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Clare Hall

Proposed Cambourne to Cambridge Busway – Bin Brook Crossing and Impact on Clare Hall

Summary Flood Risk Proof of Evidence –

Graham Sinclair

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Objector No: OBJ213

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GLOSSARY

Term	Meaning
1D	One-Dimensional
2023 JBA Model	This is the latest EA model for the full Bin Brook catchment.
2024 CCE Model	This is the name for the model updated by CCE for the purpose of undertaking a hydraulic assessment of the proposed busway and its implications on flood risk for Clare Hall and surrounding areas.
2D	Two-Dimensional
AEP	Annual Exceedance Probability
C2C	Cambourne to Cambridge
CC	Climate Change
CCC	Cambridgeshire County Council
CCE	Create Consulting Engineers
CH2M	CH2M Hill Engineering, now Jacobs.
Clare Hall College	The land under the ownership of Clare Hall college
DfT	Department for Transport
EA	Environment Agency
ES	Environmental Statement
FM	Flood Modeller hydraulic modelling software
FRA	Flood Risk Assessment
GCP	Greater Cambridge Partnership
Glasswalling	The unnatural build up of floodwaters against the edge of a model extent.
JBA	JBA Consulting
NPPF	National Planning Policy Framework
NRFA	National River Flow Archive
PPG	Planning Practice Guidance
Purchase Order Limits	The area of land being purchased permanently for the construction of the Proposed Busway.
QMED	Median annual maxima flood equating to the 1 in 2 year 50% AEP Event.
RAG Model Review	Standardised EA Red Amber Green Model review spreadsheets.
STW	Sewage Treatment Works
SuDS	Sustainable Drainage Strategies
The Applicant	Cambridgeshire County Council.
The Application	This is the November 2024 DfT submission by the applicant.
The Gough Way 2017 Model	This is the preceding EA model for Bin Brook, published in 2017 focussing on the Gough Way Estate. This model is used by WSP as the basis for their modelling work.

Term	Meaning
The Proposed Busway/Development	The proposed C2C Busway development
TUFLOW	Two-dimensional Unsteady FLOW hydraulic modelling software
WBD	Womble Bond Dickinson
WSP	William Sale Partnership Engineering Company that completed the FRA and Hydraulic Modelling to support the Application.
WSP Model	This is the model used to inform the Applicant's Flood Risk Assessment and Hydrology.

1.0 QUALIFICATIONS AND EXPERIENCE

- 1.1 My name is Graham Sinclair. I hold a Bachelor of Science (with honours) degree in Geography from the University of Leicester and a Master of Science degree in Hydrology and Water Resources Management from Imperial College London. I have been a chartered member of the Chartered Institute of Water and Environmental Management since March 2018.
- 1.2 I am a Technical Director at Create Consulting Engineers Ltd. and lead the water and flood risk team across all regions of the UK. I have over thirteen years of experience in flood risk and drainage consultancy, during which time I have specialised in advising developers and landowners regarding flood risk management and mitigation, as well as surface and foul water drainage solutions.
- 1.3 As part of the preparation for this inquiry, I was instructed by Clare Hall in May 2024 to provide expert advice and subsequently evidence regarding flood risk related matters. This proof of evidence is associated with the section of the proposed busway that runs adjacent to Clare Hall and includes the proposed crossing of Bin Brook. I can confirm that I assisted in the preparation of the Clare Hall's case and that I have visited the appeal site on a number of occasions to fully understand the area and its hydrological context.

Declaration

- 1.4 The evidence that I have prepared and provided for this Inquiry (Ref. TWA/24/APP/03) in this proof of evidence is true and the opinions expressed are my true and professional opinions.

2.0 INTRODUCTION

The Submitted Application

- 2.1 Create Consulting Engineers (CCE) has been instructed to provide expert flood risk advice for a proposed busway known as the 'Cambourne to Cambridge (C2C) Transport Works Order' specifically regarding its potential impact on Clare Hall College, Cambridge.

