

Welsh Government

**M4 Corridor around Newport -
Motorway to the South of Newport**

**WelTAG Stage 1 & 2 (Scheme)
Appraisal**

4-50-164

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Introduction

1.1 Overview

Welsh Transport Planning and Appraisal Guidance (WelTAG) was formally published by the Welsh Government in 2008. Paragraph 1.1.1 of WelTAG states that the guidance,

“...has been developed by the Welsh Assembly Government with the intention that it is applied to all transport strategies, plans and schemes being promoted or requiring funding from the Welsh Assembly Government”.

WelTAG has two primary purposes:

- *“To assist in the development of proposals enabling the most appropriate scheme to be identified and progressed – one that is focused on objectives, maximises the benefits and minimises negative impacts; and*
- *To allow the comparison of competing schemes on a like-for-like basis, so that decision-makers can make funding decisions”.*

WelTAG aims to ensure that transport proposals contribute to the wider policy objectives for Wales. Three pillars of sustainability, known as Welsh Impact Areas, underlie policy in Wales. These are:

- Economy: this reflects the importance of a strong and developing economy for Wales;
- Environment: this reflects both the legal requirements and desire to protect and enhance the condition of the built and natural environment; and
- Society: this reflects the desire to address issues of social exclusion and to promote social justice and a high quality of life for Welsh people.

WelTAG sets out that strategies and schemes need to be appraised against Transport Planning Objectives (TPOs) and the Welsh Impact Areas. For schemes, there is a formal and standardised two-stage appraisal process. Following Stage 1 appraisal, usually a small number of options will be further developed and then appraised at scheme level in considerable detail in Stage 2.

This report documents the WelTAG appraisal of the proposed section of new motorway to the south of Newport as part of the Plan for the M4 Corridor around Newport, at Stage 1 and 2 scheme level of appraisal.

1.2 Background

The M4 in South Wales forms part of the Trans-European Transport Network (TEN-T), which provides connections throughout Europe by road, rail, sea and air. The M4 plays a key strategic role in connecting South Wales with the rest of Europe, providing links to Ireland via the ports in South West Wales and England and mainland Europe to the east. It is a key east-west route being the main gateway into South Wales and also one of the most heavily used roads in Wales.

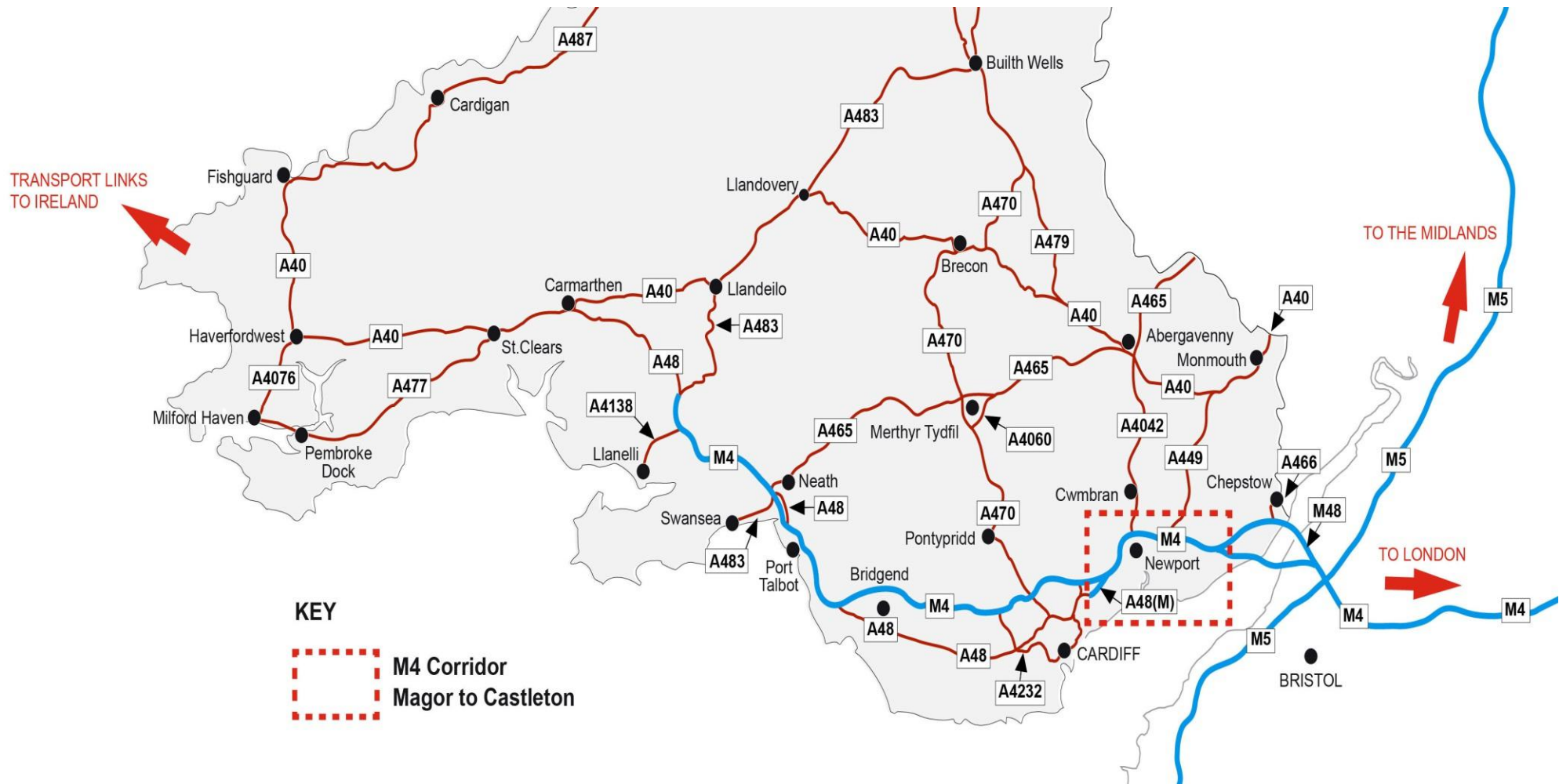
The M4 is critical to the Welsh economy. Cardiff, Newport and Swansea have ambitious regeneration strategies and Monmouthshire County Council is developing areas around Junction 23A of the M4. Rhondda Cynon Taff has important gateways onto the motorway at Junctions 32 and 34. Bridgend is served by M4 Junctions 35 and 36. Neath Port Talbot straddles the motorway and gets important access from Junctions 38 to 43. Congestion on the M4 causing unreliable journey times and reduced service levels will therefore hinder economic development in South Wales.

The M4 between Junctions 28 and 24 was originally designed as the 'Newport Bypass' with further design amendments in the 1960s to include the first motorway tunnels to be built in the UK.

The existing M4 Motorway between Magor and Castleton does not meet modern motorway design standards. This section of the M4 has many lane drops and lane gains, resulting in some two-lane sections, an intermittent hard shoulder and frequent junctions. It is often congested, especially during weekday peak periods resulting in slow and unreliable journey times and stop-start conditions with incidents frequently causing delays.

Problems with congestion and unreliable journey times have been a fact of life on the M4 around Newport for many years. The motorway and surrounding highway network does not cope with sudden changes in demand or operation, for example as a result of accidents or extreme weather events. These issues are worse at times of peak travel and have worsened as the number of users on the network has increased.

The location of the M4 Corridor around Newport is shown in its strategic context in Figure 1.1.

Figure 1.1: Location and Strategic Importance of the M4 Corridor around Newport, Magor to Castleton

1.3 Previous Work

Since the early 1990s, much assessment and consultation has been undertaken to develop a preferred solution to the problems on the motorway around Newport. A summary of previous work is provided below and a more detailed history is documented in the M4 Corridor around Newport WelTAG Appraisal Report Stage 1 (Strategy Level)¹. The history of previous work associated with the M4 Corridor around Newport is outlined in Figure 1.2.

For many years, concerns have been raised regarding the potential for delays on the motorway and trunk road network in South Wales.

In March 1989, the then Secretary of State for Wales commissioned the South Wales Area Traffic Study (SWATS) to review traffic patterns over part of the trunk road network in South Wales in order to identify problem areas and propose possible solutions.

The SWATS Report (1990) identified the need for substantial improvement to the M4 to address a growing capacity issue on the motorway, in particular the section between Magor and Castleton.

As a consequence, a proposal for a relief road around Newport (which became known as the 'M4 Relief Road', and later, the 'New M4 Project' as a new dual 3-lane motorway to the south of Newport) was included in the Welsh Trunk Road Forward Programme in 1991. An M4 Relief Road Preferred Route was published in 1995 and amended in 1997.

In 2004, the then Minister for Economic Development and Transport reported on the outcome of his review of transport programmes, which were undertaken to ensure a strategic fit with: 'Wales: A Better Country' and the Wales Spatial Plan. One of the conclusions of the review was that additional capacity was still required on the M4 motorway in South East Wales, in order to reduce congestion, improve resilience and remove an obstacle to greater prosperity along the whole corridor through to Swansea and West Wales. In addition to widening the motorway north of Cardiff, the Minister announced proposals to develop a New M4 south of Newport between Magor and Castleton.

Following Ministerial Review in 2004, the New M4 Project was the subject of a thorough re-examination in order to ensure fit with policies at that time and to take account of physical and legislative changes. Three key activities were undertaken:

1. A re-examination of route corridors considering, in particular, the implications and consequences of legislative changes and physical developments within the original project study area;
2. A comprehensive review of the previously published M4 Relief Road Preferred Route; and
3. A Junction Strategy Review.

¹ Welsh Government, M4 Corridor around Newport, WelTAG Appraisal Report Stage 1 (Strategy Level), Arup, June 2013

The conclusion of these studies confirmed the route to the south of Newport as the optimal solution to tackling the problems of congestion on the M4 corridor around Newport. Following the Preferred Route and Junction Strategy Review, a TR111 Notice² (April 2006) was published to protect a revised route corridor. A series of public exhibitions were held in April and May 2006 to explain the changes to the public and other stakeholders with an interest in transport in South Wales.

1.3.1 M4 Corridor Enhancement Measures (M4 CEM) Programme

A written statement in July 2009, by the then Deputy First Minister Ieuan Wyn Jones, announced that the New M4 was not affordable. The statement, however, accepted “the need to urgently address safety and capacity issues on the existing route” through the introduction of “a range of measures”.

The M4 Corridor Enhancement Measures (CEM) Programme³ was therefore initiated by the Welsh Government and this aimed to create a package of measures to deal with resilience, safety and reliability issues within the M4 corridor between Magor and Castleton.

Under the M4 CEM Programme, a long list of possible solutions was explored. Packages that combined public transport, highway and other travel solutions were identified for appraisal. These included widening of the M4 between Junctions 24 and 29 as well as improvement to the existing road network to the south of the Newport city centre and a new dual carriageway all-purpose road to the south of Newport.

As part of the M4 CEM Programme, a comprehensive engagement process was launched in September 2010 culminating in a public consultation held between March and July 2012. During the engagement process, the Welsh Government and its project team engaged with both internal and external specialists and expert stakeholders. This process encompassed a diverse range of views and interests relating to transport in South Wales, as well as with people likely to be interested in and affected by any transport measures potentially adopted and implemented by Welsh Government.

The consultation resulted in public support for the provision of an additional high quality road to the south of Newport⁴, supported by additional measures to address travel related problems within the M4 Corridor. These were referred to as Common Measures. They comprised a mix of network improvements, network management, demand management, alternative modes and smarter sustainable choices. The M4 CEM WelTAG Stage 1 (Strategy Level) Appraisal Report⁵ concluded that the following measures were worthy of further consideration:

² Once a preferred route is announced, Welsh Government serves a statutory notice (TR111) on the local planning authorities requiring the line to be protected from development. This is enacted under Article 19 of The Town & Country Planning (Development Management Procedure) (Wales) Order 2012

³ Further details of the M4 CEM Programme and its evolution are available at www.m4cem.com

⁴ Welsh Government, M4 Corridor Enhancement Measures (M4 CEM), Participation Report, Arup, August 2013

⁵ Welsh Government, M4 Corridor Enhancement Measures (M4 CEM), WelTAG Appraisal Report Stage 1 (Strategy Level), Arup, March 2013

- A new dual carriageway route to the south of Newport;
- Public transport enhancement; and
- Common measures.

1.3.2 M4 Corridor around Newport draft Plan

Initiatives, including discussions between the Welsh Government and HM Treasury/Department for Transport, as well as the work of the Silk Commission⁶, created potential funding opportunities for Welsh Government infrastructure projects. As a consequence, the decision was taken by the Welsh Government to further reconsider solutions to resolve transport related problems on the M4 around Newport.

Thus, in order to inform the strategy for the M4 Corridor around Newport, a further M4 Corridor around Newport WelTAG Stage 1 (Strategy Level) Appraisal⁷ was undertaken of options that included M4 CEM measures, provision of new motorway capacity routed to the south of Newport and complementary measures. The options considered within the WelTAG Appraisal were as follows:

- A new section of 3-lane motorway to the south of Newport following the protected (TR111) route (Black Route);
- A new dual 2-lane all-purpose road to the south of Newport following an alignment that would allow it to be constructed in phases (Red Route);
- A new section of 3-lane motorway to the south of Newport along a similar alignment to the all-purpose road (Purple Route);
- Public transport measures; and
- Complementary measures.

The M4 Corridor around Newport WelTAG Stage 1 (Strategy Level) Appraisal concluded that a new section of 3-lane motorway to the south of Newport following a protected (TR111) route, in addition to complementary measures, would best achieve the goals and address the problems of the M4 Corridor around Newport, and should be progressed for further appraisal.

These options subsequently formed the basis for the development of the draft Plan, which was subject to public consultation between September and December 2013. Responses to the draft Plan consultation are summarised within a draft Plan Participation Report and have been used to finalise the associated environmental, health and equality assessments at the strategy level. Taking these into account, the Welsh Government intends to adopt the draft Plan's preferred strategy and publish it within its Plan for the M4 Corridor around Newport.

The draft Plan also acknowledged that public transport enhancement will contribute to some of the goals of the M4 Corridor around Newport. Studies during the draft Plan development identified that an increased use of public

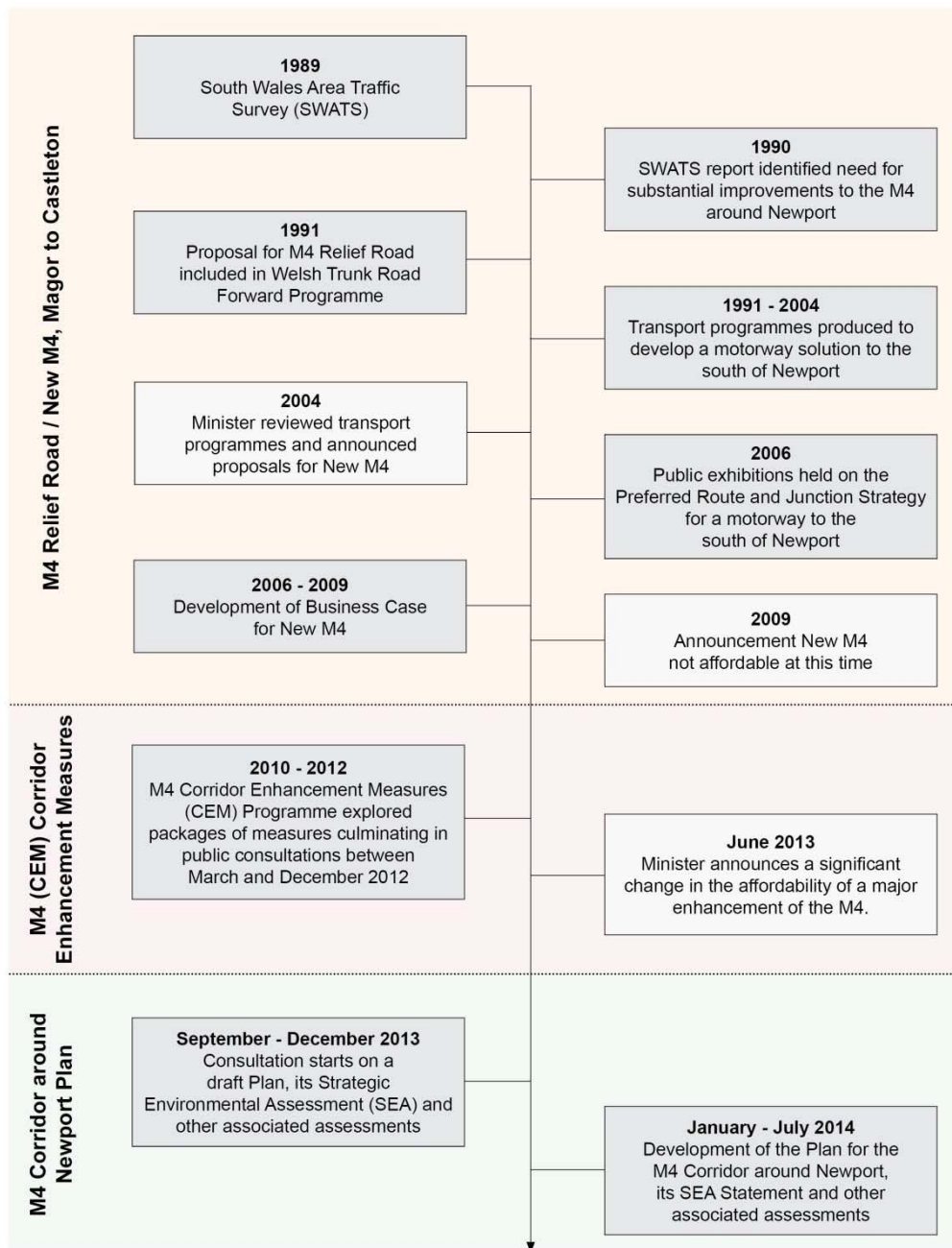
⁶ The 'Silk' Commission on Devolution in Wales, which is reviewing the case for the devolution of fiscal powers and reviewing the powers of the National Assembly for Wales, due to report in Spring 2014

⁷ Welsh Government, M4 Corridor around Newport, WelTAG Appraisal Report Stage 1 (Strategy Level), Arup, June 2013

transport in the Newport area would not solve the problems on the M4 Corridor around Newport. Nevertheless, the Welsh Government recognises the importance of public transport improvements and a dedicated separate task group has been formed to take forward proposals to develop a metro system for South East Wales. The M4 Corridor around Newport Plan will be compatible with, and will complement, the Cardiff Capital Region Metro and the electrification of the rail network.

Figure 1.2: History of the M4 Corridor around Newport

History of the M4 Corridor around Newport



1.3.3 The Plan for the M4 Corridor around Newport

In recognising the range of the transport planning objectives for the M4 Corridor around Newport, the Welsh Government intends to adopt a Plan for the M4 Corridor around Newport, which combines both highway infrastructure and other demand management solutions.

The Welsh Government's preferred strategy for the M4 Corridor around Newport consists of:

- A new section of 3-lane motorway between Magor and Castleton to the south of Newport along the TR111 protected corridor of the Black Route; and
- Complementary Measures (see Figure 1.3).

The Welsh Government's preferred strategy comprises the construction of a new 3-lane motorway mainly following the protected TR111 'Black Route', between Junctions 23 and 29, including a new crossing of the River Usk (see Figure 1.4). The River Usk is designated as a Special Area of Conservation (SAC).

The TR111 route to the south of Newport has remained protected for planning purposes since April 2006. The alignment of the proposed new section of motorway has been developed following extensive consultation, investigation and analysis. The aim is to minimise the impact on the environment, whilst fully meeting current motorway design and safety standards. Minor changes to the alignment of the TR111 protected route could still be made, subject to further investigation.

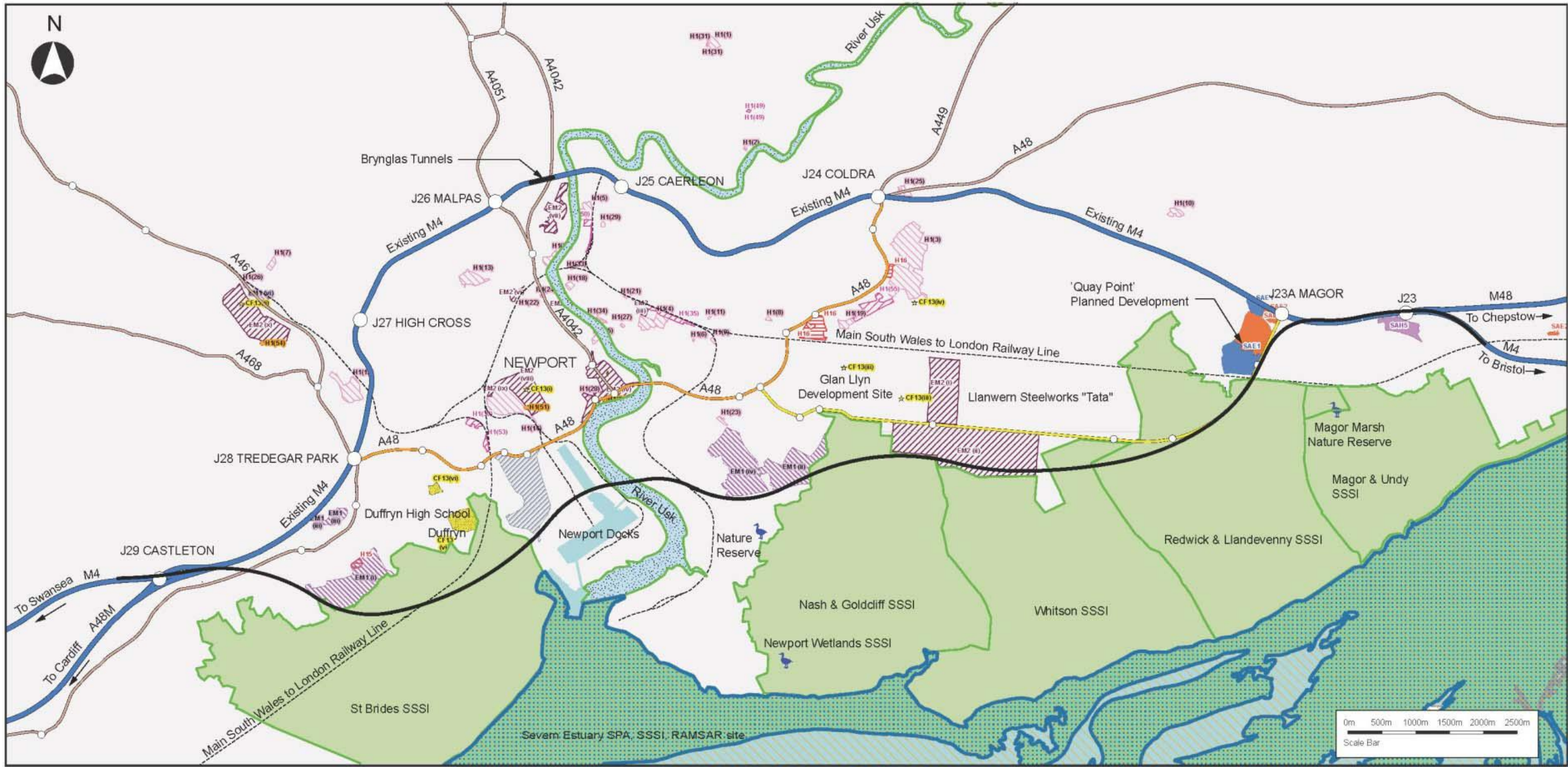
A junction strategy is investigated as part of scheme development (see Section 4.2.11).

In addition to the new highway infrastructure, the Welsh Government recognises that there are additional complementary measures that could assist in alleviating travel related problems within the M4 Corridor around Newport. The Plan's complementary measures are as shown in Table 1.1.

Table 1.1: Complementary Measures

Complementary Measure	Description
Re-classify existing M4 between Magor and Castleton	Reclassification of the existing motorway as a trunk road could enable traffic management, safety and revised access arrangements.
M4/M48/B4245 Connection	A connection between the M4, M48 and B4245 would provide relief to Junction 23A and to the local road network. It would also provide improved access to proposed park and ride facilities at Severn Tunnel Junction.
Provide cycle friendly infrastructure	Promoting the use of cycling as an alternative to the car for journeys of up to three miles by providing new infrastructure or improving existing infrastructure.
Provide walking friendly infrastructure	Promoting the use of walking as an alternative to the car for journeys of up to three miles by providing new infrastructure or improving existing infrastructure.

Figure 1.3: Plan of the Black Route



Legend

- | | | | | |
|--|----------------------------|--|-------------------------------------|---|
| — Black Route (the main element of the draft Plan) | ● Housing Proposal | ■ LDP Identified Industrial and Business Sites | — Newport Southern Distributor Road | ■ Sites of Special Scientific Interest (SSSI) |
| ★ Education Sites | ▨ Urban Regeneration Sites | ■ LDP Identified Mixed Use Sites | — Steelworks Access Road | ■ River Usk SAC and SSSI |
| X Housing Commitment | ▨ Waste Sites (ID: W1) | ■ LDP Protected Employment Sites | Existing Railway Lines | |
| | ▨ Education Sites | ■ Special Protection (SPA) | | |
| | ▨ Employment | ■ Special Areas of Conservation (SAC) | | |
| | ▨ G & T Sites | ■ Ramsar | | |
| | ▨ Housing Commitment | | | |
| | ▨ Housing Proposal | | | |

The details of the above Complementary Measures are developed as part of scheme development (see Section 4.1). They aim to maximise opportunities to complement the regional transport system, including proposals for the Metro.

Alongside its Plan for the M4 Corridor around Newport, the Welsh Government will publish a strategy level Health Impact Assessment, Equality Impact Assessment, Habitats Regulations Assessment Statement to Inform an Appropriate Assessment, and a Strategic Environmental Assessment Statement.

A Participation Report⁸ summarises the engagement and consultation process undertaken, whilst a Strategic Appraisal of Alternatives Report⁹ addresses suggested alternative options put forward during consultation.

1.4 Scheme Development

Building on the strategy stage (outlined above and discussed in more detail in Section 3), the alignment of the draft Plan route, the 'Black Route', has been progressed to scheme appraisal.

The Black Route is largely established, in that it mainly follows the alignment of the 2006 route protected for planning purposes, through the publication of the relevant TR111 notice. However, the Newport Docks area along the line of the draft Plan route contains a number of key constraints, which if impacted upon, could incur significant engineering and/or cost implications. These constraints are considered to include:

- Stephenson Street Industrial Estate;
- The River Usk, and its associated operable wharfs;
- Newport Docks and associated buildings and operations (operated by Associated British Ports and others);
- Docks Way Landfill Site (operated by Newport City Council);
- Railway lines (the Uskmouth Branch Line is Network Rail owned and operated. The lines within the Associated British Ports estate lading to South Dock southside and South Dock northside are owned by ABP but operate hand-in-hand with the national rail network); and
- The River Ebbw.

As such, an assessment of a range of alignment options through the Docks area forms the focus of Stage 1 (scheme level) appraisal, to consider the implications of route options on the economy, environment and society, also considering engineering issues, acceptability, feasibility, deliverability and risks.

Within this report, see Section 4 for the consideration of different options. Building on WelTAG Stage 1 (scheme level) appraisal, WelTAG Stage 2 assessment focuses on the potential impacts of the preferred route (Section 5 onwards).

⁸ M4 Corridor around Newport Participation Report (July 2014)

⁹ M4 Corridor around Newport Strategic Appraisal of Alternatives Submitted during draft Plan Consultation (July 2014)

Stage 2 scheme appraisal is in accordance with the Design Manual for Roads and Bridges (DMRB)¹⁰ assessment that is undertaken separately to this WelTAG appraisal and considers both the technical issues¹¹ and environmental issues¹² in developing a preferred route for the new motorway to the south of Newport. That development work has informed this WelTAG appraisal. Stages 3 and 4 of DMRB assessment will build on this WelTAG (scheme level) appraisal as part of detailed design, which will benefit from further information to inform scheme level assessments. An Environmental Impact Assessment (EIA)¹³ will be undertaken alongside further development work as part of the planning process, which will lead to the publication of an Environmental Statement.

1.5 Context and Purpose of this Report

A WelTAG Stage 1 (scheme level) Appraisal Report was prepared for the New M4 dated June 2009. After this scheme was put on hold by the Welsh Government in July 2009, the M4 CEM Programme was established, which involved an M4 CEM WelTAG Stage 1 (strategy level) Appraisal Report. A Welsh Government announcement in June 2013 stated that there had been a significant change in the assessment of the affordability of a major enhancement of the M4. A WelTAG Appraisal Report Stage 1 (strategy level) was prepared for the M4 Corridor around Newport, dated June 2013. This reconsidered the potential for motorway solutions, which then formed part of the Welsh Government's draft Plan, dated September 2013.

As the strategy contained in the draft Plan for the M4 Corridor around Newport mainly comprises a scheme to provide a new section of motorway to the south of Newport together with complementary measures, WelTAG appraisal will need to be applied for that scheme. This Stage 1 and 2 (scheme level) Appraisal builds on the work already undertaken as part of the M4 WelTAG process.

WelTAG Stage 1 (scheme level) appraisal re-visits aspects of the proposals contained in the M4 Corridor around Newport Plan, making every effort to avoid duplication during the appraisal of the scheme.

At WelTAG Stage 2, the focus of appraisal is against the Welsh Impact Areas as well as confirmation that the proposals effectively address the problems identified by evaluating performance against the Transport Planning Objectives (TPOs). In Stage 2, deliverability and public acceptability are considered further as a better appreciation is gained of how risks might be addressed. This leads to the definition and recommendation of a preferred route.

¹⁰ Design Manual for Roads and Bridges, see <http://dft.gov.uk/ha/standards/dmr/index.htm> and <http://dmrb.org/>

¹¹ See M4 Corridor around Newport DMRB Stage 2 Report (2014)

¹² See M4 Corridor around Newport DMRB Stage 2 Environmental Report (2014).

Stage 2 environmental assessment is based on the methodology set out in the DMRB Volume 11 Environmental Assessment, which is the guidance for the environmental design and assessment of trunk road schemes in the UK

¹³ Environmental Impact Assessment is an assessment of the possible impacts that a proposed project may have on the environment. The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. European Union Directive (85/337/EEC) on Environmental Impact Assessments (known as the EIA Directive) was amended in 2009.

1.6 Structure

The remaining sections are structured as follows:

- Section 2: Problems and Transport Planning Objectives;
- Section 3: Strategy Stage;
- Section 4: Scheme Appraisal;
- Section 5: Existing and Future Traffic;
- Section 6: Economic Assessment;
- Section 7: Environmental Assessment;
- Section 8: Social Assessment;
- Section 9: Appraisal Summary;
- Section 10: Monitoring and Evaluation; and
- Section 11: Conclusion.

2 Problems and Transport Planning Objectives

2.1 Context

WelTAG requires that, at the Planning Stage, an objectives-led approach be adopted. This means that planning starts by identifying problems and opportunities and defining what is to be achieved. The ultimate outcomes are expressed as transport planning objectives (TPOs). The starting point for objective identification is the Wales Transport Strategy (WTS).¹⁴ The draft Plan for the M4 Corridor around Newport is in line with the Outcomes and Strategic Priorities of the WTS.

The National Transport Plan (March 2010) recognised that *“for a long time there have been concerns about the section of the motorway around Newport, which falls well short of modern design standards. These centre on peak-time capacity, safety and the resilience of the local network”*.

As part of the National Transport Plan, the Welsh Government aims to *“deliver a package of measures designed to improve the efficiency of the M4 in south east Wales, including public transport enhancements, making the best possible use of the motorway and improving the resilience of the network”*.

2.2 Transport Problems on the M4 Corridor

The Welsh Government has looked in detail at what travel related problems exist on the M4 Corridor, Magor to Castleton, and asked the public, other stakeholders and those involved in managing transport in and around Newport what they thought the problems amount to. The problems have been defined as:

Capacity

1. A greater volume of traffic uses the M4 around Newport than it was designed to accommodate, resulting in regular congestion at peak times over extended periods.
2. The M4 around Newport is used as a convenient cross town connection for local traffic, with insufficient local road capacity.
3. HGVs do not operate efficiently on the motorway around Newport.
4. There is insufficient capacity through some of the Junctions (e.g. 3 lane capacity drops to 2 lane capacity).
5. The 2-lane Brynglas tunnels are a major capacity constraint.
6. The M4 cannot cope with increased traffic from new developments.

¹⁴ The Wales Transport Strategy was adopted on 8 May 2008

Resilience

7. Difficulties maintaining adequate traffic flows on the M4 and alternative highway routes at times of temporary disruption; alternative routes are not able to cope with M4 traffic.
8. The road and rail transport system in and around the M4 Corridor is at increasing risk of disruption due to extreme weather events.
9. When there are problems on the M4, there is severe disruption and congestion on the local and regional highway network.
10. The M4 requires essential major maintenance within the next 5-10 years; this will involve prolonged lane and speed restrictions, thus increasing congestion problems.
11. There is insufficient advance information to inform travel decisions when there is a problem on the M4.

Safety

12. The current accident rates on the M4 between Magor and Castleton are higher than average for UK motorways.
13. The existing M4 is an inadequate standard compared to modern design standards.
14. Some people's driving behaviour leads to increased accidents (e.g. speeding, lane hogging, unlicensed drivers).

Sustainable Development

15. There is a lack of adequate sustainable integrated transport alternatives for existing road users.
16. Traffic noise from the motorway and air quality is a problem for local residents in certain areas.
17. The existing transport network acts as a constraint to economic growth and adversely impacts the current economy.

2.3 Transport Planning Objectives

Having due regard for the WTS Outcomes and Strategic Priorities, the Welsh Government has identified the following Transport Planning Objectives (TPOs) for the M4 Corridor around Newport between Magor and Castleton:

1. Safer, easier and more reliable travel east-west in South Wales.
2. Improved transport connections within Wales and to England, the Republic of Ireland and the rest of Europe on all modes on the international transport network.
3. More effective and integrated use of alternatives to the M4, including other parts of the transport network and other modes of transport for local and strategic journeys around Newport.
4. Best possible use of the existing M4, local road network and other transport networks.
5. More reliable journey times along the M4 Corridor.
6. Increased level of choice for all people making journeys within the transport Corridor by all modes between Magor and Castleton, commensurate with demand for alternatives.
7. Improved safety on the M4 Corridor between Magor and Castleton.
8. Improved air quality in areas next to the M4 around Newport.
9. Reduced disturbance to people from high noise levels, from all transport modes and traffic within the M4 Corridor.
10. Reduced greenhouse gas emissions per vehicle and/or person kilometre.
11. Improved travel experience into South Wales along the M4 Corridor.
12. An M4 attractive for strategic journeys that discourages local traffic use.
13. Improved traffic management in and around Newport on the M4 Corridor.
14. Easier access to local key services and residential and commercial centres.
15. A cultural shift in travel behaviour towards more sustainable choices.

As part of this appraisal, Arup has reviewed the objectives, which have been agreed as a result of various earlier analyses and consultation/engagement exercises during the New M4 Project, the M4 CEM Programme and the draft Plan for the M4 Corridor around Newport. For the current circumstances, the objectives as previously proposed are considered to remain wholly relevant to the M4 transport corridor around Newport and, as such, represent a good framework within which to appraise the relative performance of strategic options for improvement of operating conditions/transport provision within the M4 Corridor around Newport. During this WelTAG Stage 1 and 2 scheme level appraisal, the transport options are assessed against the Welsh Impact Areas, TPOs, public and stakeholder acceptability, technical and operational feasibility, financial affordability and deliverability and risks.

3 Strategy Stage

An M4 Corridor around Newport WelTAG Appraisal Report Stage 1 (Strategy Level) was published in June 2013, which informed decisions as to which transport options might be taken forward for inclusion in the draft Plan for the M4 Corridor around Newport.

The WelTAG Stage 1 Appraisal showed that the following strategic options were worthy of further consideration in terms of schemes to be brought forward:

- New section of 3-lane motorway between Magor and Castleton to the south of Newport along the line of the Black Route; and
- Complementary Measures (see Table 1.1).

The Plan does not preclude public transport measures, but does not include them because the Welsh Government has now commissioned a separate study and report on proposals to develop a metro system for South East Wales. That report will focus on how a metro system could support economic growth and regeneration at key locations across South East Wales. Public transport enhancement will be progressed separately by a group set up by the Welsh Government to examine proposals for a Cardiff Capital Region Metro system. The Plan is cognisant of Metro proposals and the proposed section of new motorway and its complementary measures will aim to complement public transport improvements wherever possible.

As outlined in Section 1.3.2, the Welsh Government's draft Plan was subject to public consultation between September and December 2013, alongside its associated strategy level environmental, health and equality assessments. This considered the Welsh Government's preferred strategy to its two reasonable alternatives and the Do Minimum Scenario.

A summary of the assessments and decision making undertaken at the strategy stage is provided below.

3.1 Summary of strategy stage assessment of options

Identification, selection and assessment of alternatives was undertaken through the Welsh Government's WelTAG Stage 1 (Strategy Level) Appraisal; an appropriate and recognised process for the appraisal of transport strategies or schemes. This process gives equal consideration to all relevant alternatives.

WelTAG Stage 1 (Strategy Level) Appraisal was supported by inclusive and extensive development work, including option workbooks, which are publicly available on project websites (www.m4cem.com and www.m4newport.com). This work is outlined and cross-referenced throughout the WelTAG and SEA documents, in order to highlight how options have been identified, selected and appraised.

The M4 CEM development work builds on historic appraisal undertaken since the early 1990s for the M4 Relief Road and New M4 Project, as outlined in the M4 WelTAG reports. Section 3.1 of the M4 CEM Stage 1 (Strategy) WelTAG Report explains how having established the problems and the need to tackle them, the Welsh Government has involved others in exploring a very wide range of possible

ways of solving these problems and of delivering the goals of the M4 Strategy, and that a long list of possible solutions was explored.

The M4 CEM development work refined a list of potential alternatives through public, stakeholder and statutory consultee engagement and consultation aligned to Strategic Environmental Assessment (SEA) principles. The M4 CEM development work sought to identify alternatives that could reasonably resolve issues of capacity, safety and resilience along the M4 Corridor around Newport but was based upon the ability to deliver and identify measures in phases to improve affordability.

The appraisal process identified that an additional road to the south of Newport was the solution that best addressed the problems and transport planning objectives, and therefore was the option taken forward from the M4 CEM Programme into the draft Plan as a 'reasonable alternative' for assessment in the M4 Corridor around Newport Stage 1 (Strategy) WelTAG Report. Highway, walking and cycling measures, identified as being 'common' or 'complementary' measures during development work were also progressed to the draft Plan.

To meet the requirements of a 'Reasonable Alternative', appraisal must demonstrate that the alternative could reasonably deliver the objectives of the draft Plan. It is the responsibility of the Welsh Government, as a Responsible Authority as part of the SEA Directive, to determine which options will reasonably deliver the objectives of the draft Plan. The M4 CEM Stage 1 (Strategy) WelTAG Report then outlines the components of a potential strategy, as informed by the development work that involved others in identifying, selecting and appraising options.

The M4 Corridor around Newport Stage 1 (Strategy) WelTAG Report explains how changes to affordability led to the decision to further reconsider solutions to resolve capacity issues on the M4. This led to the inclusion of new motorway alternatives that were subject to the WelTAG Stage 1 (Strategy Level) Appraisal process to determine their validity as 'reasonable alternatives'. The conclusions of the M4 Corridor around Newport WelTAG Report identified the 'reasonable alternatives' for assessment in the SEA Environmental Report.

Thus, in order to inform the strategy for the M4 Corridor around Newport, appraisal has been undertaken of options that include M4 CEM short-listed measures, provision of new motorway capacity routed to the south of Newport which could potentially be unrestrained by funding, public transport and complementary measures. The conclusion of this process identified and appraised the 'reasonable alternatives' that would meet the objectives of the draft Plan, as published in September 2013. The WelTAG process, as the appropriate process for identifying, selecting and appraising options, outlined the reasons for doing so, and why certain alternatives were not recommended for further appraisal.

In accordance with the SEA Regulations, alternatives were rejected where they did not meet the objectives of the draft Plan. The reasons for selecting or discarding alternatives during development work as part of the preparation of the draft Plan is provided in a series of workshop reports, workbooks and WelTAG appraisal. This development work is referenced in the M4 Corridor around Newport Participation Report and is publicly available via the project websites www.m4cem.com and www.m4newport.com.

3.1.1 Dual 2 All Purpose Road: Red Route

Strategy level appraisal of the dual 2-lane all-purpose road on the Red Route alignment showed that it did not perform as strongly as the motorway options, scoring less well than the motorway options against 13 out of 15 Transport Planning Objectives.

The Red Route option offers significantly reduced capacity compared with the two motorway scenarios and would attract less traffic. The WelTAG Stage 1 (strategy level) appraisal showed that by 2035, the Red Route would be expected to be operating at or near capacity and, as such, would attract up to 20% less traffic than both motorway options.

A motorway solution was considered to offer greater value for money and better meet the objectives for the project.

The Red Route was largely opposed during the consultation on grounds that it would not provide sufficient capacity, would not offer a long term solution, and would lead to adverse social and environmental impacts. Many respondents stated preference for the Black or Purple Routes over the Red Route.

It was recommended at the strategy stage that the Red Route should not be taken forward for further appraisal.

3.1.2 Motorway Options: Purple and Black Routes

Of the highway infrastructure options appraised at the strategy level, a new section of motorway on the Black Route alignment offered the strongest case. Whilst high level estimated costs were similar, the Black Route was expected to produce higher economic benefits compared to the Purple Route.

When assessed at a strategic level, both Purple and Black performed strongly against the Transport Planning Objectives, although when assessed against the WelTAG criteria, the Black Route out-performed the Purple. This was principally due to the proximity of the Purple Route to the residential area of Duffryn including Duffryn High School and other potential development areas.

It is worth noting that the Black Route has benefited from planning protection as a result of the publication of the TR111 in 2006 whereas the Purple Route represented a new line of investigation. The Purple Route therefore had an increased delivery risk when compared to Black. These risks were mainly associated with crossing the Docks Way landfill site, through Newport Docks and across the River Usk. There were also on-going developments and potential further development sites along the alignment of the Purple Route.

The Docks Way landfill also represented a significant threat to the development of the Purple Route. To construct a road through the historic landfill site would require the Welsh Government obtain new Environmental Permits.

Whilst modifying permit boundaries is possible, it would require the agreement of the current permit holders to the modification and agreement of Natural Resources Wales (NRW) to the technical proposals. Effectively a new Environmental Permit Application would need to be progressed. Whilst this is likely to be achievable it introduced another major risk in the development of the Purple

Route alignment and indeed was one of the principal reasons the original M4 Relief Road was developed along the line of the Black Route.

Through the Docks and across the River Usk, the Purple Route would be more difficult to accommodate the operational requirements of businesses that are reliant on using the Docks and River Usk for trade, resulting in possible substantial claims for compensation and threatening jobs.

The Purple Route was largely opposed during the consultation on grounds that it would lead to adverse social and environmental impacts. Many respondents stated preference for the Black Route over the Purple Route.

The Black Route attracted most comments of support and preference from respondents, with many suggesting that it will address the problems and achieve the objectives. However, many respondents raised concerns over its potential adverse environmental impact, particularly on the Gwent Levels.

It was recommended at the strategy stage that the Black Route should be taken forward.

3.1.3 Public Transport

Studies have shown that new or improved public transport services are likely to have only minimal impact in terms of reducing traffic on the M4. Generally, investment in public transport measures is more likely to be aimed at achieving wider benefits than relieving motorway traffic. Public transport investment could encourage modal shift by increasing choice.

Appraisal has shown that public transport enhancement will contribute to some transport planning objectives for the M4 corridor around Newport. Outline appraisal demonstrates that public transport improvements should continue to be developed and/or promoted, as supported by the public and stakeholder engagement process.

The electrification of the South Wales Main Line railway from Paddington to Swansea and the electrification of the Valley Lines railway will be a catalyst for increased use of public transport. Provision of new and improved interchange and park and ride facilities would reinforce this trend.

These initiatives are already being progressed by Welsh Government and Network Rail.

More recently, the Welsh Government has established a taskforce to explore potential schemes to form part of a Cardiff Capital Region Metro.

It was recommended at the strategy stage that any further public transport enhancements should be considered by the Cardiff Capital Region Metro taskforce set up by the Welsh Government.

3.1.4 Common and Complementary Measures

The strategy stage identified that the provision of a new section of motorway to the south of Newport would provide the opportunity to change the function of the current M4 route around Newport to better integrate it into Newport's road network.

Re-classification of the M48/M4 from east of Magor to Tredegar Park/Castleton to non-motorway trunk road status was included as a Complementary Measure in the draft Plan, alongside the following measures:

- Provision of a road link between the M48 and the B4245, which would result in benefits to users of the local road network and relief to Junction 23a; and
- Provision of additional cycling and walking infrastructure within the M4 corridor around Newport, to encourage healthy lifestyle choices, social interaction and improved access to public transport services.

Complementary Measures were largely supported during the draft Plan consultation, for their ability to improve local accessibility.

It was recommended at the strategy stage that Complementary Measures should be taken forward.

3.2 Alternatives considered during consultation on the draft Plan

Alternatives to the draft Plan have been identified and assessed in the development of the draft Plan using Welsh Government's WelTAG Stage 1 (Strategy Level) Appraisal and supporting development work. This is an appropriate and recognised process for the identification and appraisal of transport strategies or schemes and gives equal consideration to all relevant alternatives.

Development work built on historic appraisal undertaken since the early 1990s for the M4 Relief Road and New M4 Project, as outlined in the relevant WelTAG reports.

During the M4 CEM Programme, WelTAG appraisal was supported by extensive development work, which is publicly available on project websites (www.m4cem.com and www.m4newport.com). The M4 CEM WelTAG report explains how having established the problems and the need to tackle them, the Welsh Government involved stakeholders in exploring a wide range of possible ways of solving these problems and of delivering the transport planning objectives. A long list of possible solutions was explored and the findings informed development of the draft Plan.

As explained in the M4 Corridor around Newport Stage 1 (strategy level) WelTAG report, changes to affordability led to the further identification and assessment of alternatives.

These processes identified and appraised the alternatives that would form components of the draft Plan and its 'reasonable alternatives', as published in the draft Plan Consultation Document and its associated assessments in September 2013.

Strategic Environmental Assessment (SEA) requires an SEA Environmental Report to be published alongside a draft Plan, for public consultation. This is to describe and assess reasons for the selection of a preferred strategy and 'reasonable alternatives' to that preferred strategy, compared to doing nothing above what is already planned or committed. The draft Plan Consultation Document explained this and cross-referenced the SEA Environmental Report, which was subject to consultation alongside the draft Plan¹⁵. To constitute a reasonable alternative; it must satisfy the proposer of a plan that it is able to meet the objectives for its draft Plan.

During these processes, alternatives were rejected where they did not meet the objectives of the programme. Reasons for selecting or discarding alternatives during preparation of the draft Plan is provided in workshop reports, workbooks and the WelTAG appraisals. This development work is referenced in the M4 Corridor around Newport SEA Statement and is publicly available via the project websites aforementioned.

During the draft Plan consultation, some respondents put forward alternative solutions for the Welsh Government's consideration. These are appraised in a Strategic Appraisal of Alternatives Report¹⁶. Suggested alternatives include:

- Grade-separated A48 Southern Distributor Road (SDR) and upgraded A4810 Steelworks Access Road (SAR) also known as the 'Blue Route'¹⁷;
- Alignment of the Motorway to the south of Magor;
- Alignment of the Motorway to the west of Wilcrick Hill;
- Tunnel under the River Usk;
- Barrage across the River Usk;
- Tunnel widening at Brynglas;
- Motorway to the North of Newport;
- Public Transport; and
- The 'Do Nothing' Strategy.

¹⁵ Schedule 2 (8) of the SEA Regulations require the Environmental Report to outline the reasons for selecting the alternatives dealt with; this is outlined in the 2013 M4 Corridor around Newport SEA Environmental Report. It outlines the process by which the alternatives were refined in the 2012 M4 CEM Environmental Report. It outlines the reasons for expanding on the chosen alternative to include motorway options. This work was informed by the M4 CEM and M4 Corridor around Newport WelTAG Stage 1 (Strategy Level) reports to which references and hyperlinks to the publicly available reports were included

¹⁶ M4 Corridor around Newport Strategic Appraisal of Alternatives Submitted during draft Plan Consultation (2014)

¹⁷ Professor Stuart Cole 'The Blue Route Paper' (7 December 2013) Institute of Welsh Affairs & Chartered Institute of Logistics and Transport

Appraisal concludes that none of the alternatives submitted are considered to be 'reasonable alternatives'. However, the Blue Route has attracted much media attention and has been considered in detail as part of the Environment and Sustainability Committee Inquiry into proposals for the M4 around Newport¹⁸. As such, this alternative has been progressed to a scheme level of appraisal (see Section 4.1).

A summary of the engagement and consultation process, including consultation responses, is provided within the M4 Corridor around Newport Participation Report. Alternatives suggested in responses to the draft Plan consultation are considered by the Welsh Government within the Strategic Appraisal of Alternatives Report, which is referenced within the Participation Report and SEA Statement.

3.3 Associated assessments

A series of strategic level assessments have been undertaken to appraise the Welsh Government's preferred strategy (new motorway to the south of Newport 'Black Route' and its complementary highway, walking and cycling measures) against likely environmental, health and equality issues, in accordance with the SEA Regulations, Habitats Regulations, Equality Act and WelTAG. The draft Plan public consultation welcomed comments on the draft Plan's associated assessments. Assessments have been updated to take into account the responses to the draft Plan consultation, and these will be published alongside the Plan for the M4 Corridor around Newport.

3.3.1 Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) requires an SEA Environmental Report to be published alongside a draft plan, for public consultation. This is to describe and assess reasons for the selection of a preferred strategy and reasonable alternatives to that preferred strategy, compared to doing nothing than is already planned or committed. Following consultation on the SEA Environmental Report an SEA Statement is published.

As part of the M4 CEM Programme, a report titled as an 'Environmental Report' (2012) was subject to public consultation, as part of SEA development work. The results of the consultation informed the development of the M4 Corridor around Newport draft Plan, which was published in September 2013 alongside its SEA Environmental Report for public consultation. The results of the 2013 public consultation will help the Welsh Government with its decision as to whether to adopt its draft Plan, with or without amendment.

Section 2.6.1 of the M4 Corridor around Newport SEA Environmental Report (2013) outlines the process by which the alternatives were identified and refined in the M4 Corridor Enhancement Measures (CEM) SEA development work (2012) to inform the draft Plan. Section 2.6.2 of the 2013 M4 Corridor around Newport SEA Environmental Report outlines the reasons for expanding on the chosen alternative to include motorway options. This work was informed by the M4 CEM and M4 Corridor around Newport WelTAG Stage 1 (Strategy Level)

¹⁸ <http://www.senedd.assemblywales.org/ieListDocuments.aspx?CIId=225&MID=2025>

reports, to which references were provided within the M4 Corridor around Newport SEA Environmental Report.

The reasonable alternatives to be assessed in the SEA Environmental Report were proposed within an SEA Scoping Report and issued to statutory consultees for consultation in July 2013. No comments were received from the statutory consultees indicating that additional alternatives should be considered or that the proposed alternatives were not valid. Consequently, the SEA Environmental Report, published in September 2013, assessed the draft Plan, the two agreed reasonable alternatives and the Do Minimum Scenario.

As explained in the M4 Corridor around Newport Stage 1 (Strategy Level) WelTAG report, changes to affordability led to the further identification and assessment of alternatives. These processes identified and appraised the alternatives that would form components of the draft Plan and its 'reasonable alternatives', as published in the draft Plan Consultation Document and its associated assessments in September 2013.

The SEA Statement outlines that of the high-level options considered within the SEA Environmental Report, the appraisal of the Black Route outperformed the remaining options and will provide long-term benefits in relation to the draft Plan objectives. It suggests that the Black Route will enhance air quality for a significant number of properties along the existing M4, whilst having a minor effect on a relatively small proportion of residences along the new route; none of which would likely exceed national air quality standards. Furthermore, of the three highway options, the Black Route would have the least effects on residential developments since it is located furthest from Dyffryn, has the least effects on soil and contamination by avoiding the Dock's Way landfill site and is the most distant from the Newport Transporter Bridge, thus reducing effects on a heritage feature.

The SEA Statement outlines that lack of detailed information at the strategic stage inhibits accurate prediction of effects on a number of environmental indicators. This has led to a precautionary conclusion against a number of indicators; particularly cultural heritage and landscape and townscape, for which a detailed assessment is required to assess effects. Sensitive design and detailed assessment at project level provides additional opportunities to include specific mitigation and enhancement measures to further reduce potential effects.

Following appraisal of alternatives suggested during consultation, no alternatives were identified that could reasonably meet the requirements of the draft Plan and therefore be considered to be reasonable alternatives for assessment against the high-level options of the Environmental Report.

At the detailed design stage an Environmental Impact Assessment (EIA) will facilitate a more thorough assessment of potential environmental effects and enable consideration of additional opportunities for enhancement. Modifications to a preferred route could be investigated as part of a Stage 3 level of assessment in the future (post possible announcement of a preferred route) and as part of Environmental Impact Assessment.

3.3.2 Habitats Regulations Assessment

The Plan is considered in relation to the requirements of the Conservation of Habitats and Species Regulations 2010 (as amended), known as and referred to in this report as the Habitats Regulations.

All plans and projects should identify any possible impacts on European Sites early in the plan-making process and then either alter the plan to avoid them or introduce mitigation measures to the point where no adverse impacts remain. The ‘Competent Authority’ (the Welsh Government) shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of a European site or sites in accordance with the requirements of the Habitats Regulations (Regulation 61(5)). Regulation 61(3) requires the Competent Authority to consult with the Statutory Nature Conservation Body (Natural Resources Wales) and if appropriate having obtained the opinion of the general public.

European Sites include Special Areas of Conservation (SACs), Marine SACs and Special Protection Areas (SPAs). However it is Government Policy in England and Wales to also include Wetlands of International Importance (Ramsar sites), potential SPAs (pSPA), candidate SACs (cSAC), and possible Ramsar sites as European Sites.

For highways schemes the consideration of schemes under the requirements of the Habitats Regulations is known as the Assessment of Implications on European Sites (AIES) but is equivalent to the consideration of other projects or plans, comprising a screening stage (i.e. consideration of likely significant effects) and an Appropriate Assessment stage (consideration of effects in relation to the conservation objectives).

A report titled ‘Consideration of the options in relation to the requirements of the Habitats Regulations’ formed part of the draft Plan consultation. The responses to the draft Plan consultation have been used to review and finalise a Strategic Habitats Regulations Assessment (HRA).

The consideration of the Plan has shown that it is considered unlikely that it would result in adverse effects on the integrity of European Sites. However, there is the potential for effects on European Sites from the new road route and mitigation is likely to be required to ensure that adverse effects do not occur. This mitigation would be developed and secured during the design and consenting of a new road by Welsh Government at scheme level. At the scheme level, the details of the proposal and any mitigation requirements would need to be further assessed under the Habitats Regulations to confirm that there would be no effect on the integrity of European Sites.

3.3.3 Health Impact Assessment

Scheme level Health Impact Assessment (HIA) is provided in Section 8.7 of this report. At the strategy stage, the Welsh Government has undertaken an HIA of the M4 Corridor around Newport preferred strategy¹⁹, building on responses made on the HIA of the draft Plan²⁰, which was subject to the draft Plan consultation.

The completion of HIA is a mandatory requirement of WelTAG. HIA for the M4 Corridor around Newport has been undertaken in accordance with new guidance on the HIA process that has been prepared by WHIASU in conjunction with Public Health Wales and Cardiff University entitled, “Health Impact Assessment: A Practical Guide²¹”.

Appraisal of potential impacts was undertaken against criteria including:

- Lifestyle/capacity affecting health;
- Social and Community Influences affecting health;
- Living Conditions;
- Working Conditions;
- Services (access to and quality of); and
- Socio-economic, cultural and environmental.

HIA at the strategy stage concluded that the preferred strategy performs best against HIA criteria for all groups, bringing positive benefits to health in the M4 Corridor around Newport. It suggested that doing nothing above what is already planned or committed would lead to either minor or moderate adverse impacts on the majority of HIA criteria, affecting the majority of groups within the population. It outlines an Action Plan that aims to enhance the possible beneficial impacts and/or mitigate against any potential adverse impacts on health.

Further HIA will be undertaken as part of detailed design.

¹⁹ M4 Corridor around Newport Plan Health Impact Assessment (2014)

²⁰ M4 Corridor around Newport draft Plan Health Impact Assessment (2013)

²¹ Source: Health Impact Assessment. A Practical Guide, WHIASU (2012)

3.3.4 Equality Impact Assessment

Scheme level consideration of equality issues is provided in Section 8.6 of this report. At the strategy stage, in accordance with WelTAG and the Equality Act 2010, the Welsh Government has undertaken an Equality Impact Assessment (EqIA) of the M4 Corridor around Newport preferred strategy²², building on responses made on the EqIA of the draft Plan²³, which was subject to the draft Plan consultation.

The assessment has been undertaken in accordance with guidance provided by the Welsh Government's Equality and Human Rights Division²⁴ and prepared with due regard to the guidance provided in WelTAG, the National Transport Plan Equality Impact Assessment²⁵, the Wales Transport Strategy Equality Impact Assessment²⁶ and Working for Equality in Wales²⁷. The assessment also reflects the Welsh Government's objectives outlined in its Strategic Equality Plan²⁸.

An assessment of the preferred strategy has been undertaken to appraise the significance of the following protected characteristics groups, as outlined in Annex B of the Welsh Government's guidance on Equality Impact Assessments²⁹:

- Age;
- Disability;
- Gender reassignment;
- Marriage and civil partnership;
- Pregnancy and maternity;
- Race;
- Religion and belief;
- Sex (gender); and
- Sexual orientation.

In addition, the following appraisal criteria have also been subject to assessment as outlined in WelTAG:

- Welsh language; and
- Other: Lone parent, economic inactivity, social and multiple deprivation.

²² M4 Corridor around Newport Plan Equality Impact Assessment (2014)

²³ M4 Corridor around Newport draft Plan Equality Impact Assessment (2013)

²⁴ Welsh Government – Working for Equality in Wales (2008)

²⁵ National Transport Plan Equality Impact Assessment and Equality Action Plan (2010)

²⁶ Wales Transport Strategy Equality Impact Assessment (2008)

²⁷ Working for Equality in Wales. Inclusive Policy Making. Second Edition Guidance (2010)

²⁸ Welsh Government: Strategic Equality Plan & Objectives, 2012-2016

²⁹ Welsh Government, Working for Equality in Wales – Equality Impact Assessment Guidance (November 2012)

EqIA of the Plan at the strategy stage concluded that there are likely to be no significant adverse effects from the preferred strategy, arising for any character group. It would bring benefits to all character groups with access to a car, bringing benefits in terms of reduced traffic congestion, improved resilience and journey time reliability. It would benefit the character groups in terms of improved accessibility with varying degrees of benefit dependent upon need (e.g. improved access to healthcare for pregnant women and new parents). The complementary measures would bring a variety of benefits, with improvements to walking and cycling infrastructure, offering improved access to local services, facilities and employment, as well as improved access to public transport facilities for those reliant on public transport for local and regional travel.

Doing nothing above what is already planned or committed would lead to continuing traffic congestion on the existing motorway, which would impact on journey time reliability. This would adversely impact on access to services, facilities and employment opportunities for all those with access to a car, and who rely on public transport due to continued problems associated with motorway traffic diverting onto local roads to avoid peak congestion. The continuing problems would further hamper economic growth and prosperity in the region, restricting the movement of freight and people, particularly at peak periods.

3.4 Participation

3.4.1 Strategy stage engagement and consultation

A public consultation has been undertaken on the draft Plan and its associated assessments, with a summary and consultation results provided in the M4 Corridor around Newport Participation Report.

Recognising the potential level of public interest in transport issues with the M4 corridor around Newport, and the numbers of people potentially affected by any new measures presented as part of the M4 Corridor around Newport draft Plan, the Welsh Government has undertaken wide-ranging and focussed engagement with stakeholders and local people since September 2010. This work has built on historic engagement undertaken as part of the development of the M4 Relief Road and New M4 since the early 1990s.

The approach to engagement has been based on established good practice in Wales and the UK, and has been fully compliant with Welsh Government principles for implementing public engagement, and the engagement values set out in Engage Wales. The engagement work has been appropriately aligned, in terms of timing and decision making, to the technical assessment process of the M4 Corridor around Newport work, helping to shape the Plan.

During the engagement process, the Welsh Government and its project team has conducted deliberate sessions both with internal and external specialists and expert stakeholders, as well as with communities and other organisations likely to be interested in and affected by any transport related interventions.

The M4 Corridor around Newport public consultation, which asked participants to comment on the draft Plan, its reasonable alternatives and the do minimum scenario, contributed to the Welsh Government deciding whether to adopt the draft Plan, with or without amendments, and ran between September and December 2013.

All available documents published as part of the engagement and consultation process associated with the M4 CEM Programme can be found at www.m4newport.com

3.4.2 Activities undertaken

The M4 Corridor around Newport engagement (participation) strategy involved public and stakeholders in two key phases:

- To help establish the proposed scope and level of detail required for the draft Plan's associated assessments; and
- To ensure that the Welsh Government benefited from understanding the public views as well as those of key stakeholders on how the draft Plan and its reasonable alternatives might address the problems and achieve the goals of the M4 Corridor around Newport.

A comprehensive publicity campaign was undertaken to make as many people as possible across South Wales aware of the opportunity to comment and engage with the consultation. The Minister for Economy, Science and Transport wrote to all AMs and MPs in the South Wales area informing them when the consultation was starting and where they could obtain further information. All contacts on the M4 stakeholder database (over 1,500 individuals and organisations, including statutory consultees) were informed of the start of the consultation via email. The Welsh Government arranged for adverts to be placed in Capital Times, Cardiff and South Wales Advertiser, Marshfield Mail, Newport Voice Magazine and the Big Issue Cymru. In addition paper copies of a bilingual flyer were sent to over 110,000 properties within the Newport area. Posters were displayed at motorway services along the M4 (Magor-Swansea) and at Newport Document Deposit Centres. A bilingual radio advert also ran for the duration of the consultation.

3.4.3 Summary of M4 Corridor around Newport consultation responses

After processing, a total of 1,814 responses to the consultation were received and analysed as unique respondents. Participants included members of the public as well as a range of organisations; some of which represented Welsh communities, economic, environmental and transport interests.

675 of the responses received overall were identical or largely identical responses from a campaign group led by the Woodland Trust. A number of other submissions included references to the views of interest groups, or extracts from interest groups' statements, including Campaign against the Levels Motorway (CALM), RSPB, Wales Wildlife Trusts and Friends of the Earth. While it is not feasible to identify the exact number of submissions that have been influenced by interest groups, initial analysis suggests that more than 200 submissions (in addition to the approximately 675 organised submissions) used phrases resembling those used in interest group publications related to the consultation.

Furthermore there were several responses that referred to the alternative to the draft Plan suggested by the Institute of Welsh Affairs (IWA) and the Chartered Institute of Logistics and Transport (CILT) 'The Blue Route' paper, authored by Professor Stuart Cole. The suggested alternative is commonly referred to as 'the Blue Route', and is a suggestion that received considerable media attention during the consultation. In some responses this suggested alternative is described as an option to upgrade the Newport A48 Southern Distributor Road and A4810 Steelworks Access Road, or similar.

In all likelihood many more individual responses may have been influenced by information or opinions available in the public domain during the consultation. However, this does not necessarily mean that an individual wishes to be considered part of a 'campaign', but rather they may agree with opinions shared by interest groups. This is common for public consultations and does not affect the validity of responses; similarly, organised submissions are no less valid than individual submissions. As the consultation is not a vote, the Participation Report contains frequent reminders advocating caution when considering numbers.

The Welsh Government analysed all comments, equally. All participants are listed at the end of the Participation Report.

Whilst a total of 1,814 responses were made directly to the consultation, more than 1,200 people attended M4 Corridor around Newport public exhibitions, at which members of the project team were available to discuss the draft Plan. More than 23,700 visits were made to the dedicated website www.m4newport.com between September and December 2013, equating to an average of almost 6,000 visits per month over this three month period.

A summary is provided below of respondents' views on how the transport planning objectives could be achieved and how the problems could be addressed by the draft Plan or its reasonable alternatives. In addition to the text provided in previous sections of this report, a summary is also provided on respondents' views on the draft Plan's associated assessments.

Draft Plan (Black route and its complementary measures)

The Black Route attracts the most statements of support.

Approximately 50 respondents discuss the goals generally, with about 40 suggesting that the Black Route would achieve, or largely achieve the goals. Some stakeholders who discuss the transport planning objectives (goals) refer to them generally, and the South Wales Branch of the Chartered Institution of Highways and Transportation thinks that the draft Plan would be successful in achieving these. Similarly, the South Wales Trunk Road Agency says the Black Route would achieve many of the objectives. Other key stakeholders, including Goldcliff Community Council and a number of environmental organisations, argue that the draft Plan would not achieve the goals.

Most respondents believe that the Black Route option would be successful in addressing problems associated with safety and resilience. Some stakeholders discuss specific objectives. A few transport organisations, including the Road Haulage Association, think that the Black Route would meet the goal associated with an improved travel experience. The Association of Chief Police Officers (ACPO) Cymru believes the draft Plan would achieve the goals associated with improved transport connections.

Public Health Wales, Sustrans Cymru and Wildlife Trusts Wales each question whether the Black Route could achieve the goal associated with sustainable choices and a modal shift away from cars, arguing that a new motorway would promote car use instead.

Several transport organisations, including the South East Wales Transport Alliance (SEWTA), and environmental organisations such as Friends of the Earth, as well as the Welsh Liberal Democrats, believe that the Black Route would be unsuccessful in regard to achieving the goal associated with reduced emissions.

As with the goals, some stakeholders who comment on the problems refer to them collectively. A few transport organisations express the opinion that the draft Plan would address the problems as a whole. A number of stakeholders, including Tata Steel and the Association of Chief Police Officers (ACPO) Cymru, as well as a few transport organisations, are optimistic that the Black Route would address problems associated with capacity, resilience and/or safety, generally arguing that increased capacity or reduced congestion would also benefit resilience and/or safety.

It is contested by several environmental and transport organisations, as well as by Public Health Wales, that the draft Plan would resolve problems associated with capacity. These stakeholders are generally concerned that the Black Route would encourage greater car use, undermining the intended capacity effects. Other stakeholders, including Cardiff Council and the Wales Green Party, argue that problems associated with congestion would remain or increase elsewhere if the Black Route is built. A few other stakeholders, including the Wildlife Trusts Wales, question whether the Black Route would resolve problems associated with safety.

The RAC Foundation and the Institution of Civil Engineers (ICE) Wales think that one of the Black Route's advantages would be that it would address problems associated with emissions or air quality. A few other stakeholders, including Newport Friends of the Earth, argue the opposite. The Community Councils of Goldcliff and Marshfield, as well as CTC Cymru (the national cycling charity), do not think the draft Plan would resolve problems associated with noise pollution.

A few stakeholders, mostly environmental organisations, challenge the need for the draft Plan stating that the Welsh Government has not adequately demonstrated the requirement for the proposal or made the case that the Black Route is the best solution to the supposed problems.

A number of stakeholders, including the Campaign for Better Transport, Chartered Institute of Logistics and Transport, and Sustrans Cymru are sceptical of the traffic growth projections used to demonstrate the need for the Black Route. They question the projected sharp rise in demand, highlighting the levelling pattern for the past decade. They add that changing trends in car ownership mean that levelling off is likely to continue even with economic recovery. Some stakeholders, mostly environmental and transport organisations, suggest that the draft Plan does not fit with the Welsh Government's policies in relation to improving sustainability and reducing greenhouse gas emissions.

Red Route and its complementary measures

The Red Route attracts the most statements of opposition.

Discussing the Red Route, approximately 35 respondents comment on the goals generally, and many say the route would not help meet these. The South Wales Branch of the Chartered Institution of Highways and Transportation suggests the Red Route option would achieve the goals, while Chepstow Friends of the Earth and Torfaen Friends of the Earth think the goals would not be achieved, or that the Red Route option is not a long-term solution.

The Association of Chief Police Officers (ACPO) Cymru thinks the goal associated with a modal shift away from cars may be achieved by the Red Route option. In contrast, the Wildlife Trusts Wales suggest that the Red Route may achieve the opposite.

A few environmental groups, including Gwent Wildlife Trust express concerns that the route would be detrimental to the goal associated with reducing emissions.

As with the goals, many of the respondents who comment on the problems refer to them collectively, with about five respondents stating that the Red Route option would resolve the problems and about 45 respondents asserting that the Red Route

option would not resolve the problems. Of those who say the problems would be resolved, many state that the Red Route option would only be a short-term solution. Marshfield Community Council and the RAC Foundation believe the Red Route option would not resolve the problems. The South Wales Branch of the Chartered Institution of Highways and Transportation thinks the Red Route option would be successful in addressing the problems.

Several stakeholders comment on the potential for the Red Route option to solve specific problems. In terms of problems associated with capacity, the South Wales Trunk Road Agency thinks that the route would be successful in addressing these. Newport City Council and Tata Steel UK suggest that while the Red Route option would increase capacity on the local road network, it would not entirely resolve problems associated with the capacity of the M4.

Gwent Wildlife Trust believes that the route is not the most sustainable or economical way to resolve problems associated with capacity. They also suggest that an increased road capacity is likely to encourage additional car use which would occupy the new capacity.

The Association of Chief Police Officers (ACPO) Cymru believes the Red Route option would be partially effective in solving problems associated with congestion, saying that a new road would help reduce congestion but that the design of the Red Route would not fully realise this.

Discussing problems associated with safety, the Association of Chief Police Officers (ACPO) Cymru believes the two-lane sections of the Red Route may increase the occurrence of accidents, also suggesting that reduced congestion and the resulting better traffic flow would help resolve problems associated with safety. The RAC Foundation thinks that the other Route options (but not the Do Minimum Scenario) would better address problems associated with safety than the Red Route option. A few stakeholders, including the South Wales Trunk Road Agency, think that the Red Route option would resolve problems associated with resilience. Gwent Wildlife Trust expresses concerns that problems associated with air quality would not be resolved by the Red Route option. CTC Cymru and The Woodland Trust have similar concerns about problems associated with noise pollution.

One stakeholder, the Gwent Wildlife Trust, does not believe that the Welsh Government has provided sufficient evidence to justify the Red Route option on cost, sustainability or economic grounds. Chepstow Friends of the Earth and CTC Cymru challenge the accuracy of the projected future traffic growth, saying the stabilisation of traffic volume for more than a decade and an anticipated increase in the cost of motoring make the projections unlikely. Additionally, some stakeholders argue that the projections do not accurately reflect future implications of public transport improvements and the increasing popularity of cycling and walking.

A few environmental stakeholders suggest that the Red Route option contradicts the Welsh Government's policies and commitments to sustainability and the environment.

South Wales Trunk Road Agency maintains that motorists would continue to use the existing M4, as they believe that the Red Route is unlikely to provide a viable alternative for the majority of through traffic.

Purple Route and its complementary measures

The Purple Route attracts many more statements of opposition than support.

Relatively few respondents explicitly relate their comments to how the Purple Route would address these problems and achieve these goals. In relation to the goals, most of these respondents refer to them generally, with similar numbers of comments stating that they would (or would largely) be met by the Purple Route option, and that they would not be met by the Purple Route option. Several respondents suggest that the Purple Route would have a short-term benefit, but not provide a long-term solution.

Some stakeholders refer to specific goals, with a few environmental stakeholders saying that the Purple Route would not achieve goals associated with emissions. Wildlife Trusts Wales and CTC Cymru believe that the route option would not meet goals associated with sustainability and modal shift to other forms of transport, such as walking and cycling.

In contrast, the Association of Chief Police Officers (ACPO) Cymru believes that the route could achieve goals associated with sustainability and a modal shift to other modes of transport.

Similar to comments on the goals, about 45 respondents who comment on the problems discuss them collectively. Most of these respondents express the belief that the Purple Route option would not address the problems as a whole. A small number of stakeholders, including Newport City Council, suggest the Purple Route would address problems associated with capacity. The Association of Chief Police Officers (ACPO) Cymru believes that the Purple Route option would resolve the problems associated with congestion and Tata Steel UK thinks that it would resolve problems associated with resilience. A few stakeholders, including South Wales Fire and Rescue Service, and The RAC Foundation suggest that the Purple Route would resolve problems associated with safety.

The RAC Foundation states that although the Purple Route option may solve problems associated with capacity, it may also encourage greater car use which would fill the additional capacity. Cardiff Council suggests that although the Purple Route option may solve problems associated with congestion around Newport, it could result in congestion further along the road to Cardiff. Some stakeholders believe the Purple Route option would not address problems, specifically - problems associated with air quality (CTC Cymru) and problems associated with noise pollution (the Association of Chief Police Officers (ACPO) Cymru).

A few stakeholders suggest the Welsh Government has not adequately demonstrated the need for a new motorway. CTC Cymru disputes the traffic growth projections put forward in the consultation document, suggesting they are misleading and fails to take into account developments such as electrification of the rail network and the proposed South Wales Metro.

Chepstow Friends of the Earth believes Newport would not benefit from the Purple Route option, saying this undermines the need case. Several stakeholders, including transport organisations, environmental organisations and local authorities, think the case for the Purple Route option is weakened by its incompatibility with current environmental thinking and by contradicting the Welsh Government's commitments.

The Do Minimum Scenario

The Do Minimum Scenario attracts many more statements of opposition than support.

About 30 respondents discuss the goals generally, with about 25 respondents stating that they would not be achieved by the Do Minimum Scenario. Two stakeholders refer to the goals in their comments on the Do Minimum Scenario, with South Wales Fire and Rescue Service suggesting the Do Minimum Scenario would not achieve any of the goals. Friends of the Earth Cymru thinks the Do Minimum Scenario would make it less difficult to achieve goals relating to the reduction of greenhouse gas emissions than any of the other options.

Similarly to the goals, about 65 respondents discuss the problems collectively, and about 60 believe that they would not be resolved by the Do Minimum Scenario. Torfaen Friends of the Earth and South West Wales Integrated Transport Consortium suggest the Do Minimum Scenario would not resolve the problems in the long term, with Newport City Council stating that the problems would not be resolved at all.

Where specific problems are mentioned, stakeholders do not think that the Do Minimum Scenario would address problems associated with capacity, resilience or safety. The Automobile Association and the Association of Chief Police Officers (ACPO) Cymru suggest the Do Minimum Scenario would increase congestion, with the Association of Chief Police Officers (ACPO) Cymru adding this may directly result in more accidents. The RAC Foundation suggests the Do Minimum Scenario would be the worst option for resolving problems related to safety.

Complementary Measures

A few stakeholders express support for the complementary measures in general because they believe they would improve accessibility, including to public transport facilities.

Newport Liberal Democrats welcomes the reclassification of the existing M4 from Magor to Castleton. However, Torfaen County Borough Council expresses reservations that reclassifying the M4 would result in the perception that Torfaen is further from the motorway network and this, ultimately, could hinder economic growth in the county. The Council therefore prefers the existing M4 maintain its classification. The Freight Transport Association also prefers to retain the M4's motorway classification regardless of whether a new motorway is built.

A small number of stakeholders mention support for a connection between the M48 and B4245. In particular, Network Rail proposes a park-and-ride facility at Severn Tunnel Junction as a potential complementary measure. Act Travelwise also supports a park-and-ride facility, and suggests that either this facility include a freight consolidation centre or greater use of the Wentloog rail freight terminal is promoted. Meanwhile, Newport Liberal Democrats observes that the introduction of a link from the M48 to Severn Tunnel Junction would greatly help the integration of road and public transport. Jessica Morden MP indicates that many of her constituents would be supportive of the link road.

A few stakeholders express support for providing new or improving existing infrastructure that promotes cycling and walking as an alternative to the car. One

of these stakeholders, Monmouthshire County Council, states that the final proposals should retain and enhance such infrastructure's convenience and amenity for users.

The RAC Foundation expresses scepticism about the public transport complementary measures. In particular, they maintain that the solutions to congestion and capacity issues on the M4 would be short-term if only these proposals are adopted, as these proposals would not have the capacity and quality of service needed to support the long term health of the South Wales economy.

Alternatives or additional approaches

In their responses to the consultation, some respondents discussed ideas for improving transport around Newport that were not part of the proposals put forward in the consultation document. These included alternative routes, traffic management, demand management measures and other road improvements that could be used instead, or in addition to, the proposed routes and alternative modes of transport, including public transport, walking and cycling.

A few stakeholders discuss preferences for an alternative route. Some stakeholders suggest generally that they would like to see a different or less intrusive route. Goldcliff Community Council specifically recommends a relief road for traffic in one direction to the north of the existing M4 should be considered, which they suggest would allow traffic moving in the other direction to use the existing lanes through both of the Brynglas Tunnels.

The Wildlife Trusts Wales recommend choosing alternative routes that are cheaper, more sustainable and do not have detrimental impacts on the environment. Goldcliff Community Council states that options that improve the flow of traffic on the M4 and within Newport should be considered further. A few stakeholders also suggest that the Welsh Government should look more holistically and consider an integrated approach to traffic and transport issues.

A few stakeholders, including Magor with Undy Community Council and Gwent Wildlife Trust suggest that the existing major roads around the southern perimeter of Newport, namely the A410 (Steelworks Access Road) and the A48 (Southern Distributor Road), would be a more viable and cost-effective alternative than the proposed routes, especially if these existing roads are upgraded.

A significant number of comments state their support for what is often described as the Blue Route, which is a specific set of upgrades to the A410 and A48 proposed in a report by Professor Stuart Cole for the Institute of Welsh Affairs (IWA) and Chartered Institute of Logistics and Transport. Many stakeholders, including transport organisations, private sector, business and regeneration organisations, environmental organisations, and political organisations and individuals, support what they often refer to as the Blue Route. Stakeholders who favour this alternative maintain that it would deliver additional road capacity, be more sustainable and environmentally friendly, cost less, and be built more quickly than the proposed route options.

However, one stakeholder – Newport City Council – offers a concern about the proposal known as the Blue Route, believing it would not improve capacity and resilience.

Several stakeholders, including environmental organisations, transport organisations and political organisations and individuals, support widening or upgrading the A48 Southern Distributor Road and cite its reduced cost as compared to building a new road. Some of these stakeholders express surprise that this option is not included in the consultation. In contrast, Newport City Council opposes this proposal, noting that it would result in closure of a significant number of existing junctions. They also believe this suggestion would cut off communities located to the south and would not provide needed resilience during an incident on the M4.

The Strategic Environmental Assessment

Respondents discussed the SEA both positively and negatively.

Respondents present a range of criticisms of the Strategic Environmental Assessment. Many of these challenge the documentation without giving any further details.

Stakeholders make a range of general and specific comments regarding the Strategic Environmental Assessment. The Automobile Association and Natural Resources Wales (South Operations Directorate) find the assessment to be satisfactory. In contrast, many stakeholders, particularly environmental organisations, argue that the Strategic Environmental Assessment is insufficient, with many highlighting areas of the assessment they find contentious. Some environmental organisations and transport organisations suggest the Strategic Environmental Assessment is inaccurate, inadequate or flawed.

Some stakeholders discuss the aims, objectives and purpose of the Strategic Environmental Assessment. The Campaign for the Protection of Rural Wales argues that the Strategic Environmental Assessment is not in line with the Welsh Government's policies and commitments regarding environmental protection and sustainable development. Natural Resources Wales (Strategic Assessment Team) refers to the Welsh Government's commitment to taking into account statutory stakeholder responses, received during the scoping stage of SEA, in the preparation of the document, but notes some organisations, including the RSPB, have not been included.

Wildlife Trusts Wales and Natural Resources Wales (Strategic Assessment Team) challenge the Strategic Environmental Assessment for not including alternatives to a proposed motorway. For example, Wildlife Trusts Wales suggests the lack of alternatives in the assessment is contrary to the requirements set out in the regulations for Strategic Environmental Assessments. Some stakeholders present alternatives such as the Blue Route, South Wales Metro and other public transport projects.

Strategic Habitats Regulation Assessment

A range of positive and negative comments were received by respondents regarding the Strategic HRA.

Respondents often express concerns about the document being too long and difficult to understand with some suggesting that a non-technical summary would be appropriate. Some respondents offer general support for the assessment, stating it is thorough and appropriate.

Some stakeholders, including Public Health Wales and Natural Resources Wales (Strategic Assessment Team), support some aspects of the Habitats Regulations Assessment, while others challenge or criticise this assessment. A number of stakeholders make detailed comments on the Habitats Regulations Assessment and advise on what they believe needs to be included in the assessment.

A number of stakeholders offer no comments on the Habitats Regulations Assessment with some suggesting they lack the appropriate expertise. As with the Strategic Environmental Assessment, Natural Resources Wales (Strategic Assessment Team) contributes a high proportion of the detailed comments provided about the assessment. They suggest that the Welsh Government consults Natural England, due to their knowledge of the subject. They also seek further involvement in the consultation, stating they are the appropriate nature conservation body for the area.

Health Impact Assessment

A small number of stakeholders give comments on the Health Impact Assessment. Most of these stated that they supported or were satisfied with the HIA, with most of these noting that the assessment is comprehensive. However a few respondents suggest that the assessment is so comprehensive that it could be challenging for readers to determine the main points.

Some stakeholders, including South Wales Trunk Road Agency and Public Health Wales agree with aspects of the assessment, while many offer suggestions. A number of stakeholders offer no support or opposition of the assessment. The Health Impact Assessment, or aspects of it, is challenged by a number of stakeholders, including CTC Cymru, Public Health Wales and Sustrans Cymru with some suggesting it is inadequate and insufficient. Some stakeholders are particularly concerned about a lack of detail within the Health Impacts Assessment and suggest more information and data should be included.

Public Health Wales believes the assessment is too general, recommending a further Health Impacts Assessment is carried out at scheme level. NHS Wales Health Impact Assessment Support Unit welcomes that the assessment would be updated with comments from the stakeholder workshop and the consultation.

Equality Impact Assessment

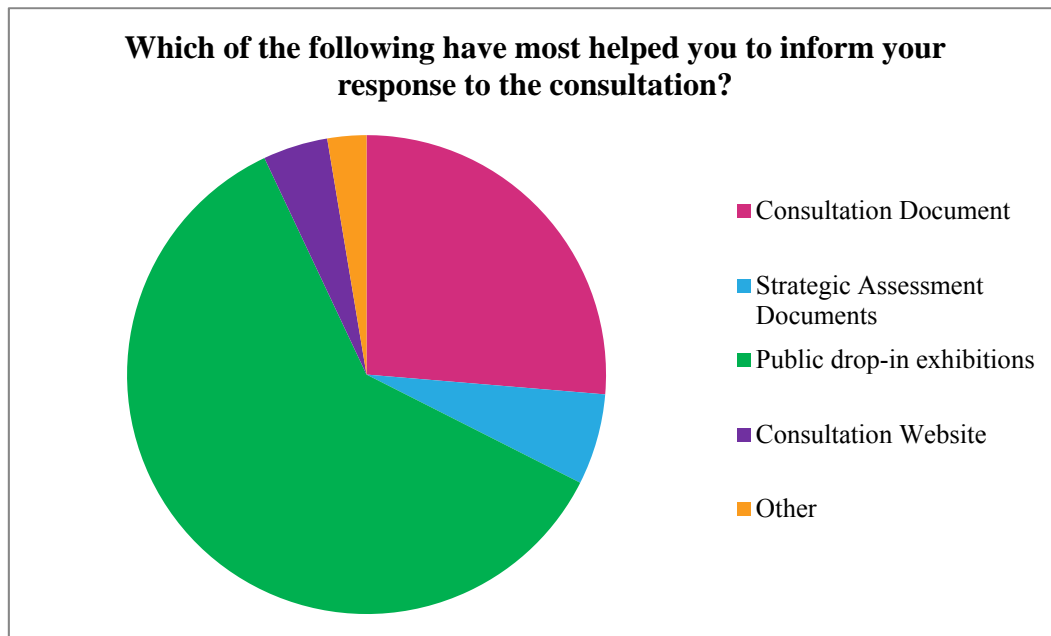
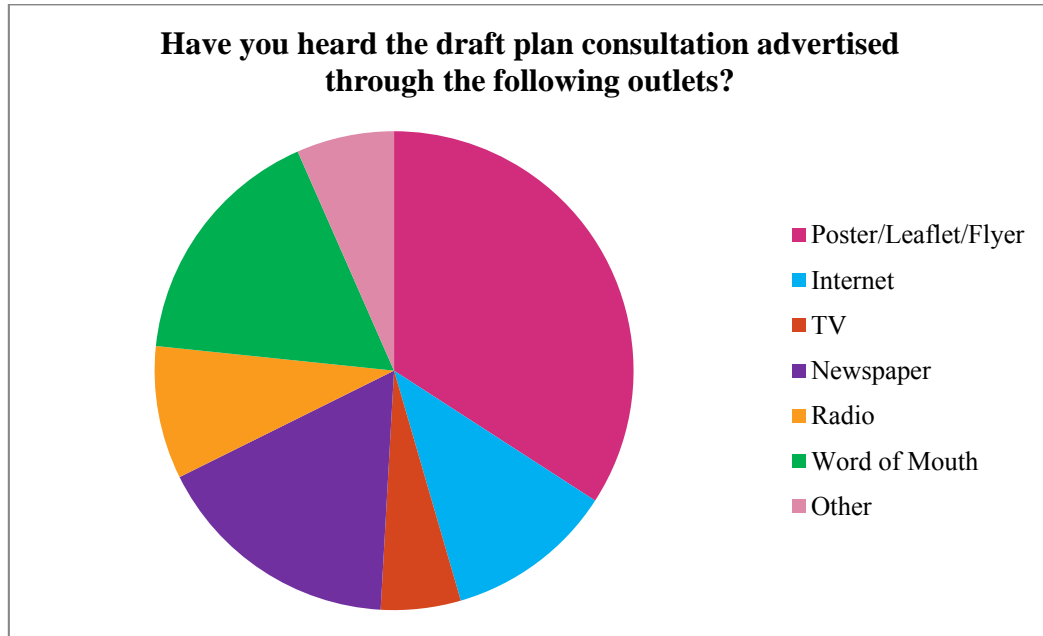
Most respondents find the assessment satisfactory, remarking that it is thorough, covers all impacts and its conclusions are accurate.

Several respondents highlight the equality impact assessment's finding that the Black Route option would have a positive impact, while taking no action would have a negative impact on equality.

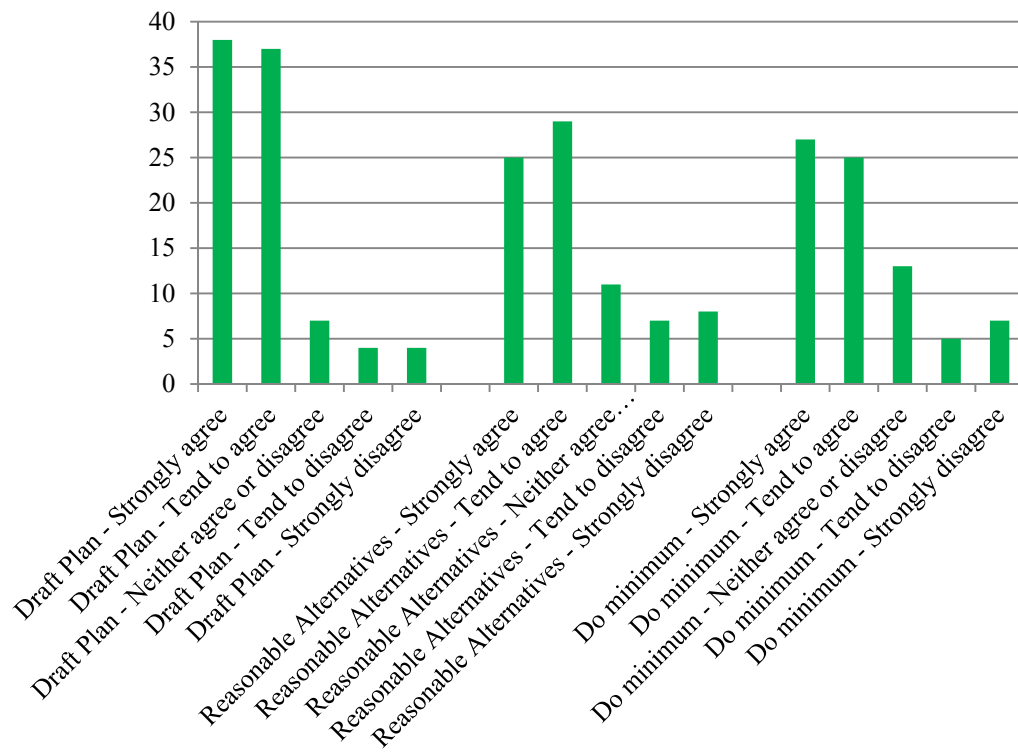
A few respondents state that they do not agree with EqIA conclusions. A number of stakeholders comment on the Equality Impact Assessment, in varying levels of detail and some are critical of the assessment, with some suggesting it is incorrect or inadequate. Most stakeholders give no statement of support or opposition to the Equality Impact Assessment.

3.4.4 Lessons learned

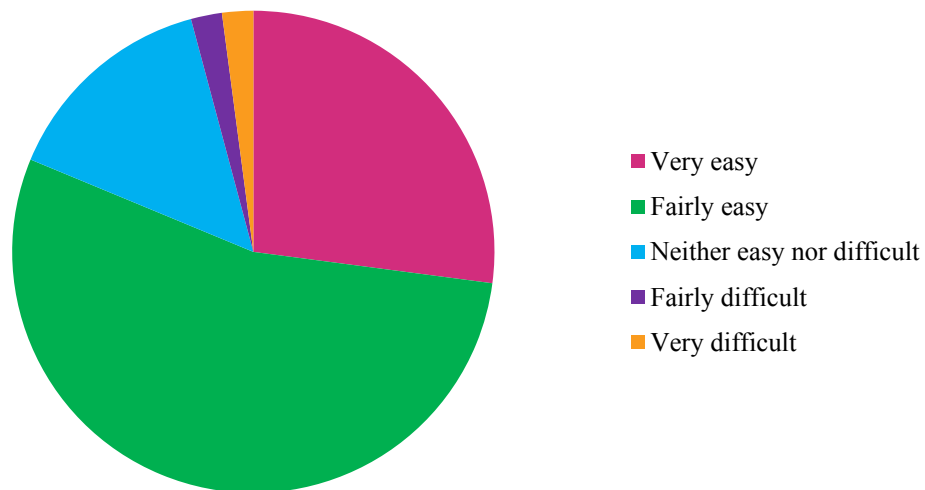
In order to assist lessons being learned from the engagement process and consultation stage, the Welsh Government invited the public and stakeholders to submit tailored feedback forms. 96 individuals returned completed feedback forms, of which three were submitted on behalf of an organisation. The following figures summarise the results received:

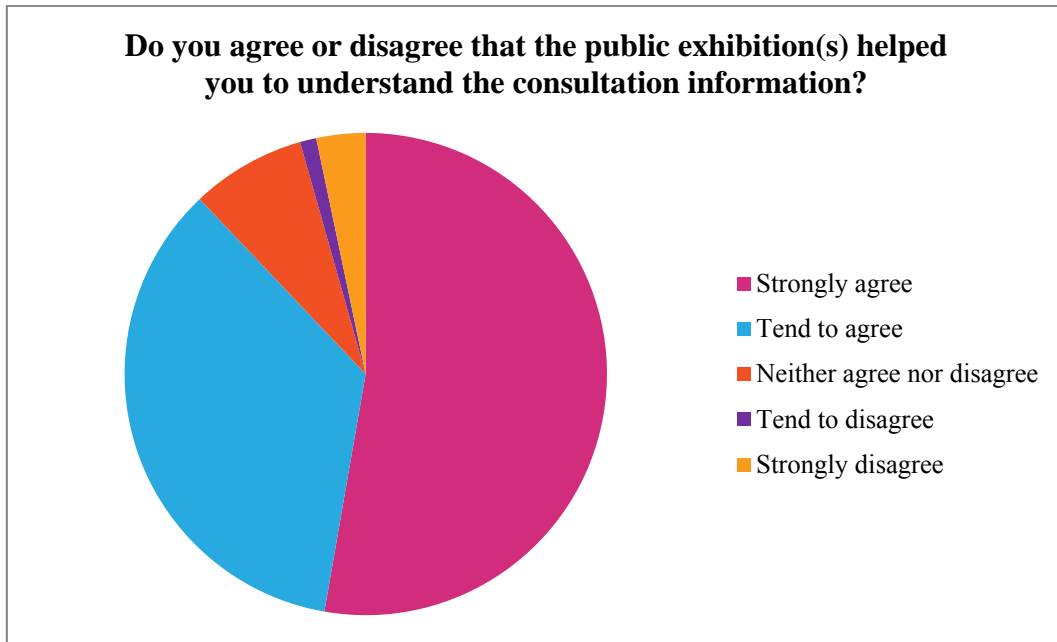


Do you agree or disagree that in the main draft Plan Consultation Document we have provided enough information on the following?



How easy or difficult did you find the main draft Plan Consultation Document to understand?





3.4.5 Scheme level engagement and consultation

The Welsh Government will be engaging with local people and other interested parties on specific and detailed elements of the scheme during detailed design as they are developed for further assessment and delivery.

The scheme will also be tested at public local inquiry.

3.5 Concluding remarks at strategy stage

WelTAG Stage 1 (strategy level) Appraisal suggests that the Black Route and its Complementary Measures provides high economic benefits and will have a positive impact on society, although adverse impacts are identified for environmental criteria including biodiversity in particular.

The Black Route attracted most comments of support and preference from respondents during the draft Plan consultation. However, many respondents raised concerns over its potential adverse environmental impact, particularly on the Gwent Levels.

SEA and Strategic HRA has shown that mitigation could reduce or remove the identified potential adverse effects of the Black Route on the environment, whilst further appraisal and mitigation measures should be identified during detailed scheme development.

The Black Route and its complementary measures will bring benefits to health and equality in the region, whilst further relevant appraisal will be undertaken as part of detailed design to progress their respective strategy level Action Plans.

The development work on the preparation of the M4 Corridor around Newport Plan, and its associated environmental, health and equality assessments, all support the recommendation made in the WelTAG Stage 1 (strategy level) appraisal that the preferred strategy should be progressed for further appraisal, and that the preferred strategy to progress to scheme appraisal should comprise:

- A new section of 3-lane motorway between Magor and Castleton to the south of Newport mainly along the TR111 protected corridor (Black Route); and
- Complementary Measures:
 - Re-classify existing M4 between Magor and Castleton;
 - M4/M48/B4245 Connection;
 - Provide cycle friendly infrastructure; and
 - Provide walking friendly infrastructure.

4 Scheme Appraisal

4.1 Context for scheme appraisal

4.1.1 Welsh and UK Government statements

Various political statements have indicated that the problems on the M4 around Newport are a priority to address. A sample of statements is provided below:

On 26 June 2013, Edwina Hart AM CStJ MBE, Minister for Economy, Science and Transport, published a written statement on behalf of the Welsh Government to state:

“Addressing the capacity and resilience issues on the M4 around Newport is the top transport challenge that we face in ensuring that Wales has an effective economic infrastructure which improves our competitiveness and access to jobs and services.”

In a Wales Office Written Statement on 1 November 2013 the Secretary of State for Wales (David Jones) outlined that:

“The Chancellor of the Exchequer, Chief Secretary to the Treasury and I are pleased to set out the Government’s plans to facilitate infrastructure investment in Wales, in order to stimulate economic recovery and build growth in the Welsh economy...Upgrading the M4 around Newport is an urgent priority for both Governments, and I am committed to working with the Welsh Government to deliver the improvements that are required.”

During the recent April 2014 Budget announcement and visit by Chancellor George Osborne to South East Wales, there have been high level political discussions and statements made to the media, associated with proposed improvements to the M4 Corridor around Newport. On 19 March 2014, Mr Osbourne announced:

“Tomorrow we introduce legislation to give new tax and borrowing powers to the Welsh Government to fund their infrastructure needs, and they can start now on work to improve the M4 in South Wales.”

During his visit to south Wales in the same month the Chancellor then told BBC Wales that the M4 around Newport is:

“one of the bottlenecks for the entire United Kingdom and, again, not dealt with for years and years and years, and damaging to the Welsh Economy.”

In reference to the Welsh Government being given more borrowing and tax powers, he went on to state:

“We don’t want to wait for those borrowing powers to be in place, we want the Welsh Assembly Government to get on and to be able to fund this earlier. Why wait for a vital improvement that will support jobs in the area?”

4.2 Options for Stage 1 scheme appraisal

The strategy stage of appraisal recommended that the Black Route and its complementary measures be progressed for further appraisal.

Significant support for a suggested alternative, commonly referred to as the Blue Route, has been expressed during the public consultation. As such, a Stage 1 appraisal is also undertaken for a scheme involving a grade-separated A48 Southern Distributor Road (SDR) and upgraded A4810 Steelworks Access Road (SAR), also known as the 'Blue Route'.

At a Stage 1 scheme level of appraisal, alignment options and the associated junction strategy of the Black Route is explored.

The outcome of the WelTAG Stage 1 (scheme) level of appraisal leads to the narrowing of options to be progressed for appraisal at WelTAG Stage 2. Stage 2 appraisal aims to lead to the recommendation for a preferred route.

4.2.1 The Blue Route

During the draft Plan consultation, an alternative was put forward in a paper entitled *"The Blue Route ~ A cost effective solution to relieving M4 congestion around Newport"*³⁰. This alternative was also proposed and/or supported by some respondents to the draft Plan Consultation. The Blue Route Paper described the alternative as *"a combination of the A48 Southern Distributor Road upgrade (as in Option C [of the M4 CEM Programme Consultation Document]³¹) together with the Steelworks road, linking together at the present Queensway Meadows Junction."*

The Wildlife Trusts Wales first referred to the Blue Route in letters to Welsh Ministers in the summer of 2013, indicating that they intended to explore an alternative, but did not provide any detail on a proposal. On 9 December 2013, a copy of the published Blue Route paper was sent to Welsh Minister Edwina Hart, MBE CStJ AM by Wildlife Trusts Wales, signed jointly by representatives of Wildlife Trusts Wales, FoE Cymru, Gwent Wildlife Trust and RSPB Cymru.

The option to upgrade the A48 Southern Distributor Road (SDR) and Steelworks Access Road to a "Newport Expressway" was first considered by the Welsh Government in 2010 in the report 'M4 CEM Strategy, Appraisal and Monitoring'³². The purpose of that report was to outline a strategy to emerge from investigation of other potential schemes to improve the operation of the existing M4 around Newport, when the M4 Relief Road was considered as unaffordable in 2009. It focused on three themes:

- Making Best Use of Existing Capacity;
- Improving the Resilience of the Network; and
- Improving Public Transport.

³⁰ From here forward referred to as the 'Blue Route Paper', authored by Professor Stuart Cole, see <http://www.iwa.org.uk/en/publications/view/227>

³¹ See www.m4cem.com

³² M4 CEM Draft Strategy, Appraisal and Monitoring Report (May 2010)

The report described and illustrated on a plan, a ‘Newport Expressway’, stating that:

“During incidents/maintenance works on the motorway, the SAR, SDR upgrading and J28 improvements would provide increased network resilience.”

The scheme was appraised against a set of Strategic Performance Indicators as well as Scheme Specific Objectives, which focused on encouraging the use of the SDR. The report went on to state:

“Limited reductions in traffic flows on the motorway around Newport may occur, especially during periods of congestion... Unless travel behaviour were to change significantly, even with corridor enhancement measures in place, traffic congestion and capacity problems could be expected to occur during weekday peak travel times with increasing frequency sometime during the period 2018-2024 on the approaches to Brynglas Tunnels.”

The Welsh Government then decided to progress the M4 CEM Programme, to consider a range of possible measures, as part of a package, to address the problems on the M4 around Newport.

During the March 2013 M4 CEM WelTAG Stage 1 (Strategy Level) Appraisal (to which section 2.6.1 of the M4 Corridor around Newport Environmental Report³³ cross-refers) an option, known as M4 CEM Highway Option C, was considered. This option involved the upgrading of the A48 Southern Distributor Road (SDR) with the inclusion of a number of grade separated junctions. This option was ruled out as a reasonable alternative to the draft Plan because of it being considered not to be able to sufficiently achieve the objectives for the M4 Corridor around Newport. Furthermore, it attracted many comments of opposition during the M4 CEM public consultation, whilst those who did offer support or qualified support often favoured its potential to improve resilience but there were concerns about it not increasing road capacity on the highway network³⁴.

Measures to upgrade the A4810 SAR to dual 3 lanes were considered as part of the M4 CEM Programme, as part of the development of a packages of measures³⁵. A high level appraisal of this option is provided in a Discarded Measure Appraisal Summary Worksheet, provided at Page 27 of the M4 CEM Alternatives Considered Workbook, publicly available at www.m4cem.com.

Whilst the upgrading of the A48 SDR and the upgrading of the A4810 SAR have previously been ruled out as individual solutions as they separately did not fulfil the objectives set for the draft Plan, the combined effect of these proposals has now been re-examined as the Blue Route.

³³ M4 Corridor around Newport Strategic Environmental Assessment (SEA) Environmental Report, September 2013

³⁴ See M4 CEM Participation Report (2013)

³⁵ For further details of options considered as part of the development of the draft Plan and the reasons why they were not progressed, please refer to the M4 Corridor Enhancement Measures (CEM) WelTAG Stage 1 (Strategy Level) Report, M4 Corridor around Newport WelTAG Stage 1 Appraisal (Strategy Level) Report and M4 CEM Alternatives Considered Workbook. The M4 CEM documents can be found at www.m4cem.com and the WelTAG reports are available at www.m4newport.com.

4.2.2 Published details

The Blue Route Paper³⁶ was first mentioned in letters to the Welsh Government from environmental groups³⁷ dated 12 July 2013 and 19 August 2013. In their letter of 12 July 2013, Wildlife Trusts Wales stated that they had commissioned Professor Stuart Cole to produce a paper. At this initial stage of correspondence, no detail of the suggested alternative was provided but a cost of £380m was suggested. Some further information on the proposal was presented in Professor Stuart Cole's evidence to the Environment and Sustainability Committee on 6 November 2013.

The Blue Route Paper was published by the Institute of Welsh Affairs (IWA) and Chartered Institute of Logistics and Transport (CILT) on 7 December 2013. This was before the public consultation closed on 16 December 2013.

The Blue Route was referred to in responses to the draft Plan Consultation by members of the public dating back to 19 October 2013 and has been actively promoted as an alternative option by members of the Campaign against Levels Motorway (CALM) on their websites and other publicity material as “*a cost-effective alternative, with far less economic and environmental impacts*”, since 16 October 2013³⁸.

Newport City Council's Cabinet met shortly after publication of the Blue Route and voiced opposition to the Blue Route³⁹. This view was presented in Newport City Council's response to the public consultation.

As described in the published paper, “*the Blue Route is a combination of the A48 Southern Distributor Road upgrade (as in M4 CEM Highway Option C) together with the Steelworks road re-constructed as a four-lane dual carriageway road at expressway standard.*” The Blue Route paper also suggests that there is no impediment to prevent the construction (by 2018) of a grade-separated strategic east/west route along the SDR and SAR.

4.2.3 Key considerations

Although the term “expressway standard” does not benefit from a designation in the UK, it is assumed that this intends to mean a road that is attractive to users of the motorway. However, the primary function of the existing Steelworks Access Road (SAR) is to provide access to existing and new development areas in East Newport. When the ownership of the land required to build the SAR was transferred from TATA and St Modwen to Welsh Government, the provision of access was stipulated in the legal agreements. Legal obligation has thus been placed on the Welsh Government to continue to provide access to designated development areas. As a consequence, between Junction 23A and the Queensway Meadows Roundabout on the A48 SDR, there are the following at-grade junctions along the A4810 SAR:

³⁶ <http://www.iwa.org.uk/en/publications/view/227>

³⁷ Including Friends of the Earth Cymru and Gwent Wildlife Trust

³⁸ <https://www.facebook.com/campaignagainsthelvelsmotorway>

³⁹

http://www.southwalesargus.co.uk/news/gwentnews/10878016.SDR_idea_is__lsquo_crazy_rsquo__as_Newport_M4_relief_road/?ref=rss#

- 5 roundabouts;
- 5 signal-controlled junctions;
- 2 all movements priority junctions;
- 2 left in left out junctions;
- 3 emergency/maintenance access points to TATA; and
- Agricultural field access points.

With such a proliferation of junctions along the route, the SAR is not currently intended to be (or could conceivably be practically employed as) a route for longer distance through traffic that would ordinarily use the motorway.

It is assumed that the Blue Route intends to provide a route attractive to users of the motorway, as well as being required to continue to provide access to designated development areas. As such, to form part of the Blue Route, the SAR would require to be completely re-built to provide a through route, whilst maintaining the above level of local access to both existing and planned residential, industrial and commercial areas.

A motorway standard alignment cannot be achieved along the Blue Route (this was recognised in M4 CEM Highway Option C when speed restrictions needed to be included because of the alignment of the A48 SDR). A route with speed restrictions is required on the SDR and therefore is unlikely to be attractive to existing or future motorway traffic, except in times of severe operational difficulties on the motorway. Furthermore, Arup analysis has shown that with the Blue Route in place, traffic flows on the M4 would exceed capacity in the design year. This would result in on-going congestion, delays and unreliable journey times on the motorway around Newport.

