

Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure



Llywodraeth Cymru
Welsh Government

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) (Amendment) Scheme 201-

The London to Fishguard Trunk Road (East of Magor to Castleton) Order 201-

The M4 Motorway (West of Magor to East of Castleton) and the A48(M) Motorway (West of Castleton to St Mellons)(Variation of Various Schemes) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and The London to Fishguard Trunk Road (east of Magor to Castleton) (Side Roads) Order 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and the London to Fishguard Trunk Road (East of Magor to Castleton)) Compulsory Purchase Order 201-

The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) (Supplementary) Scheme 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) and The London to Fishguard Trunk Road (East of Magor to Castleton)) Supplementary Compulsory Purchase Order 201-

Summary of Proof of Evidence

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Welsh Government, Tidal Flooding

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M4 CORRIDOR AROUND NEWPORT

Summary of Proof of Evidence, WG1.16.2 Tidal Flooding

1. Personal Statement

- 1.1 My name is Dr Paul Canning. I am employed by Atkins Limited as a Principal Consultant. I am a Chartered Civil Engineer with 20 years of experience in research and consultancy related to tidal flood risk. I hold a BEng Honours degree in Civil Engineering and a PhD in Coastal Processes.
- 1.2 I am a member of the project team who are responsible for the delivery of the M4 Corridor around Newport (M4CaN). I supported this project by providing information and advice on the findings and recommendations of the Severn Estuary Shoreline Management Plan 2 (SESMP2), Severn Estuary Flood Risk Management Strategy (SEFRMS), and the related tidal flood risk to the Wentlooge and Caldicot Levels.
- 1.3 This evidence represents my true and professional opinion and is given in accordance with the Institution of Civil Engineer's Rules of Professional Conduct.

2. Scope of Proof of Evidence

- 2.1 My evidence addresses the tidal flood risk aspects relating to the M4CaN proposals. My evidence does not address the following matters: fluvial hydrology and flooding, planning and sustainable development, and shipping. These specialist matters will be addressed by other Expert Witnesses.

3. The M4CaN in terms of tidal flood risk

- 3.1 In relation to tidal flood risk, the M4CaN alignment passes on a low embankment across the Wentlooge and Caldicot Levels. This area is

identified as floodplain and reported as such by Natural Resources Wales (NRW).

- 3.2 In my opinion the primary issue related to tidal flood risk for the M4CaN is that it has the potential to hold back tidal flood water originating from either a) the south, due to overtopping and/or breach of defences from along the Severn Estuary shoreline of the Wentlooge and Caldicot Levels; and b) from the north and south, due to overtopping and/or breach of defences from along the River Usk. This primary issue is dependent on whether tidal flood risk improvements are undertaken both now and in the future.

4. Consideration of hydraulic modelling relating to tidal flood risk

- 4.1 Within my Proof of Evidence I describe in detail the previous hydraulic modelling studies, and the predicted tidal flood risk now and into the future, with and without future improvements to the tidal defence system, both with and without construction of the M4CaN.
- 4.2 I note that the relevant studies are the SESMP2, SEFRMS, M4CaN Key Stage 2 (KS2) Flooding Assessment, the Stephenson Street scheme outline business case, and the Caldicot and Wentlooge Coastal Modelling study. These studies provide a reasonable description of the present day and future flood risk management position, with and without the M4CaN. I will now summarise my informed qualitative interpretation based on quantified information.
- 4.3 Between 2018 and 2030. The Wentlooge and Caldicot Levels are protected from tidal flooding by a range of earth embankments, revetments, rock armouring and walls. The Wentlooge and Caldicot Levels tidal defences generally provide a 0.1% Annual Exceedance Probability (AEP) Standard of Protection (SoP) through to 2030. Exceptions to this, relevant to the M4CaN, are located in the Caldicot Levels, at the forthcoming Scheme at Stephenson Street, low spots at

Goldcliff Pill and Coldharbour to Sudbrook Point, and small-scale works where tidal defences are only slightly lower than recommended and/or over a short length. In the Caldicot Levels prior to any of the above works being built, flooding would begin to occur in the 10%AEP event from the Stephenson Street location, with over 2,000 properties and regionally significant infrastructure flooded in the 0.1%AEP event in 2014. This would occur with or without the M4CaN in place. The magnitude of possible betterment and detriment caused by the M4CaN (based on the KS2 design) is estimated as no betterment, and detriment to 10 properties.

