

A14
**Cambridge to Huntingdon
improvement scheme**
Development Consent Order Application

HE/A14/EX/122

TR010018

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Flood Risk Assessment Position Statement

October 2015

The Infrastructure Planning (Examination Procedure) Rules 2010



A14 Cambridge to Huntingdon improvement scheme

Flood Risk Assessment Position Statement
As of 30 October 2015

HE/A14/EX/202

October 2015

Contents

Contents.....	3
Tables	3
1 Introduction.....	4
2 Landowner Agreement to an Increase in Flood Risk	4
2.1 Ellington Brook	4
2.2 Brampton Brook.....	5
2.3 River Great Ouse.....	5
2.4 West Brook	5
2.5 Beck Brook	5
3 Hydraulic Modelling and FRA Agreement.....	6
8	
4 Representations Made at the Issue Specific Hearing of 21 October	9
4.1 Modelling Tolerances	9
4.2 Greenfield Runoff	10
4.3 Queries Raised by Swavesey IDB	11
4.4 Query of Dr Kinnett, resident of Girton.....	11

Tables

Table 3-1: Summary of Hydraulic Model Progress as of 30 October 2015.....	7
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1 Introduction

- 1.1.1 To address the queries raised by the Environment Agency (EA) to the Flood Risk Assessment (FRA) submitted in support of the *Environmental Statement* for the scheme in December 2014 and repeated in their Written Representations, Highways England has been undertaking a programme of additional hydraulic modelling to refine the FRA. The hydraulic models and relevant sections of the FRA have been submitted to the EA periodically for review and agreement. All queries and comments received from the Environment Agency have been addressed and all resubmissions including updates to the FRA and hydraulic models made by or on 27 October..
- 1.1.2 This note summarises the current position of the FRA.
- 1.1.3 All updates to the FRA have been collated into a single consolidated document for submission to the Examining Authority on 30 October 2015 (Deadline 13) as discussed at the Issue Specific Hearing on 21 October 2015.

2 Landowner Agreement to an Increase in Flood Risk

2.1 Ellington Brook

- 2.1.1 The document summarising the predicted change in flood risk on the Ellington Brook was issued to affected landowners (see below) and the Alconbury and Ellington Internal Drainage Board (part of the Bedford Group of IDB's) on 11 September 2015.
- 2.1.2 Highways England met with the Land Agent representing G B Sewell and Partners on 1 September to discuss the change in risk and is seeking a meeting with the other affected landowners, the Church Commissioners for England, to achieve agreement to the change in risk during examination.
- 2.1.3 The information has been resent via email directly to Mr and Mrs Sewell on 26 October and to the land agent acting on behalf of the Church Commissioners on 28 October. Verbal discussions presenting the information and situation were undertaken ahead of those submissions. Liaison with Mr and Mrs Sewell will continue to seek agreement.
- 2.1.4 It has been confirmed that the change in flood risk does not impinge upon land owned by Eleanor Disney

2.2 Brampton Brook

- 2.2.1 The updated assessment of scheme impact based on the revised hydraulic model indicates that there is no increase to flood risk upstream of the scheme. Therefore there are no affected landowners.

2.3 River Great Ouse

- 2.3.1 The document summarising the predicted change in flood risk on the river Great Ouse as a result of the scheme was issued to landowners and the Bedfordshire Group of Internal Drainage Boards on 11 September 2015.
- 2.3.2 A meeting was held with Mr Mann (landowner left/west bank) on 21 September 2015 who suggested that the predicted change in flood risk is likely to be acceptable subject to compensation. Dialogue with Mr Mann and his land agent is ongoing to obtain written agreement, which Highways England expects to obtain before the close of examination.
- 2.3.3 A meeting was held with Mr Marcu (landowner on the east bank of the river Great Ouse) on 16 October where the change in flood risk was presented and he acknowledged receipt of the explanatory document. At that meeting Mr Marcu indicated that the change of risk is likely to be acceptable. Highways England continues to try and obtain acceptance of the change in risk in writing which they anticipate obtaining before the close of examination.

2.4 West Brook

- 2.4.1 Updated hydraulic modelling of the West Brook identifies a small area of increase in the water level for the 1% (1 in 100) Annual Exceedance Probability event between the two areas of Borrow Pit 3 which cannot be fully mitigated by the scheme. There are no properties within the area affected. It is within the red line boundary and identified in the application as an area of land to be permanently acquired by Highways England. This is highlighted in the West Brook section of the FRA.