Chronology of Communication

- 2.2 In July 2022, Dentons wrote to Cambridgeshire County Council (CCC) and the Greater Cambridge Partnership (GCP) to flag all flood risks that would be potentially resultant of the proposed West Cambridge to Grange Road section of the C2C route (July 2022 Letter).
- 2.3 CCC, the 'Applicant', submitted the application for The Cambourne to Cambridge Order in November 2024.
- 2.4 Objections were then made against the scheme by Clare Hall (CD2-OBJ-213) and by the EA (CD2-OBJ-301) in January 2025.
- 2.5 CCE Queries sent to GCP by Dentons on 17 February 2025 (February 2025 Queries List) included concerns regarding flood risk from the Applicant's submitted FRA (CD1-11.13.02):
- 2.6 On 25 March 2025, Dentons sent a letter to the Applicant reiterating the requests previously made by CCE in our earlier correspondence (March 2025 Queries List).
- 2.7 Clare Hall submitted their Statement of Case on 11 April 2025 (CD23-17 OBJ-214 SoC).
- 2.8 On the 2 July 2025, Dentons issued a note to the inspector regarding the Proposed Scheme (ES note). The ES note was prepared to specifically identify the areas where Clare Hall consider the environmental information submitted to date to be deficient and where further information is required.
- 2.9 In response to the original ES chapter submitted by the Applicant (CD10.1), an ES addendum (written by WSP, CD1-10.07), was submitted on 23 July 2025.
- 2.10 It should be noted that there is currently nothing to indicate that the EA has withdrawn its objection (CD2-OBJ-301) relating to the hydrological assessment and hydraulic modelling on which this Proof of Evidence is based.
- 2.11 On 24 July 2025, during the preparation of this Proof of Evidence, the Clare Hall team, received a data package submission directly from WSP. This included the original model submitted to the EA in July 2023 and the updated model submitted in February 2025. The package also contained additional documentation relating to the EA's approval process and the Applicant's submission, including the EA RAG review spreadsheet and WSP's responses to the EA's comments submitted as part of the February 2025 update. This information provided long-awaited insight into the model build and results, which had previously been unavailable and had significantly hindered CCE's ability, on behalf of Clare Hall to undertake a comprehensive review of the submission.

- 2.12 However, critically, no information was provided regarding the EA's response to the February 2025 submission. As such, there remained a six-month gap – between February and July 2025 – during which it was presumed that ongoing dialogue occurred between WSP and the EA.
- 2.13 A meeting between CCE and the applicant was held on 7 August 2025. In this meeting the remaining queries raised by CCE on the WSP modelling were discussed. The applicant confirmed that the data package provided on 24 July 2025 remains current with the updates request by the EA not undertaken. WSP instead have undertaken further testing of their model to endeavour to justify its findings.
- 2.14 Further to the meeting on 7 August 2025 WSP issued a revised information pack on 8 August 2025 to CCE including further EA reviews, which provided some clarity on the aforementioned six month gap in the information. These RAG reviews, dated most recently 24 July 2025 and supplied to the EA by Arcadis confirm a number of outstanding items in relation to the modelling where further information/clarification is required to make it fit for purpose.
- 2.15 It is unclear why this information was not provided at an earlier stage, having regard to the flood risk concerns raised in Clare Hall's objection and Statement of Case and the repeated requests for information to enable the flood risk implications to be understood. The lack of timely and transparent communication has resulted in CCE undertaking additional and unnecessary work to interpret the model without access to adequate supporting information – an outcome that could have been avoided through more effective engagement by the Applicant.
- 2.16 CCE has therefore been placed in a difficult position. This Proof of Evidence has been prepared based on the Applicant's submitted hydraulic modelling, without any assurance that the modelling has been, or will be, accepted or given the requisite technical sign off by the EA.
- 2.17 This situation has the potential to result in abortive work for CCE, given the Applicant's lack of engagement on this matter and failure to resolve these issues prior to the start of this inquiry.

