3 ground movement assessment as the solution. However, they suggest that the Designer /Contractor should be responsible for this, in addition to the design and implementation of any necessary mitigation measures. Waterman Moylan recommends as essential a detailed Phase 3 assessment using the correct building geometry and structural form to be completed and independently verified, ensuring the maximum damage caused to AerCap House is limited to 0.1mm cracking. This Phase 3 assessment should be carried out prior to approval being granted so that it can be reviewed by Waterman Moylan and any other experts acting on behalf of Hines to ensure that any necessary mitigation measures can be adopted in any decision of the Board to approve the proposed railway works and/or in the conditions attached to the decision.

Observation (Waterman Moylan) 2: *The construction information provided by MetroLink has been reviewed. We refer to the following points: a) Metrolink has assessed the "Groundborne Noise from Tunnel Boring Machine" and presents its findings on drawing no. ML1-JAI-EIAROUT-XX-DR-Y-14009 (a copy is attached to this submission). This drawing indicates MetroLink will generate an additional 50db directly under the location of our Client's building which is unacceptable.*

TII Response 2: *"Appendix 14.5 Groundborne Noise and Vibration Blasting Modelling Results presents predicted groundborne noise and vibration levels during the construction and operation phase of the project. The prediction of groundborne noise during TBM passage for the Aercap House (65 St. Stephen's Green) is 49 dB LASmax, which is above the 45 dB LASmax threshold, resulting a significant impact on the buildings operation for the limited duration of TBM passage. Unfortunately, there are no effective methods available to reduce groundborne noise or vibration from TBMs at source, but noting that the duration of this impact will be in the order of up to two weeks as the TBM passes. It is important to note that the noise level as the TBM passes will be noticeable and perhaps disturbing for some, but will not cause any damage to the property. TII will liaise with Hines Real Estate Ireland Limited to ensure the timing of these impacts are known. The principal mitigation measures aimed at minimising impacts are as follows:*

- Advance public consultation and stakeholder engagement can greatly reduce the significance of groundborne noise effects, as building occupants would be prepared for the passage of the TBM and resultant elevated noise and vibration levels.

- TII will accept and consider applications for additional measures on a case-by case basis, in accordance with its Noise and Vibration Mitigation Policy (see EIAR Appendix A14.6, Airborne Noise & Groundborne Noise Mitigation Policy)."

Waterman Moylan Response 2: The response suggests that we need to accept the nuisance caused by the proposed works, and there is nothing that TII are willing to undertake to prevent this nuisance.

Observation (Waterman Moylan) 3: *b) Metrolink has assessed the predicted "Settlement" and presents its findings on drawing no. ML1-JAI-EIA-ROUT-XX-DR-Y-21149 (a copy is attached to this submission). This drawing indicates MetroLink will be causing a 20mm settlement directly under the location of our Client's building which is unacceptable. Settlements of this magnitude cannot be accommodated by the building's structure and will cause damage to foundations; basement; superstructure; façade and internal finishes. As previously stated, the basement structure forms the waterproof envelope to our Client's building and any damage would result in the ingress of water into the basement.*

TII Response 3: *"Please refer to Item 1. The settlement contours calculated were used to undertake the building damage assessment and conclude that typical damage would be Negligible and likely forms of repair would be limited to hairline cracks only. This is a conservative estimate. The Phase 3 assessment which will be undertaken for this building will refine the parameters and generally reduce the potential impacts further."*

Waterman Moylan Response 3: It appears that TII has decided not to properly consider the implications of their proposed tunnelling operations so close to the existing basement substructure of AerCap House.

Again, TII refer to the EIAR Appendix A 5.17, Building Damage Report and confirms that the building has been assessed as falling within the "Negligible damage". This response is deficient for the following reasons:

1. The building that has been assessed (reference AB-37 in the EIAR) incorrectly describes the property as a five-storey building with no reference to a basement. This description does not correctly represent AerCap House, which is a six-storey building with a two-storey basement structure. The description describes one of the buildings on the site that was demolished (Canada House) prior to the

construction of AerCap House. Therefore, any assessment that has been completed can not be relied upon.

