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

Llywodraeth Cymru
Welsh Government

THE CHESTER TO BANGOR TRUNK ROAD (A55) (JUNCTIONS 16 AND 16A IMPROVEMENT REALIGNMENT AND SLIP ROADS) ORDER 202-

THE CHESTER TO BANGOR TRUNK ROAD (A55) (JUNCTIONS 16 AND 16A IMPROVEMENT REALIGNMENT AND SLIP ROADS) (SIDE ROADS) ORDER 202-

THE WELSH MINISTERS (THE CHESTER TO BANGOR TRUNK ROAD (A55) (JUNCTIONS 16 AND 16A IMPROVEMENT REALIGNMENT AND SLIP ROADS)) COMPULSORY PURCHASE ORDER 202-

PROOF OF EVIDENCE

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WELSH GOVERNMENT, WATER QUALITY AND FLOODING

DOCUMENT REFERENCE: WG 1.11.02

Contents

1. Author

1.1 I am Steve Cox. I am an Associate with Ramboll UK Limited, my employer since 2008. I work in the Water Service Line, part of the Environment and Health discipline, leading projects related to water quality and to highways. I have a PhD in environmental engineering from the University of Southampton (2002). I am a Chartered Scientist, Chartered Environmentalist and Fellow of the Chartered Institution of Water and Environmental Management.

1.2 Since joining Ramboll I have worked closely on many commissions with Highways England (HE), supporting and advising them on issues related to water quality and flooding.

1.3 On behalf of HE I was closely involved in the development of the Highways England Water Risk Assessment Tool (HEWRAT)[1] which has been adopted by Welsh Government and is used to predict the pollution risk to waters receiving runoff from trunk roads.

1.4 I co-authored Design Manual for Roads and Bridges (DMRB) chapter LA113 (Road Drainage and the Water Environment)[2] (Document Ref WG 4.01.78), both in 2009 and the more recent update in 2020. LA113 sets out the UK-wide requirements for water quality and flood risk compliance related to trunk roads.

1.5 Through my commissions with HE, I am and have been involved with around forty trunk road schemes, most often to review assessments of potential impacts on water quality and flood risk.

1.6 In terms of detailed involvement in highway impact assessment and design, my relevant experience includes the following projects:

a) A477 St Clears to Red Roses (South Wales)

b) M90 Queensferry Crossing and approach roads (Scotland) – including two years on site as designer's environmental advisor

c) A31 Magherafelt Bypass (Northern Ireland)

d) A26 Dualling - Glarryford to A44 Drones Road (Northern Ireland)

e) A500 Dualling – M6 to Crewe (English Midlands)

[1] HEWRAT is not a document but a publicly available Microsoft Excel application which can be downloaded from the downloads link on the landing page of Highways England's online Drainage Data Management System (HADDMS) https://www.haddms.com/

[2] Highways England, Design Manual for Roads and Bridges (DMRB) document LA113 Road Drainage and the Water Environment, revision 1, March 2020 LA 113 - Road drainage and the water environment - DMRB (standardsforhighways.co.uk)

f) A120 Braintree to A12 (Eastern England)

g) A27 Chichester Bypass (Southern England)

1.7 At this inquiry I am acting as an expert witness on matters relating to water quality and flooding.

2. Introduction

2.1 The project for improvements at Junctions 15 and 16 of the A55 has developed so that it also encompasses Junctions 14 and 16A. Furthermore, the two sets of junctions, namely Junctions 14 and 15 to the west at Llanfairfechan, and Junctions 16 and 16A to the east at Dwygyfylchi and Penmaenmawr, are being treated under different sets of draft Orders and Environmental Statements (ES). This proof of evidence addresses Junctions 16 and 16A, at Dwygyfylchi and Penmaenmawr, hereby referred in this proof of evidence as the 'Scheme' or the 'Junction 16 Scheme' as appropriate.

2.2 My proof of evidence provides an overview of the Junction 16 Scheme related to water quality and flooding and sets out the reasons for the proposed environmental mitigation.