The cost of providing grade-separated junctions on the A48 SDR alone has previously been estimated at in excess of £300 million as part of the M4 CEM Programme. In addition to this, extensive further work would be required at Queensway Meadows to achieve free flow connection between the A48 SDR and the SAR. This would require significant land-take with property demolition and job losses; the costs of which have not been included in the Blue Route Paper analysis. In order to provide a free flowing route between Queensway Meadows and Junction 23A, a complete re-design of the route and the access arrangements will be required. This will involve land acquisition and diversion of major gas pipelines associated with the industrial activities (Air Products) at a COMAH (control of major hazards)⁴⁰ site with Major Accident Hazard Pipelines. In light that the development of a transport link is for use by the general public, this development type would pose a high risk of challenge during the planning process if it is advised against by the Health and Safety Executive (HSE)⁴¹. A further COMAH site is present at Solutia.

⁴⁰ Control of Major Accident Hazards Regulations 1999 (as amended 2006) implement the Seveso II Directive (96/82/EC) as amended by Directive 2003/105/EC in Great Britain. Their aim is to prevent major accidents involving dangerous substances and limit the consequences to people and the environment of any accidents which do occur. Further guidance is provided in National Assembly for Wales Circular 20/01 Planning Controls for Hazardous Substances.

⁴¹ HSE's advice on land use planning, in the majority of cases, is delivered through PADHI – planning advice for developments near hazardous installations, see <http://www.hse.gov.uk/landuseplanning/padhi.pdf>

Whilst the Blue Route paper does not identify how access to existing businesses will be maintained, the likely impact on Newport's development plan, bearing in mind that East Newport is one of its main expansion areas, is likely to be significant. The Blue Route's deliverability and likely cost is dependent on a complete re-design of the SDR/SAR route and the access arrangements required. The Blue Route has gained credence in the media and with those who have historically opposed building a new section of motorway to the south of Newport. This has demonstrated tacit support that a highway solution is needed and that a highway solution should aim to limit the potential impact on the Gwent Levels.

Past and current analysis shows that a new section of motorway to the south of Newport is the optimal and long term solution to address the transport related problems around Newport and that every effort should be made to minimise the impact of this road on the environment. This is the basis of the draft Plan for the M4 Corridor around Newport.

4.2.4 Comments on Professor Stuart Coles' Evidence to the Environment and Sustainability Committee

The National Assembly for Wales Environment and Sustainability Committee began an inquiry into the Welsh Government's proposals for the M4 around Newport on 6 November 2013.

In Professor Stuart Cole's evidence to the Environment and Sustainability Committee on 6 November 2013⁴², his submission describes the Blue Route proposal as *"an upgrade of the whole route from Junctions 23a and J24 in the east to Junction 28 or 29 in the west. This would involve upgrading the current A48 SDR whose traffic flows are lower than were expected. This it has been suggested was largely a consequence of the number of at grade intersections which disrupt the free flow of east west traffic. Grade separated junctions would give these flows greater priority."*

Professor Stuart Cole suggested a cost of the Blue Route at £380m. However, Arup considers that the cost of the Blue Route has been grossly underestimated, as there would be substantial costs associated with re-constructing the A4810 SAR to provide a strategic through route (the standard proposed by Professor Stuart Cole), as well as compensation costs for the necessary land take and property demolition. A cost, based on Arup analysis (2014) suggests that the Blue Route would be likely to cost more than £600m (excluding any allowance for land and compensation).

In Professor Stuart Cole's same submission of evidence to the Environment and Sustainability Committee, the following points were also made (Arup comments are also provided in response to Professor Cole's statements:

⁴² Environment and Sustainability Committee Meeting 6 November 2013 Minutes
<http://senedd.assemblywales.org/ieListDocuments.aspx?CId=225&MIId=1897>

Statements made regarding the Blue Route in Professor Cole's submission to the Environment and Sustainability Committee	Arup Comment
Its [the current M4] resultant capacity is insufficient for current traffic volumes;	Agreed.
The resilience of the M4 at times of temporary traffic disruption requires an alternative route;	Agreed.
The stock of vehicles and the number of new registrations has fallen;	Agreed.
Policy impacts and lifestyle change has also reduced car usage and is not restricted to an economic downturn;	Agreed.
The draft Plan Consultation Document suggests that the Black/Purple Route is estimated to divert up to 40% of traffic away from the existing M4. This is more (far more?) than adequate. The proposed Blue Route is expected to divert 6%-10% but this may be an underestimate and 15% might be more appropriate;	Analysis ⁴³ has forecast that, with the Blue Route in place, the M4 around Newport would continue to experience severe operational problems.
The consultation paper takes no account of the impact of rail electrification or the Metro developments under consideration by the Government along the M4 corridor...an expected 20%-30% transfer of peak traffic would be a conservative assessment;	Analysis ⁴⁴ does not support such levels of transfer. A maximum transfer of around 5% of traffic off the M4 has been forecast as a result of major investment in public transport.
Rail electrification alone could reduce M4 peak traffic flows by 15%;	This is not supported by analysis that considers the potential impact of public transport investment, including rail electrification, on M4 traffic flows around Newport. The Outline Business Cases for rail electrification in South Wales ⁴⁵ have been based on modest decongestion benefits, i.e. transfer from road to rail, which accounts for only 4% of total benefits of electrification.
Car usage is likely to grow following economic recovery or increased consumer confidence but at a declining rate but in proportion to population change through the 30 year forecasting period;	This is not in line with government predictions informed by Department for Transport and Welsh Government guidance ⁴⁶ .
The Blue Route is likely to solve the congestion issue on the M4 as it arises;	Analysis ⁴⁷ has forecast that, with the Blue Route in place, the M4 around Newport would continue to experience severe operational problems.

⁴³ Arup analysis 2014

⁴⁴ See Public Transport Overview Update, available at www.m4cem.com

⁴⁵ Valley Lines Electrification Outline Business Cases (2012)

⁴⁶ See M4 Corridor around Newport WelTAG Stage 1 (Strategy Level) Report, available at www.m4newport.com

⁴⁷ Arup 2014

Statements made regarding the Blue Route in Professor Cole's submission to the Environment and Sustainability Committee	Arup Comment
The scheme could be constructed by 2018;	The Blue Route is unlikely to be able to be delivered any earlier than the draft Plan as it would need to follow similar due process, including land and property acquisition, whilst the Black Route already benefits from mainly following a TR111 route protecting it for planning purposes.
At the western end of the A48 north of Tredegar House conservation area and entering the M4 at J28 there is currently a confluence of high peak traffic flows. There are Government proposals for redesigning this largely at grade junction;	Analysis ⁴⁸ has forecast that, with the Blue Route in place, severe operational problems would be experienced on the approaches and at J28, even when taking into account the planned improvements.
Any financial agreement between the Welsh Government and HM Treasury is unlikely to contain a road with no revenue stream such as tolls (or shadow tolls with revenue account expenditure consequences) to cover its costs;	In May 2013, Wales' first minister reinforced his position that neither the Treasury nor the Welsh Government would impose a toll on the new road if it went ahead.
The option would improve the resilience of the network (including the M4) and could be phased to spread investment costs;	It is considered that phasing would further reduce its limited benefits until fully completed.
The benefits to the A48 corridor upon scheme completion would be realised through journey time improvements, accessibility gains for southern Newport (including some of the city's most disadvantaged wards), and benefits for the movement of people and freight to key employment areas and services;	There is limited potential for journey time improvements along the A48 corridor as the alignment of the A48 SDR requires there to be a speed restriction of 50 mph ⁴⁹ . Any potential increase in speed limit is likely to be subject to great scrutiny taking into account the route's requirement to provide local access, its urban location and potential impact on community safety.
The negative impacts would include the possibility of some minor demolition of buildings, visual adverse impacts, and some biodiversity losses associated with the River Usk SAC (though the biodiversity rating for the scheme is more positive than the motorway);	Analysis ⁵⁰ has shown that in order to improve the alignment of the A48 SDR and/or create grade-separated junctions, there would be significant property demolition and land acquisition needed, as well as loss of employment at existing businesses. The provision of a motorway standard road along the SAR, whilst maintaining access to the existing steelworks, developments and proposed development sites, would result in major disruption to the East Newport regeneration programme and could have a major impact on Newport City Council's Local Development Plan, see Appendix B.
There is woodland to the north adjacent to Tredegar Park sports facilities which could be affected;	Agreed.

⁴⁸ Arup 2014

⁴⁹ See M4 Corridor Enhancement Measures WelTAG Stage 1 (Strategy Level) Report, available at www.m4cem.com

⁵⁰ Arup 2014

Statements made regarding the Blue Route in Professor Cole's submission to the Environment and Sustainability Committee	Arup Comment
An improved A48 passes through important retail, distribution and manufacturing areas;	Agreed.
The Blue Route will touch the Gwent Levels SSSI at Barecroft Common and is therefore not free of any adverse environmental impact;	Agreed.
The grade separated junction construction would create some issues but this could coincide with the proposed construction of 4000 houses on the adjacent land;	Agreed.
The resultant more freely flowing traffic could be expected to reduce emissions and noise;	Agreed.
There will be some increase in traffic noise along the A48 SDR and SAR;	Agreed.
Present land use is largely industrial or commercial with some housing where amelioration measures can be taken while levels of emissions and noise which are reducing as the age profile of the private car 'fleet' falls;	Agreed.
This should improve accessibility to the [Glan Llyn] sites and provide greater connectivity to other parts of Newport and the M4 both east bound and west bound. The planning of these access points should have been (or should now be) considered to be compatible with the land use activities (e.g. cement works and new housing, steelworks, HGV operations to/from distribution centres and the Magor Brewery);	As referred to previously, the SAR would need to be completely re-built to accommodate both a strategic through route and the necessary access arrangements that will be compatible with existing and proposed land uses.
Any adverse effects on cyclist and pedestrian movements will need to be taken into account. Alternative routes can be provided so that any increased traffic volumes on the proposed corridor do not increase hazards or community severance.	Agreed.

4.2.5 Appraisal of the Blue Route

An Arup appraisal of the Blue Route has built on that previously undertaken as part of the M4 CEM Programme. This included analysis of grade separated junction improvements to the A48 SDR (see M4 CEM WelTAG Stage 1 Report) and appraisal of a measure to upgrade the SAR to dual 3 lanes (as included within the preceding M4 CEM Alternatives Considered Workbook)⁵¹.

Any appraisal work reported here is based on Arup's interpretation of the description provided in the submitted Blue Route Paper and evidence to the Environment and Sustainability Committee on 6 November 2013, as no detailed plans of the Blue Route have been provided by its proposers. Arup's interpretation includes a grade separated A48 SDR (based on M4 CEM Option C), and a re-

⁵¹ Both are available at www.m4cem.com

constructed A4810 SAR, as a 2 lane dual carriageway all-purpose road with free flow junctions. However, the Blue Route Paper has also placed a cost estimate of £380m on the Blue Route. The description and the cost do not appear to be consistent with each other. Therefore a range of options for the Blue Route have been considered⁵² and three scenarios have been developed for appraisal:

Scenario 1: A Blue Route that aims to be attractive to motorway users.

It has been assumed that a 70mph speed limit could apply along the SAR should it be developed to “expressway standard”. However, the SDR would continue to exercise a 50mph speed limit, as described further in this appraisal. This arrangement is considered to maximise its potential ability to attract users of the motorway and therefore maximise its capability to alleviate the transport related problems on the M4 around Newport.

This scenario has been estimated to cost more than £600m, excluding VAT. It should be acknowledged that a reduced arrangement with 50mph speed restrictions throughout would reduce the Blue Route’s performance. Whilst it is appreciated that the cost of construction could be greater for an “expressway standard” SAR compared to a reduced standard road, it is considered that this best fits the description and intentions of the Blue Route as put forward in the Blue Route Paper, which refers to this terminology.

Scenario 2: An optimal Blue Route that aims to be most attractive to motorway users.

This scenario builds on Option 1 by including free-flow grade separated junctions at the interchanges either end of the Blue Route; at Junction 28 to the west, and Junction 23A to the east. This would do most to attract traffic off the M4 and onto the Blue Route, also helping to avoid potential congestion issues at either end of the Blue Route where it meets with the existing M4.

This scenario has been estimated to cost more than £800m, excluding VAT.

Scenario 3: A Blue Route that aims to provide a low cost alternative to the Black Route.

It has been assumed for this lower cost alternative scenario, that improvement works to the A48 SDR and A4810 SAR should be in the order of £380m, as stated in the Blue Route Paper. This level of funding would be likely to limit the scope of improvements when compared to the “expressway standard” that has been targeted in Scenario 1 and to an even greater extent in Scenario 2. This scenario would involve a combination of A48 SDR grade separated junction improvements (as in Option C of the M4 CEM Programme) linking together with the A4810 SAR at the present Queensway Meadows Junction, together with at-grade junction improvements along the A4810 SAR. Such an arrangement could lend itself to the application of the “green wave” principle to progress platoons of mainline traffic during peak flows⁵³, which could provide limited resilience benefits but would not provide additional capacity on the network.

⁵² Arup analysis 2014

⁵³ This technology was considered as part of the preparation of a draft Plan when considering the potential benefits of at-grade improvements to the A48 SDR. See M4 CEM Package 2 Workbook, available at www.m4cem.com

Blue Route Scenario 2 has been designed to provide the maximum potential relief to the M4 around Newport, whereas Blue Route Scenario 3 is likely to provide the least relief to the motorway. In order to obtain an initial measure of the likely range of benefits that Blue Route options might provide, Scenarios 2 and 3 have been modelled using the SATURN traffic model. A preliminary economic assessment has also been undertaken for both scenarios using TUBA. These economic assessments are based on user benefits. Accidents and maintenance benefits have not been included for this preliminary appraisal. The resulting Transport Economic Efficiency (TEE) tables are summarised in Appendix A. A summary of the monetised costs and benefits for the two scenarios is provided below:

	Blue Route Scenario 2	Blue Route Scenario 3
Present Value of Benefits (PVB) (£000)	446,385	44,617
Present Value of Costs (PVC) (£000)	742,320	376,980
Net Present Value (NPV) (£000)	-295,935	-332,363
Benefit to Cost Ratio (BCR)	0.60	0.12

Note: All entries are discounted present values in 2010 prices and values

The assessment shows that the benefits that would accrue as a result of the Blue Route would be significantly less than the costs required to deliver either scenario. The Net Present Value of the scheme would be -£296million or -£332million for Scenarios 2 and 3 respectively. There is thus no economic justification for investment in the Blue Route.

4.2.6 Appraisal Summary Tables (ASTs)

ASTs form part of WelTAG appraisal and have been applied here in light that Professor Cole's Blue Route Paper provides an AST for his Blue Route.

The ASTs for the two reasonable alternatives to the draft Plan, of which the main elements are a dual carriageway (Red Route) and motorway along an alternative alignment (Purple Route), are shown in the draft Plan Consultation Document (see www.wales.gov.uk/consultations or www.m4newport.com).

Comparative performance against the draft Plan is then summarised against WelTAG criteria and against the transport planning objectives (TPOs).

Appraisal of the Blue Route Scenario 1 (a Blue Route that aims to be attractive to motorway users)

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	Once complete, grade separation of the SDR would improve network resilience should there be an accident or incident on the M4 around Newport. The route is unlikely to transfer journeys onto it that currently use the M4. Journey time reliability would be improved and there would be journey time savings along the SDR apart from the approaches to and at J28. The value for money in upgrading the SAR further than completed is poor, with benefits failing to cover investment costs. This scheme does not provide a long term solution to the transport related problems on the M4 around Newport and sections of the M4 would continue to experience severe operational problems.	All road users	(--)
Economic Activity and Location Impact (EALI)	Providing additional network resilience would help limit the negative economic impact caused by disruption during incidents and delays on the M4. There would be improvements to accessibility in southern Newport if local accesses are maintained. There would be adverse impacts on businesses along the SDR and SAR corridor due to land take and property demolition. Properties, including businesses, would be directly affected by land take requirements in order to facilitate grade separated junctions. The Blue Route could also compromise the access arrangements and viability of certain employment and residential land allocations as outlined in local planning policy (see Appendix B). In particular, this could have an adverse impact on the Glan Llyn development. Increased traffic flows along the SDR would increase traffic congestion around Junction 28, even taking account of planned improvements to this junction. Disruption during construction would be significant and disrupt the movement of people and freight in Newport until the upgraded route is operational.	All road users	(0)
Noise	Traffic transfer onto the upgraded SDR and SAR could result in limited reduction of noise levels along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties along the M4. The majority of new noise impacts would be in areas around the SDR and SAR where there are also noise-sensitive areas including the existing and planned residential development at Glan Llyn. During construction, noise pollution could increase temporarily, which would affect residential and commercial properties located near to the SDR and SAR.	Properties along the M4 and SDR/SAR	(0)

Criteria	Assessment	Distribution Significance	
Local Air Quality	<p>The Blue Route could provide reductions in the levels of atmospheric pollution to AQMAs by providing an alternative route for traffic when the motorway is congested.</p> <p>There would, however, be increased emissions and deterioration in air quality near the SDR and SAR should traffic volume increase along the Blue Route. The effects of this would impact on existing properties and planned residential/employment development.</p> <p>During construction, air quality could be reduced temporarily with dust impacts and construction vehicles, which would affect residential and commercial properties located near to the SDR and SAR.</p>	Properties along the M4 and SDR/SAR	(0)
Greenhouse Gas Emissions	There would continue to be severe operational problems on sections of the M4 and A48 SDR. It is not clear whether the additional road capacity created would lead to an overall increase in emissions in the longer term.	No significant distributional impacts	(0)
Landscape and townscape	Grade separated junction improvements to the A48 would result in adverse visual impacts, including some within a Historic Landscape Area, Green Wedge and the Tredegar House Historic Park and Garden. Some properties may need to be demolished to accommodate grade separation at some junctions.	Local landscape impacts	(--)
Biodiversity	<p>Junction improvements to the A48 would require additional land take and the realignment of the SDR at Church Street which crosses the River Usk SAC and SSSI. This could lead to direct and indirect adverse effects on biodiversity – including from direct physical impacts on habitats, hydromorphology and flow in the river and construction effects on species features of the European Site.</p> <p>A widened SAR alignment or footprint would run through or be directly adjacent to the Gwent Levels SSSI. Increased land take and additional traffic could have significant negative impact on biodiversity to the northern extent of the Gwent Levels in particular. Increased traffic would also have an adverse impact on biodiversity in these locations.</p>	Potential impact on River Usk SAC and SSSI	(-)
Heritage	Assuming that the improvements are outside of the Tredegar House Historic Park and Garden, Grade I Listed Building and Conservation Area, the works would still have an adverse effect on the setting of the area due to increased structures and traffic flows at and around Junction 28. The works could also affect Grade II Listed Buildings along the route, as well as disrupt access to the Newport Transporter Bridge. This option could also affect the Castell Glas Scheduled Monument if the improvements were to take place outside the existing highway footprint.	Distribution assessment not required (Para. 7.10.7 of WelTAG June 2008)	(--)
Water environment	Grade separated junction improvements to the A48 would require additional land take within TAN15 Flood Zones and could lead to adverse effects on water quality, flood plain connectivity and areas of flood risk. Some junctions of the SDR run close to the Ebbw River. Therefore, improvements could cause adverse effects such as increased flood risk due to run off and pollution due to accidental spillages. Any junction improvements or additional land take along the SAR could impact on the water management of the Tata Steelworks, River Usk surrounds, and impact on the Gwent Levels SSSI.	No significant distributional impacts	(--)

Criteria	Assessment	Distribution	Significance
Soils	Grade separated junction improvements to the A48 and SAR would require additional land take.	No significant distributional impacts	(-)
Transport safety	The junction improvements would help to improve road safety, as it is forecast that, on completion, the total number of accidents on major roads in Newport would fall as a result of these improvements. Vehicle trips could increase on the SDR and SAR, potentially leading to an increase in accidents in this area.	All road users	(0)
Personal security	Grade separated junction improvements would improve east-west traffic flows along the SDR. Reduced potential for delays may reduce travellers' perceptions of vulnerability to crime and this could have the effect of improving the perception of personal security for drivers and other road users.	All road users	(+)
Permeability	Grade separated junction improvements would improve east-west traffic flows along the SDR. This measure could therefore improve access to local health, care, training and education services.	All road users	(+)
Physical fitness	This measure could have a neutral impact on physical fitness.	Car users and pedestrians	(0)
Social inclusion	Once complete, grade separation of the SDR would improve network resilience. Access to essential services would be maintained. However, upgrades to the SAR would result in additional severance and reduction in accessibility to the Glan Llyn development area by road, which could have adverse impacts, particularly for pedestrians and cyclists, if no alternative routes for access are provided.	Distribution assessment not required (Para. 8.6.31 of WelTAG June 2008)	(0)
Equality, Diversity & Human Rights	Improved resilience and journey time reliability along the SDR would benefit those users with access to a car. Some property demolition is required, which will adversely impact on local communities and employment.	All road users	(-)
TPOs			
1	Grade separation of the SDR and upgrade to the SAR would improve network resilience.	All	(+)
2	The nature of the improvement is local rather than regional or national.	All	(0)
3	Grade separation of the SDR and upgrade to the SAR would improve network resilience and would provide an alternative route to the M4 for longer distance journeys around Newport.	All	(++)
4	Grade separation of the SDR and upgrade to the SAR could reduce congestion on the existing M4 and improve east-west travel at times of accident and delays. Local accessibility around the SAR would be reduced.	All	(0)
5	Grade separation of the SDR and upgrade to the SAR would improve network resilience	All	(+)
6	No additional cycle/pedestrian infrastructure is included with the Blue Route, acknowledging that this proposes a scheme rather than a package of measures.	All	(0)

Criteria	Assessment	Distribution Significance	
7	The junction improvements would help to improve road safety, as it is forecast that, on completion, the total number of accidents on major roads in Newport would fall as a result of these improvements. Vehicle trips could increase on the SDR and SAR, potentially leading to an increase in accidents in this area.	All	(0)
8	The Blue Route could provide reductions in the levels of atmospheric pollution to AQMAs by providing an alternative route for traffic when the motorway is congested. There would, however, be increased emissions and deterioration in air quality near the SDR and SAR should traffic volume increase along the Blue Route. The effects of this would impact on existing properties and planned residential/employment development. During construction, air quality could be reduced temporarily with dust impacts and construction vehicles, which would affect residential and commercial properties located near to the SDR and SAR.	All	(0)
9	Traffic transfer onto the upgraded SDR and SAR could result in limited reduction of noise levels along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties along the M4. The majority of new noise impacts would be in areas around the SDR and SAR where there are also noise-sensitive areas including the existing and planned residential development at Glan Llyn. During construction, noise pollution could increase temporarily, which would affect residential and commercial properties located near to the SDR and SAR.	All	(0)
10	There would continue to be severe operational problems on sections of the M4 and A48 SDR. It is not clear whether the additional road capacity created would lead to an overall increase in emissions in the longer term.	All	(0)
11	Grade separated junction improvements to the SDR and upgrade to the SAR has the potential to improve the driver experience and reduce driver stress, leading to an improved travel experience into South Wales along the M4 corridor.	All	(+)
12	The nature of the improvement is local rather than regional or national.	All	(0)
13	Improved travel conditions on the SDR and upgrade to the SAR could provide better strategic traffic management in and around Newport.	All	(+)
14	Once complete, grade separation of the SDR and upgrade to the SAR would improve network resilience although there could be disruptions to local traffic, particularly around the new development sites near the SAR. Access to essential services would be maintained.	All	(+)
15	Improved east-west travel on the SDR and SAR could benefit public transport services that use the route but is likely to increase traffic use of the SDR. The measure would not promote a cultural shift in travel behaviour to more sustainable choices.	All	(--)

Criteria	Assessment	Distribution Significance
Public acceptability	Improved operating conditions along the SDR and SAR could provide network resilience, which could be supported by the public. Closure of some existing junctions could be detrimental to local travel patterns, whilst demolition of properties and impact on residential and employment development is an emotive issue and could attract significant public opposition. Increased traffic volumes along the SDR and SAR could increase air and noise pollution, which could be met with opposition from local communities in this area.	
Acceptability to other stakeholders	Improved resilience and accessibility on the network could be supported by business groups, whilst adverse impacts on local communities and the environment may be met with opposition from stakeholder groups. The scheme is likely to be unacceptable to stakeholders in that grade separation of junctions along the SAR would also require a rationalisation of a number of junctions, reducing local access to the industrial area and Glan Llyn development site, which to resolve would need parallel local access roads further impacting upon a tight corridor. Impact on property could be significant with additional land take required. Increased traffic volumes along the SDR could increase congestion at Junction 28, which could be met with opposition from commuters and businesses accessing employment sites in this area.	
Technical and operational feasibility	The existing roundabouts on the SDR and accesses onto the SAR are closely spaced and to comply with highway design standards, some of these roundabouts and junctions could require full or partial closure. These proposals would be challenging to implement as the corridor is constrained by development sites on each side, and would most likely result in significant impact upon the Air Products site to the south side of the SAR, which is a COMAH (control of major hazards) site. There is also existing ground contamination along the corridor, which would need to be remediated. Any works to the SDR would require contractual negotiations with the SDR concessionaire.	
Financial affordability and deliverability	Land acquisition and property demolition would result in CPO and likely compensation as well as negotiations with SDR concessionaires. Construction of the works could be delivered in phases, which could improve affordability.	
Risks	The option is at a strategy level and therefore the risks require further exploration. Any works to the SDR would require contractual negotiations with the SDR concessionaire.	

Appraisal of the Blue Route Scenario 2 (an optimal Blue Route that aims to be most attractive to motorway users)

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	Once complete, grade separation of the SDR and SAR interchanges would improve network resilience. The route would transfer a limited number of journeys onto it that currently use the M4. Journey time reliability would be improved and there would be journey time savings along the SDR. This scheme does not provide a long term solution to the transport related problems on the M4 around Newport and some sections of the M4 would continue to experience severe operational problems. It would however, provide local accessibility benefits to Newport and J28 in particular. The cost of the scheme is very high compared to the accessibility benefits it could provide. The cost of the scheme greatly outweighs the benefits.	All road users	(--)
Economic Activity and Location Impact (EALI)	<p>Providing additional network resilience would limit the negative economic impact caused by disruption during incidents and delays on the M4. There would be improvements to accessibility in southern Newport if local accesses are maintained.</p> <p>There would be adverse impacts on businesses along the SDR and SAR corridor due to land take and property demolition. Properties, including businesses, would be directly affected by land take requirements in order to facilitate grade separated junctions.</p> <p>The Blue Route could also compromise the access arrangements and viability of certain employment and residential land allocations as outlined in local planning policy (see Appendix B). In particular, this could have an adverse impact on the Glan Llyn development.</p> <p>Grade separation of the SDR and SAR interchanges would reduce potential traffic congestion around Junction 28 and 23A.</p> <p>Disruption during construction would be significant and disrupt the movement of people and freight in Newport until the upgraded route is operational.</p>	All road users	(+)
Noise	<p>Traffic transfer onto the upgraded SDR and SAR could result in limited reduction of noise levels along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties along the M4. The majority of new noise impacts would be in areas around the SDR and SAR where there are also noise-sensitive areas including the existing and planned residential development at Glan Llyn.</p> <p>During construction, noise pollution could increase temporarily, which would affect residential and commercial properties located near to the SDR and SAR.</p>	Properties along the M4 and SDR/SAR	(0)

Criteria	Assessment	Distribution Significance	
Local Air Quality	<p>The Blue Route could provide reductions in the levels of atmospheric pollution to AQMAs by providing an alternative route for traffic when the motorway is congested.</p> <p>There would, however, be increased emissions and deterioration in air quality near the SDR and SAR should traffic volume increase along the Blue Route. The effects of this would impact on existing properties and planned residential/employment development.</p> <p>During construction, air quality could be reduced temporarily with dust impacts and construction vehicles, which would affect residential and commercial properties located near to the SDR and SAR.</p>	Properties along the M4 and SDR/SAR	(0)
Greenhouse Gas Emissions	There would continue to be severe operational problems on sections of the M4 and A48 SDR. It is not clear whether the additional road capacity created would lead to an overall increase in emissions in the longer term.	No significant distributional impacts	(0)
Landscape and townscape	Grade separated junction improvements to the A48 would result in adverse visual impacts, including some within a Historic Landscape Area, Green Wedge and the Tredegar House Historic Park and Garden. Some properties may need to be demolished to accommodate grade separation at some junctions.	Local landscape impacts	(--)
Biodiversity	<p>Junction improvements to the A48 would require additional land take and the realignment of the SDR at Church Street which crosses the River Usk SAC and SSSI. This could lead to direct and indirect adverse effects on biodiversity – including from direct physical impacts on habitats, hydromorphology and flow in the river and construction effects on species features of the European Site.</p> <p>A widened SAR alignment or footprint would run through or be directly adjacent to the Gwent Levels SSSI. Increased land take and additional traffic could have significant negative impact on biodiversity to the northern extent of the Gwent Levels in particular. Increased traffic would also have an adverse impact on biodiversity in these locations.</p>	Potential impact on River Usk SAC and SSSI	(-)
Heritage	Assuming that the improvements are outside of the Tredegar House Historic Park and Garden, Grade I Listed Building and Conservation Area, the works would still have a significant adverse effect on the setting of the area due to increased structures and traffic flows with a grade separated Junction 28. The works would also affect Grade II Listed Buildings along the route, as well as disrupt access to the Newport Transporter Bridge. This option could also affect the Castell Glas Scheduled Monument if the improvements were to take place outside the existing highway footprint.	Distribution assessment not required (Para. 7.10.7 of WelTAG June 2008)	(---)

Criteria	Assessment	Distribution	Significance
Water environment	Grade separated junction improvements to the A48 would require additional land take within TAN15 Flood Zones and could lead to adverse effects on water quality, flood plain connectivity and areas of flood risk. Some junctions of the SDR run close to the Ebbw River. Therefore, improvements could cause adverse effects such as increased flood risk due to run off and pollution due to accidental spillages. Any junction improvements or additional land take along the SAR could impact on the water management of the Tata Steelworks, River Usk surrounds, and impact on the Gwent Levels SSSI.	No significant distributional impacts	(--)
Soils	Grade separated junction improvements to the A48 and SAR would require additional land take.	No significant distributional impacts	(-)
Transport safety	The junction improvements and grade separated interchanges at J28 and J23A would help to improve road safety, as it is forecast that, on completion, the total number of accidents on major roads in Newport would fall as a result of these improvements. Vehicle trips could increase on the SDR and SAR, potentially leading to an increase in accidents in this area.	All road users	(+)
Personal security	Grade separated junction improvements would improve east-west traffic flows along the SDR. Reduced potential for delays may reduce travellers' perceptions of vulnerability to crime and this could have the effect of improving the perception of personal security for drivers and other road users.	All road users	(+)
Permeability	Grade separated junction improvements would improve east-west traffic flows along the SDR. This measure could therefore improve access to local health, care, training and education services.	All road users	(+)
Physical fitness	This measure could have a neutral impact on physical fitness.	Car users and pedestrians	(0)
Social inclusion	Once complete, grade separation of the SDR would improve network resilience. Access to essential services would be maintained. However, upgrades to the SAR would result in additional severance and reduction in accessibility to the Glan Llyn development area by road, which could have adverse impacts, particularly for pedestrians and cyclists, if no alternative routes for access are provided.	Distribution assessment not required (Para. 8.6.31 of WelTAG June 2008)	(0)
Equality, Diversity & Human Rights	Improved resilience and journey time reliability along the SDR would benefit those users with access to a car. Some property demolition is required, which would adversely impact on local communities and employment.	All road users	(-)
TPOs			
1	Grade separation of the SDR and upgrade to the SAR would improve network resilience.	All	(++)
2	The nature of the improvement is local rather than regional or national, but it would provide a more attractive east-west route compared to Option 1 or 3.	All	(+)

Criteria	Assessment	Distribution Significance	
3	Grade separation of the SDR and upgrade to the SAR would improve network resilience and would provide an alternative route to the M4 for longer distance journeys around Newport.	All	(++)
4	Grade separation of the SDR and upgrade to the SAR could reduce congestion on the existing M4 and improve east-west travel. Local accessibility around the SAR would be reduced.	All	(+)
5	Grade separation of the SDR, J28 and upgrade to the SAR and grade separation of J23A would improve network resilience.	All	(++)
6	No additional cycle/pedestrian infrastructure is included with the Blue Route, acknowledging that this proposes a scheme rather than a package of measures.	All	(0)
7	The junction improvements would help to improve road safety, as it is forecast that, on completion, the total number of accidents on major roads in Newport would fall as a result of these improvements. Vehicle trips could increase on the SDR and SAR, potentially leading to an increase in accidents in this area.	All	(+)
8	<p>The Blue Route could provide reductions in the levels of atmospheric pollution to AQMAs by providing an alternative route for traffic when the motorway is congested.</p> <p>There would, however, be increased emissions and deterioration in air quality near the SDR and SAR should traffic volume increase along the Blue Route. The effects of this would impact on existing properties and planned residential/employment development.</p> <p>During construction, air quality could be reduced temporarily with dust impacts and construction vehicles, which would affect residential and commercial properties located near to the SDR and SAR.</p>	All	(0)
9	<p>Traffic transfer onto the upgraded SDR and SAR could result in limited reduction of noise levels along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties along the M4. The majority of new noise impacts would be in areas around the SDR and SAR where there are also noise-sensitive areas including the existing and planned residential development at Glan Llyn.</p> <p>During construction, noise pollution could increase temporarily, which would affect residential and commercial properties located near to the SDR and SAR.</p>	All	(0)
10	Whilst network resilience would be improved, there would continue to be operational problems on some sections of the M4. It is not clear whether the additional road capacity created would lead to an overall increase in emissions in the longer term.	All	(+)
11	Grade separated junction improvements to the SDR and upgrade to the SAR has the potential to improve the driver experience and reduce driver stress, leading to an improved travel experience into South Wales along the M4 corridor.	All	(+)

Criteria	Assessment	Distribution Significance	
12	The nature of the improvement is local rather than regional or national, albeit it would provide a more attractive east-west route than Option 1 or 3. It is likely to only redistribute a limited volume of strategic traffic using the M4, except at times of incident and delay.	All	(+)
13	Improved travel conditions on the SDR and upgrade to the SAR could provide better strategic traffic management in and around Newport.	All	(+)
14	Once complete, grade separation of the SDR and upgrade to the SAR would improve network resilience although there could be disruptions to local traffic, particularly around the new development sites near the SAR. Access to essential services would be maintained.	All	(+)
15	Improved east-west travel on the SDR and SAR could benefit public transport services that use the route but is likely to increase traffic use of the SDR. The measure would not promote a cultural shift in travel behaviour to more sustainable choices.	All	(--)
Public acceptability	Improved operating conditions along the SDR and SAR could provide network resilience, which could be supported by the public. Closure of some existing junctions could be detrimental to local travel patterns, whilst demolition of properties and impact on residential and employment development is an emotive issue and could attract significant public opposition. Increased traffic volumes along the SDR and SAR could increase air and noise pollution, which could be met with opposition from local communities in this area.		
Acceptability to other stakeholders	Improved resilience and accessibility on the network could be supported by business groups, whilst adverse impacts on local communities and the environment may be met with opposition from stakeholder groups. The scheme is likely to be unacceptable to stakeholders in that grade separation of junctions along the SAR would also require a rationalisation of a number of junctions, reducing local access to the industrial area and Glan Llyn development site, which to resolve would need parallel local access roads further impacting upon a tight corridor. Impact on property could be significant with additional land take required. The significant impact on the setting of Tredegar House Historic Park and Garden is likely to be unacceptable.		
Technical and operational feasibility	The existing roundabouts on the SDR and accesses onto the SAR are closely spaced and to comply with highway design standards, some of these roundabouts and junctions could require full or partial closure. Major works would be required at Junction 28 and Junction 23A. These proposals along the route would be challenging to implement as the corridor is constrained by development sites on each side, and would most likely result in significant impact upon the Air Products site to the south side of the SAR, which is a COMAH (control of major hazards) site. There is also existing ground contamination along the corridor, which would need to be remediated. Any works to the SDR would require contractual negotiations with the SDR concessionaire.		
Financial affordability and deliverability	Land acquisition and property demolition would result in CPO and likely compensation as well as negotiations with SDR concessionaires. Construction of the works could be delivered in phases, which could improve affordability.		
Risks	The option is at a strategy level and therefore the risks require further exploration. Any works to the SDR would require contractual negotiations with the SDR concessionaire. Planned improvements at Junction 28 would be compromised by this proposal, which would redevelop Junction 28 with a grade separated junction onto the SDR.		

Appraisal of the Blue Route Scenario 3 (a Blue Route that aims to provide a low cost alternative to the Black Route)

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	Once complete, grade separation of the SDR would improve network resilience should there be an accident or incident on the M4 around Newport. The route is unlikely to transfer journeys onto it that currently use the M4. Journey time reliability would be improved and there would be journey time savings along the SDR apart from the approaches to and at J28. The value for money in upgrading the SAR further than completed is very poor, with benefits failing to cover the investment costs. This scheme does not provide a solution to the transport related problems on the M4 around Newport. Most sections of the M4 would continue to experience severe operational problems..	All road users	(---)
Economic Activity and Location Impact (EALI)	Providing additional network resilience would help limit the negative economic impact caused by disruption during incidents and delays on the M4. There would be adverse impacts on businesses along the SDR due to land take and property demolition. Properties, including businesses, would be directly affected by land take requirements in order to facilitate grade separated junctions. The Blue Route with a prioritised mainline flow along the A4810 could also compromise the access arrangements of certain employment and residential land allocations as outlined in local planning policy (see Appendix B). In particular, this could have an adverse impact on the Glan Llyn development. Increased traffic flows along the SDR would increase traffic congestion around Junction 28, even taking account of planned improvements to this junction. Disruption during construction would be significant and disrupt the movement of people and freight in Newport until the upgraded route is operational.	All road users	(-)
Noise	Traffic transfer onto the upgraded SDR and SAR could result in limited reduction of noise levels along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties along the M4. The majority of new noise impacts would be in areas around the SDR where there are also noise-sensitive areas including the existing and planned residential development at Glan Llyn. During construction, noise pollution could increase temporarily, which would affect residential and commercial properties located near to the SDR and SAR.	Properties along the M4 and SDR/SAR	(0)

Criteria	Assessment	Distribution Significance	
Local Air Quality	<p>The Blue Route could provide reductions in the levels of atmospheric pollution to AQMAs by providing an alternative route for traffic when the motorway is congested.</p> <p>There would, however, be increased emissions and deterioration in air quality near the SDR and SAR should traffic volume increase along the Blue Route. The effects of this would impact on existing properties and planned residential/employment development.</p> <p>During construction, air quality could be reduced temporarily with dust impacts and construction vehicles, which would affect residential and commercial properties located near to the SDR and SAR.</p>	Properties along the M4 and SDR/SAR	(0)
Greenhouse Gas Emissions	There would continue to be severe operational problems on sections of the M4 and A48 SDR. It is not clear whether the additional road capacity created would lead to an overall increase in emissions in the longer term.	No significant distributional impacts	(0)
Landscape and townscape	Grade separated junction improvements to the A48 would result in adverse visual impacts, including some within a Historic Landscape Area, Green Wedge and the Tredegar House Historic Park and Garden. Some properties may need to be demolished to accommodate grade separation at some junctions.	Local landscape impacts	(--)
Biodiversity	<p>Junction improvements to the A48 would require additional land take and the realignment of the SDR at Church Street which crosses the River Usk SAC and SSSI. This could lead to direct and indirect adverse effects on biodiversity – including from direct physical impacts on habitats, hydromorphology and flow in the river and construction effects on species features of the European Site.</p> <p>Increased traffic would also have an adverse impact on biodiversity in these locations.</p>	Potential impact on River Usk SAC and SSSI	(-)
Heritage	Assuming that the improvements are outside of the Tredegar House Historic Park and Garden, Grade I Listed Building and Conservation Area, the works would still have an adverse effect on the setting of the area due to increased structures and traffic flows at and around Junction 28. The works could also affect Grade II Listed Buildings along the route, as well as disrupt access to the Newport Transporter Bridge. This option could also affect the Castell Glas Scheduled Monument if the improvements were to take place outside the existing highway footprint.	Distribution assessment not required (Para. 7.10.7 of WelTAG June 2008)	(--)
Water environment	Grade separated junction improvements to the A48 would require additional land take within TAN15 Flood Zones and could lead to adverse effects on water quality, flood plain connectivity and areas of flood risk. Some junctions of the SDR run close to the Ebbw River. Therefore, improvements could cause adverse effects such as increased flood risk due to run off and pollution due to accidental spillages. Any at-grade junction improvements along the SAR could impact on the water management of the Tata Steelworks, River Usk surrounds, and impact on the Gwent Levels SSSI.	No significant distributional impacts	(-)

Criteria	Assessment	Distribution	Significance
Soils	Grade separated junction improvements to the A48 would require additional land take.	No significant distributional impacts	(-)
Transport safety	The junction improvements would help to improve road safety, as it is forecast that, on completion, the total number of accidents on major roads in Newport would fall as a result of these improvements. Vehicle trips could increase on the SDR and SAR, potentially leading to an increase in accidents in this area.	All road users	(0)
Personal security	Grade separated junction improvements would improve east-west traffic flows along the SDR. Reduced potential for delays may reduce travellers' perceptions of vulnerability to crime and this could have the effect of improving the perception of personal security for drivers and other road users.	All road users	(+)
Permeability	Grade separated junction improvements would improve east-west traffic flows along the SDR. This measure could therefore improve access to local health, care, training and education services.	All road users	(+)
Physical fitness	This measure could have a neutral impact on physical fitness.	Car users and pedestrians	(0)
Social inclusion	Once complete, grade separation of the SDR would improve network resilience. Access to essential services would be maintained. However, upgrades to the SAR could result in additional severance and reduction in accessibility to the Glan Llyn development area by road, which could have adverse impacts, particularly for pedestrians and cyclists, if no alternative routes for access are provided.	Distribution assessment not required (Para. 8.6.31 of WelTAG June 2008)	(0)
Equality, Diversity & Human Rights	Improved resilience and journey time reliability along the SDR would benefit those users with access to a car. Some property demolition is required, which would adversely impact on local communities and employment.	All road users	(-)
TPOs			
1	Grade separation of the SDR and at-grade junction improvements to the SAR would have a limited impact on reducing congestion on the existing M4 but could improve safety along the SDR.	All	(+)
2	The nature of the improvement is local rather than regional or national.	All	(0)
3	This would make better use of the SDR.	All	(+)
4	This would make better use of the SDR but this combined with at-grade junction improvements to the SAR would have a limited impact on reducing congestion on the existing M4.	All	(0)
5	Grade separation of the SDR and at-grade junction improvements to the SAR would have a limited impact on reducing congestion on the existing M4.	All	(0)
6	No additional cycle/pedestrian infrastructure is included with the Blue Route, acknowledging that this proposes a scheme rather than a package of measures.	All	(0)

Criteria	Assessment	Distribution Significance	
7	The junction improvements would help to improve road safety, as it is forecast that, on completion, the total number of accidents on major roads in Newport would fall as a result of these improvements. Vehicle trips could increase on the SDR and SAR, potentially leading to an increase in accidents in this area.	All	(0)
8	The Blue Route could provide reductions in the levels of atmospheric pollution to AQMAs by providing an alternative route for traffic when the motorway is congested. There would, however, be increased emissions and deterioration in air quality near the SDR and SAR should traffic volume increase along the Blue Route. The effects of this would impact on existing properties and planned residential/employment development. During construction, air quality could be reduced temporarily with dust impacts and construction vehicles, which would affect residential and commercial properties located near to the SDR and SAR.	All	(0)
9	Traffic transfer onto the upgraded SDR and SAR is likely to be limited and therefore this would result in limited reduction of noise levels along the route of the existing M4. The majority of new noise impacts would be in areas around the SDR and SAR where there are also noise-sensitive areas including the existing and planned residential development at Glan Llyn. During construction, noise pollution could increase temporarily, which would affect residential and commercial properties located near to the SDR and SAR.	All	(0)
10	There would continue to be severe operational problems on sections of the M4 and A48 SDR. It is not clear whether the additional road capacity created would lead to an overall increase in emissions in the longer term.	All	(0)
11	Grade separated junction improvements to the SDR has the potential to improve the driver experience and reduce driver stress, leading to an improved travel experience into South Wales along the M4 corridor.	All	(+)
12	The nature of the improvement is local rather than regional or national.	All	(0)
13	Improved travel conditions on the SDR could provide better strategic traffic management in and around Newport.	All	(+)
14	Once complete, grade separation of the SDR would improve local accessibility in southern Newport, although there could be disruptions to local traffic around the new development sites near the SAR. Access to essential services would be maintained.	All	(+)
15	Improved east-west travel on the SDR and SAR could benefit public transport services that use the route but is likely to increase traffic use of the SDR. The measure would not promote a cultural shift in travel behaviour to more sustainable choices.	All	(--)

Criteria	Assessment	Distribution Significance
Public acceptability	Improvements to operating conditions along the SDR and SAR are likely to be limited, but could provide some network resilience, which could be supported by the public. Closure of some existing junctions could be detrimental to local travel patterns, whilst demolition of properties and impact on residential and employment development is an emotive issue and could attract significant public opposition. Increased traffic volumes along the SDR and SAR could increase air and noise pollution, which could be met with opposition from local communities in this area.	
Acceptability to other stakeholders	Improved resilience and accessibility on the network in southern Newport could be supported by business groups, although the benefits are likely to be limited. Adverse impacts on local communities may be met with opposition from stakeholder groups. Impact on property along the SDR could be significant with additional land take required. Increased traffic volumes along the SDR could increase congestion at Junction 28, which could be met with opposition from commuters and businesses accessing employment sites in this area. Prioritisation of mainline traffic along the SAR could adversely impact on local access to the industrial area and Glan Llyn development site.	
Technical and operational feasibility	The existing roundabouts on the SDR are closely spaced and to comply with highway design standards, some of these roundabouts and junctions could require full or partial closure. These proposals would be challenging to implement as the corridor is constrained by development sites on each side. There are many accesses onto the SAR and at-grade junction improvements with “greenwave” technology is likely to be feasible but would demand good traffic management to limit accessibility problems to the accesses along the SAR. There is also existing ground contamination along the corridor, which would need to be remediated. Any works to the SDR would require contractual negotiations with the SDR concessionaire.	
Financial affordability and deliverability	Land acquisition and property demolition would result in CPO and likely compensation as well as negotiations with SDR concessionaires. Construction of the works could be delivered in phases, which could improve affordability.	
Risks	The option is at a strategy level and therefore the risks require further exploration. Any works to the SDR would require contractual negotiations with the SDR concessionaire.	

4.2.7 Comparative Performance of the Alternative

The comparative performance of the draft Plan and the assessed Blue Route options is summarised below against WelTAG criteria and against the goals (TPOs), acceptability, feasibility, deliverability and risk criteria. The Blue Route report provided the proposer's WelTAG scoring of the Blue Route (without more detailed associated comments). This is also shown in the comparative table below.

Comparative performance of the Blue Route to the draft Plan against WelTAG criteria

Criteria	Draft Plan	Blue Route Paper	Arup Blue Route Scenario 1	Arup Blue Route Scenario 2	Arup Blue Route Scenario 3
Economy					
Transport Economic Efficiency (TEE)	(+++)	(++)	(--)	(--)	(---)
Economic Activity and Location Impact (EALI)	(+++)	(++)	(0)	(+)	(-)
Environment					
Noise	(+)	(+)	(0)	(0)	(0)
Local Air Quality	(++)	(+)	(0)	(0)	(0)
Greenhouse Gas Emissions	(+)	(+)	(0)	(0)	(0)
Landscape and townscape	(---)	(0)	(--)	(--)	(--)
Biodiversity	(---)	(-)	(-)	(-)	(-)
Heritage	(--)	(0)	(--)	(---)	(--)
Water environment	(--)	(0)	(--)	(--)	(-)
Soils	(--)	(0)	(-)	(-)	(-)
Social					
Transport safety	(+++)	(++)	(0)	(+)	(0)
Personal security	(+)	(+)	(+)	(+)	(+)
Permeability	(+)	(+)	(+)	(+)	(+)
Physical fitness	(+)	(+)	(0)	(0)	(0)
Social inclusion	(+)	(0)	(0)	(0)	(0)
Equality, Diversity & Human Rights	(+)	(+)	(-)	(-)	(-)

Comparative Performance of the Blue Route to the draft Plan against Objectives, Acceptability, Feasibility, Deliverability and Risk⁵⁴

Goals	Draft Plan	Arup Blue Route Scenario 1	Arup Blue Route Scenario 2	Arup Blue Route Scenario3
1	(+++)	(0)	(+)	(0)
2	(+++)	(0)	(+)	(0)
3	(+++)	(++)	(++)	(+)
4	(+++)	(0)	(+)	(0)
5	(+++)	(+)	(++)	(0)
6	(++)	(0)	(0)	(0)
7	(+++)	(0)	(+)	(0)
8	(++)	(0)	(0)	(0)
9	(+)	(0)	(0)	(0)
10	(+)	(0)	(+)	(0)
11	(+++)	(+)	(+)	(+)
12	(+++)	(0)	(+)	(0)
13	(+++)	(+)	(+)	(+)
14	(+++)	(+)	(+)	(+)
15	(--)	(--)	(--)	(--)

⁵⁴ The Blue Route Paper does not assess the Blue Route against the objectives

Goals	Draft Plan	Arup Blue Route Scenario 1	Arup Blue Route Scenario 2	Arup Blue Route Scenario3
Public acceptability	<p>The new road could create economic and social benefits. However, the environmental impact of the new motorway along the alignment of M4 CEM Option A is likely to attract opposition from those who prioritise a need to protect the environment over the possible economic benefits of the scheme. The new route would be in close proximity to properties in Duffryn, which may attract opposition in light of noise and air pollution increases in this area.</p>	<p>Improved operating conditions along the SDR and SAR could provide network resilience, which could be supported by the public. Closure of some existing junctions could be detrimental to local travel patterns, whilst demolition of properties and impact on residential and employment development is an emotive issue and could attract significant public opposition. Increased traffic volumes along the SDR and SAR could increase air and noise pollution, which could be met with opposition from local communities in this area.</p>	<p>Improved operating conditions along the SDR and SAR could provide network resilience, which could be supported by the public. Closure of some existing junctions could be detrimental to local travel patterns, whilst demolition of properties and impact on residential and employment development is an emotive issue and could attract significant public opposition. Increased traffic volumes along the SDR and SAR could increase air and noise pollution, which could be met with opposition from local communities in this area.</p>	<p>Improvements to operating conditions along the SDR and SAR are likely to be limited, but could provide some network resilience, which could be supported by the public. Closure of some existing junctions could be detrimental to local travel patterns, whilst demolition of properties and impact on residential and employment development is an emotive issue and could attract significant public opposition. Increased traffic volumes along the SDR and SAR could increase air and noise pollution, which could be met with opposition from local communities in this area.</p>

Goals	Draft Plan	Arup Blue Route Scenario 1	Arup Blue Route Scenario 2	Arup Blue Route Scenario3
Acceptability to other stakeholders	The new road could help address many of the problems caused by congestion on the M4 and thus could attract support and be acceptable to other stakeholders, particularly business groups. However, possible adverse impacts on the environment could attract opposition from environmental groups and the wider public who prioritise a need to protect the environment over the possible economic benefits of the scheme. Further engagement is likely to be needed with specific land owners who may be affected directly by the scheme, including ABP.	Improved resilience and accessibility on the network could be supported by business groups, whilst adverse impacts on local communities and the environment may be met with opposition from stakeholder groups. The scheme is likely to be unacceptable to stakeholders in that grade separation of junctions along the SAR would also require a rationalisation of a number of junctions, reducing local access to the industrial area and Glan Llyn development site, which to resolve would need parallel local access roads further impacting upon a tight corridor. Impact on property could be significant with additional land take required. Increased traffic volumes along the SDR could increase congestion at Junction 28, which could be met with opposition from commuters and businesses accessing employment sites in this area.	Improved resilience and accessibility on the network could be supported by business groups, whilst adverse impacts on local communities and the environment may be met with opposition from stakeholder groups. The scheme is likely to be unacceptable to stakeholders in that grade separation of junctions along the SAR would also require a rationalisation of a number of junctions, reducing local access to the industrial area and Glan Llyn development site, which to resolve would need parallel local access roads further impacting upon a tight corridor. Impact on property could be significant with additional land take required. The significant impact on the setting of Tredegar House Historic Park and Garden is likely to be unacceptable.	Improved resilience and accessibility on the network in southern Newport could be supported by business groups, although the benefits are likely to be limited. Adverse impacts on local communities a may be met with opposition from stakeholder groups. Impact on property along the SDR could be significant with additional land take required. Increased traffic volumes along the SDR could increase congestion at Junction 28, which could be met with opposition from commuters and businesses accessing employment sites in this area. Prioritisation of mainline traffic along the SAR could adversely impact on local access to the industrial area and Glan Llyn development site.

Goals	Draft Plan	Arup Blue Route Scenario 1	Arup Blue Route Scenario 2	Arup Blue Route Scenario3
Technical and operational feasibility	The option is at a strategy level and therefore the technical and operational feasibility risks require further exploration. The new road could include a crossing of the River Usk and could also pass through the Docks Way landfill site. This would require consideration of suitable structures and land contamination issues.	The existing roundabouts on the SDR and accesses onto the SAR are closely spaced and to comply with highway design standards, some of these roundabouts and junctions could require full or partial closure. These proposals would be challenging to implement as the corridor is constrained by development sites on each side, and would most likely result in significant impact upon the Air Products (and COMAH) site to the south side of the SAR. There is also existing ground contamination along the corridor, which would need to be remediated. Any works to the SDR would require contractual negotiations with the SDR concessionaire.	Major works would be required at Junction 28 and Junction 23A. The existing roundabouts on the SDR and accesses onto the SAR are closely spaced and to comply with highway design standards, some of these roundabouts and junctions could require full or partial closure. These proposals along the route would be challenging to implement as the corridor is constrained by development sites on each side, and would most likely result in significant impact upon the Air Products site to the south side of the SAR, which is a COMAH (control of major hazards) site. There is also existing ground contamination along the corridor, which would need to be remediated. Any works to the SDR would require contractual negotiations with the SDR concessionaire.	The existing roundabouts on the SDR are closely spaced and to comply with highway design standards, some of these roundabouts and junctions could require full or partial closure. These proposals would be challenging to implement as the corridor is constrained by development sites on each side. There are many accesses onto the SAR and at-grade junction improvements with “greenwave” technology is likely to be feasible but would demand good traffic management to limit accessibility problems to the accesses along the SAR. There is also existing ground contamination along the corridor, which would need to be remediated. Any works to the SDR would require contractual negotiations with the SDR concessionaire.

Goals	Draft Plan	Arup Blue Route Scenario 1	Arup Blue Route Scenario 2	Arup Blue Route Scenario3
Financial affordability and deliverability	The implementation of a motorway would be dependent upon the availability of funding. Therefore, affordability is an important issue both in terms of timescale and the amount of capital required.	Land acquisition and property demolition would result in CPO and likely compensation as well as negotiations with SDR concessionaires. Construction of the works could be delivered in phases, which could improve affordability.	Land acquisition and property demolition would result in CPO and likely compensation as well as negotiations with SDR concessionaires. Construction of the works could be delivered in phases, which could improve affordability.	Land acquisition and property demolition would result in CPO and likely compensation as well as negotiations with SDR concessionaires. Construction of the works could be delivered in phases, which could improve affordability.
Risks	The option is at a strategy level and therefore the risks require further exploration. The new route could need to negotiate a landfill site requiring legal processes to be successfully considered. Challenge from public and/or stakeholders who may oppose the scheme on grounds of likely environmental or social impact may also require consideration.	The option is at a strategy level and therefore the risks require further exploration. Any works to the SDR would require contractual negotiations with the SDR concessionaire. Challenge from public and/or stakeholders who may oppose the scheme on grounds of likely social impact may also require consideration.	The option is at a strategy level and therefore the risks require further exploration. Any works to the SDR would require contractual negotiations with the SDR concessionaire. Planned improvements at Junction 28 would be compromised by this proposal, which would redevelop Junction 28 with a grade separated junction onto the SDR.	The option is at a strategy level and therefore the risks require further exploration. Any works to the SDR would require contractual negotiations with the SDR concessionaire.

When assessed against the WelTAG criteria, the draft Plan performs very strongly against economic criteria, strongly against social criteria and has moderate to large adverse impacts on the environment (biodiversity, landscape and townscape in particular). When assessed at a strategic level, the draft Plan performs well against the objectives of the M4 Corridor around Newport, although there is an adverse impact against one objective; achieving a cultural shift in travel behaviour towards more sustainable choices.

The provision of a new section of motorway to the south of Newport would provide the opportunity to change the function of the current M4 route around Newport to better integrate it into Newport's road network. For example, this could enable better access to/from residential areas such as Caerleon and St Julians by potentially facilitating the re-opening the western approaches to Junction 25.

Provision of a road link between the M4, M48 and the B4245 would result in benefits to users of the local road network and relief to Junction 23A. Provision of additional cycling and walking infrastructure within the M4 corridor around Newport will help encourage healthy lifestyle choices for local trips, as well as potentially supporting social interaction.

It is worth noting that the Black Route mainly follows and thus has benefits from planning protection as a result of the publication of the TR111 in 2006 whereas the other options represent a new line of investigation. Whilst early dialogue with key stakeholders such as Natural Resources Wales has taken place, it is clear that the draft Plan will impact on affected interests and operations in different ways, depending on the eventual route and design of the Black Route motorway. These are considerations for scheme rather than strategy level appraisal. However, they would be assessed in more detail at the next stage of assessment, should the draft Plan be adopted (with or without amendments taking into account the responses to the associated assessments).

The 'Blue Route' includes upgrades to the SDR and SAR to create an alternative route to the existing M4 through Newport. Appraisal indicates that the impact of additional land take on property and businesses, and the restriction of local accessibility around the SAR, would limit the economic performance of this option. The impact on the environment would be negative overall, with adverse impacts on townscape and heritage in particular. Air and noise pollution would be largely redistributed from the existing M4 to the SDR/SAR area, having a neutral impact overall. Impacts on the community would be largely neutral or minor positive, although impact on local accessibility, property demolition and loss of employment land could attract opposition from the public and stakeholders.

Overall, Arup's appraisal of the Blue Route indicates that it performs neutral or slightly positively for most objectives, acknowledging that it would not achieve Goal 15: a cultural shift in travel behaviour towards more sustainable choices. Whilst the Blue Route Paper did not appraise the alternative against the goals for the M4 Corridor around Newport, Arup's appraisal also suggests that the Blue Route performs poorly when compared to the Black Route, acknowledging that Scenario 2 performs slightly better than Scenario 1 and better than Scenario 3.

It is important to note that transport modelling has indicated little or very little relief to motorway congestion as a result of the Blue Route. Whilst Scenarios 1 and 2 would be likely to result in benefits to traffic flow, these would not be focused on long term relief to the motorway. By 2037, analysis has shown that the traffic levels on the motorway around Newport, with the Blue Route Scenario 1 in place, would exceed theoretical capacity, resulting in severe operational difficulties. With Scenario 3 in place, there would continue to be severe operational problems on most sections of the M4. Even with Scenario 2, which aims to provide an optimal Blue Route to target motorway users, there would still be operational problems on the M4 at the time of opening. This indicates that the Blue Route would not provide a long term solution to traffic-related problems on the M4 around Newport.

4.2.8 Potential interface with public transport measures

Some respondents to the draft Plan consultation suggested a combination of the Blue Route with public transport improvements, including the Cardiff Capital Region Metro.

Consideration of public transport measures is provided in Section 3.1.3 of this document. It concludes that significant investment in public transport measures will lead to positive accessibility benefits across South East Wales, but would not address the objectives for the draft Plan, and would provide limited relief to the M4 around Newport.

Transport modelling has indicated little or very little relief to motorway congestion as a result of the Blue Route. Even in combination with significant investment in public transport measures, the Blue Route would not provide sufficient relief to the M4 Corridor around Newport.

4.2.9 Concluding remarks

Professor Stuart Cole stated in his submission of evidence to the Environment and Sustainability Committee, the primary reasons for putting forward the Blue Route includes:

- *“The uncertainty of current traffic forecasts generally;*
- *Therefore the need to consider if the size of construction (and its cost) is justified;*
- *If it is not justified then unnecessary environmental dis-benefits and damage are incurred;*
- *The opportunity cost of construction if excessive financial allocation is made to this one scheme. It can through either direct (revenue account) expenditure terms or borrowing limits preclude other transport projects;*
- *All motorways of the M4’s age will require major maintenance over the next 5-10 years; and*
- *The proposition is a 2-lane Expressway standard dual carriageway matching lengths of the A470, A48 Carmarthenshire and the A55 will provide the required resilience.”*

In summary, the evidence presented within the M4 Corridor around Newport Consultation Document and appraisal of the Blue Route indicates that:

- It would provide local accessibility benefits, particularly around the A48 SDR but could exacerbate problems at Junction 28 in particular unless there is a free flow junction created;
- An upgraded A48 SDR and A4810 SAR would provide increased network resilience, particularly at times of accidents and delays on the M4;
- It would not address the problems (i.e. the need for the scheme) or achieve the objectives for the M4 around Newport, whilst it performs poorly compared to the draft Plan (Black Route) appraisal;

- The cost of a Blue Route that aims to be attractive to motorway users is likely to cost more than £600m, whilst an optimal solution would cost more than £800m, excluding any allowance for Land and Compensation;
- The provision of a Newport Expressway was first considered in May 2010, when the A4810 SAR was then included as a measure to improve access to the Newport Eastern Expansion Area⁵⁵. As part of its development, and following meetings with the landowners/developers, the Welsh Government included roundabouts and intermediate signal controlled junctions to provide access to existing and planned development sites. In particular, the legal agreements between the Welsh Government and Tata Steel, and the Welsh Government and St Modwen, included drawings that identified the required roundabouts and junctions for access points to the Tata Steel land and operational areas and to the St Modwen development areas. Therefore to upgrade the SAR to “expressway” or motorway standard would require a completely new scheme to be developed that would involve land and property acquisition and major expenditure to provide the necessary motorway standard and the necessary service roads and junctions to serve existing and planned residential and employment land developments;
- The optimal way to achieve the delivery of a through route and a route that provides for local access is by separating out these functions and thus displacing a through route in order to achieve an acceptable alignment to motorway standard. The draft Plan achieves this by providing a new motorway to the south of Newport and allows the SDR to function as a road that provides local accessibility to residential areas and key employment/regeneration sites;
- Forecasts of future traffic volumes show that in the Do Minimum scenario, severe operational problems will be experienced on the M4 around Newport on most links by 2022. By 2037 the motorway around Newport will be heavily congested. With the optimal Blue Route in place, operational problems would continue to be experienced around Newport;
- The risks of the Blue Route include greater economic, environmental and social impacts on communities, property and future development land allocations in the urban area of Newport, also resulting in possible job losses and substantial claims for compensation;
- Compared to the draft Plan (Black Route), the Blue Route would not provide a long term solution to the identified (and acknowledged) problems associated with traffic congestion and journey time variability on the motorway around Newport; and
- The Blue Route in combination with public transport measures would still not provide sufficient relief to the M4 Corridor around Newport.

The Blue Route, either as a stand-alone measure or in combination with public transport measures, is not considered to be a reasonable alternative to the draft Plan. The Blue Route, as considered within this document, should not be taken forward for further appraisal.

⁵⁵ M4 CEM Draft Strategy, Appraisal and Monitoring Report (May 2010)

4.2.10 Black Route alignment options

The M4 Corridor around Newport WelTAG Stage 1 (strategy level) Appraisal concluded that a new section of 3-lane motorway to the south of Newport mainly following the protected (TR111) route, the 'Black Route', in addition to complementary measures, would best achieve the goals and address the problems of the M4 Corridor around Newport, and should be progressed for further appraisal. The Welsh Government subsequently published its preferred strategy in its draft Plan, of which the main element was the Black Route, together with its complementary measures.

Building on this development work, the scheme will include an M4/M48/B4245 connection to the east of Magor.

The Black Route alignment has been assessed at a strategic level in the vicinity of the Newport Docks area. This initial assessment considered six indicative alignment options, including two options based upon suggested alternative alignments proposed by Associated British Ports (ABP) during previous consultation exercises. The assessment is outlined in DMRB assessment⁵⁶, which considers the initial engineering implications of each option. The options include:

1. Option B1 – the Black Route alignment, with a high level crossing over the Docks and the River Usk. No junction in the vicinity of the Docks would be provided to link to the A48 Newport Southern Distributor Road (SDR). This option would have a limited impact upon navigational operations within the Dock and the River Usk and a minimal impact upon the Docks Way Landfill Site. Details of the crossing of the River Usk and Docks are to be informed by further design as part of the DMRB Stage 3 process. However, initial analysis suggests that a 500m main span cable-stayed crossing could avoid any bridge piers being located in the wet channel of the River Usk, which would be likely to significantly reduce environmental risk, but would have a greater landscape impact than the low level crossing options.
2. Option B2 – the same as Option B1, but with the provision of a central junction, connecting the new motorway with the SDR. The crossing cost is likely to be slightly greater than Option B1.
3. Option B3 – the same as Option B2, but provides a low level crossing over the Docks and River Usk to reduce capital cost but may require the extinguishment of some navigation rights, which could impact upon businesses which utilise the Docks and the Wharfs north of the proposed route. The crossing cost is likely to be comparable to Option B2.
4. Option B4 – based on the alignment put forward by ABP, routing further north with a high level crossing over the Docks. This option would have the lowest impact upon navigational operations of all the options considered. The North Dock would be reduced in size, but would remain operational. No junction in the vicinity of the Docks could be provided because of excessive link road gradients for any connection onto the SDR. There would be a significant impact upon the Docks Way Landfill Site. This option would have a significant landscape impact with its close proximity to the Newport Transporter Bridge. The mainline geometry is constrained, resulting in a

⁵⁶ M4 Corridor around Newport – Motorway to the South of Newport: DMRB Stage 2 Assessment Report (2014)

curved alignment for the bridge. It is considered the only feasible option for bridge construction of this curvature would be a viaduct with spans of up to 100m, which would require multiple piers to be placed in the River Usk SAC. Approximate crossing cost is greater than Options B1, B2 and B3.

5. Option B5 – the same as Option B4, but with a low level crossing of the Docks and River Usk which could require the extinguishment of some navigation rights. The North Dock would be reduced in size, but would remain operational. As opposed to Option B4, with the lower level alignment, it is possible to provide a junction within the Docks area to connect the new motorway with the SDR for this option. Similar significant impacts upon the Docks Way Landfill Site would be encountered as for Option B4. Option B5 would be required to cross the River Usk on a viaduct with multiple piers in the river channel, resulting in significant environmental risks for this option. The crossing cost is likely to be comparable to Option B4.
6. Option B6 – would be aligned to the north of the Black Route, but south of Options B4 and B5. Initial analysis suggests that a 500m main span cable-stayed crossing could avoid any bridge towers being located in the wet channel of the River Usk, which could significantly reduce environmental risk. Option B6 would be a low level crossing over the Docks and River Usk, which could require the extinguishment of some navigation rights along the River Usk (to the north of the bridge). The North Dock would be reduced further in size in relation to Options B3 and B4, but would remain operational. Option B6 would provide a junction connecting the new motorway with the SDR. Option B6 would impact the Docks Way Landfill Site to a similar extent as Options B4 and B5. The crossing cost is likely to be greater than that of Option B4 and Option B5.

Options B4, B5 and B6 are significantly more expensive than Options B1 to B3, and are considered to pose significant risks to the project if they were taken forward, specifically in relation to the major impacts to the Docks Way Landfill site.

It is not possible to provide a straight alignment over the bridge, and accord to design standards, for Options B4 and B5. The only feasible structural option for bridge construction is a viaduct with multiple piers within the River Usk SAC. With other less environmentally impacting options available, it is considered that promoting Options B4 and B5 would pose a significant risk to the project.

Options B4, B5 and B6 were therefore rejected and not considered further.

Option B1 is the least expensive option, but does not provide a junction connecting onto the SDR. Provision of a junction within the area of the Docks was identified as important for Newport City Council during the consultation. Option B1 was therefore rejected.

Options B2 and B3 both provide the same level of function, with a neutral cost differential between them. However, Option B2 provides a high-level clearance over the Docks and the River Usk, which could reduce impact to ABP operations and business operations along the River Usk. The low level clearance provided with Option B3 could adversely impact on the operations of North Dock and require potential extinguishment of some navigation rights along the River Usk north of the new bridge.

Whilst vertical alignment does not need to be confirmed in order to inform a preferred route, its potential impacts are likely to significantly affect associated economic assessment.

Based on the perceived benefits and the identified environmental constraints, Options B2 and B3 are recommended for further appraisal.

4.2.11 Junction strategy

The M4 motorway in South Wales performs several roles, which include the following:

- Gateway to England and continental Europe;
- Corridor of economic activity with feeder routes from the Valleys; and
- Linkage between the main coastal urban areas, in particular Newport/Cardiff, Bridgend, Swansea Bay, Llanelli and Carmarthen.

During the public consultation, stakeholders including Newport City Council have expressed concern that the new section of motorway to the south of the city should not be perceived as a bypass. Other stakeholders have also pointed out that there would be economic development opportunities created through the provision of direct links from the new motorway to the city centre and to the Eastern Expansion Area.

An earlier junction strategy, as included within the current TR111 protected route, suggested that the main motorway junction should be located to the east of the River Usk and that this should be supplemented by a partial (east facing) junction in the Duffryn area. More recently the scheme has evolved further, especially around Magor, following discussions with stakeholders. As such, the scheme will include an M4/M48/B4245 connection to the east of Magor.

In addition, the Steelworks Access Road has been built to provide better access between the Eastern Expansion Area, the Southern Distributor Road to the west and Magor to the east. There would now appear to be advantages of a link between the motorway and the Steelworks Access Road in the Glan Llyn area. This would also suggest that a central junction might be better located to the west of the river to provide a more direct route into the city centre and to Newport Docks.

Investigations have shown that a junction could be provided at both of these locations. Preliminary analysis has indicated that suitable junction layouts can be achieved that provide sufficient capacity to cater for forecast future traffic demand.

Based on analysis that shows an additional central junction to the west of the River Usk would benefit the economy and society of Newport, and would be supported by stakeholders, it is recommended that this forms an indicative part of the scheme to be taken forward for further appraisal.

Based on analysis that shows a junction would also benefit the Eastern Expansion Area in Newport and would be complementary to indicative Cardiff Capital Region Metro proposals, it is recommended that this forms an indicative part of the scheme to be taken forward for further appraisal.

4.3 Scheme options for Stage 2 appraisal

The results of Stage 1 (strategy and scheme) appraisal have shown that the Black Route should be progressed for Stage 2 appraisal. The scheme would also provide a connection between the M4, M48 and B4232. The alignment that could be protected for planning purposes is shown in Figure 4.1.

The scheme involves interchanges east of Magor and at Castleton, with further junctions located at Llanwern and centrally, to the west of the River Usk.

4.3.1 Acceptability

As outlined in Section 3.4, the public consultation on the draft Plan demonstrates that the Black Route attracted the most comments of preference from those who responded, compared to the other options, but there is a co-ordinated opposition from interest groups. Most comments of opposition received during the public consultation focused on the environment, with a third of these concerning impact on the Gwent Levels and areas of ancient woodland.

Business interests are generally supportive of a motorway to the south of Newport, whilst the Confederation of British Industry (CBI) strongly promotes the scheme.

Newport City Council has expressed support for a new motorway to the south of Newport, as has the Institution of Civil Engineers (ICE Wales Cymru).

Further engagement with specific land owners will be undertaken during detailed design to engage those who may be affected directly by the scheme.

The acceptability of the project will be tested at public local inquiry.

4.3.2 Technical and operational feasibility

The scheme involves a large estuarial crossing, major earthworks, soft ground, contamination, two motorway interchanges and two intermediate junctions. Technical issues associated with the feasibility of the scheme are outlined within the DMRB Stage 2 Report.

4.3.3 Financial affordability and deliverability

The implementation of the scheme will be dependent upon the availability of funding. Therefore, affordability is an important issue both in terms of timescale and the amount of capital expenditure required.

In summary, a cost estimate based on preliminary design for the scheme is £998M⁵⁷. Value engineering will aim to provide cost savings as part of detailed design.

As well as Welsh Government budgets, it is planned to utilise UK borrowing powers afforded by recent initiatives, including discussions between the Welsh Government and HM Treasury/Department for Transport, as well as the work of

⁵⁷ Including allowance for land, risk and Optimism Bias but excluding VAT

the Silk Commission⁵⁸, which has created future potential funding opportunities for Welsh Government infrastructure projects.

The potential key dates for progressing the scheme are:

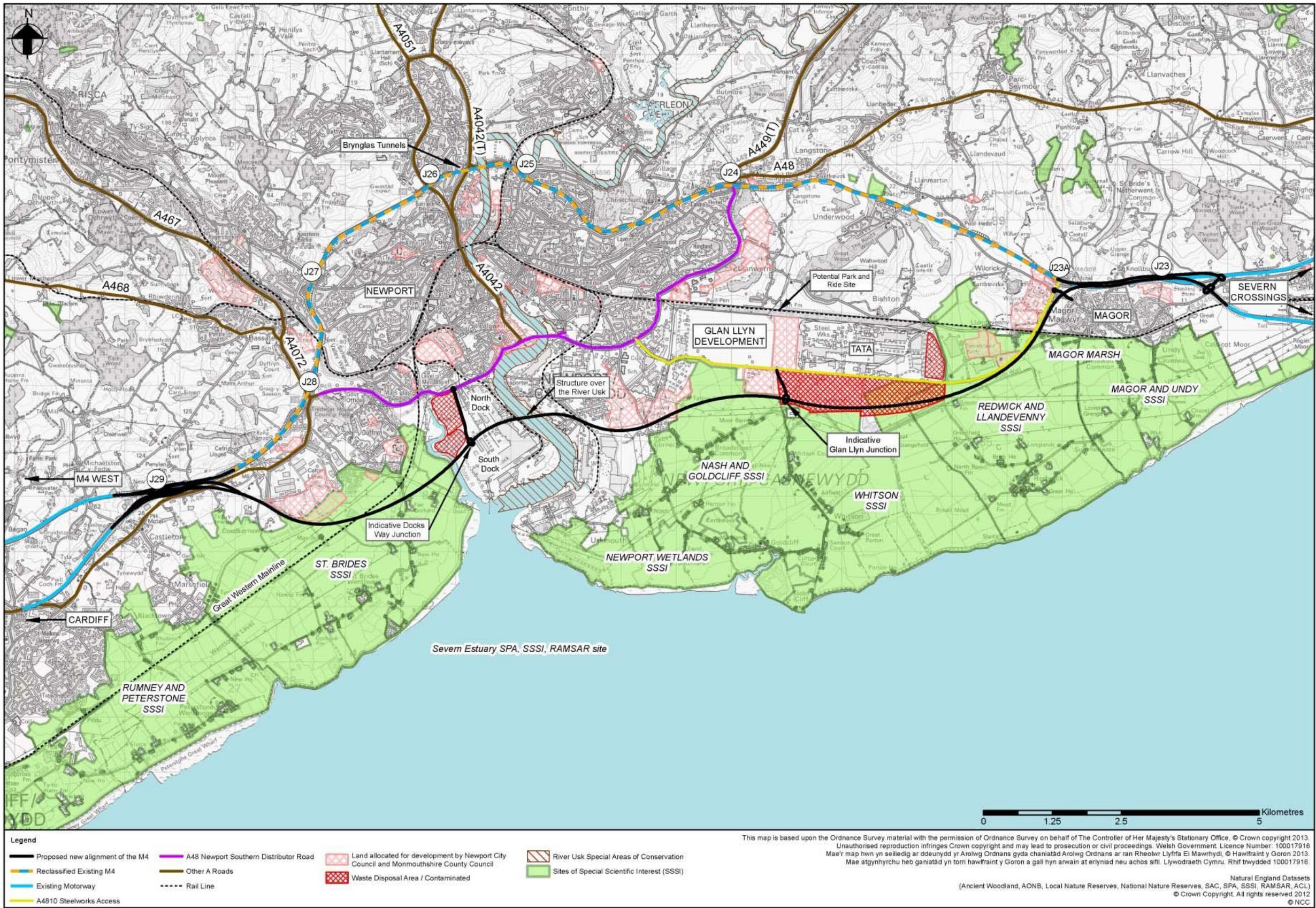
1. Publication of draft Orders and Environmental Statement: Spring 2016;
2. Public Local Inquiry: Winter 2016/2017;
3. Start of Construction: Spring 2018; and
4. Completion of Motorway Construction: Autumn 2021.

4.3.4 Risks

There is a risk of a protracted public local inquiry for this scheme. A quantified risk assessment has been undertaken for the scheme. For further information, please refer to the DMRB Stage 2 Report.

⁵⁸ The ‘Silk’ Commission on Devolution in Wales, which is reviewing the case for the devolution of fiscal powers and reviewing the powers of the National Assembly for Wales, due to report in Spring 2014

Figure 4.1: Scheme alignment for Stage 2 assessment



4.4 Additional scheme consideration: Severn Crossing Tolls end of concession agreement

The Severn Bridges Act 1992 establishes the conditions under which the concession agreement will end, and both bridges crossing the River Severn will revert to public ownership. The Act notes that the concession agreement ends either at:

- The end of the period of 30 years beginning with the appointed day; or
- Where it appears to the Secretary of State that the revenue requirement has been met on a day, the right of the concessionaire to exercise the power to levy tolls shall end at such time after that day as the Secretary of State may determine.

On 6 March 1992 the Secretary of State signed the Order setting the start date of the concession as 26 April 1992.

National Assembly for Wales guidance⁵⁹ states that the amount the concessionaire is entitled to receive in accordance with the concession agreement is a cumulative revenue of £995,830,000, expressed in July 1989 prices. The Highways Agency reviews the projected concession end date every six months using data supplied by Severn River Crossing plc (SRC) to gain assurance that the revenue target will be recovered within the concession period. The Severn Bridges Act 1992 states that once under public ownership, the Highways Agency may continue to levy tolls for a further five years to establish a maintenance fund for both crossings.

A Department for Transport letter to the Welsh Affairs Committee⁶⁰ dated 25 April 2013 states that the latest estimate of the costs that will need to be recovered following the end of the concession is £88M, whilst it expects it to take around one to two years to recover these costs following the end of the concession.

It is therefore the case that unless new legislation is agreed between the Department for Transport and the Welsh Government, the end of concession agreement for the Severn Crossing Tolls will be 2022 at the latest.

Arup analysis⁶¹ suggests that removing the tolls and eliminating any toll associated collection delay could result in an estimated increase in traffic demand across the crossings of 12%. This is equivalent to around 11,000 vehicles per day. This equates to an estimated increase in traffic demand of up to 9% on some sections of the M4 around Newport.

In light of the uncertainty over the future of the Severn Crossing Tolls, the potentially significant impacts on demand likely to be realised by the end of the concession agreement will be considered as a sensitivity test as part of the scenarios for scheme appraisal.

⁵⁹ National Assembly for Wales, Severn Crossings Tolls (2010)

⁶⁰

<http://www.publications.parliament.uk/pa/cm201314/cmselect/cmwelaf/writev/severncrossingtoll/stephenhammond.pdf>

⁶¹ Arup, The Impact of the Severn Tolls on the Welsh Economy Report (2012)

5 Existing and Future Traffic

5.1 Background

In order that traffic forecasts can be developed, a base year traffic model is required that accurately reflects traffic flows and conditions on the existing highway network. An existing SATURN traffic model that had been developed to support the New M4 project was based on traffic observations undertaken in 2005/2006. This model required updating, in order to continue to provide an adequate means of supporting the development of solutions in the M4 corridor around Newport. A specifically designed programme of traffic surveys was thus carried out between March and May 2012 in order to update the base year traffic model. The traffic model was then validated to a 2012 base year in accordance with the Department for Transport's WebTAG⁶² guidance. A Local Model Validation Report⁶³ was prepared in accordance with DMRB guidelines.

Since 2012, there have been a number of important changes affecting the way in which the M4 corridor around Newport traffic model is used to produce traffic forecasts. Values of Time (VoT) and Vehicle Operating Costs (VOC) are published by the Department for Transport in WebTAG. These values are used to derive the generalised cost parameters which govern route choice in the model assignments. Revised values of VoT and VOC were published in August 2012. The base model validation has thus been updated in 2013 using the revised generalised cost parameters. A review has also been undertaken of the variable demand model parameters, which has resulted in changes in these parameters in order to strengthen the various responses (e.g. trip frequency, trip distribution and mode shift) to changes in travel cost. The base model validation was thus further reviewed in 2014, incorporating the revised variable demand modelling parameters and a revised Local Model Validation Report⁶⁴ has been prepared.

A recent review has been undertaken of the current traffic model to ensure that it provides a robust, up to date basis to produce traffic forecasts for this WelTAG appraisal.

5.2 Traffic Surveys in 2012

For the purpose of the model update, a present-year validation required the projection of the 2005 base travel demand matrices to the re-based validation year (2012), with the model outputs compared with 2012 traffic count data. Consequently, a programme of new traffic surveys was undertaken to provide the data for this comparison. These surveys comprised:

- *Automatic Traffic Counts (ATCs)* undertaken by the Welsh Government on the motorway and trunk road network. These comprised conventional ATCs and data derived from the MIDAS (Motorway Incident Detection Automatic

⁶² WebTAG Department for Transport's web-based guidance for transport assessments see www.dft.gov.uk/webtag

⁶³ Welsh Government, M4 Corridor, Newport, Local Model Validation Report, Draft 1, Arup November 2012

⁶⁴ Welsh Government, M4 Corridor around Newport, Local Model Validation Report, Arup, June 2014

Signalling) system. ATCs were also commissioned on a number of strategic routes in Newport.

- *Classified turning counts* over a 12-hour period at 52 key junctions, supplemented by counts at a further 11 junctions that had been undertaken in 2010.
- *Classified link counts* on each section of the motorway network (between the Severn crossings and Cardiff).
- *Journey time surveys* covering 11 routes through the study area. These included the whole of the motorway network in the area, together with key routes on the local highway network.

5.3 Existing Traffic

Traffic flows on the M4 around Newport are continuously monitored using Automatic Traffic Counts (ATCs) and data from the MIDAS (Motorway Incident Detection and Automatic Signalling) system. Traffic flows are often measured in terms of Annual Average Daily Traffic (AADT), which is the average daily traffic flow in any given year.

Table 5.1 shows the observed AADT obtained from MIDAS for each section of the M4 between Junction 23A and Junction 29 during 2013.

Table 5.1: Observed 2013 AADT, Junction 23a to Junction 29

Section	AADT
J23A – J24 (Magor to Coldra)	77,600
J24 - J25 (Coldra to Caerleon)	92,800
Brynglas Tunnels	73,700
J26 – J27 (Malpas to High Cross)	104,200
J27 – J28 (High Cross to Tredegar Park)	104,400
J28 – J29 (Tredegar Park to Castleton)	106,400

These data show that there is a substantial increase in traffic on the M4 to the west of the Coldra (Junction 24), as a result of traffic joining the motorway from the Midlands via the A449. While the Malpas Relief Road slips from Junction 25A reduce the traffic on the 2-lane section through the Brynglas Tunnels, there is a further substantial increase in traffic volumes to the west of Junction 26, and the three sections between the Tunnels and Castleton (Junction 29) carry the highest volume of traffic on the M4 around Newport.

An assessment of the operation of the existing M4 between junctions 23 and 29 has been undertaken. There is no absolute measure of ‘congestion’, in the same way as there is no trigger point of capacity at which the network fails. It is simply a matter of increased traffic flows leading to decreasing speeds, deterioration of operating conditions or a declining level of service as perceived by road users. The Design Manual for Roads and Bridges⁶⁵ uses the concept of the Congestion

⁶⁵ Design Manual for Roads and Bridges, Volume 5, Section 1, Part 3, TA 46/97, Annex D, February 1997

Reference Flow (CRF) as a measure against which to judge acceptable performance for rural roads.

When the ratio of flow to CRF is 100% it is estimated that congestion will occur in approximately half of the weekday peak periods, in the peak direction. However, problems may occur before the ratio reaches 100%. In the assessment of journey time reliability for rural roads, Transport Analysis Guidance⁶⁶ adopts a stress-based approach, which considers the change in the ratio of flow to CRF between 75% and 125%. For the purpose of this assessment, therefore, 75% CRF is taken as the point at which journey time reliability becomes adversely affected and congestion begins to be experienced.

Table 5.2 shows the estimated CRF for the observed 2013 traffic volumes on the different sections of the M4 around Newport.

Table 5.2: Existing Congestion Reference Flows, Junction 23a to Junction 29

Section	CRF	2013 AADT	AADT / CRF
J23A – J24 (Magor to Coldra)	129,000	77,600	60%
J24 - J25 (Coldra to Caerleon)	134,300	92,800	69%
Brynglas Tunnels	82,100*	73,700	90%
J26 – J27 (Malpas to High Cross)	129,300	104,200	81%
J27 – J28 (High Cross to Tredegar Park)	118,000	104,400	88%
J28 – J29 (Tredegar Park to Castleton)	127,600	106,400	83%

* CRF of tunnels assumed to be equivalent of D2 AP road owing to absence of hard shoulder.

The results show that all sections from the Brynglas Tunnels through to Junction 29 at Castleton are currently operating with daily flows over 75% of CRF, indicating that they are subject to stress at times, with frequent congestion during peak periods.

The M4 around Newport also displays characteristics of an urban motorway, as defined in DMRB, passing through a built up area with closely spaced junctions. The performance of urban roads is assessed by comparing the peak hour flows against theoretical capacity. The operational assessment has therefore also compared the one-way peak hour flows on the M4 with the theoretical capacity, or maximum hourly throughput, and the results of this assessment are shown in Table 5.3.

⁶⁶ Transport Analysis Guidance, User and Provider Impacts, TAG Unit A1.3, Department for Transport, January 2014

Table 5.3: Existing Peak Hour Flows and Capacities, Junction 23a to Junction 29

Section	1-way Capacity (vehs/hr)	Highest Average Peak Hour Flow (neutral month)		Maximum Peak Hour Flow	
		(vehs/hr)	Flow/Cap	(vehs/hr)	Flow/Cap
J23A – J24 (Magor to Coldra)	5,600	3,510	63%	4,170	75%
J24 - J25 (Coldra to Caerleon)	5,600	4,050	72%	4,660	83%
Brynglas Tunnels	3,600*	3,170	88%	3,550	99%
J26 – J27 (Malpas to High Cross)	5,600	4,730	84%	5,220	93%
J27 – J28 (High Cross to Tredegar Park)	5,600	5,170	92%	5,790	103%
J28 – J29 (Tredegar Park to Castleton)	5,600	4,850	87%	5,710	102%

* Capacity of tunnels assumed to be equivalent to D2 AP road owing to absence of hard shoulder.

The table shows two levels of peak hour flow: the maximum observed hourly flow during the year, and the average peak hour flow observed during the neutral months (defined as March-June and September-November). It is generally accepted that once hourly flows reach about 80% of the theoretical capacity, operational problems can also be expected, and the results show that the sections west of the Brynglas Tunnels experience significant peak hour operational problems at times.

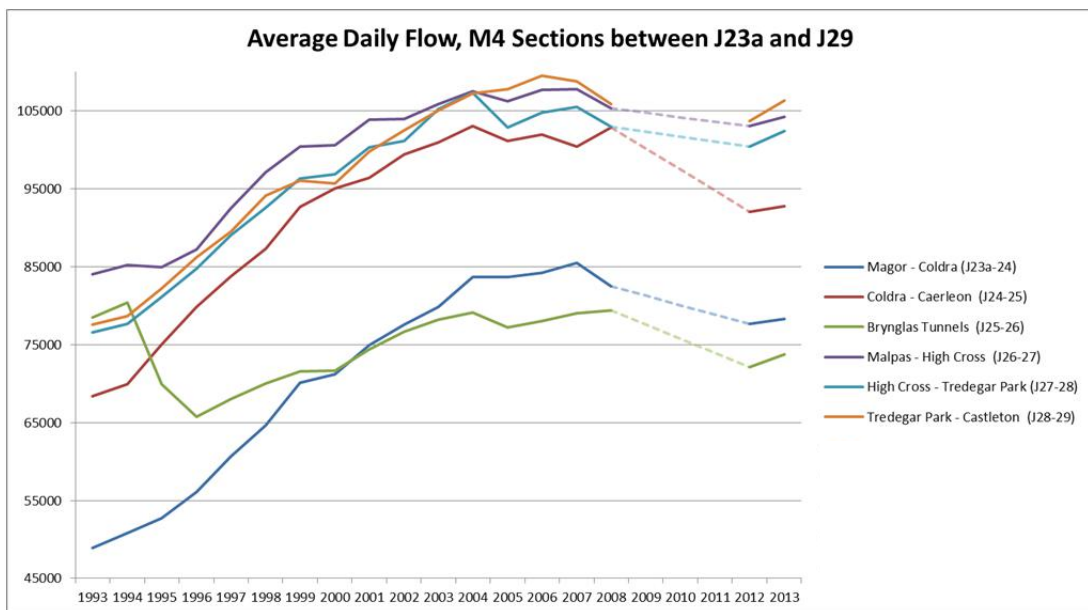
Typical Peak Period Queues on the M4



5.4 Historical Traffic Growth

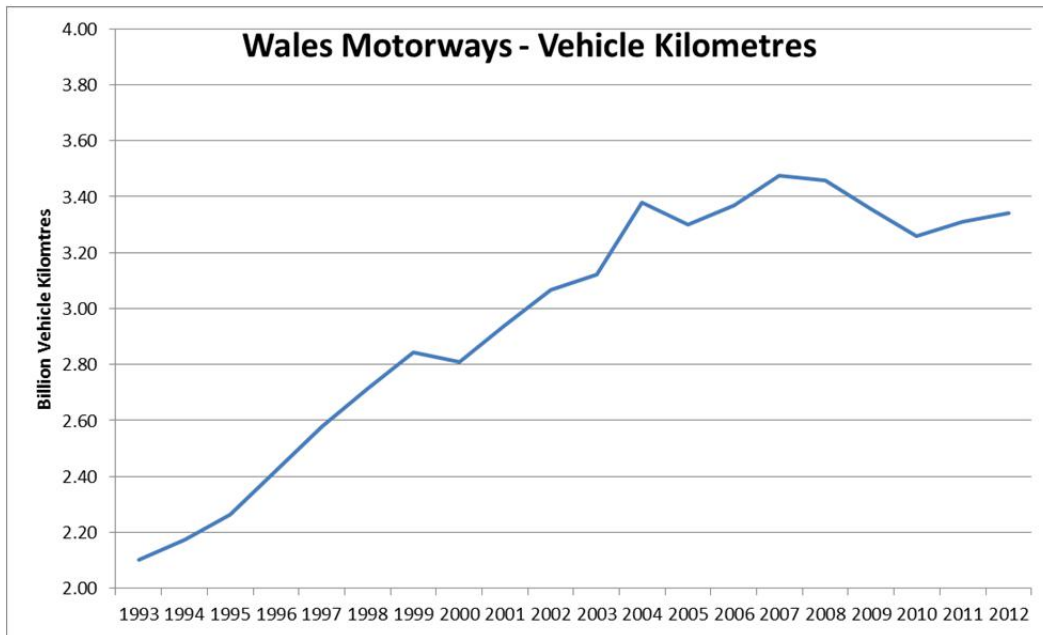
Figure 5.1 shows the growth in traffic volumes on each section of the M4 around Newport over the past 20 years. In general, the trends are characterised by a consistently strong growth from the early 1990s up to about 2006, at which point traffic volumes appear to commence a downward trend, coinciding with the start of the economic recession. Traffic volumes through the Brynglas Tunnels showed a significant drop in 1995/6 as a result of the opening of the Malpas Relief Road Scheme and the slip road connections from Junction 25a. Thereafter growth in traffic through the tunnels resumed to the point in 2008 where it was only marginally below the traffic volume experienced immediately before the Malpas slips were opened.

Figure 5.1: Average Daily Flows, M4 Junction 23a to Junction 29



Data for the three-year period 2009-2011 is unavailable as during this time major roadworks were in place on the M4 between Junction 24 and Junction 28 which severely disrupted the permanent count sites, and any data that was available is considered unrepresentative owing to the impacts on vehicle operations. Following the completion of the roadworks and the commencement of the variable speed limit operation around Newport, however, the 2012 flows showed a reduction from the 2008 level that would be consistent with the period of economic recession. Data from 2013, however, showed an increase of 1-3% on all sections from 2012, indicating that traffic growth has occurred as the country emerges from recession.

The traffic growth trends on the M4 around Newport are mirrored in the Welsh Government statistics for vehicle kilometres on motorways in Wales (essentially relating to the M4 in South Wales), as shown in Figure 5.2. This shows a similar strong growth in the use of the motorway up to a peak in 2007, followed by a dip to 2010 as the economic recession took hold. The statistics, however, show two years' of growth from 2010 to 2012, suggesting that the growth around Newport between 2012 and 2013 is likely to represent the resumption of the upward trend in traffic growth.

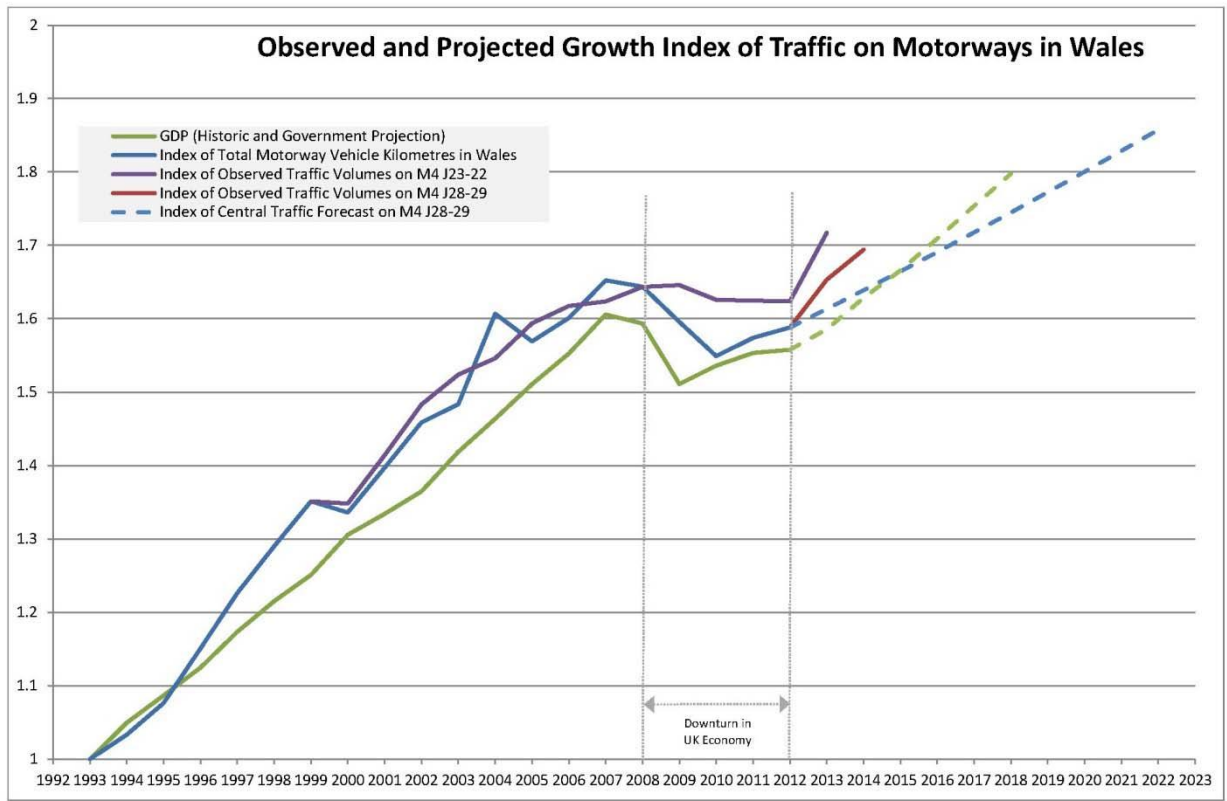
Figure 5.2: Vehicle Kilometres on Welsh Motorways

5.5 Traffic Growth Trends

Observed and projected growth of traffic for the motorway immediately west of the Severn Bridge (J22 – J23), between Newport and Cardiff (J28 – J29) and the total motorway travel in Wales are shown in Figure 5.3. Gross Domestic Product (GDP) growth trends are also shown on Figure 5.3. The following is a commentary of what the analysis shows:

- Close correlation between GDP and traffic growth historically (if anything traffic growth has been marginally higher than GDP before the economic downturn);
- Close correlation between growth in total motorway vehicle kilometres and traffic volumes on Second Severn Crossing;
- Downturn in UK economy seems to have had slightly less impact on traffic on Second Severn Crossing than on general motorway travel in Wales;
- Observed traffic growth post economic downturn (on Second Severn Crossing and J28-29) is significantly higher than the central growth traffic forecasts used in the M4 model and observed growth rates have recovered to similar levels (if not higher) compared to those seen before the economic downturn;
- Government central GDP projections show significantly higher growth than central traffic forecasts, so traffic projections may be conservative; and
- There is no evidence to support that traffic demand on the M4 motorway has peaked as the recent stagnation in growth was closely linked to the UK economic downturn and medium-term predictions are for economic growth at similar rates to those pre downturn.

Figure 5.3: Observed and Projected Growth Index of Traffic on Motorways in Wales



5.6 Traffic Model Validation

The 2005 base traffic model was updated to 2012 to incorporate subsequent changes to the highway network, including the signalisation of the Junction 24 roundabout at the Coldra together with the ‘hamburger’ layout; traffic management measures in the centre of Newport; and the revised junction layout at Cardiff Road / Commercial Street.

The base year travel demand was also updated to 2012, to incorporate revisions contained in the 2010 Newport traffic model developed by Capita, and additional traffic related to subsequent developments in the area.

The updated 2012 traffic model was validated in accordance with the procedures set out in the Design Manual for Roads and Bridges (DMRB) and the Department for Transport’s Transport Analysis Guidance (WebTAG). Validation was carried out on the mainline motorway links between Junction 23a and 29, together with a screenline of links crossing the River Usk in the Newport area.

All of the motorway links, in both directions, met the validation criteria in each of the three modelled time periods. On the Usk screenline, the screenline totals met the validation criteria in both directions in each of the three time periods. All of the individual links also passed the criteria in each of the three time periods. The results therefore indicated that the validation base of the traffic flows is very good.

The average times observed on the 11 journey time routes surveyed in 2012 were also validated in the base model. Each route met the required validation criteria in both directions in all three time periods.

5.7 Traffic Forecasting

A Do Minimum network used for the traffic forecasts includes those highway schemes that are considered to be committed. These are:

- Tredegar Park Roundabout (Junction 28), and associated improvements;
- A465 Heads of the Valley dualling (Abergavenny to Hirwaun); and
- Newport Eastern Expansion Area, link connecting the Steelworks Access Road to a signalised junction at A48/Cot Hill (2037 design year only).

Future year traffic forecasts have been prepared for a Do Minimum scenario and for a road network which includes the motorway to the south of Newport using the re-based 2012 SATURN traffic model. A Traffic Forecasting Report⁶⁷ has been prepared in accordance with WebTAG unit 3.15. Variable demand modelling has been deployed using DIADEM (Dynamic Integrated Assignment and Demand Modelling)⁶⁸ in accordance with WebTAG unit 3.10.

For appraisal purposes, the following future years are modelled:

- 2022 (assumed year of scheme opening); and
- 2037 (design year).

The DfT's latest TEMPRO (version 6.2) growth forecasts, which became definitive in July 2011, have been used in developing future year demand matrices for private vehicles. The National Transport Model⁶⁹ has been used to develop future year demand for freight movements.

The revised TEMPRO forecasts show a lower short-term rate of traffic growth than those used previously. In the longer term, however, the rates of growth of trips during peak periods in Wales have been forecast in TEMPRO to be higher than those previously used. This is based on regional projections for future population, household numbers, jobs and workers.

The treatment of uncertainties over demographic, economic and behavioural trends in forecast traffic growth is described in WebTAG unit M4 ("Forecasting and Uncertainty"). This requires an appropriate range to be explored around the core scenario growth forecast. Application of the guidance for the M4 Corridor around Newport results in the following uncertainty ranges for traffic forecasts:

- $\pm 7.91\%$ of base year matrix in 2022; and
- $\pm 12.50\%$ of base year matrix in 2037.

⁶⁷ Welsh Assembly Government, M4 Corridor around Newport – Motorway to the South of Newport, Traffic Forecasting Report, Arup, July 2014

⁶⁸ DIADEM – Department for Transport see <http://www.dft.gov.uk/topics/appraisal-evaluation/tools/diadem>

⁶⁹ Road Traffic Forecasts: Results from the Department for Transport's National Transport Model, Department for Transport, 2013

As a consequence, traffic forecasts have been prepared for low, central and high growth scenarios. The main analysis has been based on central forecasts with low and high growth applied as a sensitivity, particularly for the economic assessment.

Traffic forecasts from the three hourly models (AM peak, interpeak and PM peak) have been combined and factored to Annual Average Daily Traffic (AADT) forecasts using factors derived from observed automatic count data on the motorway around Newport. The resulting traffic forecasts for selected road links around Newport are summarised in Table 5.4 for central growth.

Table 5.4 – Annual Average Daily Traffic Forecasts in Vehicles (2-way Central Growth)

Link	2012	2022		2037	
	Base	Do Minimum	Motorway south of Newport	Do Minimum	Motorway south of Newport
J29-J28	102,900	122,000	72,500	142,200	85,800
J28-J27	102,000	116,700	71,600	135,100	86,000
J27-J26	104,200	119,700	74,100	137,000	86,900
J26-J25a (Tunnel)	69,200	80,500	34,900	94,800	44,600
J25a-J25	89,500	105,200	59,400	124,000	72,600
J25-J24	92,600	108,600	62,800	129,300	77,900
J24-J23a	77,300	89,400	38,200	105,900	47,100
J23a-J23	68,300	82,200	36,800	98,600	43,800
J29-Docks (New M4)	-	-	60,000	-	76,700
Docks-Glan Llyn (New M4)	-	-	56,000	-	69,400
Glan Llyn-J23 (New M4)	-	-	58,400	-	72,200

The results show that, in the Do Minimum situation (without the new section of motorway to the south of Newport), traffic volumes on links of the existing M4 around Newport would increase by 31-44% by 2037, with the heaviest flows experienced on the links west of the Brynglas Tunnels. The motorway to the south of Newport is predicted to carry some 70,000 – 77,000 vehicles per day by 2037, resulting in a significant reduction in traffic on the existing M4, where flows would be expected to remain below current levels.

Further information on future traffic forecasts for the road network around Newport is contained in the Traffic Forecasting Report for the motorway to the south of Newport.

6 Economic Assessment

6.1 Overview

An economic assessment of the motorway to the south of Newport has been carried out in accordance with the advice given in DMRB and WebTAG⁷⁰. In accordance with HM treasury guidance, the assessment is undertaken for a 60-year period from the proposed scheme opening year (2022).

In order to assess the costs and benefits that might be associated with the motorway to the south of Newport, traffic conditions in the assumed year of scheme opening (2022) and the design year (2037) are compared with those in the Do Minimum. The values of all costs and benefits are converted to the Present Value Year, defined in WebTAG as 2010. They are also discounted from the year in which they occur to 2010, using the discount rates defined in WebTAG, to give the Present Value of Costs (PVC) and the Present Value of Benefits (PVB). The Net Present Value (NPV) is calculated by subtracting the PVC from the PVB, while the Benefit-Cost Ratio (BCR) is calculated by dividing the PVB by the PVC.

6.2 Investment Costs

There are three main elements of the cost estimate⁷¹ for the scheme as follows:

- *The base cost* – this covers the basic costs of the option before allowing for risks;
- *Adjustment for risk* – which covers all the identified risks as assessed and quantified through a Quantified Risk Assessment (QRA) resulting in the risk adjusted cost estimate; and
- *Adjustment for Optimism Bias* – to reflect the well-established and continuing systematic bias for estimated scheme costs and delivery times to low and short respectively. This results in an uplift to the cost estimate.

The investment costs (i.e. capital costs) are distinguished from operating costs. The main components of investment costs for the new section of motorway to the south of Newport are:

- *Construction* costs including main works, ancillary works, statutory undertakings, site supervision and testing;
- *Land and Property* costs including compensation;
- *Preparation and Administration* costs including project management, design, public consultation, Public Inquiry, gaining statutory powers, surveys, compensation, supervision and testing; and

⁷⁰ WebTAG Department for Transport's web-based guidance for transport assessments in particular units 3.1, 3.5, 3.10 and 3.15

⁷¹ See the Estimation and Treatment of Scheme Costs, WebTAG unit 3.5.9, DfT, August 2012

- *Traffic Related Maintenance* costs including reconstruction, resurfacing, surface dressing etc.

6.2.1 Risk and Optimism Bias

In the context of the appraisal, there is likely to be some difference between what is expected and what actually happens. This may be due to bias, which may be unwittingly inherent in the appraisal, as well as risks and uncertainties that might materialise during the course of the project. It is thus important to identify and mitigate risks and make allowances for “Optimism Bias”.

In order to adjust the base cost for the risks associated with the cost of the motorway to the south of Newport, a Quantified Risk Assessment (QRA) has been undertaken.

As the motorway to the south of Newport has been developed, the scheme cost estimate has been refined over time.

6.2.2 Costs for Inclusion in Appraisal

The current estimate of the risk-adjusted scheme forecast cost (including Optimism Bias) is as follows:

Estimated Scheme Cost (excluding VAT) £998m

Investment costs are included in Transport Economic Efficiency (TEE) and Public Accounts (PA) tables. The investment base cost estimate is adjusted for risk and Optimism Bias and the DfT’s TUBA⁷² appraisal software carries out further adjustments required in deriving the “appraisal” cost estimations for input to the TEE and PA tables.

