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Environment Agency

Mr Richard Price
The Planning Inspectorate
Temple Quay House (2 The Square)
Temple Quay
Bristol
Avon
BS1 6PN

Our ref: KT/2016/121628/03-L01
Your ref: TR010006

Date: 28 April 2017

Dear Mr Price

APPLICATION FOR A DEVELOPMENT CONSENT ORDER FOR CONSTRUCTION OF THE PROPOSED M20 JUNCTION 10A, ASHFORD, KENT

We have reviewed Highway England's submission 'OD-22 Flood Risk Assessment modelling addendum' and relevant modelling files shared with us on 30 March 2017, updated on 19 April 2017, and have the following advice to share:

The model submitted to support the modelling addendum report cannot be signed off by the Environment Agency for the following reasons:

It has not been demonstrated that the development will not displace flood risk, or increase depth of flow, to properties further downstream. The 1 in 100 year plus 105% Climate Change scenario has identified instability issues leading to a lack of confidence in the results.

We therefore recommend that the 105% Climate Change scenario should be re-run as advised in our technical note. This will provide more confidence in the results downstream. Our enclosed 'M&F Technical Note' provides our detailed technical advice.

There are gaps in the information provided. Although model output files have been transferred over in the most recent exchange of emails to us, there is no updated Flood Risk Assessment (FRA) outlining the impact of the proposed development and providing narrative on the elements that have been modelled. There is insufficient demonstration, using depth difference analysis from the modelling, that the proposed development has no impact on Flood Risk.

We request that flood depth difference maps for all scenarios be provided as part of any updated analysis section of the FRA. The depth difference maps will show differences in flood risk levels onsite and offsite, with the inception of proposed development against the baselines. This information ensures that properties downstream, already within existing flood extents, will not be put at greater risk of flooding from the proposed development.

The updated FRA needs to demonstrate that there will be no impact from the scheme on downstream properties, for the lifetime of the development, of more than 60 years, as confirmed by Highways England.

We continue to have discussions and to support Highways England on the modelling aspects however if this cannot be resolved, we would be minded to object to this development.

If you have any questions, or require any clarification on the points below, please do not hesitate to contact me.

Yours faithfully

Mrs Ghada S. Mitri Renner
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Encl: M&F Technical Note

M&F Technical Note

Project Name	M20 Junction FRA Hydraulic Modelling
Date	28/04/17
Prepared By	Anthony Hammond – M&F
Prepared For	Ghada Mitri – P&SO

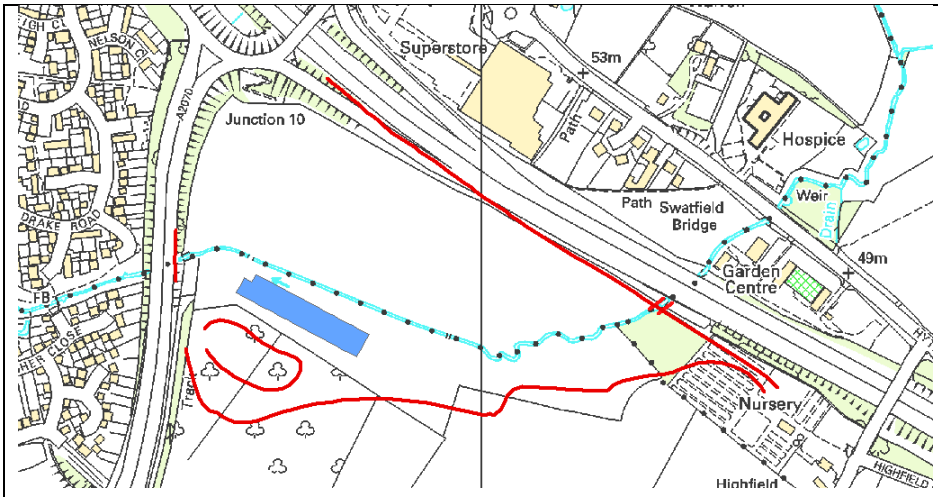
1. Introduction and Purpose:

Mott Macdonalds Sweco JV (MMSJV) undertook flood modelling work as part of a flood risk assessment for a proposed development adjacent to junction 10A on the M20. The M20 and the proposed development cross the Aylesbury stream which is a tributary to the Great Stour. The proposal has three key elements that needed adjustment in the modelling to represent the post development scenario: -

- Slip roads and associated embankments in the flood plain
- A bridge for a slip roads that runs over the Aylesbury stream.
- A mammal ledge under Lacton Farm culvert
- Flood storage pond

The specifics of these elements are not set in stone and have therefore been modelled approximately to provide an indication of their flood risk impact. The flows used as the boundary conditions are as determined by a previous study and will not be considered here. Furthermore it is assumed that the model was validated against observed events for the previous study and therefore this is also not considered here. This technical note summarises the work undertaken and considers whether or not it suitably represents the impact on flood risk from the proposed development to surrounding areas.

The below map shows the proposed embankments (red) and a flood storage area (blue).



2. Method

The Environment Agency (EA) provided MMSJV with a 1d-2d hydraulic model (FMP-Tuflow) which had been used previously for flood zone mapping studies in the wider Ashford area.

Proposal model alterations:
MMSJV altered the model to represent post development scenarios. In the floodplain, z points were raised by z-lines to represent the raised embankments. Zpoints were also lowered using a zshape to represent the proposed flood storage area.
Within the river a bridge unit was added to the FMP model to represent the proposed mammal bridge pipe crossing. An existing M20 culvert was reduced to account for a reduction in cross sectional area that is anticipated from a proposed mammal ledge.

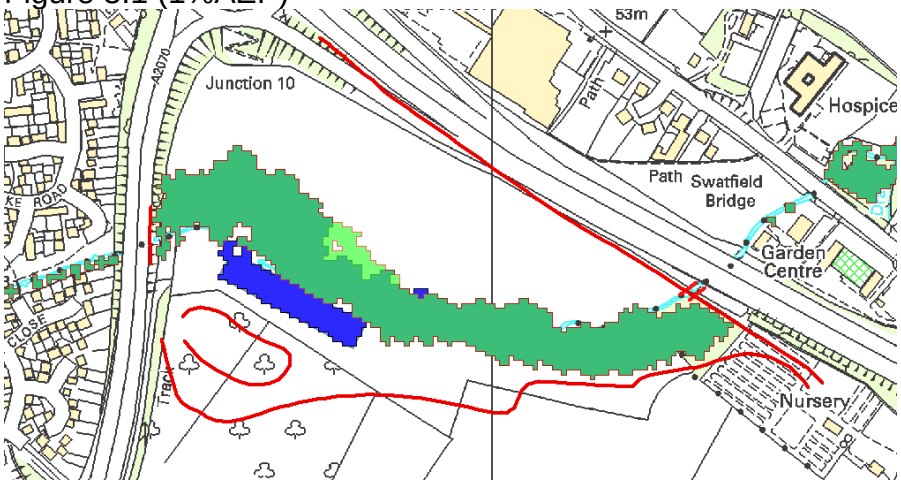
Scenarios Tested:
The baseline scenario was simulated with current day 1%AEP with design flows and climate change scenarios which included 25%, 50% and 105% increases in flow. The model with alterations to represent proposed developments was run with the same boundary conditions so that a “before – after” comparison could be made

3. Critique

Model Alterations for the proposed development:
It is important that the alterations satisfactorily represent the proposed developments. At this stage the details of proposals are not specific. The modelled road embankments are not quite the same as the road embankments in figure 4 (outline development plan) in the initial FRA (ref:08-125R_006 – FRA – Sevington West – rev A). The reviewer has seen no documentation outlining design drawings of the mammal ledge or the embankment bridge. The bridge spans the river wide enough so that the largest flow modelled does not reach the soffit and the details of which are therefore not impacting model results. A representation of the mammal ledge has not been attempted and instead a constriction of the associated culvert has been applied to represent the possible hydraulic losses. At this stage, with no further information, this is necessarily sufficient, however it is strongly recommended that once specific details are outlined, they are compared to the modelled representation to ensure the hydraulic impacts are consistent.