As discussed above, the empirical degree of damage thresholds in TII risk classification table in the BDR relate to masonry structures and do not take account of the main characteristics of AerCap House.

2. TII suggests a Phase 3 ground movement assessment as the solution. Waterman Moylan recommends a detailed Phase 3 assessment using the correct building geometry and structural form to be completed and independently verified prior to approval of the railway order to ensure that the maximum damage caused to AerCap House is limited to 0.1mm cracking.

Observation (Waterman Moylan) 4: *" The operational information provided by MetroLink has been reviewed. We refer to the following point: a) Metrolink has assessed the "Groundborne Noise from Operation" and presented its findings on drawing no. ML1-JAI-EIA-ROUT-XX-DR-Y14041 (a copy is attached to this submission). This drawing indicates MetroLink will be generating an additional 30db directly under the location of our Clients building which is unacceptable.*

TII Response 4: *" Appendix 14.5 Groundborne Noise and Vibration Blasting Modelling Results presents predicted groundborne noise and vibration levels during the construction and operation phase of the project. The prediction of groundborne noise and vibration for Aercap House (65-68 St. Stephen's Green) during railway operation are as follows: - The predicted level of groundborne noise during the railway operation for 65-68 St. Stephen's Green is 34 dB LASmax, which is below the 40 dB LASmax threshold. - The predicted level of groundborne vibration during the railway operation for 65-68 St. Stephen's Green is 0.009 ms-1.75, much lower than the VDV (Vibration Dose Value is a parameter that combines the magnitude of vibration and the time for which it occurs) threshold of 0.8 ms-1.75. As a result, we consider that no significant impact is expected on the building as a result of Metrolink operation."*

Waterman Moylan Response 4: It appears that TII has decided not to properly consider the implications of their proposed operations so close to the existing basement substructure of AerCap House.

The building that has been assessed (reference AB-37 in the EIAR) incorrectly describes the property as a five-storey building with no reference to a basement. This description does not correctly represent AerCap House, which is a six-storey building with a two-storey basement structure. The description describes one of the buildings on the site that was demolished (Canada House) prior to the construction of AerCap House. Therefore, any assessment that has been completed can not be relied upon by the Board.

Observation (Waterman Moylan) 5: *" MetroLink has proposed to acquire the substratum land located under our Client's building, which is outlined in drawing no. ML1-JAI-EIAROUT-XX-DR-Y-01096 (a copy is attached to this submission). This is unacceptable to our Client, as the future potential to develop this prominent commercial site in the future will be damaged."*

TII Response 5: *" TII note your concerns about the potential impact of MetroLink Project on future potential development of your site. The acquisition of substratum land beneath the Hines Real Estate Ireland Limited building is to enable the construction of the Metrolink tunnel and protect it from future uncontrolled development.*

MetroLink will be a catalyst for and provide opportunity for future development and regeneration. While the MetroLink Railway Order does not include for future neighbouring or overhead development, the tunnels and stations are designed to support appropriate future imposed loads.

TII will be required to make submissions in relation to planning applications for proposed future developments on or adjacent to MetroLink and there will necessarily be some engineering constraints (such as permissible loadings) required. However MetroLink is committed to engaging with known development proposals and new development proposals as they emerge with the intent of facilitating such developments as they emerge to the maximum extent consistent with the safe operation of the proposed Project.

Again in common with other existing rail and tunnel projects, following grant of the Railway Order and development of detailed design, TII will produce "Guidance Note for Developers" that will be the subject of bye-laws following the grant of Railway Order and which is designed to facilitate future adjacent or over-site development while protecting the integrity and safety of the MetroLink works and operations.

Therefore at this stage TII is dealing with known development proposals on a case by case basis, TII will work with parties in the future to assist with the wider development of sites over and above stations and tunnels. In this context TII has successfully engaged with a number of developers over the last two years to accommodate development over and in proximity to the alignment and there have been no material restrictions on development subject to the implementation of agreed design and mitigation measures and it is not anticipated that MetroLink will have a material impact on the development potential of sites above and in proximity to the alignment in future."

Waterman Moylan Response 5: This aspect will be addressed in Module 2.