During the appraisal, the risk and Optimism Bias adjusted cost estimate in 2010 prices is discounted to the standard base year (2010) using standard discounted rates. The discount rate is 3.5% for the first 30 years (ie 2022 – 2051) and 3% for each year thereafter (ie 2052 – 2081).

The aggregated cost estimates used in the TUBA economic assessment are shown in Table 6.1. These include the estimated cost of traffic-related maintenance, which is deemed likely to be needed during the appraisal period. However, no allowance for VAT is included in the input TUBA cost estimates as this is dealt with by the software as part of the analysis. The current cost estimate is for a Q4 2013 price base. For appraisal, this cost estimate is converted to DfT’s standard base year (2010) prices.

Table 6.1: New M4 Project Aggregated TUBA Costs in Q4 2013 Prices (£)

Item	Total including Risk and Optimism Bias (excluding VAT)
Construction	£813,727,408
Land	£82,250,000
Preparation	£97,102,636
Supervision	£4,920,581

⁷² Department for Transport – TUBA Guidance – Version 1.9.4, Atkins, June 2014

Sub Total: (Scheme Cost)	£998,000,626
Maintenance	£613,337,800
Total	£1,611,338,426

6.3 Transport Economic Efficiency (TEE)

Guidance on undertaking economic assessments for transport schemes is given in WelTAG, DMRB Volume 13 and the WebTAG 3.5 series of Guidance Documents.

The economic impacts are derived by comparing the future year situation with the motorway to the south of Newport (Do Something scenario) against that without the new motorway (Do Minimum). The economic assessment appraises the costs and benefits of a transport scheme that are accrued over a 60 year period in monetary terms. In order to ensure consistency, all monetary values are discounted to a common price base to give 'present values'. The current price base year for economic assessments stipulated by the Guidance is 2010.

The benefits are broadly made up of the following:

- Journey time savings;
- Vehicle operating cost savings;
- User charges, such as tolls; and
- Additional costs to travellers due to disruption during construction and maintenance works.

In undertaking the economic assessment, monetised time, operating cost and accident savings arising as a result of provision of the motorway to the south of Newport together with those occurring on the existing M4 and elsewhere on the road network are compared with the expected future situation without the motorway to the south of Newport. Allowance is made for changes in indirect taxes (eg fuel duty) and monetised values have been put on CO₂ emissions (climate change impacts). The Do Minimum, in this case, includes all recent network modifications (such as the Junction 24 improvement, the VSL system and the Steelworks Access Road) and any committed interventions (such as the Junction 28/Bassaleg Roundabout/Pont Ebbw Roundabout improvement).

In October 2011, the Department for Energy and Climate Change (DECC) published 'Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal and Evaluation', which provides guidance on a new methodology for carbon valuation in UK policy appraisal based on the estimated abatement costs per tonne of carbon dioxide equivalent to achieve the government's emissions targets. This has resulted in an increase in costs associated with CO₂ emissions.

The Department for Transport's TUBA (v1.9.4) software has been used to process the traffic model outputs, together with updated cost data, to produce the economic assessment summarised in Tables 6.2, 6.3 and 6.4 for central growth forecasts.

With the motorway to the south of Newport, benefits occur that relate to the 'Economic Efficiency' of the transport system and these are presented in Table 6.2 as a summary of Transport Economic Efficiency (TEE).

Table 6.2: Results of Economic Assessment of the Motorway to the South of Newport (Central Forecasts) – Transport Economic Efficiency**Consumers****User Benefits (£000)**

	All Modes Total	Road Personal	Bus Passengers
Personal Travel			
Travel Time	622,381	622,381	0
Vehicle Operating Costs	-20,583	-20,583	0
User Charges	0	0	0
During Construction & Maintenance	51,732	51,732	
NET CONSUMER BENEFITS	653,530 (1)	653,530	0

Business**User Benefits**

		Personal	Freight	Passengers
Travel Time	1,052,890	669,571	383,319	0
Vehicle Operating Costs	100,505	35,598	64,907	0
User Charges	0	0	0	0
During Construction & Maintenance	87,120	56,645	30,475	
Subtotal	1,240,515 (2)	761,814	478,701	0

Private Sector Provider Impacts

Revenue	32,229	31596	633	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	32,229 (3)	31596	633	0

Other Business Impacts

Developer contributions	0	(4)	0
NET BUSINESS IMPACT	1,272,744 (5)	(5) = (2) + (3) + (4)	

TOTAL (£000)

Present Value of Transport Economic Efficiency Benefits	1,926,275 (6)	(6) = (1) + (5)	
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Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Table 6.3: Results of Economic Assessment of the Motorway to the South of Newport (Central Forecasts) – Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	780,466	780,466	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	877,231	(8) 877,231	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-34,501	-34,501	
TOTALS			
Broad Transport Budget	877,231	(9) = (7) + (8)	
Wider Public Finances	-34,501		

Notes:

- 1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 2) All entries are discounted present values in 2010 prices and values.

Table 6.4: Results of Economic Assessment of the Motorway to the South of Newport (Central Forecasts) – Analysis of Monetised Costs and Benefits

Greenhouse Gases	-15,782	
Consumer User Benefits	653,530	
Business User Benefits	1,240,515	
Private Sector Provider Impacts	32,229	
Other Business Impacts	0	
Accident Benefits	60,835	
Wider Public Finances(Indirect Taxation Revenues)	34,501	
Present Value of Benefits (PVB)	2,005,829	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	877,231	
OVERALL IMPACTS		
Net Present Value (£000)	1,128,598	NPV=PVB-PVC
Benefit to Cost Ratio	2.29	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

The term ‘public accounts’ relates to costs that might be faced by Government (either local or central), including:

- Operating Costs;
- Investment Costs; and
- Indirect tax revenues, where a positive value indicates a reduction in income (cost) to government through fuel duty etc. as a result of the scheme. A negative value indicates an increase in income to government due to the scheme.

The Public Accounts costs are presented in Table 6.3.

The Analysis of Monetised Costs and Benefits (see Table 6.4) presents a summary of the costs and benefits listed above. It also includes benefits due to savings in accidents and carbon emissions, which would be negative should either of these increase. The total benefits given in the TEE Table are combined with the accident and carbon benefits to give a Present Value of Benefits (PVB). The Present Value of Costs (PVC) is the total costs taken from the Public Accounts Table.

The Analysis of Monetised Costs and Benefits Table also presents the Net Present Value (NPV) and Benefit to Cost Ratio (BCR) for the scheme. The NPV is calculated by subtracting the present value of costs (PVC) from the total present value of benefits (PVB). The BCR is calculated by dividing the PVB by the PVC.

A positive NPV and a BCR greater than unity indicate that the benefits due to the scheme outweigh its costs and so it is positive in economic terms.

As referred to in Section 5.7, the economic assessment has covered low, central and high traffic forecasts. A summary of the monetised costs and benefits for each growth scenario is provided in Table 6.5 and the summarised Transport Economic Efficiencies tables are provided in Appendix B. An Economic Assessment Report⁷³ has been prepared, which provides further details of the analysis and how the results have been arrived at.

Table 6.5: Summary of Monetised Costs and Benefits by Level of Traffic Growth

	Traffic Growth Forecasts		
	Low	Central	High
Present Value of Benefits (PVB) (£000)	1,536,384	2,005,859	2,807,412
Present Value of Costs (PVC) (£000)	877,231	877,231	877,231
Net Present Value (NPV) (£000)	659,153	1,128,598	1,933,181
Benefit to Cost Ratio (BCR)	1.75	2.29	3.27

Note: All entries are discounted present values in 2010 prices and values

Thus, the benefits that would accrue as a result of the motorway to the south of Newport would be expected to out-weight the costs by between £0.66bn and

⁷³ Welsh Government, M4 Corridor around Newport – Motorway to the South of Newport, Economic Assessment Report, Arup, July 2014

£1.93bn; and there would be a likely return on the investment of some 175% to 330%.

To further demonstrate the need for the new section of motorway, an economic assessment has been undertaken of the hypothetical situation where traffic levels remain constant at 2012 levels into the future, ie **no traffic growth**. A summary of the monetised costs and benefits is provided in Table 6.6 and the summarised Transport Economic Efficiency (TEE) tables are provided in Appendix B. Table 6.6 shows that, even if there was no additional traffic on the road network beyond 2012, the benefits of the scheme (£939m) would exceed the costs (£877m), providing a Net Present Value for the scheme of +£62million.

Table 6.6: Summary of Monetised Costs and Benefits assuming No Traffic Growth (2012 Base)

Present Value of Benefits (PVB) (£000)	939,162
Present Value of Costs (PVC) (£000)	877,231
Net Present Value (NPV) (£000)	61,931
Benefit to Cost Ratio (BCR)	1.07

Note: All entries are discounted present values in 2010 prices and values.

In Section 4.4 the removal of the Severn Crossing Tolls by 2022 was discussed. Removal of the tolls and elimination of delays associated with toll collection will result in increased traffic demand. An economic assessment has been undertaken of the likely impact of toll removal for the central growth scenario. The results are shown in Table 6.7 and the summarised Transport Economic Efficiency (TEE) tables are provided in Appendix B.

Table 6.7: Summary of Monetised Costs and Benefits with No Severn Crossing Tolls (Central Growth)

Present Value of Benefits (PVB) (£000)	2,317,754
Present Value of Costs (PVC) (£000)	877,231
Net Present Value (NPV) (£000)	1,440,523
Benefit to Cost Ratio (BCR)	2.64

Removal of the Severn Crossing Tolls would result in increased benefits due to the motorway to the south of Newport such that the Net Present Value of the scheme is estimated to increase to more than £1.4bn with a Benefit to Cost Ratio of 2.64.

In Section 4.2.10, alignment options for the motorway to the south of Newport included an option with no junction in the vicinity of the Docks (Option B1). An economic assessment of this option has been undertaken as a sensitivity test to provide an indication of the benefit of providing a centrally located junction as part of the preferred scheme. The results are shown in Table 6.8 and the summarised Transport Economic Efficiency (TEE) tables are provided in Appendix B.

Table 6.8: Summary of Monetised Costs and Benefits with No Junction in the Vicinity of Newport Docks (Central Growth)

Present Value of Benefits (PVB) (£000)	1,682,564
Present Value of Costs (PVC) (£000)	847,779
Net Present Value (NPV) (£000)	834,785
Benefit to Cost Ratio (BCR)	1.98

With no centrally located junction, the NPV of the scheme reduces from £1.1bn to around £0.8bn with a Benefit to Cost Ratio of 1.98.

6.4 Wider Impacts

DfT guidance (TAG Unit A2.1) provides a framework for estimating a number of wider economic benefits which are considered to be *additional* to the Transport Economic Efficiency benefits⁷⁴. Therefore it is possible to derive an adjusted benefit-cost ratio which captures the indirect benefits of a transport improvement that are excluded from the standard cost-benefit assessment. The Wider Impacts framework is based on the following elements:

- **Agglomeration economies** – the productivity benefits for firms of increasing the effective concentration of economic activity;
- **Increased output in imperfectly competitive markets**– welfare gains to consumers of increased turnover impacts of lower transport costs; and
- **Increased labour supply** – lower commuting costs encouraging increased labour market participation and changing patterns of employment.

Over the appraisal period, the above Wider Impacts have a Net Present Value of £715.8m, representing an uplift of 37% on the user benefits contained in the appraisal. Agglomeration effects make up the majority of Wider Impacts.

Table 6.9: Summary of Wider Impacts (£m 2010 Prices)

Wider Impact	Net Present Value (Discounted)
Agglomeration (no employment relocation)	562.7
Output in imperfectly competitive markets	130.0
Labour supply impact (no residential relocation)	23.1
Total	715.8

⁷⁴ WebTAG 3.5.14

If Wider Impacts are included in the appraisal, the total Net Present Value of the scheme rises from £1.13bn to £1.84bn and the BCR for the scheme rises to 3.10. Therefore, consideration of Wider Impacts further reinforces the conclusion that the scheme offers high value for money. The adjustment to the economic assessment is shown in Table 6.10.

Table 6.10: Summary Business Case including Wider Impacts

	Standard Economic Assessment	Adjusted Economic Assessment (including Wider Impacts)
PVB (£m, 2010)	2,006	2,722
PVC (£m, 2010)	877	877
NPV (£m, 2010)	1,129	1,844
BCR	2.29	3.10

Wider Impacts and GDP

The purpose of the economic assessment is to quantify the impacts of the scheme on welfare such that the societal costs and benefits can be compared. The inclusion of Wider Impacts acknowledges that the indirect effects of the scheme on the economy result in further benefits that should be taken into account.

The Wider Impacts analysis also provides an overall estimate of the net impact of the scheme on GDP at a national (UK) level. Table 6.11 summarises the total welfare and GDP benefits from the scheme.

Table 6.11 Summary of Welfare and GDP Benefits

Benefits	Welfare (£m, 2010)	GDP (£m, 2010)
Business user benefits	1,300	1,300
Commuting user benefits	233	
Leisure user benefits	473	
Transport user benefits - conventional appraisal	2,006	
Increase in labour force participation		58
Agglomeration benefits	563	563
Imperfect competition	130	130
Exchequer consequences of increased GDP	23	
Additional to conventional appraisal	716	
Total benefit	2,722	2,050

Overall, the scheme delivers cumulative GDP impacts of over £2bn in Present Value (2010) terms. The Economic Activity and Location Impacts (EALI) assessment given in Section 6.5 considers how these GDP effects may be distributed geographically.

6.5 Economic Activity and Location Impacts (EALI)

The EALI considers the potential impacts of a transport improvement on the *real* economy, rather than the transport sector alone. Conventional transport assessment focusses on the benefits to users of reduced travel time savings and vehicle operating costs. Such impacts are captured in the Transport Economic Efficiency assessment and comprise the welfare implications of a scheme. However, the economic consequences of transport improvements extend beyond the direct cost savings experienced by individuals and businesses.

The EALI is focussed on understanding how transport improvements affect the economic choices made by those businesses and individuals and the consequences for economic activity and economic outcomes. For example, transport improvements can influence decisions about where to work, where to invest and where to live. The EALI is also concerned with the economic impact of the scheme at a particular spatial level - local or regional impacts rather than national impacts. Many transport infrastructure improvements will result in positive economic impacts at a local level, for example, opening up land for development or providing improved access to a retail centre, but without necessarily affecting total employment or income at a national level.

6.5.1 Transport and economic development

A number of studies have sought to identify the relationship between transport and economic development. The Eddington Review,⁷⁵ was a comprehensive attempt to understand the relationship between transport and the economy in a UK context. The Eddington Review concluded that targeted, well thought out transport infrastructure investment can significantly improve economic performance:

'...the performance of the UK's transport networks will be a crucial enabler of sustained productivity and competitiveness: a 5 per cent reduction in travel time for all business travel on the roads could generate around £2.5 billion of cost savings – some 0.2 per cent of GDP.'

The review set out a framework for the assessment of transport investments based on micro economic drivers. The economic drivers of transport improvements are as follows:

- Business efficiency;
- Business investment and innovation;
- Clusters/agglomerations;
- Labour market;
- Competition;
- Domestic and international trade; and
- Globally mobile activity.

⁷⁵ The Eddington Study, Main Report to the Chancellor of the Exchequer and the Secretary of State for Transport, 2006

The most relevant drivers of economic development in the context of the M4 are discussed further in this section.

Business Efficiency

The Eddington Review concluded that, where the transport network is established, transport improvements are most likely to deliver economic benefit where the investment is a response to signals of transport demand exceeding capacity. This is of relevance in the context of the M4. A recent study by the Centre for Economics and Business Research (2012) entitled ‘the economic costs of gridlock’ analysed the number of ‘wasted hours’ in congestion for commuting, business travel and freight. It found that the UK incurred a total of cost of £4bn in 2011 due to the traffic congestion. These estimates, however, exclude the costs related to poor reliability which makes it difficult for individuals and businesses to plan their journeys and are of particular concern to the logistics sector and other business sectors, such as those dealing in perishable goods or those that rely upon Just In Time (JIT) delivery.

Agglomeration Effects and the Labour Market

The Eddington Review particularly noted the potential role of transport in driving agglomeration effects. Agglomerations are clusters or spatial concentrations of economic activity. They occur because firms derive productivity benefits from locating in close proximity to other firms, markets or a supply of suitable labour. The study noted three ‘economies of agglomeration’:

- ‘better matching of people to jobs and access to skilled labour, as a result of dense labour markets
- connection to suppliers and markets
- information spillovers between firms’

Agglomeration effects are of particular interest in the context of the new motorway to the south of Newport because, as identified later in this section, agglomeration effects are considered to be a source of untapped potential for the economy of South Wales. For example, the Welsh Government’s Economic Renewal Strategy notes that:

‘the absence of a major conurbation (by European standards) is associated with wages and productivity levels that are lower than would otherwise be the case (the “agglomeration effect”); however, there is a key opportunity in the medium term to build on the projected rapid population growth of Cardiff, our capital city.

This EALI assessment explores how the proposed scheme could act to deepen the economic concentration of the ‘sevenside agglomeration’ in order to stimulate economies of agglomeration.

Business Investment

The effects of improved transport on land use and locational patterns are another important but poorly understood impacts of transport investment. The factors influencing business investment decisions are wide ranging. They include, for example, the availability of suitable premises, access to a suitable workforce and access to customers and suppliers). Whilst these do not relate to transport directly, transport plays a contributing role. For example, the quality of the transport system will impact on the pool of labour available to a business.

Mapping the distribution of employment in South Wales suggests that the ‘M4 corridor’ strongly influences business location, at least for some sectors. As well as local accessibility, access to London and Heathrow Airport may be an important consideration for potential investors from overseas. Anecdotally, a 2-hour drive time to/from Heathrow has been considered to be an approximate benchmark for investors and it is instructive that Newport County Council identifies a ‘2 hour’ drive time to Heathrow as part of the City’s offer to investors⁷⁶.

Competition

The direct benefits of transport improvements can influence the patterns of economic activity by influencing markets and competition between firms. When considering the impact of a transport improvement at a local or regional level it is important to address the ‘two-way road’ argument; whilst transport improvements may reduce the costs for local firms entering new markets, equally, reduced costs might expose local firms to competition from elsewhere. The net effect on increased competition resulting from a transport improvement will depend on a complex set of factors such as the homogeneity of products, the size of local markets and the backward and forward linkages between firms. It should be noted that improved transport may be expected to benefit firms in lower cost economies at the expense of higher cost firms and this may characterise, for example, the relationship between Newport and Bristol on the M4 corridor. There is a lack of empirical evidence on the conditions in which an improvement in transport in a region could result in negative impacts. In any case, should the two-way road effect be strongly prevalent, it might be expected that businesses within a region would lobby for worsened rather than improved transport conditions.

Overview

In conclusion, the overall message from the literature is that transport is a necessary rather than sufficient requirement for economic success. There are no general rules about the impact of transport investment that can be applied across all areas and therefore any analysis must begin with an assessment of local economic and transport conditions in order to understand the degree to which poor transport acts as a constraint on economic activity and the degree to which the proposed improvement will deliver an improvement.

6.5.2 Economic Context

A study area has been defined for the specific purposes of the EALI assessment. This is broadly considered to be the ‘area of influence’ of the scheme based on proximity to this section of the M4 considering commuting travel to work areas and patterns of travel more generally.

Given the strategic importance of the M4, the area of influence of the scheme is considered to extend beyond the Newport and the immediate surrounding area. The study area for the EALI assessment therefore covers the collection of local authorities either side of the River Severn in Wales and England, extending from Swansea across the River Severn to Stroud, and from Bath and Northeast

⁷⁶ http://www.newport.gov.uk/_dc/index.cfm?fuseaction=locateinnewport.homepage

Somerset in the south to the Forest of Dean in the north.⁷⁷ This area incorporates the major urban centres of Swansea, Cardiff, Newport and Bristol on the M4 corridor.

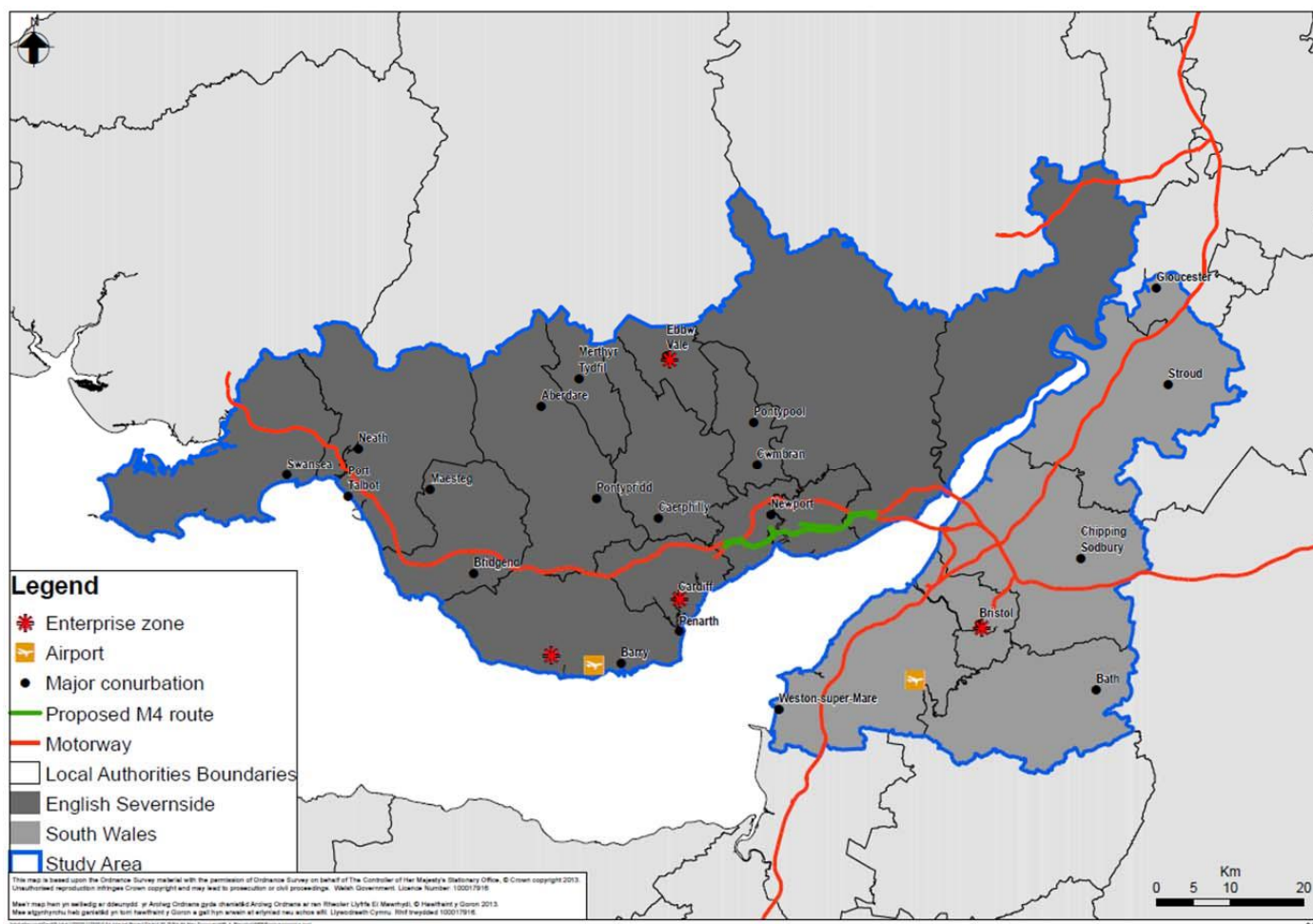
For ease of reference the baseline refers to the Welsh areas within the study area as 'South Wales' and the English areas within the study area as 'English Severnside.'

As discussed later in this section, the new motorway would improve connections between these settlements and across the region as a whole. Newport is most directly affected by the scheme as a result of the creation of two new junctions on the new route; the Central Docks Junction and Llanwern Junction. Whilst accessibility within Newport and between Newport and surrounding areas would improve in a general sense, these junctions would be expected to enhance access to key employment sites in the south of Newport. Therefore, local impacts on land use and the economy in Newport are considered to be worthy of specific attention.

The following baseline assessment of the economy considers:

- overall economic performance within the study area;
- the structure of the economy and the economic geography of the study area;
- commuting patterns and the importance of the M4, and;
- the local economic context.

⁷⁷ Full list of local authorities – Blaenau Gwent; Bridgend; Caerphilly; Cardiff; Carmarthenshire; Merthyr Tydfil; Monmouthshire; Neath Port Talbot; Newport; Pembrokeshire; Rhondda, Cynon, Taff; Swansea; Torfaen; Vale of Glamorgan; Bath and North East Somerset; City of Bristol; Forest of Dean; Gloucester; North Somerset; South Gloucestershire and Stroud. It should be noted for some analysis local authorities close to the scheme have been split to provide greater granularity. These zones are Newport East, Newport West, Cardiff East, Cardiff West, Rhondda Cynon Taff North, Rhondda Cynon Taff South, Caerphilly North, Caerphilly South, Torfaen North, Torfaen South, Monmouthshire North and Monmouthshire South.

Figure 6.1: Key Infrastructure in the Study Area

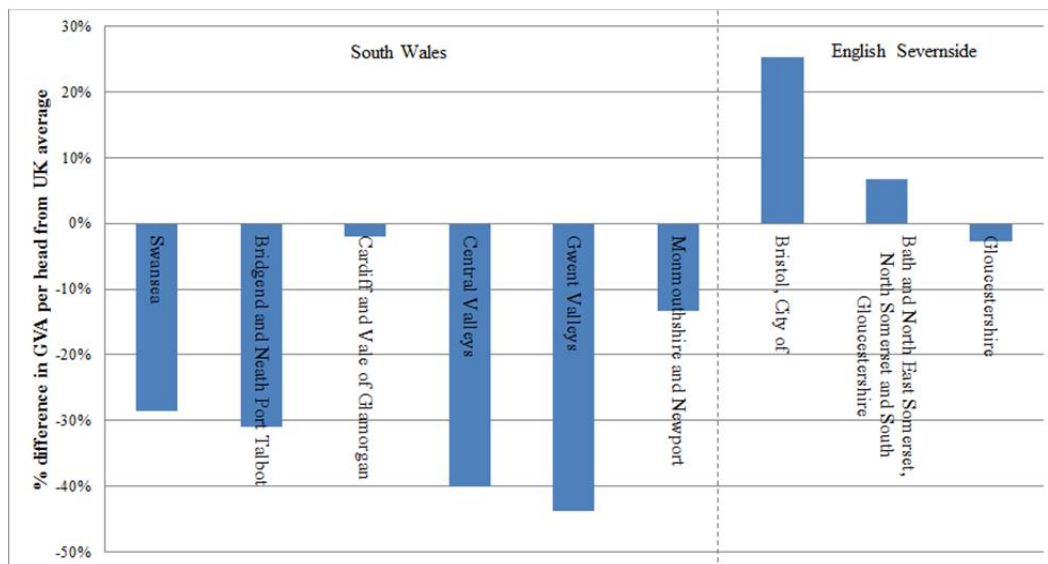
6.5.2.1 Comparative Economic Performance

A useful indicator of overall economic performance is Gross Value Added (GVA) which provides a measure of the value of goods and services produced by an economy.⁷⁸ GVA per head provides a measure of the relative strength of the economy in different areas, although at the local level it should be noted that commuting flows can provide a distorted picture of overall wellbeing.

There is a longstanding gap in economic performance between Wales and England. In 2012, GVA per head in Wales was 71% of the UK average. Notably the gap between England and Wales widened in the five years since 1997.

Although the situation is more complex at a local or regional level, the gap in economic performance is also reflected in the variation in economic performance within the study area. Figure 6.2 suggests a disparity in GVA per head of South Wales and the English Severnside. It is well established that the South Wales valley areas have suffered long term economic underperformance and it is notable that the Central Valleys and Gwent Valleys areas had GVA per capita in 2012 of 40% and 44% less than the UK average respectively. These results need to be interpreted with care because GVA per head is higher in areas with high net inwards commuting and low in areas with net outward commuting. However, it is notable that the GVA per capita of Cardiff (and the Vale of Glamorgan) is significantly lower than that of Bristol.⁷⁹

Figure 6.2: Difference in GVA per head from UK average, 2012



Source – Office for National Statistics, 2014

One of the reasons that explains lower GVA per head in Wales is that a smaller proportion of the population in Wales are in employment, either because of the

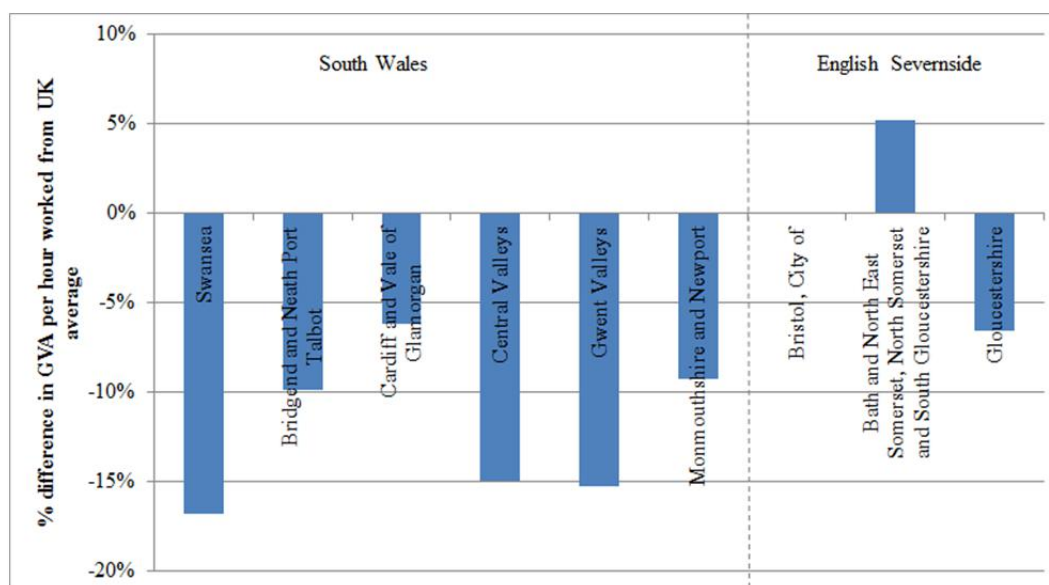
⁷⁸ GDP is more formally defined as the difference between output (the value of all goods and services produced in an economy) and the cost of intermediate inputs that are used in production.

⁷⁹ It should be noted that the Regional Gross Value Added (GVA) figures are provided at NUTS3; which includes grouped local authorities and the map shows this with its inclusion of the wider Gloucestershire area which lies outside the study area

demographic characteristics of Wales or because of lower economic activity rates and engagement in the labour market. However, as can be seen from Figure 6.3, this only partially explains the difference in economic performance. Figure 6.3 shows GVA per hour worked rather than per head and is therefore a better measure of productivity. Overall, the economy of South Wales exhibits levels of productivity of around 88% of the UK average.

One of the distinguishing features of the UK economy is that the high levels of productivity in London and the South East ‘skew’ the average level of productivity and hence this might be expected. However, comparing Cardiff and Bristol directly suggests that there may be a more general trend of lower productivity moving west along the M4 corridor.

Figure 6.3: Difference in GVA per hour worked from UK average, 2012



Source – Office for National Statistics, 2014

There are a number of explanatory factors which account for the productivity gap between Wales and the UK. Inevitably the picture is highly complex with many historic and longstanding factors. Notably, Wales has lower skills levels than the UK average with a particularly high proportion of the population with low skills levels or no formal qualifications. South Wales has a higher proportion of the working age population with no qualifications than English Severnside (27% compared to 20%) and a lower proportion qualified to level 4 and above (24% compared to 30% in English Severnside). Clearly this is in itself the product of a complex set of economic, social and cultural factors.

Related to skills levels, the industrial structure of South Wales is such that there is a more limited presence of ‘high value added’ sectors and, relative to the South West, a lower than average density of high technology or knowledge intensive sectors. This is explored further in section 6.5.2.2.

These factors alone, however, fail to fully account for the productivity gap. An empirical study undertaken for the Welsh Government has attempted to understand the relative importance of different factors in explaining the

productivity gap⁸⁰. The most recent study undertaken in 2009 concluded that, at a firm level:

‘...productivity is partially determined by geographical features such as population density and distance. The key distance variable is distance from London.’

At an industry level, distance from London (as measured by travel time) was a significant factor in explaining productivity differentials across all sectors other than catering and transport. Furthermore the research also finds that ‘cluster effects’ – the concentration of firms in particular sectors – are a significant explanatory variable. This reinforces previous research into Wales productivity that estimated that the productivity of the average firm fell by 0.7% for every 10% increase in travel time.

A further study on productivity in Wales considered specifically the role of peripherality in determining levels of productivity. The study concluded that access to towns and cities at a more local scale has a stronger relationship with productivity than accessibility at a national level (i.e. between towns and cities across the UK).

In considering the policy implications of the research the study concludes that:

‘The benefit to more peripheral regions of physical transport infrastructure investment, such as improved rail or road links is at one level an obvious response to issues of accessibility and peripherality.’

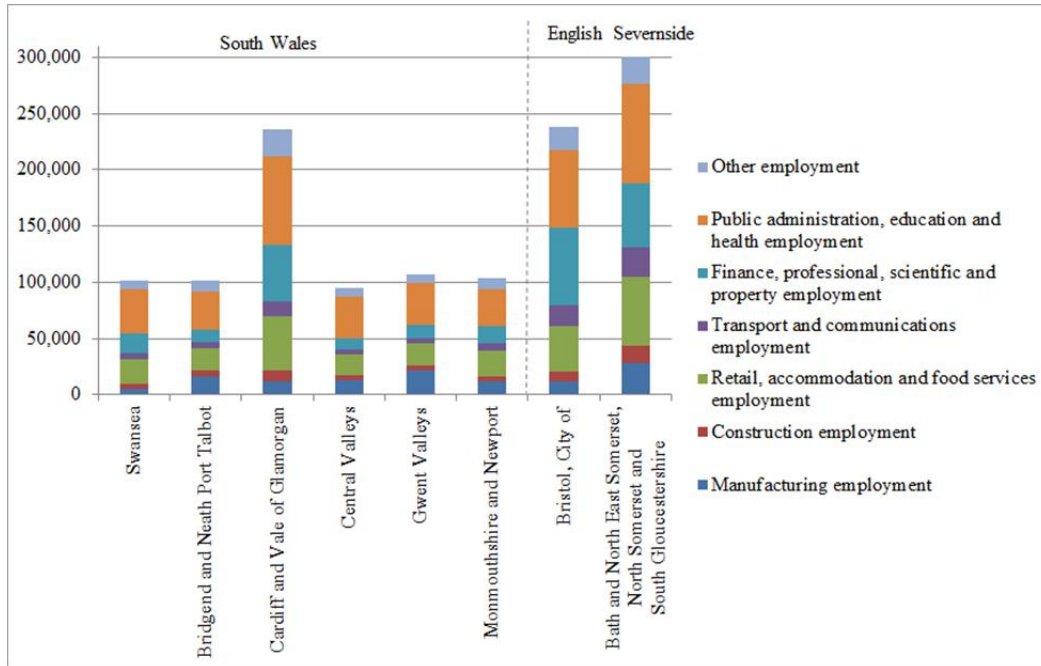
‘By UK standards, however, (Cardiff) is nevertheless relatively limited in terms of economic mass certainly compared with London and the SE but also Birmingham and the midlands, or Manchester/Liverpool. This suggests that there are still benefits to be secured by addressing the barriers presented by the Severn Crossings and in particular the real and perceived effects of congestion and disruption on the M4 and M5.’

In overview, the research, supports the conclusion of the Economic Renewal strategy that the lack of a major agglomeration is a determinant of economic performance, but interestingly it also suggests that connectivity between South Wales and London plays a role in economic performance. Economic geography in the context of the M4 is considered further below.

6.5.2.2 Economic Structure and Geography

Figure 6.4 shows the proportion of employment in different sectors for groups of local authorities in the study area. The differences in economic structure are not marked and can be explained to some extent by the degree of urbanisation. Notwithstanding this, the South Wales authorities have a higher proportion of the workforce employment in manufacturing as well as in public sector functions such as health and education. The English Severnside shows a slightly higher level of employment in professional services.

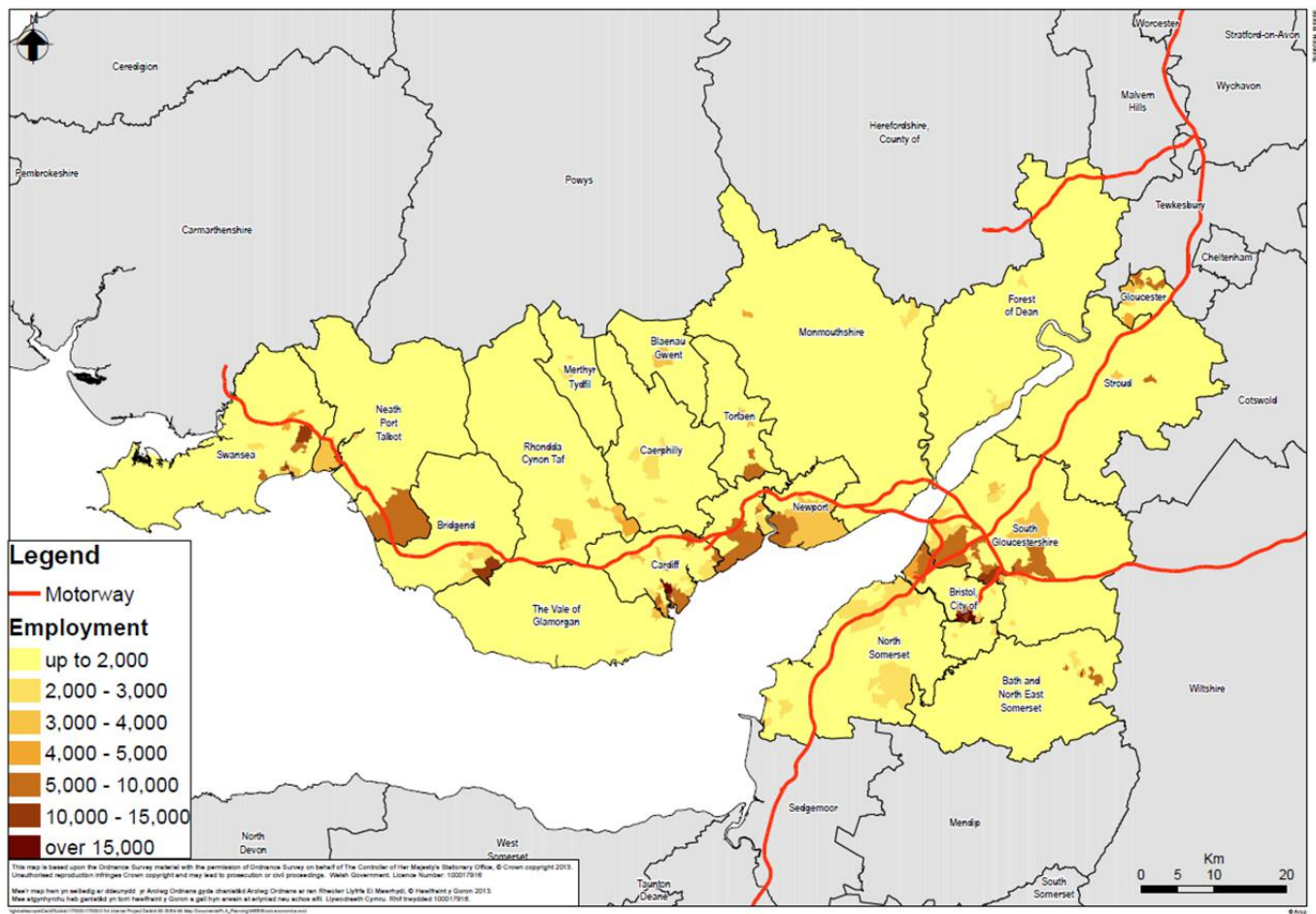
⁸⁰ Understanding the productivity variations between Wales and the UK.

Figure 6.4: Employment by Sector, 2012

Source – Office for National Statistics, 2014

The distribution of economic activity (employment) across the study area is shown in Figure 6.5. It is possible to identify concentrations of employment in the major urban centres of Swansea, Cardiff, Newport and Bristol. The existence of the 'M4 corridor' in economic terms can be discerned from the data given that employment is concentrated in the southern strip of South Wales and in Bristol and South Gloucestershire through which the M4 passes. To an extent this is to be expected given that the motorway network has developed to link the most populous areas, but land use patterns are indicative of the importance of the M4 corridor.

Figure 6.5: Employment within the Study Area, 2011

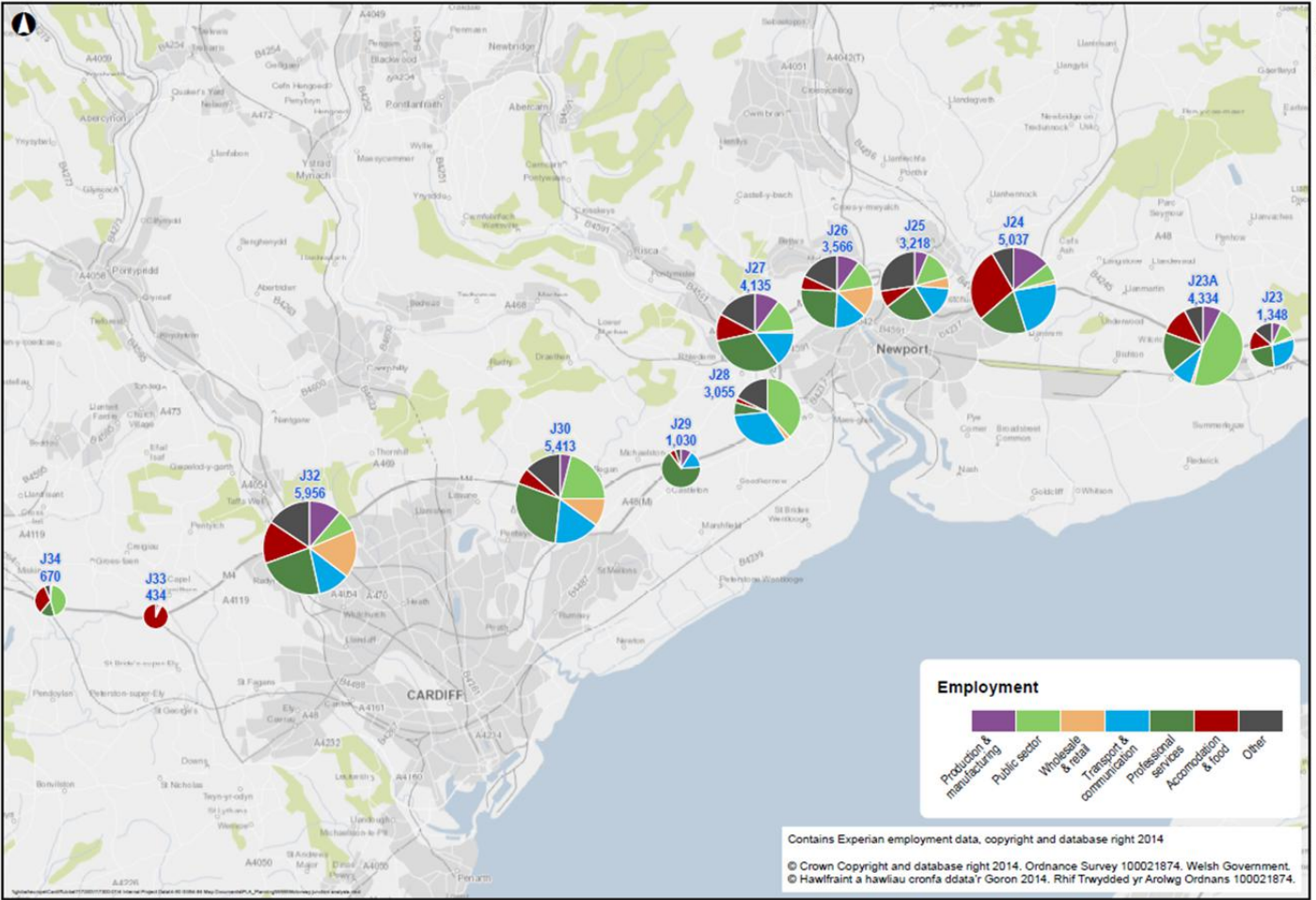


The role of the M4 in influencing land use and patterns of economic activity is further illustrated in Figure 6.6 which provides estimates of the number of jobs located adjacent to a junction of the M4 in the area surrounding Newport and Cardiff. The number of jobs has been estimated within a 1km boundary of the centre of each junction in order to capture firms that are located in business parks at the junction, or are afforded easy access to the M4 via an adjacent route.

The number of jobs at each junction varies from 434 jobs (Junction 33) to 5,956 jobs (Junction 32). Of the 12 junctions considered, 8 have local employment of in excess of 3,000 jobs. There will be a variety of factors that determine the degree of development around a junction. Planning restrictions are likely to play a key role (as is likely to be the case for Junction 33) as will the physical constraints on development imposed by residential areas (Junctions 25 and 26). Furthermore, access to the local road network will be important. For example, junction 29 is the confluence of the M4 and A48 but provides no access to the surrounding area. Another influence is likely to be proximity to Cardiff or Newport and it is notable that the junctions with the highest levels of employment (23, 24, 27, 30 and 32), with the exception of Junction 23, are situated on the outskirts of the cities.

Whilst this analysis is necessarily crude, it does suggest that, planning constraints allowing, an M4 junction in South Wales might be expected to attract in the region of 3,000 to 5,000 jobs to the immediate local area. This is a significant conclusion in the context of the new motorway scheme which will include two new junctions to the south of Newport.

Figure 6.6: Employment within 1km buffer of motorway junctions

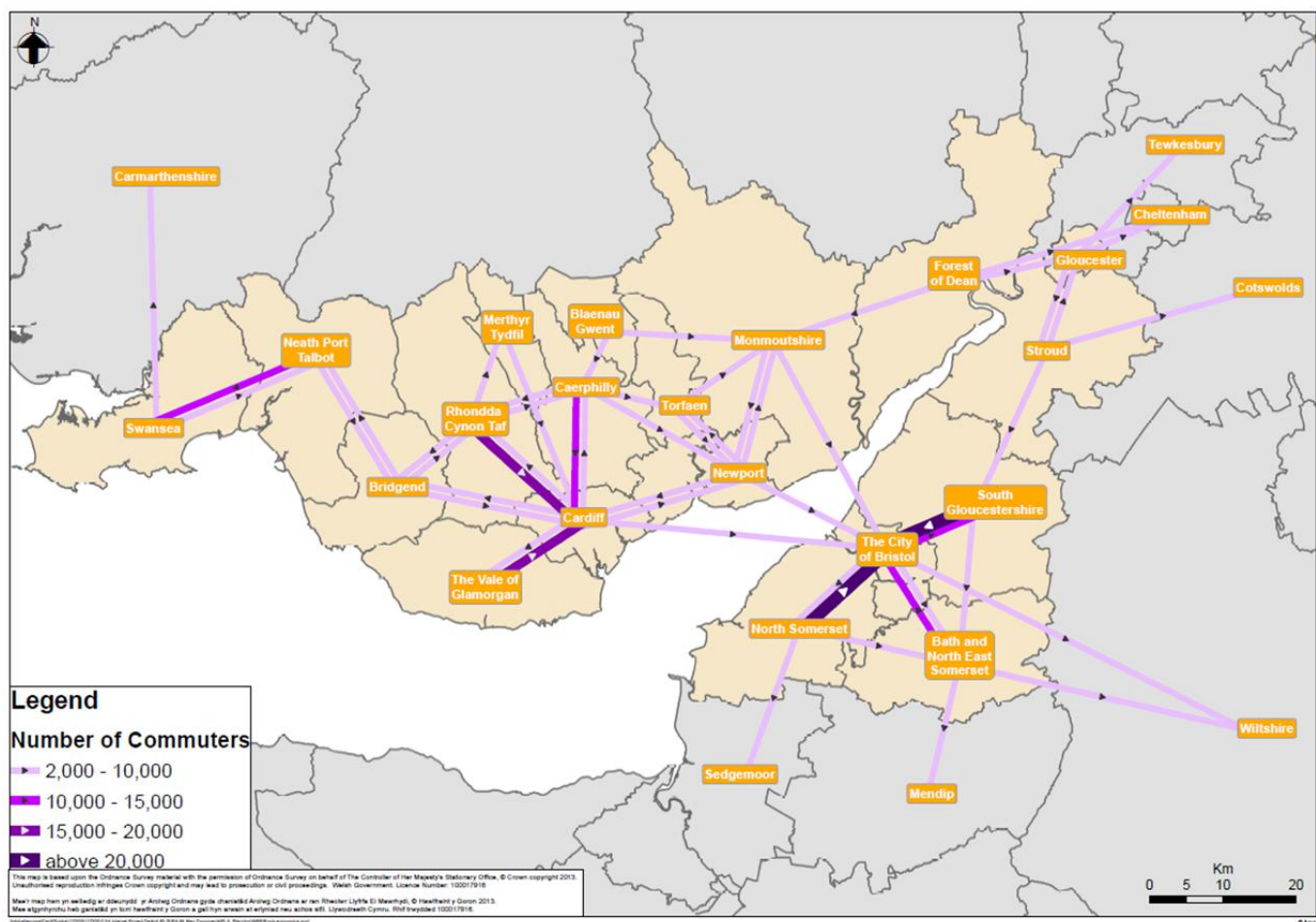


6.5.2.3 Labour Market and Commuting

Figure 6.7 shows the main commuting flows within the study area from the 2011 Annual Population Survey. This data shows flows of 2,000 daily commuters or more (disregarding those who travel within a local authority area to work). The immediate conclusion is that commuting patterns in South Wales are highly complex with a web of commuting flows between the key employment centres. North-south commuting patterns into Cardiff and Newport are strongly represented but the figure also highlights the importance of commuting flows along the M4 corridor between Cardiff and Newport. Given that transport by car accounts for the majority of commuting trips, it is likely that the motorway plays a key role in enabling these movements.

Movement of workers between South Wales and Bristol are also highly significant, although it is notable that a much larger number of Welsh residents travel to work in Bristol than travel in the reverse direction. The commuting data shows that, around 13,800 commute from South Wales to English Severnside while 6,700 commute from English Severnside to South Wales. This reflects the relative strengths of the economies and the relative wage rates between east and west, as well as factors such as property prices.

Figure 6.7: Commuting Flows within the Study Area, 2011



6.5.2.4 Local Economic Context

Overall Performance and Structure

Data on the GDP of the Newport economy specifically is not available. However, a comparison of wage rates shows that Newport had an average wage 4% lower than Cardiff and 8% lower than the UK in 2013.⁸¹

Lower wages rates are partly reflects in the economic sector structure, with a tendency towards lower value added sectors. Newport has a high proportion of employment in the retail, accommodation and food services sector (21%). Compared to Cardiff the key difference is a higher proportion of employment in manufacturing (12% compared to 4% in Cardiff) and a lower proportion of employment in finance, scientific and professional services (16% compared to 24% in Cardiff).

Unemployment is higher than the Wales average, based on the 2011 Census the unemployment rate in Newport was 5.3% compared to 4.3% in Wales.⁸² This ties in with commentary in the Newport Economic Strategy⁸³ notes that, whilst employment growth had helped recover from major job losses in 2002 following the closure of Llanwern Steel, that over 5,000 jobs have been lost in Newport in the latest economic recession.

Newport also has relatively high levels of deprivation. The Welsh Index of Multiple Deprivation 2011 shows areas within the 20% most deprived in Wales clustered around the city centre with lower concentrations of deprivation across the rest of the local authority. Improving skills levels and economic activity levels can help address deprivation issues in the area.

Economic Geography

As shown in Figure 6.8, employment in Newport is relatively dispersed with clusters of employment on the edges of the city and a relatively small commercial and administrative centre. This is reinforced by the analysis of employment around M4 junctions which identified 3,000-5,000 jobs within 1km of junctions 23a to 29 around Newport. Further key employment areas are the Newport Docks and industrial sites to the south of the Southern Distributor Road.

Labour Market and Commuting

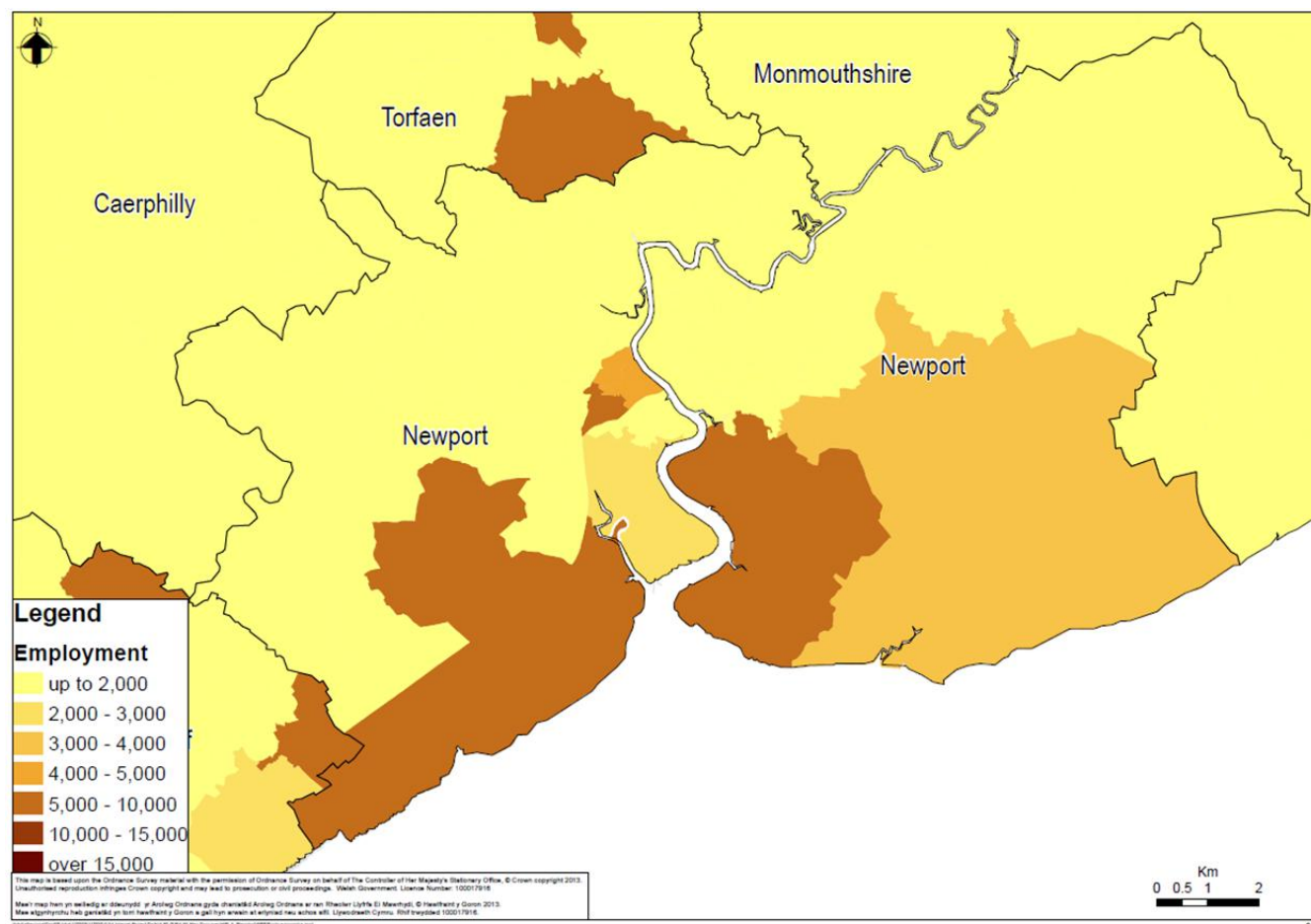
With regard to the labour market, Newport has a net inflow of commuters with around 29,600 commuting in to the local authority while 19,700 commuted out of the area.⁸⁴ Major inflows of commuters include Caerphilly (7,700 commuters), Cardiff (5,700), Monmouthshire (4,200) and Torfaen (5,700). The key outward flows largely mirror the inwards flows with Cardiff (5,500), Torfaen (3,500) and Monmouthshire (2,400) being the three largest flows. These key flows are the adjoining local authorities to Newport and whilst there are some flows to local authorities further afield, they are much smaller in magnitude.

⁸¹ Office for National Statistics (2013), Annual Survey of Hours and Earnings – Workplace Analysis

⁸² Office for National Statistics (2013), Census 2011 – Economic activity

⁸³ Newport City Council, Newport Economic Development Strategy 2011-2015

⁸⁴ Office for National Statistics (2013), Annual Population Survey commuter flows 2011

Figure 6.8 – Employment within Newport, 2011

Newport Docks

The Port of Newport handled nearly 2.5 million tonnes of freight in 2012 although the level of traffic has fallen slightly over the past 10 years. Newport is the third largest port in Wales in terms of tonnage. At a UK scale, however, the port is relatively small with Grimsby and Immingham port moving over 60 million tonnes of freight. Bristol also handled over four times the amount of freight of Newport.

Table 6.12: Changes in Total Freight Traffic, 2002-2012 (thousand tonnes)

	2002	2012
Newport	3,111	2,464
Swansea	1,069	595
Port Talbot	4,971	5,572
Barry	547	274
Cardiff	2,209	1,830
Holyhead	3,288	3,087
Milford Haven	34,543	39,832
Bristol	10,083	10,762

Newport promotes itself on its deep-water berths and port traffic chiefly consists of dry bulks (including clay, aggregates and agri-bulks), forest products, mineral and ores (including coke, petroleum coke and coal) and steel and other metals.

Table 6.13: Total Freight Traffic and Cargo Type, 2012

Thousand tonnes	Liquid Bulk	Dry Bulk	Other General Cargo	Lift On / Lift Off Containers	Roll-on / Roll-off	Total
Newport	0	1,132	1,332	0	0	2,464
Swansea	0	519	75	0	0	595
Port Talbot	0	5,410	162	0	0	5,572
Cardiff	918	402	370	140	0	1,830

The Port estate covers around 685 acres with key firms operating on the estate including Origin Fertilisers, Severn Sands, Jewson and WE Dowds. In addition to the Port estate, there are a number of other heavy industrial sites in the Docks area; these are largely across the river from the Port estate and to the south of the Southern Distributor Road. Newport City Council's Revised Deposit Local Development Plan (LDP) identifies 204 hectares of land at Newport Docks as an employment land allocation. The LDP states:

“There is a surplus of land within Newport Docks which could better meet Newport's economic development objectives if brought into alternative, productive, employment generating uses within Use Classes B1, B2 or B8.”

This potential, and the role of the M4, is considered further in Section 6.5.4.

6.5.3 Impacts on Transport and Accessibility

The EALI is predicated on the linkages between changes in transport conditions and accessibility and economic activity. Therefore, the next step is to consider the direct impacts of the scheme on accessibility in the study area. This section considers impacts on journey times between key centres and effects on accessibility to the key centres of Cardiff, Newport and Bristol and changes in access to employment opportunities resulting from the scheme.

6.5.3.1 Impacts on journey times between key centres

The new motorway to the south of Newport would improve journey times between key centres. This is illustrated schematically below showing changes in journey times between the do minimum (no new motorway) and the do something (new motorway) for journeys originating from Newport Docks.

The scheme results in a 10 minute time saving between Junctions 23 and 29 of the M4. For Newport, this means a 5 minute travel time savings to/from destinations in the West. Thus the journey time to Central Cardiff is 19 minutes with the scheme compared with 24 minutes in the absence of interventions.

The impacts on journey times are similar in an easterly direction. The time saving between Bristol and Newport Docks is 5 minutes. It is notable that Heathrow Airport is brought within a two-hour journey time as a result of the scheme. This is of particular relevance given the potential importance of access to London and Heathrow to business location decisions.

Figure 6.9: Impacts on journey times between key centres, journeys west from Newport Docks (2037)

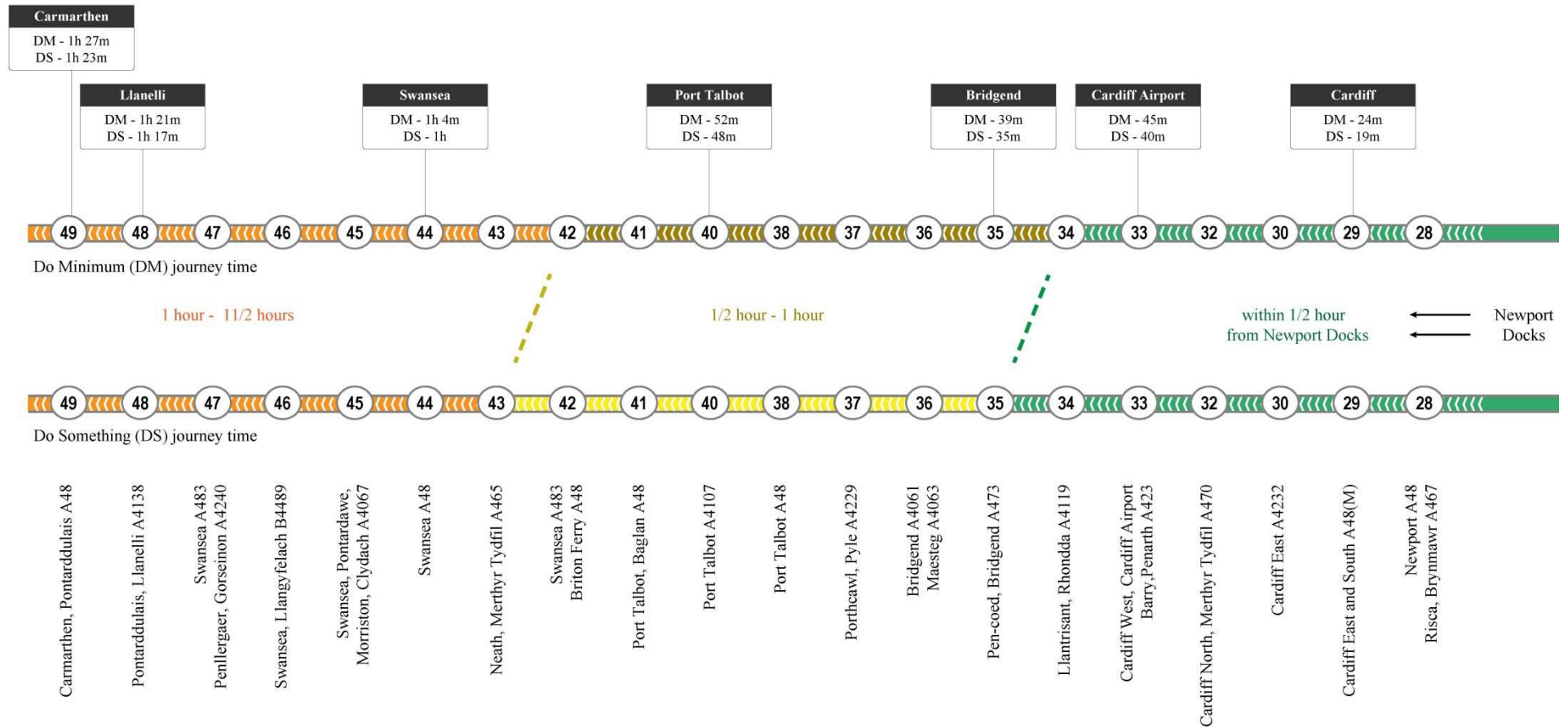
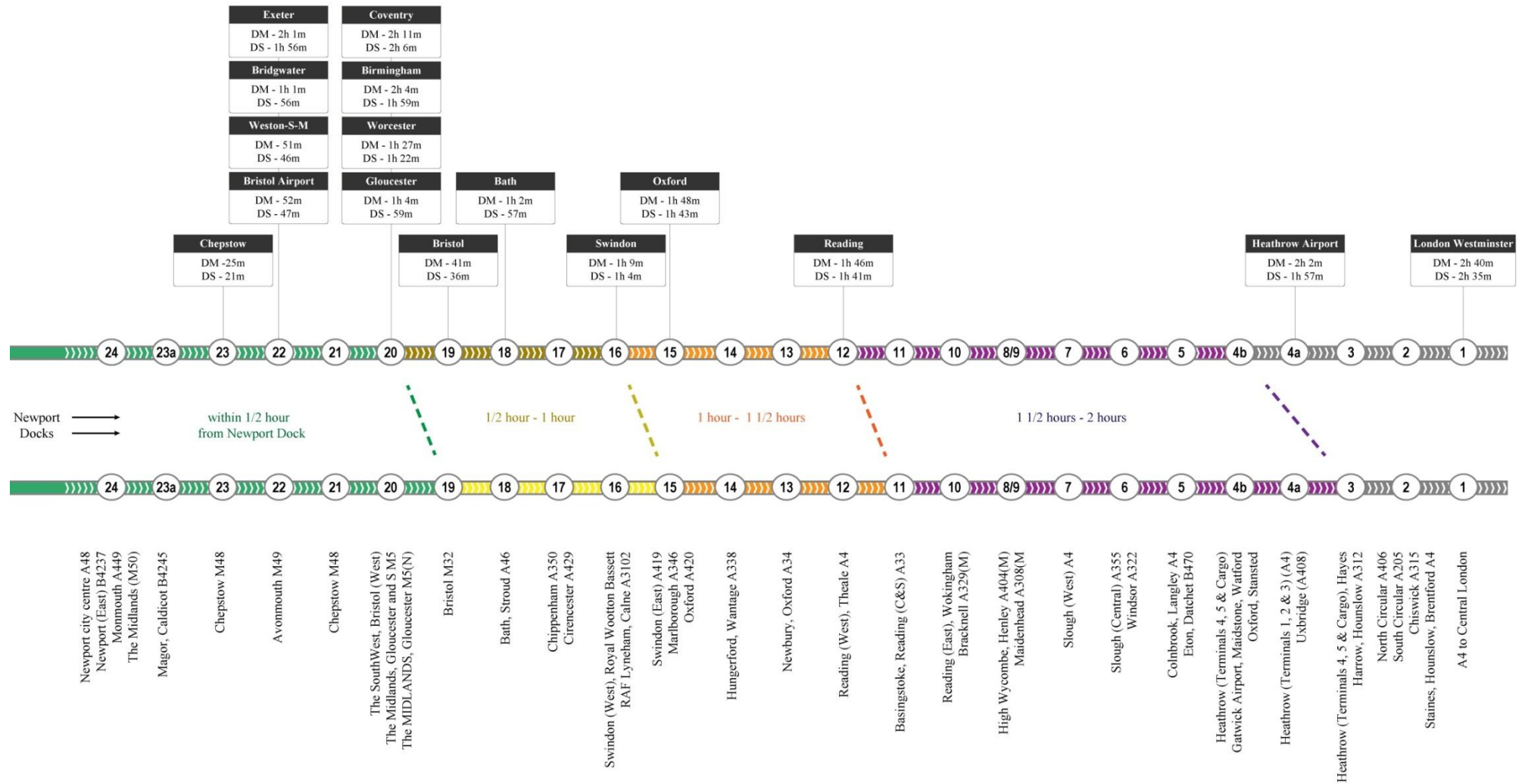


Figure 6.10: Impacts on journey times between key centres, journeys east from Newport Docks (2037)



6.5.3.2 Accessibility

Extending the analysis of journey times, Figures 6.11, 6.12 and 6.13 show journey time isochrones from Newport, Cardiff and Bristol. For Newport Docks it is notable that large parts of the study area experience some improvement in journey time to Newport Docks. Over 5 minutes time saving is achieved for much of Cardiff, as well as large parts of the South West including Bristol. For the western end of South Wales, journey time savings are in the region of 4 to 5 minutes.

As would be expected, journeys that travel the full extent of the motorway (ie. from Junctions 23 to 29) experience the greatest journey time savings. Most notably, journey time savings from Cardiff to Bristol are in excess of 10 minutes. The western portion of South Wales – from Caerphilly and Rhondda Cynon Taf westward – experiences some journey time savings to and from Bristol.

Figure 6.11: Change in journey time to Newport Dock in 2037

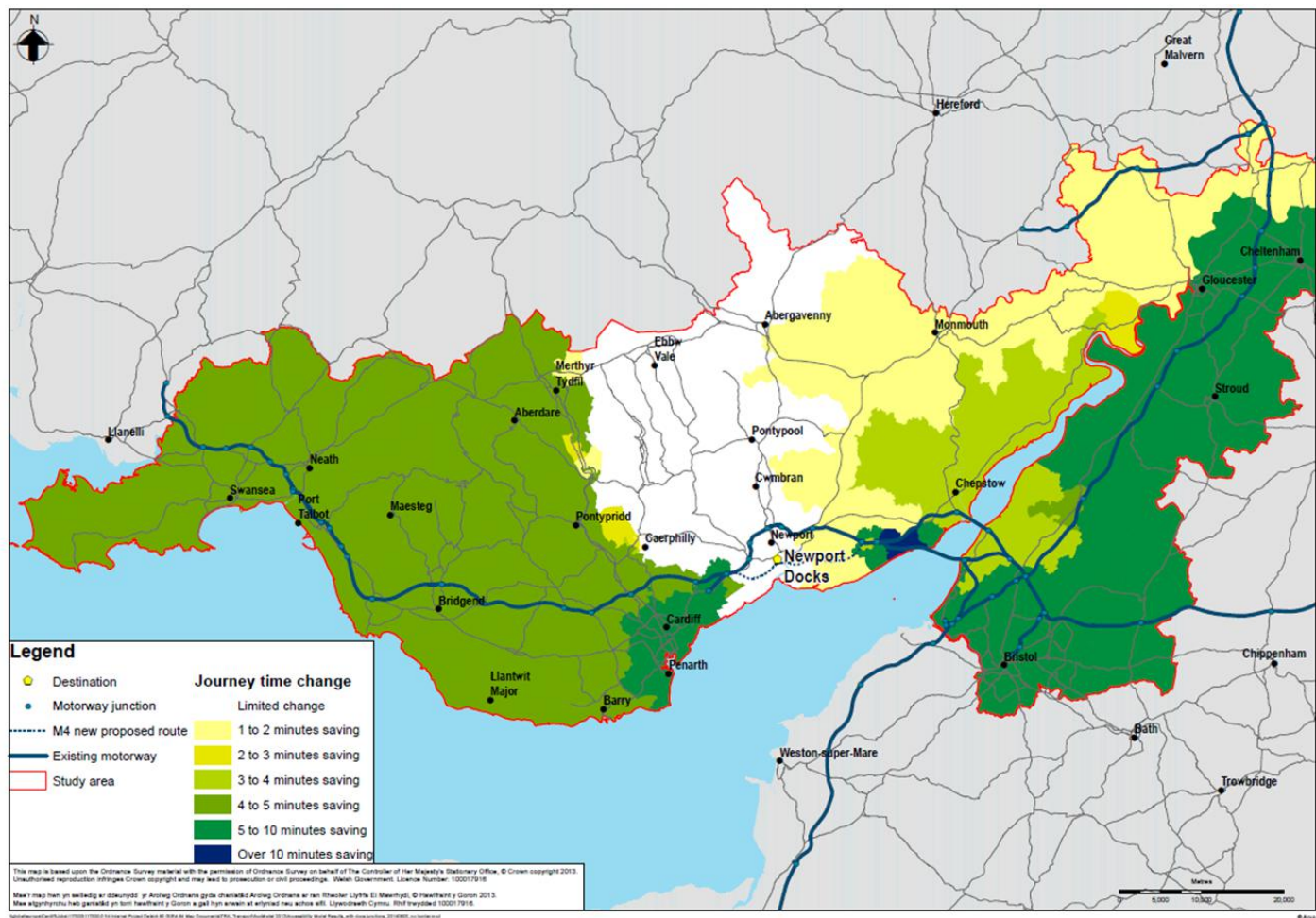


Figure 6.12: Change in journey time to Cardiff in 2037

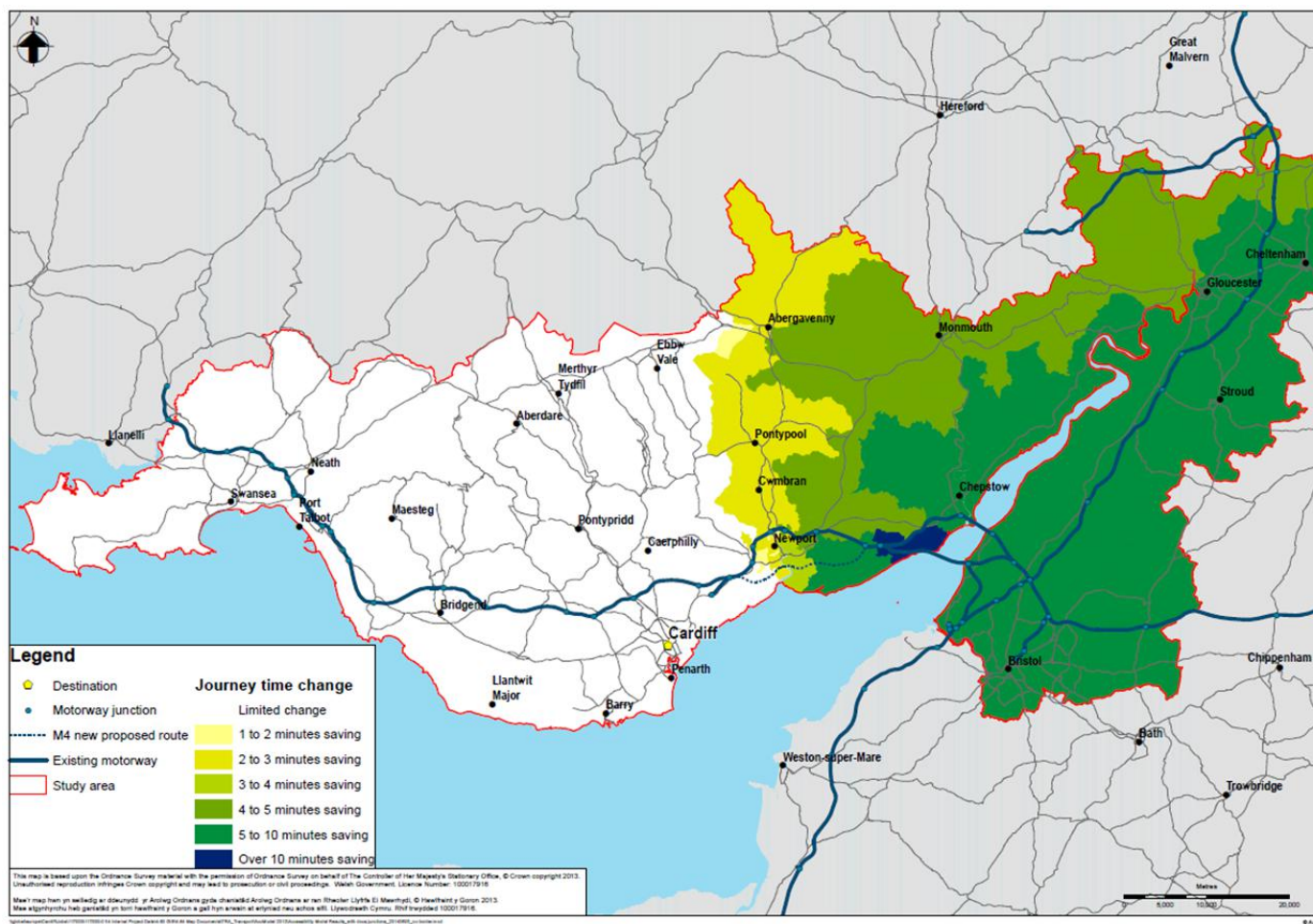
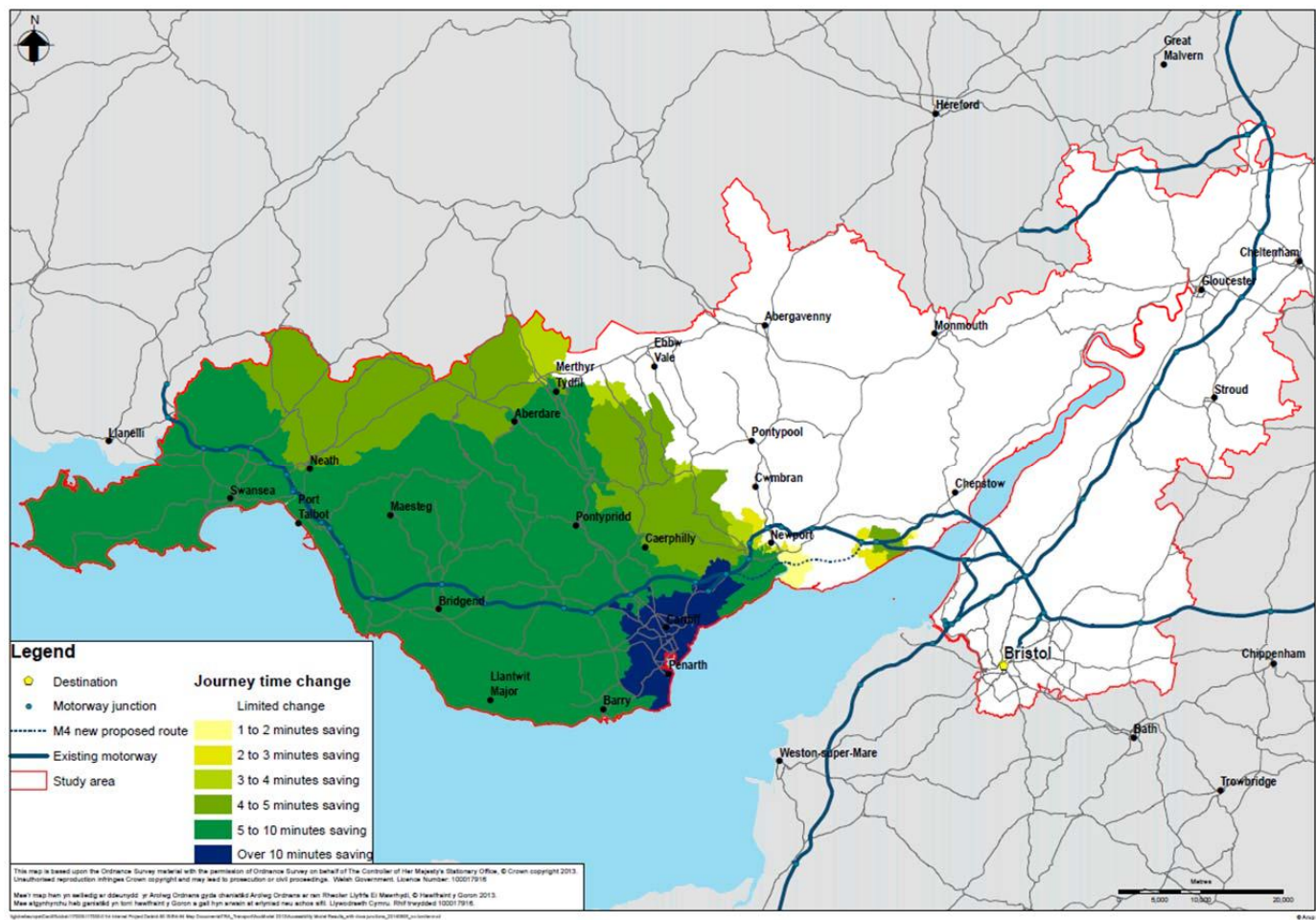


Figure 6.13: Change in journey time to Bristol in 2037



6.5.3.3 Labour market catchments

Further evidence of improvements in road user accessibility as a results of the scheme are shown in the below charts. This shows the access to employment opportunities within a one hour catchment area by road for the do minimum case (i.e. without the scheme) and the do something case (i.e. with the scheme) in 2022 and 2037. These figures show increased labour market catchments for most transport zones⁸⁵. A number of areas would experience an increase in their labour catchment areas in excess of 200,000 potential workers in 2037; this includes Rhondda Cynon Taff South, Caerphilly North, Cardiff East, Cardiff West, Monmouthshire South and Bristol. These large increases largely represent where a major urban area (Cardiff, Newport or Bristol) now fall within a 1 hour catchment area. The increased labour market catchment means that firms in the study area would have a larger pool of working age population to draw upon to fill positions which should benefit firms, particularly when seeking to fill more specialised positions.

⁸⁵ The exceptions being Torfaen North, Torfaen South, Blaenau Gwent and Monmouthshire North in 2022 and Torfaen North in 2037 which experience slight decreases in labour catchments. These are zones to the north of the scheme which wouldn't experience the benefits of enhanced east-west movements but would experience slight delays on existing junctions due to greater levels of traffic on the network.

Figure 6.14: Labour catchments 2022

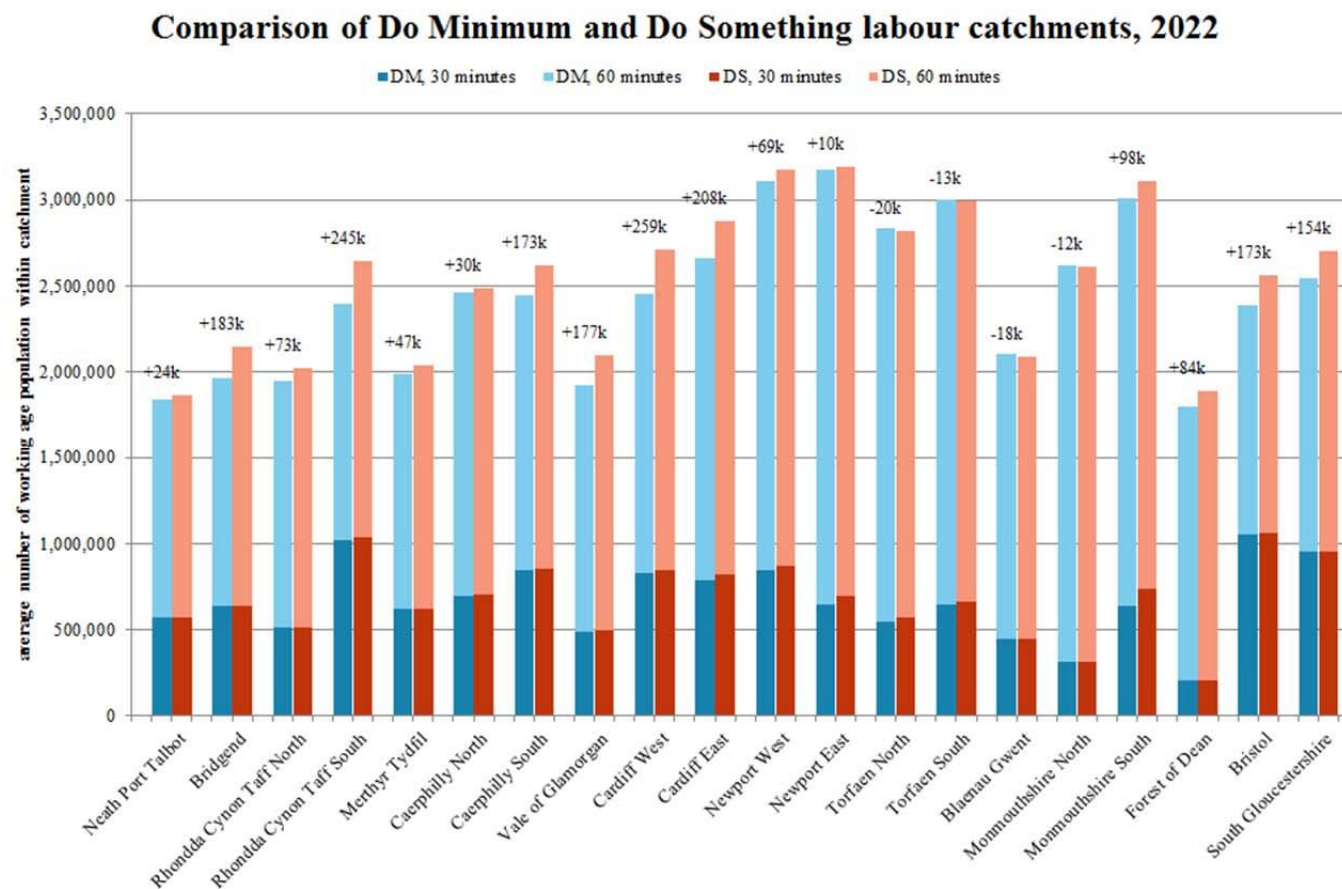
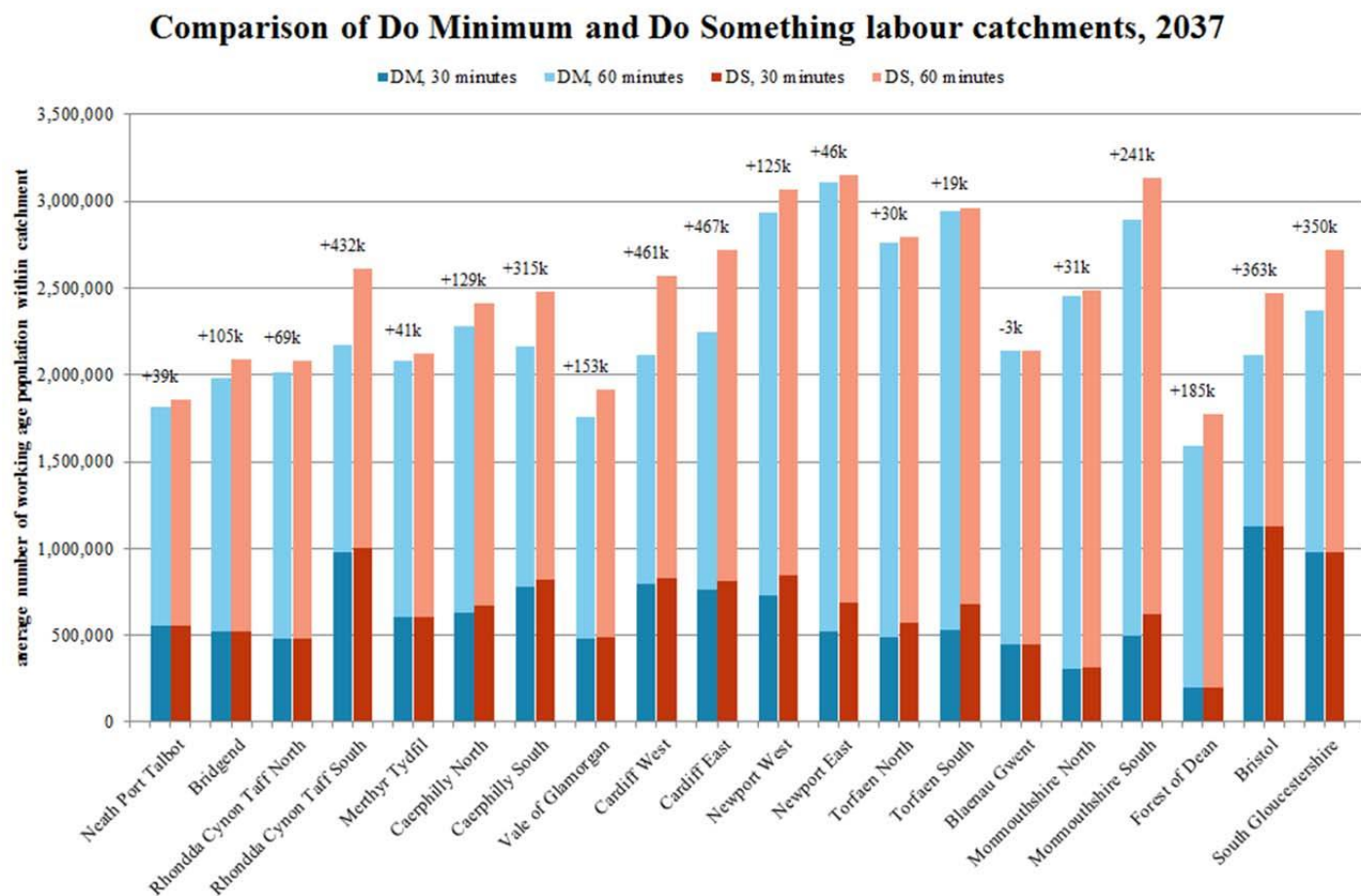
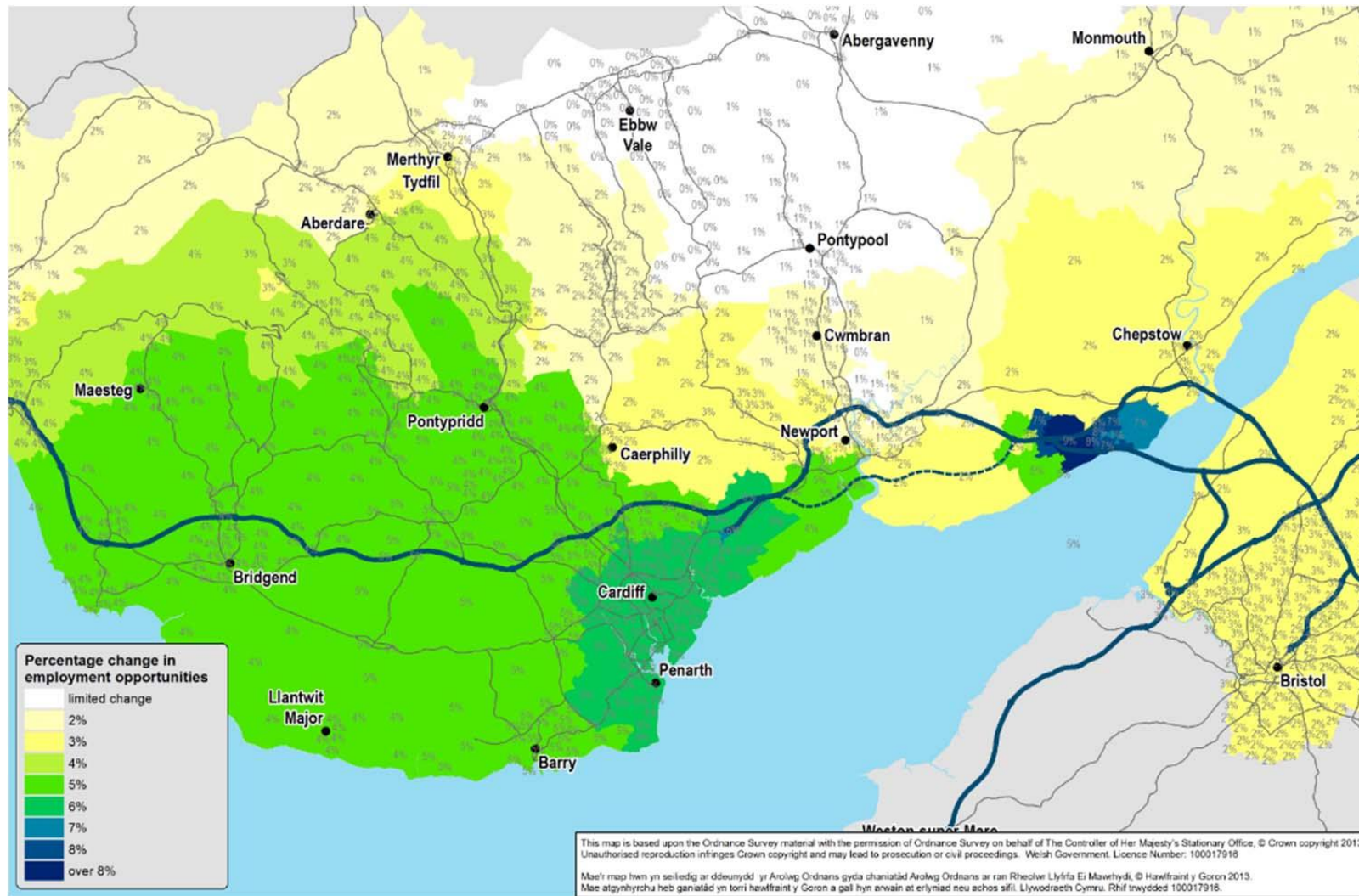


Figure 6.15: Labour catchments 2037



Further analysis has been undertaken of access to employment on the basis of an accessibility index. The accessibility index is linked on a distance deterrence function based on the time that commuters are willing to travel to work. Figure 6.16 shows the forecast impact on employment opportunities in 2037 as a result of the provision of the motorway to the south of Newport. This indicates significant increases in employment opportunities along the M4 corridor from Bridgend across the Severn Estuary to Severnside. It also shows that there are likely to be increased opportunities for employment for residents of the Vale of Glamorgan, much of the South Wales Valleys and Monmouthshire leading into Gloucestershire.

The motorway to the south of Newport will increase access to employment for the benefit of residents as well as employers on both sides of the Severn Crossings who will experience an equivalent improvement in access to a labour.

Figure 6.16 – Change in Access to Employment Opportunities, 2037 with the Motorway to the South of Newport

6.5.4 Impact Assessment

6.5.4.1 Transmission Mechanisms

As demonstrated, the new motorway will improve travel times (and therefore reduce transport costs) for users by providing a more direct and less congested route through South Wales. It will reduce the effective distance between key settlements in South Wales and between South Wales, the South West and beyond. The scheme will also reduce the costs of commuting and increase the effective search area within which people will seek employment and firms will source a suitable labour force.

Based on the economic context of the scheme, and the direct impacts of the new road, the following mechanisms have been identified through which the new motorway is expected to impact on the economy of the study area:

- **Impacts During Construction** – employment as a direct consequence of the construction of the scheme;
- **Direct Business Cost Savings** – the direct benefits to businesses of lower transport costs measured in time saved and reduced vehicle operating costs.
- **Agglomeration effects** – productivity effects resulting from improved accessibility, increasing the effective concentration of the economy;
- **Competition effects** – the direct effects of the scheme on transport costs fail to account for the indirect or downstream impacts on the economy. Reduced transport costs can influence patterns of competition between firms in different markets. With few feasible alternative routes, the M4 acts as a land bridge between South Wales and markets in much of the rest of the UK. Just as Wales' relative peripherality acts as a constraint on the economy, reducing the effective distance between South Wales and parts of England could be expected to improve the competitiveness of local firms, enabling them to gain greater market share in existing markets or access new markets.
- **Locational Patterns, Land Use and Investment** – transport schemes can impact on land use and locational decisions of firms. This is of particular relevance to the new motorway which will reduce travel times between South Wales and London, including Heathrow Airport. Access to existing and planned employment sites will be improved through the creation of two new motorway junctions to the south of Newport.

6.5.4.2 Impacts During Construction

Direct Employment Impacts

The construction phase of the new motorway to the south of Newport would provide employment opportunities in the construction sector. As the project is still at an early stage of design, a high level assessment of the likely total and peak employment requirement.

Based on an approximate construction cost of £650m, using standard benchmarks for the labour content of the construction cost, and the average cost of labour, it is expected that the scheme will require in the region of 2,400 person years overall. The average annual labour requirement of 600 full-time workers may underestimate the peak construction employment requirement in practice.

Highway construction requires a range of occupations and skillsets. The extent to which these construction jobs will be filled by local workers will depend on the availability of suitably skilled local people and the approach to recruitment of the contractor which in turn will be influenced by the contractual requirements in respect of recruitment and training policies.

Table 6.14: Approximate Construction Employment

Construction employment calculation	
Construction Cost (Approximate)**	£650m
Construction period	4 years
Per capital annum spend (Approx)	£160m
Labour spend (20% of capital cost)	£30m
Total labour hours (assuming £22 per hour average labour cost)	1,500,000
Weekly labour hours (50 working weeks)	30,000
Construction employment (50 hours per week)	600

** Construction Target Cost excluding Optimism Bias

Disruption during construction

During the construction phase there may be some disruption to the local transport network which may have a temporary negative impact on economic activity. However, given that the new motorway to the south of Newport is an offline scheme, negative impacts would be expected to be minor and largely restricted to the works connecting the new route into the existing transport network.

Another potential source of construction phase disruption could be through the use of the existing transport network by construction traffic. It is expected that this will be mitigated through careful planning of construction traffic routes to minimise the extent to which they impede users on the network.

6.5.4.3 Direct Business Cost Savings

Reduced congestion and faster journey times will deliver lower costs for businesses for both freight movements and business travel. Cost savings have been calculated using the traffic model and the benefits accruing to the economy of the study area has been estimated. Such cost savings represent a direct impact on the GDP of the study area.

The model allows us to compare the costs of travel for business users in the do minimum and do something scenarios on an origin-destination basis. However the model does not identify whether the cost savings accrue to businesses located in the area of origin or the area of destination. For example, a journey time saving for a return trip for an HGV based in Newport to Bristol would appear in the model as a benefit from Newport to Bristol and a benefit from Bristol to Newport.

To overcome this, cost savings have been split equally between the origin and - destination pairs. This is considered to be a reasonable approximation given that, in practice, irrespective of whether the vehicle is operated by a firm based on the area of origin or destination, the benefits of reduced transport costs will be shared through the price mechanism. This is further described in the next section.

The aggregate GDP impacts in the study area of the direct business cost impacts are given in Tables 6.15 and 6.16 below.

Table 6.15: 2022 direct cost savings for business and GDP impacts (£m 2013 Prices)⁸⁶

		Business travel	HGV travel	Total
Total cost saving		£16.9m	£6.8m	£23.8m
Proportion by area	Study area	£13.7m (81%)	£5.5m (80%)	£19.2m (81%)
	South Wales	£11.4m (68%)	£4.2m (61%)	£15.6m (66%)
	English Severnside	£2.2m (14%)	£1.3m (19%)	£3.6m (15%)

Table 6.16: 2037 business cost savings⁸⁷

		Business travel	HGV travel	Total
Total cost saving		£43.5m	£27.2m	£70.7m
Proportion by area	Study area	£35.5m (82%)	£23.6m (87%)	£59.2m (84%)
	South Wales	£30.5m (70%)	£20.3m (75%)	£50.9m (72%)
	English Severnside	£4.9m (11%)	£3.6m (12%)	£8.3m (12%)

The benefits of the scheme for business users are £23.8m in 2022 rising to £70.7m in 2037. Around 80% of these benefits accrue to businesses in the study area. When disaggregated further, South Wales is the key beneficiary, receiving 66% (£15.6m) of the benefit in 2022 and 72% (£50.9m) of the benefit in 2037. It should be noted that these are considered to be conservative estimates of the financial benefits of the scheme given that the benefits of improved journey time reliability are excluded.

6.5.4.4 Agglomeration Effects

The improved accessibility afforded by the scheme will generate wider economic benefits that are additional to the direct transport user benefits captured in the traditional economic appraisal. As noted, the productivity gap between Wales and the rest of the UK is, in part, explained by relative peripherality and the lack of a major agglomeration.

Improved accessibility can increase the effective density on an economy – by bringing firms and workers closer together – delivering economies of agglomeration and enhancing the productivity of firms within the area in question. Agglomeration effects of transport improvements can be estimated based on approximate empirical estimates of the relationship between accessibility (measured by transport costs) and productivity (GDP per worker).

Whilst distance from London has been noted as possible determinant of productivity, the relationships between accessibility and productivity have been established at a regional level (based on travel to work areas) and therefore the

⁸⁶ Impacts shown are 2013 prices and 2022 benefits

⁸⁷ Impacts shown are 2013 prices and 2037 benefits

assessment of agglomeration effects has been undertaken for improved accessibility within the study area.⁸⁸

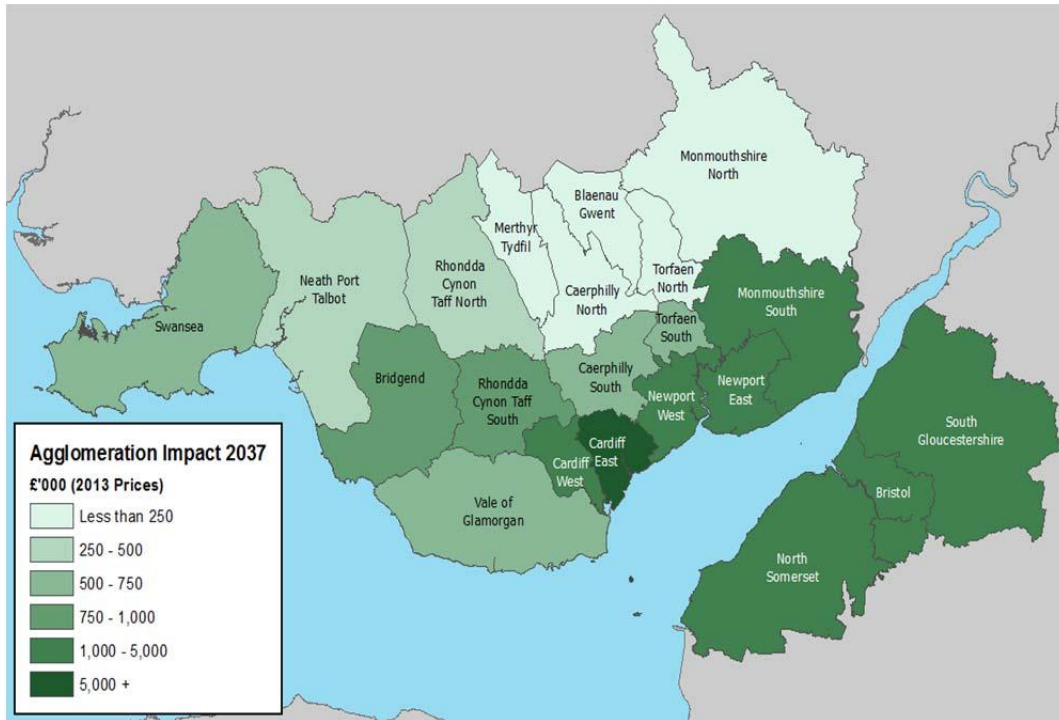
Table 6.17: Change in effective density and agglomeration by zone, 2037

Model Zone	% Change in Effective Density, 2037 (DS vs DM)*	Agglomeration Impact as % of GDP, 2037
Newport West	3.4%	0.22%
Newport East	2.7%	0.14%
Cardiff West	1.2%	0.06%
Cardiff East	1.4%	0.09%
Vale of Glamorgan	1.2%	0.05%
Swansea	0.5%	0.02%
Neath Port Talbot	0.7%	0.02%
Bridgend	1.0%	0.04%
Rhondda Cynon Taff North	1.0%	0.04%
Rhondda Cynon Taff South	1.2%	0.05%
Merthyr Tydfil	0.6%	0.02%
Caerphilly North	0.5%	0.02%
Caerphilly South	1.0%	0.05%
Blaenau Gwent	0.0%	0.00%
Torfaen North	0.9%	0.05%
Torfaen South	1.3%	0.07%
Monmouthshire North	0.4%	0.02%
Monmouthshire South	5.5%	0.28%
South Gloucestershire	0.5%	0.02%
Bristol	0.3%	0.01%
North Somerset	0.8%	0.04%

*Weighted average across the four industry sectors used in the calculation of agglomeration benefits

Figure 6.17 shows the total change in GDP that are expected to result from the scheme.

⁸⁸ It should be noted that the agglomeration impacts is based on a restricted version of the study area, excluding

Figure 6.17: Total agglomeration impact in 2037 by zone

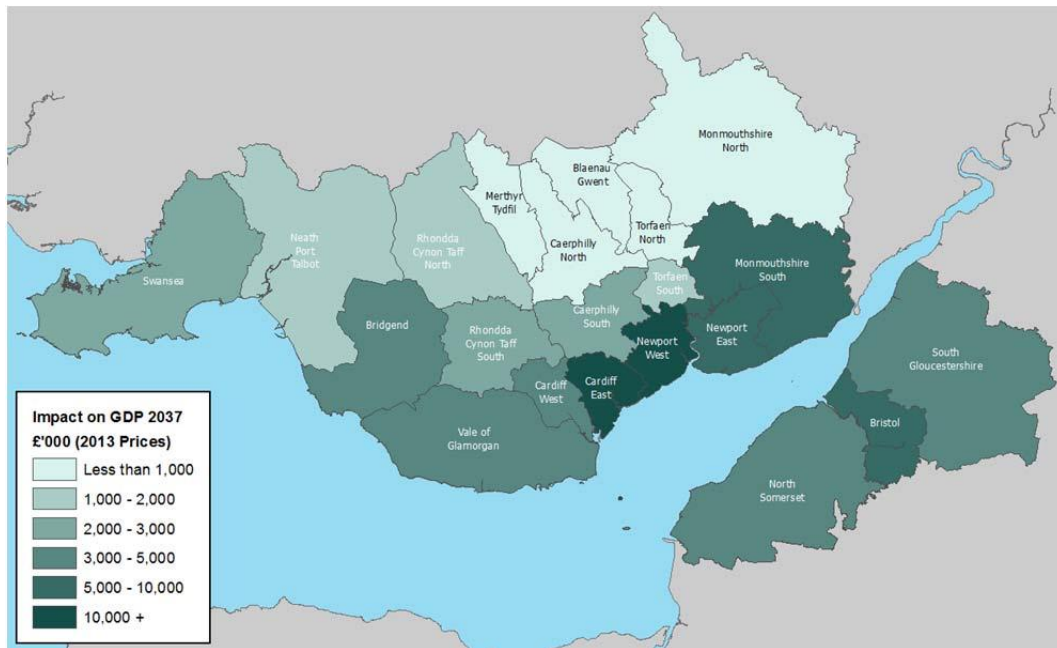
All areas of the study area would experience and improvement in GDP. Total agglomeration benefits are expected to be £10.1m in 2022 and £30.3m in 2037 (2013 prices), of which £23.2m will be realised in South Wales. In practice, agglomeration effects are long term impacts that will take time to be realised in full.

Total Impacts on GDP

The direct business cost savings and agglomeration effects can be brought together to give a total GDP impact of the scheme. It should be noted that, in practice, there will be further long term impacts of GDP due to land use changes resulting from the scheme and that competition effects will also influence the distribution of GDP impacts across the study area. Therefore, the total GDP impact result is best characterised as a 'first round' GDP impact.