Scope of Works

- 2.18 This Proof of Evidence will focus on flood risks, flood mitigation, and associated matters, specifically in relation to the section of the Proposed C2C busway that crosses the Bin Brook and the associated impacts this will have on areas upstream, as well as land under the control of Clare Hall immediately downstream.

3.0 APPLICATION BACKGROUND

Context

- 3.1 The full Transport Work Order relates to the proposed Cambourne to Cambridge (C2C) busway. However, this Summary Proof of Evidence focuses solely on the section of the route that runs east to west along Rifle Range Road, which borders the southern edge of Clare Hall. The alignment crosses the Bin Brook channel and associated floodplain just upstream of Clare Hall.
- 3.2 Bin Brook is a watercourse in southwestern Cambridge that flows from Hardwick in the west to join the River Cam just upstream of Jesus Lock. The Brook passes through and underneath both the eastern most section of the proposed C2C busway and Clare Hall. It is classified as a Main River by the EA.

Fluvial Flood Risk Summary

- 3.3 The latest Flood Map for Planning³ shows the Clare Hall and associated land to be located within all three Flood Zones.

³ Environment Agency., 2021. *Flood Map for Planning (Rivers and Sea) – Flood Zone 2 and Flood Zone 3*. [Online]. Available at: <https://data.gov.uk/dataset/cf494c44-05cd-4060-a029-35937970c9c6/flood-map-for-planning-rivers-and-sea-flood-zone-2> [Accessed August 2025]

4.0 RELEVANT PLANNING POLICY

Flood Risk

- 4.1 The key principles regarding flooding within the NPPF (CD 8-01) are in the section "*Planning and Flood Risk*", starting at paragraph 170 which details that development should be avoided in flood risk areas. Also where necessary, safety for the development lifetime should be ensured whilst not increasing flood risk elsewhere.
- 4.2 The NPPF also outlines the overarching general principles for the sequential based approach (paragraph 170) which details that a risk-based approach should be used for applications in areas at current or future flood risk (paragraph 173).
- 4.3 The main aim of the Sequential Test is to steer development to areas of lowest flood risk (as per paragraph 174).
- 4.4 The general principle of acceptability of development in flood zones, as detailed in the PPG² is the Sequential Test, as detailed above. This test steers development away from areas at greater risk, using the Flood Zone classification by way of hierarchy.
- 4.5 Once having undertaken the Sequential Test and if lower risk areas aren't suitable (CD 8-01) (Paragraph 177), then the Exception Test might need to be applied..
- 4.6 The Exception Test NPPF as detailed in paragraphs 178 and 179 state that it must be demonstrated that:
- a) *The development should provide wider sustainability benefits outweighing the flood risk; and*
 - b) *The development will be safe for its lifetime, not increase flood risk elsewhere, and ideally reduce risk overall.*
- 4.7 Both parts of the exception test have to be met to satisfy the test and to permit the development.

Acceptability of development in the Flood Zone

- 4.8 The proposed busway is classified as 'Essential Infrastructure' in Annex 3: Flood Risk Vulnerability Classification of the NPPF (CD8-01), meaning it can cross flood-prone areas. According to the PPG Table 2, the Exception Test is not needed for essential Infrastructure in Flood Zones 1 and 2 but is required in Flood Zone 3a and 3b.

Hydraulic Modelling Guidance

- 4.9 Key guidance for hydraulic modelling can be found on the GOV.UK Website under 'Using Modelling for Flood Risk Assessments'⁵.

⁵ GOV.UK., 2013. *Using modelling for flood risk assessments*. [Online]. Available at: Using modelling for flood risk assessments – GOV.UK (Accessed July 2025)

5.0 INADEQUACY OF THE WSP SUBMISSION

- 5.1 In this section, details are provided of areas where the submitted information falls short of established guidance or provides insufficient evidence to support the conclusions made.