Observation (Waterman Moylan) 6: *" In summary, our client requests that the route of the proposed MetroLink tunnels are diverted away from their current proposed location (under our client's building) to either below the public carriageway or buildings that will not be damaged or compromised by the presence of the tunnels located under."*

TII Response 6: *" TII do not intend to alter the alignment as the building damage assessments undertaken support the validity of the alignment. Refer to Item 1 above.*

The proposed vertical alignment has already been determined to provide sufficient rock cover to the tunnel and therefore to limit the ground movement impact on the building above to a sufficiently low level.

Waterman Moylan Response 6: It appears that TII has decided to ignore the information that has been provided to them through the Hines submission. AerCap House has not been assessed by TII in the BDR, and instead, it appears that the demolished Canada House was assessed.

4. Summary

TII was made aware of the existence of the two-story basement under AerCap House through a submission made on behalf of Hines. The response to the submission confirms that TII and their team have failed to identify the correct structural form of AerCap House. TII also appear to have failed to grasp the proximity of the existing structure and substructure to the proposed Metrolink Tunnel route. The responses provided to the submission are generic and do not fully consider the impact of the Metrolink Tunnel route on the existing AerCap House.

The proposed Metrolink route, as currently presented in the Metrolink Rail Order, if constructed as per the current design, is going to result in damage to AerCap House.

If the secant piled wall is damaged or compromised by the installation of the Metrolink Tunnel, there is a significant risk that the basement waterproofing, which is provided through the concrete structure, is going to be compromised and result in water ingress into the basement of an occupied building.

Additionally, if the secant wall is damaged or compromised by the installation of the Metrolink Tunnel, there is a significant risk that the concrete superstructure above is going to be damaged as a result.

The key areas of damage that are going to be caused to AerCap House if the Metrolink Tunnel is progressed as per the current design are as follows:-

- The basement uses a Whitetank waterproofing system, which relies on the watertightness of the reinforced concrete basement floor slab and walls. Therefore, even minor cracking could lead to groundwater ingress;
- The internal reinforced concrete frame uses post-tensioned reinforced concrete floor slabs for large spans, which would be more sensitive to differential settlement than conventional RC slabs;
- The tunnel passes under one of the main structural cores of the building;
- The building has a modern stone and glass façade, which would be more sensitive to distortion due to differential settlement along the perimeter secant pile wall than a masonry or blockwork structure.

If the Metrolink Tunnel is to pass under or close to AerCap House, we recommend a detailed Phase 3 assessment using the correct building geometry and structural form to be completed and independently verified, ensuring the maximum damage caused to AerCap House is limited to 0.1mm cracking. The proposed tunnel elevation may require to be lowered more than the current LOD downwards, i.e. more than the 10.0m indicated in the Wider Effects Report submitted as part of the application, considering the proximity and sensitivity of AerCap House.

The Phase 3 assessment referred to above should be carried out prior to approval being granted so that it can be reviewed by Waterman Moylan and/ or any other experts acting on behalf of Hines. This will ensure that any necessary mitigation measures (including lowering of the tunnel elevation) can be adopted in any decision of the Board to approve the proposed railway works and/or in the conditions attached to the decision.

Based on the findings of this Report, we recommend that the Metrolink Tunnel should either be:

1) rerouted around the substructure of AerCap House or,

2) the elevation of the Metrolink tunnel should be significantly lowered to a level that ensures that no damage will be caused to any part of AerCap House, to be confirmed by the Phase 3 assessment referred to above.