Notwithstanding these further effects, the combined impact of business cost savings and agglomeration effects is expected to contribute £89.5m by the design year of 2037. In South Wales specifically, the scheme would deliver an improvement in GDP of £74.1m. To place this into context, the impact of the scheme represents approximately 0.14% of the GDP of South Wales in 2037. The distribution of benefits, however, is not uniform. For Newport East, the scheme delivers a 0.44% improvement in GDP and for Monmouthshire South GDP would increase by 0.79%.

Figure 6.18 and Table 6.18 provide further detail on the distribution of GDP impacts within the study area.

Figure 6.18: Impact on GDP in 2037 by Zone**Table 6.18: Impact on GDP in 2037 by zone⁸⁹**

Impact on GDP in 2037 (£ '000 2013)			
Zone	Direct User Benefits	Agglomeration Impacts	Total Impact
Newport West	7,107	4,510	11,616
Newport East	8,042	1,952	9,994
Cardiff West	2,783	1,281	4,064
Cardiff East	8,994	8,269	17,263
Vale of Glamorgan	2,615	600	3,215
Swansea	1,882	746	2,629
Neath Port Talbot	1,218	380	1,597
Bridgend	2,224	799	3,022
Rhondda Cynon Taff North	782	355	1,137
Rhondda Cynon Taff South	2,012	781	2,793
Merthyr Tydfil	336	147	482
Caerphilly North	535	213	748
Caerphilly South	1,383	626	2,008
Blaenau Gwent	277	15	293
Torfaen North	426	159	585

⁸⁹ Agglomeration impacts have not been calculated for outlying areas in the study area and, as such, are blank in this table.

Impact on GDP in 2037 (£ '000 2013)			
Zone	Direct User Benefits	Agglomeration Impacts	Total Impact
Torfaen South	1,280	513	1,793
Monmouthshire North	601	115	715
Monmouthshire South	6,694	1,788	8,482
Carmarthenshire	961	-	961
Pembrokeshire	722	-	722
South Gloucestershire	2,296	2,202	4,498
Bristol	2,847	2,923	5,770
North Somerset	1,162	1,968	3,130
Bath and North East Somerset	592	-	592
Forest of Dean	751	-	751
Gloucester	375	-	375
Stroud	260	-	260
Total	59,157	30,342	89,495

6.5.4.5 Competition effects

The effect of reduced business costs outlined above is that firms in the study area will be able to produce goods and services at lower cost. In practice, this is unlikely to be the end of the story. Businesses could respond to lower costs in two ways: they can either retain cost savings in order to make higher profit, or they can pass the reduced costs on to consumers, in the form of lower prices, in order to attract greater market share and increase output and, in many cases, employment.

Whilst competition effects and changes in market share are not necessarily *additional* to the 'first round' impacts on GDP, competition effects are relevant to the EALI as changes in market share impact on the local economic activity and employment.

Where a transport intervention disproportionately benefits a particular region, it is reasonable to expect that there will be an increased market share for firms located within the area in question and a net increase in employment as a result of improved competitiveness.

Local and External Trade

In understanding competition effects it is important to distinguish between firms competing in local markets and firms competing in external markets. For firms competing in local markets – for example, small building contractors - any reduction in costs that is passed through into lower prices may result in local competition effects, favouring some firms in the region above others, but without an overall change in market share for the regional economy as a whole.

However, for firms competing in external markets at a UK level - much of the manufacturing sector for example – the productivity benefits delivered by the scheme may improve their competitive position relative to firms outside the region. As demonstrated, the benefits of the new motorway are disproportionately felt by firms in South Wales. Therefore, by reducing transport costs facing businesses in South Wales, the scheme can strengthen the competitive position of externally facing firms and industries in South Wales, enabling them to reduce prices and increase market share.

Competition Effects and the Two-Way Road

It is important here to consider the two-way road argument. This states that a transport improvement can introduce competition from outside the region by enabling firms from outside the area to compete with local firms. The two-way road argument tends to be applied in a more localised context – a small town neighbouring a large city for example – but also has some relevance at a wider, regional scale.

Whilst the two-way road argument is valid, there are a number of reasons to suggest that the predominant effect will be positive for firms in Wales. Firstly, as noted, the majority of the direct benefits of the scheme are likely to accrue to businesses in South Wales and such benefits will make up a much higher proportion of total production costs than for businesses located outside South Wales. Secondly, agglomeration benefits which also contribute to higher productivity are expected to result in South Wales and, to a lesser extent Bristol, and such benefits will not be experienced outside the study area.

Estimating Competition Effects

Competition effects are highly complex because of the complicated interactions between firms and regions. Because of this complexity, it is difficult to trace the impact of a change in transport costs and to determine how businesses and consumers will behave. However, for the purposes of this assessment, it is considered reasonable to present some illustrative estimates of how the productivity benefits of the scheme may result in higher local output and employment.

The results provided are not intended to be precise but rather this analysis is intended to demonstrate the linkages between direct scheme benefits and indirect effects on the economy and to consider the potential magnitude of the resulting change in output and employment.

The way in which firms will respond to the changes in transport costs depends on the particular characteristics on the industry in question and, more specifically, the degree to which demand for a product responds to changes in price (the price elasticity of demand). For goods and services for which demand is highly elastic, firms will have strong incentives to pass on cost savings to customers. However, where demand is relatively inelastic (because, for example, a firm competes on quality rather than price), then the incentives to lower prices will be weaker and firms may decide to retain higher profits.

The process described above can be summarised using the equation below, which calculates the change in output (ΔQ) based on the change in marginal cost (dMC) multiplied by the cost pass through (k), elasticity of demand (ED) and total output that is traded outside the study area (Q). This equation is adapted from a

Department for Transport paper discussing the wider economic benefits of transport schemes.⁹⁰

$$\Delta Q = dMc \times k \times ED \times Q$$

To estimate the change in output and employment within the study area of increase share of external markets, the following process has been adopted:

- As illustrated in Section 6.5.4.3, the direct cost savings for businesses have been allocated to each individual zone within the study area. Direct cost savings have further been allocated to each individual business sector within a zone based on the typical proportion of industry expenditures on transport (based on evidence from the Welsh Economy Research Unit's input-output model).
- An estimate has been made of the total value of output of firms within each industry and each zone based on data from the Interdepartmental Business Register (IDBR). This allows us to estimate the percentage change in aggregate industry costs that will result from the scheme.
- It has been assumed that the cost savings experienced by businesses would be fully passed on to customers in lower prices. As noted, because businesses typically operate in highly competitive environments they are unable to set the level of profit they are able to make and will therefore reflect an improvement in productivity in prices. In any case, given the relationship between cost-pass through and price elasticity of demand, it is reasonable to vary just one of these parameters (in this case the elasticity of demand) to account for potential variation in the responses of firms and customers.
- The equation given above has been applied assuming aggregate elasticity of demand of 0.5, 1 and 1.5 to provide a range of estimates. In practice these will vary across sector but there is very little evidence which provides a sector by sector breakdown of elasticity of demand. Research undertaken by the DfT⁹¹ suggests 0.5 but this is likely to be conservative in context of a price change which occurs in a specific region rather than economy wide i.e. where prices are changing for output from one area but not across the whole economy. Thus, the central case assumed to be 1 which means a 10% decrease in the price of product would result in a 10% increase in demand.
- The proportion of output traded in external market (outside Wales or the South West) has been estimated based on the Welsh input-output model and South West Regional accounts – exports by industry. Demand effects have been applied only to the proportion of output that is externally traded.
- The change in demand is applied to the level of externally traded output to give an estimate of change in external output. It should be noted that this was calculated at a local authority and sector level such that the calculation cannot be made using the values in the table. A multiplier effect has been applied to the change in local output. A value of 1.3 has been used in the low case, 1.5 in the medium case and 1.7 in the high case.
- The employment impacts associated with the increase in output have been calculated based on the level of output per worker.

⁹⁰ Department for Transport (2005), Transport, Wider Economic Benefits, and Impacts on GDP

⁹¹ Department for Transport (2005), Transport, Wider Economic Benefits, and Impacts on GDP

This calculation is illustrated in Table 6.19.

Whilst the analysis is necessarily high level and approximate, it serves to illustrate the point that the scheme will improve the competitive position of firms in Wales such that the direct benefits of the scheme could deliver higher levels of employment. The calculations suggest that the increase in competition in external markets could increase by over 350 jobs in 2037. This could rise to nearly 700 jobs in 2037 should a higher elasticity of demand be assumed.

It should be stressed that these employment impacts are effectively based on a 'fixed land use' model and do not account for any additional employment due to changes in land use or inward investment impacts that are considered in the next section.

The competition effect would be a gross impact for the study area and may result in redistribution in employment from outside the study area, as impacts increase. In terms of the spatial distribution of impacts, key areas which would benefit from this effect are Newport East, Newport West, Cardiff East and Monmouthshire South. Moreover, the sectors which would benefit most from the competition impact are production, finance and insurance and business administration and support services.

Table 6.19: GDP impacts of competition effects, 2037. £m unless otherwise stated

	Area	Total Output	Total Production Cost	Change in Marginal Cost due to Scheme	% Change in Industry Costs due to scheme (dMC)	K (parameter)	ED (parameter)	Total 'Externally Traded' Output	Change in external output ⁹²	Multiplier Effects	Output	Employment Impact (jobs)
Low	Study area	185,136	155,525	93	0.04%	1	0.5	71,513	11	3.2	13.8	174
	South Wales	98,065	83,763	78	0.06%			38,092	10	2.9	12.4	163
	English Severnside	87,071	71,762	15	0.01%			33,422	1	0.3	1.4	11
Medium	Study area	185,136	155,525	93	0.04%	1	1	71,513	19	9.3	27.9	356
	South Wales	98,065	83,763	78	0.06%			38,092	16	8.2	24.5	285
	English Severnside	87,071	71,762	15	0.01%			33,422	2	1.1	3.3	24
High	Study area	185,136	155,525	93	0.04%	1	1.5	71,513	32	22.3	54.3	684
	South Wales	98,065	83,763	78	0.06%			38,092	29	20.0	48.6	639
	English Severnside	87,071	71,762	15	0.01%			33,422	3	2.3	5.7	45

⁹² Note – Calculation made using model using local authority sector data therefore this value cannot be calculated using the data available in this table.

6.5.4.6 Land use and inward investment

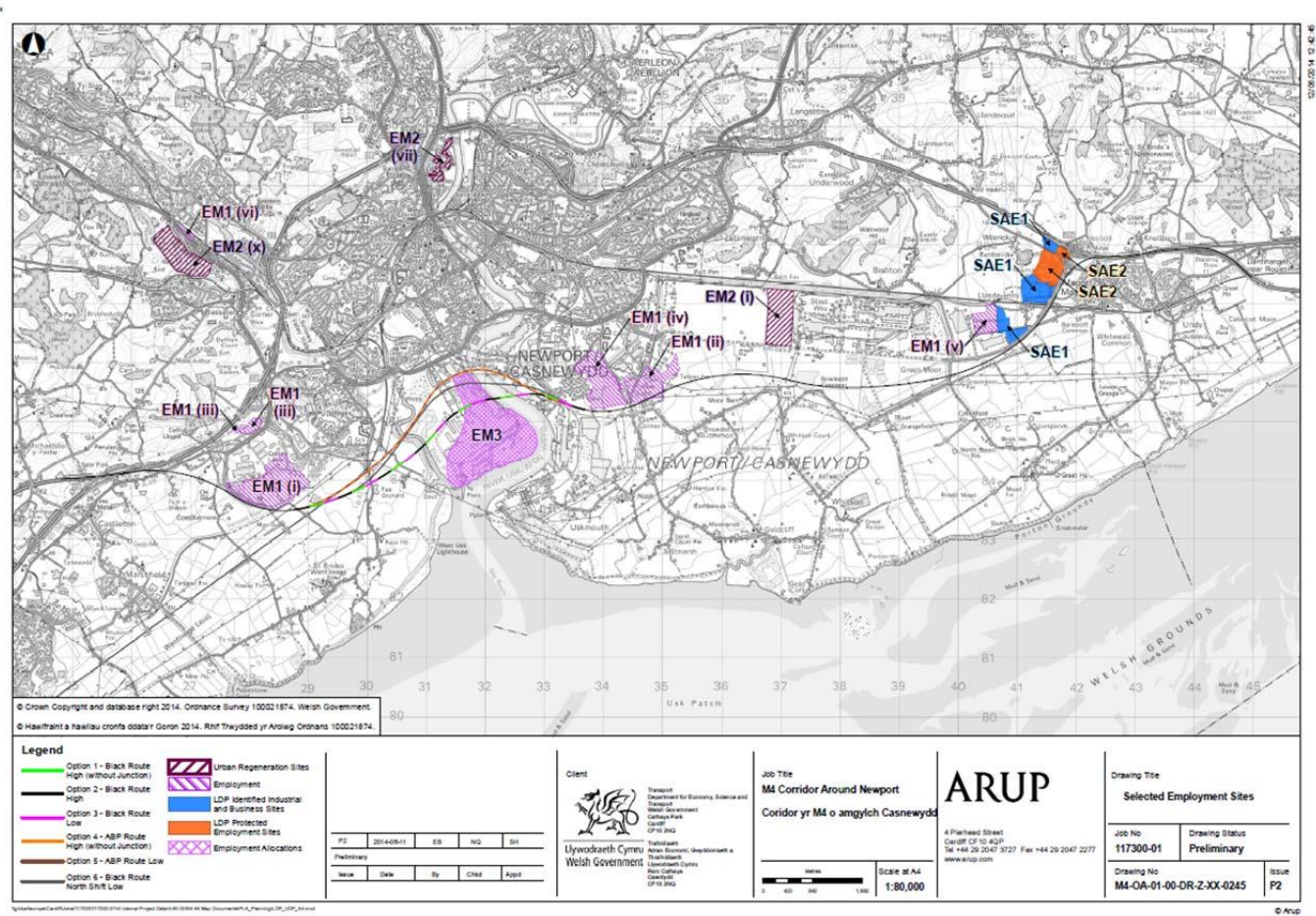
The scheme will improve accessibility to employment sites adjacent to both the existing and proposed route of the M4. This would be expected to increase the attractiveness of these sites for investment. Moreover, as discussed, the new motorway would be expected to improve perceptions of South Wales as a business location by improving accessibility and reducing journey times to London and Heathrow which is considered to be an important factor influencing business investment decisions.

This section provides a high level illustration of the potential magnitude of economic impacts relating to changes in land use to the south of Newport as a result of the scheme.

Assessment of Affected Sites Employment Sites

The availability and ‘employment potential’ of sites most directly affected by the scheme has been assessed. This is based on selected employment allocations from Newport City Council and Monmouthshire County Council Local Development Plans which would be most likely to benefit from the scheme based on their proximity to the existing and proposed alignments of the M4. These allocations are shown in Figure 6.19. They comprise 13 sites and 449 hectares of employment land.

Figure 6.19: Key employment allocations map



The ‘employment potential’ of a site is defined as the number of jobs that could be located at each site based on the total site area, assuming that the site is fully developed. The figure below outlines the step-by step process used to estimate the employment potential for the relevant sites.



The Homes & Communities Agency’s 2010 Employment Densities Guide has been used to estimate the employment potential of each site.⁹³ The guide provides employment densities for different use classes including office, warehouse & distribution and industrial use classes. A different mix of uses has been assumed for each site based on suggested usage from the LDP. Listed in Table 6.20 are the densities used to calculate employment estimates for the discussed employment sites in Newport and Monmouthshire.

A plot ratio of 0.4 has been used based on the Department for Communities and Local Government’s guidance note for employment land reviews. This is applied to the developable areas for each site to give a floorspace which employment densities can be applied to.⁹⁴

Table 6.20: Employment Densities used

Use Class	Use Type	Floorspace per FTE (m ²)
B1	General Office	12
B8	Large Scale and High Bay Warehousing	80
B1 & B2	General	36
B1, B2 & B8	Mixed Employment Use	47

An assessment has been made of the impacts of the scheme on each site based on qualitative judgement and the change in journey time from the M4 Junction 23 to the east of the scheme and the M4 Junction 29 to the west of the scheme. The change in journey times are based on 2037 calculations and show in the change in journey time between the road network with a new motorway to the south of Newport and the road network without the scheme.

⁹³ Homes & Communities Agency, 2010, Employment Densities Guide

⁹⁴ Department for Communities and Local Government, 2004, Employment Land Reviews: Guidance Note

Table 6.21: Employment Allocation Impact Assessment

Employment Site and Location	Size (ha) and Assumed Use Class	Employment Potential	Description of impacts of the scheme	Journey time change from M4 Junction in 2037 ⁹⁵ (minutes:seconds)		Significance (Based on WelTAG significance scale)
				Junction 23	Junction 29	
EM1 (i) Duffryn – junction 28	37 (B1, B2, B8)	3,224	The scheme would improve journey times for traffic coming from the east, with the site being accessed via a new motorway and the Docks junction. Journey times from the west would improve slightly as a result of the scheme.	-02:06	-00:44	(+)
EM1 (ii) East of Queensway Meadows, South of Glan Lyn - south of the Southern Distributor Road (SDR)	22 (B1, B2, B8)	1,098	Journey times to the site would be improved for traffic coming from the east and west. The Docks junction would be used by those coming from the west and the Llanwern Junction would be used by those coming from the east.	-01:54	-06:55	(+++)
EM1 (iii) Celtic Springs - south of junction 28 of the M4.	6 (B1)	1,621	The scheme would improve journey times for traffic coming from the east, with the site being accessed via new motorway and the Docks junction. Journey times from the west would improve slightly as a result of the scheme.	-02:07	-00:45	(+)
EM1 (iv) Solutia - south of the Southern Distributor Road (SDR)	35 (B1, B2, B8)	2,376	Journey times to the site would be improved for traffic coming from the east and west. The Docks junction would be used by those coming from the west and the Llanwern Junction would be used by those coming from the east.	-01:53	-05:46	(+++)
EM1 (v) Gwent Europark – Junction 23	16 (B8)	754	Journey times to the site from the east increase due to junction alterations at J23 and increased traffic on the network while traffic from the west decrease as traffic uses the new motorway.	01:02	-11:15	(++)

⁹⁵ Based on journey times in the AM peak

Employment Site and Location	Size (ha) and Assumed Use Class	Employment Potential	Description of impacts of the scheme	Journey time change from M4 Junction in 2037 ⁹⁶ (minutes:seconds)		Significance (Based on WelTAG significance scale)
				Junction 23	Junction 29	
EM1 (vi) Land off Chartist Drive – Junction 25/27	2 (B1, B2, B8)	136	Journey times would decrease from the east and west due to reduced congestion on the existing route.	-02:27	-01:40	(++)
EM2 (i) Llanwern Former Steelworks Eastern End - accessible via the Steelworks Access Road	39.5 (B1, B2, B8)	848	Journey times would decrease from both the east and west as traffic uses the new motorway and the Llanwern junction provides improved access to the site.	-01:54	-13:33	(+++)
EM2 (vii) Crindau - Junction 25a/26	10 (B1)	2,667	Journey times would decrease from the west due to reduced congestion on the existing route while changes from the east are negligible.	-00:01	-02:48	(++)
EM2 (x) Novelis (Alcan) - Junction 26/27	40 (B1)	10,667	Journey times would decrease from the east and west due to reduced congestion on the existing route.	-02:27	-01:40	(++)
EM3 Newport Docks - existing ABP Newport site	204 (B1, B2, B8)	13,113	Journey times would decrease from the east and west due to traffic using the new motorway. The Dock junction provides improved access to the site.	-01:04	-04:00	(+++)
SAE1c Gwent Europark - Junction 23	13.3 (B8)	754	Journey times to the site from the east increase due to junction alterations at J23 and increased traffic on the network while traffic from the west decrease with traffic using the new motorway.	01:02	-11:15	(++)

⁹⁶ Based on journey times in the AM peak

Employment Site and Location	Size (ha) and Assumed Use Class	Employment Potential	Description of impacts of the scheme	Journey time change from M4 Junction in 2037 ⁹⁷ (minutes:seconds)		Significance (Based on WelTAG significance scale)
				Junction 23	Junction 29	
SAE1a Wales One, Magor (West) - Junction 23	4 (B1)	1,067	Journey times to the site from the east increase due to junction alterations at J23 and increased traffic on the network while traffic from the west decrease with traffic using the new motorway.	01:04	-08:13	(++)
SAE1b Quay Point - Junction 23	19.6 (B1, B2, B8)	1,110	Journey times to the site from the east are not forecast to change while traffic from the west would decrease with traffic using the new motorway.	00:00	-07:58	(++)

⁹⁷ Based on journey times in the AM peak

From the Table 6.21, the employment allocations can be grouped based on the significance of the impact. This assessment has been made based on journey time savings from the east and west and whether the scheme provides a new access for the site.

There are four sites which would be the primary beneficiaries of the scheme with journey time savings from the east and west and new access route from the new motorway. These sites were assessed as experiencing large beneficial impacts and can be categorised as key sites; these are:

- EM1 (ii) East of Queensway Meadows, South of Glan Lyn;
- EM1 (iv) Solutia;
- EM2 (i) Llanwern Former Steelworks Eastern End; and
- EM3 Newport Docks

Together, these sites comprise 300 hectares of employment land with a capacity to cater for around 17,500 jobs if fully developed.

The other sites in the study area would expect an improvement in accessibility although the impact is expected to be less direct as a result of mixed journey time impacts or because access arrangements to the site are unchanged. These further allocations have the potential to accommodate an additional 22,000 employees.

It should be noted that a key input for this approach is the local authority employment allocations data. The Newport data is for the period 2011-2026 while the Monmouthshire data is for 2011-2021. Given that the new motorway to the south of Newport will be completed in 2022 the road falls towards the end of the time horizons considered by the local authorities. However, it is important to note that both Newport and Monmouthshire have employment allocations much in excess of their expected takeup, in Newport an employment land requirement of 168 hectares for 2011-2026 has been forecast while they allocate a total of 566 hectares of employment land. Thus, the allocations would not be expected to be fully built out by 2022.

Estimating Scheme Impacts

The analysis of M4 Junctions provided in Figure 6.6 showed that, typically, 3,000 to 5,000 jobs might be expected to locate adjacent to a motorway junction in South Wales. The assessment of allocated employment sites set out above demonstrates that there would be sufficient space for this level of development around the new junctions.

Land use changes are long term effects which are hard to predict and therefore impacts can only be estimated at a high level. However, on this basis it would be reasonable to assume that, in the long term, in the region of 6,000 to 10,000 gross jobs may be accommodated in sites located around the two new junctions.

In practice, not all of the gross employment would be additional or directly attributable to the scheme. Two factors need to be taken into account in order to move from gross to net additional employment:

- Deadweight – this refers to the development of the sites that may occur regardless of whether the scheme is implemented;

- Displacement – displacement is where businesses that locate at the new junctions as a result of the scheme would otherwise have located elsewhere within the study area and cannot therefore be deemed additional.

To incorporate the impacts of deadweight and displacement, the gross employment impact have been adjusted to reach a net employment figure. Both deadweight and displacement effects are difficult to assess accurately and therefore a range is provided.

There is reason to expect that a high proportion of the jobs would be attracted as a specific result of the scheme and therefore deadweight is expected to be relatively low. Firstly, the scheme would have a transformative effect on access to the sites near the new junctions, making the sites more attractive for development. Secondly, evidence suggests that there is insufficient demand, without the scheme, to result in the sites being built out. In Newport an employment land requirement of 168 hectares for 2011-2026 has been forecast in the LDP. In total, 566 hectares of employment land has been allocated. Thus, the allocations would not be expected to be fully built out by 2022. The central value for deadweight of 30% has been based on the fact that forecast demand for employment land in Newport in the LDP represents approximately 30% of allocated employment land in the City.

Displacement effects could be significant given that a proportion of businesses locating at these junctions are likely to be seeking a location within the study area. However, as noted, the scheme will deliver a general improvement in the perceived and actual business environment rather than simply a local benefit and therefore a displacement effect of 50% for the medium scenario is considered to be a reasonable assumption. This is in line with ready reckoners for displacement given in the Additionality Guide.⁹⁸

Table 6.22 – Net additional employment impacts of land use impacts

Scenario	Gross Jobs	Deadweight	Displacement	Net New Jobs
Low	6,000	0.5	0.75	750
Medium	8,000	0.3	0.50	2,800
High	10,000	0.1	0.25	6,750

Overall, the analysis that the net additional employment impact of land use changes brought about by the scheme could result in additional employment of up to 6,750 jobs in the long term. This, however, may be a conservative estimate given that the scheme will improve perceptions of the area as a business location in a more general sense, delivering less direct benefits beyond the south of Newport.

6.5.4.7 Impacts on the Port of Newport

Impacts of the scheme, during construction and operation, on the operation of the Port of Newport have not been assessed in detail as part of the WelTAG process, although the important direct and indirect role of the Port for the economies of Newport and South Wales as a whole is acknowledged. It is noted that ABP Ltd

⁹⁸ Homes and Communities Agency (2014), Additionality Guide: Fourth Edition 2014

(the Port owner) are currently opposed to the scheme on the grounds that it would have an impact on the operation of the Port. The key determinant of the impact of the scheme on Port operations is the height of the Usk River crossing although it should be noted that the position of the crossing is such that only the North Dock is potentially affected with the South Dock unaffected. Neither high or low crossing options are considered to be fatal to the continued future of the Port.

Negative impacts on Port operations also need to be considered alongside the offsetting benefits of the improved access that would be brought about by the provision of a docks junction and ABP Ltd are in support of the inclusion of this junction.

6.5.5 EALI conclusion

During the construction phase, based on current estimates, there would be an average of **600 full-time construction workers** during the construction phase. In the construction phase there may also be some disruption to the existing transport network.

Once operational, the new motorway would provide direct business cost savings, chiefly due to reduced journey times and reduced fuel costs, these have been forecast to total **£59.2m** in the study area in 2037, the design year for the scheme. This is likely to be a conservative estimate of the benefits of scheme given that the benefits of improved journey time reliability are excluded.

The improvements in accessibility for business and commuters are expected to deliver higher levels of productivity in the study area by stimulating agglomeration effects across the 'Sevenside' economy. These benefits are forecast to total **£30.3m** in the study area in 2037.

In total, therefore, excluding changes in land use brought about by the scheme, the impact of the new motorway on GDP is expected to be **£89.5m** in 2037. Of this, **£74.1m** is expected to accrue to South Wales with the remaining **£15.4m** accruing to the English Sevenside.

The M4 plays a crucial role in the competitiveness of a cohort of firms in South Wales that rely on the route for the movement of goods. The direct effects of reduced business costs will influence competition between firms, allowing businesses in South Wales to compete more effectively in external markets and increase their market share. It has been demonstrated that effects on competition between firms can be translated in higher employment in the study area.

Further to these effects, by improving traffic conditions and reducing journey times to key centres, the scheme would make South Wales, and in particular the south of Newport, a more attractive location for investment. Employment sites most directly benefiting from the new route and its junctions have capacity for approximately 17,500 jobs. The level of development around existing M4 junctions in South Wales, suggests that up to 10,000 jobs might be expected to locate on these sites with the new motorway in place, of which up to 6,750 could be considered to be net additional jobs.

The overarching conclusion of the EALI is that the new motorway would be expected to deliver a major positive impact on the economy of South Wales.

6.6 Appraisal Summary Tables (ASTs)

Please see Section 9 for the ASTs that consider the economic impacts of the schemes.

7 Environmental Assessment

7.1 Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) is a process that provides for the high level protection of the environment, by ensuring the integration of environmental considerations in the preparation of strategies and plans and by contributing to the promotion of sustainable development and environmental protection.

Under the SEA Directive (2001/42/EC)⁹⁹, SEA is a legal requirement for certain plans and programmes. In Wales, this is implemented through the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004¹⁰⁰ (referred to as the SEA Regulations in this report). Welsh Transport Planning and Appraisal Guidance (WelTAG)¹⁰¹ Appendix E.2 also outlines how the appraisal of transport strategies, plans or programmes should take into account the SEA Regulations.

WelTAG describes the SEA process in terms of five main stages:

- Stage A: Setting the context and objectives of the plan, establishing the baseline and deciding on the scope;
- Stage B: Developing and refining alternatives and assessing effects;
- Stage C: Preparing an Environmental Report on the likely significant effects of the plan;
- Stage D: Consulting on the draft Plan and the Environmental Report; and
- Stage E: Monitoring the significant effects of implementing the plan on the environment.

7.1.1 SEA Environmental Report

The SEA Environmental Report provided a strategic environmental assessment of the M4 Corridor around Newport draft Plan, two reasonable alternatives and the Do Minimum scenario.

The Welsh Government's decision making process on the draft Plan is informed by a number of supporting documents, the Strategic Environmental Assessment (SEA) Environmental Report is one of the supporting documents. The SEA Environmental Report was consulted on alongside the draft Plan and its other associated assessments.

7.1.1.1 Scoping Stage

The purpose of the scoping stage is to ensure that the SEA Environmental Report addresses the relevant environmental issues of the draft Plan, and that the focus of the assessment fulfils the requirements of the statutory consultation bodies (in this case Natural Resources Wales, Cadw, Environment Agency England and Natural England).

⁹⁹ Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment

¹⁰⁰ Environmental Assessment of Plans and Programmes (Wales) 2004 *SI 1633*

¹⁰¹ Welsh Transport Planning and Appraisal Guidance, June 2008

An SEA Scoping Report was issued to the statutory consultation bodies in July 2013 and requested comments within a five week consultation period, in accordance with the SEA Regulations. The Royal Society for the Protection of Birds (RSPB) also requested a copy of the SEA Scoping Report and the Welsh Government provided the document, also requesting that any comments were received within the 5 week period from the original date of issue to the statutory consultation bodies.

The scoping responses were considered in the preparation of the SEA Environmental Report, contributing to the analysis of key environmental issues, review of policies and plans and the environmental baseline. The proposed scope of the assessment of the draft Plan, in terms of the topics addressed, the spatial and temporal boundaries, have been reviewed during the assessment to ensure that they remain appropriate as the assessment progresses.

7.1.1.2 Baseline Information Review

The SEA Regulations require a discussion of the '*relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme*' (Annex 1 (b)). The baseline provides the reference point for predicting and monitoring the likely effects of the draft Plan, its reasonable alternatives and the Do Minimum scenario. In this context, the baseline means the prevailing characteristics of the current situation.

The baseline information includes a review of relevant policies, plans and programmes that contain a range of background data and information of relevance to the draft Plan. In addition, the baseline has drawn on the range of social, environmental and economic data collected to inform the M4 Corridor around Newport WelTAG Stage 1 appraisal process.

Issues identified as part of the baseline information can be positive or negative, and will help to identify enhancement opportunities as well as measures to minimise any detrimental impacts that an intervention might have.

7.1.1.3 Approach to the SEA Environmental Report

The approach to the SEA has been to provide an expert judgement, based on a system of prediction and assessment, guided by the SEA Regulations¹⁰². The methodology and overall approach for the SEA included the following:

- Scoping and Consultation;
- Identification of likely environmental effects;
- Assessment of significance of effects;
- Documentation of the assessment; and
- Limitations and uncertainties in the process.

Environmental objectives for the M4 Corridor around Newport were set out in the SEA Environmental Report alongside the Aims and Goals of the M4 Corridor around Newport. The objectives cover all the topic areas listed in Schedule II of the SEA Regulations. These were evaluated against relevant local, national and

¹⁰² The Environmental Assessment of Plans and Programmes (Wales) Regulations 2004

international policies, plans and programmes. The compatibility of environmental objectives was tested to establish potential conflicts or tensions.

Cumulative assessment of the draft Plan and its Reasonable Alternatives with other policies, plans and programmes was also undertaken.

High level mitigation measures were developed to avoid, reduce and offset potential adverse effects, or enhance positive effects. These measures were in part developed, or incorporated from, the development work to inform a draft Plan.

The draft Plan can be seen to have performed in a complex way against the Environmental Objectives assessed in the SEA, with some potentially positive and some potentially negative impacts identified.

7.1.2 Strategic Environmental Assessment Statement

The comments received on the SEA Environmental Report were given consideration and taken into account in an SEA Statement. The purpose of the SEA Statement is to outline how the environmental assessment and associated consultation on the draft Plan influence the decision making process.

The SEA Statement includes a monitoring strategy to allow the effects of any of the options progressed from the draft Plan, should it be adopted (with or without amendments) to be tested against the predicted effects, enabling significant problems to be identified and addressed. Monitoring of certain effects might be more appropriate at a scheme (project) level.

The SEA Process has shown that there are no environmental reasons for significant changes to be made to the draft Plan. The Environmental Report developed mitigation measures and integrated these measures into the Plan; consequently, potential negative effects can be shown to be mitigated, positive effects enhanced, and uncertain significant effects (negative and positive) monitored through Plan implementation.

Of the high-level options considered within the SEA Environmental Report the appraisal of the Black Route and its Complementary Measures outperformed the remaining options and was shown to provide long-term benefits in relation to the draft Plan objectives.

7.2 DMRB Stage 2 Environmental Assessment

The Design Manual for Roads and Bridges (DMRB) Stage 2 Environmental Assessment builds upon the strategy level Stage 1 assessment, providing a scheme level environmental assessment of route options within the preferred strategy.

Stage 2 environmental assessment is based on the methodology set out in the DMRB Volume 11 Environmental Assessment, which is the guidance for the environmental design and assessment of trunk road schemes in the UK¹⁰³.

This Stage 2 environmental assessment has included environmental surveys and associated modelling to identify the key effects and factors to be taken into account when developing and comparing the route options.

¹⁰³ Highways Agency (2008) Design Manual for Roads and Bridges, Volume 11

The assessment of the route options was divided into the following three sections, see Figure 7.1:

- Section A – Black Route from Junction 29 at Castleton to the western end of Newport Dock. There is one proposed alignment option in Section A;
- Section B – Black Route crossing of Newport Dock. There are six alignment options within Section B (Option B1 – Option B6); and
- Section C – Black Route from the eastern end of Newport Dock to Junction 23a at Magor. There is one proposed alignment Option in Section C.

The following environmental topics were assessed as part of the DMRB Stage 2 Environmental Assessment:

- Ecology and nature conservation;
- Noise and vibration;
- Geology and soils;
- Cultural heritage;
- Air quality;
- Landscape;
- Materials;
- Effects on all travellers;
- Community and private assets; and
- Road drainage and the water environment.

The existing baseline conditions were identified for each environmental topic derived from desktop assessments of relevant published data, and supplemented by environmental surveys and modelling work which were undertaken to establish the noise and vibration, and air quality baselines. Assessment of effects was made based on an analysis of their magnitude and the sensitivity of receptor, combined with professional judgement.

At this Stage 2, cumulative effects from the project were assessed separately within each environmental topic.

Key mitigation strategies were also identified during the Stage 2 assessment. These should be considered during further scheme development and during the Stage 3 detailed design and environmental assessment.

Based on the DMRB Stage 2 assessment, in summary, there is a multi-disciplinary environmental preference for Route Options B1, B2 or B3 to be selected over B4, B5 and B6. Route Options B1 or B2 have an overall smaller environmental footprint than B3 although the difference is minor and inclusion of a junction in the Docks area associated with Option B3 means that this option does have wider socio-economic benefits that are considered as part of the WelTAG appraisal¹⁰⁴. When balanced against each other it was determined that the smaller environmental footprint was more advantageous.

Route Options B1 and B2 emerged as the preferred Route Options following extensive multi-disciplinary Stage 2 DMRB environmental assessment.

¹⁰⁴ Welsh Government, M4 Corridor around Newport, WelTAG, Preliminary Non-Motorised Users Context Report, Arup, March 2014, Ref: 13-8980

A3



7.3 WelTAG Stage 2 Environmental Appraisal

The WelTAG Stage 2 environmental appraisal aligns with the DMRB Stage 2 assessment. The methodology followed is that set out in the WelTAG guidance document 2008 for Stage 2 appraisal. The route being appraised by WelTAG Stage 2 is the Black Route option with Junction (i.e. Option B1 & B2) (refer to section 4.2 for explanation).

The sections below set out the findings of the assessment work which is summarised further in the Appraisal Summary Tables, (Section 9). As in the DMRB assessment, the Black Route option with Junction has been divided into three sections (Section A, Section B and Section C) in order to make the assessment of the route more meaningful.

7.4 Noise

The noise assessment has been made in accordance with the methodology set out in Calculation of Road Traffic Noise and in accordance with the Welsh Planning and Appraisal Guidance. The WelTAG assessment includes the calculation of the scheme-wide net annoyance change and the scheme wide net present monetary value of the noise proposal.

Residential properties within the study area were then identified using Ordnance Survey buildings and address point data. Population data is based on the national average household size (i.e. 2.36, taken from latest January 2014 WebTAG 3.3.2 Guidance).

The same road surface corrections used in the DMRB simple assessment have been applied in this assessment. For all tertiary roads and the existing M4, hot rolled asphalt was assumed (HRA assumes a -0.5dB noise correction using the CRTN method). For the new sections of the M4, in Do Something scenarios, a 'low noise surface' correction of -3.5dB was applied.

The full WelTAG appraisal tables are given in Appendix C. The results are summarised as follows:

The net difference in people annoyed due to noise in the longer term as a result of the scheme, compared to the Do Minimum situation scenario is -825 (i.e. a reduction in people annoyed).

The net present value of noise proposal (60 year period) is £32,953,180 (i.e. a net benefit).

The existing M4 alignment passes to the north of Newport through areas of high population density. In the Do Something scenario traffic flows are greatly reduced on this alignment and the majority of through-traffic is diverted along the new alignment, to the south of Newport, through areas with a very low population density. As such, there is a significant reduction in noise level at many residential properties close to the existing alignment and significant increases at a lot fewer properties near the new alignment. Consequently, the WelTAG analysis of the scheme shows substantial reductions in the number of people annoyed due to noise and a large monetary benefit in the net present value of noise associated with the proposals over a 60 year period.

7.5 Local Air Quality

An assessment of baseline conditions was undertaken for the DMRB Stage 2 assessment (see Appendix D) which indicates that pollutant concentrations along the existing M4 corridor are elevated and in many places exceed EU limit values and national air quality objectives. As such, Newport City Council has declared four air quality management areas for exceedences of the annual mean NO₂ objective along the existing M4.

Background pollutant concentrations along the Black Route option with Junction are generally low with the exception of the docks area where monitored concentrations are higher due to the presence of industrial pollution sources.

The local air quality assessment considers all properties within 200m of the affected road network, as defined by DMRB criteria; this includes the existing M4 Corridor as well as the Black Route option with Junction. As such it is difficult to separate the assessment between Section A, B and C. However, it can be observed that the majority of receptors affected by the scheme lie along the existing M4 corridor and not the proposed option. This is confirmed by the number of properties which experience a benefit as a result of the scheme, those situated along the existing M4 corridor, compared with those that experience deterioration in local air quality, those within 200m of the proposed option.

155 properties are predicted to experience deterioration in PM₁₀ concentrations and 32 properties are predicted to experience deterioration in NO₂ concentrations, while 7780 properties are predicted to experience an improvement in PM₁₀ concentrations and 7900 properties are predicted to experience an improvement in NO₂ concentrations. It has been assumed that a number of isolated properties along the Black Route option with Junction will be demolished in order to construct the scheme. Overall the scheme is predicted to be beneficial for local air quality as the urban areas surrounding the existing M4 experience a decrease in pollutant concentrations.

7.6 Greenhouse Gas Emissions

Greenhouse gas emissions are of importance on a regional and global scale rather than at a local scale, as such the assessment considered the entire proposal network (see Appendix D). The assessment considered changes in carbon dioxide (CO₂) emissions using the Department for Transport TUBA software.

The assessment indicated that the scheme would result in an increase in CO₂ emissions over the 60 year appraisal period.

7.7 Landscape and Townscape

7.7.1 Section A

Section A passes through Landscape Character Areas (LCAs) considered of medium to very high sensitivity. The location of the Castleton Interchange on elevated ground combined with the loss of mature vegetation, which currently provides some screening of the existing motorway, would create a more open landscape with long distance views of the scheme. Due to the size, scale and the

duration of the effect on the landscape the magnitude of change on the landscape character is considered to be very high. Likewise the Wentlooge Levels are considered a tranquil landscape with little development and therefore the size and scale of the effect and the duration of the effect on the landscape is considered to be very high.

This results in some significant effects rated Large and Very Large effects on the landscape character within Section A.

Effects on views vary from location to location from Moderate for receptors in Michaelston-Y-Fedw, to Large in particular locations in Marshfield and Castleton, among others.

Woodland screen and tree-lined hedgerow planting is proposed along the embankments and verges of the main route through this area. As this planting matures it would gradually reduce the proportion of views occupied by development and effectively mitigate adverse effects. It is anticipated that effects over 15 -20 years, with the exception of that predicted on users of the Heol Pont-y-Cwch PRow, would be reduced in significance by on average one rating (for example, Large reduced to Moderate).

7.7.2 Section B

The main landscape and visual effects of the scheme in this area would result from views of the new roads, the main Bridge over the Usk and from elevated road ways either end on viaducts and then tapered embankments bringing the road back down to grade.

Effects on three sensitive landscape character areas range from Large to Very Large in terms of significance.

Effects on views vary from location to location from Moderate for receptors in Uskmoth area, to Large effects on the visual settings of the Transporter Bridge and its two Anchor Chambers, amongst others.

7.7.3 Section C

Section C crosses four Landscape Character Areas with effects ranging from Very Large on the Caldicot Levels due to environmental and landscape designations making this area highly sensitive, to Moderate across the Llanwern industrial area and rural character area north of Magor.

Visual effects vary from location to location from Slight for PRowS on the Caldicot Levels, to Very Large on the northern edge of Magor, among others.

Across the Caldicot levels visibility of the scheme throughout the area would be significantly restricted due to the existing tree cover of existing woodland and tree-lined field boundaries.

There are over 100 dwellings on the west and north edges of Magor, which are ascribed a high level of sensitivity. Residents would experience views of the scheme at close range on an embankment in the southwest and at grade to the north. The magnitude of changes to these views is predicted to be high and effects on the visual amenity of these receptors would be of Very Large significance.

Considerable amounts of woodland screen planting would be introduced around this junction to mitigate the visual amenity effects of footpath users and local residents. This would take the form of roadside planting, but may also involve enhancements to tree cover in the boundaries of intervening fields and the gardens of effected properties. It is anticipated that as this planting matures over a period of 15-20 years, it would gradually reduce the proportion of views occupied by development and effectively mitigate residual visual effects on the visual amenity of PRow users and residents would be of Slight and Moderate significance respectively.

7.7.4 Cumulative effects

The introduction of the proposed raised motorway and its associated structures, embankments, and cuttings as well as the loss of the existing vegetation which currently provides screening of the existing motorway would have a cumulative impact on the receptors within the Landscape Character Areas of Section A. The introduction of the scheme would result in a more fragmented landscape and a perceived loss of tranquillity of the area, particularly for the properties and public footpaths south of the scheme.

The temporary loss of roadside vegetation from the proposed junction of the scheme with the existing motorways as a result of construction activities would adversely impact on the character of the landscape the visual amenity of nearby receptors and the amount of habitat for wildlife.

During the construction stage, vehicle travellers on minor roads around the scheme would have reduction in views from the road across the landscape due to the presence of construction machinery site compounds and areas of stripped land.

During the operation stage, the scheme within Section A would be visually dominant for receptors travelling near to or under it and would obstruct views across the landscape for vehicle travellers on existing minor roads around the scheme.

7.8 Biodiversity

7.8.1 Designated sites

Within Section B the route crosses the River Usk Special SAC which is also designated as a Site of Special Scientific Interest (SSSI). The location of the River Usk SAC and other European Sites are shown on Figures 7.2 and 7.3.

A large proportion of the scheme is located within the various Gwent Levels SSSIs. These comprise a series of sites which cover the majority of the Gwent Levels located on the coastal fringe of the Severn Estuary between Cardiff and the first Severn Crossing. These sites are shown in Figure 7.3 and described in detail in the Phase 1 and Desk Study Report included in Appendix E. The main interest of the Gwent Levels SSSIs is the network of drainage channels, known as reens, which support a range of important plant and animal species, in particular the assemblage of aquatic and terrestrial invertebrates.

The Severn Estuary European Site is located approximately 700m to the south at its closest point to the scheme. This site incorporates the SAC, SPA and Ramsar

site. It has been designated for the range of habitats caused by the large tidal range (second largest in the world), the populations of migratory fish which use the estuary and the populations of winter birds which utilise habitats around the estuary. The bird interest includes individual species as features of the SPA and Ramsar site, and the assemblage of wintering waterfowl.

7.8.2 Non Statutory Sites

Non statutory designated sites known as Sites of Importance for Nature Conservation (SINCs) have been designated by the local authorities covering the survey area. There are a large number of these sites shown on Figure 7.4 and described in Appendix E (Phase 1 and Desk Study Report).

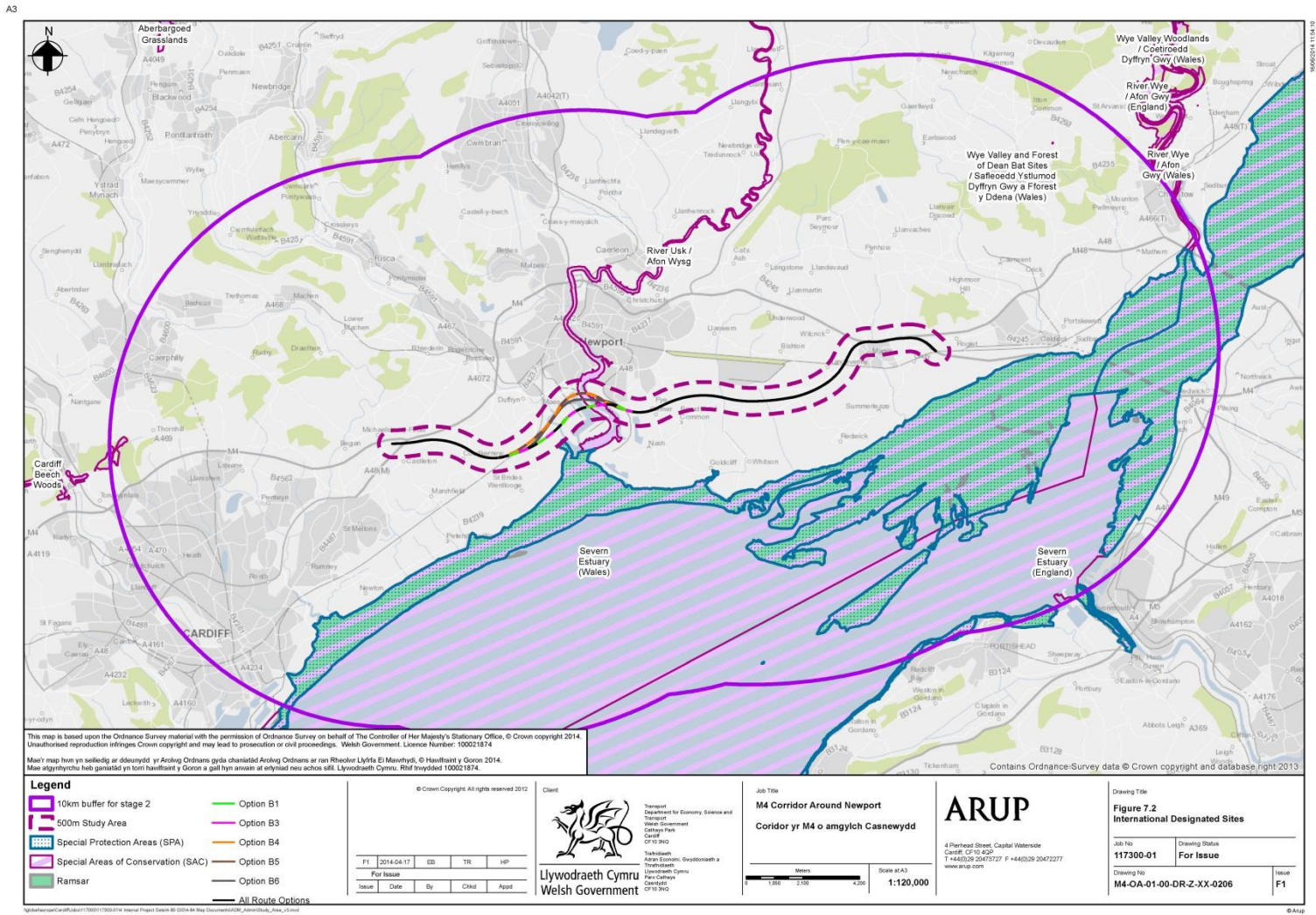
7.8.3 Protected Species Records

A search of the data provided by the South East Wales Biological Records Centre (SEWBRc) showed a large number of records of legally protected and otherwise notable species. These include records of bat species, dormouse, otter and great crested newt, all of which are European Protected Species. UK protected species previously recorded include water vole, badger, reptiles, and many breeding birds. More details are provided in the Phase 1 and Desk Study Report in Appendix E.

7.8.4 Phase 1 Habitats

The habitats present within the survey area are shown in Figures 7.5 – 7.11 and in the Phase 1 and Desk Study Report in Appendix E. The Habitats present are described in sections 7.8.4.1 to 7.8.4.3.

Figure 7.2: International Designated Sites



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Legend

- 2km DMRB stage 2 buffer
- National Nature Reserve (NNR)
- Sites of Special Scientific Interest (SSSI)
- Option B1
- Option B3
- Option B4
- Option B5
- Option B6
- All Route Options

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Client: Transport Department for Economy, Science and Transport
Welsh Government
Cardiff Park
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Welsh Government

Job Title: M4 Corridor Around Newport
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Drawing Title: Figure 7.3 Nationally Designated Sites

Job No: 117300-01
Drawing Status: For Issue

Drawing No: M4-OA-01-00-DR-Z-XX-0207

Issue: F2

Figure 7.4: Location of SINC Sites



Figure 7.5: Phase 1 Habitats

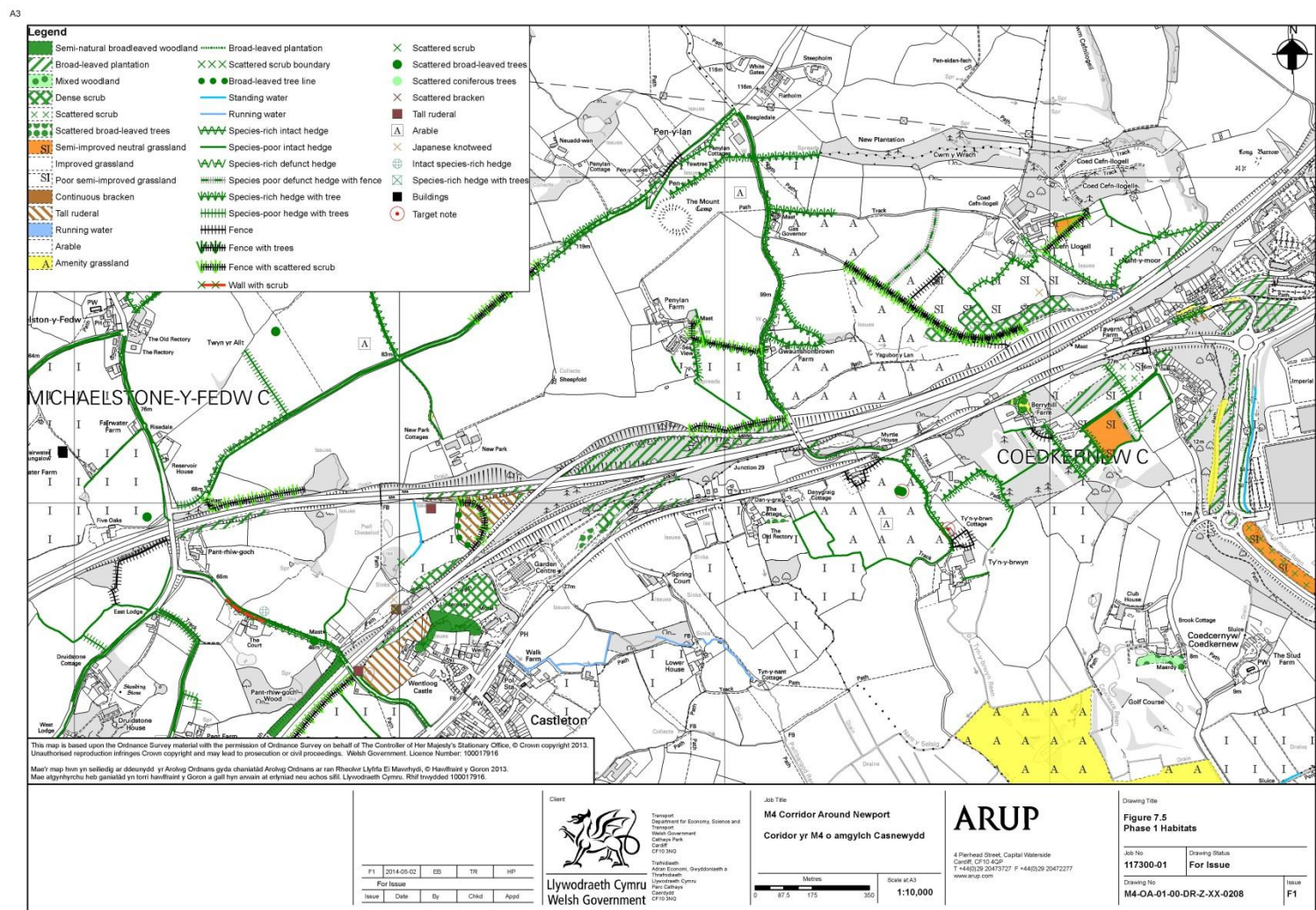


Figure 7.6: Phase 1 Habitats



Figure 7.7: Phase 1 Habitats

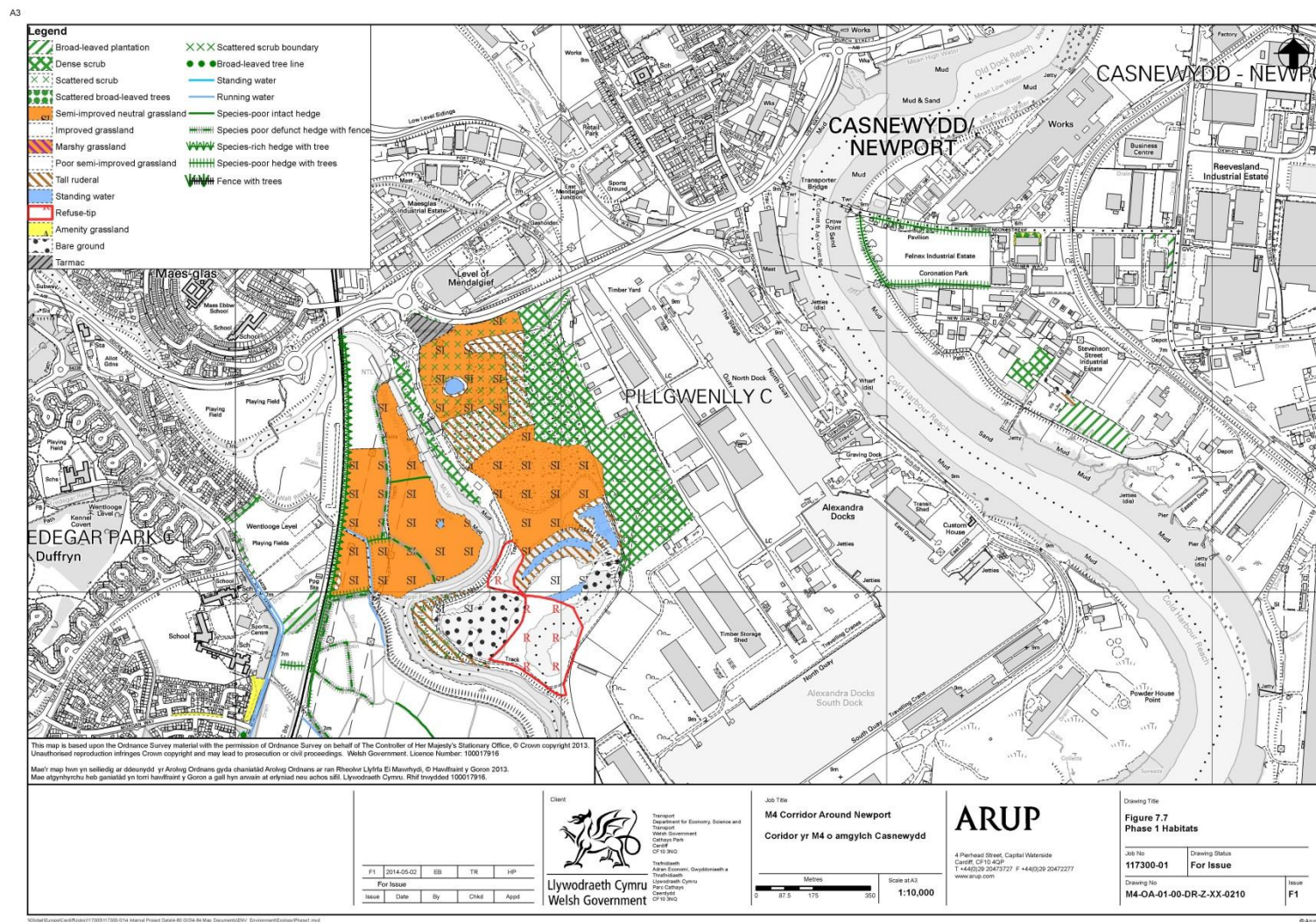


Figure 7.8: Phase 1 Habitats

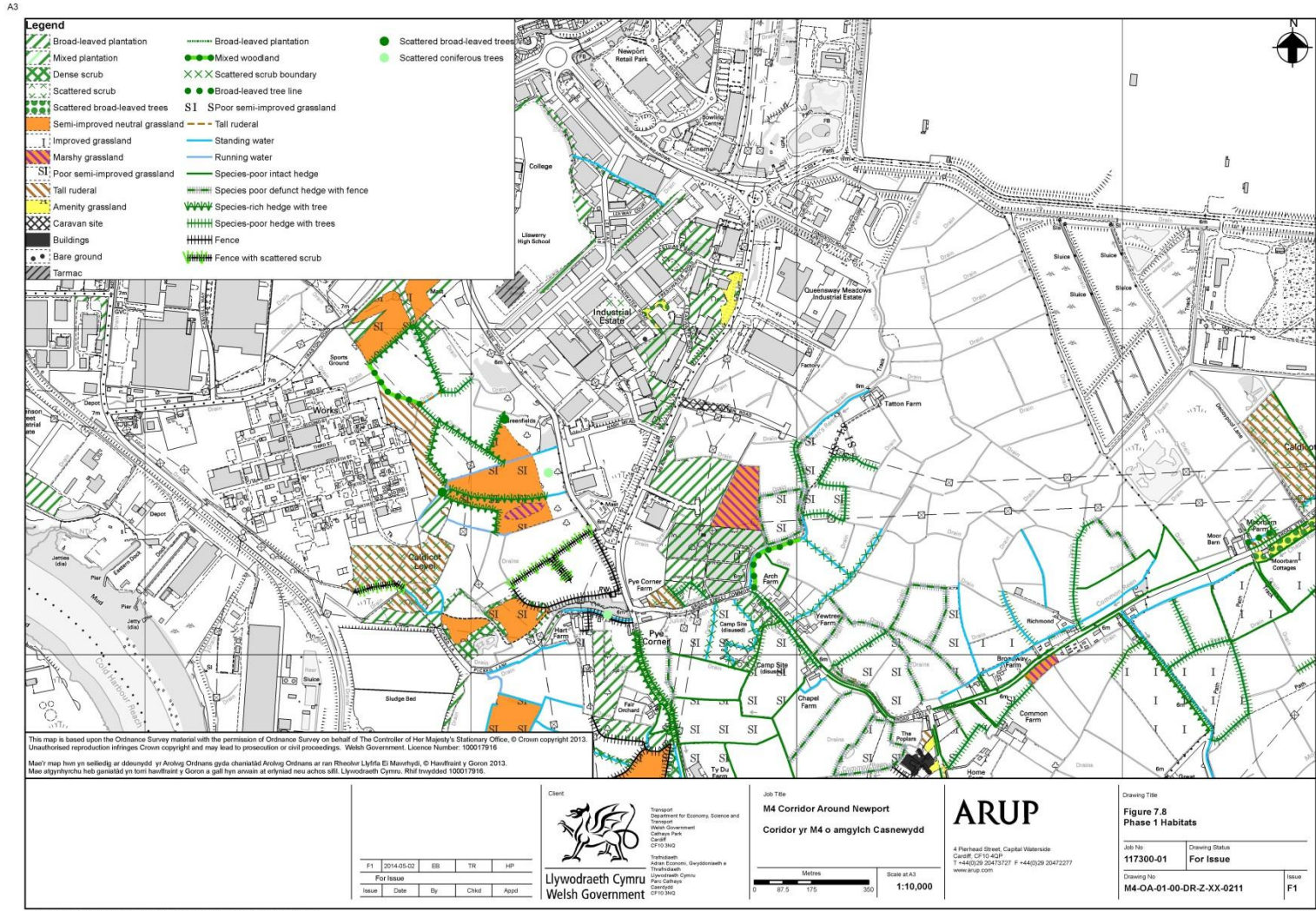


Figure 7.9: Phase 1 Habitats

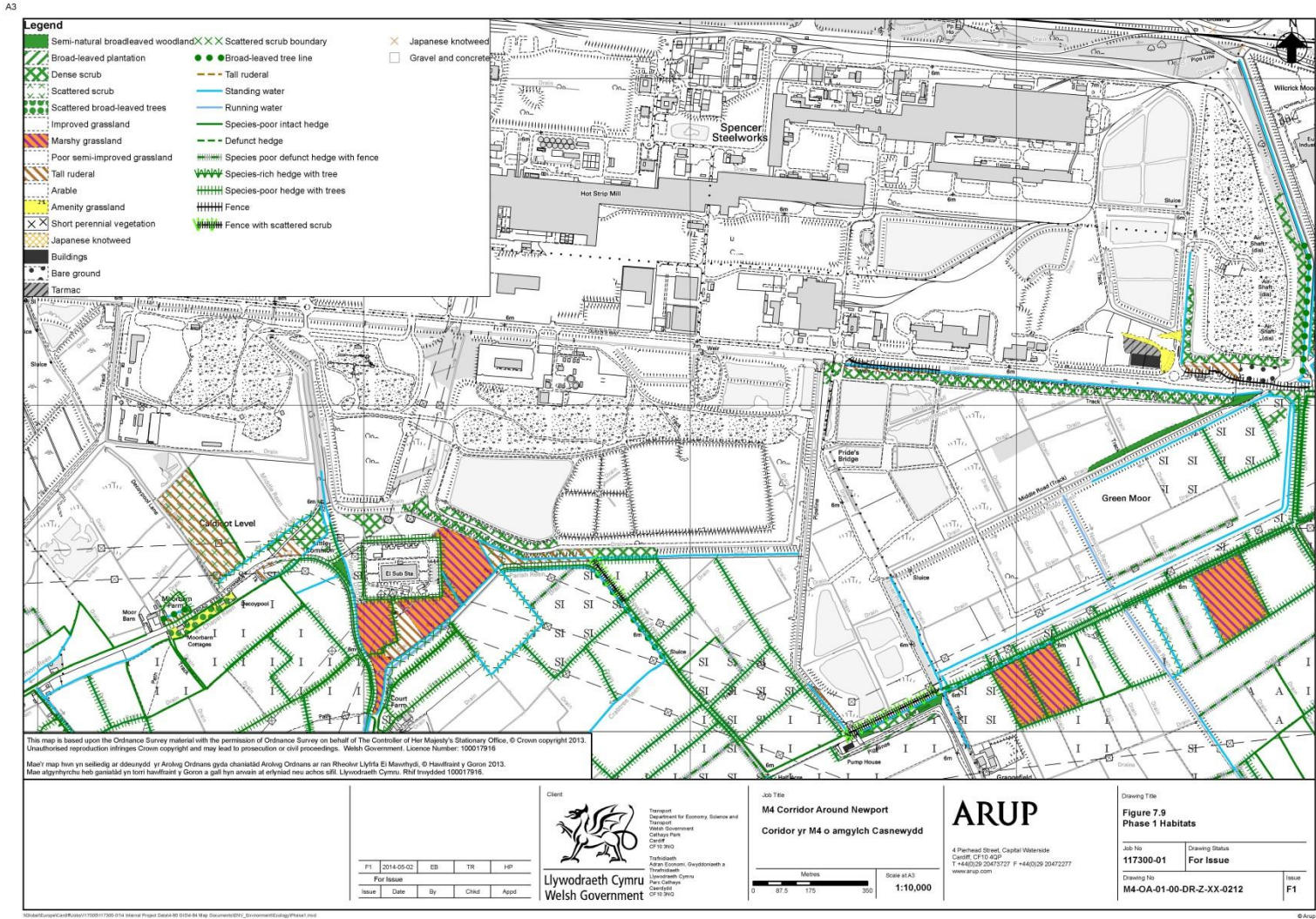
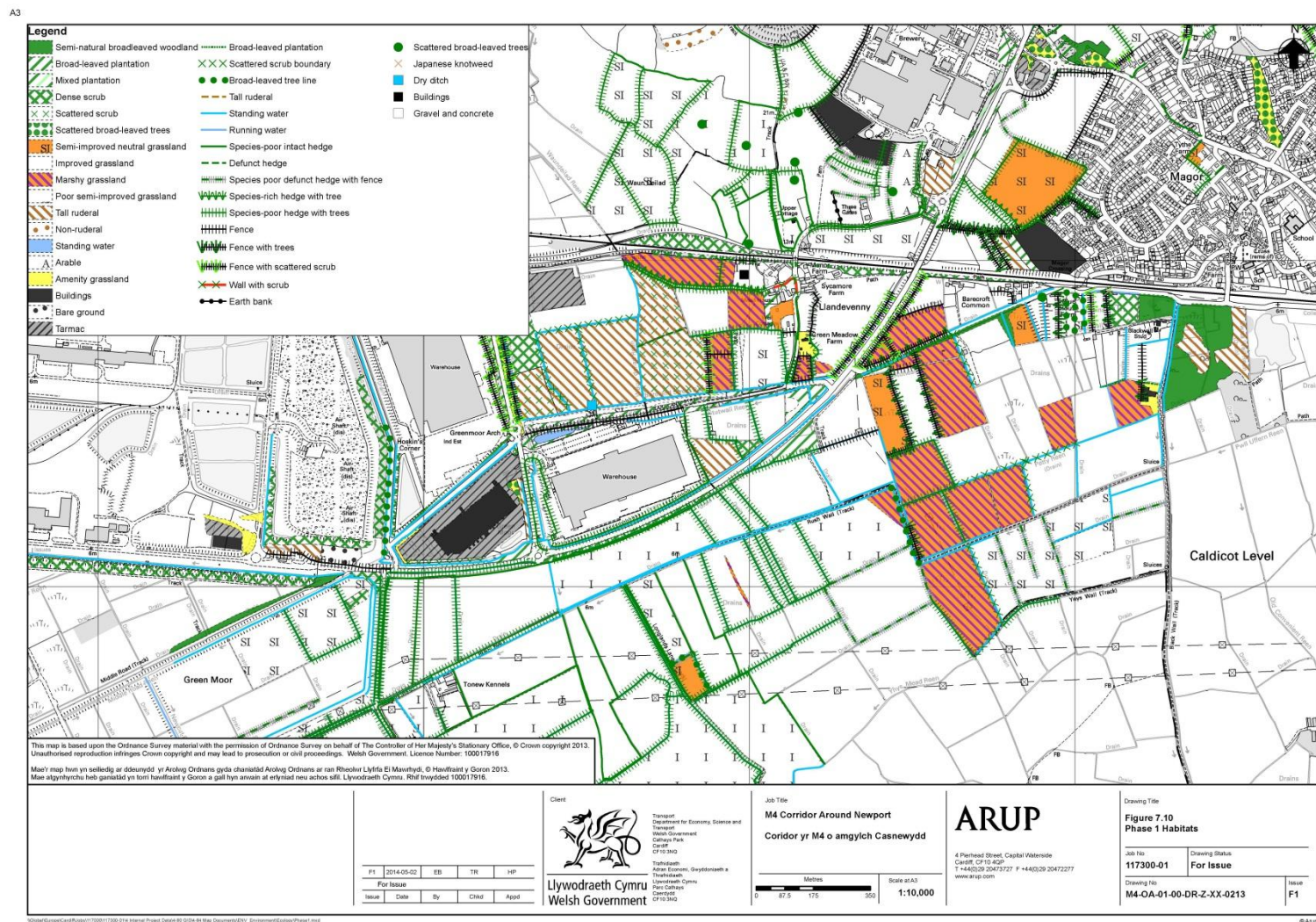


Figure 7.10: Phase 1 Habitats



A3



7.8.4.1 Section A – Phase I habitats

This section comprises two significantly different areas. At the western end of the section the route is located within the upland areas fringing the coastal plain of the Gwent Levels. This area is characterised by small woodland copses and agricultural fields, including both arable and pasture. As the route alignment curves south from the existing M4 motorway, it descends from the raised area through an existing fruit farm and golf course on the Gwent Levels.

The Gwent Levels is a large expanse of largely flat land which has historically been reclaimed from the sea by the creation of a sea wall enclosing areas of saltmarsh. An extensive network of reens (drainage ditches) is present which are managed to maintain water levels. During the drier summer months the water level is maintained by penning boards at a higher level to ensure crops are watered and livestock have access for drinking. In winter the penning boards are removed, lowering the water level to provide capacity for flood water without fields being inundated. The Levels are drained through outfalls through the sea defences protected by tidal gates/valves resulting in the periodic stagnation and flow especially in the reens closer to the coast.

Although some areas within the Gwent Levels are used for arable farming the predominant land use is for livestock grazing. The area has a rich plant and animal diversity within the reens in particular the aquatic plants and invertebrates for which the SSSIs are designated.

Other areas of particular note along this section of the route include woodland copses and hedgerows at Castleton where dormice have previously been recorded, a small area of mature woodland at Berryhill Farm, large areas of plantation woodland adjacent to the spur road at Quinn Radiators (formerly LG) and poor semi-improved grassland areas adjacent to the main railway line.

Species known to be present or for which potential has been identified include bats (roosts previously identified at Berryhill Farm and Maerdy Farm), badgers (setts present at Castleton), breeding birds including species such as barn owl and warblers (the latter breeding in areas of reeds within reens), and water voles (populations previously identified to the south of Quinn Radiators).

7.8.4.2 Section B – Phase I habitats

The majority of this area comprises the working area of Newport docks and the active landfill sites located behind the docks and the River Ebbw. The routes pass through more areas of rough pasture within the Gwent Levels SSSI before crossing the River Ebbw. The flood plain of the river has a relatively narrow band of salt marsh as the river is constrained by the sea bund on the western bank and the landfill site on the east.

Although some sections in the northern part of the landfill have been capped and seeded with grassland, the southern area is currently active. To the east of the landfill site, Newport docks comprise an area of intense industrial activity around the two deep water bodies. The docks are regularly used by vessels and vehicles moving freight around the dock yards.

The eastern side of the docks is contiguous with the western bank of the River Usk. This bank has a narrow bank of common reed at the top of the steep facing mud flats caused by the very large tidal range. A number of boat moorings are present along this bank of the river with numerous jetties and pontoons, with paths through the reeds caused by people accessing these structures.

On the east side of the River Usk the flood defences (a small bund) are set back from the crest of the bank and a band of salt marsh is present alongside the river. This is adjacent to playing fields and to more areas of industrial units located along Corporation Road. With the exception of the salt marsh and a fringe of scrub, this area is relatively low in biodiversity interest.

To the east of Corporation Road the routes dip southward of the Solutia chemical works passing through areas of grassland and wet woodland towards Pye Corner.

Within this section the rivers have the potential to be used by otters, particularly the Ebbw which is more secluded. Breeding birds are also likely to be present in areas of scrub, wet woodland and the reeds on the banks of the Usk. Bats and dormouse are less likely to be present in these areas as there is less suitable habitat. Badgers are known from previous studies to be present at Pye Corner in the old caravan park.

Previous records of great crested newts are present at Solutia where mitigation was required during the erection of two wind turbines¹⁰⁵. Previous studies for the M4 recorded the presence of several bat species including pipistrelle species and *Myotis* bats roosting in buildings at Pye Corner.

7.8.4.3 Section C – Phase I habitats

This largest section of the route can be split in to four parts. The first and third parts comprise areas within the Gwent Levels at Tatton Farm and Bareland Common similar to those described in Section A. The second part of the route is located within the boundary of the Llanwern steelworks. This area includes large reed beds which form part of the water treatment system, slag tipping areas, settlement lagoons and grazed areas at the eastern end similar in nature to the areas of the levels. The fourth part of the route is located on the higher ground to the north of Magor where the route rejoins the existing M4 corridor. This area is similar in terms of habitats to the area at Castleton in the west.

The area of the steelworks lagoons has previously been found to contain great crested newts which have also been found in a reed at North Row. The reed beds are very likely to contain populations of breeding warblers and other bird species will be breeding in the hedgerows and lagoons within this section of the route.

Badgers are known to be present at Magor both on the Queensway Link close to the railway line and at Magor Vicarage; the property at this location also previously contained roosting bats during previous surveys for the M4. Habitats present around Magor also have the potential to support dormice. Otters and water voles have both been found during previous surveys in the area to the south of the Gwent Europark.

¹⁰⁵ Peter Sturgess, 2008 (Pers comm).

7.8.5 Evaluation of Receptors

The European Sites identified within the desk study are considered to be of international value and the features of SSSIs such as the reens within the Gwent Levels sites are considered to be of national importance. SINC sites are considered to be of County importance.

Without specific detail on the distribution of legally protected species which would not normally be obtained until EIA stage, it is difficult to evaluate the populations that may be present. However the following indicative values have been ascribed as set out in Table 7.1 based on a precautionary approach and assumptions based on the previous surveys and knowledge of the distribution of species within the area.

Table 7.1: Indicative Evaluation of potential species receptors

Potential Species	Valuation	Rationale
Dormouse	County	Dormice are relatively common in South East Wales with a sizable population known to be present within east Cardiff.
Badger	Local	Badgers are only protected due to the history of persecution in accordance with the Protection of Badgers Act (1992). While of some value to biodiversity, this is of local importance.
Great crested newts	Local	Small isolated populations known to be present at Solutia, Llanwern Steel Works and North Row.
Other Bats	Local	A number of roost sites have been identified along the route corridor during previous surveys. These were all used by relatively small numbers of bats.
Horseshoe bats	National	While only two records of lesser horseshoe bats were recorded during previous studies in 2008, it is noted that Ruperra Castle is located within 5km. If horseshoe bats are recorded these could be linked to the SSSI population and therefore be of National value depending on where any bats were recorded, animals could form part of the SSSI population and therefore be of National value.
Otter	County - International	Otters are known to be present across much of the Gwent Levels and are features of the River Usk SAC. Drawing the distinction between animals which are part of the SAC population or not would be difficult due to the size of otter territories. For the purpose of this assessment it is considered that within Sections A and C otter are of county value but are of international value in section B.

Potential Species	Valuation	Rationale
Water vole	County	Water voles are likely to be present and widespread across the Levels due to the large amount of high value habitat afforded by the reen network. In addition a release programme has been undertaken at Magor Marsh by the Gwent Wildlife Trust in 2012 ¹⁰⁶ .
Reptiles	Local	Grass snakes can be assumed to be present across the Gwent Levels. Other species may also be present in areas of suitable habitat.
Breeding bird species	Local – County	The study area is likely to support a range of common breeding bird species along with some more notable or protected species such as Cetti's warbler and barn owl (Schedule 1 of the Wildlife and Countryside Act 1981). Significant populations of these species would warrant a higher valuation.
Wintering birds	Local – International	The study area has the potential to support wintering bird species including thrushes and starlings. In addition due to the proximity of the Severn Estuary SPA and Ramsar site, any species which are features of these sites should be considered to be of International value.

7.8.6 Appraisal of effects on biodiversity

7.8.6.1 Section A

Section A of the Route will result in the loss of a section of the Gwent Levels SSSIs due to the width of the motorway and any associated infrastructure (such as water treatment areas), and of approximately 1km in length. This would be a permanent loss from the designated area which could not be reversed, however it is proposed to create additional reens parallel to the new motorway to maintain the hydrological connectivity of the reen network. Aquatic flora and fauna (the features of the SSSI) would be translocated or allowed to move to these additional reens, thereby maintaining or increasing the extent of reen habitat within the SSSI areas. There may also be additional disruption and disturbance of soil in proximity to reens during construction although any impacts on the SSSI features as a result of this would be temporary and reversible. The overall impact on the SSSI features (of National conservation value) is considered to be of intermediate magnitude and Large Adverse significance.

The proposed route is unlikely to give rise to significant effects on any SINCE sites, although the tie in works at the Castleton Interchange may result in minor impacts on the SINCEs which are adjacent. This may be avoidable through design

¹⁰⁶ <http://www.gwentwildlife.org/>

and mitigation. This is considered to be a minor magnitude impact of Slight Adverse significance.

One small area of ancient woodland at Berryhill Farm is located directly beneath the footprint of the proposed route, which will therefore be removed during construction. The area is classed as Ancient Semi-Natural Woodland indicating that it is believed to have been in existence for over 400 years. One very large mature tree is known to be present in the woodland.

There are also three other areas of ancient semi-natural woodland adjacent to the Castleton Interchange which may be affected by tie in works during construction, although design and mitigation may enable these areas to be unaffected. Overall the loss of one small area of ancient woodland is considered to be a major negative impact but would be of only Slight Adverse significance.

Other habitats that would be affected by this route include areas of woodland plantation, semi-improved and improved grassland areas, amenity grassland and arable fields. None of these areas are of greater than local value, and although considerable areas would be lost the significance of this intermediate impact would be of Neutral level.

The scheme also has the potential to affect a number of protected and otherwise notable species. These include populations of dormice and badgers at Castleton, bat roosts at Berryhill Farm and Mardy Farm, other areas of bat foraging habitat and flight routes, wintering and breeding bird populations and otter populations.

The impacts on these receptors are shown in Table 7.2.

Table 7.2: Assessment of Impacts on Species Populations from Section A

Receptor	Impact	Value	Magnitude	Significance
Dormouse	The construction of the route has the potential to remove areas of dormouse habitat especially if they are present in area of scrub and woodland on the cutting slopes of the existing Castleton junction.	County	Minor	Slight adverse
Bat roosts	The two known roosts at Berryhill Farm and Mardy Farm will not be directly affected by the proposed route. However other roosts may be present.	Local	Negligible	Neutral

Receptor	Impact	Value	Magnitude	Significance
Bat flight lines and foraging areas	The proposed route is likely to cause significant disruption to the flight routes of bats within the local landscape by severing commuting corridors and removing areas of foraging habitat.	Local (horseshoe bats National if part of SSSI populations)	Major	Neutral (Very Large if horseshoe bat areas are affected)
Otter	The construction of new motorway has the potential to create a barrier to otter movement and risk the mortality of otters by being hit by vehicles. However, this can largely be avoided with standard mitigation as outlined in Volume 10 of DMRB.	County	Negligible	Neutral
Badger	The works at the Castleton Interchange have the potential to affect outlier setts used by badgers. However the main sett will not be affected (based on the 2008 survey results) and the loss of foraging habitat will be minor and only temporary during construction work.	local	Negligible	Neutral
Wintering Birds	There is the potential for loss of habitat and displacement through disturbance during construction. The effects of habitat loss are likely to be negligible as there are extensive areas of alternative habitat which birds could use.	Local	Minor	Neutral
	Disturbance of roosting or foraging areas used by SPA/Ramsar features	International	Minor	Slight adverse

Receptor	Impact	Value	Magnitude	Significance
Breeding Birds	Loss of habitat may affect breeding bird populations. In addition there is evidence that the noise of traffic on roads can deter some birds from nesting in close proximity meaning the overall loss of habitat is slightly greater than the footprint of the road.	Local - County	Minor	Neutral – slight
Water voles	The route has the potential to destroy water vole burrows and habitat on the water courses that will be lost to the scheme. A programme of translocation/displacement would be required as part of a mitigation package.	county	Minor	Neutral
Reptiles	The route has the potential to affect areas of reptile habitat, most notably that of grass snake which is assumed to be present throughout the Gwent Levels. Other species may also be present in localised populations. The construction of the route is likely to give rise to effects of habitat loss and fragmentation although these can be reduced and off set through appropriate mitigation and compensation.	Local	Minor	Neutral

7.8.6.2 Section B

The route crosses the River Usk SAC on a large bridge structure. The proposed bridge span will mean that piers are unlikely to be located within the river channel itself, but piers of the structure may be located within the SAC boundary, which

includes the areas of marginal habitat including saltmarsh on the eastern bank of the river. There may be effects on the movement of fish and otter along the river during piling or night working during construction. Design of pier locations and construction methods on the river bank should consider the potential for vibration effects to cause disturbance to migratory fish, which it is envisaged can be mitigated through careful management of construction programme and construction techniques. The effects of the construction of the bridge crossing are therefore considered to be of minor magnitude and of Slight Adverse significance.

Approximately 2.5km of this option lies within the boundaries of the Gwent Levels SSSIs, and crosses the River Usk (Lower Usk)/Afon Wysg (Wysg Isaf) SSSI. As described for the route within Section A, the construction of the scheme would give rise to an intermediate impact of Large Adverse significance.

The route would give rise to impacts on three SINC sites at the River Ebbw, the saltmarsh along the River Usk and at the Solutia chemical plant. The construction of the motorway including the potential construction of a pier within the saltmarsh is likely to give rise to major impacts on all three of these sites. These would be considered to be of Slight Adverse significance.

The construction of the route would give rise to losses in a number of habitats including arable farm land, improved and semi-improved grassland, saltmarsh and scrub habitats. These are considered to be minor impacts of Slight Adverse significance.

Effects on Protected Species from Section B

These options have the potential to affect a number of protected and otherwise notable species. The impacts on these receptors are shown in Table 7.3.

Table 7.3: Assessment of Impact Magnitude and Significance from Section B on Species Receptors

Receptor	Impact	Value	Magnitude	Significance
Bat flight lines and foraging areas	The proposed route options are likely to cause significant disruption to the flight routes of bats within the local landscape by severing commuting corridors and removing areas of foraging habitat.	Local	Major	Neutral (Very Large if horseshoe bats from SSSIs are affected)
Otter	Assessed as a feature of the River Usk SAC			

Receptor	Impact	Value	Magnitude	Significance
Great crested newt	A population of great crested newts is known to be present within the area of the Solutia chemical plant and Alpha Steel lagoons. These route options are likely to sever this population and although some mitigation is possible, the construction of the route is likely to have a major effect on the population within these areas.	Local	Major	Slight adverse
Wintering Birds	There is the potential for loss of habitat and displacement through disturbance during construction. The effects of habitat loss are likely to be negligible as there are extensive areas of alternative habitat which birds could use.	Local	Minor	Neutral
	Disturbance of roosting or foraging areas used by SPA/Ramsar features would be a larger scale impact.	International	Major	Very Large adverse
Breeding Birds	Loss of habitat may affect breeding bird populations. In addition there is evidence that the noise of traffic on roads can deter some birds from nesting in close proximity meaning the overall loss of habitat is slightly greater than the footprint of the road.	Local – County	Minor	Neutral – slight adverse
Water voles	The route has the potential to destroy water vole burrows and habitat on the water courses that will be lost to the scheme. A programme of translocation would be required as part of a mitigation package.	County	Minor	Neutral

Receptor	Impact	Value	Magnitude	Significance
Reptiles	The route has the potential to affect areas of reptile habitat, most notably that of grass snake which is assumed to be present throughout the Gwent Levels. Other species may also be present in localised populations. The construction of the route is likely to give rise to effects of habitat loss and fragmentation although these can be reduced and off set through appropriate mitigation and compensation.	Local	Minor	Neutral

7.8.6.3 Section C

Section C includes a total of approximately 5.5km within the Gwent Levels SSSIs. The effects on these designated sites would be similar in nature to those described above for Section A and Section B. The loss of area within the SSSI and the impacts on reens and ditches is considered to be of intermediate magnitude and of Large Adverse significance.

The Route within this section will also significantly affect a number of SINC sites including the Solutia SINC and Spencer Works SINC. In addition there are two further SINC sites which lie adjacent to the scheme which could suffer minor encroachment during construction subject to design and mitigation. Overall the effects on SINC sites are considered to be of major magnitude and of Slight Adverse significance.

The habitats affected by this section are similar to those within Section A, although greater areas of wet woodland, scrub and reed bed will be affected within the area of the Llanwern Steelworks to the south of the Steelworks Access Road. The loss of these habitats is considered to be of intermediate magnitude but Neutral significance due to the low value of the habitats concerned.

The protected species present within the vicinity of the proposed route in this section are similar to those in the previous two sections. Bat roosts are known to be present from 2008 data in buildings at Pye Corner and Magor Vicarage. Great crested newts are known to be present from previous surveys in 2008 within the settlement ponds in the steelworks and have been recorded in reens at North Row (during surveys for the Steelworks Access Road) and in ponds at Solutia.

Badger setts have been recorded during previous surveys on the embankments of the Steelworks Access Road (2012) and within a disused quarry in the grounds of Magor Vicarage (2008). Otters and water voles have been recorded in reens around North Row and Broadstreet Common during previous surveys in 2008.

All of these receptors will be affected by the construction of the scheme, although the impacts on many of these can be limited by the inclusion of standard

mitigation measures that would be required as part of the protected species licencing process. A summary of the impacts is provided in Table 7.4.

Table 7.4: Assessment of the Magnitude and Significance of Impacts on Species Receptors in Section C

Receptor	Impact	Value	Magnitude	Significance
Dormouse	The construction of the route has the potential to remove areas of dormouse habitat especially if they are present in area of scrub and woodland on the cutting slopes of the existing Magor junction.	County	Minor	Slight adverse
Bat roosts	The two known roosts are at Pye Corner and Magor Vicarage. The roost at Pye corner may not be directly affected however the buildings where roosts were present at Magor Vicarage will be demolished to allow construction of the new road. It is assumed that replacement roosts would be provided as part of any licence for the destruction of the roost.	Local	Intermediate	Slight adverse
Bat flight lines and foraging areas	The proposed route is likely to cause significant disruption to the flight routes of bats within the local landscape by severing commuting corridors and removing areas of foraging habitat.	Local	Major	Slight
Otter	The construction of new motorway has the potential to create a barrier to otter movement and risk the mortality of otters by being hit by vehicles. However, this can largely be avoided with standard mitigation as outlined in Volume 10 of DMRB.	County	Minor	Neutral

Receptor	Impact	Value	Magnitude	Significance
Badger	There may be disturbance of setts located on the embankments of the Steelworks Access Road during construction. The sett at Magor Vicarage would be lost to the footprint of the scheme, however it is assumed a replacement would be provided to ensure legislative compliance during construction. There is also the potential for severance effects from the scheme although underpasses should be included in accordance with DMRB Vol. 10.	Local	Minor	Neutral
Wintering Birds	There is the potential for loss of habitat and displacement through disturbance during construction. The effects of habitat loss are likely to be negligible as there are extensive areas of alternative habitat which birds could use. Disturbance of roosting or foraging areas used by SPA/Ramsar features would be a larger scale impact.	Local	Minor	Neutral
		International	Major	Very Large
Breeding Birds	Loss of habitat may affect breeding bird populations. In addition there is evidence that the noise of traffic on roads can deter some birds from nesting in close proximity meaning the overall loss of habitat is slightly greater than the footprint of the road.	Local – County	Minor	Neutral – slight
Water voles	The route has the potential to destroy water vole burrows and habitat on the water courses that will be lost to the scheme. A programme of translocation would be required as part of a mitigation package.	County	Minor	slight

Receptor	Impact	Value	Magnitude	Significance
Great crested newt	<p>A population of great crested newts is known to be present within the area of the Solutia chemical plant and with the steelworks. Great crested newts have also been recorded at North Row</p> <p>These route option has the potential to sever these populations and although some mitigation is possible, the construction of the route is likely to have a major effect on the population within these areas.</p>	Local	Major	Slight adverse
Reptiles	<p>The route has the potential to affect areas of reptile habitat, most notably that of grass snake which is assumed to be present throughout the Gwent Levels. Other species may also be present in localised populations. The construction of the route is likely to give rise to effects of habitat loss and fragmentation although these can be reduced and off set through appropriate mitigation and compensation.</p>	Local	Minor	Neutral

7.8.7 Cumulative Effects

There is the potential for impacts on other topics to give rise to consequential effects on ecological receptors. Most notable would be effects on air quality or water quality. Emissions of pollution from vehicles especially those containing nitrogen have the potential to affect habitats as the nitrogen oxides can give rise to nutrient enrichment when it is deposited on the ground. This is considered in Section 7.5. Impacts on water quality could have an effect on the features of the Gwent Levels SSSIs and more generally on the availability of prey for bats, otters and birds. Impacts on water quality are considered in Section 7.11.

7.9 Soil

7.9.1 Geology

The geology along the scheme is discussed in the sub-sections below in relation to Sections A, B and C.

The expected stratigraphic sequence along the route is presented in Table 7.5. This has been based on the published 1:50,000, 1:63,000 and 1:10,000 scale British Geological Survey maps of the area.

Table 7.5: Stratigraphic sequence

Geological Period	Material
Quaternary	Fluvial Alluvium Estuarine Alluvium River Terrace Head Deposits Morainic Drift
Triassic	Mercia Mudstone Group Marginal Facies of the above
Carboniferous	Avon Group and Black Rock Limestone Subgroup of the Carboniferous Limestone Series.
Devonian	Tintern Sandstone St Maughan's Group

In summary, the geology in the region of the scheme includes the following:

- **Western Area (from Junction 29 Castleton to Pound Hill)** - Head and morainic drift deposits over Devonian rocks of the St Maughan's Group which make up the hills in the western part of the scheme;
- **Central Area (including the flatland of the Gwent Levels)** – Alluvial and river terrace deposits over Triassic Mercia Mudstone;
- **Eastern Area (from Llandeenny to Junction 23A Magor)** - Head and morainic drift deposits over Carboniferous Limestone, Triassic Marginal Facies of the Mercia Mudstone Group and Devonian Tintern Sandstone which make up the hills in the eastern part of the scheme.

7.9.1.1 Section A

In the locale of Castleton, the scheme is underlain by the St Maughan's Group of the Devonian period, comprising interbedded marly mudstones and sandstones with occasional conglomerate bands. The maximum proven thickness of this formation found during previous ground investigations is approximately 30m. Beds generally dip at an angle of between 9° and 15° to the east, although steeper beds are present in places, with dips between 22° and 30°.

Morainic drift and terrace deposits overlie the bedrock across parts of this area. The drift cover was found during previous investigations to vary from absent to 7.6m thick in the Castleton area. To the north-east of Castleton, at Coedkernew, the Morainic drift was absent, and 2.6m to 4.4m thickness of River Terrace deposits were found to overlie directly the St Maughan's Group.

The section of the Gwent Levels to the west of the River Usk is known as the Wentlooge Levels. In this area the drift deposits were found to comprise 7.0m to 8.5m of estuarine alluvium over 0.5m to 7.0m of granular fluvial alluvium. Peat bands were encountered within the alluvium, typically absent to no thicker than 0.3m. However, layers up to 1.4m thick are encountered at isolated locations. The Mercia Mudstone Group underlying the alluvium in this area is generally a completely weathered silty mudstone. With depth, occasional bands of moderate strong mudstones are present. It was proven for a maximum depth of 27.0m.

7.9.1.2 Section B

Section B is characterised by low-lying estuarine alluvium between 7.0m and 16.0m thick, underlain by Mercia Mudstone of the Triassic period. The estuarine alluvium is generally slightly sandy organic clay with peat layers.

Granular fluvial alluvium is often present between the estuarine alluvium and the Mercia Mudstone, normally between 0.3m and 7.7m thick. Peat bands are encountered within the alluvium, either absent or generally no thicker than 0.3m, although layers up to 1.5m thick are encountered. The estuarine alluvium is absent or virtually absent in the Ebbw and Usk river channels, whilst the north dock of the ABP Newport Docks has cut through the Estuarine and Fluvial Alluvium. The typical drift stratigraphy of this area is absent to 3.3m of made ground, 6.8m to 16.2m of estuarine deposits, and absent to 7.7m of fluvial alluvium.

As discussed above, the Mercia Mudstone Group underlying the alluvium is generally a completely weathered silty mudstone with occasional bands of moderate strong mudstones at depths. The maximum proven depth of the Mercia Mudstone in this area was 37m.

7.9.1.3 Section C

The eastern section of the Gwent Levels, to the east of the River Usk, is known as the Caldicot levels. These comprise 3.4m to 12.4m of estuarine alluvium, and absent to 4.6m of fluvial alluvium. Peat bands are present within the alluvium on the Levels, where they are between 0.3m and 2.9m thick, but up to 6.2m thick near to Magor in the east. The solid geology beneath the site is Mercia Mudstone, which is proven to maximum depth of 23.1m.

The route of the scheme in the Magor and Rogiet areas crosses various stratigraphical units. In general, shallow superficial deposits overlie strong bedrock. However, the valley feature around St Brides Brook contains deeper superficial deposits.

In the east, Tintern Sandstone, Carboniferous Limestone and the Marginal Facies of the Mercia Mudstone Group are present at shallow depth. Drift cover is thin across much of this area, although river terrace deposits, head deposits and fluvial alluvium are present in some areas.

The Tintern Sandstone is well bedded slightly weathered sandstone with occasional thin bands of weak sandstone and strong conglomerate.

The Marginal Facies of the Mercia Mudstone (Dolomitic Conglomerate) contain bands of conglomerate, sandstone, dolomite and limestone with mudstone. The Dolomitic Conglomerate is occasionally completely fractured and solution cavities are anticipated locally within this stratum.

The Carboniferous limestone is generally dolomite, dolomitic limestone, oolitic limestone and dolomitic sandstone and is occasionally fractured. The Carboniferous Limestone is subdivided into Lower Dolomite in the central part of this area, with Crease and Whitehead Limestone in the east. Solution cavities are also anticipated locally within the stratum, as such features were encountered along the line of the existing M4 to the north of Magor.

To the west of Magor, up to 2.3m of River Terrace Deposits overlie Tintern Sandstone and the Marginal Facies of the Mercia Mudstone Group. Shallow head deposits are also present at some locations.

Further north, between the existing M4 and Knollbury, a 1.5m to 3.0m layer of Head Deposits overlie the Marginal Facies of the Mercia Mudstone Group. In the vicinity of St Brides Brook up to 6.9m of cohesive fluvial alluvium overlies bedrock.

Around Knollbury and towards Rogiet in the east, the Head Deposits vary from absent to 3.0m thick. The underlying bedrock consists of Carboniferous Limestone and Marginal Facies of the Mercia Mudstone Group.

7.9.2 Soils

Across Sections A, B and C of the scheme the solid geology has given rise to two distinct soil types as follows:

- On the Levels, soils are poorly drained grey clays, with a variable depth of loamy topsoil above the clay. The areas along the Ebbw and Usk rivers and on the levels to the south-west of Magor are classified as having high soil vulnerability, which means that they can readily transmit liquid discharges; and
- On the higher ground, sandy and loamy soils predominate, which are well drained, if occasionally stony and shallow. At Castleton the soils are classified as intermediate to high soil vulnerability. At Magor the soils are classified as intermediate vulnerability. High soil vulnerability means that the soils can readily transmit liquid discharges, whereas intermediate vulnerability indicates that soils possibly transmit liquid discharges.

The scheme, where it does not involve urban land uses (non-agricultural land), predominantly crosses Grade 3 Land as defined in the ALC009 map (land with moderate limitations due to the soil, relief, climate - or some combination of these factors – which restrict the choice of crops, timing of cultivations, or level of yield. There are areas of Grade 2 Land around Castleton and Grade 4 Land south-west of Newport and to the east and south of the Llanwern Steelworks. Grade 2 Land is defined as land with some minor soil limitations that may hinder cultivations or harvesting of crops, lead to lower yields or make the land less flexible than a Grade 1 Land. Grade 4 Land is defined as land with severe limitations due to adverse soil, relief or climate, or a combination of these.

7.9.3 Contamination

Desk study and site walkover information was used to identify potentially contaminated sites within the M4 Corridor around Newport or surrounding area (300m of centreline).

A total of 43 potentially contaminated sites which could affect the M4 Corridor around Newport have been identified and these are listed in Table 7.6. The site falling within the relevant sections of the M4 Corridor around Newport, Sections A to C, have been highlighted in Table 7.6 accordingly. The location in relation to the scheme is shown on Figures 7.12 and 7.13. Note that sites CL-17 and CL-20 are located within both Section B and Section C of the M4 Corridor around Newport.

The desk study information for each site is presented in the Preliminary Sources Study Report¹⁰⁷.

Table 7.6: Potentially Contaminated Sites

Feature Index Number	Feature Name	National Grid Reference
Section A		
CL - 1	Castleton Interchange Spoil Heaps	ST 251 839
CL - 2	Former construction compound	ST 252 840
CL - 3	Pound Hill	ST 262 834
CL - 4	Cefn Logell Farm	ST 264 843
CL - 5	Church Road	ST 274 839
CL - 6	Radiators manufacturers	ST 279 842
CL - 7	Electricity Substation	ST 286 837
Section B		
CL - 8	Made ground and former railway bridge and embankments approach (northern and southern sides)	ST 292 836
		ST 294 836
CL - 9	Green Lane Landfill Site	ST 292 834

¹⁰⁷ Welsh Government (2014), M4 Corridor Around Newport Preliminary Sources Study Report, ref 14/9197

Feature Index Number	Feature Name	National Grid Reference
CL - 10	Made ground	ST 301 839
CL - 11	Pencarn lane – fly-tipping	ST 299 842
CL - 12	Historical landfill (West Ebbw Bank)	ST 306 852
CL - 13	Docks Way Landfill Site	ST 292 834
CL - 14	Newport Docks	ST 306 849
CL - 15	Stephenson Street Industrial Estate	ST 326 857
CL - 16	Backfilled River Ebbw Channel	ST 316 846
CL - 17	Solutia Chemical Works	ST 335 855
CL - 18	River Usk Pier Location	ST 326 854
CL - 19	Reevesland Industrial Estate	ST 331 860
CL - 20	Mir Steel Works and associated Waste Disposal Site	ST 332 851
Section C		
CL - 17	Solutia Chemical Works	ST 335 855
CL - 20	Mir Steel Works and associated Waste Disposal Site	ST 332 851
CL - 21	Unauthorised waste management activity – Nash Mead	ST 344 857
CL - 22	Llanwern Research Laboratories/ Accommodation Camp	ST 347 853
CL - 23	Pye Corner Military Base and Gun Battery	ST 349 850
CL - 24	Area of fill west of Llanwern Electricity Sub-station	ST 365 854
CL - 25	Llanwern Electricity Sub-station	ST 371 855
CL - 26	Llanwern Steelworks former lagoons	ST 372 859
CL - 27	Green Moor Historical Landfill incl. infilled Elver Pill Reen	ST 386 854
CL - 28	Llandeenny Fields (fill areas)	ST 410 864
		ST 412 866
CL - 29	Spoil Heaps Railway Cutting Llanwern Approach Road	ST 415 820
CL - 30	Green Moor Lane Quarry Landfill	ST 417 870
CL - 31	Green Moor Lane Field Landfill	ST 417 867
CL - 32	Magor Depot	ST 419 875
CL - 33	B4245 Quarry Local Fill	ST 420 876
CL - 34	Queens Gardens Old Quarry Landfill	ST 421 874
CL - 35	Magor Services	ST 422 880

Feature Index Number	Feature Name	National Grid Reference
CL - 36	Dinch Hill Quarry Landfill	ST 428 877
CL - 37	Dancing Hill Landfill	ST 427 877
CL - 38	Knollbury Cesspits	ST 430 880
CL - 39	Old quarry and limekiln	ST 436 880
CL - 40	Rockfield Road Old Quarry (South) and old lime kiln	ST 437 877
CL - 41	Severn Tunnel Junction Yard	ST 450 875
CL - 42	Tesco distribution depot	ST 404 863
CL - 43	Dinch Hill quarry	ST 428 875

Figure 7.12: Potentially Contaminated Sites

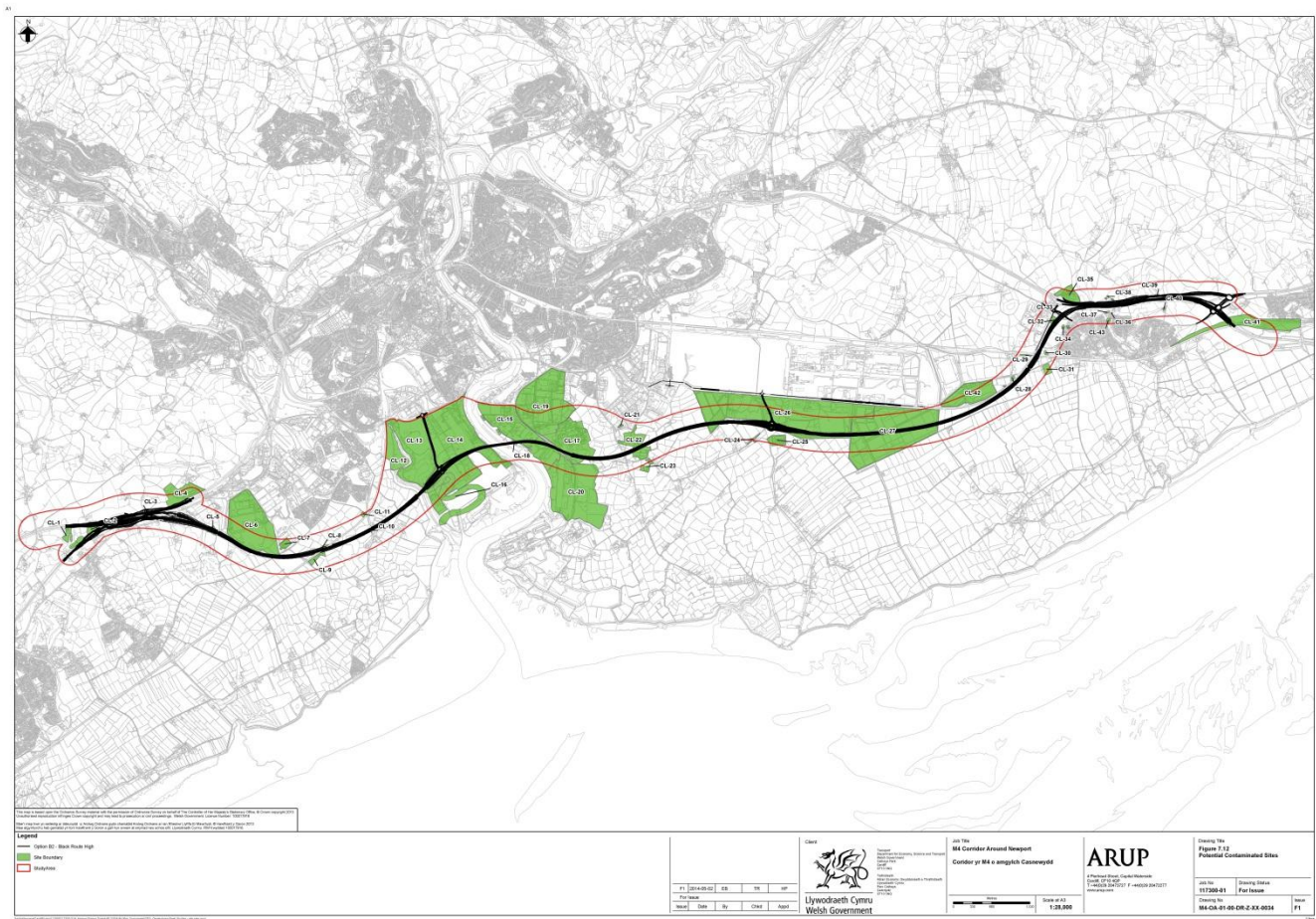
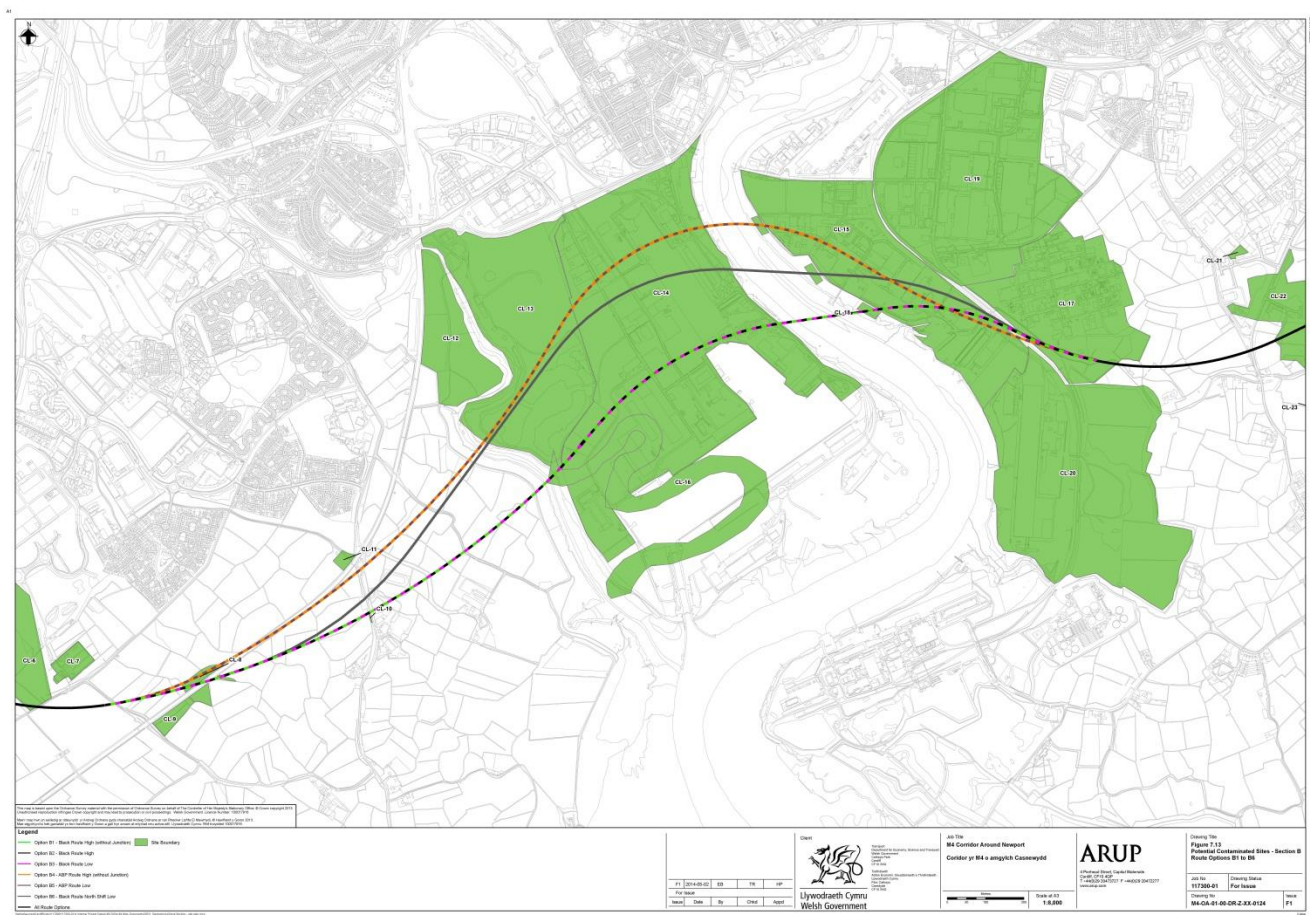


Figure 7.13: Potentially Contaminated Sites – Section B Routes



7.9.4 Appraisal of effects on geology and soils

7.9.4.1 Section A

No designated geological or geomorphological sites (SSSIs or RIGS) are present within the study area.