- 4.4 Between 2030 and 2110, if the existing tidal flood defence system is maintained and not improved in the future the majority of the Wentlooge and Caldicot Levels tidal defences would not provide a SoP against breach of 0.1%AEP. The Caldicot and Wentlooge Coastal Modelling study estimates that by 2115 that extensive flooding of the Wentlooge and Caldicot Levels would occur to up to 11,999 (Wentlooge Levels) and 15,025 (Caldicot Levels) properties, and nationally significant infrastructure, in the 0.1%AEP event. The magnitude of possible betterment and detriment caused by the M4CaN (based on the KS2 design) is estimated as betterment to 6,000 properties, no change to 14,000 properties, and detriment to 3,000 properties.
- 4.5 I note that the betterment and detriment numbers for 2018-2030, and 2030-2110, would tend to reduce in light of the difference between the M4CaN KS2 and January 2016 design road levels, and Schemes for Stephenson Street, Goldcliff Pill and Coldharbour Pill to Sudbrook Point, and small-scale works being in place.
- 4.6 Between 2030 and 2110, with the SESMP2 and SEFRMS recommended programme of improvements. The tidal flood defence system would provide a 0.1%AEP SoP against breach through to 2110. The recommended programme of improvements are independent of the M4CaN. Under these conditions the M4CaN would

not be expected to cause any betterment or detriment to properties within the Wentlooge and Caldicot Levels.

5. Consideration of recommended improvements to the tidal flood defences now and into the future

- 5.1 I will now describe the recommended improvements to the tidal flood defences now and into the future.
- 5.2 Management of the shoreline and tidal flood risks in England and Wales is broadly considered in a hierarchical manner, consisting of Shoreline Management Plans (now at their 2nd version, and therefore referred to as SMP2), strategies, and schemes.
- 5.3 The SESMP2 sets out agreed preferred policies for managing the Wentlooge and Caldicot Levels shoreline and associated flood and erosion risks, of 'Hold the Line' for the next 100 years.. The SESMP2 was agreed by Welsh Ministers on 26th November 2014.
- 5.4 My review of the broad scale economic analysis within the SESMP2 and all other SMP2s relevant to Wales, identifies that the Benefit Cost Ratios for the Wentlooge and Caldicot Levels are in the top ten of over two hundred shoreline units in Wales. However, I note that SMP2s do not provide certainty of funding.
- 5.5 The reason for the robust Benefit Cost Ratios is primarily the extensive property and infrastructure present in the tidal floodplain of the Wentlooge and Caldicot Levels. The tidal flood risk to this infrastructure is managed by the tidal defences along the Wentlooge and Caldicot Levels, and would increase as described previously if Welsh Government did not fund the 'Hold the Line' policy in the SESMP2.
- 5.6 The draft SEFRMS was also undertaken by the Environment Agency (including NRW). One of the aims of the SEFRMS was to define the optimal SoP of tidal defences over the next 100 years, on balanced

engineering, economic and environmental grounds. It has not been approved yet, but nevertheless is actively being used by NRW and the Environment Agency to guide investment in flood risk management infrastructure around the Severn Estuary in Wales and England.

- 5.7 The SEFRMS found that the optimal SoP would be 0.1%AEP over the next 100 years. The SEFRMS also identified three Priority Schemes of relevance to tidal flood risk to the M4CaN. NRW have confirmed that of the three Priority Schemes, both the Tabbs Gout and Portland Grounds Schemes are now completed. NRW also confirmed that as and when the three Priority Schemes were completed, the Wentlooge and Caldicot Levels would have a 0.1%AEP SoP through to 2030. Further to this, at a meeting on the 22nd September 2016, NRW confirmed that Newport City Council are promoting the remaining Priority Scheme, referred to as the Stephenson Street Scheme. The Outline Business Case is with Welsh Government to consider for approval.
- 5.8 Subsequent findings from the Caldicot and Wentlooge Coastal Modelling study indicate that, relevant to the M4CaN, further improvements and/or small-scale works would be required at Goldcliff Pill and Coldharbour Pill to Sudbrook Point. The SEFRMS would provide a strong economic case for these works to occur, and the SEFRMS recommendation and justification for 0.1%AEP SoP over the next 100 years would remain robust.