2.5 Beck Brook

- 2.5.1 The updated hydraulic modelling and assessment of scheme impact has identified an increase to flood risk on the Beck Brook upstream of the local access road, south of the main A14. This risk is limited to farmland and does not affect any properties. Highways England have spoken to the land agent acting on behalf of the affected landowner, The University of Cambridge in mid-October, to seek agreement to the change in risk which indicated the change was likely to be acceptable. A memo summarising the change in risk was issued to the landowner and their agent on 29 October. This will be

followed by further liaison to seek written confirmation of the change in risk in writing before the close of examination.

3 Hydraulic Modelling and FRA Agreement

- 3.1.1 The Environment Agency has responded to the submission of all hydraulic models and watercourse specific sections of the FRA. Highways England have in turn addressed these comments with all re-submissions to the Environment Agency submitted on or before 28 October. The EA will be sent the full, collated FRA on 30 October for acceptance. A summary of the current position of each watercourse is included in Table 3-1.
- 3.1.2 The next stages to achieve agreement of the FRA are summarised in Table 3-1.
- 3.1.3 From Highways England's perspective the outstanding issues are as follows, which we believe our latest submissions to the EA have addressed:
- Confirmation of the appropriateness of the model's downstream boundary on Beck Brook; and
 - Agreement of the revised FRA and model submission addressing concerns relating to flood risk in Oakington village from Oakington Brook; and
 - Re-acceptance of the changes to the FRA sections on Cock Brook and West Brook re-submitted to the Environment Agency on 30/10.

Table 3-1: Summary of Hydraulic Model Progress as of 30 October 2015

Watercourse	Current Position		Areas to be resolved
	Model	FRA Update	
Alconbury	See Ellington Brook		None
Cock Brook	Informal agreement provided 29/10 – formal confirmation awaited Resubmission by HE to EA 30/10	Previous version believed accepted*, resubmitted to EA for re-acceptance on 30/10	Re-submitted for approval on 30/10
Ellington Brook	Accepted	Accepted	None
Brampton Brook Grafham Road Drain	Informal agreement provided 29/10 – formal confirmation awaited	Resubmission addressing EA reviewing comments 27/10	Await EA re-review and confirmation – thought to be resolved
River Great Ouse	Informal agreement provided 29/10 – formal confirmation awaited	Accepted	Await EA re-review and confirmation, thought to be resolved
West Brook	Informal agreement provided 29/10 Resubmission by HE to EA 30/10	Previous version believed accepted*, resubmitted to EA for re-acceptance on 30/10	Re-submitted for approval on 30/10
Oxholme Drain	Informal agreement provided 29/10 – formal confirmation awaited	Accepted*	Await EA re-review and confirmation of model – thought to be resolved
Covell's Drain	Informal agreement provided 29/10 – formal confirmation awaited	Accepted*	Await EA re-review and confirmation of model – thought to be resolved

Watercourse	Current Position		Areas to be resolved
	Model	FRA Update	
Utton's Drove Drain	Accepted	Informal acceptance provided 29/10, formal acceptance awaited	Await EA confirmation, thought to be resolved
Longstanton Brook	Accepted	Informal acceptance provided 29/10, formal acceptance awaited	Await EA confirmation – thought to be resolved
Oakington Brook	Informal agreement provided 29/10 – formal confirmation awaited	Resubmitted 30/10 addressing concerns of potential water level rise downstream, significance now considered to be neutral	Updated FRA explains the change in water level and why this is considered of neutral significance
Beck Brook	EA resubmission comments received 28/10	Ongoing dialogue regarding downstream boundary query – resubmission of model to EA 30/10 for approval, remodelling indicates no impact on FRA conclusions. HE believe now resolved subject to EA review.	Updated FRA section submitted to EA on 28/10 indicating neutral significance

* subject to agreement of hydraulic model by EA

4 Representations Made at the Issue Specific Hearing of 21 October

4.1 Modelling Tolerances

- 4.1.1 Two modelling systems were used to quantify the flood risk assessment of the proposed scheme:
- Flood Modeller Pro (by CH2M): 1 dimensional hydraulic modelling
 - TuFLOW (by WBM): 2 dimensional hydraulic modelling.
- 4.1.2 Flood Modeller is generally used for the modelling of the linear “in channel” flows and for simple storage based floodplain elements.
- 4.1.3 TuFLOW is used for the representation of more complex floodplain conditions.
- 4.1.4 Both software packages are industry standard tools approved for use by the Environment Agency and they have been calibrated for use against real-world data.
- 4.1.5 The governing equations used by both systems to simulate the propagation of flow and determine water levels are a simplification of three dimensional fluid dynamics. They are still very complex calculations (third order partial differential equations) and cannot be solved by normal means. For every time step, the model repeatedly runs a set of simultaneous equations across the entire domain (study area) until an accurate solution is determined which works for all locations within the domain, this is called an iterative numerical solution.
- 4.1.6 The performance of the iterative solution is monitored during the simulation based on two key factors:
- *Model convergence*: This is variation of the solution between each repeated iteration, it should ideally be small, remaining within a pre-determined tolerance. The standard tolerance for Flood Modeller Pro is 0.01m for water level and 0.01m³/s for flow.
 - *Mass conservation*: The volume of water flowing into the system is recorded along with the outflow from the model. Therefore it is known what the volume within the system should be at any given time. It is possible for the modelled volume to diverge from this due to small inaccuracies in the modelled solution. This “mass error” is recorded for every time step as well as the cumulative error. The general industry standard is that the cumulative error should remain less than 1% of the total volume in the model. However the situation is complex and the modeller considers carefully the absolute volumes as well as the proportional error.