The cuttings at Castleton, at the western end of the route, would require considerable excavation into the mudstones and sandstones of the St Maughan's Group.

The development to the east of Castleton will require minimal excavation of materials. Embankments would be constructed over the estuarine alluvium. Structures would mainly be supported on piled foundations into the granular fluvial alluvium or underlying mudstone.

In parts of Section A the route will cross land currently used for agriculture. The land is classed as good to moderate and poor quality agricultural land and is of local importance.

The overall significance of the effects from construction on geology and soils is considered to be Neutral/Slight, based on negligible magnitude of impact on receptors of negligible or low value.

The effects from Operation on geology and soils is Neutral.

7.9.4.2 Section B

No designated geological or geomorphological sites (SSSIs or RIGS) are present within the study area.

The development within Section B1 will require minimal excavation of materials. Embankments would be constructed over the made ground and estuarine alluvium. Structures would mainly be supported on piled foundations into the granular fluvial alluvium or underlying mudstone.

In the west of Section B1 the route will cross land currently used for agriculture. The land is classed as good to moderate and poor quality agricultural land and is of local importance.

The overall significance of the effects from construction on geology and soils is considered to be Neutral / Slight, based on negligible magnitude of impact on receptors of negligible or low value.

The effects from Operation on the solid and drift geology is Neutral.

7.9.4.3 Section C

No designated geological or geomorphological sites (SSSIs or RIGS) are present within the study area.

The cuttings at Magor would require excavation. At Magor, the new rock cutting would expose up to 14m of Tintern Sandstone, Carboniferous Limestone and the Marginal Facies of the Mercia Mudstone Group.

In parts of Section C the route will cross land currently used for agriculture. The land is classed as good to moderate and poor quality agricultural land and is of local importance.

The overall significance of the effects from construction on geology and soils is considered to be Neutral or Slight, based on negligible magnitude of impact on receptors of negligible or low value.

The effects from Operation on the solid and drift geology are Negligible.

7.9.5 Appraisal of effects on contamination

7.9.5.1 Section A

Throughout the scheme area, potentially polluting construction materials may be used. These could include fuels, liquid chemicals or other leachable construction materials. For the purpose of the assessment it has been assumed that best practice is followed during construction works. Therefore the potential minor adverse effect on soils, groundwater and surface water is mitigated through the implementation of the Construction Code of Practice. The effect of the works within Section A of the M4 Corridor around Newport would be Neutral.

However, there is a potential for the scheme to have an impact on identified receptors in areas where there is a potential for existing subsurface contamination, as detailed in Table 7.7.

The preliminary risk assessments identified a number of pollution linkages in relation to the sites of concern resulting from Section A and assigned a level of risk to each of the pollution linkage. The preliminary risk assessments are presented in Preliminary Sources Report¹⁰⁸ and the sites location in relation to the scheme is shown on Figure 7.12. The effects of the scheme that have been derived are presented in Table 7.7 for the construction phase and in Table 7.8 for the operation phase.

Section A of the scheme mainly crosses agricultural land with some brownfield areas mainly associated with the development of the A48(M) or in-filling activates. No significant issues in relation to land contamination have been identified. Generally, the sites of potential concern in this part of the scheme may pose a very low to moderate/low risk to identified receptors. The construction of the piled underpass over Church Lane may pose a moderate risk to controlled waters as a result of insertion of the piles.

The identified risks in relation to construction/maintenance workers and general public during construction would be addressed by implementation embedded mitigation measures i.e. appropriate health & safety measures including dust control in accordance with the best practice and therefore having a neutral effect.

¹⁰⁸ Welsh Government (2014), M4 Corridor Around Newport Preliminary Sources Study Report, ref 14/9197

In general the sensitivity is considered to be high as pollution linkages have been identified within the sites of potential concern however with a general negligible magnitude of impact. Consequently the effect of Section A of the scheme on soil contamination is considered to be Slight Adverse.

Table 7.7: Identified potential pollution linkages and effects during construction

Feature Plan Index Number	Feature Name	Construction phase effects on:			
		Constructi on workers	Site neighbours / general public	Ground water	Surface water
CL - 1	Castleton Interchange Spoil Heaps	Neutral	Neutral	Neutral	Moderate
CL - 2	Former construction compound	Neutral	Neutral	Neutral	Neutral
CL - 3	Pound Hill	Neutral	Neutral	Neutral	Neutral
CL - 4	Cefn Logell Farm	Neutral	Neutral	Neutral	Neutral
CL - 5	Church Road	Neutral	Neutral	Slight	Moderate
CL - 6	Radiators manufacturers	Neutral	Neutral	Neutral	Moderate
CL - 7	Electricity Substation	Neutral	Neutral	Neutral	Neutral

Table 7.8: Identified potential pollution linkages and effects during operation

Feature Plan Index Number	Feature Name	Operational phase effects on:				
		Mainte nance worker	Neighb ours/ general public	Ground water	Surface water	Buildin g fabric
CL - 1	Castleton Interchange Spoil Heaps	Neutral	Neutral	Neutral	Neutral/ slight	Neutral
CL - 2	Former construction compound	Neutral	Neutral/slight	Slight	Neutral	Neutral
CL - 3	Pound Hill	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 4	Cefn Logell Farm	Neutral	Neutral	Moderate	Neutral	Neutral
CL - 5	Church Road	Neutral	Neutral	Moderate/ large	Neutral	Slight/ moderate
CL - 6	Radiators manufacturers	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 7	Electricity Substation	Neutral	Neutral	Neutral	Neutral	Neutral

7.9.5.2 Section B

As per Section A, the potential minor adverse effect on soils, groundwater and surface water is mitigated through the implementation of mitigation measures including the Construction Code of Practice. The effect of the works within Section B of the M4 Corridor around Newport would be Neutral.

However, there is a potential for the scheme to have an impact on identified receptors in areas where there is a potential for existing subsurface contamination, as detailed in Table 7.9.

Section B of the scheme is dominated by industrialised areas, namely the Newport Docks, industrial estates on the eastern bank of the Usk River and Solutia chemical works. In addition, a large active landfill site, the Docks Way Landfill, is also located in this part of the scheme.

The preliminary risk assessments indicated that these areas may pose a high to moderate risk to the identified receptors.

The construction of the piled viaduct across the area of the Newport Docks, the Stephenson Street Industrial Estate and Solutia chemical works may pose a high to moderate risk to human health and controlled waters as a result of insertion of the piles, which may allow for downward contamination migration and upward ground gas migration.

A chemical waste, including PCBs, disposal cell is located within the Solutia chemical works. It is currently proposed to span over the disposal area however the location of it requires confirmation to minimise the risks of compromising the integrity of the cell.

Construction of the Usk River crossing may result in mobilisation of contaminants contained within the river sediments posing a high risk to the river water quality.

The identified risks in relation to construction/maintenance workers and general public during construction would be addressed by implementation of health & safety measures including appropriate PPE and dust control measures in accordance with the best practice and therefore having a Neutral effect.

In general the sensitivity is considered to be high as pollution linkages have been identified within the sites of potential concern however with a general moderate magnitude of impact. Consequently the effect of the scheme on soil contamination is considered to be Moderate/Large Adverse.

Table 7.9: Identified potential pollution linkages and effects during construction

Feature Plan Index Number	Feature Name	Construction phase effects on:			
		Construction workers	Site neighbours /general public	Groundwater	Surface water
CL - 8	Made ground and former railway bridge	Neutral	Neutral	Slight	Moderate/large
CL - 9	Green Lane Landfill Site	Neutral	Neutral	Neutral	Neutral
CL - 10	Made ground	Neutral	Neutral	Neutral	Neutral

Feature Plan Index Number	Feature Name	Construction phase effects on:			
		Construction workers	Site neighbours /general public	Groundwater	Surface water
CL - 11	Pencarn lane – fly-tipping	Neutral	Neutral	Neutral	Neutral
CL - 12	Historical landfill (West Ebbw Bank)	Neutral	Neutral	Neutral/slight	Neutral
CL – 13	Docks Way Landfill Site (Option1)*	Neutral	Neutral	Slight/Moderate	Moderate
	Docks Way Landfill Site (Option2)**	Neutral	Neutral	Moderate/large	Moderate
CL - 14	Newport Docks	Neutral	Neutral	Slight	Slight
CL - 15	Stephenson Street Industrial Estate	Neutral	Neutral	Slight	Moderate
CL - 16	Backfilled River Ebbw Channel	See CL-14			
CL - 17	Solutia Chemical Works	Neutral	Neutral	Slight	Slight/Moderate/large
CL - 18	River Usk Pier Location	Neutral	Neutral	Slight	Large
CL - 19	Reevesland Industrial Estate	Neutral	Neutral	Neutral	Neutral
CL - 20	Mir Steel Works and associated Waste Disposal Site	Neutral	Neutral	Neutral	Neutral

Note: * - Option 1: Removal of all waste from scheme footprint and reengineering of landfill installation

** - Option 2: Partial removal of waste and construction of piled embankment over the remaining waste

Table 7.10: Identified potential pollution linkages and effects during operation

Feature Plan Index Number	Feature Name	Operational phase effects on:				
		Maintenance workers	Neighbours /general public	Ground water	Surface water	Building fabric
CL - 8	Made ground and former railway bridge	Neutral	Neutral	Moderate / large	Neutral	Slight/moderate
CL - 9	Green Lane Landfill Site	Neutral	Neutral	Neutral	Neutral	Neutral
	Green Lane Landfill Site	Neutral	Neutral	Moderate / large	Moderate	Slight/moderate
CL - 10	Made ground	Neutral	Neutral	Neutral	Neutral	Neutral

Feature Plan Index Number	Feature Name	Operational phase effects on:				
		Maintenance workers	Neighbours /general public	Ground water	Surface water	Building fabric
CL - 11	Pencarn lane – fly-tipping	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 12	Historical landfill (West Ebbw Bank)	Neutral	Neutral	Neutral/slight	Neutral	Neutral/slight
CL – 13	Docks Way Landfill Site (Option 1)*	Neutral	Neutral	Neutral	Neutral	Slight/moderate
	Docks Way Landfill Site (Option 2)**	Neutral	Slight/moderate	Moderate / large	Moderate	Slight/moderate
CL - 14	Newport Docks	Neutral	Slight/moderate	Moderate /large	Moderate	Slight /moderate
CL - 15	Stephenson Street Industrial Estate	Neutral	Slight/moderate	Moderate / large	Moderate	Slight/moderate
CL - 16	Backfilled River Ebbw Channel					
CL - 17	Solutia Chemical Works	Neutral	Neutral	Moderate / large	Moderate	Slight/moderate
CL - 18	River Usk Pier Location	Neutral	Neutral	Slight	Moderate/large	Slight
CL - 19	Reevesland Industrial Estate	Neutral	Neutral	Neutral/slight	Neutral	Neutral
CL - 20	Mir Steel Works and associated Waste Disposal Site	Neutral	Neutral	Neutral	Neutral	Neutral

Note: * - Option 1: Removal of all waste from scheme footprint and reengineering of landfill installation

** - Option 2: Partial removal of waste and construction of piled embankment over the remaining waste

7.9.5.3 Section C

As per Section A, the potential minor adverse effect on soils is mitigated through the implementation of mitigation measures including the Construction Code of Practice. The effect of the works within Section C of the Black Route with junction would be Neutral.

However, there is a potential for the scheme to have an impact on identified receptors in areas where there is a potential for existing subsurface contamination, as detailed in Table 7.11.

The preliminary risk assessments identified a number of pollution linkages in relation to the sites of concern resulting from Section C and assigned a level of risk to each of the pollution linkage. The preliminary risk assessments are

presented in the Preliminary Sources Study Report¹⁰⁹ and the sites location in relation to the scheme is shown on Figure 7.12. Following the methodology of assessment, (WelTAG methodology), the effects of the scheme have been derived and are presented in Table 7.11 for the construction phase and in Table 7.12 for the operation phase.

Section C of the scheme is dominated by the Llanwern Steelworks former lagoons containing waste originating from processes associated with the steel production. The scheme will also cross other sites of potential concern including Green Moor Historical landfill, Magor Depot, Llanwern Research laboratories and Severn Junction Yard.

The preliminary risk assessments indicated that these sites may pose a high to moderate risk to identified receptors.

The construction of the scheme within the former lagoons site would require removal of the waste from the route corridor. These materials may be reused within the scheme if subjected to treatment. These works may pose a significant risk to human health and controlled waters. However, once treated, these materials are likely to be acceptable for reuse within the scheme and this would result in a significant positive impact of the scheme.

The risks associated with the other above mentioned sites mainly lay with excavation works encountering materials containing elevated levels of contamination, and risks to groundwater arising from impacted materials remaining in-situ.

In addition, evidence of hydrocarbon contamination was encountered in the vicinity of the uncovered underground storage tank in Magor Depot site presenting a moderate/large risk to identified receptors.

A number of sites of potential concern comprise an in-filled quarry including in-filled quarry near Llanwern Approach Road, B4245 Quarry, Old Quarry and Kiln and Green Moor Lane Quarry Landfill. These sites might be potential sources of ground gas and if located within or in a close proximity to the scheme area may pose a moderate/low risk to construction and/or maintenance workers.

The construction of the piled structures within the area of former lagoons and across the South Wales to London Mainline may pose a moderate risk to controlled waters as a result of insertion of the piles, which may allow for downward contamination migration and upward ground gas migration.

The remainder of sites of potential concern identified within Section C are located outside the scheme alignment and would have no impact on the identified receptors.

The identified risks in relation to construction/maintenance workers and general public during construction would be addressed by implementation of health & safety measures including appropriate PPE and dust control measures in accordance with the best practice and therefore having a neutral effect.

In general the sensitivity is considered to be high as pollution linkages have been identified within some of the sites of potential concern with a general moderate

¹⁰⁹ Welsh Government (2014), M4 Corridor Around Newport Preliminary Sources Study Report, ref 14/9197

magnitude of impact however the treatment and reuse within the scheme of the waste materials originating from the former lagoons would have a significant beneficial impact and would result in a general minor magnitude of impact on the scheme. Consequently the effect of Section C of the scheme on soil contamination is considered to be Slight/Moderate adverse.

Table 7.11: Identified potential pollution linkages and effects during construction

Feature Plan Index Number	Feature Name	Construction phase effects on:			
		Construction workers	Site neighbours/ general public	Ground water	Surface water
CL - 21	Unauthorised waste management activity – Nash Mead	Neutral	Neutral	Neutral	Neutral
CL - 22	Llanwern Research Laboratories/ Accommodation Camp	Neutral	Neutral	Slight/ moderate	Slight/ moderate/ Moderate
CL - 23	Pye Corner Military Base and Gun Battery	Neutral	Neutral	Neutral	Neutral
CL - 24	Area of fill west of Llanwern Electricity Sub-station	Neutral	Neutral	Neutral	Neutral
CL - 25	Llanwern Electricity Sub-station	Neutral	Neutral	Neutral	Neutral
CL - 26	Llanwern Steelworks former lagoons (Option 1)*	Neutral	Neutral	Neutral/slight/ Slight	Moderate
	(Option 2)**	Neutral	Neutral	Neutral/slight/ Slight	Moderate
CL - 27	Green Moor Historical Landfill incl. Elver Pill Reen	Neutral	Neutral	Moderate/ large/ Slight	Moderate/ large/ Slight/ moderate
CL - 28	Llandeenny Fields (fill areas)	Neutral	Neutral	Neutral	Neutral
CL - 29	Spoil Heaps Railway Cutting Llanwern Approach Road	Neutral	Neutral	Neutral/slight/ Slight	Neutral
CL - 30	Green Moor Lane Quarry Landfill	Neutral	Neutral	Neutral	Slight
CL - 31	Green Moor Lane Field Landfill	Neutral	Neutral	Neutral	Slight
CL - 32	Magor Depot	Neutral	Neutral	Moderate	Neutral
CL - 33	B4245 Quarry Local Fill	Neutral	Neutral	Slight/ moderate	Neutral

Feature Plan Index Number	Feature Name	Construction phase effects on:			
		Construction workers	Site neighbours/ general public	Ground water	Surface water
CL - 34	Queens Gardens Old Quarry Landfill	Neutral	Neutral	Neutral	Neutral
CL - 35	Magor Services	Neutral	Neutral	Neutral	Neutral
CL - 36	Dinch Hill Quarry Landfill	Neutral	Neutral	Neutral	Neutral
CL - 37	Dancing Hill Landfill	Neutral	Neutral	Neutral	Neutral
CL - 38	Knollbury Cesspits	Neutral	Neutral	Neutral/slight	Neutral
CL - 39	Old quarry and limekiln	Neutral	Neutral	Slight/moderate	Neutral
CL - 40	Rockfield Road Old Quarry (South) and old lime kiln	Neutral	Neutral	Neutral	Neutral
CL - 41	Severn Tunnel Junction Yard	Neutral	Neutral	Neutral	Neutral
CL - 42	Tesco distribution depot	Neutral	Neutral	Neutral	Slight
CL - 43	Dinch Hill quarry	Neutral	Neutral	Neutral	Neutral

* Option 1 = remove for off site disposal of lagoon material

**Option 2 = stabilisation/treat and reuse lagoon material

Table 7.12: Identified potential pollution linkages and effects during operation

Feature Plan Index Number	Feature Name	Operational phase effects on:				
		Maintenance workers	Neighbours/ general public	Ground water	Surface water	Building fabric
CL - 21	Unauthorised waste management activity – Nash Mead	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 22	Llanwern Research Laboratories/ Accommodation Camp	Neutral	Neutral	Moderate / large	Moderate	Neutral
CL - 23	Pye Corner Military Base and Gun Battery	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 24	Area of fill west of Llanwern Electricity Sub-station	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 25	Llanwern Electricity	Neutral	Neutral	Neutral	Neutral	Neutral

Feature Plan Index Number	Feature Name	Operational phase effects on:				
		Maintenance workers	Neighbours/ general public	Ground water	Surface water	Building fabric
	Sub-station					
CL - 26	Llanwern Steelworks former lagoons (Option 1)*	Neutral	Neutral	Neutral	Neutral	Slight
	(Option 2)**	Neutral	Neutral/ slight	Slight/ moderate	Moderate	Slight/ moderate
CL - 27	Green Moor Historical Landfill incl. Elver Pill Reen	Neutral	Neutral	Moderate /large	Moderate	Neutral
CL - 28	Llandeenny Fields (fill areas)	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 29	Spoil Heaps Railway Cutting Llanwern Approach Road	Neutral	Neutral	Slight	Neutral	Slight/ moderate
CL - 30	Green Moor Lane Quarry Landfill	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 31	Green Moor Lane Field Landfill	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 32	Magor Depot	Neutral	Neutral	Moderate /large	Neutral	Neutral
CL - 33	B4245 Quarry Local Fill	Neutral	Neutral	Slight	Neutral	Slight/ moderate
CL - 34	Queens Gardens Old Quarry Landfill	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 35	Magor Services	Neutral	Neutral/ slight	Slight/ moderate	Neutral	Neutral
CL - 36	Dinch Hill Quarry Landfill	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 37	Dancing Hill Landfill	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 38	Knollbury Cesspits	Neutral	Neutral	Neutral/ slight	Neutral	Neutral
CL - 39	Old quarry and limekiln	Neutral	Neutral	Slight	Slight	Neutral
CL - 40	Rockfield Road Old Quarry (South) and old lime kiln	Neutral	Neutral	Neutral	Neutral	Neutral
CL - 41	Severn Tunnel Junction Yard	Neutral	Neutral	Slight/ moderate	Neutral	Neutral
CL - 42	Tesco distribution depot	Neutral	Neutral	Neutral/ slight	Neutral	Neutral
CL - 43	Dinch Hill quarry	Neutral	Neutral	Neutral	Neutral	Neutral

* Option 1 = remove for off site disposal of lagoon material

**Option 2 = stabilisation/treat and reuse lagoon material

7.9.6 Cumulative effects

There is the potential risk to ecology/ aquatic life within surface water arising from spillages or discharges. This has been considered in Section 7.8 of this report.

The effect of works associated with the waste movement within Section B in terms of nuisance on general public due to potential increase in odour and noise emission is discussed in Section 7.5 of this report (Local Air Quality).

The effects of works on ecology/aquatic life within surface water are discussed in Section 7.8 of this report.

Risk to ecology/ aquatic life within surface water relating to the Gwent levels SSSI is considered in Section 7.8.

7.10 Heritage

The following section describes general baseline conditions across the scheme with regard to heritage assets. Detail discussion of these can be found in Appendix C of 'Wessex Archaeology and Cultural Heritage Baseline Assessment' (Appendix F of this report); a full bibliography of references mentioned below can also be found in Appendix C 'Wessex Archaeology and Cultural Heritage Baseline Assessment'.

7.10.1 Prehistoric

Gwent lies close to the southern edge of a number of the glaciations which transformed the landscape of Britain over the past 500,000 years, with the Severn Estuary cut and recut by meltwaters from these glaciations. Wales is thought to have been occupied by Neanderthals as early as 225,000 BP, this early occupation is likely to have continued until c.175,000 BP after which there was no human activity in the area until at least 60,000 BP.

In the light of the paucity of evidence for Lower Palaeolithic activity in Wales, the recovery of a small quantity of Palaeolithic material from the Gwent Levels must be regarded as significant (Aldhouse-Green 2004). Lower Palaeolithic material has been recovered during the archaeological investigations connected with the first and second Severn crossings.

The Mesolithic period is generally seen as one in which diverse habitats were exploited for their natural resources. The wetlands would have provided opportunities for fishing, fowling, hunting and gathering. Sites which provided easy access to both the wetlands and higher areas, may well have been particularly attractive.

There are few excavated Mesolithic sites in Gwent as a whole, but of these, a number lie on or close to the Gwent Levels. These include the sites at Goldcliff, Llandeenny, Uskmouth and Magor. At Uskmouth three sets of human footprints were found in laminated silts overlain by peat deposits radiocarbon dated to 6250 +/- 80 BP (Walker, 2004). Similar footprints from Magor are slightly later at 5720 +/-80BP (Aldhouse- Green et al. 1992). Excavations at Goldcliff identified a Late Mesolithic site (Bell, Castledine and Neumann, 2000; Bell et al., 2001; 2002; 2003). The site seems to have occupied a small wooded island surrounded by salt

marsh. Several hundred stratified worked flints were recovered, associated with a substantial faunal assemblage, some of which bear cut marks indicative of processing by humans.

The Lower Wentlooge formation originated in the Mesolithic when the Gwent Levels were dominated by intertidal saltmarshes and mudflats, whilst reed swamp developed along the fen edge (Rippon 1996). When at the end of the Mesolithic the rise in sea level slowed, it was still some c. 8 m below present mean sea level (Allen 1990) and peats, now known as the 'middle' Wentlooge Formation, formed as land plants colonised the saltmarshes and mudflats (Rippon 1996a). The evidence suggests that from the end of the Mesolithic to the end of the Bronze Age 'the Levels were dominated by first wet alder woodland, and then more open reed swamps and raised bogs' (Rippon 1996a) and that there would have been rivers and streams which drained the uplands.

There is little evidence for Neolithic activity on the Levels themselves, although a late Neolithic skull was recovered from Alexandra Docks in Newport. Although little is known of Bronze Age settlement and agriculture across much of Gwent (Hamilton 2004), rather more is known about settlement on the Levels. A series of field surveys along the Gwent coast has revealed the extent to which the peatlands were exploited in the Late Bronze Age, with timber roundhouses recorded at Rumney Great Wharf (Allen 1996) and Chapel Tump (Whittle 1989).

Evidence for occupation and other activities are recorded at Caldicot throughout the Bronze Age (Nayling and Caseldine, 1997). The remains of Bronze Age boats have been recovered at Caldicot (Parry and McGrail 1994) and Goldcliff (Bell 1992). These indicate that the importance of the River Severn for transport, communication and trade, which is clear in the historical record, may well date back into the prehistoric period (Green 1996).

7.10.2 Iron Age and Romano-British

A recent study of Iron Age settlement patterns in the Severn Estuary has indicated that the edge of the fenlands was most favoured, allowing access both to the resources of the wetlands and to higher ground (Sylvester 2004). Smaller unenclosed settlements are likely to have been interspersed between the larger hillforts. Conditions on the Gwent Levels in the Iron Age probably favoured pastoral rather than arable agriculture. As with the Bronze Age, there is a dearth of well excavated Iron Age sites in Gwent, with the Levels perhaps providing the only exception. The latter include the excavations at Goldcliff, which identified a number of rectangular Iron Age buildings and trackways (Bell 1992). More recent excavations on the Greenmoor Arch (Gwent Euro Park) site near Magor revealed three Iron Age wooden structures, and a rectangular structure was excavated within the Lodge Hill Camp hillfort near Caerleon (Howell and Pollard 2000).

An Iron Age hillfort is known at Tredegar to the north of the housing estate (HER ref. 00049g) a possible enclosure was also recorded in early 20th century may also have existed at Maindy Hill Camp (HER ref. 08950g), now beneath Maes-glas housing estate just to the north-west of the northernmost Study Area. A further Iron Age hillfort, Wilcrick Hill lies approximately 1km to the west of Magor, just outside of the study area, and dominates the landscape at the eastern end of the route within Section C.

At the time of the Roman Conquest, the area lay within the territory of the Silures. The Roman Conquest of Britain was undertaken in stages, and by c. AD 47 the borders of modern Wales had been reached. The result of these early campaigns was the construction of a legionary fortress at Usk and forts at Monmouth and Abergavenny. However, the Boudiccan revolt and its aftermath delayed the completion of the conquest of Wales until AD 74, under Julius Frontinus. As part of this conquest, the legionary fortress at Usk was abandoned in favour of a new fortress at Caerleon, to the south. It has been suggested that the Gwent Levels were amongst the lands appropriated by the Roman Army to support the fortress at Caerleon because of the excellent grazing they provided.

It has been suggested that the first attempts to drain the Levels were made during the Roman period, with the pattern of long rectangular fields around the Peterstone Area on Wentlooge being a relict survival of the drainage and agricultural system imposed in the Roman period. A programme of investigation at Rumney Great Wharf supports this, with an extensive Roman drainage system recorded on both sides of the present sea wall (Allen et al. 1992). The excavated pottery assemblage from Rumney Great Wharf is of mid-3rd/4th -century date, though unstratified material dating back to late 2nd century was recovered (Rippon 1997).

Excavations at Nash revealed evidence for Roman field systems along with both human and animal burials dated to the 1st to 3rd centuries AD. It is likely that this enclosed land was used as pasture.

7.10.3 Early medieval and medieval

The limited evidence for Gwent in the post-Roman period points to some continuity in both land-use and settlement. It is likely that the void left by the departing Roman authority was taken up initially at least by members of the local elites, with activity continuing in key sites such as Caerleon and Caerwent. Caerwent may have been the site of an early monastic community, continuing to emphasise its importance.

Caerwent remained the main ecclesiastical centre of Gwent in the 6th and 7th centuries. Early churches were established throughout the region, including early churches at Bassaleg, Coedkernew and at Great Pencarn, as well as an early church on the site of the Newport Cathedral (GGAT 2003). Re-colonisation of the Levels appears to have been largely piecemeal, perhaps initially focussing on small embanked 'infield' enclosures (Rippon, 2000) which expanded over time, with the construction of sea walls and canalisation of rivers into reens such as Monks Ditch and Elver Pill Reen undertaken later on.

In 1055 Gruffudd ap Llewellyn, ruler of north Wales, defeated Gruffudd ap Rhydderch, thus becoming the first ruler of a united Wales. He marched into south Wales and proclaimed himself king of all Wales. The Norman Conquest of 1066, however, changed the situation entirely. Castles were established at strategic locations, and nucleated settlements and common fields similarly imported. Examples of these common fields are more frequent to the east of Monks ditch within Section C than to the west and a greater proportion of English names also lie to the east of Monks ditch. This is likely also to reflect a degree of immigration, with English tenants being brought in to populate the nucleated villages (Rippon 1997).

The flooding in the late/post-Roman period was followed by considerable wetland colonisation by the time of the Domesday Survey of 1086 (Rippon 1997).

Enclosure, the conversion of open fields and common meadow/pasture into consolidated areas of land held by one person, had been underway since the late medieval period, but the process intensified and by the 17th century few open fields survived (Rippon 1997). In the post-medieval period there appears to have been a shift towards a pastoral agricultural specialism on the Levels concentrating on dairy products (probably because the heavy soils were suited to pasture) (Rippon 1997).

It is believed that the early focus of Newport was at Stow Hill with a church possibly established as early as the fifth or sixth century though it is first documented c1100 (HERref.00166g). It was also at Stow Hill that medieval settlement was formed, focused on the 12th century fortifications (HER ref. 00226g). The current castle remains date to the 14th century (HER ref.00192g).

Within Section A, Tredegar House, which lies within the current housing estate, is a Grade I Listed mid-17th century mansion. Part of the earlier house, which dates to the late 15th or early 16th century, survives in the service wing. The grounds of this estate would have originally been extensive including the present day housing estate though the agricultural land holdings of the estate would have extended further and included land within the scheme.

7.10.4 Modern

Within Section B, the construction of the Alexandra Docks was instigated by the First Lord Tredegar, and the Alexandra (Newport) Dock Company was incorporated by an Act of Parliament in 1865. The North Dock and lock was first opened in July 1875. Business expanded rapidly, and the construction of railways leading to the coalfields of the Rhondda and Cynnon enabled Newport to tap into the lucrative coal exporting trade. Demand was sufficient for a second, South Dock to be planned, enabled by an Act of Parliament in 1882, which opened in 1893. Initially this was smaller than the current south Dock, and accessed by a lock to the east, now blocked. It soon became clear that an expanded South Dock was required. This was incorporated by an Act of Parliament in 1904, and work began in 1905. This construction also involved moving stretches of the River Ebbw to its present canalised course. The extension, some 48 acres in size, opened in 1907, with a further 27 acres added with the new South Lock in 1914.

Much of the establishment and growth of the canal, tramway and railway network around Newport was linked to the needs of industry, particularly the coalfields. These lines were only later to become passenger routes with linked to the main lines only established in the late 19th century.

Due to its strategic location and importance of its docks, Newport suffered several air raids during the Second World War (WWII) and defensive structures such as pillbox, anti-aircraft batteries and air raid shelters can be found in the area.

A number of important industrial sites were constructed in the 20th century within south Newport, reflecting the increasing industrialisation of the area at this time. These include the Solutia Engineering Works, which potentially lies within the proposed route corridor to the east of the River Usk, opened in 1949 and Llanwern Steelworks, formerly Spencer Works, opened in 1962, which lies to the north of the eastern part of the Study Area within Section C.

7.10.5 Appraisal of effects on cultural heritage

7.10.5.1 Section A

Figure 7.14 shows all existing listed building, palaeochannel, walkover and scheduled ancient monument features within 500m of Section A.

Listed Buildings

15 Grade II and one Grade II*¹¹⁰ Listed Buildings are present within 500m of the scheme.

Table 7.13 Grade II and Grade II* Listed Buildings within 500m of scheme

Number	Name	Grade
15937	Old Windmill, Rogiet	II
15938	Farm Range At Old Court Farm, B4245 (S Side), Llanfihangel Rogiet	II
15939	Stables At Old Court Farm, B 4245 (S Side), Llanfihangel Rogiet	II
15940	Green Farmhouse (Including Attached Walls And Railings To Front), B 4245 (S Side), Llanfihangel Rogi	II
15941	Cowhouse Range East Of Green Farmhouse, B 4245 (S Side), Llanfihangel Rogiet	II
15943	Barn To East Of Green Farmhouse, B 4245 (S Side), Llanfihangel Rogiet	II
16070	Great House Farmhouse Including Attached Range Of Farm Buildings	II
16071	Moorgate Cottage	II
17542	Pye Corner Farm	II
17543	Tatton Farm	II
17544	Fair Orchard	II
17545	Fair Orchard Barn And Attached Agricultural Buildings	II
2035	Church Of Saint Michael And All Angels, B 4245 (S Side), Llanfihangel Rogiet	II*
2036	Cross Base In Churchyard To St.Michael And All Angels Church, B 4245 (S Side), Llanfihangel Rogiet	II
2037	Old Court Farmhouse (Including Attached Cross Wing Known As Llanfihangel Court), B 4245 (Side), Lla	II
2931	Manor Farmhouse	II

Adverse effects upon the setting of the above listed buildings may occur as a result of visual and noise changes to their settings. The degree of impact would require detailed consideration at EIA stage.

Scheduled Monuments

One Scheduled Monument is present within 500m of the scheme.

¹¹⁰ Grade II* is exceptional significance, but not as high as Grade I

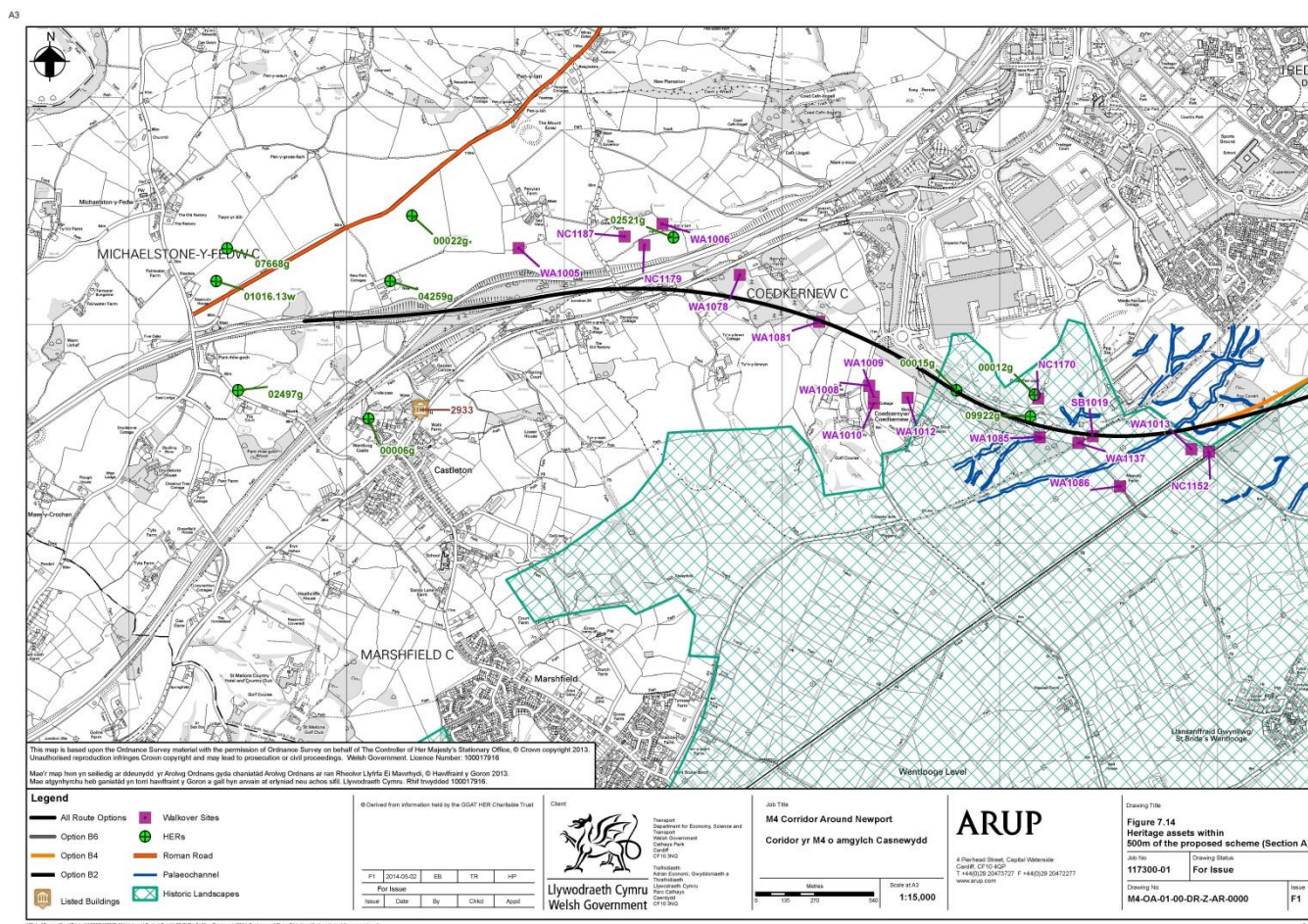


Table 7.14 Scheduled Monuments within 500m of scheme

No.	Name	Type
MM131	Wentlooge Castle	Motte

Adverse effects upon its setting may occur as a result of visual and noise changes to their settings. The degree of impact would require detailed consideration at EIA stage.

Designated Landscapes

The eastern part of Section A would pass through the Gwent Levels designated landscape, although the majority of this area would have experienced impacts as a result of the construction of existing infrastructure. Considering the urbanised nature of this part of the route, impacts upon setting are considered likely to be Neutral, however this will require detailed assessment by ASIDOHL2 methodology. Direct impacts are considered under Unknown below.

HER Sites

The HER has identified 2 sites within the construction footprint of the scheme as shown in Table 7.15.

Table 7.15 HER sites within construction footprint of scheme

HER No.	Description	Period
09922g	A shallow erosive hollow (0.15m deep) ran across the site aligned east-west. This had become filled with a fibrous reedy peat containing some fragments of roundwood. This horizon has been radiocarbon dated to 495-395 BC (Beta 109345 and 109346).	Iron Age
00015g	Coedkernew, in the early days of the conquest, was a manor of the lordship of Gwynllog and was held by Iorwerth ap Rees. This lord had his own manor house as well as his own demesnes, tenantry and courts.	Medieval

Asset 09922g is the result of an archaeological excavation and therefore this site is no longer extant. Asset 00015g is considered to be of regional importance and would be likely to experience a Moderate Adverse effect as a result of the scheme.

Palaeochannels

The lidar analysis has identified 1 distinct palaeochannel that lies within the footprint of the scheme. This has the potential to contain environmental evidence of the past landscape, and also material evidence of human occupation of the area. This would be directly impacted by construction, although only discreet sections of these channels would be affected. It is probable that these impacts would result in a Slight/Moderate Adverse effect.

Walkover Survey

The walkover survey was undertaken as part of the baseline data which identified 20 heritage assets that would experience direct impacts as a result of the scheme.

Table 7.16 Heritage assets identified from walkover survey

HER No.	Description	Period
NC1179	Some slight visible earthworks corresponding to possible enclosure (WA103).	Undated
SB1019	Cast iron post c. 0.30m dia and c.8.00m high.	Modern
WA1078	Building shown on early map, including late C18th Tredegar estate map. No longer extant.	Post-medieval
WA1081	Ancient coppiced woodland shown on late 18th century map, tithe map and early OS maps. Still extant (entry 15233). Two ancient oaks on the north eastern boundary. Geophysical survey around this area did not locate any anomalies.	Post-medieval
WA1085	A series of palaeochannels have been identified on LIDAR surveys to the south and south east of Coedkernew, aligned roughly north east to south west	Undated
WA1137	Percoed reen, aligned north east-south west, possibly dug as early as the Roman period. Two test pits excavated either side of the reen found no conclusive evidence for the original construction date of the ditch.	Romano-British

It is considered that these assets are of local importance and it is likely that they would experience Slight Adverse effects as a result of the scheme.

Unknown archaeology

The baseline assessment has demonstrated that there is clear potential for encountering as yet undiscovered archaeological deposits within the footprint of the scheme, in particular across the Gwent Levels. These remains are likely to date predominantly from the prehistoric and Romano-British periods, though remains from later periods are also likely to be represented. At this stage it is not possible to determine the significance of such remains, however the waterlogged conditions that prevail along the route suggests that any remains, in particular those that are organic in nature, such as wood, are likely to be well preserved. Within the footprint of the scheme any such remains would be destroyed by construction activity, and those outside of the footprint may also be affected by changes to the water table/flows. Any such impacts would be considered to be Large Adverse.

7.10.5.2 Section B

Figure 7.15 shows all existing listed building, palaeochannel, walkover and scheduled ancient monument features within 500m of Section B.

Listed Buildings

No Listed buildings are present within the footprint of the scheme, nor within 500m of the scheme. It is probable that impacts upon setting of any Listed buildings outside of the 500m study area would be Neutral.

Scheduled Monuments

No Scheduled Monuments are present within the footprint of the scheme or within the 500m study area. No impacts are expected as a result of the scheme.

HER

The Historic Environment Record identifies 3 known sites located within the footprint of the scheme.

Table 7.17: Section B – HER sites

HER no.	Description	Period
08891g	A post-medieval weir.	Post-Medieval
09580g	A post-medieval seawall, extant since at least 1883. It is depicted on the 1st and 2nd edition OS maps.	Post-Medieval
08464g	Field boundary, defined by tall grasses and reeds. Note also the grips in the field. The Newport Transporter Bridge is visible on the horizon.	Post-Medieval

These assets are considered to be of local significance and the effect upon them is likely to be Slight Adverse.

Foreshore Walkover Survey

A walkover of the foreshore identified seven assets that lie within the footprint of the scheme.

Table 7.18: Section B – Foreshore walkover survey

WA_ID	Description
WA405	Mooring chain
WA406	Permanent Jetty
WA420	Water end of jetty 9
WA422	Water end of jetty 11
WA423	Shore end of jetty 12
WA424	Water end of jetty 13
WA425	Water end of jetty 14

These assets are considered to be of local significance and the effect upon them is likely to be Slight Adverse.

Walkover Survey

The walkover survey identified six heritage assets within the construction footprint of the scheme.

Table 7.19: Section B – Walkover survey

No.	Name	Summary	Period
NC1122	Trackway	Trackway, west-south-west – east-north-east aligned. Visible on late 18th century and 1842 tithe map. Shown as extant on 1920 OS map. Still visible on LiDAR.	Post-medieval
NC1138	Bridge	Footbridge at proposed crossing - only piers remain. Victorian, first seen on 1901 OS edition and still shown on late 20th century maps.	Modern
WA1016	Mendalgylf Port Sanitary Hospital	Mendalgylf Port Sanitary Hospital, shown on OS 1901 2nd edition. Already demolished by 1921 edition.	Modern
WA1017	Mendalgylf New Reen	19th century canalised reen shown on 2nd edition OS. No longer extant.	Modern
WA1023	Union Dry Docks Cottages, Newport	Terrace of Victorian cottages built for the Union Dry Docks. No longer extant. Shown on OS 2nd (1901) edition.	Modern
WA1092	Trackway	Old trackway, visible on LiDAR but not depicted on the 1844 tithe map or later OS mapping.	Post-medieval

These assets are considered to be of local significance and the effect upon them is likely to be Slight Adverse.

Dock Buildings

26 structures associated with the docks were identified within the footprint of the scheme; these are considered to be of local importance and the effect upon them is considered likely to be Slight/Medium Adverse in light of their group value association with the historic development of the docks.

Palaeochannels

The lidar analysis has identified 4 distinct palaeochannels that lie within the footprint of the scheme. These have the potential to contain environmental evidence of the past landscape, and also material evidence of human occupation of the area. These would be directly impacted by construction, although only discreet sections of these channels would be affected. It is probable that these impacts would result in a Slight/Moderate Adverse effect.

Designated Landscapes

The western part of the option would pass through the Gwent Levels designated landscape, which are currently open fields. The effect upon the setting of the Levels as a result of this is likely to be Moderate Adverse, due to modern intrusion into the landscape. Direct impacts are considered under Unknown Archaeology in the paragraph below.

Unknown Archaeology

The baseline assessment has demonstrated that there is clear potential for encountering as yet undiscovered archaeological deposits within the footprint of the scheme, in particular across the Gwent Levels. These remains are likely to date predominantly from the prehistoric and Romano-British periods, though remains from later periods are also likely to be represented. At this stage it is not possible to determine the significance of such remains, however the waterlogged conditions that prevail along the route suggests that any remains, in particular those that are organic in nature, such as wood, are likely to be well preserved. Within the footprint of the scheme any such remains would be destroyed by construction activity, and those outside of the footprint may also be affected by changes to the water table/flows. Any such impacts would be considered to be Large Adverse.

7.10.5.3 Section C

Figure 7.16 shows all existing listed building, palaeochannel, walkover and scheduled ancient monument features within 500m of Section C.

Listed Buildings

One Listed Building, the Grade II Vicarage at Magor, is located within construction the footprint of the scheme, and this building would be demolished. This impact upon a designated heritage asset would result in a High Adverse effect.

15 Grade II and one Grade II* Listed Buildings are present within 500m of the scheme. These are shown in Table 7.20.

Table 7.20: Section C – Listed Buildings

Number	Name	Grade
15937	Old Windmill, Rogiet	II
15938	Farm Range At Old Court Farm, B4245 (S Side), Llanfihangel Rogiet	II
15939	Stables At Old Court Farm, B 4245 (S Side), Llanfihangel Rogiet	II
15940	Green Farmhouse (Including Attached Walls And Railings To Front), B 4245 (S Side), Llanfihangel Rogi	II
15941	Cowhouse Range East Of Green Farmhouse, B 4245 (S Side), Llanfihangel Rogiet	II
15943	Barn To East Of Green Farmhouse, B 4245 (S Side), Llanfihangel Rogiet	II
16070	Great House Farmhouse Including Attached Range Of Farm Buildings	II
16071	Moorgate Cottage	II
17542	Pye Corner Farm	II
17543	Tatton Farm	II
17544	Fair Orchard	II
17545	Fair Orchard Barn And Attached Agricultural Buildings	II
2035	Church Of Saint Michael And All Angels, B 4245 (S Side), Llanfihangel Rogiet	II*
2036	Cross Base In Churchyard To St.Michael And All Angels Church, B 4245 (S Side), Llanfihangel Rogiet	II

Number	Name	Grade
2037	Old Court Farmhouse (Including Attached Cross Wing Known As Llanfihangel Court), B 4245 (Side), Lla	II
2931	Manor Farmhouse	II

Adverse effects upon their settings may occur as a result of visual and noise changes to their settings. The degree of impact would require detailed consideration at EIA stage.

Scheduled Monuments

One Scheduled Monument, a standing stone, lies immediately adjacent to the scheme to the north west of the proposed junction with the B4245, but would not experience direct impacts. Considering the proximity of this heritage asset to the existing M4, it is expected that there would be a Negligible effect on the Scheduled Monument as a result of the scheme.

Three other Scheduled Monuments are present within 500m of the scheme. These are shown in Table 7.21.

Table 7.21: Section C – Scheduled Monuments

No.	Name	Type
MM325	St. Michael's Churchyard Cross, Llanfihangel Rogiet	Cross base
MM127	Wilcrick Hill Camp	Hillfort
MM198	Medieval Moated Site 400m N of Undy Church	Moated Site

Adverse effects upon their settings may occur as a result of visual and noise changes to their settings. The degree of impact would require detailed consideration at EIA stage.

Designated Landscapes

The central part of Section C would pass through the Gwent Levels designated landscape, with the remainder passing immediately adjacent to the north from the eastern end of Section B to Magor. This part of the route is predominantly rural, although the former steelworks site to the north exerts an existing adverse influence upon the wider setting of the Levels. Nonetheless, Adverse effects upon the setting of the Levels are likely to occur as a result of the scheme, which will require detailed assessment by ASIDOHL2 methodology. Direct impacts are considered under 'Unknown Archaeology'.

HER Sites

The HER identified one site within the construction footprint of the scheme. This can be seen in Table 7.22.

Table 7.22: Section C – HER sites

HER No.	Description	Period
00241g	Monk's Ditch is the name of the principal drain which may indicate that it was the work of the monks of Goldcliff Priory. (1113-ca.1414)	Medieval

A3



It is considered that this asset is of local/regional importance in its context of the historical management of the Levels. It is likely that the effect of direct impacts upon this asset would be Slight/Medium Adverse.

A Roman road is known on the HER, the line of which passes through the scheme to the south of Magor Services. Widening of the existing M4 northwards at this location may impact on the remains of this road, if present.

Walkover Survey

The walkover survey undertaken as part of the baseline data gathering identified 10 heritage assets that would experience direct impacts as a result of the scheme. These are shown in Table 7.23.

Table 7.23: Section C - Walkover survey

HER No.	Description	Period
NC1049	Early reen in the enclosure of the landscape in this area, but may be post-medieval in date. Aligned roughly east-north-east to west-south-west. Test pits excavated either side of the reen encountered a sequence of peat deposits sealed by a clay layer.	Post-medieval
NC1080	Substantial bridge abutment comprising of stone blockwork. Current bridge much narrower width of brick and stone construction may be later phase. Crossing shown on 1845 tithe map.	Modern
NC1082	Black Wall Reen, north-north-west – south-south-east aligned, depicted on 1842 tithe map. Originally extended further northwards but now built over by steelworks.	Modern
NC1099	Remains of old trackway, shown as already partially incorporated into field system on 1842 tithe map likely linked to WA282 and WA283.	Post-medieval
NC1113	Concrete settings for a barrage balloon. May be related to the anti-aircraft battery to the south-east (HER ref. 04295g).	Modern
WA1032	The site of the New House complex, shown on the 1845 tithe map, and on early OS maps, site now lies under the boundary to the Llanwern steelworks.	Modern
WA1040	Decoypool Lane depicted on 1842 tithe map, now overgrown. May have originally linked through to WA281 and WA282.	Modern
WA1138	Major reen in the vicinity of Pye Corner, north-north-west – south-south-east aligned, fossilised in the landscape by its incorporation within field boundaries. Pre-dates the enclosure of the landscape. Test pits did not establish a construction date.	Undated
WA1140	Early north-south canalisation of watercourse into a reen. Discharges directly into the estuary.	Undated
N/A	Complex of buildings and well shown on tithe and early OS mapping. Elements still extant.	Modern

It is considered that these assets are of local importance and it is likely that they would experience Slight Adverse effects as a result of the scheme.

Palaeochannels

The lidar analysis has identified 12 distinct palaeochannels that lie within the footprint of the scheme. These have the potential to contain environmental evidence of the past landscape, and also material evidence of human occupation of the area. These would be directly impacted by construction, although only discreet

sections of these channels would be affected. It is probable that these impacts would result in a Slight/Medium Adverse effect.

Unknown Archaeology

The baseline assessment has demonstrated that there is clear potential for encountering as yet undiscovered archaeological deposits within the footprint of the scheme, in particular across the Gwent Levels. These remains are likely to date predominantly from the prehistoric and Romano-British periods, though remains from later periods are also likely to be represented. At this stage it is not possible to determine the significance of such remains, however the waterlogged conditions that prevail along the route suggests that any remains, in particular those that are organic in nature, such as wood, are likely to be well preserved. Within the footprint of the scheme any such remains would be destroyed by construction activity, and those outside of the footprint may also be affected by changes to the water table/flows. Any such impacts would be considered to be High Adverse.

7.11 Water Environment

The following section sets out the key features of interest relating to the water environment across Sections A, B and C of the Route.

7.11.1 Catchment Area

The scheme assessment area lies wholly within the River Usk catchment, which forms part of the Severn River Basin District. The River Usk catchment covers approximately 5,700 km² with 1,008 kilometres of main rivers, on ten different rivers, and an extensive network of reens across the Gwent Levels, which include designated Sites of Special Scientific Interest (SSSI)¹¹¹. The source of the River Usk is in the Black Mountains from which it flows 120km to its mouth at the Sever Estuary. It flows along a narrow catchment that passes through the towns of Brecon, Crickhowell, Abergavenny and Usk, before ultimately joining the Severn Estuary at Newport¹¹². The land use is mainly agricultural but its character varies considerably with residential and commercial uses concentrated in the central section and more industrial uses dominating the southern extent¹¹³. The catchment has a recognised ecological value due to the high level of designations, including the River Usk as a Special Area of Conservation (SAC) and SSSI and the Severn Estuary as a Special Protection Area (SPA), Ramsar Site and SSSI.

7.11.2 Watercourses

Within the study area, the major watercourse is the River Usk which transects the scheme, running North to South through Section B of the scheme before ultimately discharging into the Severn Estuary. The River Usk is recognised as

¹¹¹ Environment Agency – Wye and Usk Catchment Flood Management Plan – Summary Report January 2010.

¹¹² Environment Agency – River Basin Management Plan, Severn River Basin District Main Document – December 2009.

¹¹³ Newport City Council – Draft River Usk Strategy – November 2008.

nationally and internationally important for conservation and has been designated as a SSSI and SAC.

The River Ebbw is also located within the study area and flows in a northwest-southeast direction through the western portion of the scheme from its source at Mynydd Langynidr to its point of discharge into the Severn Estuary at the mouth of the River Usk¹¹⁴.

At the point at which the Route crosses the Rivers Usk and Ebbw, these rivers are collectively classified as part of the Usk Estuary, by the Severn River Basin Management Plan. However, given the relatively localised potential impacts associated with the crossing point of the Route, they are assessed as separate water bodies.

The Rivers Usk and Ebbw are locally used for fishing, particularly for trout and salmon. There are no other recreational uses of the river systems due to the large tidal range associated with the Severn Estuary. The River Usk is used for commercial activities associated with its operational wharfs and the Newport docks infrastructure operated by Associated British Ports (ABP).

Also within the study area is an unnamed tributary of the River Ebbw which flows in a west-east direction from its source to its confluence with the River Ebbw.

Within Section C of the scheme Monks Ditch is a large reen with its own small catchment and it flows in a predominately north-south direction through the eastern part of the scheme assessment area.

Table 7.24 provides a more complete list of the major watercourses potentially affected by the scheme and their key features associated with the WFD, as identified within the Severn River Basin Management Plan, such as its current risk status and whether or not it is a protected area.

Table 7.24: Watercourses potentially affected by the scheme¹¹⁵

Water course	Route Section	Typology description	Hydromorphological status	Overall Risk	Protected Area
Usk estuary	B	Mixed, macro, extensive intertidal	Heavily modified	At Risk	Yes - Freshwater Fish Directive, Natura 2000 (Habitats and/or Birds Directive)
Ebbw R – conf Ebbw Fack R to Maes-glas	B	Mid, Medium, Siliceous	Heavily modified	At Risk	Yes – Freshwater Fish Directive
Unnamed trib – source to conf Ebbw R	B	Low, extra small, calcareous	Artificial	At Risk	No

¹¹⁴ <http://www.southeastwalesrivertrust.org.uk/pages/rivers/ebbw> accessed on 20/01/2014

¹¹⁵ Data from Environment Agency, Annex B Severn River Basin District, December 2009. Viewed on the 25/03/2014

Water course	Route Section	Typology description	Hydromorphological status	Overall Risk	Protected Area
Monks Ditch – Wainbrindge to mouth	C	Low, Extra Small, Calcareous	Artificial	At Risk	Yes – Natura 2000 (Habitats and/or Birds Directive).
Monks Ditch – source to Wainbridge	C	Low, small, calcareous	Artificial	At Risk	No
Broadway Reen – source to R Severn Estuary	A	Low, small, calcareous	Artificial	At Risk	Yes – Natura 2000 (Habitats and/or Birds Directive).

7.11.3 Reens

There is an extensive network of reens and drainage channels that drain the land within the Gwent Levels (see Figure 7.17).

‘Reen’ refers to a NRW or CWLIDB maintained watercourse, or a newly created one of similar dimensions capable of retaining water all year round. A ‘Field reen’ is a drainage ditch around or within a field which does not necessarily take water all year round and which has a base level above that of the surrounding reens. Field reens are also significantly smaller. Unless differentiation between the two is required, they have been collectively referred to as ‘reens’.

The reens are intensively managed and serve an important dual function: to store run-off during tide locked periods in the winter and to supply water for livestock in the summer. They are dredged periodically, with reens managed by NRW being dredged every 1-3 years, while those managed by the IDB’s are dredged on a longer cycle, averaging every 7.5 years^{116, 117}.

Few of the ditches flow consistently with the majority being stagnant. The water levels in the ditches are controlled by a complex system of pumps and weirs. During the winter, the level in the reens is kept low with some flow so that water is allowed to drain from the land into the Severn Estuary. At the end of the winter the water level in the reens is allowed to fall before raising the weirs and sluices causing the ditches to refill with clean water from spring and summer rain to provide wet fencing and stock watering, at which point they become more stagnant.

¹¹⁶ Anon. 1998. *Towards a strategy for the Gwent Levels into the next millennium. A consultation document*. Bangor, CCW.

¹¹⁷ Drake, C.M. 1986. *A survey of the invertebrates of the Gwent Levels, 1985*. Contract Surveys, No.1. Nature Conservancy Council.

This map illustrates the proposed M4 Corridor Around Newport, specifically focusing on the area around Newport Docks. The map shows various route options (B1 through B6) and existing infrastructure like roads and water bodies. A north arrow is present in the top left corner.

Legend

- Option B1
- Option B2
- Option B3
- Option B4
- Option B5
- Option B6
- All Route Options
- Existing M4 Route
- Reens
- Waterbodies

Client: Ulywodraeth Cymru Welsh Government

Job Title: M4 Corridor Around Newport
Coridor yr M4 o amgylch Casnewydd

ARUP

Drawing Title: Figure 7.17 Watercourses - Overview

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Issue: P1

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North Arrow: N

Map Labels: Newport Docks

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The levels comprise an extensive area of reclaimed coastal grasslands that is predominately used for agriculture. A key feature of the Gwent Levels is the 1400km's of interconnected ditches which form an extensive drainage network, which is the largest in Wales. NRW are responsible for 64 km's of this and the Caldicot and Wentlooge IDB's, which will transfer to NRW in 2015, are responsible for a further 130kms and the rest are the responsibility of private landowners, mainly farmers¹¹⁸.

The Gwent Levels includes several Sites of Special Scientific Interest (SSSI's).

- St Brides SSSI;
- Nash and Goldcliff SSSI;
- Magor and Undy SSSI;
- Whitson SSSI; and
- Redwick and Llandeenny SSSI.

These sites are important, amongst other things, for the aquatic plant communities which are present within the reens and include a number of notable and rare flora and invertebrate species. Although these are ecological features as opposed to aquatic features, the two are inextricably linked and it is important to understand the sensitivity of the area in order to determine the potential impact of the scheme.

The St Brides SSSI covers a small proportion of the assessment area for Sections A and B of the proposed route whereas Section C of the route is located, for much of its length, within the Wentlooge and Caldicot Levels, jointly comprising the Gwent Levels.

All the reens and watercourses ultimately drain into the Severn Estuary which lies to the south of the scheme and is designated as a SSSI, RAMSAR, SPA and SAC.

NRW have confirmed that there are no licenced surface water abstractions within the study area. However, it is assumed that there would be frequent abstractions from the reens by farmers across the levels that are less than 20 cubic metres a day and therefore do not require a permit. These abstractions are not accounted for in the assessment.

7.11.4 Water Environment

The WFD statuses of the main waterbodies within the scheme area are identified in Table 7.25.

¹¹⁸ Countryside Council for Wales – Aquatic invertebrates recorded in the Gwent Levels: introduction, checklist and bibliography – J.H. Bratton, 2002

Table 7.25: WFD classification for the main waterbodies within 1km of the scheme¹¹⁹

Waterbody	Route Section	Chemical status	Ecological Status
Unnamed tributary – source to conf Ebbw R	B	Does Not Require Assessment (DNRA)	Good
Monks Ditch – source to Wainbridge	C	DNRA	Moderate
Monks Ditch – Wainbridge to mouth	C	DNRA	Moderate
Broadway Reen – source to R Severn Estuary	A	DNRA	Moderate
Usk Estuary (covers River Ebbw and River Usk)	B	Good	Moderate
River Ebbw	B	Fail	Moderate

The water quality in the reens is unknown. However, the reens that are within SSSI designated sites are considered to have very high ecological sensitivity due to the habitat they provide for qualifying species. Therefore, the sensitivity of the water quality is also considered to be very high as it is required to support the ecological potential of the reens.

7.11.5 Flood risk

TAN 15 Development Advice Map indicates that the scheme is within the flood plain (Zone C1), areas of the flood plain which are developed and served by significant infrastructure, including flood defences.

The Gwent Levels are protected from extreme tide levels by the sea/River Usk defences which are maintained by NRW. The mechanism of flooding would be a catastrophic breach in the River Usk or the sea defences.

It is assumed that NRW will maintain, strengthen and raise the defences in the future to cater for the increases in sea level due to climate change.

7.11.6 Appraisal of effects on the water environment

7.11.6.1 Section A

Section A passes, in part, through the Gwent Levels: St Brides SSSI. The route would cross up to 7 field reens and the larger Percoed Reen (see Figure 7.18), which it is assumed would either be filled in or culverted in order for the road to pass over them.

¹¹⁹ Data from Environment Agency, Annex B Severn Basin District, December 2009. Viewed on the 25/03/2014

The main potential environmental impacts associated with the water environment of Section A could be:

- Pollution of watercourses from road surface water runoff including sediment, heavy metals and hydrocarbons;
- accidental spillages of chemicals, fuel oils and other products toxic to the water environment, from vehicle accidents;
fire fighting water used in the event of vehicle fires;
- increases in salinity due to road salting during winter periods; and
- direct impact on the water bodies due to culverting or infilling of channels, where dissected by the scheme.

The Strategic Environmental Assessment (SEA) provides a commitment that new reens would be constructed to offset losses from motorway development and any losses associated with mitigation measures; new reens would be constructed to Caldicot and Wentlooge Levels Internal Drainage Board (CWLIDB) standards and size. The length of reens to be offset would be determined through Environmental Impact Assessment (EIA) at project level but would aim to enhance the baseline situation.

It is assumed that the drainage design would incorporate features such as petrol interceptors and Sustainable Urban Drainage Systems (SUDS) drainage features, such as swales and attenuation ponds, would also be incorporated into the design. Water treatment areas would be included as part of the detailed scheme design to manage surface water discharges.

The impact on water quantity and transfer of surface water flows is not considered likely to significantly change. Main watercourses will be culverted where they coincide with the highway, or minor watercourse and reens may be diverted as required, to maintain water transfer and to provide water storage capacity. Project level detail will be required to inform this; however, the structure will be 'permeable' and permit the passage of water past the structure in a manner to be developed in consultation with NRW. Consequently, water levels should not significantly change, or mitigation would be identified at project level if required.

However the extent of the scheme and the predicted increase in the volumes of surface run-off entering the various surface water bodies, including the reen system, could result in impact on flood risks. The Strategic Environmental Assessment (SEA) provides a commitment that runoff from the highway will be managed via balancing ponds, which will attenuate and treat water prior to release into local watercourses. These ponds will be designed to accommodate climate change adaptation such that they will be able to manage extreme rainfall events. Their capacity and design will permit storage and gradual release in periods of high rainfall, therefore managing potential flood risks associated with changes in down stream flows.

The scheme is in flood zone C1 and in line with the Planning Policy Wales Technical Advice Note 15: Development and Flood Risk (TAN 15) a Flood Consequence Assessment (FCA) for the development will be undertaken. At Stage 2 the level of design is not progressed sufficiently and discharge locations have not been identified to enable assessment of option preference. The FCA will therefore be carried out at detailed design stage, when the design is progressed sufficiently to inform the assessment.

The key potential impacts and associated significance is assessed against the key receptors in Table 7.26.

Table 7.26: Summary of Potential Effects – Section A

Potential Impact	Feature	Quality	Importance	Mitigation	Magnitude	Significance
Impacts on Water Quality and Physical Impacts from in-channel works	Reens	SSSI	Very High	-	Minor	Moderate/Large Adverse

The magnitude of the potential impact to the water environment is considered to be minor taking into account the potential impacts and sensitive design measures.

The high sensitivity of the reens and magnitude of the potential impacts means that the significance would be Moderate/Large Adverse. Given the small number of reens within the SSSI designation that would be crossed by the proposed route, the overall impact is considered to be Moderate Adverse.

7.11.6.2 Section B

Section B would cross up to 36 watercourses including the Rivers Usk and Ebbw and the Newport Docks with the remainder being reens, some of which are within the St Brides SSSI (see Figure 7.19). The proposed bridge span will mean that piers are unlikely to be located within the river channel itself, although the span and design of bridge crossings would be determined through design development at a later stage.

The principle environmental impacts associated with the water environment for Section B could be:

- Pollution of watercourses from road surface water runoff, including sediment, heavy metals and hydrocarbons;
- accidental spillages of chemicals, fuel oils and other products toxic to the water environment, from vehicle accidents;
- fire fighting water used in the event of vehicle fires;
- increases in salinity due to road salting during winter periods; and
- direct impact on the water bodies due to culverting of reens or infilling of channels, where dissected by the scheme.

Any potential impact on the economic value of the water environment of the docks and River Usk wharfs has been considered outside the scope of this report.

It is assumed that any significant adverse effects to these environments from highway runoff and spillages would be minimised through sensitive design, for example by provision of drainage features, such as petrol interceptors, spillage tanks and SUDs. New reens would also be constructed to offset those lost as a result of the proposed route.

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Map's map from an aerial photograph of the River Usk and the River Ebbw. The map shows the M4 corridor around Newport, with various route options (B1 to B8) and the All Route Options. The map also shows the River Usk, the River Ebbw, and the Newport Docks. The map is a detailed plan of the area, showing the M4 corridor and the surrounding urban and rural areas. The map is a technical drawing, showing the M4 corridor and the surrounding urban and rural areas. The map is a technical drawing, showing the M4 corridor and the surrounding urban and rural areas.

Legend

- Option B1
- Option B2
- Option B3
- Option B4
- Option B5
- Option B6
- Option B8
- All Route Options
- Reens
- Waterbodies
- Sites of Special Scientific Interest (SSSI)
- Special Protection Areas (SPA)
- Special Areas of Conservation (SAC)
- Ramsar

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Drawing No: M4-0A-05-00-DR-ZX-0050

Issue: 1

The impact on water quantity and transfer of surface water flows is not considered likely to significantly change. Main watercourses will be culverted where they coincide with the highway, or minor watercourse and reens may be diverted as required, to maintain water transfer and to provide water storage capacity. Project level detail will be required to inform this; however, the structure will be 'permeable' and permit the passage of water past the structure in a manner to be developed in consultation with NRW. Consequently, water levels should not significantly change, or mitigation would be identified at project level if required.

However the extent of the scheme and the predicted increase in the volumes of surface run-off entering the various surface water bodies, including the reen system, could result in impact on flood risks. The Strategic Environmental Assessment (SEA)¹¹ provides a commitment that runoff from the highway will be managed via balancing ponds, which will attenuate and treat water prior to release into local watercourses. These ponds will be designed to accommodate climate change adaptation such that they will be able to manage extreme rainfall events. Their capacity and design will permit storage and gradual release in periods of high rainfall, therefore managing potential flood risks associated with changes in down stream flows.

The scheme is in flood zone C1 and in line with the Planning Policy Wales Technical Advice Note 15: Development and Flood Risk (TAN 15) a Flood Consequence Assessment (FCA) for the development will be undertaken. At Stage 2 the level of design is not progressed sufficiently and discharge locations have not been identified to enable assessment of option preference. The FCA will therefore be carried out at detailed assessment stage (EIA).

Management of surface water from the River Usk crossing would either have to be within the bridge structure or via land based drainage systems, before discharge. This is particularly important in the vicinity of sensitive environments of the River Usk SAC and SSSI and relevant Gwent Levels SSIs. Where discharges were made to the river, dilution and dispersion would limit the impact of any residual pollutants, after treatment. This would be further evaluated at detailed design stage to confirm the environmental effectiveness of such systems.

The key potential impacts and associated significance is assessed below against the key receptors in Table 7.27.

Table 7.27: Summary of Potential Effects – Section B

Potential Impact	Feature	Quality	Importance	Mitigation	Magnitude	Significance
Impacts on Water Quality and Physical Impacts from in-channel works	River Usk	WFD - 'Good' water quality - 'Moderate' ecological potential SPA, Ramsar, SSSI	Very High	-	Minor Adverse	Moderate/ Large Adverse
	River Ebbw	WFD - 'Moderate' ecological potential	Medium	-	Minor Adverse	Slight Adverse

Potential Impact	Feature	Quality	Importance	Mitigation	Magnitude	Significance
		- 'Fail' chemical status.				
	Reens	SSSI	Very High	-	Minor adverse	Moderate/ Large Adverse

A summary and overall judgement of significance associated with Section B is provided below.

Section B crosses sensitive receptors - River Usk and the St Brides SSSI (very high sensitivity). The Route Options also cross the River Ebbw. The River Ebbw achieves a WFD chemical status of 'Fail', according to Annex B of the Severn River Basin District plan, and it is not within any protected designated sites. However, it has a moderate ecological potential and care should be taken to avoid adversely affecting this. Therefore, it is considered to have a medium sensitivity/importance.

The magnitude of the potential impact on the water environment in the River Usk and Ebbw is considered to be Minor as the route will not require any structures to be built within the rivers and it is assumed that potentially polluting discharges would be minimised through sensitive design. The magnitude of the potential impact on the water environment of the reens is also considered to be minor as a result of sensitive design and the provision of compensatory reens.

As a result of the very high sensitivity of the River Usk and the reens within the St Brides SSSI combined with the magnitude of potential impact, the significance is assessed as Moderate/Large Adverse. However, on balance, given the sensitive design measures and the absence of in-channel structures for the Usk crossing, the overall impact of Section B on the water environment is considered to be Moderate Adverse.

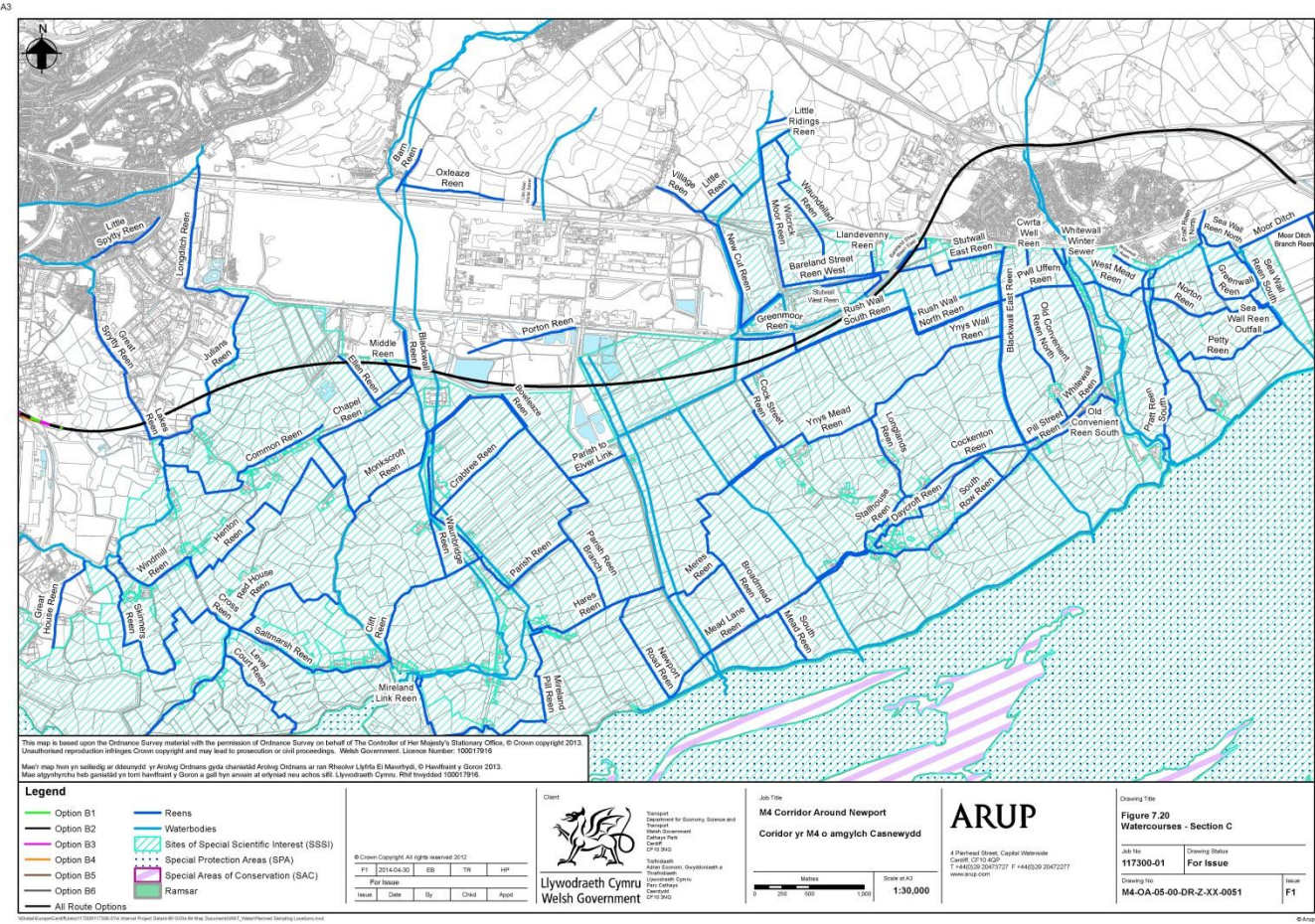
7.11.6.3 Section C

Section C of the scheme would run through the Gwent Levels: Whitson and Redwick and Llandeenny SSSI's and would require up to 50 watercourse crossings. The majority of these are small field reens but also includes the larger: Lakes Reen, Julian's Reen, Ellen Reen, Middle Reen, Monk's Ditch, Elver Pill Reen, Middle Road Reen, Newcut Reen and Stutwall Reen (see Figure 7.20).

The principle environmental impacts associated with the water environment across Section C would be:

- Pollution of watercourses from road surface water runoff, including sediment, heavy metals and hydrocarbons;
- Accidental spillages of chemicals, fuel oils and other products toxic to the water environment, from vehicle accidents;
- Fire fighting water used in the event of vehicle fires;
- Increases in salinity due to road salting during winter periods; and
- Direct impact on the water bodies due to culverting or infilling of channels, where the route crosses channels.

Figure 7.20: Watercourses – Section C



The Strategic Environmental Assessment (SEA) provides a commitment that new reens would be constructed to offset losses from motorway development and any losses associated with mitigation measures; new reens would be constructed to Caldicot and Wentlooge Levels Internal Drainage Board (CWLIDB) standards and size. The length of reens to be offset would be determined through Environmental Impact Assessment (EIA) at project level but would aim to enhance the baseline situation.

It is assumed that the drainage design would incorporate features such as petrol interceptors and Sustainable Urban Drainage Systems (SUDS) drainage features, such as swales and attenuation ponds, would also be incorporated into the design. Water treatment areas would be included as part of the detailed scheme design to manage surface water discharges.

The impact on water quantity and transfer of surface water flows is not considered likely to significantly change. Main watercourses will be culverted where they coincide with the highway, or minor watercourse and reens may be diverted as required, to maintain water transfer and to provide water storage capacity. Project level detail will be required to inform this; however, the structure will be 'permeable' and permit the passage of water past the structure in a manner to be developed in consultation with NRW. Consequently, water levels should not significantly change, or mitigation would be identified at project level if required.

However the extent of the scheme and the predicted increase in the volumes of surface run-off entering the various surface water bodies, including the reen system, could result in impact on flood risks. The Strategic Environmental Assessment (SEA)¹¹ provides a commitment that runoff from the highway will be managed via balancing ponds, which will attenuate and treat water prior to release into local watercourses. These ponds will be designed to accommodate climate change adaptation such that they will be able to manage extreme rainfall events. Their capacity and design will permit storage and gradual release in periods of high rainfall, therefore managing potential flood risks associated with changes in down stream flows.

The scheme is in flood zone C1 and in line with the Planning Policy Wales Technical Advice Note 15: Development and Flood Risk (TAN 15) a Flood Consequence Assessment (FCA) for the development will be undertaken. At Stage 2 the level of design is not progressed sufficiently and discharge locations have not been identified to enable assessment of option preference. The FCA will therefore be carried out at detailed design stage, once the design is progressed sufficiently to inform the assessment. The key potential impacts and associated significance is assessed against the key receptors in Table 7.28.

Table 7.28: Summary of Potential Effects – Section C

Potential Impact	Feature	Quality	Importance	Mitigation	Magnitude	Significance
Impacts to Water Quality and Physical Impacts from in-channel works	Reens	SSSI	Very High	-	Minor Adverse	Moderate/ Large Adverse
	Monk's Ditch – Source to Wainbridge	WFD - Moderate ecological potential	High	-	Minor Adverse	Slight/ Moderate Adverse
	Monk's Ditch – Wainbridge to mouth	WFD - Moderate ecological potential SSSI	Very High	-	Minor Adverse	Moderate/ Large Adverse

The reens have a high sensitivity given their location within a SSSI.

The magnitude of the potential impact to the water environment is considered to be minor taking into account the potential impacts and sensitive design measures.

The high sensitivity of the reens and magnitude of the potential impacts means that the significance is assessed as Moderate/Large Adverse. Given the cumulative impact associated with multiple reen crossings within a SSSI designated site, the overall impact is considered to be Large Adverse.

7.11.6.4 Cumulative assessment

Cumulative effects associated with the proposed route include the loss of ecological habitat. The reens and ditches provide a valuable habitat for notable flora and fauna species and the cumulative impact from crossing multiple reens could have a significant adverse impact on habitats.

7.12 Appraisal Summary Tables (ASTs)

Please see Section 9 for the ASTs that consider the environmental impacts of the schemes.

8 Social Assessment

8.1 Transport Safety

The new motorway, which will be designed to modern standards, will provide a significant improvement in transport safety for users of the new route, located south of the urban area of Newport. Reduced congestion and delays on the existing M4 route will also provide benefits to transport safety.

Initial accident forecasts for the scheme show that the new motorway will provide an improvement to transport safety. With the scheme in place, total accidents saved by the scheme over 60 years from opening are estimated to be over 1,100 – about 19 each year. The benefits would be improved should traffic demand increase as a result of the Severn Crossing Tolls being removed (see Section 4.4).

8.2 Personal Security

Road users are more vulnerable to crime in circumstances where they are required to stop their vehicles or travel at slow speeds, such as at the approaches to signals or in congested conditions. In the roads context, security includes the perception or risk of personal injury, damage to or theft of vehicles, and theft of property from individuals or vehicles. There are three locations in which security issues may arise when using roads:

- On the road itself (e.g. being attacked whilst broken down);
- In service areas, car parks and so on (e.g. vehicle damage while parked at a service station, being attacked while walking to parked car); and
- At signals or junctions (e.g. smash and grab incident while queuing at lights).

Improved traffic flow and less congestion will reduce the potential for delays, which will reduce travellers' perceptions of vulnerability to crime.

Formal surveillance (CCTV etc.) will also be present to monitor the new motorway, whilst the new motorway will be designed to include appropriate provision of emergency call and help points to standard. Appropriate landscaping, lighting and design standards will be incorporated during detailed design with personal security issues to be a key consideration. Where walking and cycling measures are progressed to improve links, including to public transport services, opportunities will be sought to design-out crime at interchanges as part of detailed design.

Overall security provision will be improved with the scheme. Security levels will be high in terms of formal surveillance provision, lighting and visibility, and emergency call facilities along the road and at signals/junctions. Landscaping and pedestrian and cyclist facilities will provide moderate or high levels of security.

Issues of equality in terms of the relationship between transport and personal security and protected characteristic groups are explored in more detail in Section 9. Increased security will benefit all users, but protected characteristic groups in addition to women and the elderly are likely to place greater value on security and therefore could benefit the most. More detailed issues of safety and personal security will be considered at the detailed design stage.

8.3 Permeability

The new motorway could affect a number of existing public rights of way and local routes, which cross or adjoin the route, to which continuity of access should be maintained by means of footpath diversions and appropriate crossing facilities. However, the new motorway would help reduce congestion on the existing motorway and local road network, to benefit severance issues around Newport.

A preliminary Non-Motorised Users (NMU) Context Report¹²⁰ considers the impact on pedestrians, cyclists and equestrians in terms of severance and opportunities to maintain or enhance accessibility where the new motorway interfaces with existing highway or pedestrian infrastructure. Where possible, permeability is maintained or enhanced through retaining, diverting or creating structures, footpaths, cycle paths and bridleways that pass, cross over or navigate under highway infrastructure. A list of schemes identified to achieve this is provided in the NMU Context Report. No strategic accesses would be compromised as a result of the scheme.

In terms of benefits to the existing M4 between Magor and Castleton, reclassification of the existing motorway could lead to schemes that aim to provide benefits to permeability, particularly to the communities of Caerleon and St Julians.

Initial accessibility modelling demonstrates the benefits to permeability as a result of the scheme, in terms of changes in journey times with and without the scheme in place (see Section 6.5.3.2). This accessibility modelling also takes into account the benefits to areas identified as experiencing deprivation (using the Index of Multiple Deprivation), as well as the location of community facilities of importance particularly to vulnerable groups, including the following:

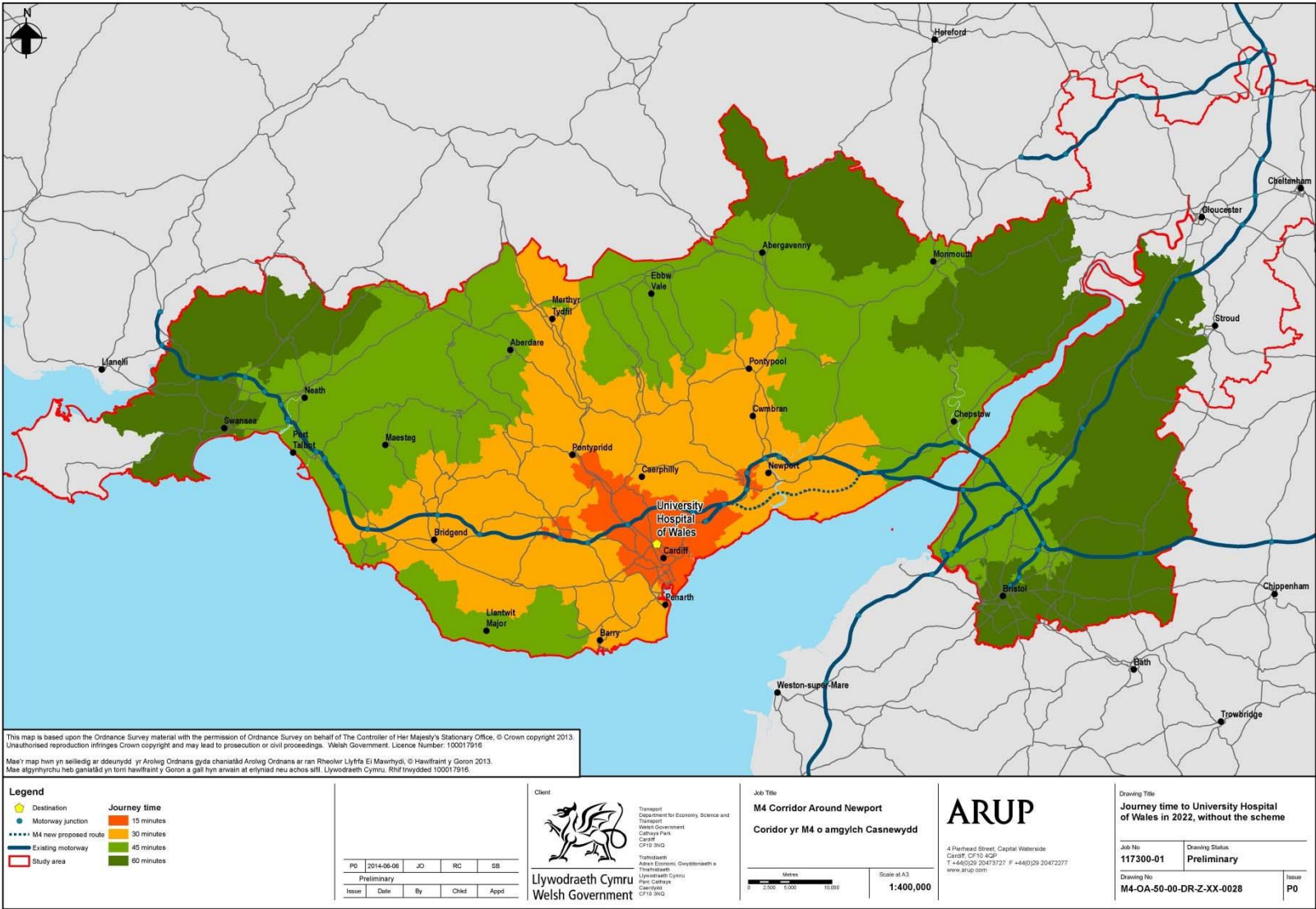
- Health and care facilities;
- Community centres and services;
- Education facilities;
- Shopping centres;
- Churches and other places of worship;
- Places for recreation and leisure; and
- Public transport interchanges.

The results show that with the scheme in place, people will be able to travel further in the same time as they could typically travel without the scheme in place. This means that accessibility is increased for car users. See Figures 8.1 to 8.4 for examples of journey time savings to strategic health services in South East Wales over time. See Figures 8.5 to 8.8 for examples of journey time savings to strategic education services in South East Wales over time.

Furthermore, sensitivity tests show that if the Severn Crossing Tolls are removed, increased demand could lead to even further benefits to accessibility with the scheme in place as a result of increased capacity and resilience on the network.

¹²⁰ Welsh Government, M4 Corridor around Newport, Preliminary Non-Motorised Users Context Report, Draft 2, 25 April 2014

Figure 8.1: Journey time to strategic healthcare service in opening year 2022 (without the scheme)



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Legend

- Destination
- Motorway junction
- M4 new proposed route
- Existing motorway
- Study area

Journey time change

- Limited change
- 1 to 2 minutes saving
- 2 to 3 minutes saving
- 3 to 4 minutes saving
- 4 to 5 minutes saving
- 5 to 10 minutes saving
- Over 10 minutes saving

Client

Transport
Department for Economy, Science and
Transport
Welsh Government
Cathays Park
Cardiff
CF10 3NP

**Llywodraeth Cymru
Welsh Government**

Job Title

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Drawing Title

Change in journey time to
University Hospital of Wales in 2022

Job No
117300-01

Drawing Status
Preliminary

Drawing No
M4-OA-50-00-DR-Z-XX-0029

Scale at A3
1:400,000

Issue
Date By Chkd Appt

Issue
Date By Chkd Appt

Figure 8.3: Journey time to strategic healthcare service in 2037 (without the scheme)

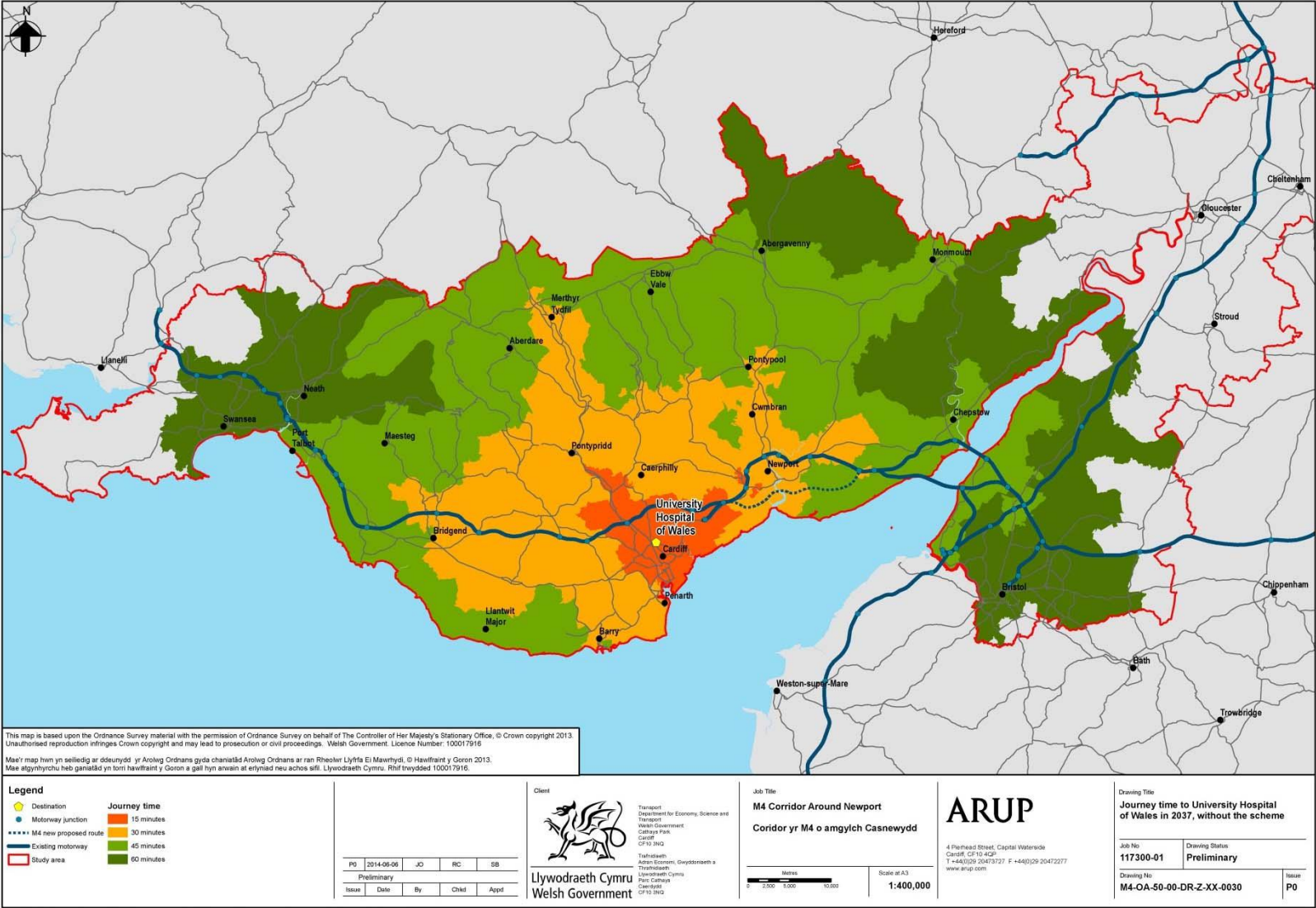


Figure 8.4: Change in journey time saving to strategic healthcare service in 2037 (with the scheme)

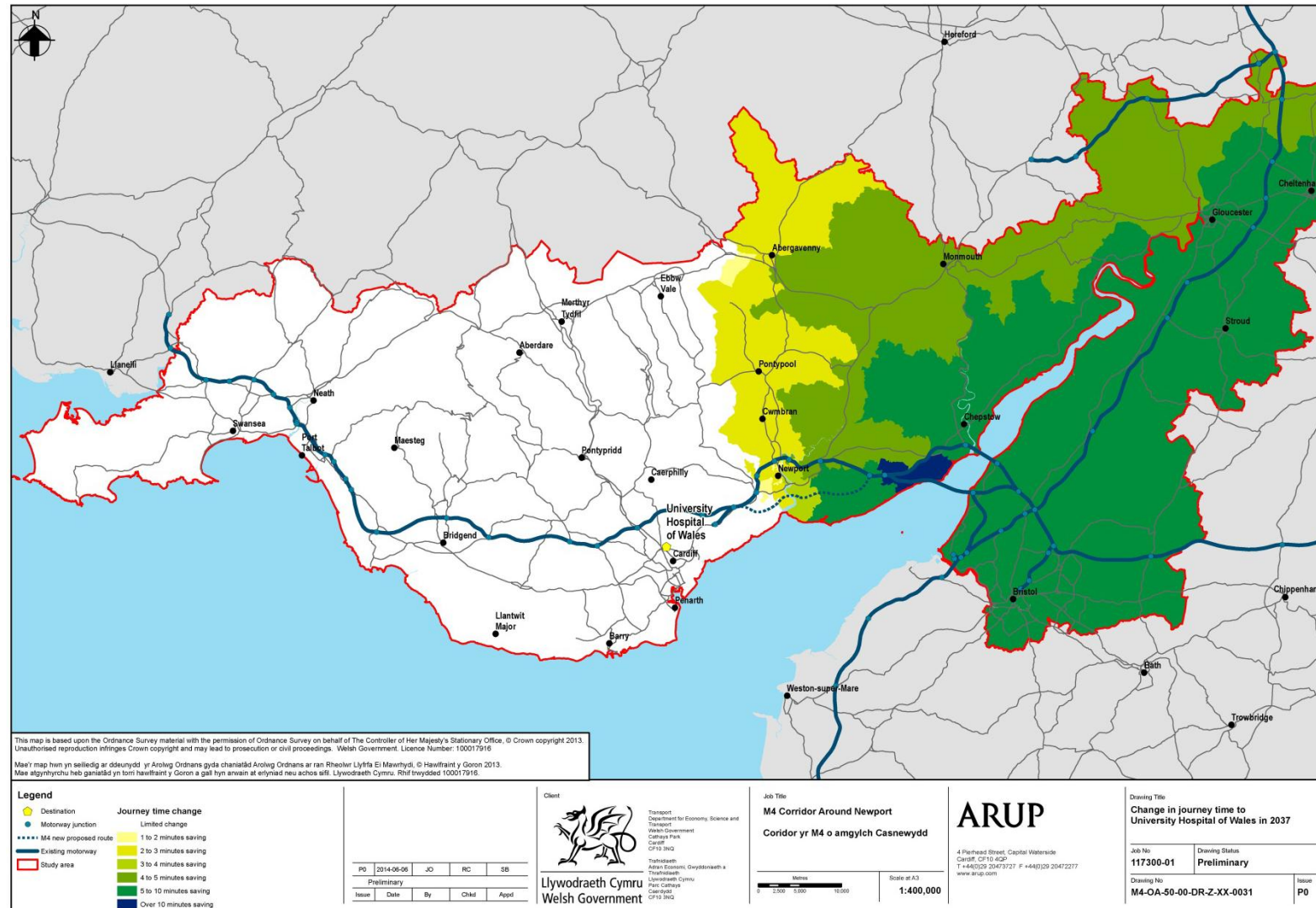


Figure 8.5: Journey time to strategic education service in opening year 2022 (without the scheme)

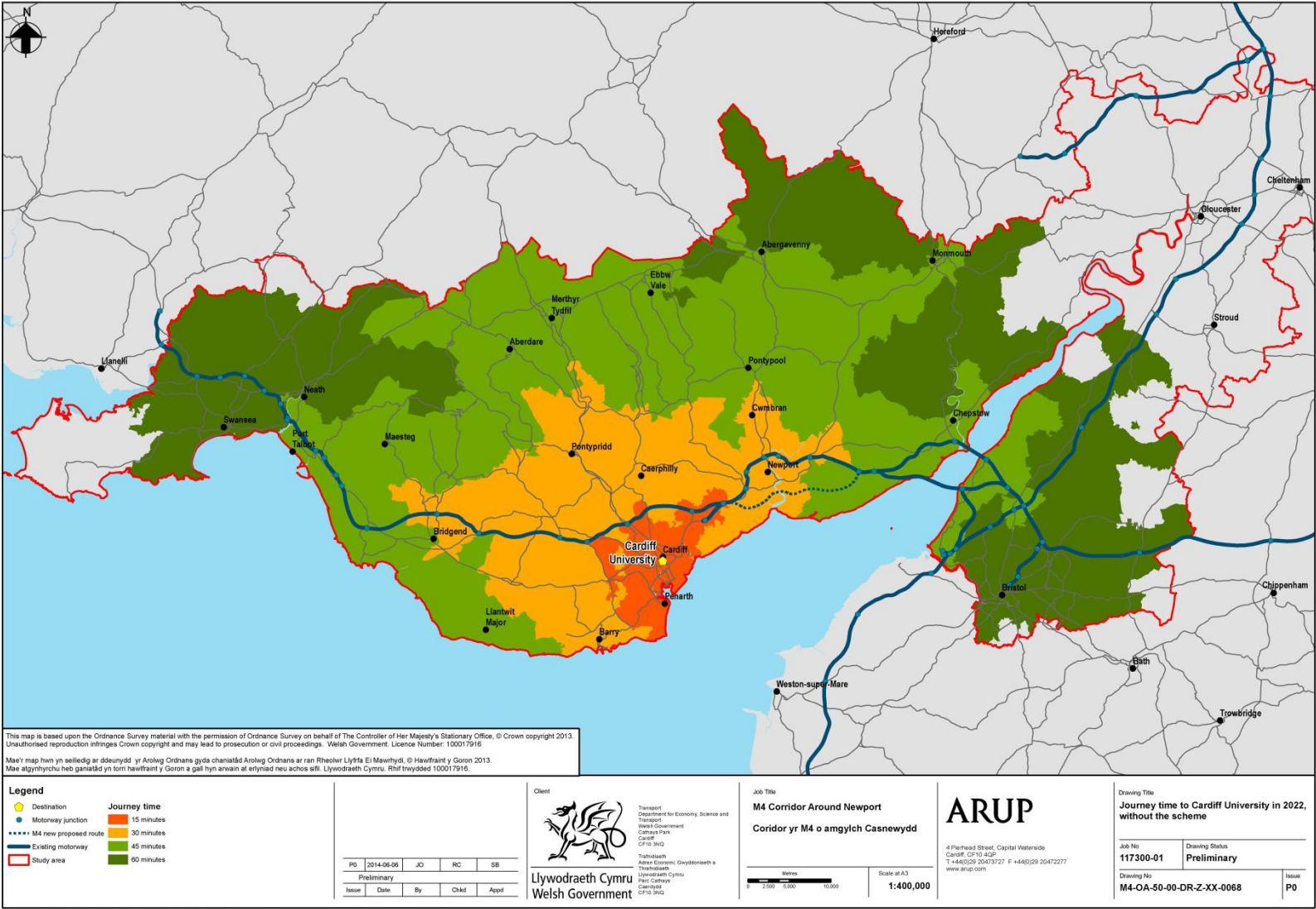


Figure 8.6: Change in journey time saving to strategic education service in opening year 2022 of the scheme

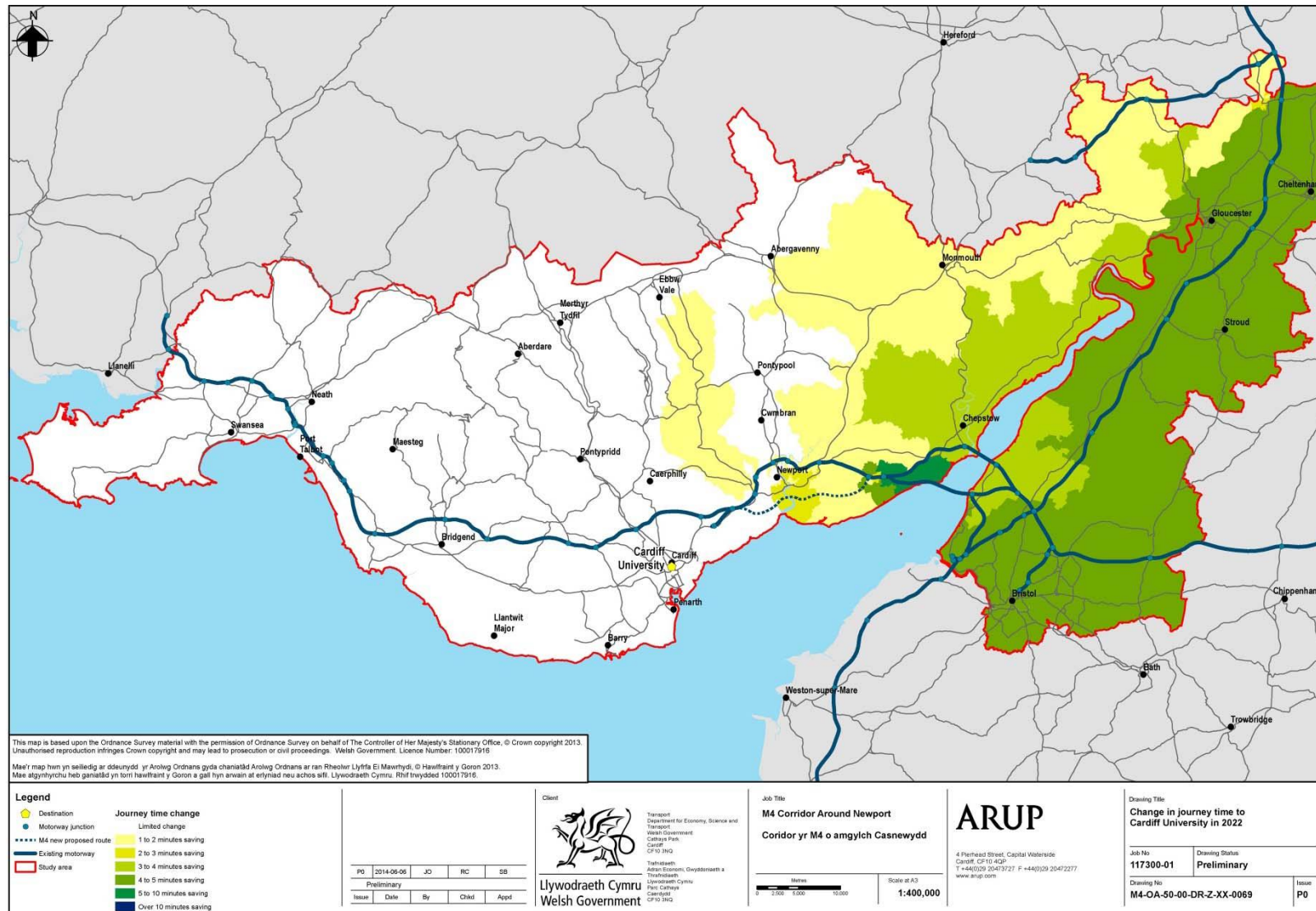


Figure 8.7: Journey time to strategic education service in 2037 (without the scheme)

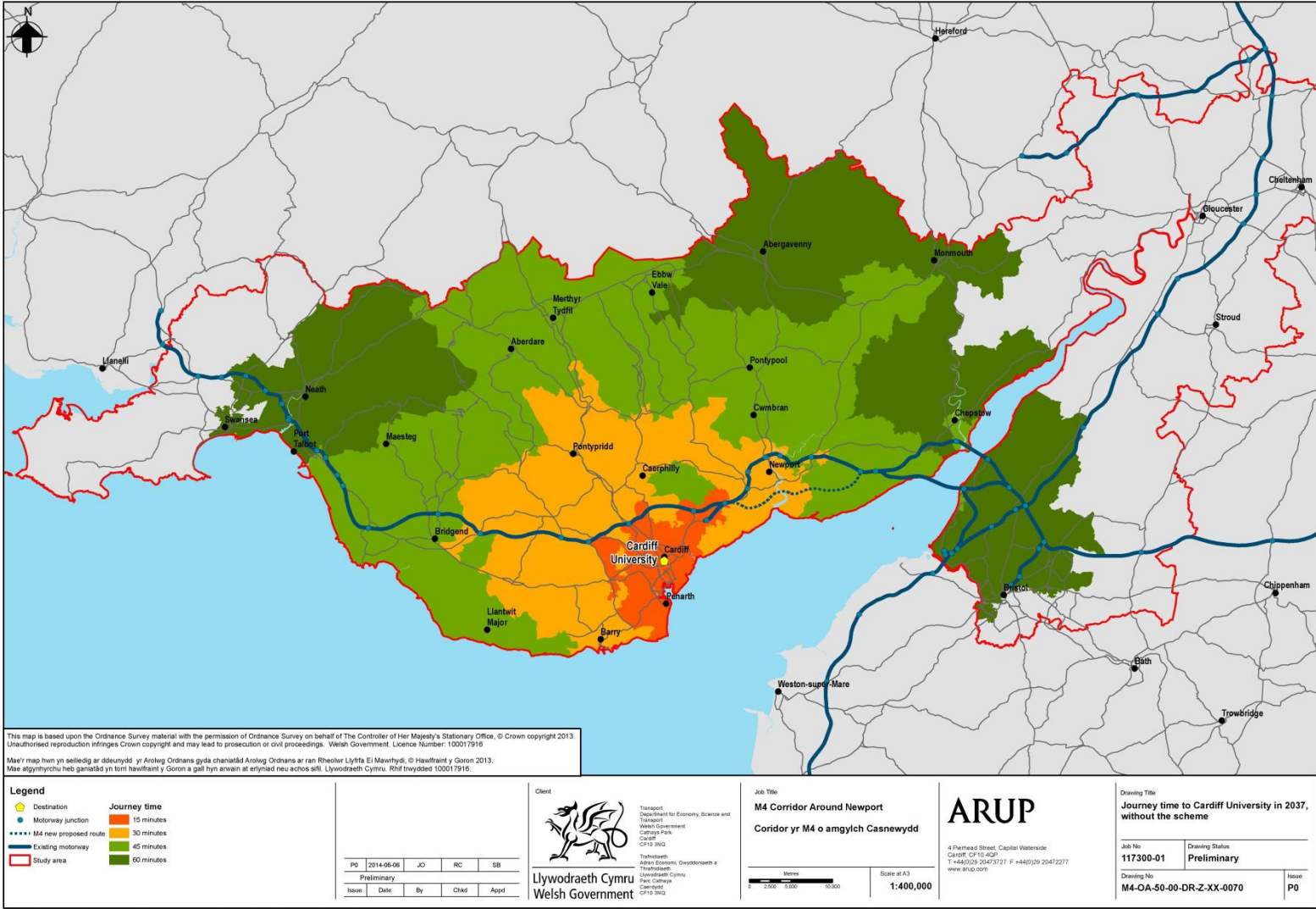
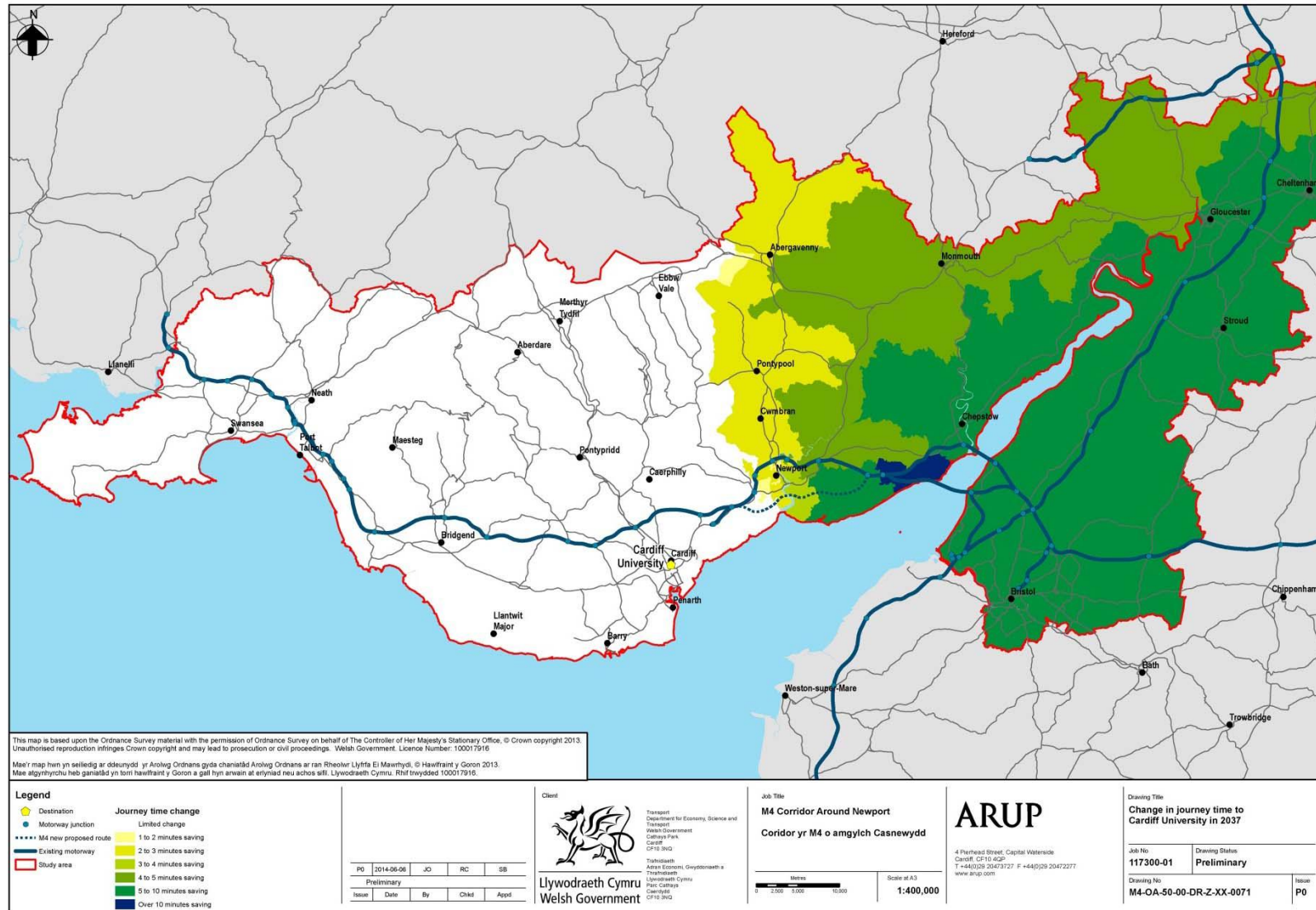


Figure 8.8: Change in journey time saving to education healthcare service in 2037 (with the scheme)



8.4 Physical Fitness

The scheme aims to contribute to physical fitness and general well-being by providing benefits to safety, air and noise quality, journey ambience and the numerous benefits that arise through decongestion such as time savings, reduction in accidents and reduced emissions.