Scenarios Tested:
The results before and after development are very similar with in-channel reductions in water levels for the most part. The only reductions close to significant are at cross sections in and around the proposed mammal ledge (represented by the culvert constriction). This reduction is due to the increase in velocity through the culvert, which has the impact of reducing head in the immediate vicinity. The flood extents are almost identical for pre and post development scenarios except for the vicinity of the proposed flood storage area. This has the effect of reducing extents on the other side of the river. The light green area is reduced due to the storage area (blue) In figure 3.1.

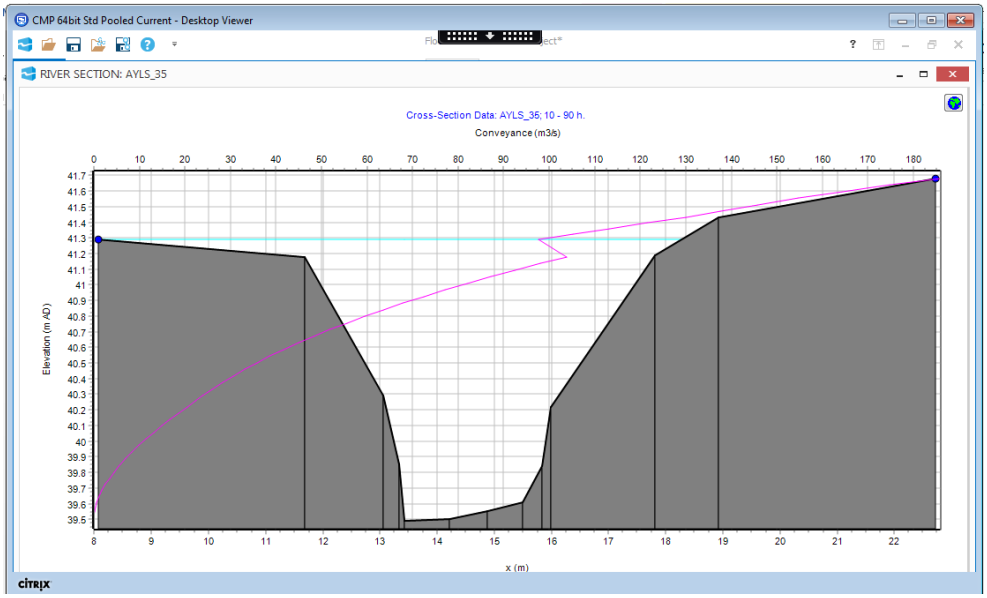
Figure 3.1 (1%AEP)



Model verification:
The model was accepted for the previous study and this work is a pre and post modelling scenario. Therefore the full suite of checks was not completed as part of this technical note. However, a review template was provided to MMSJV to