2.3 The opinions expressed are my own unless I state otherwise. I have been assisted by colleagues from within the project team in the various tasks that are reported in this document. Colleagues are also presenting evidence within their specialist environmental expertise. Where a topic is covered in detail by the proof of evidence of another specialist, I provide a cross Ref to the relevant proof.

2.4 It is not my intention to reproduce large sections of text from the ES, but simply to cross refer to, or highlight key procedural and technical matters that are pertinent to the assessment of the published Scheme. Consequently, I will refer in this proof of evidence to supporting material contained within the ES and the ES Supplements where relevant.

2.5 My Proof of Evidence is structured in the following manner:

Part 3 Scope and purpose of the proof of evidence

Part 4 A summary of the assessment of flooding and water quality – this covers the key issues of the Scheme and summarises the findings of the assessment contained in the ES

Part 5 Objections to the Scheme – this summarises matters raised in the objections that are relevant to my Proof of Evidence and sets out my response

Part 6 Conclusion and declaration

Links with other Proofs of Evidence

2.6 I will rely on the following expert witnesses to cover their respective specialist fields:

a) Donna Hall – Nature Conservation (WG 1.08)

b) Simon Price – Climate Change (WG 1.02)

3. Scope and Purpose of this Proof of Evidence

3.1 In this Proof of Evidence, I will provide evidence on:

a) The hydrology of the site of the Scheme;

b) The potential impacts on the flood regime that might occur as a consequence of the Scheme;

c) The potential of the Scheme to contribute to changes in the water quality of water bodies in the local area; and

d) The mitigation measures proposed to minimise these impacts.

3.2 The evidence I provide is based on the findings of the ES (Chapter 7) together with the following documents:

a) ES Appendix 7.1 - Assessment of Effects on Water Framework Directive (WFD) Water Bodies (Document Ref WG 3.01.05);

b) ES Appendix 7.2 Flood Consequences Assessment (FCA) (Document Ref WG 3.01.05);

c) ES Appendix 7.3 Water Quality Assessment (Document Ref WG 3.01.05);

d) ES Appendix 7.4 Hydrological Calculations Record (Document Ref WG 3.01.05);

e) ES Appendix 7.5 Afon Gyrach Flood Modelling Report (Document Ref WG 3.01.05);

f) ES Appendix 7.6 Correspondence with Natural Resources Wales (NRW) (Document Ref WG 3.01.05);

g) Supplementary Report on Surface Water Quality and Water Framework Directive (July 2021) (Document Ref WG 4.06.03); and

h) Supplementary Report - Hydrological Calculations Record and Flood Risk Update (July 2021) (Document Ref WG 4.06.04).

3.3 The ES, its appendices and the supplementary reports are Deposit Documents.

4. Summary of the Assessment of Flooding and Water Quality

Hydrological Setting

4.1 The Scheme runs parallel with the sea at Conwy Bay. At its closest the A55 is within approximately 15 m of the sea wall. Approximately 1 km northeast of the existing Junction 16 roundabout the Afon Gyrach main river flows under the existing A55 and adjacent railway before discharging to Conwy Bay.

4.2 To connect Junction 16 and 16A a link road would be constructed parallel to the A55. The link road would cross the Afon Gyrach main river requiring a new bridge structure.

4.3 Toward the northeast end of the Scheme, approximately 425 m southwest of the Penmaen-bach tunnels, there is a small unnamed watercourse which passes under the A55 in a culvert. The watercourse is herein referred to as Watercourse 425.

4.4 Most of the runoff from the existing A55 within the Scheme boundary drains directly to Conwy Bay via a series of sea outfalls. The remainder drains to the Afon Gyrach and Watercourse 425. There is not believed to be any attenuation of flow rates prior to discharge.

Flood Risk from Rivers and the Sea

4.5 The land rises steeply from the coastline such that the majority of the Scheme is in a zone considered to be at little or no risk of coastal/tidal flooding. The fluvial and coastal/tidal flood risk is further described and illustrated in the FCA and ES Figure 7.3 (Document Ref WG 3.01.02).

4.6 Land adjacent to the Afon Gyrach is at risk of fluvial flooding (flooding from the river). Approximately 300 m upstream from where the A55 crosses the Afon Gyrach, a small residential area (Gardd Eryri) lies to the east of the river and is at high risk of fluvial flooding. High risk means that each year, the area has a chance of flooding of greater than 1 in 30 (3.3%).