The new motorway is unlikely to lead to significant changes in travel by active modes. However, it will:

- Improve transport safety (see Section 8.1);
- Reduce emissions on the M4 Corridor around Newport and bring benefits to the AQMAs to the north of Newport, although there will be minor adverse impacts to the south of Newport, where there are few receptors, along the route of the new motorway (see Section 7.5);
- Reduce noise levels to the north of Newport, although there will be minor adverse impacts to the south of Newport, where there are few receptors, along the route of the new motorway (see Section 7.4);
- Reduce driver stress by providing a new free flowing route to motorway standards, as well as improving travel conditions along the existing M4; and
- Improve journey times and journey time reliability.

Furthermore, provision of walking and cycling friendly infrastructure is proposed as part of the draft Plan for the M4 Corridor around Newport.

Overall, it is considered that the impact of physical fitness will be minor positive. Issues of health and poverty are explored in more detail in Section 8.7.

8.5 Social Inclusion

Relieving congestion and improved traffic flows will lead to improvements in the reliability and journey times of car users and strategic bus services, which use the motorway network, offering an opportunity to improve accessibility to key centres. As part of the draft Plan for the M4 Corridor around Newport, reclassification of the existing M4 may provide future opportunities to progress schemes aiming to increase accessibility along the northern fringe of Newport.

Accessibility benefits, as a result of the motorway to the south of Newport, are likely to be mainly beneficial for car users. However, as part of the draft Plan for the M4 Corridor around Newport, benefits to walking and cycling aim to be realised.

Improvements in accessibility to healthcare, education and other facilities and services are discussed and presented in Section 8.3.

The information provided within this WelTAG Appraisal is considered appropriate to satisfy the requirements of a Social Inclusion Report. Therefore to avoid duplication, rather than prepare a separate report, it has been incorporated within Section 8 of this report.

8.6 Equality, Diversity and Human Rights

At the strategy stage, and in accordance with WelTAG and the Equality Act 2010, the Welsh Government has undertaken an Equality Impact Assessment (EqIA) of the M4 Corridor around Newport preferred strategy¹²¹, building on responses received to the EqIA of the draft Plan¹²², which was subject to the draft Plan consultation (see Section 3.3.4).

EqIA of the M4 Corridor around Newport Plan at the strategy stage concluded that there are likely to be no significant adverse effects from the preferred strategy, arising for any character group. The assessment identifies that the scheme would bring benefits to all character groups with access to a car, bringing benefits in terms of reduced traffic congestion, improved resilience and journey time reliability. It would benefit the character groups in terms of improved accessibility with varying degrees of benefit dependent upon need (e.g. improved access to healthcare for pregnant women and new parents). The complementary measures would bring a variety of benefits, with improvements to walking and cycling infrastructure, offering improved access to local services, facilities and employment, as well as improved access to public transport facilities for those reliant on public transport for local and regional travel.

Strategies as well as schemes are required to undergo an EqIA if an impact is identified at Stage 1. In light that Stage 1 identified that there are likely to be no significant adverse effects, consequently further EqIA is not considered to be required at Stage 2 assessment. Further issues of safety and personal security will however be considered at the detailed design stage.

In summary, the scheme would be expected to provide positive impacts on the population and equality, whereas without the schemes the current situation would worsen. Building on the results of the strategy level EqIA, a scheme level consideration of the potential equality impacts arising from the M4 Corridor around Newport Plan indicates:

- The scheme would lead to a reduction in traffic congestion, improved resilience, transport safety and journey time reliability. This would bring benefits to people with access to a car. The scheme would improve access to services and facilities (e.g. education and healthcare) as well as employment opportunities primarily for those of working age. Complementary measures could also provide improved walking and cycling connections to provide benefits to people of all ages. They would also bring health benefits to people of all ages through promoting walking and cycling locally;
- The scheme would bring benefits to those with a disability who have access to a car, making both local and regional trips more accessible. The new motorway would be unlikely to significantly benefit those without access to a car, however the complementary measures could bring benefits to those with a disability and without access to a car if walking and cycling links are built with 'access for all' in mind;
- The new motorway would also be designed to improve transport safety and personal security. This would bring benefits to all groups of people in terms of

¹²¹ M4 Corridor around Newport Plan Equality Impact Assessment (2014)

¹²² M4 Corridor around Newport draft Plan Equality Impact Assessment (2013)

providing improved safe access to support services, facilities and employment opportunities;

- The scheme would bring reduced traffic congestion improved resilience, transport safety and journey time reliability. This would bring direct benefit to married couples and those in civil partnership, improving accessibility to employment opportunities, services and facilities;
- The scheme would benefit those with access to a car, improving accessibility to key facilities and services (e.g. health care and support groups). The new motorway is aligned away from the main area of residential properties. The scheme would help reduce the exposure of pregnant women to air pollution associated with traffic;
- The scheme aims to provide economic benefits and support the regeneration of Newport. The junction strategy will aim to provide opportunities for economic development and complement public transport access to key employment sites. This would particularly benefit adults from minority ethnic groups who may be on low incomes or who have problems accessing employment opportunities with or without private vehicles. The construction of the scheme is likely to attract many travellers groups during works, as they generally seek this type of work. However sufficient facilities would need to be provided during their temporary residence;
- The scheme would bring specific positive impacts with increased accessibility for Somali Muslims who predominately travel from Newport to Cardiff to worship;
- The scheme would benefit both male and female drivers, improving access to employment as well as facilities and services;
- The scheme will benefit access to employment as well as facilities and services. The complementary measures will offer a positive benefit for LGB people. However safety concerns on the road network, existing walking and cycling infrastructure would remain or even worsen. This would have a particular impact on the personal security of LGB community;
- The impact on Welsh language is considered to be limited;
- The scheme would support regional economic development, through enhanced accessibility to employment centres and improving the movement of people and freight. This would lead to improved economic outcomes, contributing to increased economic activity and supporting the regeneration of Newport. The junction strategy will aim to provide increased opportunities for economic development and accessibility to existing and future employment sites by all car and public transport.

Appraisal of the Do Minimum Scenario outlines that:

- Traffic forecasting suggests that the problems will continue to worsen and several operational problems will be experienced on all sections of the M4 around Newport in the longer term;
- The Do Minimum scenario would lead to continuing traffic congestion on the existing motorway, which would impact adversely on journey times and journey time reliability. Continued congestion would impact on people of all ages particularly in access to services and severe operational problems of the motorway;

- Continuing congestion on the motorway would impact negatively on those with a disability who are car users, by reducing access to services, facilities and employment opportunities. Diversion of traffic to local roads, particularly during peak times, would impact on disabled people who do not have access to a car;
- The Do Minimum scenario would impact negatively on all those wishing to access support services, facilities and employment opportunities by car. It would also impact on those reliant on alternative transport modes, particularly during peak periods;
- Safety concerns on the road network, on existing walking and cycling links, and on public transport would also remain or even worsen; and
- Air quality and noise pollution problems would also continue to worsen along the existing motorway, impacting on people living and working in urban centres of Newport.

8.7 Health Impact Assessment

Health Impact Assessment (HIA) is a mandatory requirement of WelTAG. However, there is no set procedure for conducting an assessment. In line with WelTAG, HIA has been developed to suit the circumstances, making the best use of resources and information available at this stage.

At the strategy stage, the Welsh Government undertook HIA of the M4 Corridor around Newport preferred strategy¹²³, building on responses received to the HIA of the draft Plan¹²⁴, which was subject to the draft Plan consultation (see Section 3.3.3). HIA at the strategy stage concluded that the preferred strategy performs best against HIA criteria for all groups, bringing positive benefits to health in the M4 Corridor around Newport. It suggested that doing nothing above what is already planned or committed would lead to either minor or moderate adverse impacts on the majority of HIA criteria, affecting the majority of groups within the population. It outlines an Action Plan that aims to enhance the possible beneficial impacts and/or mitigate against any potential adverse impacts on health.

A scheme level HIA may be undertaken at detailed design stage, when more information is available. At this stage and building on the results of the strategy level HIA, a scheme level consideration of the potential health impacts arising from the M4 Corridor around Newport Plan indicates:

- The scheme would improve accessibility to health, care, training and education facilities and services. However this may primarily benefit those with access to a private vehicle. The peak for rush hour is spreading, which means that people may travel to work earlier or later, which impacts on personal time and compromises the work/life balance. If journey times are improved and journey time reliability is increased, there could be more time for leisure and recreation, which brings health and wellbeing benefits. Complementary measures could bring improved access to facilities for those who rely on other transport modes through improved walking and cycling infrastructure and linkages to public transport interchanges. This would be

¹²³ M4 Corridor around Newport Plan Health Impact Assessment (2014)

¹²⁴ M4 Corridor around Newport draft Plan Health Impact Assessment (2013)

likely to encourage local trips to be made by such modes and as such benefit health and well-being.

- The new motorway would help to reduce noise and air pollution along the route of the existing M4, where there are four AQMAs and higher than average noise levels. However, noise and air quality would be expected to deteriorate in the area around the new motorway, although the surrounding area is less populated than the urban areas of Newport and thus the impact on human health would be less. It is estimated that there would be a reduction of some people annoyed by noise with the new motorway and some 7900 properties would experience lower atmospheric pollutants compared with an increase for some 155 properties. The impacts of air, noise and dust pollution during construction are likely to affect those who live in close proximity to the new motorway. The new motorway would also partly pass through contaminated land. Modern construction methods would aim to limit any impacts.
- The scheme would improve transport safety largely by reducing traffic congestion and associated impacts on accidents and incidents. On completion, it is forecast that the total number of accidents would fall, with total accidents saved by the scheme over 60 years estimated to be over 1,100 – about 19 each year.
- The crossing of the Usk bridge structure is likely to be attractive to vulnerable people with severe mental health problems. Mitigation would include no provision of pedestrian access in order to prevent suicide attempts.
- The new motorway would cross the River Usk SAC and SSSI and the Gwent Levels and would be likely to impact adversely on the landscape. There could be a negative impact on health as a result from the actual or perceived loss in physical space and/or quality of recreational amenity use of these areas. There may also be a psychological impact from construction activities and possible impact on property values and perceived quality of life. This may be positive or negative depending on proximity to the route and stage of the project. However, as described in 6.5, new job opportunities will arise and value will be added into the local economy.
- There will be a psychological impact when the new motorway is opened in terms of actual and perceived benefits to the economy. These are described in 6.5. The new motorway is expected to deliver a positive impact on the economy.

Appraisal of the Do Minimum Scenario's likely impacts on health outlines that:

- Traffic conditions are expected to deteriorate and stop/start driving conditions would create an adverse travel experience, leading to higher levels of driver stress. Increased congestion would also exacerbate the risk of incidents and accidents occurring.
- The Do Minimum scenario would be detrimental to the environment as it would not, for example, achieve any improvement in air quality or noise, meaning that the Welsh Government and Newport City Council would not be able to fulfil their statutory duties for managing local air quality under Part IV of the Environment Act 1995, to meet the EU limit values for pollutants for the four Air Quality Management Areas which were declared as a result of emissions from traffic on the M4 motorway.

- Ill health is often associated with economic deprivation. Congestion on the M4 between junctions 24 and 29 is already thought to be impacting on business performance and the level of congestion is expected to increase. Cardiff and Newport have ambitious regeneration strategies and Monmouthshire is developing areas around Junction 23A of the M4. Traffic congestion on the M4 could hamper these plans and impact negatively on regional economic development. Congestion on the M4, particularly around Cardiff and Newport, is sighted by the business community in South Wales as a barrier to economic growth. Where congestion increases, the cost of transport for businesses, commuters and consumers and economic performance can be affected.
- Increased congestion would adversely impact on the movement of commuters. The M4 is heavily used by commuters and there are already significant movements of commuters between Wales and England over the Severn Crossings. Increased congestion would result in higher journey times for commuters, reducing the effective travel to work area.

Potential actions that the Welsh Government have considered as part of scheme development, and will consider as part of detailed design include:

- Use of modern construction methods and appropriate management and mitigation of potential noise, air and dust pollution impacts during construction;
- Identify and adopt mitigation measures to limit potential adverse environmental impacts on the Gwent Levels;
- Consider health issues as part of the development of a junction strategy;
- Ensure safe working practices during construction;
- Consider measures to enhance the safety of users;
- Consider measures to ensure the safety of vulnerable groups and people with mental health problems;
- Appropriate diversions to any highway or pedestrian/cycle/equestrian route should be made, if required, during construction works that might obstruct an existing route;
- Appropriate measures should be introduced to maintain or enhance highway or pedestrian/cycle/equestrian route, if appropriate;
- Work with stakeholders and local communities to identify appropriate pedestrian and cycling infrastructure issues, potential improvements and new connections;
- Ensure appropriate mitigation measures are identified to enhance the environment and offset any adverse impacts on cultural and historical identity;
- Identify opportunities to address cultural needs as part of scheme development;
- Ensure the procurement process associated with any option targets local recruitment and training;
- Seek sustainable sourcing of materials and minimise site waste; and
- Prepare a monitoring and evaluation plan.

8.8 Appraisal Summary Tables (ASTs)

Please see Section 9 for the ASTs that consider the social impacts of the schemes.

9 Appraisal Summary

9.1 Appraisal Summary Tables (ASTs)

Appraisal Summary Tables (ASTs) for the Do Minimum Scenario and the scheme have been prepared using the seven point scale of impact significance set out in Paragraph 3.7.1 of WelTAG.

Following each impact appraisal for both Stages 1 and 2, WelTAG recommends that the significance of impact for each criterion is assessed using a seven point scale detailed in Paragraph 3.7.1 of the WelTAG guidance. This scale includes the following assessment criteria:

- Large beneficial (+++);
- Moderate beneficial (++);
- Slight beneficial (+);
- Neutral (0);
- Slight adverse (-);
- Moderate adverse (--);
- Large adverse (---).

The assessment of impact on each of the Welsh Impact Areas is to be provided in Appraisal Summary Tables (ASTs).

WelTAG also requires, in Paragraph 3.5.1, that the distribution of impacts is carefully considered. This part of the assessment refers to how impacts might be distributed geographically and how they might affect different groups in society.

Table 9.1: Assessment of the Do Minimum Scenario against WelTAG Criteria and Transport Planning Objectives (TPOs)

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	Congestion on the M4 between junctions 24 and 29 is already thought to be impacting on business performance and the level of congestion is expected to increase. Cardiff and Newport have ambitious regeneration strategies and Monmouthshire is developing areas around Junction 23a of the M4. Traffic congestion on the M4 could hamper these plans and impact negatively on regional economic development. Assessment has shown that no improvement to the motorway would lose the opportunity to create £2 bn to £2.7 bn (including wider impacts) in benefits.	All	(---)

Criteria	Assessment	Distribution Significance	
Economic Activity and Location Impact (EALI)	Congestion on the M4, particularly around Cardiff and Newport, is sighted by the business community in South Wales as a barrier to economic growth. Where congestion increases, the cost of transport for businesses, commuters and consumers and economic performance can be affected. Increased congestion will adversely impact on the movement of commuters. The M4 is heavily used by commuters and there are already significant movements of commuters between Wales and England over the Severn Crossings. Increased congestion will result in higher journey times for commuters, reducing the effective travel to work area.	All	(---)
Noise	High traffic volumes along the M4 contribute to noise pollution, compromising the aural amenity of neighbouring residential communities.	Properties along the existing M4	(--)
Local Air Quality	High traffic volumes along the M4 contribute to poor air quality, compromising the amenity of neighbouring residential communities. This will affect the condition of four out of Newport's nine Air Quality Management Areas (AQMA) that are associated with the M4.	Properties along the existing M4	(--)
Greenhouse Gas Emissions	Traffic conditions are expected to deteriorate and slow-moving, stop/start driving conditions can lead to higher CO ₂ emissions than free-flowing traffic.	No significant distributional impacts	(-)
Landscape and townscape	There would be no or limited change as a result of the Do Minimum scenario.	No significant landscape impacts	(0)
Biodiversity	There would be no or limited change as a result of the Do Minimum scenario.	No significant distributional impacts	(0)
Heritage	There would be no or limited change as a result of the Do Minimum scenario.	No significant distributional impacts	(0)
Water environment	There would be no or limited change as a result of the Do Minimum scenario.	No significant distributional impacts	(0)
Soils	There would be no or limited change as a result of the Do Minimum scenario.	No significant distributional impacts	(0)
Transport safety	The more congested road conditions become, the greater the risk of incidents and accidents occurring. The most common accidents on the M4 between junctions 25 and 28 are rear-end shunts on both the westbound and eastbound approaches to the Brynglas Tunnels. This is largely due to the stop-start conditions that occur during peak periods.	All road users	(--)
Personal security	The Do Minimum scenario would lead to continuing traffic congestion on the existing motorway which would impact on journey time reliability. There would be limited improvements to infrastructure which would negatively impact on many vulnerable groups who rely on transport modes other than the car to access activities and services.	No significant distributional impacts	(0)

Criteria	Assessment	Distribution Significance	
Permeability	The Do Minimum scenario would lead to continuing traffic congestion on the existing motorway which would impact on journey time reliability. This would bring negative impacts to those reliant on the car to access facilities, services and employment opportunities, as well as those utilising public transport for this purpose, with traffic diverting to local roads during peak periods.	No significant distributional impacts	(-)
Physical fitness	Air quality and noise issues could also continue to increase along the existing motorway corridor, impacting on residential areas to the north of Newport.	No significant distributional impacts	(0)
Social inclusion	The Do Minimum scenario would lead to continuing traffic congestion on the existing motorway which would impact on journey time reliability. This would adversely impact on access to services, facilities and employment opportunities for all those with access to a car, and who rely on public transport due to continued problems associated with motorway traffic diverting onto local roads to avoid peak congestion. The continuing problems would further hamper economic growth and prosperity in the region.	No significant distributional impacts	(-)
Equality, Diversity & Human Rights	The Do Minimum scenario would lead to continuing traffic congestion on the existing motorway which will impact on journey time reliability. This would impact those vulnerable groups reliant on the car to access services, facilities and employment opportunities. This continuation of reported problems would also continue to hamper economic growth potential of the region, restricting the movement of people and freight, particularly at peak periods.	No significant distributional impacts	(0)
TPOs			
1	As congestion increases, safety conditions and journey time reliability will deteriorate.	All	(---)
2	Travel conditions on the M4 are forecast to worsen over time, reducing accessibility on the transport network.	All	(--)
3	There would be no or limited change as a result of the Do Minimum scenario.	All	(0)
4	There would be no or limited change as a result of the Do Minimum scenario.	All	(0)
5	Increased levels of congestion will reduce journey time reliability, particularly at peak travel times.	All	(--)
6	There would be no or limited change as a result of the Do Minimum scenario.	All	(0)
7	Increased congestion will exacerbate the risk of incidents and accidents occurring.	All	(--)
8	Increased traffic volumes and stop/start conditions will exacerbate poor air quality, particularly in the AQMAs along the route of the M4 around Newport.	All	(--)
9	Higher traffic volumes along the M4 will contribute to noise pollution.	All	(--)
10	Traffic conditions are expected to deteriorate and stop/start driving conditions will lead to higher emissions.	All	(--)
11	Traffic conditions are expected to deteriorate and stop/start driving conditions will create an adverse travel experience, leading to higher levels of driver stress.	All	(---)

Criteria	Assessment	Distribution Significance	
12	Increased congestion on the M4 may lead to severe disruption and congestion on the local and regional highway network, with significant delays and adverse effects on local roads being used as diversions.	All	(---)
13	There would be no or limited change as a result of the Do Minimum scenario.	All	(0)
14	There would be no or limited change as a result of the Do Minimum scenario.	All	(0)
15	There would be no or limited change as a result of the Do Minimum scenario.	All	(0)
Public acceptability	Traffic congestion during peak periods results in unreliable journey times, which impacts on the ability of individuals to take up job opportunities and discourages investment from high value businesses. Transport congestion also has environmental impacts affecting local communities. Increasing levels of congestion are unlikely to be acceptable to the public.		
Acceptability to other stakeholders	The M4 motorway plays the vital role in providing the east/west strategic road link that underpins the economy of South Wales and facilitates the mass movement of people and goods to stimulate economic and social activity within the region and beyond. Any disruption to the operation of the motorway in South Wales has a negative impact upon economic development, particularly around Cardiff, Newport and beyond. Congestion is sighted by the business community in South Wales as a barrier to economic growth and increasing levels of congestion are unlikely to be acceptable to stakeholders.		
Technical and operational feasibility	Planned or committed schemes as part of the Do Minimum scenario have demonstrated their feasibility as part of their associated planning stages.		
Financial affordability and deliverability	Planned or committed schemes as part of the Do Minimum scenario have demonstrated their affordability and deliverability as part of their associated planning stages.		
Risks	There are no or limited risks associated with planned or committed schemes as part of the Do Minimum scenario.		

Table 9.2: Assessment of the motorway to the South of Newport against WelTAG Criteria and Transport Planning Objectives

Criteria	Assessment	Distribution	Significance
Transport Economic Efficiency (TEE)	The new motorway to the south of Newport will alleviate problems of congestion on the highway network, thus leading to journey time savings and improved journey time reliability. The new motorway will also provide significant resilience to the network and will be likely to result in lower accident rates. The scheme is expected to deliver high value for money. The Net Present Value of the scheme is forecast to be in the range of +£660 million to +£2 billion depending upon future traffic growth. For central growth, the Benefit to Cost Ratio is estimated to be 2.3 increasing to 3.1 when wider impacts are included.	All road users	(+++)
Economic Activity and Location Impact (EALI)	A new section of motorway to the south of Newport will deliver significant travel time savings and reliability benefits for businesses leading to lower production costs and contributing to the competitiveness of transport dependent business in Wales. The new motorway could significantly improve perceptions of access to South Wales, potentially making Wales a more attractive place to do business. Additional junctions to the south of Newport would increase the potential of employment sites. The new motorway is forecast to add £89.5 million to the GDP in 2037. Up to 6,750 net additional jobs might be created. The new motorway is thus expected to deliver a major positive impact on the economy of South Wales.	All road users	(+++)
Noise	With the new motorway, traffic flows are reduced on the existing alignment as through traffic is diverted along the new alignment to the south of Newport, through areas with a very low population density. As such there is a significant reduction in noise level at many residential properties close to the existing alignment and significant increases at a lot fewer properties near the new alignment. Consequently, the WelTAG analysis of the scheme shows a reduction of -825 people annoyed due to noise and a monetary benefit in the net present value of £33 million over a 60 year period.	Properties along the M4	(+)
Local Air Quality	The new motorway will provide reductions in the levels of atmospheric pollution to a large number of local receptors alongside the existing M4 through Newport, by removing traffic from areas where the existing motorway is frequently congested. 155 properties are predicted to experience deterioration in PM10 concentrations and 32 properties are predicted to experience deterioration in NO ₂ concentrations, while 7780 properties are predicted to experience an improvement in PM10 concentrations and 7900 properties are predicted to experience an improvement in NO ₂ concentrations. It has been assumed that a number of isolated properties along the proposed Route Options will be demolished in order to construct the scheme. Deterioration in air quality occurs near the new motorway. The effects of this, however, would be of limited significance given the low number of properties affected. National Air Quality Standards would not be exceeded.	Properties along the M4	(++)

Criteria	Assessment	Distribution Significance	
Greenhouse Gas Emissions	Carbon dioxide emissions have been estimated to increase over the 60 year appraisal period by approximately 335,945 tonnes. The Net Present Value of CO ₂ emissions is - £15,729,559. However, the impact of congestion and stop-start conditions along the existing M4 without the scheme may not have been fully taken into account. More detailed simulation of future conditions would be likely to identify additional benefits as a result of the new motorway.	No significant distributional impacts	(-)
Landscape and townscape	<p>Section A passes through Landscape Character Areas considered of medium to very high sensitivity. The location of the Castleton Interchange on elevated ground combined with the loss of mature vegetation, which currently provides some screening of the existing motorway, would create a more open landscape with long distance views of the scheme. Due to the size, scale and the duration of the effect on the landscape the magnitude of change on the landscape character is considered to be very high. Likewise the Wentlooge Levels are considered a tranquil landscape with little development and therefore the size and scale of the effect and the duration of the effect on the landscape is considered to be very high.</p> <p>Effects on views vary from location to location from Moderate for receptors in Michaelston-Y-Fedw, to Large in particular locations in Marshfield and Castleton, among others.</p> <p>In Section B there would be views of the new roads, the main Bridge over the Usk and from elevated road ways either end on viaducts and then tapered embankments bringing the road back down to grade.</p> <p>Effects on three sensitive landscape character areas range from Large to Very Large in terms of significance.</p> <p>Effects on views vary from location to location from Moderate for receptors in Uskmouth area, to Large effects on the visual settings of the Transporter Bridge and its two Anchor Chambers, amongst others.</p> <p>Section C crosses four Landscape Character Areas. Across the Caldicot levels visibility of the scheme throughout the area would be significantly restricted due to the existing tree cover of existing woodland and tree-lined field boundaries.</p> <p>There are over 100 dwellings on the west and north edges of Magor. Residents would experience views of the scheme at close range on an embankment in the southwest and at grade to the north. The magnitude of changes to these views is predicted to be high and effects on the visual amenity of these receptors would be of Very Large significance.</p> <p>Considerable amounts of woodland screen planting would be introduced around this junction to mitigate the effects visual amenity of footpath users and local residents. It is anticipated that visual effects on the visual amenity of PRoW users and residents would be of Slight and Moderate significance respectively.</p>	Local landscape impacts	(---)

Criteria	Assessment	Distribution Significance	
Biodiversity	<p>The new motorway would cross approximately 9km of Sites of Special Scientific Interest (SSSI) resulting in the loss of up to 60ha (less than 1.5%) of the total SSSI. The principal ecological interest of the Gwent Levels SSSI lies in the reën drainage system.</p> <p>One small area of ancient woodland at Berryhill Farm is located directly beneath the footprint of the scheme, which will therefore be removed during construction.</p> <p>Other designated sites along or within the vicinity of the route include the River Usk (SAC) and (SSSI), the River Severn (SPA), the River Severn Ramsar Site, and Local Nature Reserves (LNR). The scheme would impact on a number of SINC sites along the length including at the River Ebbw, the saltmarsh along the River Usk, Spencer Works SINC and at the Solutia chemical plant.</p>	Potential impact on River Usk SAC and SSSI	(---)
Heritage	<p>The new motorway crosses a number of distinct topographic zones, the cultural heritage of which is characterised by particular attributes related to landform and historic land use. Much of the motorway would cross the marginal wetlands of the Gwent Levels, which is identified as an Historic Landscape of Outstanding Historic Interest. The area is also designated as being archaeologically sensitive in the adopted Newport UDP and the area has potential for encountering as yet undiscovered archaeological deposits.</p> <p>The built heritage of the area includes the historic Newport Docks, a number of individual listed buildings and structures and a range of buildings characteristic of the vernacular architecture of the area.</p> <p>A Grade II listed building, Magor Vicarage, would need to be demolished and a standing stone Scheduled Ancient Monument (SAM) at Llanfihangel would have to be relocated in order to accommodate the scheme.</p>	Distribution assessment not required (Para. 7.10.7 of WelTAG June 2008)	(--)
Water environment	<p>A new motorway could lead to adverse effects on water quality, hydrological regimes, flood plains and areas of flood risk. However, it is assumed that any significant adverse effects to these environments from highway runoff and spillages would be minimised through sensitive design, for example by provision of drainage features, such as petrol interceptors, spillage tanks and SUDs. New reens would also be constructed to offset those lost as a result of the scheme.</p> <p>The scheme crosses the highly sensitive River Usk and the reens within the St Brides SSSI. It would also run through the Gwent Levels: Whitson and Redwick and Llandeenny SSSI's and would require up to 50 watercourse crossings. Given the cumulative impact associated with multiple reën crossings within a SSSI designated site.</p> <p>Although the New M4 would be constructed on the floodplain of the Severn Estuary, the Gwent Levels are protected by a sea wall from inundation. The presence of the Usk Bridge would lead to a slight increase in flood levels upstream, particularly during construction, but these would be of negligible significance.</p>	No significant distributional impacts	(--)

Criteria	Assessment	Distribution	Significance
Soils	<p>A major cutting will be required at Castleton to accommodate the new interchange. The overall effect on surface geological features is of negligible significance. However, the proposed development would result in permanent loss of approximately 504ha of Best and Most Versatile Agricultural Land (i.e. land within Grade 1, 2 or 3a).</p> <p>There are some areas of contamination along the route, particularly in Section B which is dominated by industrialised areas, namely the Newport Docks, industrial estates on the eastern bank of the Usk River and Solutia chemical works. In addition, a large active landfill site, the Docks Way Landfill, is also located in this part of the scheme.</p>	No significant distributional impacts	(--)
Transport safety	The new motorway which will be designed to current standards, will provide a significant improvement in transport safety for users of the new route, located south of the urban area of Newport. Reduced congestion and delays on the existing M4 route would also provide benefits to transport safety. Total accidents saved by the scheme are estimated to be about 19 per year.	All road users	(+++)
Personal security	Improved traffic flow and less congestion will reduce the potential for delays, which may reduce travellers' perceptions of vulnerability to crime.	All road users	(+)
Permeability	The new motorway will affect a number of existing public rights of way and local routes, which cross or adjoin the route, to which continuity of access should be maintained by means of footpath diversions and appropriate crossing facilities. However, the new motorway will help reduce congestion on the existing motorway and local road network, to benefit severance issues around Newport. A Non-Motorised User Study will aim to maximise opportunities to enhance accessibility by walking, cycling and on horse-back, maintain existing routes where possible, and limit any potential severance issues.	All road users	(+)
Physical fitness	The new motorway is unlikely to lead to any changes in travel by active modes.	Car users	(0)
Social inclusion	Relieving congestion and improved traffic flows will lead to improvements in the reliability and journey times of strategic bus services, which use the motorway network, offering an opportunity to improve accessibility to key centres. Improved transport safety will benefit all groups of people.	Distribution assessment not required (Para. 8.6.31 of WelTAG June 2008)	(+)
Equality, Diversity & Human Rights	A new motorway could improve access to key facilities and employment opportunities for all groups. However, detailed issues of safety and personal security will be considered at the detailed design stage.	All road users	(+)

Criteria	Assessment	Distribution Significance	
TPOs			
1	An additional high quality road is likely to create a significantly safer, easier and more reliable transport link along the M4 between Magor and Castleton.	All	(+++)
2	The new motorway will form part of the European transport network and provide increased accessibility along the M4.	All	(+++)
3	The new motorway will provide an alternative route to the existing M4 around Newport with capacity to reduce congestion along the existing route and provide increased resilience on the network.	All	(+++)
4	A new motorway could improve traffic conditions on the existing network.	All	(+++)
5	A new motorway would provide increased network resilience and could significantly improve journey time reliability.	All	(+++)
6	The new motorway would provide an additional route between Magor and Castleton.	All	(++)
7	A new section of motorway would provide a safe alternative route.	All	(+++)
8	A new route to the south of Newport would help reduce air pollution along the route of the current M4, improving conditions in the Air Quality Management Areas.	All	(++)
9	Noise impacts would be reduced along the route of the existing M4, which would reduce the noise nuisance to nearby residential properties.	All	(+)
10	The new motorway will help to reduce congestion and vehicle emissions; however it is not clear whether the additional road capacity would lead to an overall increase in emissions in the longer term.	All	(+)
11	A new motorway would provide a high quality and free flowing highway to the south of Newport.	All	(+++)
12	A new motorway would provide a high quality route for strategic journeys.	All	(+++)
13	A new motorway could improve traffic conditions on the existing network.	All	(+++)
14	A new motorway could improve access to key facilities and employment opportunities.	All	(+++)
15	A new motorway would not support a behavioural change towards more sustainable modes but may encourage additional car use on a free flowing route.	All	(--)
Public acceptability	A new motorway to the south of Newport attracted the most comments of preference during the public consultation on the draft Plan, with support for its ability to address the problems and objectives for the M4 Corridor around Newport. There is a co-ordinated opposition largely from local interest groups, Wales Wildlife Trusts, RSPB and Friends of the Earth Cymru. Most comments arising from the public consultation on the draft Plan were made on the topic of the environment, with a third of these concerning potential impact on the Gwent Levels. The acceptability of the new motorway will be tested at public local inquiry.		

Criteria	Assessment	Distribution Significance
Acceptability to other stakeholders	Business interests are generally supportive, while environmental groups generally oppose the scheme. The CBI strongly promotes the scheme as a key priority for their members. Further engagement is likely to be needed with specific land owners who may be affected directly by the scheme, including ABP. The acceptability of the new motorway will be tested at public local inquiry.	
Technical and operational feasibility	The new motorway is a challenging scheme with a large estuarial crossing, major earthworks, soft ground, contamination, two motorway interchanges and intermediate junctions. It would considerably improve network resilience by providing a new strategic route to the south of Newport.	
Financial affordability and deliverability	Affordability is an important issue both in terms of timescale and the amount of capital required.	
Risks	There is a risk of a protracted public local inquiry for this scheme.	

9.2 Comparative Performance

The comparative performance of the proposed scheme for the M4 Corridor around Newport against doing nothing more than what is already planned or committed is summarised against WelTAG criteria in Table 9.3 and against TPOs and acceptability/feasibility/deliverability criteria in Table 9.4.

Table 9.3: Comparative Performance against WelTAG Criteria

Criteria	Doing Nothing	Black Route Motorway
Economy		
Transport Economic Efficiency (TEE)	(---)	(+++)
Economic Activity and Location Impact (EALI)	(---)	(+++)
Environment		
Noise	(--)	(+)
Local Air Quality	(--)	(++)
Greenhouse Gas Emissions	(-)	(+)
Landscape and townscape	(0)	(---)
Biodiversity	(0)	(---)
Heritage	(0)	(--)
Water environment	(0)	(--)
Soils	(0)	(--)
Social		
Transport safety	(--)	(+++)
Personal security	(0)	(+)
Permeability	(-)	(+)
Physical fitness	(0)	(0)
Social inclusion	(-)	(+)
Equality, Diversity & Human Rights	(0)	(+)

Table 9.4: Comparative Performance against Objectives, Acceptability, Feasibility, Deliverability and Risk

Transport Planning Objectives	Doing Nothing	With the Scheme
1	(---)	(+++)
2	(--)	(+++)
3	(0)	(+++)
4	(0)	(+++)
5	(--)	(+++)
6	(0)	(++)
7	(--)	(+++)
8	(--)	(++)
9	(--)	(+)
10	(--)	(+)
11	(---)	(+++)
12	(---)	(+++)
13	(0)	(+++)
14	(0)	(+++)
15	(0)	(--)
Criteria	Doing Nothing	With the Scheme
Public acceptability	Traffic congestion during peak periods results in unreliable journey times, which impacts on the ability of individuals to take up job opportunities and discourages investment from high value businesses. Transport congestion also has environmental impacts affecting local communities. Increasing levels of congestion are unlikely to be acceptable to the public.	The new road could create economic and social benefits. There is a co-ordinated opposition largely from local interest groups and Friends of the Earth. Most comments arising from the 2006 series of public exhibitions were made on the topic of the environment, with a third of these concerning noise. The location receiving the most comments was Magor/Undy. The acceptability of the project will be tested at public inquiry.
Acceptability to other stakeholders	The M4 motorway plays the vital role in providing the east/west strategic road link that underpins the economy of South Wales and facilitates the mass movement of people and goods to stimulate economic and social activity within the region. Any disruption to the operation of the motorway in South Wales has a negative impact upon economic development, particularly around Cardiff and Newport. Congestion is sighted by the business community in South Wales as a barrier to economic growth and increasing levels of congestion are unlikely to be acceptable to stakeholders.	Newport City Council and Newport Unlimited are supportive of the New M4 project. Business interests are generally supportive, while environmental groups generally oppose the scheme. The CBI strongly promote the scheme and it is included in SEWTA's Regional Transport Plan. Further engagement is likely to be needed with specific land owners who may be affected directly by the scheme, including ABP. The acceptability of the project will be tested at public inquiry.

Criteria	Doing Nothing	With the Scheme
Technical and operational feasibility	N/A	The New M4 is a challenging scheme with a large estuarial crossing, major earthworks, soft ground, contamination, two motorway interchanges and two intermediate junctions. It would considerably improve network resilience by providing a new strategic route to the south of Newport.
Financial affordability and deliverability	N/A	The implementation of the New M4 will be dependent upon the availability of funding. Therefore, affordability is an important issue both in terms of timescale and the amount of capital required.
Risks	N/A	There is a risk of a protracted public inquiry for this scheme. A quantified risk assessment has been undertaken for the scheme.

9.3 Summary of Appraisal

Appraisal of the Do Minimum Scenario demonstrates the need to do something, with largely negative or neutral impacts on all WelTAG criteria.

The motorway to the south of Newport scheme scores strongly against the TPOs; very positively against 10 of the 15 objectives resulting in large beneficial impacts. There is an adverse impact against only one objective; achieving a cultural shift in travel behaviour towards more sustainable choices. It should be acknowledged that the motorway to the south of Newport scheme forms part of the wider M4 Corridor around Newport Plan, which is cognisant of the Cardiff Capital Region Metro proposals and the proposed section of new motorway and its complementary measures will complement public transport improvements.

Overall, the scheme scores strongly against the WelTAG assessment criteria. It results in large beneficial economic impacts, with the scheme performing attractively with less distance to be travelled and hence lower journey times. The scheme performs positively against the social criteria. Appraisal indicates moderate to large adverse impacts on the environment (biodiversity, landscape and townscape in particular).

It should be noted that WelTAG appraisal does not take into account mitigation measures, which might address any potential adverse impacts. Further information should be made available as part of an Environmental Impact Assessment at the next stage of appraisal, should the scheme be progressed.

It should also be noted that should the Second Severn Crossing Tolls be reduced or removed, as outlined in Section 4.4 of this report; the impacts on the objectives and WelTAG criteria are likely to be further positive, in light that traffic congestion problems would be exacerbated in the Do Minimum Scenario.

The appraisal at this stage indicates that the scheme, as assessed in accordance with WelTAG Stage 2, should be progressed.

10 Monitoring and Evaluation

Monitoring and evaluation will provide evidence of the successes and failures of the implemented proposal.

It is considered that the performance of the proposal should be assessed against the transport planning objectives at regular monitoring intervals (annually), to assess the on-going effectiveness of the proposal. There should be flexibility in the setting of these intervals in that different proposals may need to be monitored more regularly than others.

The production of a monitoring and evaluation report should form the output of this stage but this is outside the scope of WelTAG. The data potentially required in this stage may include the following:

- Traffic volumes by type;
- Changes in journey times and journey time reliability;
- Changes in safety/accidents recorded;
- Mode share;
- Changes in employment; and
- Environmental impacts.

11 Conclusion

11.1 Recommendations

This WelTAG scheme level assessment has shown that the Welsh Government should progress its scheme for the M4 Corridor around Newport, comprising a new section of 3-lane motorway between Magor and Castleton to the south of Newport, with intermediate junctions at Glan Llyn and centrally to the west of the River Usk.

11.2 Next Steps

The potential key dates for progressing the M4 Corridor around Newport motorway to the south of Newport scheme are:

1. Publication of draft Orders and Environmental Statement: Summer 2016;
2. Public Local Inquiry: Winter 2016/2017;
3. Start of Construction: Spring 2018; and
4. Completion of Motorway Construction: Autumn 2021.

Appendix A

Transport Economic Efficiency
(TEE) Tables for Blue Route
Scenarios 2 and 3

A1 Transport Economic Efficiency (TEE) Tables for Blue Route Scenarios 2 and 3

A1.1 Economic Efficiency of the Transport System (TEE) – Blue Route Scenario 2

Consumers

User Benefits (£000)

	All Modes Total	Road Personal	Bus Passengers
Personal Travel			
Travel Time	90,683	90,683	0
Vehicle Operating Costs	-22,145	-22,145	0
User Charges	0	0	0
During Construction & Maintenance	0	0	
NET CONSUMER BENEFITS	68,538	(1) 68,538	0

Business

User Benefits

		Personal	Freight	Passengers
Travel Time	293,418	220,858	72,560	0
Vehicle Operating Costs	70,330	2,705	67,625	0
User Charges	0	0	0	0
During Construction & Maintenance	0	0	0	
Subtotal	363,748	(2) 223,563	140,185	0

Private Sector Provider Impacts

Revenue	13,007	12931	76	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	13,007	(3) 12931	76	0

Other Business Impacts

Developer contributions	0	(4) 0
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NET BUSINESS IMPACT 376,755 (5) = (2) + (3) + (4)

TOTAL (£000)

Present Value of Transport Economic Efficiency Benefits	445,293	(6) = (1) + (5)
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Notes

:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	645,555	645,555	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	742,320	(8) 742,320	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-3,114	-3,114	
TOTALS			
Broad Transport Budget	742,320	(9) = (7) + (8)	
Wider Public Finances	-3,114		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1) All entries are discounted present values in 2010 prices and values.
 - 2)

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-2,022	
Consumer User Benefits	68,538	
Business User Benefits	363,748	
Private Sector Provider Impacts	13,007	
Other Business Impacts	0	
Accident Benefits	0	
Wider Public Finances(Indirect Taxation Revenues)	3,114	
Present Value of Benefits (PVB)	446,385	
Local Government Funding	0	
Central Government Funding	742,320	
Present Value of Costs (PVC)	742,320	
OVERALL IMPACTS		
Net Present Value (£000)	-295,935	NPV=PVB-PVC
Benefit to Cost Ratio	0.60	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

A1.2 Economic Efficiency of the Transport System (TEE) – Blue Route Scenario 3

Consumers

User Benefits (£000)

	All Modes Total	Road Personal	Bus Passengers
Personal Travel			
Travel Time	-36,443	-36,443	0
Vehicle Operating Costs	-20,328	-20,328	0
User Charges	0	0	0
During Construction & Maintenance	0	0	
NET CONSUMER BENEFITS	-56,771	-56,771	0

(1)

Business

User Benefits

		Personal	Freight	Passengers
Travel Time	84,419	61,111	23,308	0
Vehicle Operating Costs	7,595	68	7,527	0
User Charges	0	0	0	0
During Construction & Maintenance	0	0	0	
Subtotal	92,014	61,179	30,835	0

(2)

Private Sector Provider Impacts

Revenue	4,694	4694	0	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	4,694	4694	0	0

(3)

Other Business Impacts

Developer contributions	0	(4)	0
-------------------------	---	-----	---

NET BUSINESS IMPACT

(5) = (2) + (3) + (4)

TOTAL (£000)

Present Value of Transport Economic		
Efficiency Benefits	39,937	(6) = (1) + (5)

Notes

:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes		
Local Government Funding	Total	Road	Bus
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	280,215	280,215	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	376,980	(8) 376,980	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-8,883	-8,883	
TOTALS			
Broad Transport Budget	376,980	(9) = (7) + (8)	
Wider Public Finances	-8,883		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1)
- 2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-4,203	
Consumer User Benefits	-56,771	
Business User Benefits	92,014	
Private Sector Provider Impacts	4,694	
Other Business Impacts	0	
Accident Benefits	0	
Wider Public Finances(Indirect Taxation Revenues)	8,883	
Present Value of Benefits (PVB)	44,617	
Local Government Funding	0	
Central Government Funding	376,980	
Present Value of Costs (PVC)	376,980	
OVERALL IMPACTS		
Net Present Value (£000)	-332,363	NPV=PVB-PVC
Benefit to Cost Ratio	0.12	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Appendix B

Transport Economic Efficiency
(TEE) Tables for Motorway to
the South of Newport

B1 Transport Economic Efficiency (TEE) Tables for Motorway to the South of Newport

B1.1 Central Growth

Economic Efficiency of the Transport System (TEE)

Consumers				
User Benefits (£000)	All Modes	Road		Bus
Personal Travel	Total	Personal		Passengers
Travel Time	622,381	622,381		0
Vehicle Operating Costs	-20,583	-20,583		0
User Charges	0	0		0
During Construction & Maintenance	51,732	51,732		
NET CONSUMER BENEFITS	653,530	(1)	653,530	0

Business				
User Benefits		Personal	Freight	Passengers
Travel Time	1,052,890	669,571	383,319	0
Vehicle Operating Costs	100,505	35,598	64,907	0
User Charges	0	0	0	0
During Construction & Maintenance	87,120	56,645	30,475	
Subtotal	1,240,515	(2)	761,814	478,701
Private Sector Provider Impacts				
Revenue	32,229	31596	633	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	32,229	(3)	31596	633
Other Business Impacts				
Developer contributions	0	(4)	0	
NET BUSINESS IMPACT	1,272,744	(5) = (2) + (3) + (4)		
TOTAL (£000)				
Present Value of Transport Economic				
Efficiency Benefits	1,926,275	(6) = (1) + (5)		

Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	780,466	780,466	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	877,231	(8) 877,231	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-34,501	-34,501	
TOTALS			
Broad Transport Budget	877,231	(9) = (7) + (8)	
Wider Public Finances	-34,501		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1) All entries are discounted present values in 2010 prices and values.
- 2)

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-15,782	
Consumer User Benefits	653,530	
Business User Benefits	1,240,515	
Private Sector Provider Impacts	32,229	
Other Business Impacts	0	
Accident Benefits	60,835	
Wider Public Finances(Indirect Taxation Revenues)	34,501	
Present Value of Benefits (PVB)	2,005,829	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	877,231	
OVERALL IMPACTS		
Net Present Value (£000)	1,128,598	NPV=PVB-PVC
Benefit to Cost Ratio	2.29	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

B1.2 Low Growth

Economic Efficiency of the Transport System (TEE)

Consumers				
User Benefits (£000)	All Modes	Road	Bus	
Personal Travel	Total	Personal	Passengers	
Travel Time	471,203	471,203	0	
Vehicle Operating Costs	-7,932	-7,932	0	
User Charges	0	0	0	
During Construction & Maintenance	31,258	31,258		
NET CONSUMER BENEFITS	494,529	(1) 494,529	0	

Business				
User Benefits		Personal	Freight	Passengers
Travel Time	796,954	506,387	290,567	0
Vehicle Operating Costs	90,507	30,463	60,044	0
User Charges	0	0	0	0
During Construction & Maintenance	54,164	36,461	17,704	
Subtotal	941,625	(2) 573,311	368,315	0

Private Sector Provider Impacts				
Revenue	24,727	24314	413	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	24,727	(3) 24314	413	0

Other Business Impacts		
Developer contributions	0	(4) 0
NET BUSINESS IMPACT	966,352	(5) = (2) + (3) + (4)

TOTAL (£000)	
Present Value of Transport Economic	
Efficiency Benefits	1,460,881
(6) = (1) + (5)	

Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	780,466	780,466	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	877,231	(8) 877,231	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-19,823	-19,823	
TOTALS			
Broad Transport Budget	877,231	(9) = (7) + (8)	
Wider Public Finances	-19,823		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1) All entries are discounted present values in 2010 prices and values.
 - 2)

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-9,125	
Consumer User Benefits	494,529	
Business User Benefits	941,625	
Private Sector Provider Impacts	24,727	
Other Business Impacts	0	
Accident Benefits	64,805	
Wider Public Finances(Indirect Taxation Revenues)	19,823	
Present Value of Benefits (PVB)	1,536,384	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	877,231	
OVERALL IMPACTS		
Net Present Value (£000)	659,153	NPV=PVB-PVC
Benefit to Cost Ratio	1.75	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

B1.3 High Growth

M4 CAN Project, Central Growth, Final TEE

Economic Efficiency of the Transport System (TEE)

Consumers				
User Benefits (£000)	All Modes	Road		Bus
Personal Travel	Total	Personal		Passengers
Travel Time	921,031	921,031		0
Vehicle Operating Costs	-34,594	-34,594		0
User Charges	0	0		0
During Construction & Maintenance	76,434	76,434		
NET CONSUMER BENEFITS	962,871	(1)	962,871	0

Business				
User Benefits		Personal	Freight	Passengers
Travel Time	1,535,254	982,620	552,634	0
Vehicle Operating Costs	120,675	44,359	76,316	0
User Charges	0	0	0	0
During Construction & Maintenance	126,388	80,557	45,831	
Subtotal	1,782,317	(2)	1,107,536	674,781

Private Sector Provider Impacts				
Revenue	38,246	38048	198	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	38,246	(3)	38048	198

Other Business Impacts				
Developer contributions	0	(4)	0	
NET BUSINESS IMPACT	1,820,563	(5) = (2) + (3) + (4)		

TOTAL (£000)				
Present Value of Transport Economic				
Efficiency Benefits	2,783,434	(6) = (1) + (5)		

Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values.
- 2)

Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	780,466	780,466	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	877,231	(8) 877,231	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-49,484	-49,484	
TOTALS			
Broad Transport Budget	877,231	(9) = (7) + (8)	
Wider Public Finances	-49,484		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1)
 - 2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-22,400	
Consumer User Benefits	962,871	
Business User Benefits	1,782,317	
Private Sector Provider Impacts	38,246	
Other Business Impacts	0	
Accident Benefits	59,893	
Wider Public Finances(Indirect Taxation Revenues)	49,484	
Present Value of Benefits (PVB)	2,870,412	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	877,231	
OVERALL IMPACTS		
Net Present Value (£000)	1,993,181	NPV=PVB-PVC
Benefit to Cost Ratio	3.27	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

B1.4 No Growth Test

Economic Efficiency of the Transport System (TEE)

Consumers				
User Benefits (£000)	All Modes	Road	Bus	
Personal Travel	Total	Personal	Passengers	
Travel Time	280,454	280,454	0	
Vehicle Operating Costs	3,672	3,672	0	
User Charges	0	0	0	
During Construction & Maintenance	19,455	19,455		
NET CONSUMER BENEFITS	303,581	(1) 303,581	0	

Business				
User Benefits		Personal	Freight	Passengers
Travel Time	462,071	315,666	146,405	0
Vehicle Operating Costs	81,061	26,824	54,237	0
User Charges	0	0	0	0
During Construction & Maintenance	32,762	21,302	11,460	
Subtotal	575,894	(2) 363,792	212,102	0

Private Sector Provider Impacts				
Revenue	17,196	16731	465	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	17,196	(3) 16731	465	0

Other Business Impacts		
Developer contributions	0	(4) 0
NET BUSINESS IMPACT	593,090	(5) = (2) + (3) + (4)

TOTAL (£000)	
Present Value of Transport Economic	
Efficiency Benefits	896,671
(6) = (1) + (5)	

Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	780,466	780,466	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	877,231	(8) 877,231	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-5,091	-5,091	
TOTALS			
Broad Transport Budget	877,231	(9) = (7) + (8)	
Wider Public Finances	-5,091		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1) All entries are discounted present values in 2010 prices and values.
 - 2)

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-2,214	
Consumer User Benefits	303,581	
Business User Benefits	575,894	
Private Sector Provider Impacts	17,196	
Other Business Impacts	0	
Accident Benefits	39,614	
Wider Public Finances(Indirect Taxation Revenues)	5,091	
Present Value of Benefits (PVB)	939,162	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	877,231	
OVERALL IMPACTS		
Net Present Value (£000)	61,931	NPV=PVB-PVC
Benefit to Cost Ratio	1.07	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

B1.5 Severn Crossing Tolls Removed

Economic Efficiency of the Transport System (TEE)

Consumers				
User Benefits (£000)				
Personal Travel	All Modes	Road		Bus
	Total	Personal		Passengers
Travel Time	749,228	749,228		0
Vehicle Operating Costs	-30,902	-30,902		0
User Charges	0	0		0
During Construction & Maintenance	59,777	59,777		
NET CONSUMER BENEFITS	778,103	(1) 778,103		0

Business				
User Benefits		Personal	Freight	Passengers
Travel Time	1,240,913	782,238	458,675	0
Vehicle Operating Costs	100,438	35,279	65,159	0
User Charges	0	0	0	0
During Construction & Maintenance	100,668	65,454	35,214	
Subtotal	1,442,019	(2) 882,971	559,048	0

Private Sector Provider Impacts				
Revenue	0	0	0	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	0	(3) 0	0	0

Other Business Impacts				
Developer contributions	0	(4) 0		
NET BUSINESS IMPACT	1,442,019	(5) = (2) + (3) + (4)		

TOTAL (£000)	
Present Value of Transport Economic	
Efficiency Benefits	2,220,122
(6) = (1) + (5)	

Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	780,466	780,466	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	877,231	(8) 877,231	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-47,462	-47,462	
TOTALS			
Broad Transport Budget	877,231	(9) = (7) + (8)	
Wider Public Finances	-47,462		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
 - 2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-20,126	
Consumer User Benefits	778,103	
Business User Benefits	1,442,019	
Private Sector Provider Impacts	0	
Other Business Impacts	0	
Accident Benefits	70,296	
Wider Public Finances(Indirect Taxation Revenues)	47,462	
Present Value of Benefits (PVB)	2,317,754	
Local Government Funding	0	
Central Government Funding	877,231	
Present Value of Costs (PVC)	877,231	
OVERALL IMPACTS		
Net Present Value (£000)	1,440,523	NPV=PVB-PVC
Benefit to Cost Ratio	2.64	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

B1.6 No Docks Junction

Economic Efficiency of the Transport System (TEE)

Consumers

User Benefits (£000)

Personal Travel

	All Modes Total	Road Personal	Bus Passengers
Travel Time	492,102	492,102	0
Vehicle Operating Costs	-19,116	-19,116	0
User Charges	0	0	0
During Construction & Maintenance	51,732	51,732	
NET CONSUMER BENEFITS	524,718	524,718	0

(1)

Business

User Benefits

		Personal	Freight	Passengers
Travel Time	880,807	574,760	306,047	0
Vehicle Operating Costs	81,166	29,385	51,781	0
User Charges	0	0	0	0
During Construction & Maintenance	87,120	56,645	30,475	
Subtotal	1,049,093	660,790	388,303	0

(2)

Private Sector Provider Impacts

Revenue	28,303	27680	623	0
Operating Costs	0	0	0	0
Investment Costs	0	0	0	0
Grant/Subsidy	0	0	0	0
Subtotal	28,303	27680	623	0

(3)

Other Business Impacts

Developer contributions	0	(4)	0
NET BUSINESS IMPACT	1,077,396	(5) = (2) + (3) + (4)	

TOTAL (£000)

Present Value of Transport Economic Efficiency Benefits	1,602,115	(6) = (1) + (5)
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Notes:

- 1) Benefits appear as positive numbers, while costs appear as negative numbers.
- 2) All entries are discounted present values, in 2010 prices and values.

Public Accounts

	All Modes		
	Total	Road	Bus
Local Government Funding			
Revenue	0	0	0
Operating Costs	0	0	0
Investment Costs	0	0	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	0	(7) 0	0
Central Government Funding			
Revenue	0	0	0
Operating Costs	96,765	96,765	0
Investment Costs	751,014	751,014	0
Developer & Other Contributions	0	0	0
Grant/Subsidy Payments	0	0	0
NET IMPACT	847,779	(8) 847,779	0
Central Government Funding: Non-Transport			
Indirect Tax Revenues	-36,139	-36,139	
TOTALS			
Broad Transport Budget	847,779	(9) = (7) + (8)	
Wider Public Finances	-36,139		

Notes:

- Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
- 1) Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.
 - 2) All entries are discounted present values in 2010 prices and values.

Analysis of Monetised Costs & Benefits

Greenhouse Gases	-16,525	
Consumer User Benefits	524,718	
Business User Benefits	1,049,093	
Private Sector Provider Impacts	28,303	
Other Business Impacts	0	
Accident Benefits	60,835	
Wider Public Finances(Indirect Taxation Revenues)	36,139	
Present Value of Benefits (PVB)	1,682,564	
Local Government Funding	0	
Central Government Funding	847,779	
Present Value of Costs (PVC)	847,779	
OVERALL IMPACTS		
Net Present Value (£000)	834,785	NPV=PVB-PVC
Benefit to Cost Ratio	1.98	BCR=PVB/PVC

Notes:

This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Appendix C

Noise Appraisal Tables

C1 Noise Appraisal Tables

Appraisal for noise pollution

No. of households experiencing 'without scheme' & 'with scheme' noise levels (given in dB _{Leq}) in Opening Year															
	With scheme	<45	45-47.9	48-50.9	51-53.9	54-56.9	57-59.9	60-62.9	63-65.9	66-68.9	69-71.9	72-74.9	75-77.9	78-80.9	81+
Without scheme															
<45		4625	540	114	5	5	3	0	0	0	0	0	0	0	0
45-47.9		3289	1077	120	33	3	5	0	0	0	0	0	0	0	0
48-50.9		256	4031	737	85	3	0	0	0	0	0	0	0	0	0
51-53.9		0	301	2194	379	32	2	0	0	0	0	0	0	0	0
54-56.9		0	0	259	1068	325	61	0	0	0	0	0	0	0	0
57-59.9		0	0	0	146	512	272	26	0	0	0	0	0	0	0
60-62.9		0	0	0	0	75	373	187	3	0	0	0	0	0	0
63-65.9		0	0	0	0	0	51	210	89	0	0	0	0	0	0
66-68.9		0	0	0	0	0	0	24	103	50	3	0	0	0	0
69-71.9		0	0	0	0	0	0	0	11	98	7	0	0	0	0
72-74.9		0	0	0	0	0	0	0	0	12	17	2	0	0	0
75-77.9		0	0	0	0	0	0	0	0	0	1	1	0	0	0
78-80.9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
81+		0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. of households experiencing 'without scheme' & 'with scheme' noise levels (given in dB _{Leq}) in 15th Year After Opening															
	With scheme	<45	45-47.9	48-50.9	51-53.9	54-56.9	57-59.9	60-62.9	63-65.9	66-68.9	69-71.9	72-74.9	75-77.9	78-80.9	81+
Without scheme															
<45		3762	559	143	15	4	4	0	0	0	0	0	0	0	0
45-47.9		2963	1287	144	46	3	4	1	0	0	0	0	0	0	0
48-50.9		232	3785	1176	95	5	0	0	0	0	0	0	0	0	0
51-53.9		0	233	2471	471	39	4	0	0	0	0	0	0	0	0
54-56.9		0	0	185	1148	368	127	0	0	0	0	0	0	0	0
57-59.9		0	0	0	99	604	293	48	0	0	0	0	0	0	0
60-62.9		0	0	0	0	72	392	294	5	0	0	0	0	0	0
63-65.9		0	0	0	0	1	37	188	91	1	0	0	0	0	0
66-68.9		0	0	0	0	0	0	15	168	77	3	0	0	0	0
69-71.9		0	0	0	0	0	0	0	8	94	19	1	0	0	0
72-74.9		0	0	0	0	0	0	0	0	12	24	3	0	0	0
75-77.9		0	0	0	0	0	0	0	0	0	1	1	0	0	0
78-80.9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
81+		0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Net Present Value of Noise of
Proposal
(60 Year Period)**

£32,953,180

*positive value reflects a **net benefit** (i.e. noise reduction)

Estimated Population Annoyed (Do-Minimum):

3438

Estimated Population Annoyed (Do-Something):

2613

**Net Noise Annoyance Change in 15th Year After
Opening (no. of people):**

-825

*positive value reflects an **increase** in people annoyed by noise

Subject

Date 16 June 2014

Job No/Ref

Appendix: Noise

WelTAG Appraisal for noise pollution

No. of households experiencing 'without scheme' & 'with scheme' noise levels (given in dB _{Leq}) in Opening Year															
	With scheme	<45	45-47.9	48-50.9	51-53.9	54-56.9	57-59.9	60-62.9	63-65.9	66-68.9	69-71.9	72-74.9	75-77.9	78-80.9	81+
Without scheme															
<45		4625	540	114	5	5	3	0	0	0	0	0	0	0	0
45-47.9		3289	1077	120	33	3	5	0	0	0	0	0	0	0	0
48-50.9		256	4031	737	85	3	0	0	0	0	0	0	0	0	0
51-53.9		0	301	2194	379	32	2	0	0	0	0	0	0	0	0
54-56.9		0	0	259	1068	325	61	0	0	0	0	0	0	0	0
57-59.9		0	0	0	146	512	272	26	0	0	0	0	0	0	0
60-62.9		0	0	0	0	75	373	187	3	0	0	0	0	0	0
63-65.9		0	0	0	0	0	51	210	89	0	0	0	0	0	0
66-68.9		0	0	0	0	0	0	24	103	50	3	0	0	0	0
69-71.9		0	0	0	0	0	0	0	11	98	7	0	0	0	0
72-74.9		0	0	0	0	0	0	0	0	12	17	2	0	0	0
75-77.9		0	0	0	0	0	0	0	0	0	1	1	0	0	0
78-80.9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
81+		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Subject

Date

16 June 2014

Job No/Ref

No. of households experiencing 'without scheme' & 'with scheme' noise levels (given in dB _{Leq}) in 15th Year After Opening															
	With scheme	<45	45-47.9	48-50.9	51-53.9	54-56.9	57-59.9	60-62.9	63-65.9	66-68.9	69-71.9	72-74.9	75-77.9	78-80.9	81+
Without scheme															
<45		3762	559	143	15	4	4	0	0	0	0	0	0	0	0
45-47.9		2963	1287	144	46	3	4	1	0	0	0	0	0	0	0
48-50.9		232	3785	1176	95	5	0	0	0	0	0	0	0	0	0
51-53.9		0	233	2471	471	39	4	0	0	0	0	0	0	0	0
54-56.9		0	0	185	1148	368	127	0	0	0	0	0	0	0	0
57-59.9		0	0	0	99	604	293	48	0	0	0	0	0	0	0
60-62.9		0	0	0	0	72	392	294	5	0	0	0	0	0	0
63-65.9		0	0	0	0	1	37	188	91	1	0	0	0	0	0
66-68.9		0	0	0	0	0	0	15	168	77	3	0	0	0	0
69-71.9		0	0	0	0	0	0	0	8	94	19	1	0	0	0
72-74.9		0	0	0	0	0	0	0	0	12	24	3	0	0	0
75-77.9		0	0	0	0	0	0	0	0	0	1	1	0	0	0
78-80.9		0	0	0	0	0	0	0	0	0	0	0	0	0	0
81+		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Subject

Date

16 June 2014

Job No/Ref

**Net Present Value of Noise of
Proposal
(60 Year Period)**

£32,953,180

*positive value reflects a **net benefit** (i.e. noise reduction)

Estimated Population Annoyed (Do-Minimum):

3438

Estimated Population Annoyed (Do-Something):

2613

**Net Noise Annoyance Change in 15th Year After
Opening (no. of people):**

-825

*positive value reflects an **increase** in people annoyed by noise

Appendix D

Assessment of Local Air Quality and Greenhouse Gas Emissions

D1 Assessment of Local Air Quality and Greenhouse Gas Emissions

D1.1 Local Air Quality – changes in Population Exposure as a result of the Scheme

Local Air Quality – Changes to Population Exposure as a result of the Scheme

PM10, SUMMARY OF ROUTES: THE AGGREGATED TABLE	0-50m (i)	50-100m (ii)	100-150m (iii)	150-200m (iv)	0-200m (v=i+ii+iii+iv)
Total properties across all routes (min)	621	2304	2462	2527	7914
Total properties across all routes (some)	623	2311	2473	2528	7935
<i>Do-minimum PM10 assessment across all routes</i>	9917.80	35038.79	36653.02	37423.70	Total assessment PM10 (I): 119033.31
<i>Do-something PM10 assessment across all routes</i>	9787.44	34944.16	36766.48	37480.29	Total assessment PM10 (II): 118978.37
Net total assessment for PM10, all routes (II-I)					-54.94
Number of properties with an improvement					7780
Number of properties with no change					0
Number of properties with a deterioration					155

Reference Sources: Same traffic data used for the DMRB Stage 2 Assessment

Quantitative Measures: There are a number of properties that have the potential to be demolished along the proposed option B2. These have been deleted from the DS Scenario.

Section

A 5 properties which will likely be demolished

Section

B No Residential demolition

Section

C 4 properties which will likely be demolished

Assessment Scores: -54.94

Qualitative Comments: 7780 properties with an improvement in PM10 concentrations as a result of the scheme
0 properties with no change in PM10 concentrations as a result of the scheme
155 properties with a deterioration in PM10 concentrations as a result of the scheme

NO ₂ , SUMMARY OF ROUTES: THE AGGREGATED TABLE	0-50m (i)	50-100m (ii)	100-150m (iii)	150-200m (iv)	0-200m (v=i+ii+iii+iv)
Total properties across all routes (min)	621	2304	2462	2527	7914
Total properties across all routes (some)	623	2311	2473	2528	7935
<i>Do-minimum NO₂ assessment across all routes</i>	13963.39	41715.73	41870.43	41670.33	Total assessment NO ₂ (I): 139219.88
<i>Do-something NO₂ assessment across all routes</i>	12972.35	40392.99	41441.47	41229.48	Total assessment NO ₂ (II): 136036.29

Net total assessment for NO₂, all routes (II-I)		-3183.59
Number of properties with an improvement		7900
Number of properties with no change		3
Number of properties with a deterioration		32

Reference Sources:

Same traffic data used for the DMRB Stage 2 Assessment

Quantitative Measures:

There are a number of properties that have the potential to be demolished along the proposed option B2. These have been deleted from the DS Scenario.

Section

A 5 properties which will likely be demolished

Section

B No Residential demolition

Section

C 4 properties which will likely be demolished

Assessment Scores:

-3183.59

Qualitative Comments:

7900 properties with an improvement in NO₂ concentrations as a result of the scheme

3 properties with no change in NO₂ concentrations as a result of the scheme

32 properties with a deterioration in NO₂ concentrations as a result of the scheme

D1.2 Assessment of Greenhouse Gas Emissions

Assessment of Greenhouse Gas Emissions

APPRAISAL- Greenhouse Gases

Proposal Name: M4 Corridor around Newport

Present Value Base Year

Current Year

Proposal Opening year:

Project (Road/Rail or Road and Rail):

Overall Assessment Score:

Net Present Value of Carbon dioxide Emissions of Proposal (£):

(60 Year Period)

positive value reflects a net benefit (i.e. CO2E emissions reduction)

Quantitative Assessment:

Change in Carbon dioxide Emissions over 60 year appraisal period (tonnes):
(between 'with scheme' and 'without scheme' scenarios)

Of which Traded

Change in Carbon dioxide Emissions in Opening year (tonnes):
(between 'with scheme' and 'without scheme' scenarios)

Qualitative Comments:

The change in CO2 emissions were modelled using the Department for Transport TUBA appraisal program

Sensitivity Analysis:

Description:

Upper Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):

Lower Estimate Net Present Value of Carbon dioxide Emissions of Proposal (£):

Data Sources:

Traffic data was based on the Black Route, High Level with Docks option.

Appendix E

Designated Sites

E1 Designated Sites




Welsh Government

M4 Corridor around Newport

**Desk Study and Phase 1 Habitat
Survey Report 2013**

ECOL/DMRB2/001

Issue 1 | 6 May 2014






This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 117300

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ARUP

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3 Results	5
3.1 Desk Study	5
3.2 Field Survey	3
4 Recommendations	7

Appendices

Annex A

Non Statutory Designated Sites

Annex B

Species Records

Annex C

Target Notes

1 Introduction

Ove Arup & Partners Limited has been commissioned by Welsh Government to undertake a Stage 2 Design Manual for Roads and Bridges (DMRB) assessment for the M4 Corridor South of Newport.

To inform the Stage 2 Environmental Assessment a desk study and preliminary Phase 1 Habitat Survey have been undertaken from roads and public rights of way to identify the habitats present within the study area and, where possible, to assess the potential for protected animals species to be present.

The results of these studies are provided in this report, the aim of which is to inform the ecology assessment which forms part of the Stage 2 Environmental Assessment Report. Section 2 of this report provides details of the methodology used and the results are provided in Section 3.

2 Methodology

A study area has been identified for the purposes of this survey and the Stage 2 Assessment which comprises 500m around centrelines of the Route Options.

2.1 Desk Study

2.1.1 Designated Sites

The location of statutory designated sites for nature conservation within the vicinity of the Route Options has been established using Geographic Information System (GIS) layers provided by the Countryside Council for Wales (now Natural Resources Wales (NRW)) and the Joint Nature Conservancy Council.

A search radius of 10km from study area has been used for European Sites, including Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar Sites¹. Nationally designated Sites of Special Scientific Interest (SSSIs) have been identified within 2km of the Study area. Local designations (primarily Sites of Importance for Nature Conservation, but including Local Nature Reserves where information is available) have been identified within 500m from information provided by the South East Wales Biodiversity Records Centre (SEWBReC).

2.1.2 Biological Records

Records of legally protected and otherwise notable species (Species of conservation concern including Species of Principle Importance for the conservation of Biological Diversity (Section 42 Species), UK BAP species, Red data book and Nationally Scarce species) was requested from SEWBReC on November 4th 2013. This is included records for bat species up to 5km; other legally protected and priority species within 2km; and Species of Conservation Concern within 1km.

2.1.3 Previous Studies

The M4 Corridor around Newport has been studied on a number of occasions including detailed surveys for the Environmental Impact Assessments of new motorways to the south of Newport in the form of the M4 Relief Road (1997-1998) and the New M4 Project (2006-2008). The results of the more recent surveys undertaken in 2006 – 2008 have been collated in this report and form part of the Desk Study information.

2.2 Field Survey

A preliminary Phase 1 Habitat Survey was undertaken from roads and public rights of way to identify the broad habitats present within the study area and, where possible, to identify the potential for legally protected species. The survey was undertaken between October and December 2013 by suitably qualified ecologists following the methodology set out in the Handbook for Phase 1 Habitat Survey (JNCC, 2010).

The limitation on the survey to areas visible from roads and public rights of way means that there are numerous areas which could not be surveyed. Where this is the case the previous Phase 1 survey data from 2006 has been used. Whilst it is acknowledge that there may have been changes in habitat since 2006, given the designation of extensive areas of the study area as SSSIs, it is

¹ Ramsar Sites are included as a matter of UK and Welsh Government policy (Tyldesley & Chapman, 2013).

Although outside of the optimum survey window for identify plant communities the habitat types can be identified from residual vegetation which sufficient confidence to provide baseline information for the assessment and comparison of different route options under the requirements of a DMRB Stage 2 Assessment.

3.1.1.1 European Sites

Table 1 European Sites within 10km

Site	Description ²
SAC	
Coed y Cerrig	Coed y Cerrig lies in a narrow valley at the southern edge of the Black Mountains in the eastern end of the Brecon Beacons National Park. The site is of European importance for its alder woodland developed on the valley floor. The ground flora is characterised by abundant large sedges, and a wide variety of wet woodland species including marsh marigold, meadowsweet, opposite-leaved and alternate-leaved golden saxifrage and the rare marsh fern.
Cwm Clydach Woodlands	Cwm Clydach in south Wales is of European importance for its stands of beech woodland on both calcareous and acid soils. The woodland occurs mainly on steep valley sides, comprising a canopy of large mature trees with abundant dead wood. Rare whitebeam trees grow on limestone outcrops within and outside the woodland. The woodland also supports an important fungi assemblage and there are populations of uncommon vascular plants such as bird's-nest orchid and yellow bird's-nest.
River Usk/Afon Wysg	The River Usk SAC rises in the Black Mountain range in the west of the Brecon Beacons National Park and flows east and then south, to enter the Severn Estuary at Newport. Of key European importance are the river's migratory and resident fish species, including twaite and allis shad, sea, river and brook lamprey, Atlantic salmon and bullhead. Other species features of the SAC are the water crowfoot beds and the European otter which breeds along its sheltered banks and hunts for fish in the river and its tributaries.
River Wye / Afon Gwy	The River Wye rises on Plynlimon in the Cambrian Mountains and flows in a generally south-easterly direction to enter the Severn Estuary at Chepstow. The Wye provides exceptionally good habitat for migratory and resident fish species, including twaite and allis shad, sea, river and brook lamprey, Atlantic salmon and bullhead. Other species features of the SAC are the native, and rare, white-clawed crayfish and the European otter which breeds along its sheltered banks and hunts for fish in the river and its tributaries. The vegetation in the upland reaches is dominated by mosses and liverworts. The vegetation of the lower river is a European feature, with various water crowfoots, lesser water-parsnip and curled pondweed.
Severn Estuary / Mor Hafren (The Severn Estuary is located between Wales and England in south-west Britain. It has the second largest tidal range in the world. This creates unique estuarine conditions which produce a never-ending cycle of exposure and concealment of its great banks of sand, mud, rocks and vegetation. The site is of international importance for the estuary itself, and also for its component reefs, intertidal mudflats and sandflats, subtidal sandflats, and saltmarsh. The Severn is internationally important for its fish assemblage and migratory fish species, which include sea lamprey, river lamprey, and twaite shad. The site also hosts important

² Information on the description of sites has been obtained from the website of the former Countryside Council for Wales <http://www.ccw.gov.uk/landscape--wildlife/protecting-our-landscape/designated-sites-search.aspx>

3.1.1.2 Sites of Special Scientific Interest

There are ten Sites of Special Scientific Interest within study area the study area and a further two sites within 2km. These are described in **Table** below and shown on Figure 6.5.2. The proposed route options all pass through several of the Gwent Levels Sites and cross the River Usk SSSI.

Table 2 Sites of Special Scientific Interest

Site	Description ³
Gwent Levels – Rumney and Peterstone	<p>The Rumney and Peterstone area supports a number of important plant species including the nationally rare brackish water-crowfoot and several regional rarities including the pondweeds <i>Potamogeton obtusifolius</i> and <i>Potamogeton berchtoldii</i>. The northern section of this SSSI is a stronghold on the Gwent Levels for the flowering rush.</p> <p>The area also supports a rich and important invertebrate fauna with a number of nationally notable species largely confined to this sub-unit including the marsh-flies <i>Pherbellia brunnipes</i> and <i>Lamprochromus elegans</i>, the water-beetle <i>Plateumaris braccata</i> and the variable damselfly <i>Coenagrion pulchellum</i>.</p>
Gwent Levels – St. Brides	<p>The reens in the St Brides area support a number of interesting plant species most notably thread-leaved water-crowfoot and small pondweed <i>Potamogeton berchtoldii</i>. Reen bank and green lane habitats in this area are also important for relict meadow plant species such as the regionally notable grass vetchling and common meadow-rue. The St Brides area also supports rich invertebrate communities with a number of nationally notable and notable marshland species, e.g. the true fly <i>Chrysogaster macquarti</i> and the beetle <i>Hydaticus transversalis</i>. It is the only area on the Gwent Levels where the rare fly <i>Stenomicroa cogani</i> has been recorded.</p>
Gwent Levels – Nash and Goldcliff	<p>The Nash and Goldcliff area forms an important part of the Gwent Levels system and is of particular botanical interest as it is the only area in Wales for the least duckweed. There is also an interesting community where two species of hornwort <i>Ceratophyllum submersum</i> and <i>C. demersum</i> grow together.</p> <p>The invertebrate interest is also high, as rare and notable species are present.</p>
Gwent Levels – Whitson	<p>The Whitson area is of particular importance for its large number of nationally rare and notable invertebrate species. A total of 65 of these rare invertebrates have been recorded in this area.</p> <p>This area is also important for its botanical interest as it contains the nationally rare hairlike pondweed <i>Potamogeton trichoides</i> and is the only location in Gwent for the tussock sedge . Arrowhead also grows in abundance in several main reens in this area.</p>
Gwent Levels – Redwick and Llandeenny,	<p>The Redwick and Llandeenny area supports rich assemblages of invertebrate species including <i>Chalcis sispes</i> a parasite of the <i>Stratiomys</i> fly larvae, the beetle <i>Scirtes orbicularis</i> and the drone fly <i>Pharhelophilus consimilis</i>.</p> <p>The area also contains a number of nationally rare plant species including the rare whorled water milfoil located in peaty ditches in the northern part of the site and the brackish water crowfoot associated with the ditches bordering the sea wall.</p>
Gwent Levels – Magor and Undy	<p>The Magor and Undy area is the most easterly of the Gwent Levels sites supporting a total of 43 nationally rare and notable invertebrate species such as the soldier fly <i>Stratiomys furcata</i>, the snail killing fly <i>Pherbellia brunnipes</i> and the water beetle <i>Haliphus mucronatus</i>. This area also supports a number of rare and notable aquatic plant species including the pondweeds <i>Potamogeton trichoides</i> and <i>P. berchtoldii</i> and narrow-leaved water plantain.</p> <p>The boundary of this site has been drawn to include the sea wall back ditch which contains brackish water fauna and flora such as the water beetle <i>Agabus conspersus</i> and the nationally rare brackish water crowfoot.</p>
Severn Estuary	<p>The Severn Estuary has the second largest tidal range in the world causing many millions of tonnes of sediment to be moved around the estuary by the tide and storms. These unique conditions make the Severn Estuary special for a number of features, including saltmarsh, plants, invertebrates, fish, birds and marine habitats, as well as the functioning of the estuary itself.</p>
River Usk (Lower Usk)/Afon Wysg	<p>The SSSI incorporates adjacent areas of riparian habitat which directly support the special interest of the river. These include woodlands dominated by alder <i>Alnus glutinosa</i> and willows <i>Salix</i> spp., marshy grassland, stands of tall herb, swamp and fen</p>

³ Information on SSSI interests has been taken from the website of the Countryside Council for Wales, now part of Natural Resources Wales.

3.1.2 Non-statutory Designated Sites

Of these six are either beneath the potential footprints of the proposed routes or are in very close proximity. These include the River Ebbw, Marshall's, Solutia Site and Spencer Works 3 which would be directly impacts by any scheme.

3.1.3 Species Records

The data provided by SEWBReC included a large number of records. This data is presented in Annex B, subject to the limitations imposed by the SEWBReC data release agreement. Of particular note are the records of species which receive legal protection under EU and UK legislation. These are summarised in **Table 3**.

Table 3 Protected Species Records including Schedule 1 bird species

Species	Comments
European Protected species⁴	
Great crested newt	10 records of sightings, including bottle trapping of male and female adults: Cardiff and Newport.
Otter	52 records including spraints, prints, sightings and mortalities: M4 (Began Farm, Cefn Mably, near River Rhymney and various locations), A48 St. Mellons, Goitre Wood, River Rhymney, Wentloog Levels, Newport, High Cross, Percoed reen, A48 Maes-glas, Duffryn Pond, River Ebbw, Blackwall reen, St Brides (Wentlooge), George St. Bridge, SDR Bridge, Newport Wetlands (various locations), Gwent Levels Wetland Reserve, Llanwern Steelworks, Monk's Ditch, Whitson Arch, Caldicot Level, near Redwick, Magor, Magor Marsh Reserve, Whitewall and Whitewall Common.
Bat species	There are 869 records for bats within 5km of the proposed route corridor of ten species since 2000. These include the following: brown long-eared bat, common pipistrelle, Daubenton's bat, greater horseshoe bat, lesser horseshoe bat, Nathusius's pipistrelle, Natterer's bat, noctule, serotine, soprano pipistrelle, and whiskered/Brandt's bat. The presence of potential roosts are shown in Annex B.
Hazel dormouse,	8 records including nests, counts and hazelnut evidence: Bogod's Field and Nant Mwan Wood.
Common porpoise	3 records for sightings: Newport, River Usk and mortality: Goldcliff
Fin Whale	1 record for stranding: Usk Estuary
Unidentified Cetacea	1 record for mortality in West Usk Lighthouse Beach
Nationally Protected Species⁵	
Bluebell	6 records: Goitre Wood, Park Wood, Coed Wen, Upper Grange Farm Field
Eel ⁶	2 records: Caldicot
Common frog,	9 records including frogspawn, adult or juvenile presence: Cardiff, Duffryn Pond, Newport Wetlands, Newport.
Common toad	16 records of sightings including tadpoles, toadlets and adults: Cardiff, Wentlooge, Wentlooge Levels, Duffryn, Uskmouth Powerstation.

⁴ Species protected under the Conservation of Habitats and Species Regulations 2010 (as amended)

⁵ Species protected under the Wildlife and Countryside Act 1981 (as amended) or the Protection of Badgers Act 1992

⁶ Eel (England and Wales) Regulations 2009.

Palmate newt	1 record for all life stages in Newport.
Smooth newt	6 records of adult sightings: Wentlodge and Caldicot.
Adder	3 records of sightings: Newport, Marshfield/Uskmouth, Rogiet.
Grass snake	23 records for sightings and mortality, including adults and juveniles: St Mellons, Marshfield/Uskmouth, Wentlodge Level, Newport Wetlands, Duffryn, Julian's Gout, Magor Marsh.
Common lizard	5 records including sightings: Cardiff, Marshfield/Uskmouth, Gaer Fort, Newport and mortality: Newport.
Slow-worm	5 records of sightings including adult and juvenile: Cardiff, Gaer Fort, Newport.
Barn owl	38 records of sightings and mortalities: M4 (various), A48(M) (various), Redwick, Newport (various), Magor, Newport Wetlands (various), Nash, Uskmouth, St. Brides, Wentlooge Levels, Lower Machen, Hendre Lake, Marshfield.
Bearded tit	53 records including sightings and calls: Uskmouth (including reedbeds), Nash, Newport Wetlands (including Reserve) Saltmarsh Lane.
Bewick's swan	3 records: St Brides, St Brides Wentlooge, Newport Wetlands Reserve.
Black redstart	3 records: St Brides Old Lighthouse, Uskmouth Power Station.
Black tern	1 record: Goldcliff.
Black-tailed godwit	92 records: St Brides Wentlooge, St Brides, St Brides Wentlooge, River Usk Estuary, West Usk Lighthouse, Newport Wetlands, Uskmouth, Newport Wetlands Reserve, Uskmouth, Newport Wetlands Reserve, Gwent levels wetlands reserve, Nash pools, Saltmarsh Grasslands, Farmfield Lane, Goldcliff.
Black-winged stilt	1 record: Newport Wetlands Reserve, Goldcliff.
Brambling	14 records: Castleton, Newport Wetlands, Uskmouth, Farmfield Lane, Magor.
Cetti's warbler	164 records: Marshfield, St Brides Wentlooge, Uskmouth, Newport Wetlands, Newport Wetlands Reserve, Nash, Magor, Redwick + various other locations.
Common crossbill	5 records: Magor Marsh, Lower Minnetts Wood, Minnetts Wood
Common goldeneye	34 records: river Usk Estuary, Uskmouth, Uskmouth Reserve West, Uskmouth Lagoons, Newport Wetlands (various), Nash, Nash Pools, Red Pools
Badger	6 records including mortality: A48(M), Junction 29, evidence, tracks and latrine: Newport Wetlands Sett – Penhow
Water vole	4 records including evidence and sightings: Caldicot Level, Magor Marsh Nature Reserve

3.2 Field Survey

3.2.1 Phase 1 Habitat Survey

The habitats which have been recorded and mapped are shown on Figures 6.5.4.1 to 6.5.4.74. As the survey was limited to areas visible from roads and public rights of way there are a number of gaps within the habitat map. Information has therefore been used from the previous surveys in 2008 to supplement the dataset and this is presented on the Figures. Due to the timing of the surveys and the restriction of the surveyors to roads and public rights of way, it was not possible to establish detailed species lists for habitats recorded during the survey. Target notes were recorded largely relate to the potential for protected species to be present, which is described at the end of each of the Sections.

To inform the DMRB Stage 2 Assessment the proposed routes have been split into three sections each of which will be described in turn.

3.2.1.1 Section A

This section comprises two significantly different areas. At the western end of the section the route is located within the upland areas fringing the coastal plain of the Gwent Levels. This area is characterised by small woodland copses and agricultural fields, including both arable and pasture. A narrow band of houses are located along the A48 to the south of the existing motor corridor. These include a mixture of farms and cottages. There are also relatively large areas of scrub and plantation woodland located between the two roads.

As the route bends southwards from the existing M4 motorway it descends from the raised area through an existing fruit farm and golf course on the Gwent Levels. The areas within the fruit farm at Berryhill comprise a mixture of apple orchards and improved grassland areas which have previously been used for pick-your-own fruit production. Within the Berryhill Farm area there is a small area of mature broadleaved woodland which is shown as Ancient Woodland within the desk study. It was not possible to access the woodland during the survey, however from previous surveys in 2008 it is known that the woodland has a diverse ground flora and a number of mature oak trees. There are also a number of mature oak trees present within the field boundaries within the area around the fruit farm. The golf course and driving range comprise an area of regularly mown amenity grassland with scattered broadleaved trees.

To the south of the golf course the route passes along a narrow band of plantation woodland which was created as part of the screening for the road constructed alongside the Quinn Radiators Factory.

The Gwent Levels is a large expanse of largely flat land which has historically been reclaimed from the sea by the creation of a sea wall enclosing areas of saltmarsh. An extensive network of drainage ditches (reens) is present which are managed to maintain water levels. During the drier summer months the water level is maintained by penning boards at a higher level to ensure crops are watered and livestock have access for drinking. In winter the penning boards are removed, lowering the water level to provide capacity for flood water without fields being inundated. The Levels are drained through outfalls through the sea defences.

protected by tidal gates/valves resulting in the periodic stagnation and flow especially in the reens closer to the coast.

This section of the route passes through a large arable field adjacent to the railway line and Maerdy Farm. This field is likely to have been created through the removal of field boundaries although a number of larger trees have been retained within the field which may have been within the boundaries at one point in time.

Other species known to be present or for which potential has been identified include bats (roosts previously identified at Berryhill Farm and Maerdy Farm), badgers (setts present at castleton), breeding birds including species such as barn owl and warblers (the latter breeding in areas of reeds within reens), and water voles (populations previously identified to the south of Quinn Radiators).

3.2.1.2 Section B

This section of the Routes covers the areas from the railway line across the River Ebbw, Newport Docks and the River Usk before the Route options converge near Pye Corner. The route options will cross the railway line at a point where the OS base maps record an area of woodland called Fox Covert. The woodland on the northern side of the railway is no longer present as the field is now used for arable farming. To the south of the railway a small fragment of woodland remains, although a further section has been lost through the construction of a compound for the replacement of the railway bridge carrying green land over the railway. It was not possible to access this area of woodland at the time of the survey.

Between the railway and the River Ebbw the Route options pass through an area of pasture fields within the SSSI designations. These fields are predominantly improved or semi-improved in their nature. Some of the lower lying fields have considerable amounts of rushes where as others show more signs of improvement through either grazing or re-seeding. Perennial rye grassland is frequently the dominant species within these grasslands. To the east of Lighthouse road the hedgerows become sparse or have been lost completely with the exception of the occasional are of hawthorn scrub along the reens. Where hedges remain within this area they are more likely to be have been regularly cut back and mature trees are not present.

The River Ebbw is separated from the Levels by a bund which is part of the main coastal defence running along the coast from Newport to Cardiff. The bund also supports semi-improved grassland with sheep and cattle being allowed to graze the bund and foreshore at times during the year. The channel of the River is relatively narrow with a band of saltmarsh between the bund and the river.

To the east of the River Ebbw is the Newport Civic Amenity Site which is an active landfill site. Although some sections in the northern part of the landfill have been capped and seeded with a species rich grassland mix, the southern area is currently active, comprising tipping areas and areas of bare ground where the lower slopes have been covered.

Newport docks comprises an area of intense industrial activity around the two deep water bodies. The docks are regularly used by vessels and vehicles moving freight around within the docks. There are also a large number of buildings, the majority being modern metal clad warehouses, although a few older buildings are present especially on the eastern side of the North Dock.

The eastern side of the docks is contiguous with the western bank of the River Usk. This bank has a narrow bank of common reed at the top of the steep facing mud flats caused by the very large tidal range. A number of boat moorings are present along this bank of the river with numerous jetties and pontoons being present along with paths through the reeds caused by people accessing the jetties.

On the east side of the River Usk the flood defences (a small bund) are set back from the crest of the bank and a band of salt marsh is present along side the river. This borders on to playing fields and to more areas of industrial units located along Corporation Road. With the exception of the salt marsh and a fringe of scrub, this area is relatively low in biodiversity interest.

To the east of Corporation Road the routes dip southward of the Solutia chemical works passing through areas of grassland and wet woodland towards Pye Corner. Again the grassland within this area comprise improved or semi-improved neutral grasslands which are grazed by sheep. The woodlands comprise areas of alder and willow carr located around some ponds and former steel works lagoons, and an area adjacent to Picked Lane which is slightly dryer. A National Cycle network route runs through this woodland and it appears to be subject to significant recreational pressure from dog walkers. As a result the ground flora mainly comprised ivy at the time of the surveys, although this was not the optimum time to record woodland ground flora.

Within this section the rivers have the have the potential to be used by otters, particularly the Ebbw which is more secluded. Breeding birds are also likely to be present in areas of scrub, wet woodland and the reeds on the banks of the Usk. Bats and dormouse are less likely to be present in these areas as there is less suitable habitat. Badgers are known from previous studies to be present at Pye Corner in the laboratory site.

Previous record of great crested newts are present at Solutia where mitigation was required during the erection of two wind turbines. Previous studies for the M4 recorded the presence of several bat species included pipistrelle species and *Myotis* bats roosting in buildings at Pye Corner.

3.2.1.3 Section C

This largest section of the route can be split in to four parts. The first and third part comprises areas within the Gwent Levels at Tatton Farm and Bareland common similar to those described in Section A comprising improved and semi-improved grassland with rushes dominating the shallow drainage channels within the fields. The second part of the route is located within the boundary of the Llanwern steelworks. This area includes large reed beds which form part of the water treatment system, slag tipping areas, settlement lagoons and grazed areas at the eastern end similar in nature to the areas of the levels. The fourth part of the route is located on the higher ground to the north of Magor where the route rejoins the existing M4 corridor. This area is similar in terms of habitats as the area at Castleton in the west with a mixture of improved grassland, woodland stripes and arable farm land.

The area of the steelworks lagoons has previously been found to contain great crested newts which have also been found in a reed at North Row. The reed beds are very likely to contain populations of breeding warblers and other bird species will be breeding in the hedgerows and lagoons within this section of the route.

Badgers are known to be present at Magor both on the Queensway Link close to the railway line and at Magor Vicarage, the property there also previously having contained bats. Habitats present around Magor also have the potential to support dormice. Otters have water voles have both been previously found in the area to the south of the Gwent Europark.

4 Recommendations

Should any scheme be taken forward to environmental impact assessment and construction a wide range of surveys would be required to inform the baseline. These include:

- Detailed Extended Phase 1 Habitat Survey
- National Vegetation Classification Survey (identification of plant communities in areas of notable habitats)
- Badger Surveys
- Otter survey
- Water vole surveys
- Bat surveys including identification of roosting sites and understanding patterns of bat activity to identify important flight routes and foraging areas
- Wintering bird surveys (due to the proximity of the Severn Estuary European Site)
- Breeding bird surveys
- Dormouse surveys
- Amphibian surveys, in particular to determine the presence or likely absence of great crested newts
- Reptile surveys
- Surveys of reens for aquatic invertebrates and plants
- Terrestrial invertebrate surveys
- Other surveys may also be required for Biodiversity Action Plan species or Species of Principle Importance for the Conservation of Biodiversity (known)

Annex A

Non Statutory Designated Sites

Site	Distance and direction from the study area	Description
Pant-Rhiw-Goch Wood	Within 500m buffer; south	H1-Woodlands Ancient semi-natural woodland
Coal Pit Lane Pond	Within 500m buffer; south	H16-Standing open water, H11-Reed beds, S1-Mammals, S2-Birds, S4-Amphibians and S6-Invertebrates. Mature pond with emergent vegetation.
White Gates	Within 500m buffer; north	H4-Neutral Grasslands Species-rich semi-improved neutral grassland
Celtic Springs	Within 500m buffer; north	H20-Mosaic Habitat Post-industrial mosaic habitat. Neutral grassland. Calcareous grassland.
LG Duffryn Site 1 (South Lake Drive)	Within 500m study area	H16-Standing open water, H11-Reed beds and S2-birds Pond / <i>Phragmites</i> reedbed, Cettis Warbler
LG Duffryn Site 2	Within 500m study area	H4-Natural grasslands. Large area of neutral grassland adjacent to Gwent Levels.
Duffryn Pond	Within 500m buffer; north	H7-Marshy Grasslands, S1-Mammals, S2-Birds, S3-Reptiles, S4-Amphibians and S6-Invertebrates. Pond with emergent swamp vegetation, which supports a range of important invertebrates, plant, reptile, amphibian and mammal species.
Afon Ebbw River	crossed by proposed route options	H15-Major river system with associated semi-improved neutral grassland and marshy grassland, swamp, scrub and semi-neutral woodland. Associated species include: bulbous foxtail (<i>Alopecurus bulbosus</i>) near confluence with Usk, Kingfisher, Sand Martin, Grass Snake. Forms part of corridor G1,TP2,GR13, RO1 and MF10
Marshall's	crossed by proposed route options	H20-Mosaic habitats, H18-Post-industrial land and H4-Neutral grassland Mosaic neutral grassland, post-industrial, wetland.
Solutia Site	crossed by proposed route options	S2-Birds and S6-Invertebrates A series of improved and semi-improved grasslands with traditional ditches and ponds; site supports a range of species including nesting birds such as Cetti's warbler, and invertebrates including hairy dragonfly (<i>Brachytron pratense</i>).
Alpha Steel Site	crossed by proposed route options	H18-Post-industrial and S2-Birds Area of former Levels, scrub and other habitats which support a range of species including scarce moth species, birds such as Cetti's warbler, and plants including orchids (<i>Epipactis palustris</i> , <i>Ophrys apifera</i> , <i>Anacamptis pyramidalis</i> , <i>Dactylorhiza</i> spp.)
Spencer Works 3	crossed by proposed route options	H7-Marshy grasslands Marshy grassland with wet drains.
Elver Pill Reen	Within 500m	H4-Neutral grasslands, H20-Mosaic habitat, H11-Fens,

Site	Distance and direction from the study area	Description
Grassland & Pond	study area	reed beds and other swamps Lagoon with mosaic of swamp and marshy and dry semi-improved neutral grassland; supports Cetti's warblers.
Greenmoor Pool	Within 500m buffer; north	H16-Open standing water, H7-Marshy grasslands, H11-Fens, reed beds and other swamps, S1-Mammals, S2-Birds, S3-Reptiles, S4-Amphibians, S5-Fish Formerly standing water which now supports reedswamp (UKBAP Priority Habitat), which itself supports bird populations including Cetti's warbler.
Wilcrick Fort West	Within 500m buffer; north	H4-Neutral Grasslands Unimproved neutral grassland on slopes.
Upper Cottage Pond (within LDP candidate site CS/0021)	Within 500m buffer; north	This pond site is surrounded by agriculturally improved fields. Grazed up to the margins and used for drinking by stock, therefore the banks are muddy. The pond does lack diversity, the main interest lies with the abundance of <i>Catabrosa aquatica</i> . There are mature <i>Quercus robur</i> to the south of the pond. This pond is within a candidate LDP site. Qualifying features: S7) Vascular plants H16) Standing open water
Bowkett Field, Barecroft	Within 500m study area	Large, linear, flat field. May have been used as a cart/motorbike track. Has been horse grazed and hay cut in past, but now comprises tall swamp/marshy grassland and appears to be overgrown and neglected. Species present include locally frequent/abundant <i>Epilobium hirsutum</i> , <i>Filipendula ulmaria</i> , <i>Eupatorium cannabinum</i> , <i>Molinia caerulea</i> , <i>Iris pseudacorus</i> , <i>Phalaris arundinacea</i> , <i>Juncus acutiflorus/articulatus</i> , and occasional/locally frequent <i>Lythrum salicaria</i> , <i>Pulicaria dysenterica</i> , <i>Lychnis flos-cuculi</i> . Around the field margins, the reens, particularly on the eastern edge support mature willow scrub, host to many bird species. A small piece of land at the entrance to the site (in the north) comprises overgrown willow scrub and some interesting herb species including <i>Centaurea nigra</i> and <i>Melilotus altissimus</i> . The stand height is approx 100cm and supports abundant invertebrate life. Qualifying features: H7 Marshy Grassland
Barecroft Fields	Within 500m study area	Two large, flat fields, comprising semi-improved, relatively species-poor damp grassland/wet pasture. However, there are some localised and widespread patches of uncommon species such as <i>Thalictrum flavum</i> & <i>Cirsium dissectum</i> . Field 1 was very uniform indicating possibly has been ploughed in the past? Sward height was low - indicating has been topped recently. Field 2 slightly more mixed and 'rough' - (long sward, uncut/grazed), but still low in herb diversity indicating some nutrient improvement. A small patch of <i>Thalictrum flavum</i> was present in the south-western edge. Qualifying features:

Site	Distance and direction from the study area	Description
		H7 Marshy Grassland S7 Vascular plants (primary species: <i>Thalictrum flavum</i>)
Blue House Farm	Within 500m study area	<p>The site consists of two fields units which are partially divided by a ditch but are otherwise physically continuous with each other and thus form a single management unit. The site comprises a botanically interesting tall mosaic of damp and dry grassland habitats, lying on fairly level ground and enclosed by ditches and reens (which support important aquatic flora including <i>Wolffia arrhiza</i> and form part of the Gwent Levels Magor & Undy SSSI). These ditches are accompanied along north, west much of the eastern boundary) by bramble scrub and grown up hedges/tall tree lines. A potential native black poplar tree (coppiced) is located at the western edge of the northern most field. The site was recently acquired at auction by the owners who live adjacent to the site at Bluehouse Farm, and was surveyed as part of CCW's Lowland Peatland Survey in May 2009. The CCW survey records the northern part as M23a marshy grassland centrally, together with areas of damp SI grassland, swamp and bramble scrub and trees towards the edges. The southern part of the site supports M23 marshy grassland in a mosaic with M24. Strips of swamp and scrub reside along the edges of the field. This still remains the case although a lack of grazing (or some other factor) appears to have resulted in a reduction of the main marker; <i>Cirsium dissectum</i> (CCW survey notes 300+ plants, whereas despite a number of visits only limited plants were recorded this year) and an apparent increase in ruderal species. Other forbs observed included <i>Succisa pratensis</i>, <i>Centaurea nigra</i>, <i>Lathyrus pratensis</i> and <i>Lotus uliginosus</i>. Other species of particular note observed during the June 2012 visit include <i>Lysimachia vulgaris</i>, <i>Oenanthe fistulosa</i> and potential <i>Carex pseudocyperus</i>.</p> <p>Qualifying features:</p> <p>H4 Neutral grassland H7 Marshy grassland indicators S7 Vascular Plants – Contributory Species – tubular water drop wort & cyperus sedge</p>
Land at Barecroft Common	Within 500m buffer, south	<p>Three large, flat fields on the Gwent Levels at Magor: All fields comprise semi-improved damp grassland, which is ungrazed/uncut and with a sward height of 70cm - 100cm. Species present comprise of frequent <i>Agrostis stolonifera</i> (and locally frequent <i>Agrostis canina</i>), <i>Centaurea nigra</i>, <i>Persicaria maculosa</i>, <i>Lotus pedunculatus</i> and locally frequent <i>Cirsium dissectum</i>, <i>Thalictrum flavum</i>, <i>Phalaris arundinacea</i>, <i>Juncus articulatus</i> and <i>Juncus acutiflorus</i>. The reens adjacent to the field supports aquatic species such as <i>Galium palustre</i>, <i>Apium nodiflorum</i>, <i>Berula erecta</i>, <i>Oenanthe fistulosa</i> and <i>Rumex hydrolapathum</i> (however these reens are notified as SSSI's). Occasional species included <i>Hydrocotyle vulgaris</i>, <i>Lythrum salicaria</i>,</p>

Site	Distance and direction from the study area	Description
		<p><i>Eupatorium cannabinum</i> and <i>Senecio aquaticus</i>. All fields are fenced but gates between fields are open. Occasional escaped cattle from adjacent improved pastures have grazed some localised patches. The land owner Bill Reece reports nesting birds such as Lapwing and Curlew.</p> <p>Qualifying features:</p> <p>H7 Marshy Grasslands</p> <p>S7 Vascular Plants (Primary species: <i>Thalictrum flavum</i> and contributing species: <i>Oenanthe fistulosa</i>)</p>
Blackwall Lane Field	Within 500m buffer, south	<p>Small, horse grazed, flat meadow, off Blackwall Lane. The fence is moved across the field one foot at a time, therefore the north-east quarter of the field is most diverse and grazed least intensively, as grazing is started west to east, or south to north (as it has been this year). The un-grazed half comprised of tall species rich grassland with occasional Hawthorn scrub establishing from the overgrown hedge line with same mature/approaching veteran trees. Species included locally frequent <i>Centaurea nigra</i>, <i>Thalictrum flavum</i>, <i>Lathyrus pratensis</i>, <i>Lotus corniculatus</i>, <i>Trifolium pratense</i>, abundant <i>Agrostis stolonifera</i>, locally occasional <i>Dipsacus fullonum</i>, <i>Juncus articulatus</i>, <i>Leucanthemum vulgare</i> & <i>Stellaria graminea</i>. The reed to the east supported a herb-rich community including <i>Carex acutiformis</i>, <i>Pulicaria dysenterica</i>, <i>Oenanthe crocata</i>, <i>Filipendula ulmaria</i> and <i>Epilobium hirsutum</i>. Swans nested in this reed summer 2007.</p> <p>Qualifying features:</p> <p>H7 Marshy Grassland</p> <p>S7 Vascular plants (primary species: <i>Thalictrum flavum</i>)</p>
Grange Road	Within 500m study area	<p>Two fields including both flat low lying field with a watercourse and gentle to moderately sloping fields towards the east of the site. Throughout the site there is scattered scrub and hedgerows. The site is surrounded by motorway embankment to the north, pasture to the east and west and a strip of mature semi-natural woodland and housing to the south. The site includes an unmodified stream that runs north to south along the western boundary of the site. The fields include species-rich neutral grassland on the steeper slopes to the east of the site and semi-improved neutral grassland between the more diverse slope and the stream to the east. The richer grasslands include a range of forbs indicative of the unimproved nature of the ground. The sward has approximately 5% bare earth and includes fairy flax, <i>Linum catharticum</i>, burnet saxifrage <i>Pimpinella saxifraga</i>, autumn hawk's-bit <i>Leontodon autumnalis</i>, agrimony <i>Agrimonia eupatoria</i>, and smaller cat's-tail <i>Phleum bertolonii</i>. West of the site the horse grazing was more influential on the structure and composition of the sward and coarser grasses and ruderal species were more dominant and the neutral indicator species were less numerous. Running north-south along the western</p>

Site	Distance and direction from the study area	Description
		<p>boundary there is a stream that is lined with emergent and marginal aquatic vegetation and species-rich banks. These include, meadow sweet <i>Filipendula ulmaria</i>, plicate sweet-grass <i>Glyceria plicata</i>, <i>Mentha</i> sp. common figwort <i>Scrophularia nodosa</i> and hard rush <i>Juncus inflexus</i>. The woodland to the south of the site is not of SINC quality and includes a complete canopy of mature oak <i>Quercus</i> sp., ash <i>Fraxinus excelsior</i> and sycamore <i>Acer pseudoplatanus</i> with an understorey of common hazel <i>Corylus avellana</i> and common hawthorn <i>Crataegus monogyna</i>. The ground flora includes a range of typical woodland vascular plants some of which are ancient woodland indicators and some more ruderal species.</p> <p>Qualifying features: H4 Neutral grassland Running water</p>
Upper Grange Farm Field	Within 500m study area	<p>Species-rich grassy bank, comprising some areas of rank, tussocky grass, with locally frequent <i>Allium schoenoprasum</i>, <i>Sanguisorba minor</i>, <i>Origanum vulgare</i>, <i>Lotus corniculatus</i>, <i>Plantago lanceolata</i>, <i>Galium mollugo</i> and occasional <i>Cirsium eriophorum</i>, <i>Genista tinctoria</i>, <i>Trifolium pratense</i>, and <i>Hypochaeris radicata</i>. This bank forms the south-eastern boundary of a larger field comprising improved grassland, which is cattle grazed. This year this bank has been left but it is becoming rank and tussocky. There is no formal boundary on the eastern edge, adjacent to an arable field/ley.</p> <p>Qualifying features: H5 Calcareous Grasslands H4 Neutral Grasslands</p>
Grange Wood & The Larches	Within 500m buffer, north	Designated for ASNW/PAWS and currently does not have SINC summary information available.
Wood West of Common-y-Coed	Within 500m buffer, north	Designated for ASNW/PAWS and currently does not have SINC summary information available.
Breezy Bank to Rockfield Farm (Includes part of CS/0244)	Within 500m study area	<p>Narrow strip of broadleaved woodland / scrub on a north facing slope. Well developed, good structure with a variety of species including a woodland ground flora. Dominated by <i>Craetagus monogyna</i>, other species include <i>Corylus avellana</i>, <i>Prunus spinosa</i>, <i>Sambucus nigra</i>, <i>Fraxinus excelsior</i>, <i>Quercus robur</i>, <i>Ilex aquifolium</i>. Field layer includes <i>Hyacinthoides non-scripta</i>, <i>Anemone nemorosa</i>, <i>Carex sylvatica</i>, <i>Brachypodium sylvaticum</i> and <i>Dryopteris</i> sp. To the west the scrub becomes woodland and within the neighbouring land unimproved neutral grassland with scrub and tall herb communities. Species in the grassland include <i>Primula x polyantha</i>, <i>Primula veris</i>, <i>Carex flacca</i>, <i>Vicia cracca</i>, <i>Hypericum maculatum</i>. The surrounding land is semi-improved (poor) grassland, fenced.</p> <p>Qualifying features: H1 Broadleaved woodland, H3 Scrub communities,</p>

Site	Distance and direction from the study area	Description
		H4 Neutral grassland, H17 hedgerows
Bridewell Common Fields	Within 500m buffer, south	<p>Two large flat fields. Field 1 comprising damp rush pasture and Field 2 comprising dense swamp. Field 1 comprised abundant <i>Agrostis</i> sp., frequent <i>Cirsium arvense</i>, <i>Carex hirta</i>, <i>Juncus effusus</i>, <i>Juncus articulatus</i>, <i>Carex riparia</i>, <i>Juncus inflexus</i>, <i>Epilobium hirsutum</i> and occasional <i>Lotus pedunculatus</i>, <i>Oenanthe crocata</i>, <i>Phalaris arundinacea</i> and <i>Ranunculus flammula</i>. The field is bordered by reens to the south, east, and west and by the railway to the north. Some mature willows are present in the hedgerow along the eastern reen. Field 2 comprises a larger field of dense swamp vegetation of up to 2m in height. Species diversity is relatively low, including abundant/dominant <i>Phalaris arundinacea</i>, <i>Iris pseudacorus</i>, <i>Carex riparia</i>, <i>Typha latifolia</i> and <i>Epilobium hirsutum</i>. This field is difficult to access and looks to be unmanaged. Both fields are bordered by a network of reens and adjacent grazing land.</p> <p>Qualifying features:</p> <p>H7 Marshy Grasslands</p> <p>H11 Fens, Reedbeds and other swamps</p>

Annex B

Species Records

A1 Species Records

A1.1 Bird species of Conservation Concern within 1km

The SEWBRc search includes UK BAP Species of Conservation Concern, Red Data Book and Nationally Rare and Scarce species, EC Birds Directive, Bonn Convention Species post 2000. Bird species are summarised below.