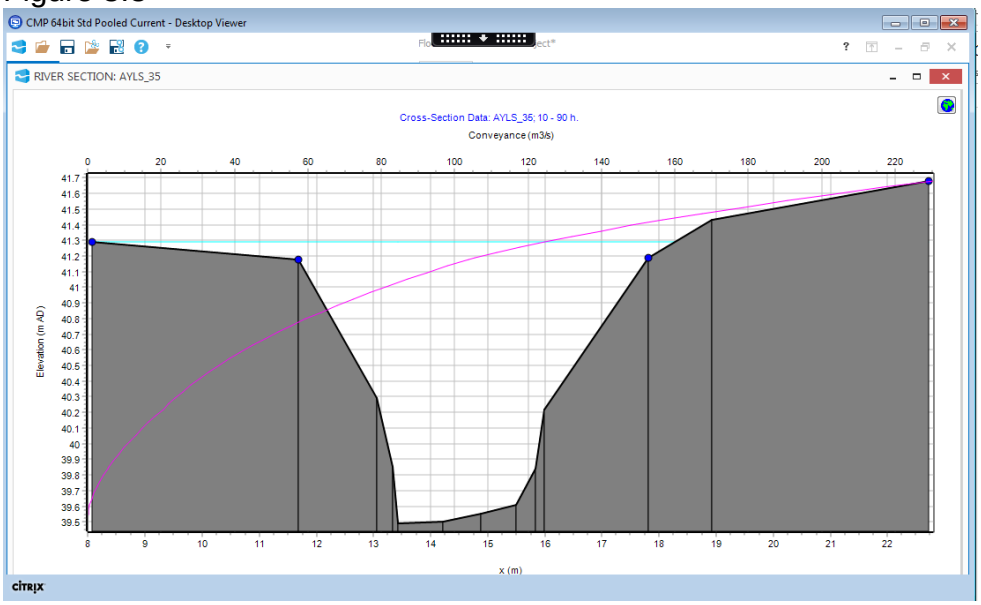
populate for EA consideration and a few key aspects of review were checked. Hydrographs and bitmap outputs from flood modeller pro were checked for stability issues and conveyance was checked for possible causes of instability. For the most part stability issues do not appear to significantly impact the hydrographs along the Aylesford stream. However, the 105% scenario shows significant oscillations in cross sections downstream of the proposed development (starting at the area circled in red)

It is noted that conveyance immediately upstream of the hydrograph oscillations, at cross section AYLS_35, is not monotonic (figure 3.2) as can be seen by the pink line with a kink. Conveyance is mentioned in the review template by MMSJV. It is unknown whether or not an attempt was made to improve the conveyance.



An addition of panel markers (blue dots) as in figure 3.3 below, demonstrates that this is easily rectified and should have beneficial effects on the stability. The flow equations, of which conveyance is one of many terms, are assisted by breaking the cross section up into discrete sections with panel markers. It is specifically an issue when flow comes out of bank. In both figure 3.2 and 3.3 the maximum flow level is shown by a turquoise line and can be seen to come out of bank at the point of conveyance reducing as levels increase (which shouldn't happen).

Figure 3.3



This simple addition of panel markers may solve the instability issue.
Despite the oscillations, results can be obtained and appear the same for pre and post development, as with all the other scenarios. Given this fact and the fact that the levels upstream where stability isn't causing oscillation in water level, it is considered unlikely that the difference in results would be significant (once rectified).
However, it is recommended that the model is re-run for the 105% event with the addition of panel markers for cross sections along the Aylesford stream. If this is not undertaken there is less confidence that the true impact of the proposal on the 1%AEP+105% scenario is represented.

For node by node baseline and development levels see Appendix A.

4. Conclusion & Recommendations

The results of the modelling suggest that the proposed development has little impact on flood levels and flood extents; suggesting negligible impact on flood risk. This is to be expected given that the proposed embankments, for the most part, lie outside of the flood extents and the in channel changes are relatively minor. However, the specific designs are not yet finalised and very approximate representation has been provided.
The model experiences stability issues during the 105% climate change scenario reducing the confidence in the results downstream of the site on the Aylesford stream. Given the results upstream and for all the other scenarios it is deemed likely that the resulting difference between the baseline and developed scenario would not be significantly different if this issue was rectified.

Recommendations:

1. Any further details of proposed development should be cross referenced with the schematisation in the model. If it is considered that there is significant difference, this impact assessment should be revisited.
2. The 105% scenario should be re-run with panel markers along the Aylesford stream. This may improve the stability issues and provide more confidence in the results downstream.
3. The differences in depths in the flood plain have not been investigated here and flood depth difference maps for all scenarios should be provided.