4.7 To determine whether the new structure carrying the link road over the Afon Gyrach would increase the risk of flooding to receptors, a hydraulic modelling exercise was carried out. The modelling concluded that the structure carrying the link road over the Afon Gyrach should have an opening size (shape, width and height) the same as or larger than the existing A55 arch structure. Full details of the modelling are given in ES Appendices 7.2, 7.4, 7.5 (Document Ref WG 3.01.05) and the Supplementary Report (Hydrological Calculations Record and Flood Risk Update) (Document Ref WG 4.06.04).

4.8 The modelling also concluded that in the rainfall events[3] modelled there would be some afflux (increase) in flood level immediately upstream of the proposed structure. During a 1-in-100 year + 30% climate change event, the increase in flood height (afflux) immediately upstream would be 10 mm. During a 1-in-1000 year event the afflux would be 130 mm. The modelling shows that afflux is limited to a distance of 28 m on the upstream side (it may be less than 28 m but this is the position of the next cross-section in the model). The land that would be impacted by this minor increase in flood level in this very rare event is currently pasture and would become land acquired by Welsh Government. Given that the land which would experience this afflux would be acquired by the Welsh Government, and that no residential receptors or other buildings would be affected, the afflux is considered acceptable. This principle has been discussed with and accepted by NRW. Flood risk to the residential area of Gardd Eryri would not be affected.

4.9 The modelling also shows that a freeboard of more than 600 mm would remain between the soffit (highest point on the underside) of the proposed structure and the peak flood level during a 1-in-1000 year event, thus allowing floating debris to pass under and through the structure.

4.10 The last revision of the FCA was dated 9 June 2020 and referred to flood zones 1, 2 and 3 in NRW's mapping system. Since then, and as noted by NRW in a letter to Welsh Government regarding the Scheme dated 10 May 2021, the references to flood zones 1, 2 and 3 have changed, and updated flood risk maps have been published.

4.11 Review of the new flood risk mapping[4] reveals that the extent of the flood outlines within the Scheme boundary have not changed, with the exception of those along the Afon Gyrach corridor where a more refined flood pattern is shown, likely as a result of higher resolution remote survey using LiDAR (Light Detection and Ranging) technology.

4.12 As a ground-based topographic survey was used to form the basis of the Afon Gyrach hydraulic model for the Scheme, the results from the model are considered to remain the most reliable dataset upon which to assess impacts. As NRW's letter of 10 May 2021 states "the modelling work would seem acceptable to show that the flood risk associated with the new crossing of the Afon Gyrach (designated as a main river) is manageable."

[3] Rainfall events with return periods of 2 years, 30 years, 75 years, 100 years, 100 years + a 30% climate change allowance, and 1000 years were modelled.

[4] Natural Resources Wales (NRW) Flood Risk Map Viewer. Available at https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=0 [Accessed August 2021]

4.13 The Welsh Government wrote to NRW on 19 July 2021 explaining that NRW's Flood Risk Assessment Wales maps had been updated after the FCA was completed but prior to its publication. The 19 July 2021 letter also stated that the detailed flood modelling supplanted the assessment of flooding based on the Flood Risk Assessment Wales maps which were likely based on generalised methods. In a further response from NRW to Welsh Government on 09 August 2021[5], NRW noted and accepted this conclusion.

4.14 In terms of flood risk to the A55 and the Scheme itself, no increase in flood risk has been identified.

Surface Water Flooding and Drainage

4.15 Most of the runoff from the existing A55 within the Scheme boundary drains directly to Conwy Bay via a series of sea outfalls. Some runoff drains to the Afon Gyrach where it is crossed by the A55 and also to Watercourse 425. There is not believed to be any attenuation of flow rates prior to discharge.

4.16 NRW flood risk maps show part of a field to the southeast of the A55, between the Afon Gyrach and the Puffin Café, to be at risk of 'surface water flooding'. Surface water flooding is flooding that takes place when surface runoff generated by rainwater falls on the surface of the ground and has not yet entered a watercourse, drainage system or public sewer. The link road would pass through this area but would be raised above the original ground level on a low embankment such that the road would not be at risk of surface water flooding. A drainage system such as a ditch, swale or filter drain would be installed along the southern boundary of the link road to intercept surface water flows and convey these to the Afon Gyrach.