Species	Comments
Barn Swallow, <i>Hirundo rustica</i>	49 records
Brent Goose, <i>Branta bernicla</i>	1 record
Coal tit, <i>Periparus ater</i>	2 records
Common Eider, <i>Somateria mollissima</i>	1 record
Common Pochard, <i>Aythya ferina</i>	2 records
Common Redpoll, <i>Carduelis flammea</i>	3 records
Common Redshank, <i>Tringa totanus</i>	35 records
Common Sandpiper, <i>Actitis hypoleucos</i>	5 records
Common Shelduck, <i>Tadorna tadorna</i>	25 records
Common Snipe, <i>Gallinago gallinago</i>	27 records
Common Swift, <i>Apus apus</i>	27 records
Common Whitethroat, <i>Sylvia communis</i>	23 records
Dunlin, <i>Calidris alpina</i>	22 records
Eurasian Oystercatcher, <i>Haematopus ostralegus</i>	24 records
Eurasian Teal, <i>Anas crecca</i>	49 records
Eurasian Wigeon, <i>Anas penelope</i>	9 records
Eurasian Woodcock, <i>Scolopax rusticola</i>	2 records
Gadwall, <i>Anas strepera</i>	17 records
Garden Warbler, <i>Sylvia borin</i>	6 records
Goldcrest, <i>Regulus regulus</i>	14 records
Great Black-backed Gull, <i>Larus marinus</i>	2 records
Great Cormorant, <i>Phalacrocorax carbo</i>	25 records
Green Woodpecker, <i>Picus viridis</i>	22 records
Grey Plover, <i>Pluvialis squatarola</i>	5 records
Grey Wagtail, <i>Motacilla cinerea</i>	4 records
Greylag Goose, <i>Anser anser</i>	17 records
House Martin, <i>Delichon urbicum</i>	24 records
Jack Snipe, <i>Limnocryptes minimus</i>	1 records
Lesser Black-backed Gull, <i>Larus fuscus</i>	23 records
Little Egret, <i>Egretta garzetta</i>	49 records
Long-tailed Tit, <i>Aegithalos caudatus</i>	20 records

Species	Comments
Mallard, <i>Anas platyrhynchos</i>	78 records
Meadow Pipit, <i>Anthus pratensis</i>	8 records
Mew Gull, <i>Larus canus</i>	8 records
Mistle Thrush, <i>Turdus viscivorus</i>	13 records
Mute swan, <i>Cygnus olor</i>	84 records
Northern Shoveler, <i>Anas clypeata</i>	27 records
Northern Wheatear, <i>Oenanthe oenanthe</i>	23 records
Red Knot, <i>Calidris canutus</i>	12 records
Ruddy Turnstone, <i>Arenaria interpres</i>	15 records
Sand Martin, <i>Riparia riparia</i>	1 records
Sanderling, <i>Calidris alba</i>	7 records
Spotted Redshank, <i>Tringa erythropus</i>	1 records
Stock Pigeon, <i>Columba oenas</i>	10 records
Stonechat, <i>Saxicola torquata</i>	23 records
Tufted Duck, <i>Aythya fuligula</i>	21 records
Water rail, <i>Rallus aquaticus</i>	28 records
White-throated Dipper, <i>Cinclus cinclus</i>	1 records
Willow Warbler, <i>Phylloscopus trochilus</i>	25 records

Annex C

Target Notes

Target Note Number	Notes
1	Tree with bat potential
2	Tree with high bat roost potential
3	Species rich hedge
4	Dead oak with bat potential
5	Dead ash with bat potential
6	Oak with bat potential
7	Ash with bat potential
8	Wet ditch with GCN potential
9	Wet stream with crayfish potential
10	GCN potential
11	2x Mature oaks with bat potential
12	3x Mature oaks with bat potential
13	Stream with crayfish potential
14	Buzzard landed on tree

Appendix F

Wessex Archaeology and Cultural Heritage Baseline Assessment

F1 Wessex Archaeology and Cultural Heritage Baseline Assessment



making sense of heritage

M4 Corridor Around Newport South Wales

Archaeology and Cultural Heritage Baseline Assessment



Ref: 102830.01
March 2014



M4 Corridor Around Newport South Wales

Archaeology and Cultural Heritage Baseline Assessment

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Archaeology and Cultural Heritage Baseline Assessment

Summary

Wessex Archaeology was commissioned by Arup, acting on behalf of the Welsh Government, to prepare an Archaeology and Cultural Heritage Baseline Assessment informing an Environmental Impact Assessment (EIA) of new proposals for the M4 corridor around Newport, South Wales. This report examines the archaeological and cultural heritage background for three route options. These options would be for a new road, leaving the current M4 close to Junction 29 (National Grid Reference (NGR) 325233, 184050), to the north of Castleton, traversing the Gwent levels to the south of Newport, with three options for crossing the Rivers Usk and Ebbw in the vicinity of Newport Docks and skirting to the south of the former Llanwern steel works before in the re-joining the M4 to Junction 23a in the east, just north west of Magor, (NGR 342780, 187787).

The recorded historic environment resource within a 250m study area around each of the three options was considered in order to provide the context for the discussion and interpretation of the known and potential resource.

This assessment has determined that three Grade II Listed Buildings are situated within the 250m Study Area. Not just direct impacts but also indirect impacts to the setting of these heritage assets will need to be considered at a later stage of the project.

An assessment of the unlisted historic buildings along the course of the route has determined that the majority are post-medieval or modern in origins. At either end of the route, and on the Gwent levels themselves, these are dominated by domestic houses and farm complexes. None lie close to the likely centreline of the route, and the primary impacts are likely to be indirect impacts to the setting of these assets, and this should be a material consideration in designing the landscaping for the route. Assessment of these options has indicated that Option 1 is likely to affect the greatest number of historic structures, some possibly through direct as well as indirect impact, but that this is also least likely to negatively affect the setting of the Grade I listed Transporter Bridge. Conversely, whilst Options 2 and 3 are likely to impact on fewer historic buildings in the Newport Docks area, these lie much closer to the Transporter Bridge and may well affect its setting more.

Investigation of the foreshore of the River Usk has identified a number of modern structures. These predominantly lie on the western bank of the river, and relate to the construction, use and alteration of the Newport Docks. A small number of structures on the eastern bank appear to relate to the Union Docks. Assessment of the three route options indicates that Option 1 would most likely impact the greatest number of these, but their historical significance should be regarded as relatively low. Although the structures identified were all likely to be modern in date, there is a potential for the survival of earlier structures, deposits and features below the mud of the foreshore.

This assessment has established that there is an archaeological interest within the Site. This is defined as the potential for the presence of buried archaeological remains, in particular relating to features associated with modern, post-medieval, Iron Age and Romano-British activity though other periods are also anticipated. Archaeological investigations as part of earlier iterations of this project have clearly established that there is a potential for the survival of archaeological remains



across the Gwent Levels and the fen-edge, but archaeological investigations within the area of Newport Docks and its surrounds have inevitably been restricted due to the built up nature of the area. As such, the assessment of the 3 different route options must be considered in the light of this, and with the understanding that there is not sufficiently clear evidence on the likely potential for buried archaeological remains along each of the three route options for a meaningful assessment of the three routes to be made in this regard.

Much of the landscape pattern within the western and eastern part of the proposed route corridor preserves elements of the 19th century and earlier enclosure and as such may be considered to have historic value, where these are marked by hedgerows they may be considered to be historically important, as defined by the *Hedgerow Regulations 1997* (amended 2002).

The Gwent levels are a Registered Landscape of Outstanding Historical Importance, and as such, any development which impacts upon them must go through a formal assessment process. In the light of this it is anticipated that an ASIDOHL2 assessment will form a necessary part of any further archaeological work on the scheme, regardless which option is finally favoured.

M4 Corridor Around Newport South Wales

Archaeology and Cultural Heritage Baseline Assessment

Acknowledgements

This project was commissioned by Arup, acting on behalf of the Welsh Government and Wessex Archaeology is grateful to Jim Keyte and Helen Peake in this regard. The HER data was sourced from the Glamorgan Gwent Archaeological Trust and supplied direct to Wessex Archaeology. Aerial photographs and other records held in the National Monuments Record for Wales curated by the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) and Wessex Archaeology would like to thank the staff, and in particular Mr Medwyn Parry, for their assistance in this matter. Historic maps and other documents held in the National Library of Wales and Gwent Archives, and the staff of both are thanked for their assistance in this matter.

The report was researched and compiled by Naomi Brennan with specialist reports by Paolo Croce (foreshore survey), Bob Davis (built heritage) and Nick Cooke (historic maps and aerial photographs) and with illustrations prepared by Naomi Brennan and Karen Nichols. The additional surveys were undertaken by Naomi Brennan (archaeology), Paolo Croce and Michael Murray (foreshore survey) and Bob Davis. Nick Cooke managed the project on behalf of Wessex Archaeology.

M4 Corridor Around Newport South Wales

Archaeology and Cultural Heritage Baseline Assessment

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by Arup, acting on behalf of the Welsh Government, to prepare an Archaeology and Cultural Heritage Baseline Assessment informing an Environmental Impact Assessment (EIA) of new proposals for an M4 corridor around Newport, South Wales (hereafter 'the Site'). This report examines the archaeological and cultural heritage baseline for three route proposed route options. These options would be for a new road (**See Figure 1**), leaving the current M4 close to Junction 29 (National Grid Reference (NGR) 325233, 184050), to the north of Castleton, traversing the Gwent levels to the south of Newport, with three options for crossing the Rivers Usk and Ebbw in the vicinity of Newport Docks and skirting to the south of the former Llanwern steel works before in the re-joining the M4 to Junction 23a in the east, just north of Magor, (NGR 342780, 187787), leaving the current M4 close to Junction 29 (National Grid Reference (NGR) 325233, 184050), to the north of Castleton, traversing the Gwent levels to the south of Newport, with three options for crossing the Rivers Usk and Ebbw in the vicinity of Newport Docks and skirting to the south of the former Llanwern steel works before in the re-joining the M4 to Junction 23a in the east, just north of Magor, (NGR 342780, 187787).
- 1.1.2 This report presents the results of an updated survey of the baseline conditions for the project and builds on work undertaken on previous schemes (the M4 Relief Road and the New M4 Project) by Wessex Archaeology. This updated baseline survey incorporates documentary research, aerial photography, detailed field survey, LiDAR analysis, geophysical survey, palaeo-environmental assessment, an extensive walkover survey and trial trenching undertaken for both this and the earlier schemes. The principal existing sources comprise the Historic Environment Record (HER) compiled and curated by the Glamorgan Gwent Archaeological Trust. Other sources include the Gwent Levels Historic Landscape Study (Rippon 1996a and b), and a number of recent archaeological evaluation, recording and research reports.
- 1.1.3 For much of its proposed route, this would cross the Gwent Levels, a registered Landscape of Outstanding Historic Interest, as well as a SSSI. Developments which impact significantly on Registered Landscapes of Outstanding Historic Interest are required to undertake an assessment of the significance of this impact (ASIDOHL2). It is anticipated that a further ASIDOHL2 level assessment of the route options will be necessary at a later stage. This will more fully consider the landscape and setting impact of the proposed development.

1.2 The Site

- 1.2.1 The proposed route will run for some 20 km, leaving the line of the current M4 to the north of Castleton, turning south east past Coedkernew church across the Wentlooge Levels to the south of Tredegar Park and Dyffryn. Here the route options diverge with Option 1 (which largely follows the route examined for the New M4 Project) crossing the River Ebbw, traversing Newport Docks at the 'Junction cut' before crossing the River Usk. Options 2 and 3 follow a slightly more northerly route skirting Maes-glas to the south before passing through the southern edge of the Newport and part of the North Dock. Here both Option 2 and Option 3 cross the River Usk, with Option 2 passing slightly further north to just south of the Transporter Bridge.
- 1.2.2 To the east of the River Usk Option 1 curves around the Solutia engineering works before passing to the north of Pye Corner where it is re-joined by the other route options. Options 2 and 3 are situated slightly further north passing through the engineering works. Once the options are back on the same line, the route then passes to the south of the Llanwern steelworks, from where it turns northwards, passing to the east of the hamlet of Llandeenny, before re-joining the current motorway to the north-east of Magor.
- 1.2.3 Much of the proposed route options for the new M4 will cross the marginal wetlands of the Severn Estuary – the Gwent Levels. It should be noted that the depth of alluvium which covers much of the Levels, makes archaeological remains less visible and more difficult to detect with conventional archaeological evaluation techniques than in dry land areas. The wetland conditions also, however, provide conditions in which the potential for preservation of archaeological and palaeo-environmental remains is considerable. The proposed route does not impinge on the present day intertidal zone, which will not therefore be considered in detail in this report. However, work in the intertidal area has played a crucial role in indicating the nature of human utilisation of the Levels through time, and in showing the possible types of archaeological deposits which may be found further inland, at depth below the alluvium. The upland areas adjacent to the Levels have also been shown by previous research, and by the visible nature of some upstanding archaeological remains, to have a long record of occupation and exploitation by man.
- 1.2.4 The western (Castleton end) falls steeply from the motorway, before levelling off closer to the wetlands, becoming gentle slopes and hills on the margins of the Levels (some 50-100m aOD). It then passes down on to the low-lying reclaimed coastal wetlands of the Wentlooge Levels - the western of the Gwent Levels (generally less than 7.5m aOD). The Gwent Levels are divided by the Rivers Ebbw and Usk which merge and join the Severn estuary to the south of Newport. The area around the rivers is heavily developed with housing, infrastructure and industry, resulting in considerable disturbance to natural stratigraphic deposits. The uplands adjacent to the Gwent Levels mainly comprise gently undulating hills and valleys derived from a very mixed geology. Having crossed the Usk, the route passes through the Caldicot Levels, which are similar in nature to the Wentlooge Levels. At Magor (at the eastern end of the route) the proposed route leaves the Levels and passes again into the south-facing slopes of low hills.
- 1.2.5 Due to their low-lying nature the Levels are protected from flooding by sea walls and banks. They are drained by a series of ditches (reens) which have largely replaced a network of streams and tidal creeks. The River Ebbw and the Usk, are likely to have changed course through time as they 'meandered across the Levels' (Rippon 1996b, 5). Streams such as St Brides Brook and Monks Ditch, also draining from the uplands were canalised or raised across the back-fens, probably in the Medieval period (Rippon 1996b 5). 'Here and there on the Wentlooge Level traces of tidal creeks survive in the form of

meandering or curving field boundaries, presumably where it was convenient to exploit a natural feature for drainage or property division' (Allen & Fulford 1986; Allen 1990). A lower lying (4.9m O.D.) back-fen is formed in an inland basin on both the Wentlooge and Caldicot Levels, although on the latter there is slightly higher land towards the coast (Rippon 1996b, 5). The back-fen areas contain deep deposits of peat, which in the lowest areas are just below the surface.

- 1.2.6 'The Levels lie on a bedrock platform at -5 to -20m OD backed by an ancient cliff line' (Rippon 1996a, 14). They are covered by deep alluvial deposits. The higher land at either end of the proposed routes is formed by solid geology which comprises Keuper Marl (Mercian Mudstone) and Devonian Mudstone (with moranic drift) at the western end, and Carboniferous Limestone at the eastern end (BGS 1:50,000 Maps 249 and 250). There are small patches of Head deposits located to the North of the proposed routes, and Glacial deposits are found to the South of the Route at the Western (Castleton) end. At the junction between the Levels and the higher ground Terrace gravel deposits have been mapped, for example around Coedkernew (west of Newport) and at Magor.

2 METHODOLOGY

- 2.1.1 The methodology employed for the preparation of this assessment, including the study areas, sources and assessment methods as well as terminology used in the report, is described in detail in **Appendices 1 and 2**.
- 2.1.2 In summary, the recorded historic environment resource within a 250m Study Area around each of the three route options was considered in order to provide the context for the discussion and interpretation of the known and potential resource.

2.2 Scope of document

- 2.2.1 This assessment was requested by the Client in order to determine, as far as is possible from existing information, the nature, extent and significance of the historic environment and to assess the potential impact of development on the heritage assets that embody that significance.
- 2.2.2 The Historic Environment, as defined in Planning Policy Wales (PPW 2012): Chapter 6, comprises:
- 'archaeology and ancient monuments, listed buildings, conservation areas and historic parks, gardens and landscapes.'*
- 2.2.3 In the *Conservation Principles for the Sustainable Management of the Historic Environment in Wales* (Cadw 2011), the Historic Environment is further defined as:
- 'all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed'.*
- 2.2.4 Conservation Principles (Cadw 2011) defines a Heritage (Historic) Asset as:
- 'an identifiable component of the historic environment. It may consist or be a combination of an archaeological site, a historic building or a parcel of historic landscape. Nationally important historic assets will normally be designated'.*

2.3 Aims

2.3.1 The specific aims of this assessment are to:

- *outline the known and potential heritage assets within the three route options based on a review of existing information within a 250m Study Area;*
- *assess the significance of known and potential heritage assets through weighted consideration of their valued components;*
- *assess the impact of potential development or other land changes on the significance of the heritage assets.*

3 PLANNING BACKGROUND

3.1 Introduction

3.1.1 There is national legislation and guidance relating to the protection of, and proposed development on or near, important archaeological sites or historical buildings within planning regulations as defined under the provisions of the Town and Country Planning Act 1990. In addition, local authorities are responsible for the protection of the historic environment within the planning system.

3.1.2 The following section provides details of the national, regional and local planning and legislative framework governing the treatment of archaeological remains within the planning process.

3.2 Planning Policy Wales

3.2.1 The Planning Policy Wales (PPW) was published by the Welsh Government in March 2002 and updated in November 2012. This document provides advice on all aspects of planning policy in Wales and detailed advice the historic environment in the planning process is contained in Welsh Office Circulars:

- *60/96 Planning and the Historic Environment: Archaeology;*
- *61/96 Planning and the Historic Environment: Historic Buildings and Conservation Areas; and*
- *1-98 Planning and the Historic Environment: Directions by the Secretary of State for Wales.*

3.2.2 PPW Chapter 6: *Conserving the historic environment* sets out the principal national guidance on the importance, management and safeguarding of heritage assets within the planning process.

3.2.3 The aim of PPW Chapter 6 is to ensure that Local Planning Authorities, developers and owners of heritage assets adopt a consistent and holistic approach to their conservation and to reduce complexity in planning policy relating to proposals that affect them.

3.2.4 To summarise, government guidance provides a framework which:

- *recognises that heritage assets are a non-renewable resource;*
- *requires an assessment and/or evaluation of the historic environment resource affected by the proposals and an impact assessment of the proposed development on the importance of the heritage assets;*

- *takes into account the desirability of preserving and enhancing the importance of heritage assets and their setting;*
- *places weight on the conservation of designated heritage assets (which include World Heritage Sites, Scheduled Ancient Monuments, Listed Buildings, Historic Landscapes, Parks and Gardens, or Conservation Areas).*

3.3 Local Planning Policy

- 3.3.1 While the majority of the scheme falls within the unitary authority of Newport the eastern end of the route, to the east of Greenmoor Arch Industrial Estate and composing of the areas around Llandeenny and Magor, is situated within the administrative boundaries of Monmouthshire County Council.
- 3.3.2 Newport City Council has prepared a Local Development Plan for Newport (2013) to guide planning and development to 2026. This has been submitted to the Welsh Government but not approved and so the Adopted Newport Unitary Development Plan (2006) currently remains in force. Relevant policies from both these documents are presented in **Appendix 3** for reference.
- 3.3.3 Monmouthshire County Council has prepared a new Local Development Plan to guide development from 2011-2021 this has been submitted to the Welsh Government but has yet to be formally adopted as such the current development plan (2006) still remains in force. Relevant policies from both these documents are presented in **Appendix 3** for reference.

4 BASELINE RESOURCE

4.1 Introduction

- 4.1.1 The following section provides a brief summary of the archaeological and historical development of the Site and the Study Area, compiled from sources listed in **Appendix 1**. The aim is to establish the known and potential resource which could be affected by the development.
- 4.1.2 All heritage assets identified are listed in **Appendix 4**. The Glamorgan Gwent Archaeological Trust Historic Environment Record (GGAT HER), National List entries and other data sources are listed by number within the text:
- **1-43 Built Heritage (including Listed Buildings) and Scheduled Monuments;**
 - **101-142 Archaeological records (derived from the HER);**
 - **201-306 Features identified from walkover survey and map regression;**
 - **401-460 Features identified by the foreshore survey**
 - **501-522 Previous work related to this scheme.**
- 4.1.3 Entries are given a **WA** prefix in the text for ease of reference. An overall illustration of the identified heritage assets is provided in **Figures 2-12**.

4.2 Overall archaeological and historical background

Prehistoric

- 4.2.1 Gwent lies close to the southern edge of a number of the glaciations which transformed the landscape of Britain over the past 500,000 years, with the River Severn cut and recut by meltwaters from these glaciations. Wales is thought to have been occupied by

Neanderthals as early as 225,000 BP, this early occupation is likely to have continued until c.175,000 BP after which there was no human activity in the area until at least 60,000 BP.

- 4.2.2 In the light of the paucity of evidence for Lower Palaeolithic activity in Wales, the recovery of a small quantity of Palaeolithic material from the Gwent Levels must be regarded as significant (Aldhouse-Green 2004, 1). Lower Palaeolithic material has been recovered during the archaeological investigations connected with the first and second Severn crossings.
- 4.2.3 The Mesolithic period is generally seen as one in which diverse habitats were exploited for their natural resources. The wetlands would have provided opportunities for fishing, fowling, hunting and gathering. Sites which provided easy access to both the wetlands and higher areas, may well have been particularly attractive.
- 4.2.4 There are few excavated Mesolithic sites in Gwent as a whole, but of these, a number lie on or close to the Gwent Levels. These include the sites at Goldcliff, Llandeenny, Uskmouth and Magor. At Uskmouth three sets of human footprints were found in laminated silts overlain by peat deposits radiocarbon dated to 6250 +/- 80 BP (Walker, 2004, 34). Similar footprints from Magor are slightly later at 5720 +/-80BP (Aldhouse-Green *et al.* 1992, 43-46). Excavations at Goldcliff identified a Late Mesolithic site (Bell, Castledine and Neumann, 2000; Bell *et al.*, 2001; 2002; 2003). The site seems to have occupied a small wooded island surrounded by salt marsh. Several hundred stratified worked flints were recovered, associated with a substantial faunal assemblage, some of which bear cut marks indicative of processing by humans.
- 4.2.5 The Lower Wentlooge formation originated in the Mesolithic, when the Gwent Levels were dominated by intertidal saltmarshes and mudflats, whilst reed swamp developed along the fen edge (Rippon 1996, 16). When at the end of the Mesolithic the rise in sea level slowed, it was still some c. 8 m below present mean sea level (Allen 1990, fig. 4) and peats, now known as the 'middle' Wentlooge Formation, formed as land plants colonised the saltmarshes and mudflats (Rippon 1996a, 17). The evidence suggests that from the end of the Mesolithic to the end of the Bronze Age 'the Levels were dominated by first a wet alder woodland, and then more open reed swamps and raised bogs' (Rippon 1996a, 19), and that there would have been rivers and streams which drained the uplands.
- 4.2.6 There is little evidence for Neolithic activity on the Levels themselves, although a late Neolithic skull was recovered from Alexandra Docks in Newport. Although little is known of Bronze Age settlement and agriculture across much of Gwent (Hamilton 2004, 95), rather more is known about settlement on the Levels. A series of field surveys along the Gwent coast has revealed the extent to which the peatlands were exploited in the Late Bronze Age, with timber roundhouses recorded at Rumney Great Wharf (Allen 1996) and Chapel Tump (Whittle 1989).
- 4.2.7 Evidence for occupation and other activities are recorded at Caldicot throughout the Bronze Age (Nayling and Caseldine 1997). The remains of Bronze Age boats have been recovered at Caldicot (Parry and McGrail 1994) and Goldcliff (Bell 1992). These indicate that the importance of the River Severn for transport, communication and trade, which is clear in the historical record, may well date back into the prehistoric period (Green 1996, 97).

Iron Age and Romano-British

- 4.2.8 A recent study of Iron Age settlement patterns in the Severn Estuary has indicated that the edge of the fenlands was most favoured, allowing access both to the resources of the wetlands and to higher ground (Sylvester 2004). Smaller unenclosed settlements are likely to have been interspersed between the larger hillforts. Conditions on the Gwent Levels in the Iron Age probably favoured pastoral rather than arable agriculture. As with the Bronze Age, there is a dearth of well excavated Iron Age sites in Gwent, with the Levels perhaps providing the only exception. The latter include the excavations at Goldcliff, which identified a number of rectangular Iron Age buildings and trackways (Bell 1992, 13-19). More recent excavations on the Greenmoor Arch (Gwent Euro Park) site near Magor revealed three Iron Age wooden structures, and a rectangular structure was excavated within the Lodge Hill Camp hillfort near Caerleon (Howell and Pollard 2000).
- 4.2.9 An Iron Age hillfort is known at Tredegar to the north of the housing estate (HER ref. 00049g) a possible enclosure was also recorded in early 20th century may also have existed at Maindy Hill Camp (HER ref. 08950g), now beneath Maes-glas housing estate just to the north-west of the northernmost Study Area. A further Iron Age hillfort, Wilcrick Hill lies some 1km to the west of Magor, just outside the study area, and dominates the landscape at the eastern end of the route.
- 4.2.10 At the time of the Roman Conquest, the area lay within the territory of the Silures. The Roman Conquest of Britain was undertaken in stages, and by c. AD 47 the borders of modern Wales had been reached. The result of these early campaigns was the construction of a legionary fortress at Usk and forts at Monmouth and Abergavenny. However, the Boudiccan revolt and its aftermath delayed the completion of the conquest of Wales until AD 74, under Julius Frontinus. As part of this conquest, the legionary fortress at Usk was abandoned in favour of a new fortress at Caerleon, to the south. It has been suggested that the Gwent Levels were amongst the lands appropriated by the Roman Army to support the fortress at Caerleon because of the excellent grazing they provided.
- 4.2.11 It has been suggested that the first attempts to drain the Levels were made during the Roman period, with the pattern of long rectangular fields around the Peterstone Area on Wentlooge is a relict survival of the drainage and agricultural system imposed in the Roman period. A programme of investigation at Rumney Great Wharf supports this, with an extensive Roman drainage system recorded on both sides of the present sea wall (Allen et al. 1992). The excavated pottery assemblage from Rumney Great Wharf is of mid-3rd/4th-century date, though unstratified material dating back to late 2nd century was recovered (Rippon 1997, 111).
- 4.2.12 Excavations at Nash revealed evidence for Roman field systems along with both human and animal burials dated to the 1st to 3rd centuries AD. It is likely that this enclosed land was used as pasture.

Early medieval and medieval

- 4.2.13 The limited evidence for Gwent in the post-Roman period points to some continuity in both land-use and settlement. It is likely that the void left by the departing Roman authority was taken up initially at least by members of the local elites, with activity continuing in key sites such as Caerleon and Caerwent. Caerwent may have been the site of an early monastic community, continuing to emphasise its importance.

- 4.2.14 Caerwent remained the main ecclesiastical centre of Gwent in the 6th and 7th centuries. Early churches were established throughout the region, including early churches at Bassaleg, Coedkernew and at Great Pencarn, as well as an early church on the site of the Newport Cathedral (GGAT 2003, 9). Re-colonisation of the Levels appears to have been largely piecemeal, perhaps initially focussing on small embanked 'infield' enclosures (Rippon, 2000) which expanded over time, with the construction of sea walls and canalisation of rivers into reens such as Monks Ditch and Elver Pill Reen undertaken later on.
- 4.2.15 In 1055 Gruffudd ap Llewellyn, ruler of north Wales, defeated Gruffudd ap Rhydderch, thus becoming the first ruler of a united Wales. He marched into south Wales and proclaimed himself king of all Wales. The Norman Conquest of 1066, however, changed the situation entirely. Castles were established at strategic locations, and nucleated settlements and common fields similarly imported. Examples of these common fields are more frequent to the east of Monks ditch than to the west and a greater proportion of English names also lie to the east of Monks ditch. This is likely also to reflect a degree of immigration, with English tenants being brought in to populate the nucleated villages (Rippon 1997, 23).
- 4.2.16 The flooding in the late/post-Roman period was followed by considerable wetland colonisation by the time of the Domesday Survey of 1086 (Rippon 1997, 184). Enclosure, the conversion of open fields and common meadow/pasture into consolidated areas of land held by one person, had been underway since the late medieval period, but the process intensified and by the 17th century few open fields survived (Rippon 1997, 260). In the post-medieval period there appears to have been a shift towards a pastoral agricultural specialism on the Levels concentrating on dairy products (probably because the heavy soils were suited to pasture) (Rippon 1997, 259).
- 4.2.17 It is believed that the early focus of Newport was at Stow Hill with a church possibly established as early as the fifth or sixth century though it is first documented c1100 (HERref.00166g). It was also at Stow Hill that medieval settlement was formed, focused on the 12th century fortifications (HER ref. 00226g). The current castle remains date to the 14th century (HER ref.00192g).
- 4.2.18 Tredegar House, which lies within the current housing estate, is a Grade I Listed mid-17th century mansion. Part of the earlier house, which dates to the late 15th or early 16th century, survives in the service wing. The grounds of this estate would have originally been extensive including the present day housing estate though the agricultural land holdings of the estate would have extended further and included land within the proposed route options.

Modern

- 4.2.19 The construction of the Alexandra Docks was instigated by the First Lord Tredegar, and the Alexandra (Newport) Dock Company was incorporated by an Act of Parliament in 1865. The North Dock and lock was first opened in July 1875. Business expanded rapidly, and the construction of railways leading to the coalfields of the Rhondda and Cynnon enabled Newport to tap into the lucrative coal exporting trade. Demand was sufficient for a second, South Dock to be planned, enabled by an Act of Parliament in 1882, which opened in 1893. Initially this was smaller than the current south Dock, and accessed by a lock to the east, now blocked. It soon became clear that an expanded South Dock was required. This was incorporated by an Act of Parliament in 1904, and work began in 1905. This construction also involved moving stretches of the River Ebbw to its present

canalised course. The extension, some 48 acres in size, opened in 1907, with a further 27 acres added with the new South Lock in 1914.

- 4.2.20 Much of the establishment and growth of the canal, tramway and railway network around Newport was linked to the needs of industry, particularly the coalfields. These lines were only later to become passenger routes with linked to the main lines only established in the late 19th century.
- 4.2.21 Due to its strategic location and importance of its docks, Newport suffered several air raids during the Second World War (WWII) and defensive structures such as pillbox, anti-aircraft batteries and air raid shelters can be found in the area.
- 4.2.22 A number of important industrial sites were constructed in the 20th century within south Newport, reflecting the increasing industrialisation of the area at this time. These include the Solutia Engineering Works, which potentially lies within the proposed route corridor to the east of the River Usk, opened in 1949 and Llanwern Steelworks, formerly Spencer Works, opened in 1962, which lies to the north of the eastern part of the Study Area.

4.3 Western part of the route (all options) (Figures 2 and 3)

- 4.3.1 This section considers the part of the route from its western end at Castleton until the route options diverge just south of Tredegar Park housing estate.

Previous studies

- 4.3.2 Evaluation carried out in relation to the widening of the M4 between junctions 29-32 found only a single shallow pit containing 19th century demolition material (**E000065**). A watching brief carried out during widening in the areas of Pond 5 and Began Road near Junction 29 of the M4 (**E000021**) found no archaeological features or deposits though a single abraded sherd of Roman pottery was recovered.
- 4.3.3 Between January and March 1997 the Glamorgan-Gwent Archaeological Trust Ltd carried out excavation of a site at Great Pencarn Farm, in advance of road construction (**WA106**). This located a history of activity on the site from the Bronze Age through to the Romano-British period.
- 4.3.4 In conjunction with the previous scheme proposal a number of areas of geophysical survey and trial trench evaluation have been undertaken (**WA501, 502, 503, 504, 505, 506, 208, 508**), which identified a number of settlement enclosures and field boundaries.
- 4.3.5 A series of geo-technical pits excavated along the previous proposed route were archaeologically monitored and elements of the Wentlooge depositional sequence identified (**WA507**). This was found to be largely untruncated by later development except within the area of Newport Docks. The watching brief also identified a number of peat deposits thought to relate to the Bronze Age and Iron Age landscape.

Statutory and local heritage designations

- 4.3.6 There are no designated heritage assets within this portion of the proposed scheme.

Archaeological and historical context

Prehistoric and Romano-British

- 4.3.7 A struck flint of prehistoric date was located near New Park Farm at the western end of the route (**WA101**) and a sub-rectangular cropmark identified in this area was also thought

to be potentially of prehistoric date (**WA102**). However geophysical survey and subsequent evaluation undertaken on this site indicates that the enclosure is medieval (**WA501**).

- 4.3.8 Possible prehistoric activity has also been suggested at Gwaunshonbrown Farm where an earthwork was noted on aerial photographs (**WA103**) and confirmed during the walkover survey (**WA203**). An area was subjected to geophysical survey that identified anomalies corresponding to the possible enclosure, however, no archaeological features were visible within an evaluation trench dug across the site and the earthwork may be geological in origin (**WA504**).
- 4.3.9 The excavations at Great Pencarn Farm (**WA106**), while locating predominantly Romano-British activity, also located an Iron Age peat deposit and a driven upright pile which was radiocarbon dated to the Bronze Age. Geo-technical investigations within the vicinity of Pont-estyll (**WA507**) located peat deposits within the Middle Wentlooge part of the sedimentary sequence, mostly likely reflecting the Bronze Age landscape.
- 4.3.10 Geophysical survey and evaluation at Stud Farm, Coedkernew located Late Iron Age to Romano-British enclosures (**WA505** and **WA506**). The presence of a number of ovens in conjunction with the environmental evidence suggests that this may have been a local centre for farming and crop processing.
- 4.3.11 Percoed Reen, which drains land to the east of Great Pencarn Farm, may have been dug as early as the Romano-British period (**WA215**). Two test pits excavated either side of the reen found no conclusive evidence for the original construction date of the ditch.

Early medieval, medieval, post-medieval and modern

- 4.3.12 Both Coedkernew and Great Pencarn are known to have had medieval manor houses (**WA105** and **WA107**) and the Victorian church of All Saints at Coedkernew is thought to be on the site of an original Early medieval structure, though little further conclusive medieval activity has been located in the area.
- 4.3.13 Geophysical survey and evaluation to the south of Penylan Farm located a post-medieval farmstead and enclosure with finds dating to the 16th or 17th century and quarry pit (**WA502**). It could not be determined whether the quarry was related to the stone built structures to the north (**WA201**) or whether there is a link between this and the earlier medieval enclosure to the west (**WA501**).
- 4.3.14 An area of mature coppiced woodland is to be found to the south-east of Berryhill Farm, visible on 18th century mapping. A pair of ancient oaks survive on the north-eastern boundary of the area of woodland (**WA208**) (**Figure 13, Map A**). A former field boundary depicted on the 1843 tithe map was also noted during the walkover survey near Gwaunshonbrown Farm (**WA202**) while trees were noted to mark former field boundaries near Pont-estyll (**WA218** and **WA219**).
- 4.3.15 A number of post-medieval and early modern structures were identified during on historic maps and during the walkover surveys (**WA01, WA201, WA204 (Plate 1), WA02, WA03, WA207, WA04, WA209-213, WA05 (Figure 13, Map A), WA217, WA220**). These buildings are predominantly agricultural, reflecting the rural nature of the area. Although mostly identified on late 18th or 19th century maps a number of these structures may well be earlier in date.

- 4.3.16 More modern activity was also identified during the earlier walkover survey consisting of a cast iron post adjacent to Percoed Reen (**WA216**) and the embanked bridge across the railway line at Pont-estyll (**WA221**). Although the Great Western Railway line can be seen from the 1st edition 1883 OS map a bridge crossing at the junction with Green Lane is not shown until the 1901 edition.

Undated

- 4.3.17 Although possible archaeological features were identified during geophysical survey to the south-east of Penylan Farm later evaluation indicated that these were geological in origin (**WA503**).
- 4.3.18 Ridge and furrow and lynchets located either side of the A48 near Berryhill Farm and Gwaunshonbrown Farm are undated but are likely to relate to medieval or post-medieval cultivation (**WA104**).
- 4.3.19 Two linear features were noted during the walkover survey in a field adjacent to Longhouse (**WA205** and **WA206**). Although visible on aerial photographs neither is shown on the tithe or OS mapping suggesting that they may be earlier in date.
- 4.3.20 A review of LiDAR survey data was able to identify a series of palaeochannels at Great Pencarn Farm (**WA214**) and to the east of Pont-estyll (**WA508**) in land that was common (unenclosed) moorland until the 19th century. These channels run in a predominantly a north-east to south-west direction and would have drained the land prior to the establishment of the more formalised reens. A section dug across the palaeochannel to the east of Pont-estyll established the presence of three channels within this location, including one which was an earlier feature.

4.4 Central part of the route (option 1) (Figures 4 and 5)

- 4.4.1 This section considers the option 1 route as it passes through Fair Orchard Farm before crossing the River Ebbw. It then traverses Alexandra Docks to the south of the other route options, passing over the Junction cut, before crossing the River Usk. To the east of the River Usk it curves around the Solutia engineering works before passing through Pye Corner.

Previous studies

- 4.4.2 Some known sites of historic interest within this part of the route have been visited as part of targeted surveys including the Tir Gofal agri-environment scheme Historic Environment 2 assessment (**WA121**) and the Waterfronts in Southeast Wales survey (**WA127**).
- 4.4.3 Following a desk-based assessment of the sea defences from Cardiff to Sudbrook (**WA128**) some areas of watching brief were undertaken during improvement works, both within the Study Area (**E002213**) and further south (**E002219**). The watching brief within the Study Area located a number of post-medieval reens (**WA122-126**).
- 4.4.4 Work undertaken in relation to a proposed overhead grid connection identified potential Bronze Age and Iron Age peat deposits as well as elements of the probably medieval enclosure and post-medieval drainage (**WA509**) (Wessex Archaeology 2012). Geo-technical pits excavated along this section of the route did not locate any peat deposits and considerable truncation was noted within the area of the docks (**WA507**).

- 4.4.5 At Arch Farm, where there are known earthworks (**WA139**), an area of geophysical scanning survey was undertaken. Due to modern interference no clear responses were possible and so more detailed survey was not undertaken.
- 4.4.6 Desk-based assessments have also been carried at Newport Docks (**E003221**, **E003556**) and at East Bank Road on the eastern side of the River Usk (**E004128**). A Level 2 building survey of the 19th century former Baptist chapel at Pye Corner (**WA35**) was also undertaken prior to its conversion into a dwelling (**E004128**).

Statutory and local heritage designations

- 4.4.7 The Study Area encompasses the Grade II Listed Pye Corner Farm (**WA36**) which though rebuilt and modernised in the 18th and 19th centuries most probably originated as a 17th century house.

Archaeological and historical context

Prehistoric and Romano-British

- 4.4.8 No prehistoric and Romano-British sites or findspots are recorded in the HER within this section of the route. This is likely a result of extensive development and re-working of much of this landscape in the 19th and early to mid-20th centuries before archaeology was routinely considered. Some prehistoric finds are known from the dock development though the precise location of these is unknown (Keith 1911).
- 4.4.9 The reclamation of the Wentlooge Levels is thought to have begun in the Romano-British period. Possible earlier Bronze Age peat deposits were located within test pits to the north of Pont-y-cwcw Reen (**WA509**). Due to the accumulation of silt and peat deposit within the estuarine environment earlier archaeological features and sites may lie at some depth below the present ground surface.

Early medieval, medieval and post-medieval

- 4.4.10 The river course as seen today is substantially altered from that depicted on post-medieval mapping (**WA240**). The sea defences along the western side of the River Ebbw potentially originate from medieval period (**WA128**) and watching briefs conducted along the present defences have located post-medieval banks and reens (**WA121-6**) while a weir lies within the River Ebbw (**WA127**). Another stretch of seawall is recorded on the far side of the River Usk and shown on the tithe and early OS maps (**WA136**).
- 4.4.11 Other evidence of the medieval and post-medieval re-colonisation and reclamation of the landscape is seen with the tradition rectilinear gridded grips and blind ditches (**WA112** and **WA509**); evidence of similar drainage could be seen on the LiDAR imaging in the wider landscape around Fair Orchard Farm and within the farmland to the south-east of the Solutia engineering works. Despite changes in modern agricultural practice much of this drainage was still partially visible during the walkover survey. Geo-technical investigations in this area did not locate any peat deposits, though it was thought that this area was enclosed relatively early, potentially in the medieval period (**WA507**). Other reens and field boundaries in the vicinity of Fair Orchard Farm are thought to reflect the post-medieval organisation of this landscape (**WA113**, **WA114 (Plate 2)**, **WA115**, **WA117** and **WA121**). A footbridge (**WA118**) is noted crossing the Pont-y-cwcw Reen (**WA117**).
- 4.4.12 Post-medieval and later trackways were noted during the map regression, a number of which are still visible on the LiDAR imaging (**WA223**, **WA229** and **WA239**).

- 4.4.13 A number of 19th century farmsteads and associated structures are depicted on the tithe maps (**WA06, WA231, WA232, WA259, WA262, WA138** and **WA266** (**Figure 14, Map C**)) of which Whitecross Farm (**WA231**) and Fair Orchard Farm (**WA06**) are still extant. Earthworks at Arch Farm are likely to be the remains of post-medieval settlement (**WA139** and **WA268**) while a post-war orchard was noted during the walkover survey (**WA267**). The Baptist chapel at Pye Corner (**WA35**) was built in 1822.
- 4.4.14 The railway runs south-west – north-east through the western part of the route area, with a bridge crossing at the junction with Lighthouse Road (**WA233**). Although not depicted on the late 19th century maps the 1901 OS map also shows a footbridge crossing between this and the Green Lane junction (**WA224**) which is still depicted on later editions throughout the 20th century. The piers are still visible today.
- 4.4.15 As well as the larger number of historic buildings identified at Alexandra Docks (see **Section 5** below), a number of structures have also been identified from the historic maps which are no longer extant reflecting the scale and pace of development in this area (**WA246, 247, 250** and **254-258**) (**Figure 15**). The mid-19th century tithe maps show that this area of land was originally farmland until the late 19th century drained by a similar system of reens as still seen within the extant farmland to the west and east (**WA243** (**Figure 13, Map B**) and **WA245**). The homesteads of Ty Glas (**WA248, Figure 13, Map B**) and Ty Coch (**WA253**) are shown on the 1845 tithe map but this whole area was already redeveloped by the 1884 first edition OS map. The Mendalgf Port Sanitary Hospital to the south-west of the then limit of the dock is first shown on the 1901 OS map but had apparently been demolished by 1921 (**WA244**).
- 4.4.16 Second World War (WWII) defensive sites are known at Pye Corner with a barrage balloon site identified during the walkover survey (**WA265**) most likely related to the heavy Anti-Artillery (HAA) battery situated just to the south of the Study Area (HER ref. 04295g, marked as camp site on OS maps).

Undated

- 4.4.17 A number of undated moated sites were identified from the LiDAR imaging these are most likely to represent medieval or post-medieval settlement (**WA225, WA238** and **WA263**).

4.5 Central part of the route (option 2) (Figures 6 and 7)

- 4.5.1 This section considers the option 2 route as it skirts round the east of Tredegar Park housing estate and traverses through the northern part of the dockyard before crossing the River Usk just south of the Transporter Bridge and passing through the Reevesland Industrial Estate and Solutia engineering works. The route then passes just to the north of Pye Corner.

Previous studies

- 4.5.2 Few archaeological investigations have been taken part within the Study Area. An evaluation undertaken prior to development off Morgan Way in Tredegar Park housing estate found no archaeological finds or features (**E004430**), though a palaeochannel was noted (**WA108**).
- 4.5.3 Following a desk-based assessment of the sea defences from Cardiff to Sudbrook (**WA128**) some areas of watching brief were undertaken during improvement works, both within the Study Area (**E002213**) and further south (**E002219**). The watching brief within the Study Area located a number of post-medieval reens (**WA119** and **WA120**).

- 4.5.4 A site visit was undertaken to Tredegar Pill (**WA116**) as part of the Waterfronts in Southeast Wales survey (**E001296**).
- 4.5.5 Work undertaken in relation to a proposed overhead grid connection identified potential Bronze Age and Iron Age peat deposits as well as elements of the probably medieval enclosure and post-medieval drainage (**WA509**) (Wessex Archaeology 2012). Geo-technical pits excavated along this section of the route located peat deposits in the area of Pye Corner thought potentially to relate to the Bronze Age landscape (**WA507**).
- 4.5.6 Desk-based assessments have been undertaken within the Study Area as part of the wider assessment of the Roman fortress of Caerleon (**E001411**) as well as one undertaken for a site off East Bank Road (**E003430**).

Statutory and local heritage designations

- 4.5.7 There are no designated heritage assets within this portion of the proposed scheme though the medieval Scheduled Monument of Castell Glas Castle Mound (**WA43**) and the Grade I Listed Transporter Bridge (**WA34**) lie just to the north of the route.

Archaeological and historical context

Prehistoric and Romano-British

- 4.5.8 Two Bronze Age axes are recorded as being found within the Study Area, though the precise location of the discovery is unknown (**WA135**). The discovery of such valuable items may indicate deliberate deposition rather than chance losses. Peat deposits located in test pits to the north of to the north of Pont-y-cwch Reen (**WA509**) and in the vicinity of Pye Corner (**WA507**) may reflect elements of the Bronze Age and Iron Age landscape.
- 4.5.9 Iron Age (**WA134**) and Romano-British coins (**WA133**) have also been found within the general area, including a late 4th century Romano-British hoard (**WA129**). Though no settlement evidence is recorded within the area of the route there is potential for occupation from this period.

Early medieval, medieval and post-medieval

- 4.5.10 The battle of Dinas Newydd is reputed to have taken place in 918 AD though little is known about the battle or its precise location (recorded in the c.1100 text *Annales Cambriae* as 921) (**WA130**).
- 4.5.11 Medieval finds are listed in Study Area (**WA137**) including an ecclesiastical bronze mould (**WA131**). A tanhouse and brewery in Newport are also recorded as owned by the church or chapel of St Lawrence in 1534 (**WA132**). An area of woodland on the edge of former wider extent of Tredegar Park is visible on the tithe mapping and is designated as an area of Ancient Woodland (ID 22087) (**WA228**).
- 4.5.12 The former river channel of the River Ebbw is shown further east than that seen today, meandering through the area now used as landfill (**WA240**). The sea defences along the western side of the River Ebbw potentially originate from medieval period (**WA128**) and watching briefs conducted along the present defences have located post-medieval banks and reens (**WA119** and **WA120**). Another stretch of seawall is recorded on the far side of the River Usk shown on the tithe and early OS maps (**WA136**).
- 4.5.13 Other evidence of the medieval and post-medieval re-colonisation and reclamation of the landscape is apparent with reens and field boundaries in the vicinity of Fair Orchard Farm (**WA113**, **WA114** (Plate 2) and **WA117**). A footbridge (**WA118**) is noted crossing the

Pont-y-cwcw Reen (**WA117**) and a former sluice gate was also noted during the walkover survey (**WA234**). Tredegar Pill (**WA116**), which discharges water from the reen into the river, is visible on the 1st edition OS map and is still visible today. The Great Wharf and Hundred Acres Reen originally ran through the area now occupied by Alexandra Docks (**WA243**) (**Figure 13, Map B**).

- 4.5.14 Within the Gwent Levels a traditional drainage system of rectilinear gridded grips and blind ditches is used. Evidence of this drainage could be seen on the LiDAR imaging in the wider landscape around Fair Orchard Farm and within the farmland to the east of the Solutia engineering works. Despite changes in modern agricultural practice much of this drainage was still partially visible during the walkover survey.
- 4.5.15 The walkover survey identified a number of oak trees marking former field boundaries seen on late 18th century (**WA227, Plate 3**) and early 19th century maps (**WA226**). A track identified on late 18th century and early 19th century maps can still be seen as a shortened spur off Pont Estyll Lane (**WA223**) while a track to the west of Lighthouse Road shown on late 18th century mapping can still be discerned on the LiDAR imaging (**WA229**).
- 4.5.16 A number of 19th century farmsteads and other rural buildings are depicted on the tithe maps (**WA06, WA231, WA232, WA242 (Figure 13, Map B), WA260, WA261 and WA264**) of which Whitecross Farm (**WA231**) and Fair Orchard Farm (**WA06**) are still extant. Earthworks at Arch Farm are likely to be the remains of post-medieval settlement (**WA139** and **WA268**) while a post-war orchard was noted during the walkover survey (**WA267**). A watch house (**WA251**) and powder magazine (**WA252**) can be seen on the 1845 tithe map (**Figure 13, Map B**).
- 4.5.17 The Great Western Railway line passes through the western part of this route section, with a bridge crossing at the junction with Lighthouse Road (**WA233**). Although not depicted on the late 19th century maps the 1901 OS map also shows a footbridge crossing between this and the Green Lane junction (**WA224**) which is still depicted on later editions throughout the 20th century. The piers are still visible today. The walkover survey noted culverts taking Old Dairy Reen (**WA230, Plate 4**) and Sea Wall Reen (**WA236**) under the railway.
- 4.5.18 The route passes through the northern part of the historic dockyard (see **Section 5** below) (**Figure 15**). A feeder channel is shown on the 1881 OS map leading to the docks (**WA241**). A terrace of cottages on the eastern side of the River Usk were built for the dock workers though these are no longer extant (**WA256**).

Undated

- 4.5.19 A number of undated moated sites were identified from the LiDAR imaging these are most likely to represent medieval or post-medieval settlement (**WA225, WA235, WA237 and WA238**).
- 4.5.20 A palaeochannel (**WA108**) was identified during evaluation of land off Morgan Way, prior to development (**E004430**).

4.6 Central part of the route (option 3) (Figures 8 and 9)

- 4.6.1 This section considers the option 3 route as it passes through the eastern edge of Tredegar Park housing estate and crosses through the northern part of the dockyard. This navigates the River Usk slightly further south than the option 2 route before passing

through Reevesland Industrial Estate, Solutia engineering works and the north of Pye Corner on a broadly similar route.

Previous studies

- 4.6.2 Few archaeological investigations have been taken part within the Study Area. An evaluation was undertaken prior to development off Morgan Way in Tredegar Park housing estate found no archaeological finds or features (**E004430**), though palaeochannel was noted (**WA108**).
- 4.6.3 Following a desk-based assessment of the sea defences from Cardiff to Sudbrook (**WA128**) some areas of watching brief were undertaken during improvement works, though there are no recorded features identified within the Study Area (**E002213**).
- 4.6.4 A site visit was undertaken to Tredegar Pill (**WA116**) as part of the Waterfronts in Southeast Wales survey (**E001296**).
- 4.6.5 Desk-based assessments have been undertaken within the Study Area as part of the wider assessment of the Roman fortress of Caerleon (**E001411**) as well as one undertaken for a site off East Bank Road (**E003430**).

Statutory and local heritage designations

- 4.6.6 There are no designated heritage assets within this portion of the proposed scheme though the medieval Scheduled Monument of Castell Glas Castle Mound (**WA43**) and the Grade I Listed Transporter Bridge (**WA34**) lie just to the north of the route.

Archaeological and historical context

Prehistoric and Romano-British

- 4.6.7 Two Bronze Age axes are recorded as being found within the Study Area, though the precise location of the discovery is unknown (**WA135**). The discovery of such valuable items may indicate deliberate deposition rather than chance losses. Peat deposits located in test pits to the north of Pont-y-cwch Reen (**WA509**) and in the vicinity of Pye Corner (**WA507**) may reflect elements of the Bronze Age and Iron Age landscape.
- 4.6.8 Iron Age (**WA134**) and Romano-British coins (**WA133**) have also been found within the general area, including a late 4th century Romano-British hoard (**WA129**). Though no settlement evidence is recorded within the area of the route there is potential for occupation from this period.

Early medieval, medieval and post-medieval

- 4.6.9 The battle of Dinas Newydd is reputed to have taken place in 918 AD though little is known about the battle or its precise location (recorded in the c.1100 text *Annales Cambriae* as 921) (**WA130**).
- 4.6.10 Medieval finds are listed in Study Area (**WA137**) including an ecclesiastical bronze mould (**WA131**). A tanhouse and brewery in Newport are also recorded as owned by the church or chapel of St Lawrence in 1534 (**WA132**). An area of woodland on the edge of former wider extent of Tredegar Park is visible on the tithe mapping and is designated as an area of Ancient Woodland (ID 22087) (**WA228**).
- 4.6.11 The former river channel of the River Ebbw is shown further east than that seen today, meandering through the area now used as landfill (**WA240**). The sea defences along the western side of the River Ebbw potentially originate from medieval period (**WA128**).

Another stretch of seawall is recorded on the far side of the River Usk shown on the tithe and early OS maps (**WA136**).

- 4.6.12 Other evidence of the medieval and post-medieval re-colonisation and reclamation of the landscape is apparent with reens and field boundaries in the vicinity of Fair Orchard Farm (**WA114 (Plate 2)** and **WA117**). A former sluice gate was also noted (**WA234**) across the Pont-y-cwcw Reen (**WA117**). The walkover survey also identified a former crossing point over the Morfa-Gronw Reen (**WA222**). Tredegar Pill (**WA116**), which discharges water from the reen into the river, is visible on the 1st edition OS map and is still visible today. The Great Wharf and Hundred Acres Reen originally ran through the area now occupied by Alexandra Docks (**WA243**) (**Figure 13, Map B**).
- 4.6.13 Within the Gwent Levels a traditional drainage system of rectilinear gridded grips and blind ditches is used. Evidence of this drainage could be seen on the LiDAR imaging in the wider landscaping around Fair Orchard Farm and within the farmland to the east of the Solutia engineering works. Despite changes in modern agricultural practice much of this drainage was still partially visible during the walkover survey.
- 4.6.14 The walkover survey identified a number of oak trees marking former field boundaries seen on late 18th century (**WA227, Plate 3**) and early 19th century maps (**WA226**). A track identified on late 18th century and early 19th century maps can still be seen as a shortened spur off Pont Estyll Lane (**WA223**) while a track to the west of Lighthouse Road shown on late 18th century mapping can still be discerned on the LiDAR imaging (**WA229**).
- 4.6.15 A medieval charter and a 17th century survey indicate the presence of wind mills within the Newport region though there is no precise location for these features (**WA109** and **WA110**).
- 4.6.16 A well is noted in a 16th century document (**WA111**) however this is listed as near the church of St Woollo's (now the cathedral) which actually lies a considerable distance to the north of the route.
- 4.6.17 A number of 19th century farmsteads and other rural buildings are depicted on the tithe maps (**WA231, WA232, WA242, WA248 (Figure 13, Map B), WA260, WA261** and **WA264**) of which Whitecross Farm (**WA231**) is still extant. Earthworks at Arch Farm are likely to be the remains of post-medieval settlement (**WA139** and **WA268**) while a post-war orchard was noted during the walkover survey (**WA267**).
- 4.6.18 A powder magazine (**WA252**) can be seen on the 1845 tithe map adjacent to the river (**Figure 13**) while an area of brickfields and potteries shown on the 1887 OS map indicates the increasing industrialisation of the southern part of the Newport during the late 19th century (**WA249**).
- 4.6.19 The Great Western Railway line passes through the western part of this route section, with a bridge crossing at the junction with Lighthouse Road (**WA233**). Although not depicted on the late 19th century maps the 1901 OS map also shows a footbridge crossing between this and the Green Lane junction (**WA224**) which is still depicted on later editions throughout the 20th century. The piers are still visible today. The walkover survey noted culverts taking Old Dairy Reen (**WA230, Plate 4**) and Sea Wall Reen (**WA236**) under the railway.
- 4.6.20 The route passes through the northern part of the historic dockyard (see **Section 5** below) (**Figure 15**). A feeder channel is shown on the 1881 OS map leading to the docks

(**WA241**). A terrace of cottages on the eastern side of the River Usk were built for the dock workers though these are no longer extant (**WA256**), another complex of buildings seen on the western bank of the River Usk on the 1st and 2nd edition OS maps are also no longer extant (**WA254**).

Undated

- 4.6.21 A number of undated moated sites were identified from the LiDAR imaging these are most likely to represent medieval or post-medieval settlement (**WA225**, **WA235** and **WA237**).
- 4.6.22 A palaeochannel (**WA108**) was identified during evaluation of land off Morgan Way, prior to development (**E004430**).

4.7 Eastern part of the route (all options) (Figures 10 to 11)

- 4.7.1 This section considers the portion of the route where the three options converge just to the east of Arch Farm till it joins the existing M4 to the north of Magor.

Previous studies

- 4.7.2 In conjunction with the previous scheme proposal a number of areas of geophysical survey, geo-technical boreholes and trial trench evaluation have been undertaken (**WA510-514**, **516-522**), which identified a number of palaeochannels, settlement enclosures and field boundaries.
- 4.7.3 A series of geo-technical pits excavated along the previous proposed route were archaeologically monitored and elements of the Wentlooge depositional sequence identified (**WA507**). The watching brief identified a number of peat deposits thought to relate to the Bronze Age and Iron Age landscape.
- 4.7.4 Test pitting by Reading University near Llandeenny identified Mesolithic flint scatters (**WA515**). Two areas of archaeological investigation has taken place within Greenmoor Arch Industrial Estate which located prehistoric (**WA141**) and medieval activity (**WA140**).
- 4.7.5 Desk-based assessments carried in conjunction with the Roman fortress of Caerleon (**E001411**) and the Second Severn Crossing (**E001482**) have considered the wider landscape including parts of the route.

Statutory and local heritage designations

- 4.7.6 Within the Study Area lie the Grade II Listed early 19th century Tatton Farm (**WA37**) as well as The Vicarage at Magor, built in 1861 (**WA40**).

Archaeological and historical context

Prehistoric and Romano-British

- 4.7.7 Test pitting near Green Meadow Farm at Llandeenny identified two Mesolithic flint scatters indicating activity in the liminal zone between the wetland and the dryer ground (**WA515**). Evaluation adjacent to this site found further prehistoric lithics though no confirmed features of this date (**WA514**). Further prehistoric activity was noted during a borehole survey near Llandeenny where a probable man-made deposit thought to represent a crossing point was located and dated to the 1st millennium BC (**WA141**).
- 4.7.8 Geophysical survey and evaluation just to the west of Magor identified the remains of a Late Iron Age/ Early Romano-British settlement (**WA517** and **WA518**). Further Romano-

British settlement was also discovered just to the south-west at Llandeenny (**WA514**) after geophysical survey and evaluation in this area.

Medieval and post-medieval

- 4.7.9 Monk's Ditch, which runs along the western edge of Whitson is mentioned in medieval documents and must represent a canalised river of at least medieval origin (**WA285**) while a medieval structure and ditch were located during excavations prior to the construction of a distribution centre at Greenmoor Arch Industrial Estate (**WA140**).
- 4.7.10 A green lane adjacent to Tatton Farm is a known post-medieval trackway but also potentially a medieval route as well (**WA270, Figure 14, Map C and Plate 5**). Other trackways can be seen to the east (**WA277**) and south-east of the farm (**WA280, Figure 14, Map C**) which may have been linked to tracks further east (**WA281** and **WA282**). Further trackways depicted on the tithe maps can be seen to the south (**WA275**) and near Rush Wall (**WA289, WA297** and **WA299**).
- 4.7.11 The re-colonisation of this area of the Levels can be seen with the typical system of pills and reens (**WA269, WA283** and **WA291, WA300 (Figure 14, Map D)**), this is likely to date to the post-medieval period though some may be earlier. The traditional drainage system of grips and blind ditches can still be seen on the LiDAR imaging and was still partially visible during the walkover survey (**WA520**).
- 4.7.12 A bridge (**WA286**) crosses Monk's Ditch adjacent to the New House complex shown on the 1845 tithe map (**WA287**). During the walkover survey it was noted that the bridge abutments suggest that a much more substantial structure pre-dating the current brick and stone construction.
- 4.7.13 As with Arch Farm to the south-west, areas of orchard were noted around Tatton Farm on the 19th century maps, one of which was still extant today (**WA271** and **WA276**) (**Figure 14**).
- 4.7.14 A number of 19th century farmhouses and other buildings are depicted on the tithe maps, some of which may be earlier in origin (**WA272, WA273 (Figure 14, Map C), WA284, WA287, WA290, WA292, WA293, WA298, WA301 (Figure 14, Map D), WA303, WA306** and **WA41**). The rural character of the area is reflected in the agricultural nature of many of these buildings.
- 4.7.15 Evidence of quarrying can be seen near Barecroft Common on the 1882 and early 19th century OS maps (**WA302**). This area lies on the sandstone bedrock geology and given the proximity of the railway it is also possible that the quarrying is related to the construction of the line.
- 4.7.16 A WWII pillbox is located at Sycamore Farm, Llandeenny (**WA142, Plate 6**) these defensive structures were to be utilised in protecting key sites and along routeways in the event of an invasion. Another pillbox lies some 700m to the south-east, just beyond the Study Area on Barecroft Common (HER ref. 08971g).

Undated

- 4.7.17 A number of moated sites and house platforms are visible either as earthworks or on the LiDAR imaging, these most likely relate to medieval or post-medieval settlement (**WA274, WA278, WA279, WA294** and **WA296**).

- 4.7.18 A number of palaeochannels could be identified from the LiDAR imaging in the area of Whitson and Green Moor (**WA288** and **WA295**). A number of these have been further investigated and although not dated they appear to lie within the upper levels of the sedimentary sequence (**WA510**, **WA511**, **WA512** and **WA513**) and therefore may represent the latest phase of tidal creek incision.
- 4.7.19 Some boundary features were noted during the walkover survey near the eastern end of the route which could not be identified on historic mapping (**WA304** and **WA305**) while elements of the potentially post-medieval field system were identified during geophysical survey to the north of Woodlands House (**WA519**).
- 4.7.20 Results from the several of the evaluation trenches did not reveal any archaeological finds or features (**WA516**, **WA521** and **WA522**).

4.8 Historic Landscape Character

- 4.8.1 It is anticipated that further and more complete assessment of the historic landscape character will take place at a later stage of the project therefore only a broad background will be included here.
- 4.8.2 Much of the western and eastern parts of the Study Area lie within or adjacent to the Gwent Levels, a Landscape of Outstanding Historic Interest.
- 4.8.3 This is characterised by the reclamation of former wetland and its agricultural management and is one of the few surviving areas of coastal wetland in Britain and includes is largely registered as a Site of Special Scientific Interest (SSSI). Map regression shows that much of the farmland within the western and eastern parts of the Study Area preserves the field patterns shown on the 19th century tithe maps and the likelihood is that much of this enclosure reflects post-medieval, medieval or even Roman re-organisation of the landscape.
- 4.8.4 Much of the central portion of the route reflects modern development and 19th and 20th century industrialisation. Certain aspects of this such as the dockyards, the growth of the railways and the engineering and steelworks sites, though modern, marks significant elements of the history of the area.
- 4.8.5 A historic landscape exercise has previously been undertaken on the Gwent levels by Dr Steven Rippon in 1995, and is available online on the GGAT website (http://www.ggat.org.uk/cadw/historic_landscape/Gwent%20Levels/English/GL_Main.htm). This characterisation, however, confines itself to the levels alone, and does not consider the area of the docks or the east bank of the River Usk, nor does it cover the area of land formerly enclosed within the Llanwern steelworks, and will require updating and refining to suit the proposed scheme.
- 4.8.6 To the west of the Docks, the proposed scheme crosses the Marshfield/Coedkernew character area (characterised as a low-lying back-fen landscape north of the major “catchwater drain”), the Maerdy character area (a “regular landscape” of medieval/post-medieval date in low-lying back-fen), the western St Brides character area (a simpler landscape laid out within a framework of elements surviving from the Roman landscape) and the Eastern St Brides character area (a complex “irregular landscape” on higher coastal area). To the east of the River Usk, on the Caldicot level, it crosses 5 further character areas: the Nash/Goldcliff coastal zone (a complex “irregular landscape” in higher coastal area, with small irregular fields, sinuous lanes and dispersed settlement),

the Chrstchurch/Nash/Whitson back-fen (low-lying back-fen with simpler “intermediate” landscape), the Whitson character area (unique planned village), the Northern Redwick character area (fairly simple landscape including Tintern Abbey’s estate at Grangefield) and the Green Moor character area (simple landscape in the back-fen of Redwick/Llandeenny/Magor). Because these existing character areas do not cover the main areas where the three route options divide, they do not provide significant assistance in assessing any differences in the likely impacts between them.

5 BUILT HERITAGE

5.1.1 Much of the built heritage along the line of the route was covered by surveys undertaken in 2008 as part of an earlier iteration of the scheme, which largely followed the route of Option 1 assessed here, which included both surveys of the built heritage of the proposed route and of Newport Docks (Wessex Archaeology 2008a). The addition of Option 2 and Option 3 required further survey of the central zone of the route in the Dyffryn area, to the north of Newport Docks and on either side of the River Usk adjacent to the proposed river crossing. This additional survey work was undertaken in early February 2014. With the exception of a small number of buildings surveyed in 2008 where it was possible to gain access, survey was largely confined to an examination of the external elevations of buildings alone.

5.1.2 A total of 42 buildings, structures and building complexes were identified within the Study Areas of the three route options. At the western and eastern ends of the scheme, the majority comprise domestic or agricultural dwellings, whilst in the central section industrial buildings, the majority related to Newport Docks, dominate.

5.2 Western part of the route (all three options) (Figure 16)

5.2.1 Within this zone five historic buildings lie within the Study Area for the three options. None of these are listed, and all have seen a degree of modern alteration. At the western end, the farm complex at New Park Farm (**WA1**) lies closest to the centreline of the proposed route, although it may not be directly impacted. The farmhouse here has seen much alteration, and its original form is hard to determine, but a fine range of associated farm buildings survive.

5.2.2 Further to the east, three sites are clustered fairly close together on the lower slopes close to the edge of the levels. Myrtle House (**WA2**) is a modest late 19th century double pile plan cottage. Modern painted external render and replacement windows have probably obscured any historic features. Further downslope, Longhouse (**WA3**) is of unknown date but exhibits a long-house plan form. It is now painted red with yellow brick dressings. A lower two storey stone cottage is attached at the south-west end, all with slate roofs, suggesting a possible late 18th or early 19th century origin. Berryhill Farm (**WA4**) lies a short distance to the east. It is shown on the 1844 Tithe map and may date to the 18th century. Part of a large group, the original farm seems to be centred on the farm house and a pair of stone built cottages. This early group has been extended to the south and a later set of farm buildings create a ‘linear’ group with large modern facilities beyond.

5.2.3 The final historic building along this stretch of the route lies on the low-lying peninsula of Coedkernew, which projects into the surrounding levels. 38 Church Farm (**WA5**) lies close to the medieval church, and is considered to be of historic origin, although the present buildings do not appear old. The buildings are rendered and contain modern windows and are thought to be symptomatic of a modern re-build.

- 5.2.4 Whilst none of these structures is understood to lie directly along the line of the proposed route, the setting of all is likely to be affected by the proposed route.

5.3 Central part of the route (Figures 17 and 18)

- 5.3.1 This stretch of the route containing the greatest number of historic buildings and structures, the majority of which can be directly related to Newport Docks. At the western and eastern ends of this stretch of the route buildings more typical of the Gwent levels provide a characteristic counterpoint to the industrial buildings of the Docks and their surroundings.
- 5.3.2 The historic buildings on the levels comprise two agricultural complexes (at Fair Orchard Farm (**WA6**) on the Wentlooge Level and the Grade II listed Pye Corner Farm (**WA36**, Plate 8) on the Caldicot Level), and a non-conformist chapel (**WA35**) also at Pye Corner, now converted into a house.
- 5.3.3 Within Newport Docks the structures within the three differing study areas include both the earliest dock (**WA9**) and its subsequent southern extension (**WA28**) along with two locks – the original North Dock (**WA14**), now a dry dock, and the East Lock (**WA31**). The site of a former graving dock (**WA15**) also lies within this area.
- 5.3.4 An array of Dock Buildings were identified ranging from fine late 19th century office buildings (**WA10** and **11**, Plate 11) to former warehouses (**WA 8** and **29**), dry-dock engineering buildings (**WA13**) and a group of early 20th century buildings (**WA12, 16, 18, 19, 20, 21, 22, 26 and 27**), some of which almost certainly related to the adjacent swing bridge (**WA17**) which could be used to cross Junction cut - the gap between the North Dock and the southern docks. Other historic buildings include the former Custom's house adjacent to the East Dock (**WA30**).
- 5.3.5 Of particular interest is a complex of engine sheds and maintenance workshops for the engines and trucks used on the dock railways, which although in some disrepair are largely complete (**WA 23, 24 and 25**, Plate 12). These are an important survival.
- 5.3.6 To the north of the Docks lies the Grade I Listed Transporter Bridge (**WA34**, Plate 7). The building of the bridge commenced in 1902 and was completed in 1906, this is one of only two such bridges to survive in the UK, and one of only twenty built worldwide. Ever since its construction, it has dominated the Newport skyline, and remains a potent iconic landmark for the city. Although this lies only partially within the northernmost Study Area (Option 2), all three options lie close enough to the bridge for its setting to be negatively impacted by whichever option was selected.
- 5.3.7 Two docks on the eastern bank of the River Usk, formerly part of the Union Dry Docks (**WA32 and 33**) also lie within the combined Study Areas, although would likely only be directly impacted by Option 1. Unlike the docks and dry docks of the main dockyard, these have lost much of their associated structural infrastructure, which have been replaced by modern sheds and warehouses.

Options 1, 2 and 3

- 5.3.8 This central stretch of the route is key to understanding the differing impacts that the different route options would have on the built heritage. Key to this will be an assessment of both the direct physical impacts that the scheme may have on these historic structures and buildings and perhaps more important, the effect that each of these routes would have on their setting.

- 5.3.9 The study area for Option 1 suggests that it is the least favourable option in terms of the number of historic structures and buildings likely to be impacted. Both of the historic farms on the Gwent levels (**WA6 and 36**) and the former Chapel at Pye Corner (**WA35**) lie within the Option 1 study area, as do the North Dock and original South Dock, both locks, the graving dock and the vast majority of the historic buildings in the Docks (**WA9, 11 - 31**). Assuming that the route is likely to take a central line within the Study Area and crosses the docks at Junction cut, it may well have a direct impact on some of these structures, including the group of railway engineering workshops and sheds (**WA23**). On the eastern side of the river both of the former dry docks of the Union Docks lie within this study area (**WA32 and 33**). This option is, however, the furthest from the Transporter Bridge (**WA34**), and could be considered most sensitive to its setting.
- 5.3.10 The study area for Option 2 contains by far the fewest historic structures and buildings, although it does include Fair Orchard Farm (**WA6**) the North Dock and one of the buildings within the docks (**WA 8 and 9**). It does however, incorporate part of the Transporter Bridge on the east back of the River Usk (**WA34**), and its proximity to the bridge might have a detrimental negative effect on its setting.
- 5.3.11 Option 3 avoids the Fair Orchard Farm complex, but impinges slightly on the edge of a Victorian railway bridge (**WA7**), both the North Dock and a number of buildings in the docks (**WA8- 14**). However, it too runs relatively close to the Newport Transporter Bridge.

5.4 Eastern part of the route (all three options) (Figures 18 -19)

- 5.4.1 Six historic structures and buildings lie within the combined Study Area for the eastern end of the route, stretching from Pye Corner to the north west of Magor. Close to Pye corner lies the Grade II listed Tatton Farm (**WA37, Plate9**) and its outbuildings. This is a typical large Gwent levels farmhouse, probably dating to the early 19th century, currently in a poor state of repair.
- 5.4.2 The remaining five structures all cluster in the vicinity of Llandevenny and Magor, and include the Grade II Listed Magor Vicarage (**WA 40, Plate 12**), built in 1861 by the architect John Norton, who restored the nearby Magor church. This lies close to the centreline of the study area, and may well be physically impacted by the proposed project.
- 5.4.3 The remaining four structures are unlisted, and comprise a cottage and stables on Barecroft Common (**WA38**), a World War II pillbox at Llandevenny (**WA39**) and two late 19th / early 20th century houses in Knollbury (**WA 41 and WA42**)
- 5.4.4 The main impact on historic structures and buildings along this stretch of the route is likely to be an indirect one, with the possible exception of the Grade II listed Magor Vicarage, which lies close to the centre of the indicative Study Areas. Here it is considered that there may well be both significant direct and indirect impacts.

6 FORESHORE SURVEY

6.1 Background

- 6.1.1 In order to establish the likely impact of Options 2 and 3, a survey of the foreshore of the banks of the River Usk was undertaken on 12th-13th February 2014. This built on the work of a similar survey undertaken as part of the works in advance of the proposed New M4 Project (Wessex Archaeology 2008d).

- 6.1.2 The character of the foreshore area within the proposed development options is entirely industrial with the transporter bridge the main feature dominating the fluvial landscape of the River Usk within the sturdy areas. Whilst the eastern side of the river is mostly grassy floodplain with mudflats sloping down steeply from the high water line, the western bank is heavily built up and presents considerable remains of late 19th – early 20th maritime infrastructures.
- 6.1.3 The majority of the historic features recorded by these surveys are located along the western bank and consist of remains of wharfs and piers associated with the Alexandra Docks complex whose construction commenced in May 1868. These structures represent part of River Usk industrial marine heritage and are a tangible link to the extraordinary development of Newport and the Welsh coal industry during the years of the industrial revolution between the 19th and early 20th century.
- 6.1.4 Fewer significant archaeological features were noticed along the eastern bank.
- 6.1.5 Although the historic features identified and recorded along the foreshore are exclusively modern in date and industrial in nature, there is nonetheless a potential for the survival of earlier significant archaeological features and deposits buried within the foreshore covered by modern alluvium or within deeper stratified deposits. These archaeological remains need not be limited to remains of riverine infrastructures or wrecks but potentially could include submerged sites and prehistoric deposits as suggested by the sheer number of sites within the mouth of the Usk River and the surrounding area (Aldhouse-Green *et al* 1992, Allen 1996, Davidson 2002).

6.2 Archaeological features (Figure 20)

- 6.2.1 The archaeological walkover survey recorded a total 59 post medieval features along the foreshore of River Usk. Of these 59 features, eleven are assessed of low archaeological importance (**WA446, WA450, WA452, WA455, WA443, WA410, WA414, WA416, WA426, WA429 and WA435**) and are provisionally dated between the late 19th and early 20th century. These eleven features are all located on the western bank of the river and consist of remnants of abandoned structures associated with the past uses of Alexandra Docks.

Western Bank of the River

- 6.2.2 From the transporter bridge toward the south limit of the development area only partial remnants of wharfs and piers built around the canal basin to handle the increase in trade of the 19th and 20th century are still visible. These, once located northward of the Cork Steam packet wharf, between the wharf and the bridge, were replaced in the 20th century by a single long wharf called Fuel Wharf (**WA460**).
- 6.2.3 100m south to the fuel wharf the Cork Wharf, where the Cork steam packet steamed out in the mid-19th century for Belfast and Glasgow, is replaced today by a modern jetty built with metal cylindrical pillars (**WA459**).
- 6.2.4 Continuing southward are four wooden jetties (**WA446, WA450, WA452, WA455**) associated with an early development of the Alexandra Docks (**Plates 13 and 14**). Although partly dismantled and in poor conditions the lower timber framework of the jetties is still in place and pilings, cross bracings and drift pins are visible. The two northern jetties that were fitted with coal hoist are now the most complete and still retains some of the fittings and upper structural elements (upper wales). Built before the end of the 19th century these structures were closely connected to train rails. Possible infrastructures for

operating the piers were found in the proximity (**WA449, WA448, WA458**). These historical features lie within the study areas for both Options 2 and 3 of the proposed development and should be recorded if impacted.

- 6.2.5 The bank is still active, as indicated by three modern floating pontoons that are in between the remnants of the jetties. Two watercraft are in state of abandon on the foreshore (**WA457, WA451**). These consist of a small (4.8m x 1.8m) clinker-built boat nailed with modern machined nails with propeller and shaft still in situ and a small aluminium boat (3.8m x 1.7m). The boats are modern and dated to the second half of the 20th century.
- 6.2.6 Possibly associated with the enlargement of the Alexandra docks at the very beginning of the 20th century is the 120m long ferroconcrete wharf (**WA443**) which still retains at its ends two bollards (**WA443-447**) (**Plates 13 and 14**). From its southern edge the old breakwater and wooden posts at the entrance of the harbour are visible against the bank (**WA442**). The wharf also lies within the study areas for route options 2 and 3.
- 6.2.7 To the south of the ferroconcrete wharf lie are six timber structures dated to the late 19th and early 20th centuries and also possibly associated to the construction and use of the Alexandra Docks (**WA410, WA414, WA416, WA426, WA429 and WA435**).
- 6.2.8 Two of these timber features take the form of semi-circular frame towers and are situated at what was the entrance of the North Dock (now enclosed and used as a dry dock). They represent remains of the previous dock gates that were located here prior to the new docks being constructed (**WA435 and WA429**). A further concrete wall (**WA431, WA432**) was seen adjacent to the former North Lock. This wall was built when the original north dock for the Alexandra Docks was converted for use as a dry dock. The old entrance to the Alexandra Docks lies within the study areas for both options 1 and 3.
- 6.2.9 Two similar timber structures (**WA410, WA414**) are found at the mouth of the former East lock, approx. 380 m to the south, and constitute part of the entrance structures for this lock, which was built as part of the southward extension of the Alexandra Docks. These lie within the study area for route option 1.
- 6.2.10 Two further, and possibly contemporary, timber structures lie within the shoreline between the two dock entrances (**WA416, WA426**). Their condition suggests that they are modern but have been out of use, and therefore not maintained, for a considerable period of time.
- 6.2.11 There are 17 active jetties (**WA408, WA409, WA411-413, WA415, WA418-425, WA427, WA428 and WA434**) along the western bank. These are not permanent structures and are of little archaeological significance.

Eastern Bank of the River

- 6.2.12 Four timber dock features (**WA 417-420**) recorded on the eastern bank are the only features seen during the survey that are likely to have more than a very low level of archaeological importance. These all relate to the construction and use of the Union Dry Docks on the eastern bank of the River Usk in the late 19th and 20th centuries. The Union Dry Docks have undergone significant changes since their original construction, with very little of the original layout surviving apart from the docks themselves. The structures on the foreshore related to the use of these docks are of some significance on a local scale, therefore, and may be regarded as of low to moderate importance. The chain (**WA 405**), the permanent jetty (**WA 406**) and the concrete mooring block (**WA 407**) are all modern and still in use, and are therefore considered to be of very low archaeological importance.

- 6.2.13 There is a considerable amount of jetsam (**WA440-441**) on the floodplain and mud slope, which would suggest that the area is flooded on a regular basis.
- 6.2.14 Possible elements of eastern bank drainage system with pills discharging into the tidal channel (**WA436, WA439**) were also recorded during the survey.

Route options 1, 2 and 3

- 6.2.15 The study area for proposed route Option 1 incorporates the largest number of historic features within the foreshore, including the features associated with both of the former locks on this bank of the river (**WA435, WA429, WA410** and **WA414**) and possible contemporary features (**WA416, WA426**) between the two entrances. The study area for Option 2 incorporates a number of jetty features (**WA446, 450, 452, 455**). These also lie within the study area for Option 3 would impact the jetty features and the timber features at the old access of the North Alexandra Docks (**WA435 and 429**).

7 SUMMARY OF HERITAGE ASSETS

7.1 Introduction

- 7.1.1 The planning policies listed in **Section 3** aim to promote development proposals that will preserve, conserve and, where possible and appropriate, enhance the historic environment; and that will seek to avoid or mitigate against harm.
- 7.1.2 In line with national and local planning policies, development proposals which have the potential to affect designated and non-designated heritage assets and their settings will be permitted only where it can be demonstrated, along with sufficient evidence, that the asset would be conserved and, where appropriate, enhanced.
- 7.1.3 A description of the significance of heritage assets directly affected by the proposed development, based on the current level of available information, is presented below in line with current planning policy.

7.2 Known heritage assets

Designated heritage assets

- 7.2.1 Only four designated heritage assets lie within the Study Areas, comprising the Grade I listed Newport Transporter Bridge (**WA34**), the eastern end of which lies within the study area for option 2, and three listed buildings. These are the Grade II Listed Pye Corner Farm (**WA36**), which lies within the central area of the option 1 as well as Tatton Farm (**WA37**) and The Vicarage (**WA40**), both Grade II Listed Buildings within the eastern part of the route corridor, and therefore within the study areas of all three route options.
- 7.2.2 A number of the field boundaries within the western and eastern part of the proposed route corridor preserve elements of the 19th century and earlier enclosure patterns and as such may be considered to have historic value, where these are marked by hedgerows they may be considered to be historically important, as defined by the *Hedgerow Regulations 1997* (amended 2002). Map regression has established that a number of these boundaries can be identified on maps extending as far back as the Tredegar Estate maps of the late 18th century.

Non-designated heritage assets

- 7.2.3 Previous geophysical survey and evaluation has already identified a number of sites along the proposed route corridor including prehistoric activity identified at Great Pencarn Farm

(**WA106**) and near Llandeenny (**WA141** and **WA515**). Iron Age and Romano-British activity was also located at Stud Farm, Coedkernew (**WA505** and **WA506**), Great Pencarn Farm (**WA106**) and at Llandeenny (**WA514**). Medieval and post-medieval settlement was noted at New Park Farm and Penylan Farm, Castleton (**WA501** and **WA502**) and Greenmoor Arch industrial Estate (**WA140**).

- 7.2.4 Additionally a number of potential moated sites have been identified from the LiDAR images (**WA225**, **WA235**, **WA237**, **WA238**, **WA263**, **WA274**, **WA278**, **WA279**, **WA294** and **WA296**) and there is considerable potential for as yet unknown archaeological sites with the proposed route corridor.
- 7.2.5 In addition to the four listed buildings described above, this assessment has identified a further thirty eight historic buildings and structures along the line of the route which lie within the study areas for the three route options. Where the route options are combined, the majority are domestic structures, with houses and farms dominating, whilst industrial and dockyard structures dominate the central areas of the route where the route options diverge. Where the routes are combined, the majority of the historic buildings lie away from the centre of the proposed route, and the main impacts are likely to relate to the setting of these historic buildings. The one obvious exception to this is the Grade II listed Magor Vicarage, which lies in the centre of the proposed route to the west of Magor.
- 7.2.6 In the central area, and in particular in the area of Newport Docks, there are differences in the likely impact of the three routes. Option 1 appears most likely to have the greatest impact in terms of the number of historic structures likely to be affected, but has the benefit of being further from the Transporter Bridge, and less likely to have a significant impact on its setting than Options 2 or 3. Conversely, Options 2 or 3 are less likely to directly or indirectly impact as many historic structures in this area than Option 1, but are both sited considerably closer to the Transporter Bridge, and therefore much more likely to impact upon its setting.
- 7.2.7 Survey of the foreshore on the banks of the River Usk has established that there are a number of historic structures in this area. The majority occur on the western bank of the river, and are modern structures associated with the construction and use of Newport Docks, including both jetties and entrance structures for the two former locks on the river. On the eastern bank, a smaller number of historic structures was identified, of which the most significant probably comprise structures related to the former Union Docks. All of the features identified during the course of this survey are likely to be modern in date, but there is nevertheless a potential for the survival of earlier deposits, features and structures buried beneath the mud of the foreshore.

7.3 Potential buried archaeological remains

- 7.3.1 Based on the evidence presented within the baseline resource (**Section 4**) there is considered to be the potential for as yet unknown buried archaeological remains within the proposed route corridor.
- 7.3.2 This is summarised in **Table 1** below.

7.4 Assessment of survival and previous impacts

- 7.4.1 Due to the nature of the estuarine environment with successive phases of inundation and stabilisation as well as fluctuating sea levels there is potential for earlier archaeological remains to be deeply stratified and concealed beneath later deposits. Geo-technical investigations already conducted along the route have demonstrated variation in the

stratigraphic sequence with number of the test pits identifying Middle Wentlooge peats and clays which could potentially date from the Neolithic into the Iron Age at anything between 0.2-5.0m below current ground level (**WA507**) (Wessex Archaeology 2008b). As a result there is the potential even in built up areas for earlier deposits and potentially archaeological sites to survive.

- 7.4.2 The area of Alexandra Dock is known to have been deeply impacted by modern development however even here the potential for deeply buried early remains cannot be entirely discounted.

7.5 Summary

- 7.5.1 The following table (**Table 1**) presents a summary of the known and potential remains within the Site which may be subject to direct impacts as a result of the proposed development.
- 7.5.2 The risk of encountering heritage assets has been given a rating, calculated using professional judgement based on the various datasets assessed during the course of the study.
- 7.5.3 A survival rating has been determined following a review of previous impacts identified within the Site, based on a Site visit, cartographic sources and other relevant Site information (e.g. HER event records).

Table 1: Summary of known and potential remains within the Site

Risk	Period and Description		Areas of potential	Significance	Value	Survival
High	Iron Age and Romano-British	Iron Age and Romano-British settlement activity has been identified along the proposed route corridor (WA505 , WA506 , WA511 , WA513 and WA514) as well as recorded finds of Roman coins (WA129 , WA133 and WA134). There is also evidence that some of the enclosure and drainage of the Levels may also date to this time (WA215). Evidence of Iron Age and Romano-British settlement and colonisation of the Levels will contribute to local and regional research objectives.	Since much of this activity has been located as after geophysical survey along the previous proposed route the potential remains for other sites in areas yet unsurveyed.	Regional to local	Evidential	Extant
	Post-medieval	Post-medieval settlement and enclosure is recorded throughout the Study Area reflected the increasing colonisation of The Levels at this time. This evidence is of value to the local and wider regional understanding of the Gwent Levels at this time.	Post-medieval activity and landscape features and should be expected throughout the route corridor except where truncated by later development.	Regional to local	Evidential, historical	Extant
	Modern	A number of the modern sites along the route contribute to the local history of Newport in particular that of the historic dockyard and defensive sites related to WWII.	Modern development is largely restricted to the central route areas.	Local	Evidential, historical	Extant
Medium	Bronze Age	Geo-technical investigation has established surviving peat deposit thought to relate to the Bronze Age landscape at a number of points along the route (WA507). There is only one confirmed site of Bronze Age activity (WA106), though the discovery of two flat axes suggests further activity (WA135). However the evidence from Great Pencarn Farm suggests that Bronze Age activity may lie beneath later Iron Age and Romano-British sites and likely may be poorly visible within the archaeological record. Remains of this date are likely to contribute to regional research objectives about the exploitation of the Gwent Levels at this time.	Areas of greatest potential will be where the depositional sequence indicates drier more vegetated land. In areas where modern disturbance exceeds depths of 3m sites of this period are likely to have been heavily truncated or removed.	Regional	Evidential	Extant



	Mesolithic	Two flint scatters at Llandeenny demonstrate Mesolithic activity on the dryland/wetland interface (WA515) though it is likely that the wetland areas would also have been exploited. Due to its ephemeral nature Mesolithic activity is often difficult to locate with the archaeological record but if present is likely to contribute to regional and potentially national research objectives.	Llandeenny is currently the only known Mesolithic site within the Study Area though there must be considered to be potential for similar sites along the dryland/wetland interface at the western end of the route.	National to regional	Evidential	Unknown
	Medieval	Medieval settlement is recorded at New Park Farm, Castleton (WA501) and a number of the nearby settlements and churches are documented at this time. This evidence is of value to the local and wider regional understanding of the Gwent Levels at this time.	It is likely that much of the Study Area lay within the rural and agricultural hinterland of medieval settlement activity though there is some potential for small farmsteads along the route and some of the undated moated sites may date to this time.	Regional to local	Evidential	Extant
Unknown	Palaeolithic	The Palaeolithic potential of the area is largely unknown though finds at Severn crossing suggest some potential in the wider area. If present such remains are likely to contribute to regional and potentially national research objectives.	The exact potential for this period and its likely distribution is largely unknown.	National to regional	Evidential	Unknown
	Neolithic	There are few recorded Neolithic sites or features in the area though a skull is thought to have been recovered from the dockyard area. Due to the lack of evidence of this period any features of this period would contribute to regional research objectives.	The exact potential for this period and its likely distribution is largely unknown.	Regional	Evidential	Unknown
	Early medieval	The Early medieval potential of the area is largely unknown though there is documented activity within the vicinity of Newport few sites have been confidently documented to this period. There may be potential for some medieval sites to have earlier antecedents. Due to the lack of evidence of this period any features of this period would contribute to regional research objectives.	The exact potential for this period and its likely distribution is largely unknown.	Regional	Evidential	Unknown

8 CONCLUSIONS

- 8.1.1 This assessment has determined that one Grade I Listed Building (**WA34**) and three Grade II Listed Buildings (**WA36**, **WA37** and **WA40**) are situated within the Study Area. Not just direct impacts but also indirect impacts to the setting of these heritage assets will need to be considered at a later stage of the project. Of particular concern is the Grade II listed Magor Vicarage, which lies close to the presumed centreline of the route, and could potentially suffer direct impacts.
- 8.1.2 An assessment of the unlisted historic buildings along the course of the route has determined that the majority are post-medieval or modern in origins. At either end of the route, and on the Gwent levels themselves, these are dominated by domestic houses and farm complexes. None lie close to the likely centreline of the route, and the primary impacts are likely to be indirect impacts to the setting of these assets, and this should be a material consideration in designing the landscape mitigation for the route.
- 8.1.3 Both Newport Docks and the Newport Transporter Bridge are key aspects of the historical landscape of Newport, and both stand witness to the rise of the city on the back of the docks and the wider welsh mining industry. In a sense they both represent the apogee of the city, and are key to an understanding of its history. The three different routes diverge to the south of Tredegar Park, and take different routes through the Area of Newport Docks and across the Rivers Ebbw and Usk. Assessment of these options has indicated that Option 1 is likely to affect the greatest number of historic structures, some possibly through direct as well as indirect impact, but that this is also least likely to negatively affect the setting of the Grade I listed Transporter Bridge. Conversely, whilst Options 2 and 3 are likely to impact on fewer historic buildings in the Newport Docks area, these lie much closer to the Transporter Bridge and may well affect its setting more.
- 8.1.4 Investigation of the foreshore of the River Usk has identified a number of modern structures. These predominantly lie on the western bank of the river, and relate to the construction, use and alteration of the Newport Docks. A small number of structures on the eastern bank appear to relate to the Union Docks. Assessment of the three route options indicates that Option 1 would most likely impact the greatest number of these, but their historical significance should be regarded as relatively low. Although the structures identified were all likely to be modern in date, there is a potential for the survival of earlier structures, deposits and features below the mud of the foreshore.
- 8.1.5 This assessment has established that there is an archaeological interest within the Site. This is defined as the potential for the presence of buried archaeological remains, in particular relating to features associated with modern, post-medieval, Iron Age and Romano-British activity though other periods are also anticipated. Archaeological investigations as part of earlier iterations of this project have clearly established that there is a potential for the survival of archaeological remains across the Gwent Levels and the fen-edge, but archaeological investigations within the area of Newport Docks and its surrounds have inevitably been restricted due to the built up nature of the area. As such, much of the assessment of the 3 different route options must be considered in the light of this, and with the understanding that there is not sufficiently clear evidence on the likely potential for buried archaeological remains along each of the three route options for a meaningful assessment of the three routes to be made in this regard. Due to the regional value of the Gwent Levels much of the potential archaeological would probably have regional to national significance.



- 8.1.6 Much of the landscape pattern within the western and eastern part of the proposed route corridor preserves elements of the 19th century and earlier enclosure and as such may be considered to have historic value, where these are marked by hedgerows they may be considered to be historically important, as defined by the *Hedgerow Regulations 1997* (amended 2002).
- 8.1.7 The Gwent levels are a Registered landscape of Outstanding Historical Importance, and as such, any development which impacts upon them must go through a formal assessment process. In the light of this it is anticipated that an ASIDOHL2 assessment will form a necessary part of any further archaeological work on the scheme, regardless which option is finally favoured.

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8.3 Historic Environment Records

The Glamorgan Gwent Archaeological Trust Historic Environment Record (GGAT HER)
Gwent Archives (GA)

8.4 Cartographic and Documentary Sources

Estate maps

- 1760 A plan of the level of Wenlloogh containing the parishes of Basalleg, Coydkenew, Marshfield, St Mellons and Rumney parishes of Peterstown and St Brides situate in the county of Monmouth (Tredegar 1012)
- 1760 Map of Bassaleg parish. (WIAbNL 0028462301758)
- 1758 Pye Corner Farm (Van Estate Map 19)
- 1758 Traston Farm (Van Estate Map 10a)
- 1777 Map of farms in Coed Kernew, Marshfield, St Mellons and Michaelstone. Tredegar Vol. 1 094/8/3
- 1820 A plan of the town and borough of Newport, and parish of St. Woollos in the county of Monmouthshire. Tredegar 918 140/1/1

Tithe maps

- 1840 Plan of the parish of Christchurch in the County of Monmouth by Thomas Morris
- 1842 Plan of the parish of Nash in the County of Monmouth by Thomas Morris
- 1842 Plan of the parish of St Brides in the County of Monmouth by Thomas Morris
- 1842 Plan of the parish of Undy in the County of Monmouth by Thomas Morris
- 1843 Plan of the parish of Coedkernow in the County of Monmouth by Thomas Morris
- 1844 Plan of the parish of Bassaleg in the County of Monmouth by William Jones
- 1844 Plan of the parish of Marshfield in the county of Monmouth by Thomas Morris
- 1845 Plan of the parish of St Woollos in the County of Monmouth by Thomas Morris
- 1845 Plan of the parish of Whitson in the County of Monmouth by Thomas Morris
- 1846 Plan of the parish of Redwick in the County of Monmouth by Thomas Morris
- 1847 Plan of the parish of Magor in the County of Monmouth by Thomas Morris

Alexandra Docks

- 1875 Plan of Alexandra Docks, Newport
- 1886 Bristol Channel. Nash Pt to New Passage. Surveyed by Staff Commr. W. E. Archdeacon RN
- 1907 Alexandra (Newport and South Wales) Docks and Railway. Plan showing existing docks and Extensions
- 1909 Alexandra (Newport and South Wales) Docks and Railway. Proposed customs watch-house, South lock.

- 1910 Alexandra Newport Docks. New shed on South Quay
- 1912 Alexandra (Newport and South Wales) Docks and Railway. General Plan
- 1914 Alexandra (Newport and South Wales) Docks and Railway. General Plan
- 1928 Coal shipping appliances Alexandra Docks, Import Cranes (Hydraulic) Alexandra Docks, Import Cranes (Electric) Alexandra Docks
- 1930 Coal shipping appliances Alexandra Docks, Import Cranes (Hydraulic) Alexandra Docks, Import Cranes (Electric) Alexandra Docks
- 1933 Coal shipping appliances Alexandra Docks, Import Cranes (Hydraulic) Alexandra Docks, Import Cranes (Electric) Alexandra Docks
- 1941 Coal shipping appliances Alexandra Docks, Import Cranes (Hydraulic) Alexandra Docks, Import Cranes (Electric) Alexandra Docks
- 1950 British Transport Commission Plan of the Alexandra Docks

Ordnance survey

- 1882-3 Monmouthshire 25" (1:2500)
- 1886-7 Monmouthshire 6" (1:10,560)
- 1901-2 Monmouthshire 25" (1:2500)
- 1901-2 Monmouthshire 6" (1:10,560)
- 1920-1 Monmouthshire 25" (1:2500)
- 1922 Monmouthshire 6" (1:10,560)
- 1938-54 Monmouthshire 6" (1:10,560)
- 1954 Monmouthshire 25" (1:2500)
- 1953-4 Monmouthshire 6" (1:10,560)
- 1964-5 Monmouthshire 6" (1:10,560)
- 1969 Monmouthshire 25" (1:2500)

British Geological Survey http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html

8.5 Online resources

www.archiveswales.org.uk/ - online catalogue for archives in Wales
www.coflein.gov.uk/ - online database for the National Monuments Record of Wales
www.forestry.gov.uk/forestry/inf-d-8vpjfd - Ancient Woodland Inventory for Wales
<http://www.newportpast.com/index.htm> - history and online resources for Newport
<http://www.cofiadurcahcymru.org.uk/arch/index.html> - Archwiliio, HER information
<http://www.old-maps.co.uk/index.html> - historic OS maps

9 APPENDICES

9.1 Appendix 1: Methodology

Study Area

- 9.1.1 A 250m Study Area around all three route options was considered in order to provide a context for the discussion and interpretation of the known and potential resource within the Site. The recorded historic environment resource within the Study Area was acquired for this assessment from sources listed below.

Sources

- 9.1.2 A number of publicly accessible sources of primary and synthesised information were consulted, including:
- *The Glamorgan Gwent Archaeological Trust Historic Environment Record (GGAT HER), comprising a database of all recorded archaeological sites, find spots, and archaeological events within the county;*
 - *National heritage datasets including the those on designated assets;*
 - *Historic manuscripts, surveyed maps, and Ordnance Survey maps held at the Gwent Record Office;*
 - *Relevant primary and secondary sources held at the Gwent Record Office and in Wessex Archaeology's own library. Both published and unpublished archaeological reports relating to excavations and observations in the area around the Site were studied;*
- 9.1.3 A bibliography of documentary, archive, and cartographic sources consulted is included in the References section of this report.
- 9.1.4 Extensive work along the line of the route had previously been undertaken in 2008, comprising a desk-based study, walkover survey, an historic map regression exercise, LiDAR analysis, earthworks survey, geophysical surveys, borehole transects, field evaluations, built heritage survey, a survey of Newport Docks, a foreshore survey of the River Usk, a historic landscape characterisation exercise and a watching brief on ground investigation works (Wessex Archaeology, 2008a, 2008b, 2008c, 2008d, 2008e and 2008f). These works in turn built on a series of earlier surveys undertaken as part of the M4 Relief Rd scheme (Wessex Archaeology 1998a – c, 1999 a and b, 2000 and 2001)
- 9.1.5 However, the decision to assess three route options meant that additional work was required to ensure that all areas were assessed to a similar standard.

Site visit

- 9.1.6 Site surveys were undertaken on the 12th-13th February 2014. The aim of the visit was to update and extent the previous walkover survey, foreshore survey and vernacular building survey and to identify any potential impacts not evident from secondary sources. Weather conditions were overcast with occasional showers.
- 9.1.7 Recording was undertaken in the field using a Compaq IPAQ handheld PC connected to a Garmin Etrek handheld GPS device. This combination provided a stated accuracy of +/- 1m, although this sometimes reduced to up to +/- 3m under woodland cover. This equipment ran Pocket GIS software loaded with OS Landline data (1:10,000), aerial photographic coverage of the route, LiDAR plots and Arcview shapefiles for known archaeological monuments, as supplied by the Glamorgan-Gwent SMR and the NMR, and

Arcview shape files (shp) to record newly discovered findspots and earthworks. This package allowed the surveyors to quickly navigate around the plots and to record earthworks within the stated accuracy range of the GPS device.

- 9.1.8 As appropriate, digital photographs of archaeological features and sections of were taken to provide a record of the survey and to aid the production of this report. The location and direction of view of each photograph was recorded within the project database. More general observations were recorded in the project diary as appropriate.
- 9.1.9 A database developed for the survey was loaded onto each mobile PC. This allowed the survey teams to record and input data directly on-site, reducing the need to 'double-handle' data and eliminating the possibility of secondary transcription errors entering the database.