Appendix A – Level Results 1%AEP

Cross section node	Pre Development (mAOD)	Post Development (mAOD)	Difference (m)
AYLS_55	46.826	46.826	0.000
AYLS_54	46.853	46.853	0.000
AYLS_54D	46.710	46.710	0.000
AYLS_53	46.470	46.470	0.000
AYLS_53_i1	45.768	45.768	0.000
AYLS_53_i2	45.450	45.450	0.000
AYLS_53_i3	45.450	45.450	0.000
AYLS_52	44.713	44.707	-0.006
AYLS_52D	44.532	44.524	-0.009
AYLS_51	44.352	44.335	-0.017
AYLS_50	44.260	44.238	-0.022
AYLS_50D	44.202	44.172	-0.030
AYLS_49	44.148	44.116	-0.032
AYLS49_CLU	44.116	44.083	-0.033
AYLS49_CLD	44.040	44.002	-0.038
AYLS_48U	43.968	43.927	-0.041
AYLS_48	43.959	43.917	-0.042
AYLS_48D	43.939	43.897	-0.042
AYLS_47	43.823	43.823	0.000
AYLS_47i25	43.772	43.772	0.000
AYLS_47i50	43.766	43.766	0.000
AYLS_47i75	43.761	43.761	0.000
AYLS_46	43.764	43.764	0.000
AYLS_45	43.181	43.181	0.000
AYLS_44	43.029	43.029	0.000
AYLS_43	42.846	42.846	0.000
AYLS_42	42.760	42.760	0.000
AYLS_42D	42.739	42.738	0.000
AYLS_41	42.491	42.491	0.000

AYLS41_CLU	42.465	42.464	0.000
AYLS41_CLD	42.386	42.386	0.000
AYLS_40U	42.359	42.359	0.000
AYLS_40	42.342	42.342	0.000
AYLS_39	42.226	42.225	0.000
AYLS_39D	42.203	42.203	0.000
AYLS_38	42.042	42.042	0.000
AYLS_37	41.854	41.854	0.000
AYLS_36	41.548	41.548	0.000
AYLS_35	41.248	41.248	0.000
AYLS_35U	41.202	41.202	0.000
AYLS_35D	40.448	40.447	-0.001
AYLS_34	40.455	40.455	0.000
AYLS_34D	40.436	40.436	0.000
AYLS_33	40.338	40.338	0.000
AYLS_32	40.204	40.204	0.000
AYLS_32D	40.186	40.186	0.000
AYLS_31	40.129	40.129	0.000
AYLS_30U	39.847	39.847	0.000
AYLS_30	39.847	39.847	0.000
AYLS_29	39.865	39.865	0.000
AYLS_29D	39.733	39.733	0.000
AYLS_28	39.550	39.550	0.000
AYLS_27	39.272	39.273	0.001
AYLS_26	39.089	39.090	0.000
AYLS_25	38.908	38.908	0.000
AYLS_23	38.676	38.676	0.000
AYLS_23D	38.652	38.651	0.000
AYLS_22	38.612	38.611	0.000
AYLS_22D	38.582	38.582	0.000
AYLS_21	38.453	38.454	0.000
AYLS_20	38.296	38.296	0.000
AYLS_20D	38.243	38.244	0.001
AYLS_19	38.119	38.119	0.000
AYLS_19D	38.054	38.053	-0.001
AYLS_18	37.982	37.983	0.001
AYLS_17	37.980	37.979	-0.001
AYLS_16	37.831	37.834	0.003
AYLS_16D	37.781	37.783	0.002
AYLS_15	37.664	37.665	0.001
AYLS_15D	37.617	37.618	0.001
AYLS_14	37.549	37.549	0.000
AYLS_13	37.471	37.471	0.000
AYLS_12	37.268	37.268	0.000
AYLS_11	37.207	37.208	0.000

AYLS_10	37.097	37.097	0.000
AYLS_09	37.029	37.029	0.000
AYLS_08	37.019	37.019	0.000
AYLS_08D	37.018	37.018	0.000
AYLS_07	36.999	36.999	0.000
AYLS_07D	36.995	36.995	0.000