4.17 The fields adjacent to Watercourse 425 are also shown to be at risk of surface water flooding. A realigned west-bound off-slip would cross this area as part of the Scheme. The existing culvert carrying the watercourse would be extended. The off-slip itself would be raised on embankment and not at risk of surface water flooding. A drainage system such as a ditch, swale or filter drain would be installed along the toe of the embankment to convey water away from the embankment in order to prevent slope stability issues.

4.18 The Scheme would result in a larger area of impermeable road surface than at present. Without mitigation this would lead to an increased rate of surface water runoff which could exacerbate surface water flooding. To prevent this, the Scheme drainage design would include attenuation systems such as over-sized pipes and attenuation ponds to temporarily store runoff and discharge it at a rate no greater than the existing rate.

[5] A copy of the correspondence with NRW can be found in the Appendices to the Environment Proof of Evidence (Document Ref WG 1.06.03)

Water Quality and the Water Framework Directive

4.19 Impacts on water quality from highway runoff can occur either as a result of traffic accidents which result in spillages, or as a result of 'routine' runoff whereby rainfall removes contaminants from the road surface that originate from the wear and tear of vehicles (e.g. brakes, tyres) and the road surface itself.

4.20 Water running off the existing A55 is discharged via outfalls direct to the adjacent Conwy Bay and to the Afon Gyrach and Watercourse 425 both of which flow into Conwy Bay around 100 m to 150 m downstream of the A55 outfalls. Conwy Bay is designated as a coastal water body under the Water Framework Directive (WFD). Within it, less than 2 km from the Scheme, are two areas designated for their habitat quality. These are Liverpool Bay Special Protection Area (SPA) and Menai Strait and Conwy Bay Special Area of Conservation (SAC). The SAC overlaps the SPA. As well as these protected habitats, Penmaenmawr is a designated bathing water.

4.21 Penmaenmawr Wastewater Treatment Works lies immediately adjacent to the north-easterly end of the Scheme on its seaward side. It discharges secondary treated sewage effluent into coastal waters via an outfall 360 m from the shore.

4.22 At present, the runoff from the existing A55 is discharged without settlement or treatment to improve water quality.

4.23 The potential impact of the Scheme on the water quality of Conwy Bay, the Afon Gyrach and Watercourse 425 was determined using the processes prescribed in DMRB LA113 and the Highways England Water Risk Assessment Tool (HEWRAT)[6]. LA113 and HEWRAT have both been adopted by the Welsh Government. The HEWRAT tool is principally designed to assess impacts on freshwater and, in lieu of an alternative, was adapted for use with the saline waters of Conwy Bay. Further details are given in ES Appendix 7.3 Water Quality Assessment (Document Ref WG 3.01.05).

4.24 It is normal for contaminants in routine runoff from trunk roads to rely on a degree of dilution and dispersal in the receiving waterbody in order to achieve concentrations which are below the prescribed acceptability thresholds in HEWRAT. The thresholds used by HEWRAT derive from collaborative research undertaken between Highways England and the Environment Agency to improve the reliability and extent of data for pollutant concentrations found in road runoff from non-urban trunk roads and

[6] HEWRAT is a Microsoft Excel application designed to assess the acute and chronic risks of pollution related to the intermittent nature of road runoff and associated with soluble and sediment bound pollutants

motorways and their effects on the ecology of receiving waters (Document References WG 4.06.05, 4.06.06 and 4.06.07)[7,8,9].

4.25 The assessment for the Scheme concluded that discharges to both the Afon Gyrach and Watercourse 425 pass all aspects of the water quality assessment for routine runoff.

4.26 For discharges to Conwy Bay, the assessment concluded that the runoff requires only a small volume of seawater to dilute dissolved contaminants to concentrations below the acceptable thresholds given in HEWRAT/LA113. Dilution of runoff is anticipated to take place within a short distance of each sea outfall. Following this, the runoff would be subject to further, significant, dispersion within the coastal water body. The exact volume of seawater and distance from the outfall required to dilute dissolved contaminants would vary between rainfall events depending on the intensity and duration of the event. A reasonable worst-case scenario is considered in ES Appendix 7.3 (Document Ref WG 3.01.05).