Survey Information

- 5.2 There are several structures in and around the purchase order area that are not included in the WSP hydraulic model. Despite EA comment, these structures are still not within the latest version of the model received. Our position is that given the sensitivity of the design and the proximity of these structures to the proposed development, a complete hydraulic model should include them. These structures will have a material impact on flow patterns

Model Hydrology

- 5.3 A number of shortfalls have been noted in the applicant's submitted hydrology report. Consequently, when comparing like for like flood estimation points between the applicant and CCE hydrology studies, the WSP estimated design flow rates are 15–20% lower than the CCE design flow rates and are lower than the EA Approved 2023 JBA Model design flow rates. This is important because a 15–20% variation in inflow rates can alter significantly the design flood levels that are being used to design the proposed development and therefore change the potential impact the development is having on surrounding landowners.

Model Results

- 5.4 Model files submitted on 25 July 2025 and the applicant in a meeting held on 7 August 2025 agree that there is an increase in offsite flood risk upstream of the proposed busway, and to a lesser degree, downstream of the proposed busway. This is supported by the ES Note addendum (CD1-10.07) which states in section 3.3.2 that there would be an increase in depth of 8mm upstream of the Bin Brook within the Gough Way Estate. The applicant has stated that this increase is occurring in areas already subjected to large scale inundation, however this increase is in direct contravention of the NPPF (CD8-01) which states that developments should aim to create a betterment to existing flood risk. The Gough Way Estate has experienced significant flood events in 2001 and 2012 which would now be worsened by the proposed development.

6.0 LIKELY IMPACTS ON CLARE HALL – CCE MODELLING

- 6.1 In order to provide independent testing of the proposed development, CCE was instructed to build a hydraulic model of the catchment.
- 6.2 To begin the assessment CCE requested the latest EA approved hydraulic model in June 2024. The model received was the EA Approved 2023 JBA Model. In accordance with EA guidelines and standard practice the model was updated by CCE to take into account any changes to guidance or available data since it was built.
- 6.3 The results of the 2024 CCE Model indicate that when the development is tested in the latest model, and the tolerance is reduced to 1mm, there are offsite impacts observed in the results both upstream and downstream at each of the events.
- 6.4 The independent CCE assessment included a review of the impact of velocity. This assessment indicated that there was an increase too in channel velocity by between 50 and 100% as a result of the development. The impact of the development on velocity and flow rate through the structure is not discussed in the WSP report (CD1-11.13.02 Appendix TR13.1.1).

7.0 POLICY TEST – PPG 031, NPPF PARA 177, 178 (B), 179 and 181 – IMPACT ON FLOOD RISK ELSEWHERE AND FLOODPLAIN COMPENSATION

The Sequential Test

- 7.1 The purpose of the Sequential Test is to direct development to areas with the lowest risk of flooding (CD8-01, para 173). Development should not be permitted if there are reasonably available alternative sites in areas of lower flood risk (CD8-01, para 173).
- 7.2 The development is not policy compliant because it fails to undertake the Sequential Test, so it is in contravention of CD8-01, paragraph 173. Furthermore, with regard to the sequential approach set out in paragraphs 174 and 175, the development does not comply. This is because an alternative option is presented in the Transport Proof of Evidence of Mr Kamran Haider, which proposes a solution located largely in Flood Zone 1. From a flood risk perspective, this alternative is therefore considered sequentially preferable.