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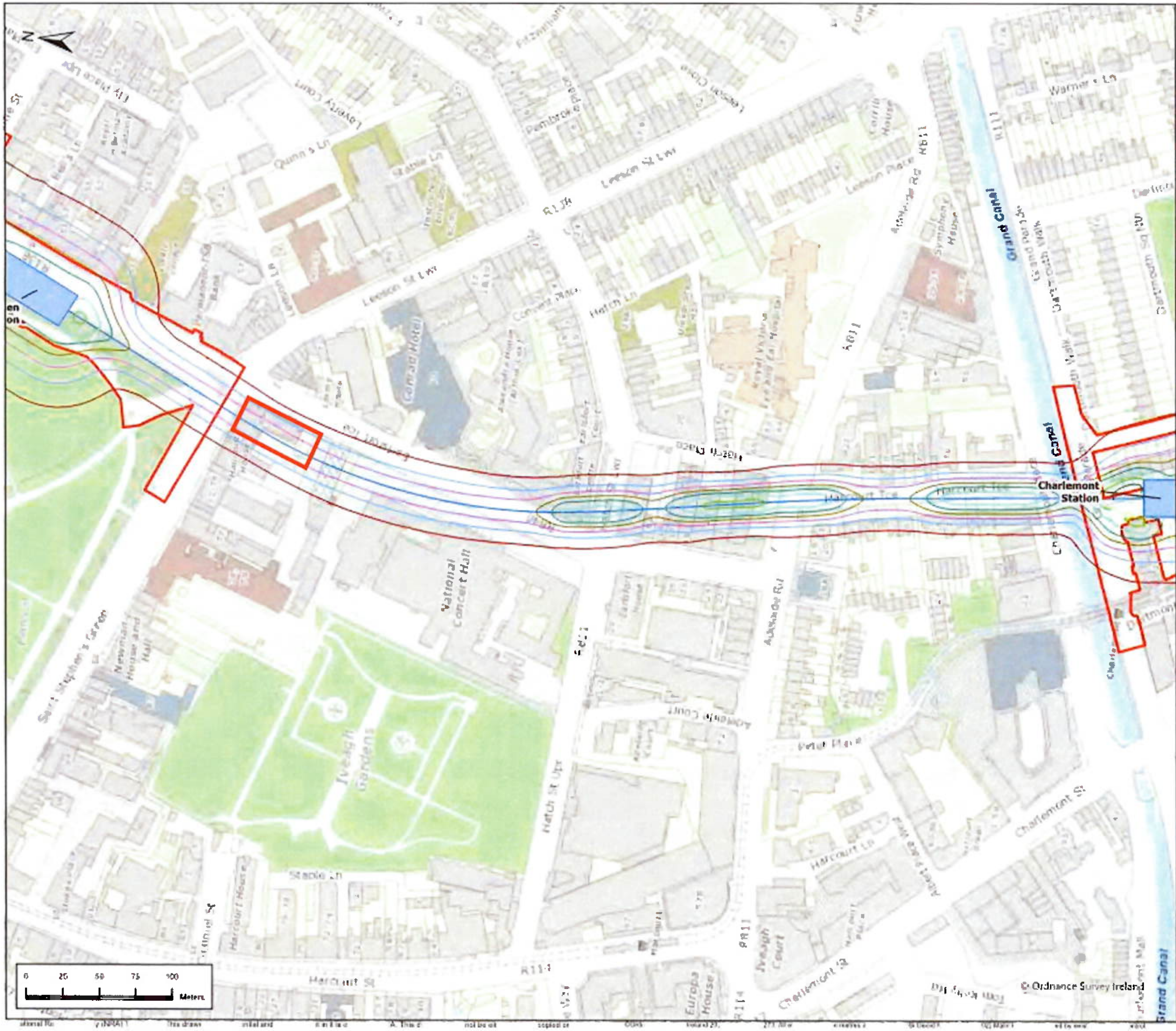
APPENDICES