4.27 For sediment-bound pollutants, the coastal environment is dynamic and subject to currents, waves and tides which would disperse fine sediments such that they would not be sufficiently concentrated to be toxic to aquatic organisms living in or near bed sediments.

4.28 Taking the above into account, the water volume and area of bed sediments with contaminant concentrations above the acceptable thresholds set by HEWRAT were considered to be insignificant.

4.29 In terms of spillage risk, LA113 defines the acceptable level of risk of a pollution incident occurring as being an annual probability of less than 1% (1 in 100 years) or, where sensitive areas such as SACs and SPAs are present, 0.5% (1 in 200 years).

4.30 The assessment of spillage risk concluded that, with the Scheme in place, the annual probability of an incident would be 0.17 % (1 in 595 years) and therefore substantially less than the acceptable probability such that no specific pollution control measures would be required.

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[7] Highways Agency, 2008. Crabtree R W, Dempsey P, Moy F, Brown C and Song M. UC 7697, 'Improved Determination of Pollutants in Highway Runoff - Phase 2: Final Report, WRc Plc, Report: UC 7697'

[8] Highways Agency, 2007. Johnson I and Crabtree R W. WRc UC 7486/1, 'Effects of Soluble Pollutants on the Ecology of Receiving Waters, WRc Plc, Report No: UC 7486/1'

[9] Highways Agency, 2008. Gaskell P, Maltby L and Guymer I. HA 3/368, 'Accumulation and Dispersal of Suspended Solids in Watercourses, ECUS, University of Sheffield, University of Warwick, Report No: HA3/368'

4.31 Of the various road types (slip road, roundabout, side road, no junction etc) LA113 states that for roundabouts on rural trunk roads there are an average of 3.09 serious spillages per billion heavy goods vehicles (HGV) km/year. For rural trunk roads near slip roads there are an average of 0.83 serious spillages per billion HGV km/year. A serious spillage at/near a slip road junction is therefore approximately 3.7 times less likely than at a roundabout. Removal of the existing Junction 16 roundabout would therefore decrease the risk of spillage.

4.32 Taking the above into account, the likelihood of a pollution incident resulting from a spillage on the Scheme is considered to be acceptably low and would be lower than the existing situation.

4.33 Chapter 8 of the ES (Nature Conservation) discusses the potential effects of the Scheme on the adjacent SPA and SAC in terms of the protected habitats and species within them. The assessment within that chapter concludes that any effects associated with surface water runoff from the Scheme would be neutral.

4.34 With respect to bathing water quality, turbidity (the amount of suspended material in the water) and faecal content are the main parameters of concern. Road runoff should not contain any faecal content so the Scheme would not result in any change in that context. Increased runoff from the Scheme during periods of high rainfall could potentially contribute to the turbidity of the sea on a very localised basis during such events, but inclusion of flow attenuation within the Scheme drainage design would assist in negating that and thus would not be expected to have any detrimental effect on the status of the bathing water.

4.35 The WFD Assessment, detailed in ES Appendix 7.1 (Document Ref WG 3.01.05) concludes that, with implementation of the noted design measures plus environmental management during construction, the proposed Scheme would not result in deterioration of the adjacent coastal water bodies. It is thus in compliance with the requirements of the WFD.

Construction Phase

4.36 During the construction phase, as with all infrastructure works of a similar scale, there is a risk of impact to water quality from spillage of fuel and chemicals and from silt-laden surface water runoff from exposed earthworks and construction compounds. Flood risk, particularly surface water flood risk, could also be exacerbated if site drainage systems are not in place or overland drainage routes are not considered. Good construction site layout and management procedures would reduce such risks. These procedures would be set out in a Construction Environmental Management Plan (CEMP).