The Exception Test and Loss of Flood Storage

- 7.3 The purpose of the Exception Test is to ensure that development in areas of higher flood risk is both justified and safe – but only *after* the Sequential Test has demonstrated that that no suitable lower-risk sites are available.
- 7.4 With respect to the Exception Test, Paragraph 178 (b) of the NPPF (CD8-01) requires that it be demonstrated that the development will not increase flood risk elsewhere. However, the proposed scheme would result in modelled flood impacts upstream and downstream for the 1% AEP plus climate change design event, indicating that flood risk is not contained within the proposed development's red line boundary. In addition we should not forget the significant increases in velocity which also create increased flood risks as a result of the scheme. This is a direct contravention of NPPF paragraph 178 (b) and therefore the proposed development would fail to pass the Exception Test.
- 7.5 The PPG² paragraph 049 also requires that where flood storage from any source of flooding is to be lost as a result of development, on site level for level compensatory storage, accounting for the predicted impacts of climate change over the lifetime of the development, should be provided. The Applicant has not done this.
- 7.6 Building on this, the requirements for Essential Infrastructure in the functional floodplain (Flood Zone 3b), as outlined in the notes to Table 2 of the PPG² state that there is a requirement for no net loss of flood storage, no impeding of flows and no increase in flood risk elsewhere. The proposals in their current form, fail to adhere to any of these requirements.

Paragraph 181 NPPF

- 7.7 The proposed development does not comply with Paragraph 181 of the NPPF (CD8-01) for several reasons. Firstly, the modelling clearly shows that the scheme would result in impacts upstream and downstream for the 1% AEP plus climate change design event. This indicates that the flood risk is not contained within the purchase order limits for the proposed busway, contrary to paragraph 181 which

requires that flood risk elsewhere must not be increased. This is further corroborated by information provided by WSP for the submitted model as well.

8.0 Potential Mitigation and Associated Viability

8.1 CCE has examined potential mitigation measures for the proposed development to address paragraph 178(b) of the NPPF (CD8-01). The two final mitigation approaches that have been identified are as follows:

- Adding flood storage upstream of the proposed crossing to offset the storage loss as a result of the structure; and
- Realigning the busway to reduce velocity impacts immediately downstream and contain them within busway land.

8.2 From the results it can be seen that the development is now demonstrating a net positive in regard to flood risk and flood levels within the catchment, with no offsite increases to flood levels and areas of decrease in flood risk.

8.3 Whilst this mitigation option appears to be viable it is important to consider this in the context of the current proposals and their ability to deliver this within the bounds of the application. The re-aligned busway lies beyond the compulsory purchase order limits. Furthermore, the volume of flood storage required, along with its likely impact on the surrounding landscape, has not been addressed in the submitted Landscape and Visual Impact Assessment nor ES. Therefore, drawing on this I have to conclude that it is not possible for these mitigating factors to be included within the bounds of the current application (see CD23-178 OBJ-213 SoC sections 6.4.7 – 6.4.8 for further details).

9.0 SUMMARY AND CONCLUSIONS

- 9.1 The modelling undertaken shows impacts in flood level and extent, as well as flow velocity, beyond the bounds of the application site. An assessment of potential mitigation options shows these impacts can be solved, however the mitigation measures required are not possible within the bounds of the purchase order limits.
- 9.2 Building on the above it is evident the development, as proposed, fails the Sequential Test and Exception Test and thus is not in accordance with the NPPF (CD8-01) Paragraph 177, 178(b), 179 and 181 as there is an increase in flood risk elsewhere as a result of the proposals. This also follows into the PPG² and confirms a contravention of paragraph 031 as well as the South Cambridgeshire Local Plan (CD6-02, pages 109-111) Policy CC/9.
- 9.3 The development also fails to meet the criteria required for development within the functional floodplain (Flood Zone 3b) in that no level-for-level or volume-for-volume floodplain compensation is proposed, thus creating a net loss in floodplain storage. In addition, the scheme impedes floodplain flows and thus contravenes the requirements of the PPG² at paragraph 049 and the notes to Table 2.
- 9.4 On the basis of the above I must conclude that significant weight should be given to the increased flood risks posed by the proposed C2C busway in the vicinity of Clare Hall.

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The information contained within this report and any appendices or supporting information provided are to be treated as confidential.



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