A. Jacob / IDOM drawing number ML1-JAI-EAI-ROUT_XX-DR-Y-21146



P02	Final Issue
Rev	Date / Purpose of revision / Drawn / Checkd / Rev'd / Apprvd

JACOBS IDOM

TII

METROLINK

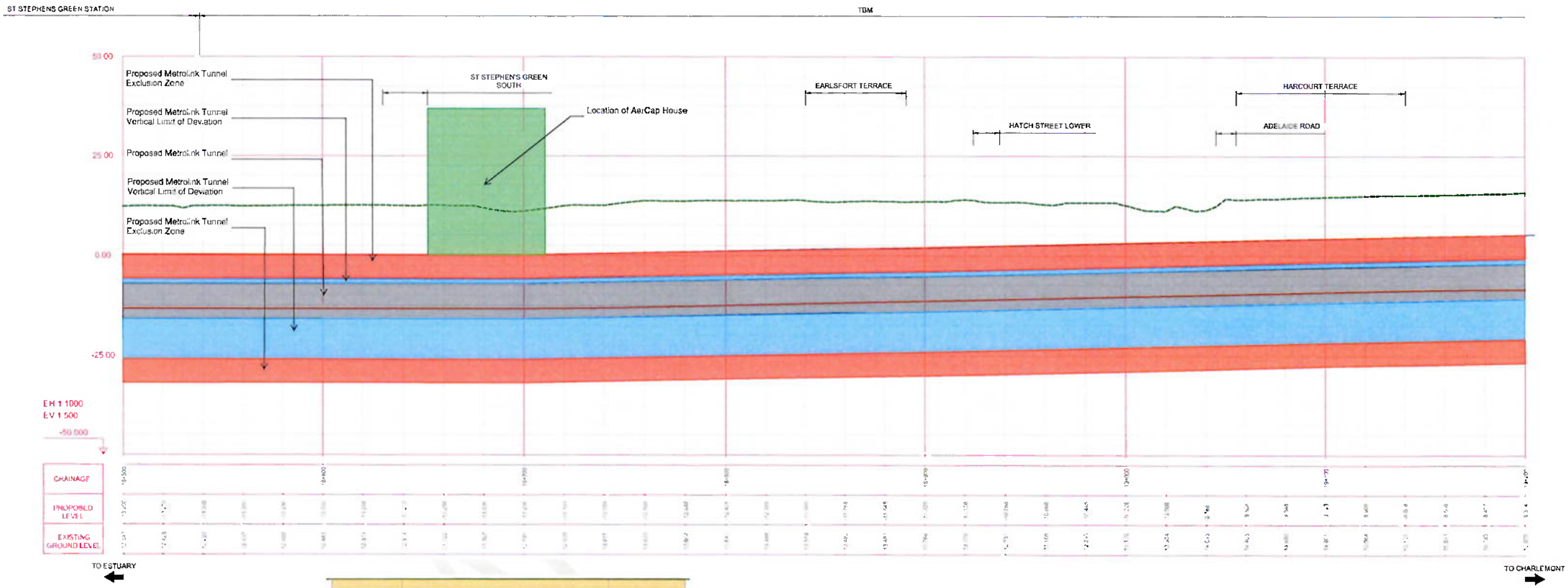
Figure 20.16 Settlement Contours
Sheet 27 of 28

Drawing Status: Final

Scale @ A3: 1:2,500 — DO NOT SCALE

Drawing No: ML1-JAI-EIA-ROUT_XX-DR-Y-21146 — Rev P02

B. Jacob / IDOM drawing number ML1-JAI-EAI-ROUT_XX-DR-Y-01018



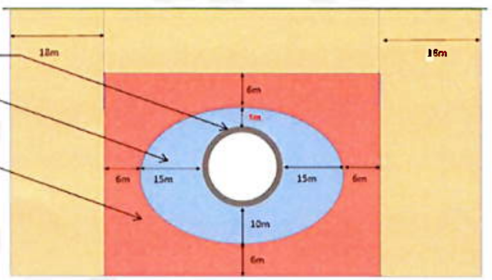


Figure 11. Bored Tunnel Protection and Exclusion Zones

0 10 20 30 40 50 60 70 80 90 100 METRES

SCALE 1:1000 (A1)
SCALE 1:2000 (A3)

DRAWING LEGEND

— RAIL LEVEL
— EXISTING GROUND LEVEL

REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01	29/07/21	For Railway Order	JS	JR	RS	NC
P02	21/12/21	For Railway Order	BJ	RG	AS	NC
P03	12/05/22	For Railway Order	BJ	JR	AS	PB

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - ALIGNMENT LONG SECTION 18

Drawing Status: S0

Drawing Nº: ML1-JAI-ARD-ROUT_XX-DR-Y-01018

Plan Drawing Nº: ML-LN O-018

Scales Original Size A1 1:1000

Sheet 18 of 19

UK and Ireland Office Locations