Mitigation

4.37 The Scheme would include the following elements of mitigation for flood risk and water quality:

a) Interception of drainage from road and catchment runoff into the existing drainage network by measures including drainage ditches, filter drains and pipes/culverts;

b) Provision of flow attenuation and, where space allows, pollution control measures (the nature of which would be determined at detail design stage); and

c) Construction works would be undertaken under the management of a CEMP which would include measures such as management of surface water runoff from exposed earthworks and construction compounds, provision of spills kits and emergency spill procedures.

4.38 Monitoring during the construction phase would also be carried out to identify risks and prevent incidents. Monitoring would include:

a) Regular visual inspection of all discharges;

b) Regular inspection of surface water runoff control measures to ensure that transport of sediment off site is minimised; and

c) Regular inspection of plant that contain fuels or chemicals to ensure there is minimal risk of leakage/spillage.

Significance of Effects

4.39 Chapter 7 of the ES (Document Ref WG 3.01.01) concludes that, provided the mitigation outlined is implemented, the Scheme would not result in any significant effects on the water environment.

5. Objections to the Scheme

5.1 Objections have been made that raise matters that fall within the scope of my proof of evidence or that of one of my colleagues. I will address each and where appropriate I will refer to the proofs of others.

Objection Ref A55J15J16-2021-124A – Water Quality and Flooding

5.2 On 10 May 2021 NRW wrote to the Welsh Government stating *"NRW have concerns with regards to the conclusions of the Environmental Statement (ES) document and advise that the document is updated to take into account the comments below."* The full text of NRW's letter can be found in Document Ref WG 1.06.03.

5.3 In order to address NRW's concerns, the Welsh Government issued a response to NRW on 19 July 2021 (Document Ref WG 1.06.03). The response set out a series of clarifications and gave further reasoning to the conclusions reached in the ES. In addition, two supplementary reports on water quality and WFD (Document Ref WG 4.06.03) were issued to NRW on 4 August 2021 to provide more extensive clarification and further assessment of some queries raised by NRW. The supplementary reports were:

a) Supplementary Report on Surface Water Quality and Water Framework Directive (Document Ref WG 4.06.03); and

b) Supplementary Report - Hydrological Calculations Record and Flood Risk Update (Document Ref WG 4.06.04).

5.4 Following these clarifications, NRW wrote again to Welsh Government on 9 August 2021 (Document Ref WG 1.06.03) stating that they are "satisfied with the approach taken and agree with the proposed updates to the Register of Environmental Actions and Commitments" and that they would provide further comments on the submitted supplementary reports.

Objection Ref A55J15J16-2021-043H - Surface Water Flooding / Drainage

5.5 Objection text: *"There is a history of flooding in close proximity to where Ysguborwen Road is being altered for this project. The scheme plans should take account of this & resolve the issue within the proposed surface water drainage plans for the project"*

5.6 These concerns relate to existing surface water flooding issues along Ysguborwen Road. The drainage system for the Scheme has yet to be designed in detail but would be designed to current standards including consideration for higher intensity rainfall due to climate change. As noted earlier in this proof of evidence, temporary storage of runoff during rainfall events would likely use over-sized pipes and attenuation ponds. Where Ysguborwen Road is realigned as part of the Scheme, the drainage system associated with it would also be renewed in line with current standards and

this may reduce the frequency and depth of surface water flooding experienced at this location. However, if the location of the surface water flooding referred to is beyond the boundary of the Scheme then it is a separate matter for Conwy County Borough Council.

6. Conclusion and Declaration

6.1 My proof of evidence includes facts which I regard as being relevant to the opinions which I have expressed, and the Inquiry's attention has been drawn to any matter which would affect the validity of that opinion.

6.2 As an expert in water quality and flooding I have reviewed available data and sought, with the engineering and other environmental specialists in the team, to minimise impacts of the Scheme and to optimise the effectiveness of proposed mitigation.

6.3 In my opinion the water quality and flooding assessment, has been carried out and published in accordance with legislation and professional guidance.

6.4 In my opinion the development of measures to mitigate the water quality and flooding effects of the Scheme are effective, justifiable and achievable.

6.5 I believe the facts I have stated in this proof of evidence are true and that the opinions expressed are correct.

6.6 I understand my duty to the Inquiry to assist it with matters within my expertise and believe that I have complied with that duty.