- 4.1.7 It is considered acceptable for both of these parameters to exceed the tolerance under controlled circumstances, such as where the only effects are removed from the area of interest, or when the error is short in duration and it can be proven that the net effect does not affect simulated flow and water level in any significant way.
- 4.1.8 Model Precision is the level of detail that can be achieved. This can be considered in terms of how finely measurements are considered; such as water depths to the nearest centimetre or millimetre. The confidence with which varying degrees of precision can be quoted depends greatly upon the amount of detail that is applied to the model. Factors may include the cell size in the 2d model or the node spacing in the 1d model as well as the performance of the model solution as described above. Many users consider the convergence tolerance of 10mm and 0.01m³/s as a good rule of thumb for the level of precision that should be quoted, and that the water level would in reality be within ±10mm of the modelled level.
- 4.1.9 In the flood risk assessment of a proposed development it is important to remember that a comparison between two situations is being undertaken. A fixed, existing situation case is developed as robustly as is reasonably possible. This model is then adjusted with the introduction of the proposed scheme. The effect of the scheme is then considered by the comparison of the model results for the two scenarios. As stated above it is generally held that such results can be quoted confidently at the centimetre scale but somewhat less confidently at the millimetre scale. Both scenarios are subject to the same modelling accuracy and precision so a fair comparison is made, at whatever level of precision is being considered, and the results are the best available measure of the flood risk associated with scheme.

4.2 Greenfield Runoff

- 4.2.1 If the surface water (drainage) runoff from a development is permitted to discharge off-site at an unrestricted rate it could increase flood risk downstream. The NPPG requires a development to not increase flood risk to other parties. Consequently rainfall runoff from the new A14 carriageway will be drained to attenuation ponds whose outfall will be restricted to Greenfield rates for all events up to the 1% (1 in100) AEP event plus an allowance for climate change. Greenfield rates are the same rate of runoff that an undeveloped site would produce. Consequently restricting outflows to such rates ensure there is no increase in flow and flood risk downstream. Details of the rates calculated and the process are included in Section 24 of the Flood Risk Assessment.

4.3 Queries Raised by Swavesey IDB

- 4.3.1 Swavesey Internal Drainage Board made representation at the issue Specific Hearing of 21 October regarding the impact of changes in flow on Utton's Drove Drain affecting the Swavesey Drain which falls under the responsibility of the Board. The confluence of the two watercourses is approximately 4km downstream/north of the A14. Table 14.3 of the FRA indicates that the increase in water levels as a result of the scheme is limited to a localised stretch of watercourse which extends for approximately 30m downstream of the A14 and no further and will therefore result in no impact to the Board's area. Additionally as indicated in Section 24 of the FRA attenuation facilities are included to mitigate for any increase in drainage runoff from the road and ensure peak flows do not increase compared to the existing situation.
- 4.3.2 A response to the IDB's query is included in the Utton's Drove Drain section of the updated FRA.

4.4 Query of Dr Kinnett, resident of Girton

- 4.4.1 Dr Kinnett, a resident of Girton raised a query regarding the impact of the scheme on flood risk to the village of Girton at the Issue Specific Hearing of 21 October.
- 4.4.2 Highways England's response to Written Question 1.13.2. summarises the current flood risk to the village and how the scheme will not impact upon it through the provision of floodplain compensation on Beck and Washpit Brooks. Attenuation measures are included in the scheme to ensure no increase in peak flows from the highways drainage system to these watercourses.
- 4.4.3 At the hearing of 21 October Dr Kinnett did query the predicted increase in water levels on the Beck Brook as a result of the local access road crossing the watercourse's floodplain south of the main A14. However the affected area is located approximately 1.8km south (upstream) of the village and would not affect flood risk in the village. Hydraulic modelling of the Beck Brook concludes that the scheme will not exacerbate existing flood risk in Girton.