6. TAN15 compliance in relation to tidal flood risk

- 6.1 I note that NRW have objected to the M4CaN in relation to tidal flood risk and TAN15 compliance. Drawing from NRW's letter of 4th May 2016, page 86 to 88, I quote *"the key issue is lack of certainty that improvements to the coastal defences will be funded, programmed and implemented to keep track with providing a standard of protection which would mean that the Scheme (M4CaN), and properties to the*

south would remain flood free during a 0.1% (1 in 1000) tidal event throughout the lifetime of the Scheme (M4CaN).”

- 6.2 Of particular relevance to NRW’s objection is the fact that TAN15 requires that there are no adverse flood consequences for any existing development resulting from the construction of any new development, tested against a 0.1%AEP event over the lifetime of the development. NRW’s objection is on the basis that the recommended SoP of 0.1%AEP would only be met to the year 2030 on construction of the Stephenson Street Scheme, and that beyond 2030 there would not be complete funding certainty for further tidal flood defence improvements in response to climate change.
- 6.3 From consideration of the tidal flood risk information I have described previously, I consider that:
- 6.3.1 With the Stephenson Street Scheme, Goldcliff and Coldharbour Pill to Sudbrook Point improvements, and small-scale works in place, the M4CaN would not cause detriment in the 0.1%AEP event up to 2030. The M4CaN would then meet the key element of NRW’s objection.
- 6.3.2 With the SESMP2 and SEFRMS programme of tidal defence improvements after 2030, a 0.1%AEP SoP would continue to be provided to the Wentlooge and Caldicot Levels. The M4CaN would then achieve the key element of NRW objection.
- 6.3.3 Without the SESMP2 and SEFRMS programme of improvements after 2030, the SoP of the Wentlooge and Caldicot Levels would reduce over time. The M4CaN would then fail the key element of NRW objection. Mr John Davies MBE addresses how this scenario should be viewed by the decision maker in this case.
- 6.4 I recognise that neither the SESMP2 nor SEFRMS provides absolute funding certainty for improvements to the tidal defence after 2030. However, I note that:

- 6.4.1 The SESMP2 policies are agreed by Welsh Ministers.
- 6.4.2 The economic justification for both the SESMP2 policy of Hold the Line and the SEFRMS recommended SoP of 0.1%AEP over the next 100 years is robust and strong in comparison to other SMP2 recommendations in Wales.
- 6.4.3 The SEFRMS is already being used to guide the investment in tidal flood defence infrastructure along the Wentlooge and Caldicot Levels. This is proven by the Welsh Priority Schemes recommended by the SEFRMS having already been progressed to scheme appraisal (Stephenson Street) or construction (Tabbs Gout and Portland Grounds).
- 6.5 On these grounds I consider it reasonable to work on the basis that the SESMP2 policies and SEFRMS recommendations would be implemented between 2018 and 2030, and more widely from 2030 to 2122.

7. Tide levels in the vicinity of the River Usk and climate change

- 7.1 I will now move on to consider the tide levels and lock gate levels at Newport Docks, now and in the future. Associated British Ports have stated that the crest level of the existing Newport Docks lock gates is 7.74mAOD, and that the proposed crest level of the new Newport Docks 'Outer Lock' gates would be 8.41mAOD. In light of inspection of extreme water level and climate change guidance I consider that the proposed crest level of the new Newport Docks 'Outer Lock' gates reasonably accounts for predicted climate change.

8. Conclusions

- 8.1 In conclusion, my Proof of Evidence provides a detailed description of the existing and future tidal flood risks on the Wentlooge and Caldicot Levels.
- 8.2 In my opinion, if the SESMP2 and SEFRMS recommendations are funded into the future, this would address NRW's objection relating to TAN15. I consider there is a compelling case for that future funding to occur, with which TAN15 section 7 and Appendix 1 compliance would be achieved.
- 8.3 I believe the facts which I have stated in my Proof of Evidence are true and that the opinions expressed are correct, and I understand my duty to the Inquiry to assist it with matters within my expertise and I believe that I have complied with that duty.