Assessment Criteria

- 9.1.10 Assessment of the significance of a site sets out to identify how particular parts of a place and different periods in its evolution contribute to, or detract from, identified heritage values associated with the site. This approach considers the present character of the site based on the chronological sequence of events that produced it, and allows management strategies to be developed that sustain and enhance the significance of heritage assets.
- 9.1.11 The level of the assessment should be proportionate to the significance of the asset. However, there is no single accepted guidance for the assigning of different levels of the overall significance to heritage assets. As a result, based on professional judgement and available guidance, the following criteria were developed in order to determine the significance of heritage assets (**Table 4**):

Table 2: Summary of factors for determining significance of heritage assets

Significance	Factors determining significance
International	World Heritage Sites Assets of recognised international importance Assets that contribute to international research objectives
National	Scheduled Ancient Monuments Grade I and Grade II* Listed Buildings Grade I and Grade II* Registered Parks and Gardens Undesignated assets of the quality and importance to be designated Assets that contribute to national research agendas
Regional	Grade II Listed Buildings Grade II Registered Parks and Gardens Conservation Areas Assets that contribute to regional research objectives
Local	Locally listed buildings Assets compromised by poor preservation and/or poor contextual associations Assets with importance to local interest groups Assets that contribute to local research objectives
Negligible	Assets with little or no archaeological/historical interest
Unknown	The importance of the asset has not been ascertained from available evidence

- 9.1.12 Current national guidance for the assessment of the significance of heritage assets is based on criteria provided by Cadw in the document *Conservation Principles for the Sustainable Management of the Historic Environment in Wales* (Cadw 2011). Within this document significance derives from the sum of values (aesthetic, communal, evidential and historical) attached to heritage assets. The criteria for which heritage assets are valued are presented below (**Table 5**).



- 9.1.13 In order to accurately assess the significance of a heritage asset, it is necessary to understand the relative contribution of each identified heritage value to the overall significance of the asset. Wessex Archaeology developed a method for assessing the relative importance of each of the values ascribed to heritage assets and their potential to contribute to people's understanding of the past, based on the *Conservation Principles* and professional judgement. This approach is presented in **Table 5**, below:

Table 3: A method for assessing the importance of values of heritage assets

Value	Criteria	Importance	Factors determining the relative importance
Evidential	Deriving from the potential of a place to yield evidence about past human activity.	High	There is a high potential for the heritage assets to provide evidence about past human activity and to contribute to our understanding of the past. This potential relates to archaeological sites that are likely to survive (both below and above ground) and, in the absence of written records, provide the only source of evidence about the past, resulting in enhanced understanding of the development of the area. It also relates to other physical remains of past human activity, such as historic fabric within buildings and surviving elements in the historic landscape which contribute to its historic character
		Medium	The potential for heritage assets to yield physical evidence contributing to the understanding of the development of the area is recognised, but there may be fewer opportunities for new insights to be deduced due to the nature of the heritage assets in question, our knowledge of the past of the area or subsequent changes to the development of the area throughout history. The potential for archaeological deposits to contribute to an understanding of the development of an area may not be fully recognised due to the current level of understanding of the local and regional history. The potential may also be impacted, in a limited way, by later development.
		Low	The physical remains are preserved in a limited way – limited assets survive, very few are recorded or assets are known to have been partially or significantly damaged. Low evidential value of archaeological deposits may be affected by the current lack of research within the area, but this does not preclude for further remains of higher value to be discovered.
		None	There are no surviving physical remains from which evidence about past human activity could be derived (assets are known to have been removed or destroyed by later activity)
Historical	Deriving from the ways in which past people, events and aspects of life can be connected through a place to the present. It tends to be illustrative or associative.	High	The legible heritage assets are clearly perceptible in the landscape/townscape and the links between the assets and the history or prehistory of the area (illustrative value) or to historical events or figures associated with the area (associative value) are easily visible and understandable. The high value is not precluded by some degree of the 20th/21st century alterations to the historic buildings and landscapes.
		Medium	The legible heritage assets are present in the area, but their legibility may have been compromised by some form of alteration to the asset or its surroundings (i.e. rural parish church now situated within a suburban residential development). Even in their present form, such assets enable the local community to visualise the development of the area over time as there are potential associations between assets. The presence of these assets may contribute to an understanding of the development of the area. Further research, including archaeological investigations, may clarify these associations and elucidate the contribution of these assets to the history of the wider area.
		Low	The historical associations of the asset are not clearly understood, as a result of severe changes to the asset or its surroundings



		None	There are no legible heritage assets and their associations are not understood.
Aesthetic	Deriving from the ways in which people draw sensory and intellectual stimulation from a place.	High	The aesthetic values of the heritage assets are visually perceptible within sympathetic surroundings, developed through conscious design or fortuitously, throughout prehistory and history. The completeness or integrity of the heritage assets within the landscape is clear and their contribution to the aesthetics of the surrounding area is significant.
		Medium	The aesthetic qualities of the individual assets or landscapes are legible, but there may have been considerably impacted upon by the modern, unsympathetic development.
		Low	The aesthetic qualities of the individual assets or landscapes have been significantly impacted upon by the modern development as a result of which the aesthetic value is not clear, however, there may be a possibility for improvement.
		None	Assets have no aesthetic values as they have been removed by inconsiderate modern development. Buried archaeological remains are not ascribed aesthetic values as, whilst buried, they are not visible/perceptible in their context.
Communal	Deriving from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values, but tend to have additional and specific aspects.	High	Heritage assets which could be used to engage the community through interpretation. Assets that clearly form part of a wider history of an area which can be drawn into a narrative. There may already have been a degree of interpretation and/or the community/public already has access to at least some of the heritage assets within the area.
		Medium	The ability for the heritage assets to contribute to the history of the place may be limited by the current understanding, their legibility within the townscape or through limited access. Potential for improvement is recognised
		Low	There are few known heritage assets which make it difficult to elucidate their history or apply it to a wider interpretation. There is no access or the legibility of the heritage assets is negligible.
		None	Heritage assets that have been destroyed. Heritage assets with little or no archaeological/historical interest to the local community

9.2 Appendix 2: Terminology used within this report

9.2.1 The following terminology used in this assessment follows definitions contained within appropriate guidance and legislative documents and has been collated in tabulated format for convenience.

Glossary

Archaeological interest	There will be archaeological interest in a heritage asset if it holds, or potentially may hold, evidence of past human activity worthy of expert investigation at some point. Heritage assets with archaeological interest are the primary source of evidence about the substance and evolution of places, and of the people and cultures that made them.
Conservation (for heritage policy)	The process of maintaining and managing change to a heritage asset in a way that sustains and, where appropriate, enhances its significance.
Designated heritage assets	World Heritage Sites, Scheduled Monuments, Listed Buildings, Protected Wreck Sites, Registered Park and Gardens, Registered Battlefields and Conservation Areas designated under the relevant legislation.
Heritage asset	A building monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage assets include designated heritage assets and assets identified by the local planning authority (including local listing).
Historic environment	All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora.
Historic environment record	Information services that seek to provide access to comprehensive and dynamic resources relating to the historic environment of a defined geographic area for public benefit and use.

Setting of a heritage asset	The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.
Significance (for heritage policy)	The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.
Value	An aspect of worth or importance

Chronology

Palaeolithic	900,000 – 9500 BC
Early Post-glacial	9500 – 8500 BC
Mesolithic	8500 – 4000 BC
Neolithic	4000 – 2200 BC
Bronze Age	2200 – 700 BC
Iron Age	700 BC – AD 43
Romano-British	AD 43 – 410
Early medieval	AD 410 – 1066
Medieval	1066 – 1500
Post-medieval	1500 – 1800
19th century	1800 – 1899
Modern	1900 – present day

9.3 Appendix 3: National and Local Historic Environment Policies

National planning policy

Policy Ref.	Title	Scope
n/a	Ancient Monuments and Archaeological Areas Act 1979 (as amended)	Scheduled Monuments and Archaeological Areas of Importance (AAIs or their equivalent) are afforded statutory protection and the consent of Welsh Government, as advised by Cadw, is required for any works.
n/a	Planning (Listed Buildings and Conservation Areas) Act 1990	Works affecting Listed Buildings and Conservation Areas are subject to additional planning controls administered by Local Planning Authorities (LPAs). Cadw are a statutory consultee in works affecting Grade I or II* Listed Buildings.
PPW – Chapter 6	Development management and the historic environment – Archaeological remains. Para. 6.5.1	The desirability of preserving an ancient monument and its setting is a material consideration in determining a planning application, whether that monument is scheduled or unscheduled. Where nationally important archaeological remains, whether scheduled or not, and their settings are likely to be affected by proposed development, there should be a presumption in favour of their physical preservation in situ. In cases involving lesser archaeological remains, local planning authorities will need to weigh the relative importance of archaeology against other factors, including the need for the proposed development.
PPW – Chapter 6	Development management and the historic environment – Archaeological remains. Para. 6.5.3	Where local planning authorities decide that physical preservation in situ of archaeological remains is not justified in the circumstances of the case, and that development resulting in the destruction of the archaeological remains should proceed, before granting planning permission the authority needs to be satisfied that the developer has made appropriate and satisfactory provision for the archaeological investigation and subsequent recording of the remains and the publication of the results. Archaeological investigations should be carried out before development commences, working to a project brief prepared by the planning authority.
PPW – Chapter 6	Development management and the historic environment – Listed Buildings. Para. 6.5.9	Where a development proposal affects a listed building or its setting, the primary material consideration is the statutory requirement to have special regard to the desirability of preserving the building, or its setting, or any features of special architectural or historic interest which it possesses.
PPW – Chapter 6	Development management and the historic environment – World heritage sites and historic landscapes, parks and gardens. Para. 6.5.25-25	World Heritage Sites are a material consideration to be taken into account by local planning authorities in the determination of planning applications, and by the Welsh Government in determining cases on appeal or following call-in. The impact of development proposals on both the sites and their settings should be carefully considered. Local planning authorities should protect parks and gardens and their settings included in the first part of the 'Register of Landscapes, Parks and Gardens of Special Historic Interest in Wales'. Cadw should be consulted on planning applications affecting grade I and II* sites and the Garden History Society should be consulted on all parks and gardens on the Register. Information on the historic landscapes in the second part of the Register should be taken into account by local planning authorities in considering the implications of developments which are of such a scale that they would have a more than local impact on an area on the Register. The effect of proposed development on a park or garden contained in the Register of Landscapes, Parks and Gardens of Special Historic Interest in Wales, or on the setting of such a park or garden, may be a material consideration in the determination of a planning application.

Policy Ref.	Title	Scope
Welsh Office Circular 60/96	Planning and the Historic Environment: Archaeology	Archaeology is a material consideration in the planning process and LDPs should include policies for the protection, enhancement and preservation of sites and their settings. There is a presumption in favour of the preservation in situ of nationally important remains and their settings, whether Scheduled or not. Planning applications should include an assessment of likely impacts on archaeology. It is reasonable for an LPA to require archaeological evaluation in order to make an informed and reasonable decision.
Welsh Office Circular 61/96	Planning and the Historic Environment: Historic Buildings and Conservation Areas	Guidance on protection and enhancement of the historic environment including built heritage and historic landscape through the Local Development Plans (LDPs). LPAs must inform statutory consultees of works involving the demolition of part or the whole of a listed building. LPAs must also inform the Secretary of State of all developments affecting Grade I and II* listed buildings and all work affecting the exterior of Grade II listed buildings
n/a	Hedgerow Regulations 1997 (amended 2002)	Under the Hedgerow Regulations 1997, hedgerows are deemed to be historically Important if they are over 30 years old and if: A hedgerow incorporating, or associated with, an archaeological feature or site which is: a) Included in the schedule of monuments compiled by the Secretary of State under section 1 (schedule of monuments) of the Ancient Monuments and Archaeological Areas Act 1979; or b) Recorded at the relevant date in a Sites and Monuments Record c) A hedgerow that forms an integral part of a pre-1845 field system, or a pre-1870 enclosure field system In practice hedgerows are deemed Important under the above regulations if they can be demonstrated to exist on the appropriate pre-1845 parish tithe or enclosure map.

Local planning policy:

Newport Unitary Development Plan 1996 – 2011: Adopted Plan (May 2006)		
Policy ref.	Title	Scope
SP9	Conservation of the Built Environment	Buildings or groups of buildings of architectural or historic interest, and also other features which contribute to the quality of the built environment will be protected and, where appropriate, enhanced.
CE 15	Listed Buildings	Buildings of special architectural or historic interest, their settings and features of architectural or historic interest will be protected and preserved
CE 25	Ancient Monuments and Archaeological Remains	Scheduled Ancient Monuments and sites recognised as being of national importance or remains of more than local archaeological or historic interest will be preserved and enhancement of their setting will be sought.
CE26	Archaeologically Sensitive areas	Within the Archaeologically Sensitive Areas of: Caerleon, The Levels, Lower Machen and the City Centre, details of all proposed ground works and services, along with a written assessment of the likely archaeological impact of the development (archaeological statement) will be required.
CE 27	Archaeological	Where development is likely to affect a known or suspected site of archaeological significance, further information (which

	Evaluation	may include archaeological field evaluation) will be required before the proposal is determined, so that the effect of the proposed development on the archaeological resource can be determined.
CE 28	Development on Archaeological Sites	Where development is permitted on a site of archaeological interest and it is not possible to preserve the remains in situ, the developer will be required to implement, prior to the commencement of the development, or as part of it, measures to mitigate the effect on the remains, which may include the carrying out of prior excavations and recording the archaeological evidence.
CE 29	Historic Landscapes, Parks and Gardens	There will be a presumption in favour of the protection, conservation and, where appropriate, restoration of sites included in the registers of landscapes, parks and gardens of special historic interest.
T 18	Port Development	The retention and development of cargo handling facilities at Newport Docks and wharves on the River Usk south of the Southern Distributor Road will be supported, including ship to rail interchange facilities and the development of port related industries.
Newport Local Development Plan: Revised Deposit Plan (December 2013)		
Policy ref.	Title	Scope
SP9	Conservation of the Natural, Historic and Built Environment	The conservation, enhancement and management of recognised sites within the natural, historic and built environment will be sought in all proposals.
CE5	Historic Landscapes, Parks, Gardens and Battlefields	Sites included in the Register of Landscapes, Parks and Gardens of Special Historic Interest and Historic Battlefields should be protected, conserved, enhanced and where appropriate, restored. Attention will also be given to their setting.
CE6	Locally Listed Buildings and Sites	Buildings and sites of local significance for their architectural or historic interest will be included on a local list and should be protected from demolition or inappropriate development.
CE7	Archaeology	Development proposals will normally be required to undertake an archaeological impact assessment before the proposal is determined: I) where groundworks and/or the installation of services are proposed within the archaeologically sensitive areas of Caerleon, The Levels, Lower Machen and the City Centre, or; II) within other areas of recognised archaeological interest.
CE8	Conservation Areas	Development within or adjacent to Conservation Areas will be required to: I) be designed to preserve or enhance the archaeological or historic character or appearance of the area, having regard to the Conservation Area appraisal where appropriate. II) avoid the removal of existing historic features, including traditional shopfronts and joinery.

		<p>lii) use materials which are traditional, or appropriate to their context.</p> <p>lv) complement or reflect the architectural qualities of nearby buildings which make a positive contribution to the character of the area.</p> <p>V) pay special attention to the settings of buildings, and avoid the loss of any existing domestic gardens and open spaces which contribute to the character of the area.</p> <p>Vi) avoid adverse impact on any significant views, within, towards and outwards from the Conservation Area.</p>
Monmouthshire County Council Unitary Development Plan 1996 – 2011: Adopted Plan (June 2006)		
Policy ref.	Title	Scope
SP 7	Conservation of the Historic Environment	The Plan will promote the preservation or enhancement of Monmouthshire's historic environment. Development that would harm the special character of the historic environment will not be permitted.
DES 5	Existing trees / hedgerows and development	Development will not be permitted if it results in unacceptable tree or hedgerow loss. Tree Preservation Orders will be made where trees worthy of such protection are under threat from development proposals. Where some loss of trees or hedges is considered acceptable adequate provision for mitigatory planting will be required.
CH 1	Development in Conservation Areas	<p>Within Conservation Areas, development proposals will be approved if they:</p> <ul style="list-style-type: none"> • preserve or enhance the architectural or historic character and appearance of the area and its landscape setting; • have no serious adverse effect on significant views into and out of the conservation area; • have no serious adverse effect on significant vistas within the area and the general character and appearance of the street scene and roofscape; • use materials appropriate to their setting and context and which protect or enhance the character and appearance of the Conservation Area; and • pay special attention to the setting of the building and its open areas. <p>Where development is acceptable in principle it should complement or reflect the architectural qualities of adjoining and other nearby buildings (unless these are harmful to the character or appearance of the area) in terms of its profile, silhouette, detailing and materials. However, good modern design may be acceptable particularly where new compositions and points of interest are created. Materials must be durable and of a high quality.</p>
CH 6	Demolition of Listed Buildings	<p>Consent to demolish listed buildings will only be granted where the building is wholly beyond economic repair or re-use. The applicant must also demonstrate that:</p> <ul style="list-style-type: none"> • all reasonable efforts have been made to sustain existing uses or find viable new uses; and • adequate attempts have been made to sell the building and its freehold on the open market at a price reflecting the building's condition; and • preservation in some form of charitable or community ownership is not possible or suitable; and • detailed plans for the redevelopment of the site have been approved and a contract for those works has been let before demolition commences.
CH 7	Protection of Listed	New development that would have an unacceptable adverse effect on the setting of a listed building will not be permitted.

	Buildings	Proposals to alter or extend a listed building, or any features of special architectural or historic interest which contribute to the reasons for its listing, or its setting, will only be permitted where the special architectural or historic interest is not adversely affected. Development should be in accordance with the period, style and detailing of the listed building, relate sensitively to the parent building in terms of scale, location, design, detail and material and avoid dominating its appearance.
CH 8	Recording of Historic Features	Specialist recording, archiving and publishing may be required prior to the demolition of any listed building or other historic building within a conservation area and may be required in other cases of alteration.
CH 10	Archaeology	Proposals to develop sites where there are known archaeological remains or good reason to believe that such remains exist must incorporate appropriate measures to verify and protect the archaeological interest, including: the proper investigation and recording of the site; and a layout that, where appropriate, allows for the retention in situ of archaeological remains with adequate safeguarding of the retained features. In designated areas of special archaeological sensitivity appropriate investigations will be necessary before the principle of developing sites can be determined. Where these requirements are not complied with or serious harm to archaeological interests would occur, planning permission may be refused.
CH 11	Unscheduled Archaeological Sites	Unscheduled archaeological sites and monuments listed in the County Sites and Monuments Record, which is held by the Glamorgan Gwent Archaeological Trust, will be protected wherever possible by management measures and the reasonable control of new development.
CH 12	Scheduled Ancient Monuments	Scheduled Ancient Monuments and sites recognised as being of archaeological or historic interest will be preserved and the protection and, where appropriate, enhancement of their setting will be sought.
CH 14	Historic Landscapes, Parks and Gardens	Development that would have an unacceptable adverse impact on the character, appearance or setting of the Parks and Gardens identified in Part 1 of the Cadw/ICOMOS Register of Landscapes, Parks and Gardens of Special Historic Interest in Wales, will not be permitted. The Council will have regard to the information contained in Part 2 of the Register when considering proposals affecting historic landscapes listed in the Register. Section 10.17.3 states: The Register includes the following landscapes within the Plan area: Blaenavon Gwent Levels Lower Wye Valley
Monmouthshire Local Development Plan: Deposit Plan (September 2011)		
Policy ref.	Title	Scope
S13	Landscape, Green Infrastructure and the Natural Environment.	Development proposals must: 1. Maintain the character and quality of the landscape by: (i) recognising, protecting and, where appropriate, enhancing the distinctive landscape and historical, cultural, ecological and geological heritage, including natural and man-made elements associated with existing landscape character;

		<p>(ii) protecting areas subject to international and national landscape designations;</p> <p>(iii) preserving local distinctiveness, sense of place and setting;</p> <p>(iv) respecting and conserving specific landscape features, such as hedges, trees and ponds;</p> <p>(v) protecting existing key landscape views and vistas.</p> <p>2. Maintain, protect and enhance the integrity and connectivity of Monmouthshire's green infrastructure network.</p> <p>3. Protect, positively manage and enhance biodiversity and geological interests, including designated and non-designated sites, and habitats and species of importance.</p> <p>4. Recognise the interdependency and multi-functionality of landscape elements, green infrastructure and biodiversity features, particularly the role that connectivity can play in enhancing biodiversity, improving access to green spaces and providing opportunities for healthy activities such as walking and cycling.</p>
LC5	Protection and Enhancement of Landscape Character	<p>Development proposals that would impact upon landscape character, as defined by LANDMAP Landscape Character Assessment, must demonstrate through a landscape assessment how landscape character has influenced their design, scale, nature and site selection.</p> <p>Development will be permitted provided it would not have an unacceptable adverse effect on the special character or quality of Monmouthshire's landscape in terms of its visual, historic, geological, ecological or cultural aspects by:</p> <p>a) Causing significant visual intrusion;</p> <p>b) Causing significant adverse change in the character of the built or natural landscape;</p> <p>c) Being insensitively and unsympathetically sited within the landscape;</p> <p>d) Introducing or intensifying a use which is incompatible with its location;</p> <p>e) Failing to harmonise with, or enhance the landform and landscape; and /or</p> <p>f) Losing or failing to incorporate important traditional features, patterns, structures and layout of settlements and landscapes of both the built and natural environment.</p> <p>Particular emphasis will be given to those landscapes identified through the LANDMAP Landscape Character Assessment as being of high and outstanding quality because of a certain landscape quality or combination of qualities.</p>
HE1	Development in Conservation Areas	<p>Within Conservation Areas, development proposals should, where appropriate, have regard to the Conservation Area Appraisal for that area and will be permitted if they:</p> <p>a) preserve or enhance the character and appearance of the area and its landscape setting;</p> <p>b) have no serious adverse effect on significant views into and out of the Conservation Area;</p> <p>c) have no serious adverse effect on significant vistas within the area and the general character and appearance of the street scene and roofscape;</p> <p>d) use materials appropriate to their setting and context and which protect or enhance the character and appearance of</p>



		<p>the Conservation Area; and</p> <p>e) pay special attention to the setting of the building and its open areas.</p> <p>Where development is acceptable in principle it should complement or reflect the architectural qualities of adjoining and other nearby buildings (unless these are harmful to the character and appearance of the area) in terms of its profile, silhouette, detailing and materials. However, good modern design may be acceptable, particularly where new compositions and points of interest are created.</p>
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9.4 Appendix 4: Gazetteer of heritage assets within the Study Area (based on GGAT HER and other sources)

Table 4: Listed Buildings within the Study Areas

WA No.	NPRN	List Entry No.	Name	Grade	Easting	Northing
034	43157	17415	Transporter Bridge including E and W anchor chambers	I	331767	186220
		17414			331794	186211
		3076			331794	186207
036	410539	17542	Pye Corner Farm	II	334534	185164
037	-	17543	Tatton Farm	II	335214	185796
040	309161	16068	The Vicarage	II	342042	187635

Table 5: Scheduled Monuments within the Study Area

WA No.	NPRN	List Entry No.	Name	Easting	Northing
043	300125	MM190	Castell Glas Castle Mound	330180	185774

Table 6: Historic Buildings within the Study Area

WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
01			New Park Farm, Castleton. Farmstead shown on 1844 tithe map. Farmhouse appears to be a traditional slate-roofed long house, extended to the north-east, though now rendered and with replacement windows. Large farmyard to north originally had building ranges around three sides. Long barn range along north side, dated 1828; stone with brick dressings, extended at east end with historic openings blocked, and three oculi in north wall. Hip-roofed stable range survives along south side, complete with internal fixtures and fittings.	325165	184140	Unlisted
02			Mrytle House. Modest late 19th century, double pile plan cottage situated at road junction. Painted render and replacement windows obscure historic detail.	326490	184170	Unlisted



WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
03			Longhouse. Traditional long house of unknown date; now red painted with yellow brick dressings. Lower two-storey stone cottage attaching at south-west end, with dogtooth brick eaves detail. Slate roofs.	326650	184049	Unlisted
04			Berryhill Farm. Farmstead shown on 1844 tithe map. Group originally comprised a house and a pair of stone, two-storey cottages, now extended in brick, with two stone, slate-roofed farm buildings set perpendicular to the south. Later farm buildings have created a typical 'linear' farmyard layout, giving access to the large modern farm and nursery buildings beyond.	326930	184260	Unlisted
05			Church Farm, Coedkernew. Although this farm is of historic origins, the buildings that survive at Church Farm today give no suggestion of same. The buildings are rendered and have modern windows, and may well represent a complete rebuilding.	327650	183590	Unlisted
06			Fair Orchard Farm. A good group of regional farm buildings. The farmhouse has been rendered and re-fenestrated, such that the detail of its historic fabric is obscured. The adjacent stone, slate-roofed 18th century barn survives in relatively authentic condition, with large threshing doorway retaining its timber boarded doors, though has been extended to rear in 19th century. Stable range to the south undergoing comprehensive refurbishment. Property set back from the road behind stone-walled yards and gardens.	330120	183870	Unlisted
07			Railway bridge. Iron rail bridge consisting of a flat span constructed with rolled steel joists riveted together. Of unknown date but riveted construction suggests late 19th or early 20th century.	330325	185730	Unlisted
08			'Timber yard' and 'saw mill' marked 1887 NB timber float pre 1901 still present in 1928. 1901 map has 'timber yard' labelled on site of e-w orientation. Extension to the north (giving a similar footprint to today) occurred post 1950. The amalgamation of the Alexandra Dock Co. and the GWR in 1922 resulted in a considerable amount of money being spent on modernizing and improving the docks with the complete restructure of the timber stage (Hutton 1996). Three conjoined elements. The west part is constructed in random coursed limestone similar in appearance to that used in the construction of the steam engine and boiler buildings 23h, 23i and 23j. The same pale cream bricks have been used for dressings around the windows, doors and buttressing. The building is presently used as offices. The curved profile of the roof may hide light weight	331160	185770	Unlisted



WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
			curved Belfast or lattice roof trusses. The centre element has cast iron columns supporting a wooden beam or plate onto which bear lightweight wooden lattice trusses. The east most element is constructed from steel framing with a curved lightweight steel roof covered with corrugated iron sheeting. The buildings have been extended to the north in several phases.			
09			'North Dock'. The Alexandra (Newport) Dock Act of 1865 authorised the Alexandra Dock Company to construct this dock between 1868 and 1875. This original dock covered an area of 28.5 acres and was called Alexandra Dock. Following construction of the first southern extension of the docks in 1893, this original dock became known as the 'North Dock'. The original Alexandra Dock basin is a long rectangular structure, aligned north-west to south-east, roughly parallel to the River Usk to its east. It has two main operational quays along its east and west sides. The construction of the basin below water level is not known, though it is assumed to be of mass concrete, with stone capping at quay level. The timber stage on the east side of the North Dock was completely reconstructed in reinforced concrete in 1922. Although the jetties of the two northernmost former coal hoists survive, the hoists themselves were all removed in the 1960's, though the quay structures themselves were retained.	331550	185700	Unlisted
10			Dock Managers Office. Constructed in red bricks laid in stretcher bond over three floors. The first and second floors are defined on the external elevations by moulded stone strings that run around all four elevations. Segmental window arches have a continuous terracotta hood that runs around all sides of the building on all floors. All windows have been replaced with upvc. The building is square in plan with central glazed atrium providing natural light to central quarter turn staircase. The building has an entrance porch of stone with moulded arched door head and spandrels in moulded relief. The porch is topped by a broken pediment and floral design within the tympanum. Internally the building still retains many fixtures and fittings but has generally been refitted for modern office use.	331845	185615	Unlisted
11			Engineers Office. Built in a distinctively different style to the adjoining dock manager's office building in mottled mid brown bricks with pale white bricks used for horizontal banding at window sill level, window head level and under roof eaves. The corners of the building are also highlighted in the same pale white	331860	185585	Unlisted



WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
			bricks. The roof is hipped and slate covered with three chimney stacks also reflecting the pale white banding of bricks. The building sits on a coursed stone plinth.			
12			Possible air raid shelter. Of extremely robust construction in solid brick laid in English bond with a cast concrete flat roof. This structure has limited natural light and ventilation, and appears most likely to have been an air raid shelter for dock office staff, although situated in a rather exposed position. It was not possible to access the interior at the time of survey.	331880	185600	Unlisted
13			Group of early/mid-20th century offices and workshops constructed when former North Lock converted to dry dock.	331850	185525	Unlisted
14			North Lock. Originally the North Lock, providing access into the North Dock Basin, the structure is now a dry dock. In 1883 it is shown as having two sets of opposing lock gates each set in a slight curved recess in the lock walls. Also shown are a possible static swing crane in the centre of the north side, and various small square structures on either sides of the lock of unknown purpose, possible gear mechanisms for lock gates. It now retains only a single pair of lock gates situated at the west end. The dock as it currently survives is constructed from cast concrete and all of the earlier associated features have gone, though remains of these features may survive in a buried context. The present dock has iron railings along both sides of the top and also parallel rail tracks along the south side. The dock is still used occasionally for loading and unloading material for the engineering works close by.	331860	185505	Unlisted
15			Graving dock. Mostly infilled and part silted up Graving dock. Lock gates survive at the west end but above water line the walkway has collapsed. Below water line in unknown condition. Most of dock infilled and grassed over. But some features remain in the form of iron mooring points on top of cast concrete plinths. The dock was 532ft long x 74 ft wide, with an entrance width of 50ft.	331925	185420	Unlisted
16			Ammunition store/Air raid shelter. The robust construction of this building, and the similarity of its form to the air raid shelter suggests its construction dates to the early years of the 2nd World War. There is some suggestion that it was built as an ammunitions store, though this is considered unlikely in view of its location in proximity to the narrow channel and swing bridge between the North and South Docks. First depicted in the cartographic record in 1950.	331745	185266	Unlisted



WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
17			Junction cut. 152ft long spanning the 60 feet wide channel between the North Dock and the South Dock ('Junction Cut'). Constructed in 1893, in association with the construction of the first phase of the South Dock, and first appears on 1901 plan of the docks. The bridge provided access from the east to the west for rail traffic. It was also a principal route for steam locomotives to gain access to the engine sheds and workshop complex on the east side of the docks. The pivot of the bridge would seem to have been located on the west side of the passage and the swinging arm of the bridge rotated into a curved recess on the east side. The bridge no longer exists.	331795	185310	Unlisted
18			? Mess building. The function of this building is not known, though its scale, fenestration and detail suggests that it might represent a mess or welfare building for dockyard staff. Small rectangular building constructed in red bricks laid in stretcher bond. Pitched gable roof covered in slate. Three cambered arched window openings in the east wall, one blocked, the other two have replacement upvc windows. A small brick porch at south end.	331823	185340	Unlisted
19			Probable air raid shelter. Low flat roofed cast concrete. Narrow entrance at north-west corner. Divided internally and with what appears to be a store at the south end accessed via a double wooden door. Evidence of internal wall being knocked through at south end.	331832	185342	Unlisted
20			Swing bridge operation room. small single storey building constructed in red bricks laid in stretcher bond. Pitched roof covered with slate. Now derelict. Internally of single room with lobby, room has windows facing onto both the east and west aspects giving occupier views over swing bridge and approaching rail traffic from south dock area. Building was heated by a single fireplace and is thought to have been the swing bridge operators office.	331833	185325	Unlisted
21			Early 20 th century building of uncertain function. Single storey in red brick laid in stretcher bond. Concrete flat roof. Metal framed windows with concrete lintels	331860	185345	Unlisted
22			Early 20 th century shed. A building is shown on the 1921 OS plan but would appear to be of smaller proportion. It is likely therefore that this present building replaces an older structure. Concrete modular construction with pitched roof. Cast concrete frame with textured concrete panel walling of mid-20th century appearance	331900	185345	Unlisted
23			Important group of late 19th century stone built locomotive running sheds and	331975	185375	Unlisted



WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
			engineering workshops of considerable historic significance within the docks. Some 21 buildings and structures with different functions.			
24			Workshop. Small rectangular in plan and constructed in pale orange bricks laid in stretcher bond. The gabled roof is pitched and covered in slate with red clay ridge tiles. The small windows are metal framed and have double brick on edge shallow arches over. Door access is through the west end wall. Internally there is a line shaft attached to the north wall at high level. There is no clear indication what this drive shaft was actually connected to.	332025	185415	Unlisted
25			Engine shed. The basic frame is constructed using round steel columns with 'I' beam plates. These support lightweight steel roof trusses of Fan design. The pitched roof is covered with corrugated asbestos sheeting with glazed roof panels. The curtain walls are built in red brick and each bay has a frosted glazed window panel with concrete sill and lintel. There is a large door opening in the west end wall located to the south side which is probably the original entrance for trains and running stock.	332030	185370	Unlisted
26			Early 20 th century building of unknown significance. A building of two elements, a raised north part and a south part with lower roof. Built in red brown bricks laid in stretcher bond. Pitched roofs covered in corrugated iron sheeting. Window openings have metal frames with concrete sills and lintels. The elevated north section has a wide door opening in the north end wall suggesting it was used for vehicle servicing. The lower south end has a small chimney stack.	332090	185380	Unlisted
27			Welfare building. Curtain wall of concrete blocks with a shallow sloping roof covered with corrugated iron sheeting. Unlikely to be air raid shelter as roof is not cast concrete. Possibly an outside lavatory.	332090	185362	Unlisted
28			South Dock. This is the first extension of the Alexandra Dock, whose construction began in 1892 and was opened in 1893. It became known as the South Dock while the original Alexandra Dock became known as the North Dock. This first small extension continued the NW-SE alignment of the original dock, to which it was connected by a narrow channel crossed by a swing bridge, providing rail access to the east side of the South Dock, the engineering shed complex, and the Central Pumping Station. The dock basin was accessed from the River Usk by its own lock, which became known as the South Lock. The original phase of construction of the South Dock appears to be of similar	331940	185200	Unlisted



WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
			construction to that of the earlier Alexandra Dock (later North Dock). It was originally 1,500 ft long by 650 ft wide and covered an area of 20 acres.			
29			No 3 Transit Shed. Large rectangular warehouse facility. Built in red brick laid in English bond. Pitched roof covered with softwood sarking boards and then corrugated sheeting. East elevation has many arched window openings (now blocked). Map of 1912 shows single rail track entering the east side of the north end and exiting the east side of the south end. There are existing blocked openings in these positions with 'I' beam steel lintels. Further door openings are found in the west side of the south end and a wide sliding double door is located in the north end. All of the original openings have blue brick dressings. Along the west elevation there is a continuous horizontal steel plate mid way up the wall. Below this level the wall has been divided into small bays by vertical steel stanchions. it is possible that originally these small bays were open fronted to allow access for the unloaded material to be placed directly under storage. The bays are all now infilled with brick. The roof is supported by lightweight steel frame trusses of triple Howe design.	332120	185190	Unlisted
30			Customs House. Built between 1901 and 1912. Marked HM Customs 1912 and 'Custom's House' 1921. A building proposal plan dated 1909 refers to this building as Customs Watch House, South Lock. This single storey building was to include a mens room with cooking and hot water range, Officers Room, Supervisors Room, coal store and a bicycle house next to toilets, wash basins and lamp cupboard. Constructed using red bricks laid in stretcher bond. The original windows have been replaced with modern upvc units. The pitched roof has been reroofed in slate.	332258	185209	Unlisted
31			East Lock. The South Lock opened in 1893 enabling vessels to reach the South Dock directly from the River Usk. It was renamed the East Lock following the opening of the new South Lock from the Bristol Channel in 1914. The East lock was closed during the middle of WW1 (1916) and was regarded as an emergency entrance to the docks for many years, before being filled in during 1937. The east end has been blocked with the eastern roadway now crossing over it. Lock walls of limestone blocks with iron mooring points. Lock still used as dock for timber imports.	332285	185205	Unlisted
32			Smaller of two dry docks on the Eastern bank of the River Usk. Dates to late	332925	185295	Unlisted

WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
			19th/20th century. Now forms part of a container terminal. Originally part of the Union Dry Docks			
33			Dry dock aligned SW - NE on eastern site of river. Originally part of the Union Dry Docks. This is the larger, most southerly of the 2. Modified (lengthened) in the early - mid 20th century. Originally part of the Union Dry Docks.	333060	185280	Unlisted
34	43157	17415 17414 3076	Newport Transporter Bridge including East and West anchor chambers. Finest and largest transporter bridge in the UK, and one of only two major ones still functioning. One of only a handful of surviving transporter bridges in the world.	331800	186200	Grade 1 listed
35			Pye Corner Baptist Church. Modest 19th century chapel, cement-rendered with slate roof, with attached rendered cottage. Both set within stone-walled burial ground.	334430	185180	Unlisted
36	410539	17542	Pye Corner Farm. Well-preserved farmhouse typical of the Gwent levels. Probably of 17th century origin; rebuilt late 18th/early 19th century. Grey stone now rendered.	334530	185160	Grade II Listed
37	-	17543	Tatton Farm. Well-preserved example of a typical Gwent levels farmhouse, dating to the early 19th century.	335215	185800	Grade II Listed
38			Cottage and Stables at Barecroft Common. Stone two-storeyed cottage of unknown date, now rendered and heavily buttressed on south side. First floor lit by gabled dormers; now has profiled cement roof tiles.	341610	186925	Unlisted
39			Hexagonal pillbox, with projecting lintels.	341210	186880	Unlisted
40	309161	16068	Magor Vicarage. Vicarage built 1861 to the designs of John Norton who restored Magor Church. Built in the Tudor/Jacobean Revival style of rock-faced stone with ashlar dressings with steep roof and swept eaves. Internal architectural detail and fixtures survive well.	342040	187630	Grade II Listed
41			The Beeches, Knollbury. House constructed 1912. Brick with cement render; two canted bays facing south-west. Attractive original cast and wrought iron spandrels and brackets, the house now has replacement windows and profiled cement roof tiles. Good group of single and two-storey stone farm buildings with red brick dressings, forming a farmyard layout typical to the local area and including pig sties. Stylistically in keeping with adjacent Dunline, but now owned in association with the Beeches.	342860	187910	Unlisted
42			Dunline, Knollbury. late 19th/early 20th century house formerly known as 'The Cedars'. Stone with red brick dressings, the house now has replacement	342920	187865	Unlisted

WA No.	NPRN	List Entry No.	Name	Easting	Northing	Status
			windows and a profiled cement tile roof. Front garden enclosed with well-built stone wall with gate piers.			

Table 7: GGAT Historic Environment Record - Archaeology

WA No.	HER No.	Name	Period	Description	Easting	Northing
101	04259g	Findspot	Prehistoric	Surface find, worked flint flake. Prehistoric (not further defined).	325200	184200
102	08952g, E001544	New Park cropmark enclosure	Undated	A simple rectangular cropmark of a sub-rectangular enclosure of approximately 0-40m east-west by 20-30m on south facing hill slope east of New Park farm. Possibly prehistoric but difficult to be sure. Noted on air photographs. A possibly related track leads off to the east. Flint scraper and other flake fragments found in vicinity.	325280	184190
103	02140g, E001521	Gwaunshonbrown Farm	Undated	A possible much-eroded earthwork enclosure was noted on an AP immediately east of Pound Lane, Coedkernew. The cropmark is situated on a knoll, possibly utilised as a semi-defensive siting for a small earthwork enclosure. A field visit in 2006 concluded that nothing was to be seen from this site except a slight rise, which may be natural, as this area in general is undulating. The area commands good views out over the Estuary and the Gwent Levels. It cannot be stated for certain either way regarding the defensive nature of this site, although from the black and white aerial photo of the site it does suggest some possible buried earthworks.	326180	184315
104	02521g	Ridge and Furrow, Coedkernew	Undated	Ridge and furrow in a series of fields opposite Berrykent Farm and on the north side of the A48; there are lynchets along the field boundaries	326500	184400
105	00015g	Coedkernew, Manor House	Medieval	Coedkernew, in the early days of the conquest, was a manor of the lordship of Gwynllog and was held by Iorwerth ap Rees. This lord had his own manor house as well as his own demesnes, tenantry and courts. It's known to have been extant in the 14 th century.	327800	183700
106	05667g, 09957g, 09946g,	Great Pencarn Farm	Multi-period	Between January and March 1997 the Glamorgan-Gwent Archaeological Trust Ltd carried out excavation of a site in advance of road construction. The site was situated on the boundary between the 'hard' geology and the	328100, 328140	183600, 183580

WA No.	HER No.	Name	Period	Description	Easting	Northing
	09945g, 09922g, 09900g, 05684g, E002200, E003364			alluvial peats and clays of the Gwent Levels. The remains proved to be a building of Roman date associated with a series of cobbled surfaces situated next to a road. This building was identified from the foundations of its western and southern walls, a series of loose cobble spreads comprising its internal flooring, and a single hearth. Its purpose is likely to be associated with the agricultural exploitation of the surrounding environment, the Wentlooge Level to the south in particular. Underlying these structures were a number of ditches, also of Roman date, representing a pre-existing drainage system. The Roman remains were directly overlying the waterlogged Holocene deposits of the Wentlooge Formation, within which were preserved an Iron Age peat deposit and a single Bronze Age wooden upright post. Palaeoenvironmental analysis of these deposits and others allowed for the reconstruction of the prehistoric and Roman environment.		
107	00012g	Great Pencarn	Medieval	Manor house or Court house, extant in the 14 th century.	328160	183680
108	07642g E004430	Palaeochannel	Undated	Palaeochannel seen in Trench 12 of BUFAU assessment 1998.	329920	184490
109	00287g	Windmill Tump	Post-medieval	Wind mill tump listed in a survey of the Lordships of Liswerry and Lebenith dated 1655.	330000	185000
110	00173g	Mill	Medieval	An inspeximus & confirmation of a charter, in favour of the prior & monks of Goldcliff by Hoel, Lord of Karlivn.	330000	185000
111	00165g	St Gwynllyw's Well	Medieval	Survey of Newport 1567 at the southern end of the town near the church of St Woollo's was the well of St Gwynllyw	330000	185000
112	08468g	Fair Orchard Farm, Newport	Undated	Network of shallow surface drainage gullies, known as grips, which take water off the fields into ditches and reens. Traditionally they were hand-dug with the spaces between them are known as spanes.	330320	183920
113	08561g	Fair Orchard Farm, Newport	Post-medieval	A 'dry' field boundary in an area where the majority of boundaries are 'wet' (i.e. ditches). Consists of a post and wire fence adjacent to a 'live' boundary comprising an intermittent line of stunted hawthorns, reeds and juncus grass.	330340	184300
114	08467g	Fair Orchard Farm, Newport	Post-medieval	Old Dairy Reen. This is one of the larger reens in the property. Two test pits situated either side of the reen found no evidence of any bank	330350	184170

WA No.	HER No.	Name	Period	Description	Easting	Northing
				deposits but instead encountered a sequence of alluvial clays (Wessex Archaeology 2008a).		
115	05695g	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, modern fill contains ceramic pipe drain, 2.00m wide x 1.00m deep, Reen depression visible running inland. N-S	330450	183920
116	08892g, E001296	Tredegar Pill	Undated	Tredegar Pill, depicted on the 1st edition OS map (1884).	330480	184974
117	08466g	Fair Orchard Farm, Newport	Post-medieval	Pont-y-cwcw Reen. This reen skirts the northern boundary of the plot which surrounds Fair Orchard Farm buildings.	330480	184400
118	08460g	Fair Orchard Farm, Newport	Post-medieval	Footbridge crossing the Pont-y-cwcw Reen. The small structure is brick-built with a cement capping along each edge, parts of which have disintegrated. Although difficult to precisely date, some may go back to at least the 18 th century or earlier.	330480	184400
119	05696g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, as 116. N-S	330500	184780
120	05697g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, unrecorded. Peat fill, cut from surface. N-S	330600	184720
121	08464g, E001942	Fair Orchard Farm, Newport	Post-medieval	Field boundary, defined by tall grasses and reeds. Note also the grips in the field. Visited as part of the Tir Gofal agri-environment scheme Historic Environment 2 assessment.	330670	184290
122	05688g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, peat filled, 0.10m deep x 0.80m wide, 1.10m below ground surface. N-S	330760	184680
123	05689g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, peat filled, 1.00m deep x 1.40m wide, 0.10m below ground surface. N-S	330850	184640
124	05690g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, back filled prior to works, 1.00m wide x 1.90m deep, cut from surface. N-S northeast - west southwest by 45m north-south, overlain & obscured by ridge & furrow cultivation & associated boundaries.	330920	184450
125	05692g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, modern peat fill, 2.00m wide x 1.0m deep, cut from surface. N-S	330960	184380
126	05691g, E002213	Wentlooge Sea Defences	Post-medieval	GGAT assessment Wentlooge Sea Defences. Linear Reen cut, peat filled, 0.67m wide x 0.20m deep, 1.80m below ground surface. N-S. Finds	330960	184370

WA No.	HER No.	Name	Period	Description	Easting	Northing
				Oak: Quarter-sawn, regular pencil point with flat facets, possible stake for bracing of reen or sluice gate construction, post-medieval.		
127	08891g, E001295	Weir	Post-medieval	A post-medieval weir. Visited as part of the Waterfronts in Southeast Wales survey (GGAT 2005).	330981	184587
128	E003705, E002219	Sea defences	Medieval	Cardiff- Sudbrook sea defences. A desk-based assessment concluded that elements of the sea defences may date from the medieval period (GGAT 1993) though a watching brief undertaken on a section to the south of the Study Area dated bank construction to the post-medieval period (GGAT 1996). For features identified within the Study Area see WA219, WA220, WA222-224, WA225, WA226.	330927	184536
129	00235g	Findspot	Romano-British	Coin hoard 30 brass Theodosius coins	332000	186000
130	00234g	Battle Of Dinas Newydd	Early medieval	Reputed battle of Dinas Newydd, 918 AD.	332000	186000
131	00233g	Bronze mould for making Agnus Dei	Medieval	Bronze mould, appears to have been used for casting the cakes made out of the Paschal candle known as Agnus Dei .	332000	186000
132	00231g, 0232g	Tannery and malthouse	Post-medieval	A tanhouse and a brewhouse in the town of Newport formed part of the possessions of the church or chapel of St Lawrence in 1534.	332000	186000
133	00230g	Findspot	Romano-British	Roman Coins, including two of Septimus Severus (193-211 AD) said to belong to a hoard, but improbable.	332000	186000
134	00229g	Findspot	Iron Age	A silver tetradrachm of the Syrian King Demetrius 1 (162-150 B.C) has been recovered from the bed of the River Usk at Newport.	332000	186000
135	00228g	Findspot	Bronze Age	Two flat axes found, Monmouthshire, Newport. No additional information was obtained during field investigation.	332000	186000
136	09580g	Seawall, East Bank Road	Modern	A post-medieval seawall, extant since at least 1883. It is depicted on the 1st and 2nd edition OS maps.	333120	185420
137	03986g	Findspot	Medieval	No details available, medieval find.	333600	186050
138	05250g	Tyd-Love Farm	Modern	Shown on 1831 and 1886 maps, now deserted.	334050	184950
139	05243g	Arch Farm	Modern	Shown on 1831 map; earthworks visible on 1946 aerial photograph. An area of geophysical scanning survey was undertaken by Wessex Archaeology; although the earthworks were still visible modern interference meant that no clear geophysical responses could be identified.	334900	185200

WA No.	HER No.	Name	Period	Description	Easting	Northing
140	E000033	Westway, Gwent Europark Watching Brief and Excavation	Medieval	An archaeological watching brief was undertaken during construction of a distribution warehouse for Tesco at Westway (Gwent Europark) Magor, Newport. The greater part of the site was stripped and the building foundations laid without archaeological cover. Areas of deeper excavation including interceptor pits, drainage channels and an attenuation pond were monitored by an archaeological watching brief. Following discovery of a stone deposit an excavation took place, revealing remains of a ditch and stone structure dating to the medieval period.	340157	186194
141	E000432, E000433, E000434, E003823	Borehole survey	Prehistoric	A borehole survey took place at Llandeenny near Magor, Gwent prior to planning consent for a regional distribution centre. 48 boreholes were sunk across the development area. The nature of the alluvial stratigraphy and the potential for further archaeology was ascertained. A probable man-made sandstone rubble deposit at a depth of 3.6m below ground level can be dated to 1st millennium BC and may be possible crossing point. The remains of relict drainage channels were also noted. Other evidence of possible human activity was noted with the discovery of a thin lens of charred material including charred twigs in the upper levels of peats and may indicate possible management of lowland peat moors.	340611	186353
142	04905g	Sycamore Farm	Modern	Hexagonal brick pillbox, in amongst farm buildings. Type 22. Historic Landscape, Gwent Levels. GGAT site visit 2010.	341224	186913

Table 8: GGAT Historic Environment Record – No archaeology

HER No.	Name	Description	Easting	Northing
E000065	Negative	An archaeological evaluation was conducted for five sites of archaeological potential adjacent to the M4 in relation to the M4 widening scheme J29-J32. No archaeological features were discovered in all but one of the trenches, where a shallow pit containing 19th century demolition material was uncovered.	325260	184070
E004430	Negative	An evaluation conducted by Birmingham University Field Archaeology Unit into a site off Morgan way in Duffryn, Newport. No archaeological finds were made.	329930	184530

HER No.	Name	Description	Easting	Northing
E003854	Negative	An Evaluation was carried out by Cotswold Archaeological Trust on land south to the Whitbread Brewery, Magor, Gwent, during November 1993. This was due to an outline planning application for industrial development. However the field evaluation has revealed no significant archaeological features within the areas sampled.	341325	187227
E001482	DBA	Archaeological assessment of the Second Severn Crossing	344289	187273
E000021	Negative	Archaeological watching brief on topsoil stripping for the M4 widening scheme J29-J32: for the areas of Pond 5 and Began Road only. The monitoring of the topsoil stripping produced little evidence for archaeological activity in the areas investigated. One sherd of abraded Roman pottery was found on the site adjacent to Began Road. All other finds (pottery) from both sites were nineteenth century or later in date.	325315	184011
E003221	DBA	BioGen Power Ltd commissioned RSK to carry out an archaeological desk-based assessment for a planning application for the construction of an energy recovery facility at Newport Docks	331310	185290
E003430	DBA	East Bank Road, Newport. GGAT Contracts has undertaken an assessment of the archaeological effects of the proposed sand offloading and storage facility at East Bank Road, Newport. Geotechnical information was made available and a site visit was also made.	332373	185624
E004128	Building survey	GGAT Projects were commissioned to undertake a Level 2 building survey of Nash Chapel, Pye Corner, Nash prior to its conversion into a dwelling. The survey of the chapel was limited to the structure alone.	334434	185182
E003556	DBA	Hyder consulting conducted an Environmental Statement for Vogen Energy Ltd for the proposed Newport Dock bulk drying, pelleting and combined heat and power facility in the South dock complex, Newport.	331233	184743
E002186	DBA	Legend Court, Newport DBA	341049	188674
E002212	DBA	Legend Court, Pencoed, Newport DBA	341049	188674
E003221	DBA	Newport Energy Recovery Facility DBA	331325	185240
E001411	DBA	The Roman fortress of Caerleon and its environs: A framework	332726	187638
E001379	DBA	Waterfronts in Southeast Wales: phase 1	322345	185555
E003205	DBA	Wind turbines at Tesco Gwent Euro Park	340410	186286

Table 9: Features identified through the walkover survey or map regression

WA No.	Name	Period	Description	Easting	Northing
201	Peny-lan-fach	Modern	Farmstead shown on 1844 tithe map and early OS maps. Originally two buildings. Now only one still extant, no roof, and walls in poor state.	325790	184351
202	Linear earthwork	Undated	Former field boundary depicted on 1843 tithe map, still partially visible.	326245	184377
203	Enclosure	Undated	Some slight visible earthworks corresponding to possible enclosure (WA103).	326366	184365
204	Ysgybor-y-Lan	Post-medieval	Building shown on late 18 th century map, and on 1843 tithe and early OS maps. Structure still extant to some degree.	326450	184462
205	Linear feature, Longhouse	Undated	Shallow and broad linear feature. May be trackway, not shown on tithe or OS mapping but visible on aerial photographs.	326586	184113
206	Linear feature, Longhouse	Undated	Linear feature, possible ditch. Not shown on tithe or OS mapping but visible on aerial photographs.	326612	184077
207	West of Berryhill farm	Post-medieval	Building shown on early maps, including late 18 th century Tredegar estate map. No longer extant.	326805	184228
208	Coppiced woodland, Berryhill Farm	Post-medieval	Ancient coppiced woodland shown on late 18 th century map, tithe map and early OS maps. Still extant (entry 15233). Two ancient oaks on the north eastern boundary, presumably originally standard oaks. Recorded scanning geophysical survey in the fields around this area of woodland did not located any archaeologically interesting anomalies.	327170	184012
209	Building, Coedkernew	Post-medieval	Building, shown as 'ruins' on a late 18 th century map of Coedkernew (Tredegar collection).	327400	183720
210	Building, Coedkernew	Post-medieval	Building, shown on a late 18 th century map of Coedkernew (Tredegar collection).	327420	183670
211	Barn, Coedkernew	Post-medieval	Building, shown as 'barn' on a late 18 th century map of Coedkernew (Tredegar collection).	327420	183640
212	Small building, Coedkernew	Modern	Pair of small buildings shown on the 2 nd edition (1901) OS map of the area.	327576	183666
213	Barn	Post-medieval	Stone built barn, decaying. Visible on 1844 Bassaleg tithe map and late 18 th century mapping.	328176	183663
214	Palaeochannels	Undated	A series of palaeochannels have been identified on LiDAR surveys to the south and	328183	183484



WA No.	Name	Period	Description	Easting	Northing
			south east of Coedkernew, aligned roughly north-east to south-west.		
215	Percoed reen	Romano-British	Percoed reen, aligned north east-south west, possibly dug as early as the Roman period. Two test pits excavated either side of the reen found no conclusive evidence for the original construction date of the ditch.	328360	183458
216	Post	Modern	Cast iron post c. 0.30m diameter and c.8.00m high.	328427	183489
217	Maerdy	Modern	Farmhouse and outbuildings shown on 1842 tithe map. Still extant.	328552	183258
218	Boundary	Modern	Former field boundary visible as tree line. Depicted on 1842 tithe map.	328676	183497
219	Boundary	Modern	Former field boundary visible as tree line. Depicted on 1842 tithe map.	328692	183457
220	Pont-estyll	Modern	Farm complex buildings shown on 1842 tithe map and early OS maps. No longer extant. Now under plough though building rubble visible.	328880	183430
221	Bridge	Modern	Embanked bridge carrying road over railway – brick built. Although the railway line can be seen from the 1883 OS map a bridge crossing is not shown until the 1901 edition.	328960	183417
222	Bridge	Modern	Former bridge over reen, likely agricultural access, steel girder construction.	329211	183905
223	Trackway	Post-medieval	North-west – south-east aligned trackway, shown on late 18 th century maps and still visible on LiDAR imaging. Still extents as shorted spur off Pont Estyll Lane.	329291	183503
224	Bridge	Modern	Footbridge at proposed crossing - only piers remain. Victorian, first seen on 1901 OS edition and still shown on late 20 th century maps.	329304	183636
225	Moated site	Undated	Very well preserved feature- surrounding field system seems to respect it. Fourth side seems to comprise current field boundary. Likely post-medieval.	329556	183976
226	Boundary	Modern	Oak tree marks former field boundary, seen on 1842 tithe map.	329803	184221
227	Boundary	Post-medieval	Oak trees mark former boundary, seen on late 18 th century and 1842 tithe map.	329815	184142
228	Tredeggar Park	Post-medieval	Area of woodland shown on 1844 tithe, still present today. Registered as area of Ancient Woodland (22097).	329848	184390
229	Trackway	Post-medieval	Trackway, west-south-west – east-north-east aligned. Visible on late 18 th century and 1842 tithe map. Shown as extant on 1920 OS map. Still visible on LiDAR.	329884	183927
230	Culvert	Modern	Victorian culvert taking Old Dairy Reen under railway. Brick arch with stone superstructure.	329997	184223
231	Whitecross Farm	Modern	White cross farm, still extant, shown on 1842 tithe map and early OS maps.	330028	184215
232	Pheasant, Dyffryn	Modern	Building complex shown on the 1842 tithe and early OS Maps, known as 'Pheasant'. No longer extant.	330030	184030
233	Bridge	Modern	Victorian brick built railway bridge with cast iron trough.	330044	184221
234	Sluice	Modern	Former sluice gate.	330119	184718

WA No.	Name	Period	Description	Easting	Northing
235	Moated site	Undated	Possible moated site identified from the LiDAR imaging.	330258	185038
236	Culvert	Modern	Victorian culvert taking Sea Wall Reen under railway. Brick arch with stone superstructure.	330309	185202
237	Moated site	Undated	Possible moated site identified from the LiDAR imaging.	330357	184956
238	Moated site	Undated	Moated site and associated fields, visible on LiDAR survey. Presumably medieval or post-medieval in date.	330460	184472
239	Trackway	Post-medieval	Old trackway, visible on LiDAR but not depicted on the 1844 tithe map or later OS mapping.	330613	184348
240	River Ebbw	Post-medieval	Former river course seen on 18 th and 19 th century mapping.	330627	184994
241	Channel	Modern	Feeder channel to Newport Docks, seen on 1 st edition 1884 OS map.	330742	185889
242	Building/ farm	Modern	Ty Gwyn bach (White House Farm), marked on 1845 tithe map, no longer extant.	331290	185788
243	Reen	Modern	Course of Great Wharf and Hundred Acres Reen, shown on 1845 tithe map.	331304	185809
244	Mendalgylf Port Sanitary Hospital	Modern	Mendalgylf Port Sanitary Hospital, shown on OS 1901 2 nd edition. Already demolished by 1921 edition.	331337	185083
245	Mendalgylf New Reen	Modern	19 th century canalised reen shown on 2 nd edition OS. No longer extant.	331370	185090
246	Timber float	Modern	Timber float built in Newport docks in the second half of 19 th century, but no longer extant.	331380	185180
247	Building, Newport Docks	Modern	Small building in Newport Docks shown on the 2 nd edition OS map. No longer extant.	331425	185240
248	Building/ house	Modern	Ty Glas (Blue House), marked on 1845 tithe map, no longer extant.	331463	185517
249	Brickfields	Modern	Area of brickfields and potteries marked on 1887 OS map.	331469	186328
250	Buildings, Newport Docks	Modern	A series of buildings in Newport Docks associated with railways shown on the 1 st and 2 nd edition OS maps. No longer extant.	331565	185345
251	Watch house	Modern	Watch House marked on 1845 tithe map, no longer extant. No marked on 1883-1884 town plan though road is called Watch House Parade.	331572	186240
252	Powder magazine	Modern	Powder magazine marked on 1845 tithe map, no longer extant.	331750	185818
253	Building/ house	Modern	Ty Coch (Red House), marked on 1845 tithe map, redeveloped during late 19 th century expansion of the docks.	331933	185269
254	Buildings, Newport Docks	Modern	A series of buildings in Newport Docks close to the north lock on the 1 st (1883-4) and 2 nd (1901) edition OS maps. No longer extant.	331990	185475
255	Building, Newport	Modern	Small building in Newport Docks, shown on OS 2 nd (1901) edition map to the north of	332222	185282



WA No.	Name	Period	Description	Easting	Northing
	Docks		the south lock. No longer extant.		
256	Union Dry Docks Cottages, Newport	Modern	Terrace of Victorian cottages built for the Union Dry Docks. No longer extant. Shown on OS 2 nd (1901) edition.	332832	185466
257	Buildings, Union Dry Docks, Newport	Modern	A number of buildings shown on the 2 nd (1901) edition Ordnance Survey map associated with the Union Dry Docks in Newport are no longer extant.	332932	185260
258	Pumping House and Electric Light Station, Union Dry Docks	Modern	Pumping House and Electric Light Station shown on OS 2 nd (1901) edition map within Union Dry Docks, Newport. No longer extant	333010	185175
259	Building/ farm	Modern	Cold Harbour, marked on 1842 tithe map, redeveloped during the post-war expansion of the docks.	333403	185019
260	Building/ farm	Modern	Little Troston/Traston, marked on 1840 tithe map and 1 st edition 1883-4 OS map, no longer extant.	333422	185828
261	Building/ farm	Modern	Great Troston/Traston, marked on 1840 tithe map and 1 st edition 1883-4 OS map, no longer extant.	333434	185647
262	Pickedlane Farm, Nash	Modern	Farmhouse shown on 1842 tithe map and early OS maps. Now longer extant.	333960	184960
263	Moated site	Undated	Moated site, possibly site of a former farmstead, to west of Pye Corner. Visible on LIDAR. Associated with trackway.	334117	184942
264	Lower Lake, Nash	Modern	Complex of buildings and orchards shown on early OS maps. Apparently demolished late 20 th or early 21 st century. Demolition rubble heaps noted on site during walkover.	334195	185760
265	Barrage balloon	Modern	Concrete settings for a barrage balloon. May be related to the anti-aircraft battery to the south-east (HER ref. 04295g).	334436	185215
266	Buildings, Pye Corner Farm, Nash	Modern	Buildings to the east of Pye Corner Farm, shown on the 1842 tithe map and early OS maps. Demolished in the late 20 th century. No longer extant.	334570	185165
267	Orchard	Modern	Post-war orchard associated with Arch Farm.	334896	185262
268	Arch farm	Undated	Irregular earthwork complex, possible post-medieval settlement or small fields. Relates to WA139.	334959	185279
269	Julian's Reen	Undated	Major reen in the vicinity of Pye Corner, north-north-west – south-south-east aligned. Watercourse fossilised in the landscape by its incorporation within field boundaries. Pre-dates the enclosure of the landscape. It is unclear when this incorporation occurred. Test pits excavated either side of the reen did not establish a construction date for the reen though a possible buried soil horizon was located on the easternmost	335028	185536

WA No.	Name	Period	Description	Easting	Northing
			test pit. This lay within a green lane (WA271), which most likely was a medieval road (Wessex Archaeology 2008a).		
270	Trackway	Post-medieval	Green lane, possible medieval trackway.	335142	185773
271	Tatton farm	Modern	Small orchard next to farm complex. Visible on 1842 tithe map. Still extant.	335174	185752
272	Agricultural building	Modern	Abandoned, but roofed. Depicted on 1 st edition 1883 OS map. May have replaced or enlarged building shown on 1842 tithe map.	335237	185814
273	Tatton farm	Modern	Barn, poor condition. Depicted on 1 st edition 1883 OS map.	335252	185812
274	Moated site	Undated	Roughly square moated platform next to trackway identified from LiDAR imaging. Integrated into present field system, likely post-medieval. Near similar sites WA279 and WA280.	335262	185872
275	Trackway	Modern	Old trackway, now overgrown. Depicted on 1842 tithe map.	335281	185415
276	Drainage system	Modern	Shown as orchard on the 1842 tithe map. Now mostly grass, drainage channels visible on LiDAR and observed as earthworks during walkover survey.	335304	185818
277	Trackway	Modern	Old trackway depicted on 1842 tithe map. The northern ditch is now largely backfilled but it is still occasionally used.	335345	185849
278	Moated site	Undated	Three conjoined moated platforms visible on LiDAR imaging to the north-east of Tatton Farm at end of trackway (WA278). Possible post-medieval settlement. Near similar sites WA275 and WA280.	335421	185863
279	House platforms close to Tatton Farm	Undated	A conjoined pair of possible medieval or post-medieval house platforms close to Tatton Farm. Near similar sites WA275 and WA279.	335480	185800
280	Trackway	Post-medieval	Remains of old trackway, shown as already partially incorporated into field system on 1842 tithe map likely linked to WA282 and WA283.	335513	185701
281	Trackway	Modern	Trackway, survives largely intact. Depicted on 1842 tithe map. Likely linked to WA281 and WA283.	335913	185567
282	Trackway to west of Whitson substation	Modern	Decoy pool Lane, depicted on 1842 tithe map, now overgrown. May have originally linked through to WA281 and WA282.	336300	185795
283	Black Wall Reen	Modern	Black Wall Reen, north-north-west – south-south-east aligned, depicted on 1842 tithe map. Originally extended further northwards but now built over by steelworks.	336853	185790
284	Ty Pridd, Whitson	Modern	Building or possible farmhouse at Ty-pridd. Shown on first edition 1883 OS map and throughout the 20th century. No longer extant. Name may derive from 'earth house'.	336860	185618
285	Monks Ditch	Medieval	Mentioned in medieval documents, a canalised river of at least medieval origin. Possibly built by the monks from Tintern, who held a grange (Lower Grange) nearby.	336866	185772

WA No.	Name	Period	Description	Easting	Northing
286	Bridge	Modern	Substantial bridge abutment comprising of stone blockwork. Current bridge much narrower width of brick and stone construction may be later phase. Crossing shown on 1845 tithe map.	336880	185714
287	New House, Whitson	Modern	The site of the New House complex, shown on the 1845 tithe map, and on early OS maps, site now lies under the boundary to the Llanwern steelworks.	336885	185760
288	Palaeochannels, Whitson	Undated	Numerous palaeochannels identified in the Whitson area on the LiDAR plot. Both Monks ditch and the planned landscape at Whitson seem likely to post-date these channels.	337436	185817
289	Trackway	Undated	Trackway shown on 1845 tithe map. Removed by construction of steelworks.	337656	185709
290	Building	Modern	Two small, likely agricultural buildings, shown on 1st edition 1882-3 OS map but absent from later editions.	338524, 338863	185700, 185862
291	Elver Pill Reen	Undated	Early north-south canalisation of watercourse into a reen. Discharges directly into the estuary.	338552	185662
292	Building	Modern	Series of small, likely agricultural buildings along Middle Road, shown on 1882-3 OS map but absent from later editions.	338636 to 339710	185524 to 185560
293	Building	Modern	Series of small, likely agricultural buildings along Rush Wall, shown on 1882-3 OS map but absent from later editions.	339450, 339710	185467, 185560
294	Enclosure	Undated	Ephemeral ditched enclosure, possible house platform. Likely post-medieval, nothing seen on 19 th century maps.	339654	185520
295	Palaeochannel	Undated	Palaeochannels and inland bodies of water are suggested to the south east of Llanwern steelworks on the LiDAR plot.	339655	185836
296	Moated site	Undated	Moat surrounding small house platform, with possible garden enclosure to the south. Appears to be tied in to or respected by the gridded drainage system in this field, likely post-medieval.	339839	185606
297	Trackway	Modern	Clear earthworks of old trackway and drainage grid. Visible on LiDAR imaging and depicted on 1846 tithe map.	339932	185559
298	Greenmoor Farm	Modern	Greenmoor Farm, depicted on 1846 tithe map and 1882 OS map. Now kennel complex.	340025	185698
299	Trackway	Modern	Longlands Lane, depicted on 1846 tithe map.	340646	185945
300	Stutwall reen	Post-medieval	Early reen in the enclosure of the landscape in this area, but may be post-medieval in date. Aligned roughly east-north-east to west-south-west. Test pits excavated either	341345	186643

WA No.	Name	Period	Description	Easting	Northing
			side of the reën encountered a sequence of peat deposits sealed by a clay layer. A piece of post-medieval pottery was recovered from this clay layer.		
301	Building/ farm	Modern	Complex of buildings and well shown on tithe and early OS mapping. Elements still extant.	341609	186926
302	Quarry	Modern	Quarry shown on 1882 OS map and early 19th century OS mapping.	341732	186994
303	Building	Modern	Two houses shown on the 1847 tithe map at junction, likely incorporated into the present buildings.	342341	187629
304	Boundary	Undated	Earthwork boundary and possible hollow way. Not marked on tithe map or early OS maps. Possible enclosure.	342679	187706
305	Boundary	Undated	Possible field bank, not depicted on tithe or OS mapping.	342854	187690
306	Building, Magor	Modern	Building shown on 1 st and 2 nd edition OS Maps. Likely agricultural. No longer extant. Some vegetation covered ruins noted during walkover survey.	342858	187732

Table 10: Features identified through the foreshore survey

WA No.	Co-ordinates (National Grid)		Description
	Easting	Northing	
401	332931	185169	Timber dock feature 1
402	332874	185222	Timber dock feature 2
403	332847	185257	Timber dock feature 3
404	332811	185287	Timber dock feature 4
405	332449	185465	Mooring chain
406	332369	185490	Permanent Jetty
407	332307	185567	Concrete mooring block
408	332506	185172	Water end of jetty 1
409	332474	185204	Water end of jetty 2
410	332394	185223	Timber dock feature 5
411	332395	185252	Water end of jetty 3
412	332345	185216	Shore end of jetty 4



WA No.	Co-ordinates (National Grid)		Description
	Easting	Northing	
413	332325	185273	Water end of jetty 5
414	332308	185286	Timber dock feature 6
415	332269	185273	Shore end of jetty 6
416	332267	185300	Timber dock feature 7
418	332233	185305	Shore end of jetty 7
419	332218	185307	Shore end of jetty 8
420	332228	185344	Water end of jetty 9
421	332195	185325	Shore end of jetty 10
422	332218	185368	Water end of jetty 11
423	332155	185366	Shore end of jetty 12
424	332166	185413	Water end of jetty 13
425	332158	185418	Water end of jetty 14
426	332058	185470	Timber dock feature 8
427	332027	185470	Shore end of jetty 15
428	332020	185474	Shore end of jetty 16
429	332001	185540	Timber dock feature 9
430	331962	185539	Modern Wall
431	331947	185540	Southern end of concrete dam
432	331916	185585	Northern end of concrete dam
434	331916	185585	Shore end of jetty 17
435	331944	185609	Timber dock feature 10
436	331902	186167	Wood post with drain hole
437	331871	186096	Metal cable
438	331924	185944	Wooden Post
439	331976	185870	Sewage drain and wooden posts
440	332214	185667	Barrels and floats
441	332251	185701	Timber washed ashore
442	331901	185641	Old breakwater and pilings

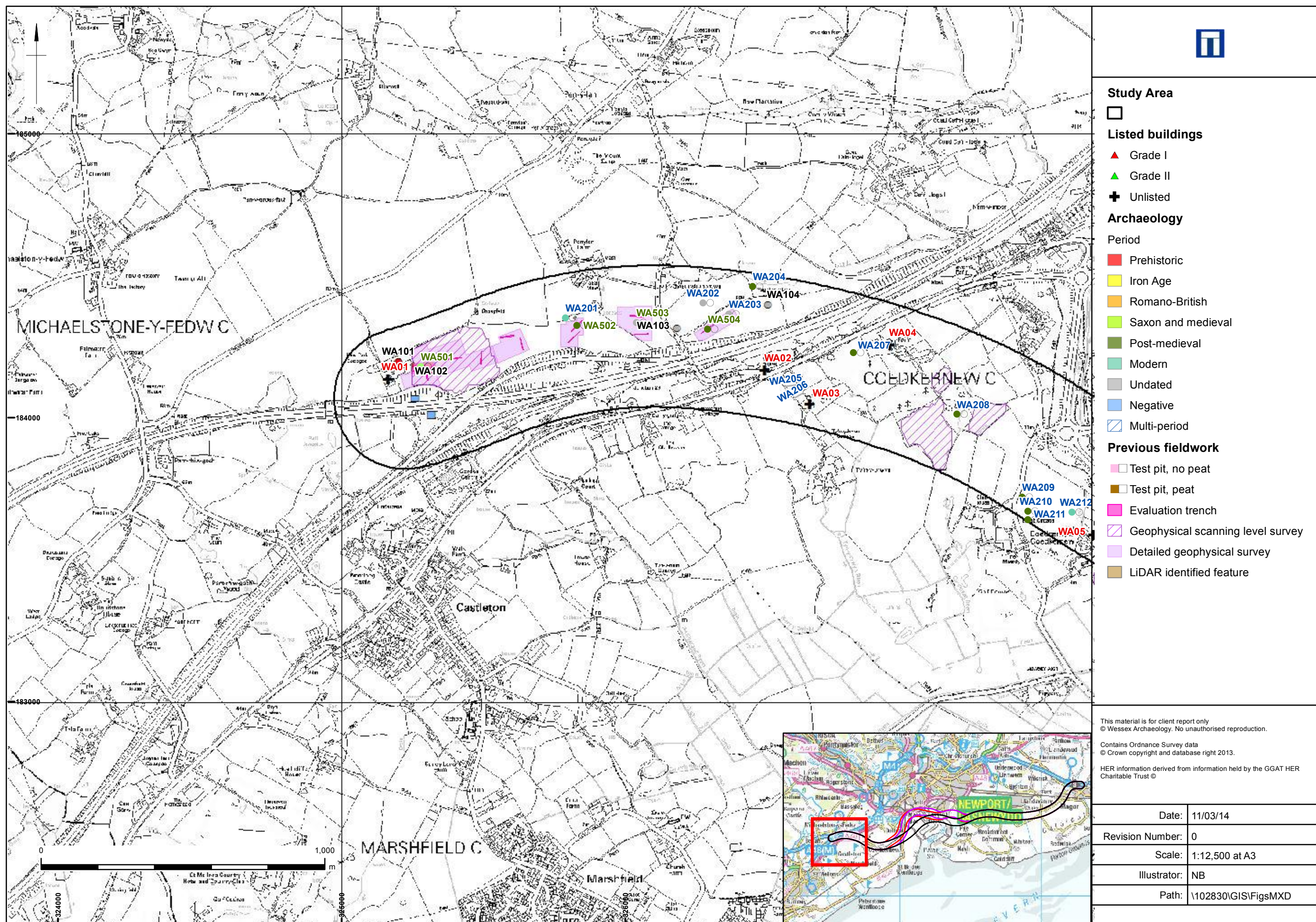
WA No.	Co-ordinates (National Grid)		Description
	Easting	Northing	
443	331905	185654	Bollard – ferroconcrete wharf
444	331898	185662	Brick mortar concrete filled with access pipe
445	331899	185662	Mooring rope - 100m from pier
446	331835	185754	Wooden Jetty 18 - old pilings
447	331842	185752	Bollard - ferroconcrete wharf
448	331787	185783	Staging area for pier made of articulated mortared brick and concrete
449	331767	185777	Stone wall mortared
450	331791	185794	Wooden Jetty 19
451	331783	185808	Vernacular lapstrake built boat
452	331768	185829	Wooden Jetty 20
453	331770	185845	Motor possibly associated with pier operations
454	331746	185878	wooden sewage sluice
455	331737	185889	Wooden Jetty 21
456	331679	186237	Wooden Wharf remains
457	331768	185829	aluminium boat
458	331737	185889	articulated stone wall
459	331722	185970	Metal cylinder pier – ex cork wharf
460	331685	186178	Wooden coal wharf

Table 11: Previous work related to the scheme

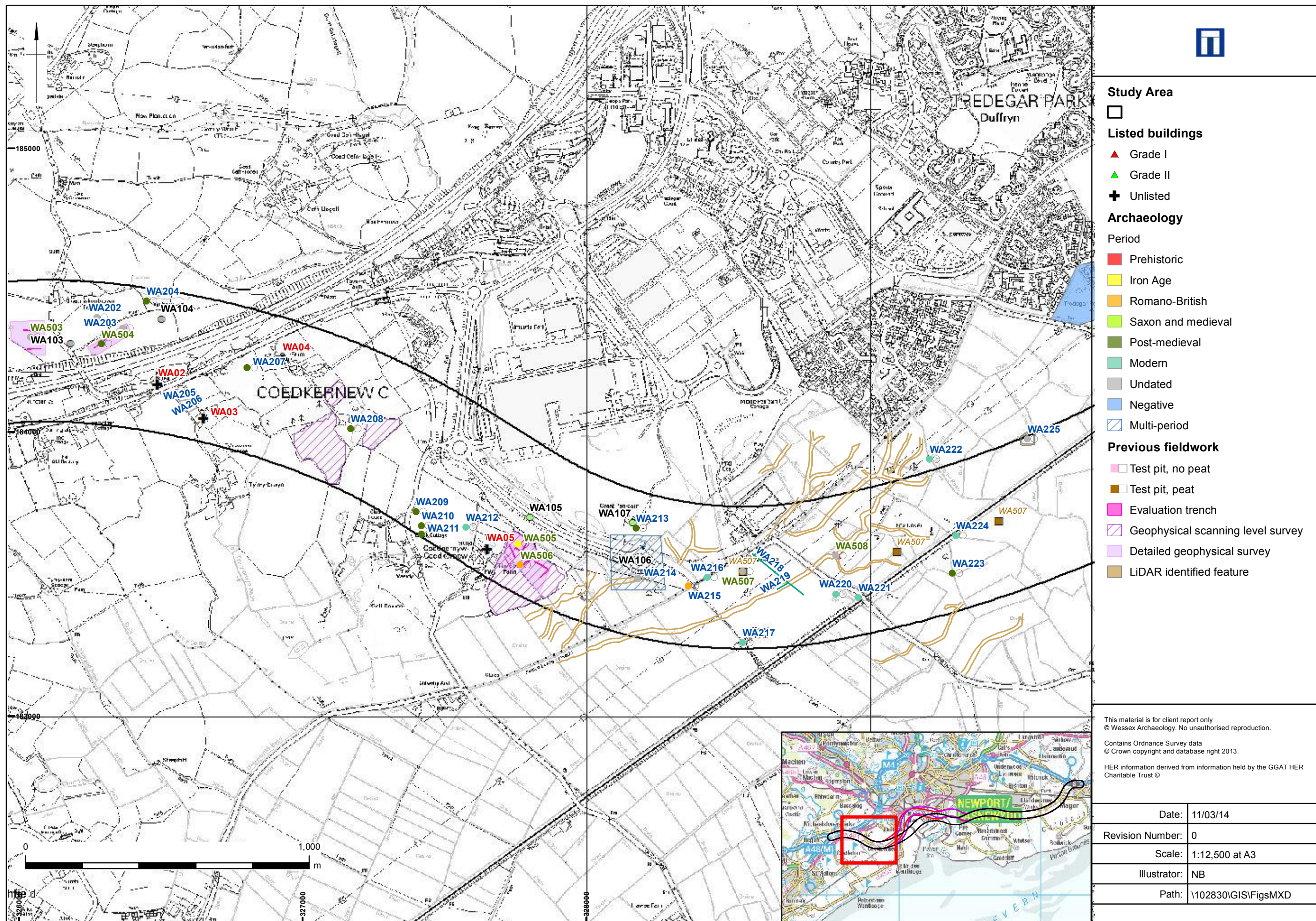
WA No.	Name	Period	Description	Easting	Northing
501	New Park Farm, Castleton	Medieval	Enclosure identified on aerial photographs. Not clear on geophysics, but recorded in evaluation trenches and proved to be medieval, possibly early phase of settlement seen at WA502.	325280	184180

WA No.	Name	Period	Description	Easting	Northing
502	Penylan Farm	Post-medieval	Geophysical survey to the south of the surviving barn identified an enclosure and possible structures. Evaluation confirmed the presence of a small farmstead dating to the post medieval period (16 th or 17 th century).	325830	184325
503	East of New Park Farm	Undated	Geophysical survey identified anomalies in this area, although evaluation indicated that these are geological in origin.	326040	184335
504	Gwaunshonbrown Farm	Post-medieval	Geophysics survey and evaluation trench on site of possible earthwork enclosure. Geophysics identified probable features however these were not identified in an evaluation trench.	326291	184311
505	Stud Farm, Coedkernew	Iron Age	Geophysical survey and evaluation in 1999 identified a small enclosure. Evaluation trenching identified Late Iron Age to early Romano-British settlement.	327760	183605
506	Stud Farm, Coedkernew	Romano-British	Extended geophysical survey identified a large rectangular enclosure and other anomalies. Evaluation trenching suggests the enclosure is Roman in date. Other features identified included a series of ovens.	327768	183532
507	Geo-technical investigations	Undated	Series of geo-technical test pits excavated to explore the sedimentary sequence along the previous proposed route. The Wentlooge sequence was found to be largely untruncated by later development and peat deposits thought to relate to the Bronze Age and Iron Age landscape were identified in a number of the test pits (Wessex Archaeology 2008b).	328552 to 342349	183511 to 187872
508	Palaeochannel	Undated	Palaeochannel identified on LiDAR plot, investigated with evaluation trench in 2008. The position of this channel suggests that it predates the enclosure of the field, possibly indicating a late medieval or post-medieval date.	328880	183564
509	Field systems	Undated	Test pits and topographical survey undertaken in 2012 investigated the sedimentary sequence and also identified elements of probable medieval enclosure and post-medieval drainage.	330629	184364
510	Palaeochannel, Whiltson	Undated	Evaluation trench targeted on palaeochannel to the west of Whitson substation. Confirmed presence of silt filled channel. Undated.	336562	185811
511	Palaeochannel, Green Moor	Undated	Evaluation trench targeting palaeochannels identified on Green Moor revealed two palaeochannels. Two layers of peats were identified in the sequence.	339943	185825
512	Palaeochannel	Undated	Four borehole transects were excavated in order to investigate the sedimentary sequence and palaeochannels identified in the area of Green Moor. These indicated that the channels were relatively shallow, below were peat layers identified within the Middle Wentlooge sequence.	340434	185984

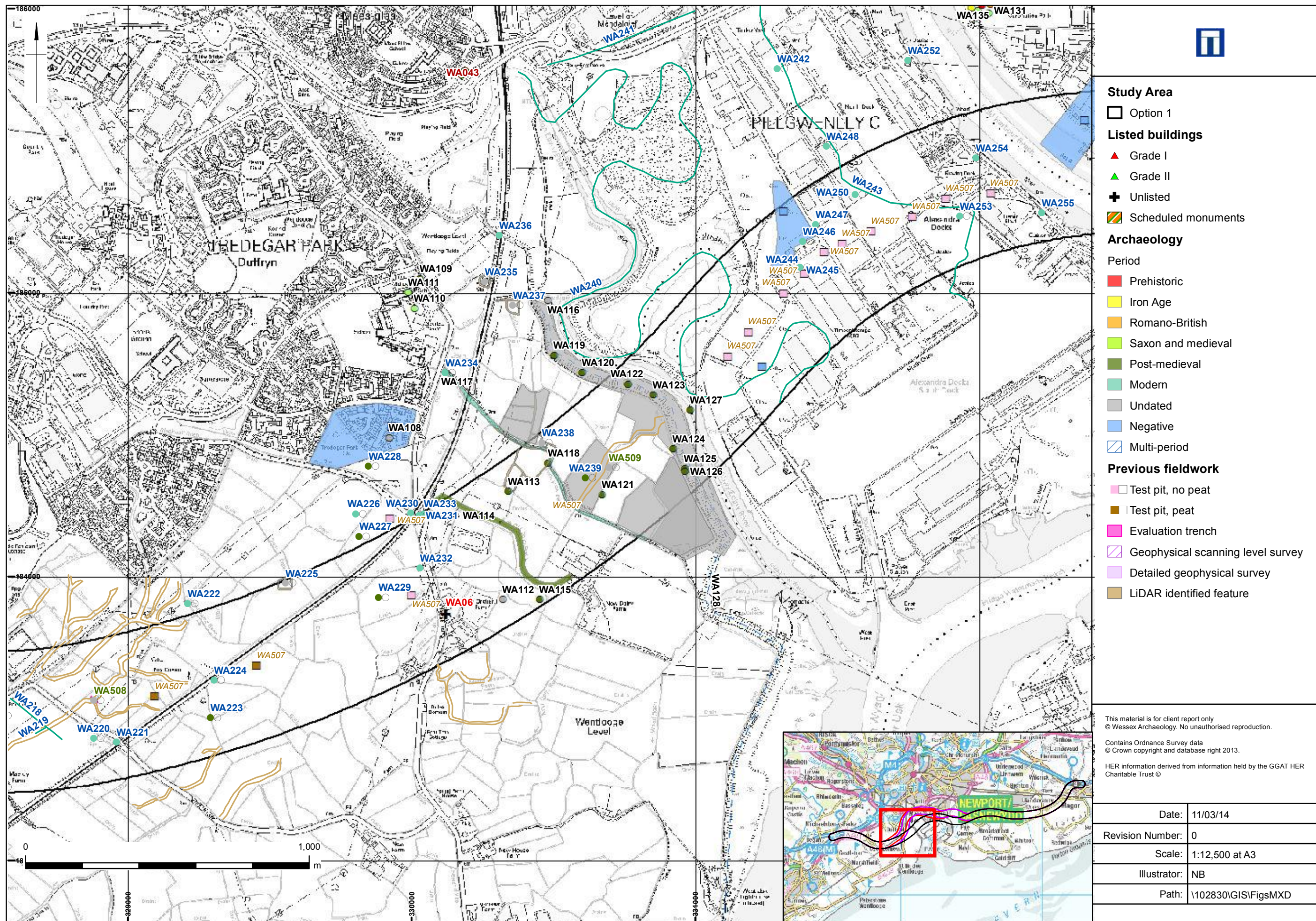
WA No.	Name	Period	Description	Easting	Northing
513	Palaeochannels, Green Moor	Undated	Palaeochannels identified from LIDAR on Green Moor. Two evaluation trenches excavated in 1999 could not clearly identify channel deposits. Later boreholes indicated that the channel deposits were difficult to differentiate from the Wentlooge deposits through which they were cut and they were shallow and represent the latest phase of tidal creek incision.	340637	186094
514	East of Llandeenny	Romano-British	Geophysical survey to the east of Llandeenny identified a complex of ditches and enclosures. Evaluation suggested that these represent the remains of a Roman settlement, including one building. A small number of prehistoric flints were recovered from the evaluation though no features of this date were found.	341218	186831
515	East of Llandeenny	Prehistoric	Test pitting by Reading University revealed two Mesolithic flint scatters interleaved with layers of peat, indicating Mesolithic activity on the dryland/wetland interface.	341242	186664
516	Green Moor	Undated	An evaluation trench excavated to explore the archaeological potential of this area found no archaeological finds or features.	341579	187023
517	West of Magor	Iron Age	Geophysical survey in 1999 identified a series of enclosures. Evaluation identified the remains of a Late Iron Age/Early Roman settlement.	341841	187446
518	West of Magor	Iron Age	Extended geophysics survey in 2008 extended the known boundaries of the settlement previously identified in 1999. Evaluation in 2008 confirmed a Late Iron Age/Early Romano-British date.	341901	187424
519	Field system	Undated	Geophysics survey in 2008 to the north of Woodlands House identified a small number of possible anomalies likely to relate to post-medieval field boundaries.	342041	187738
520	Old Court Farm	Undated	Recorded scanning geophysics survey in 2008 should only weak anomalies though some extant earthworks which probably relate to drainage were noted.	342412	187982
521	Unknown	Undated	Geophysical survey in 1999 identified a number of possible archaeological anomalies. Two trenches excavated in 2008 suggested that these anomalies were geological in origin.	342595	187941
522	West of Knollbury	Undated	Geophysical survey in 1999 identified a number of linear anomalies, possibly archaeological in origin. A single evaluation trench was opened in 2008 to investigate these anomalies, which were revealed to be geological and agricultural in origin.	342870	188024



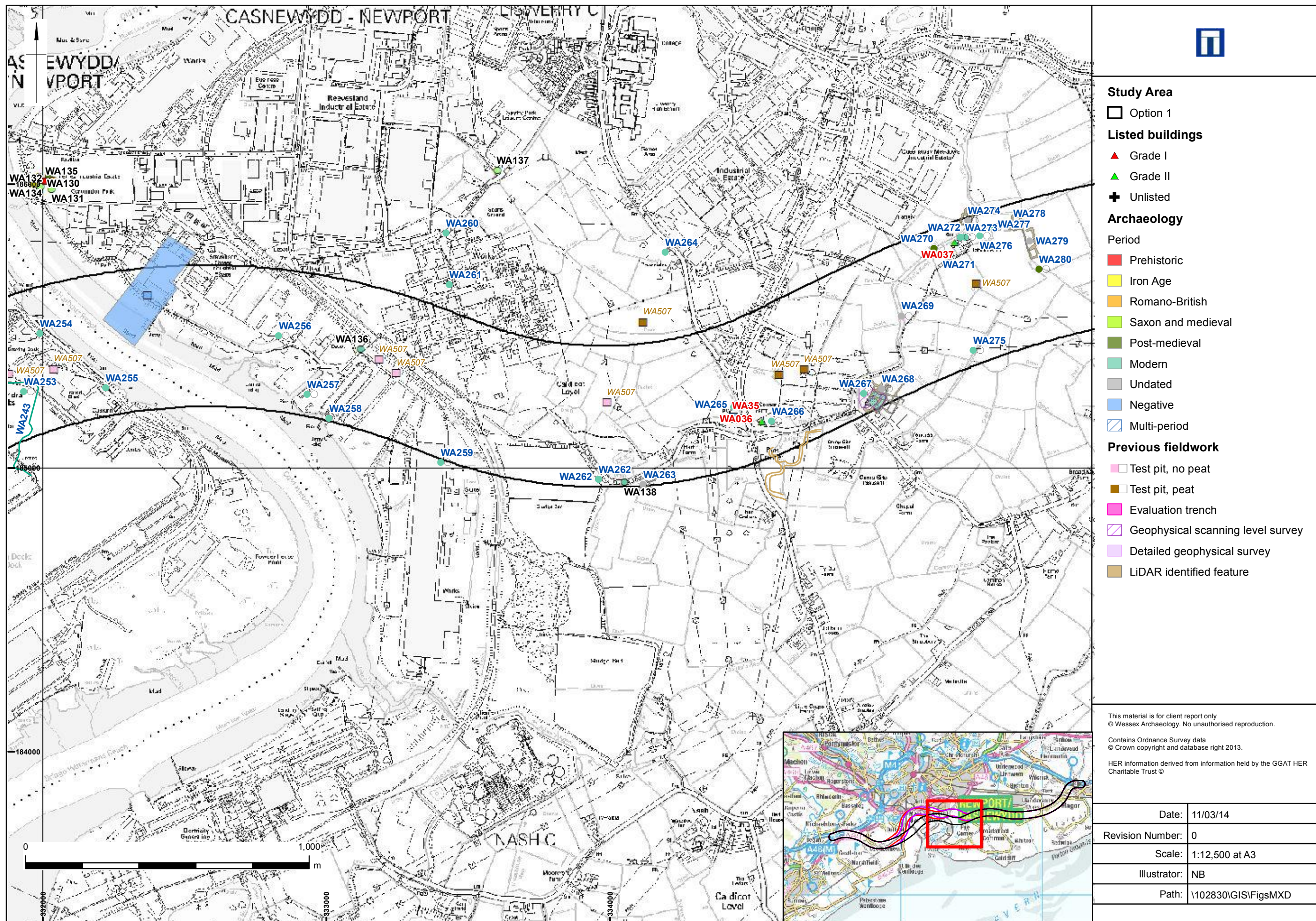
Western area: All routes, Castleton



Western area: All routes, south of Tredegar Park

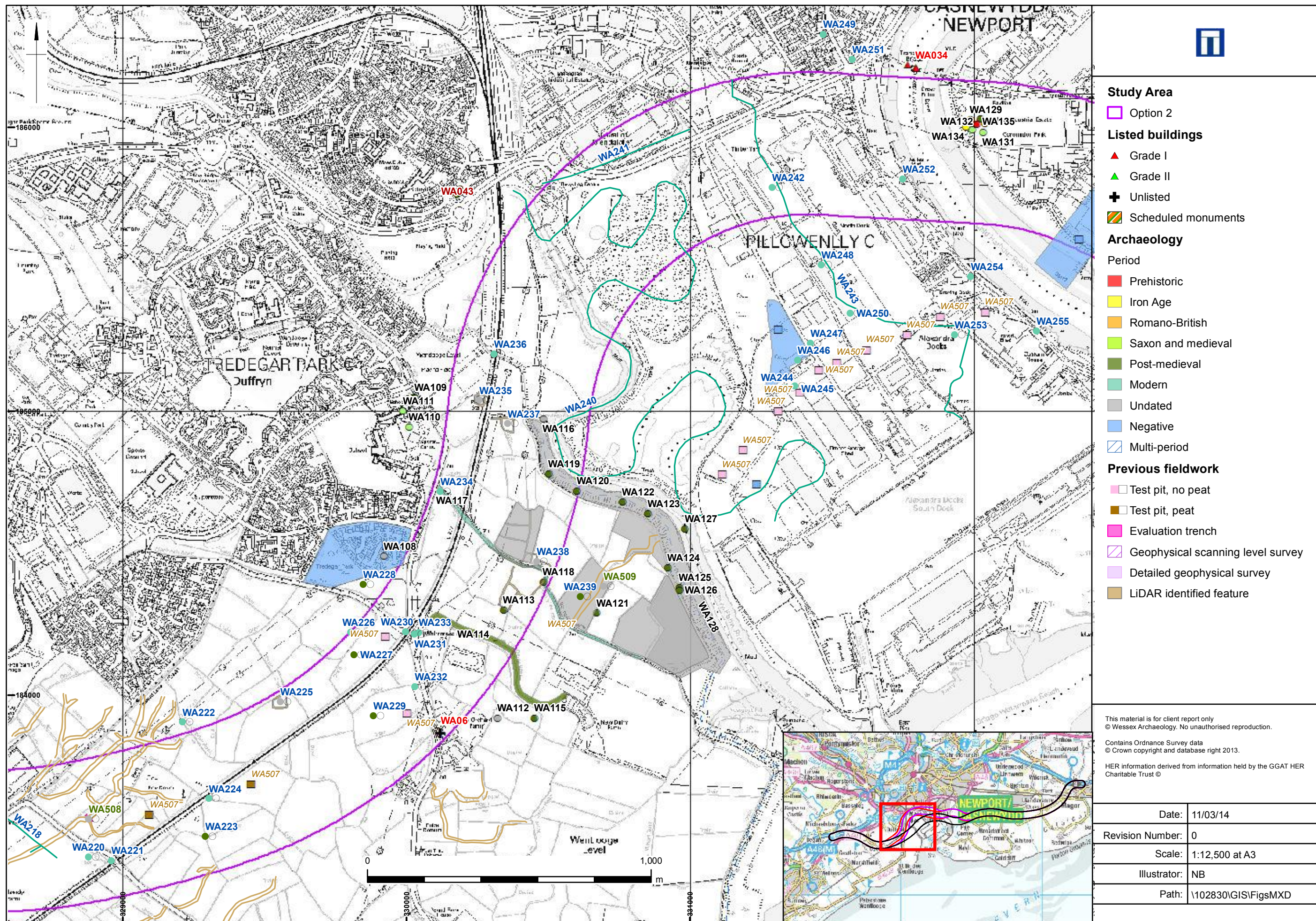


Central area: Option 1, the Wentlooge Levels and Alexandra Dock

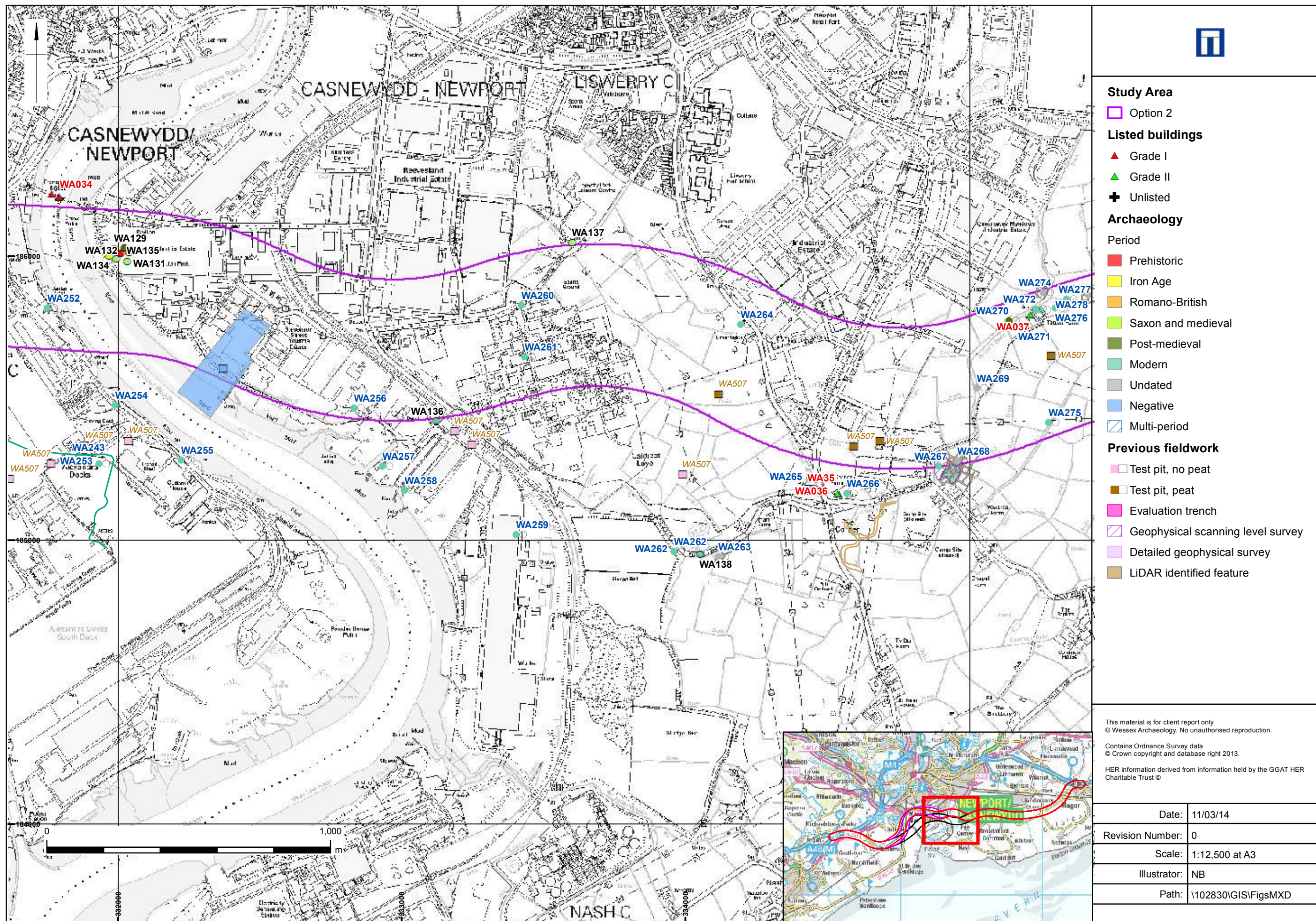


Central area: Option 1, east of the River Usk to Arch Farm

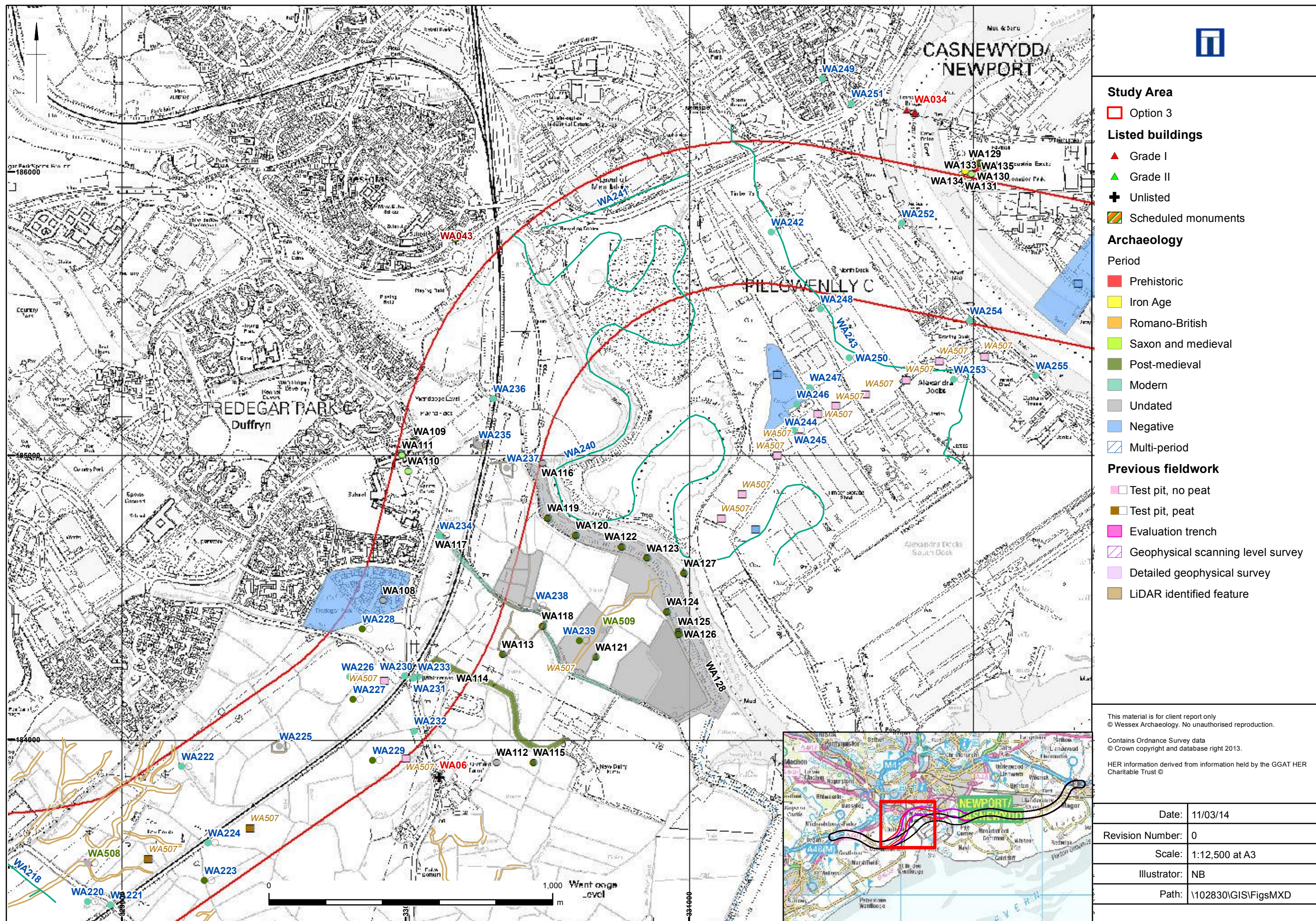
Figure 5



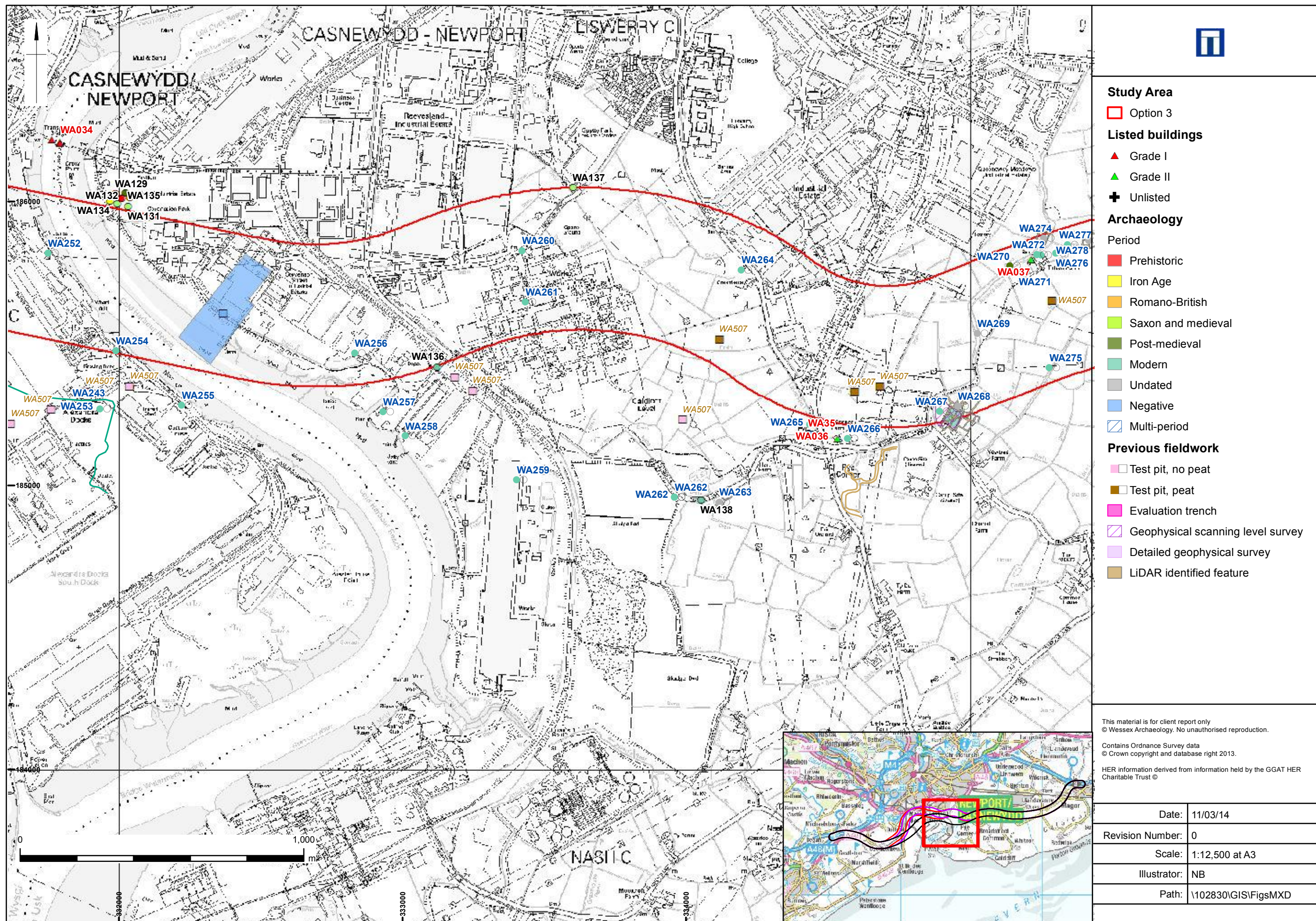
Central area: Option 2, the Wentlooge Levels and Alexandra Dock



Central area: Option 2, east of the River Usk to Arch Farm

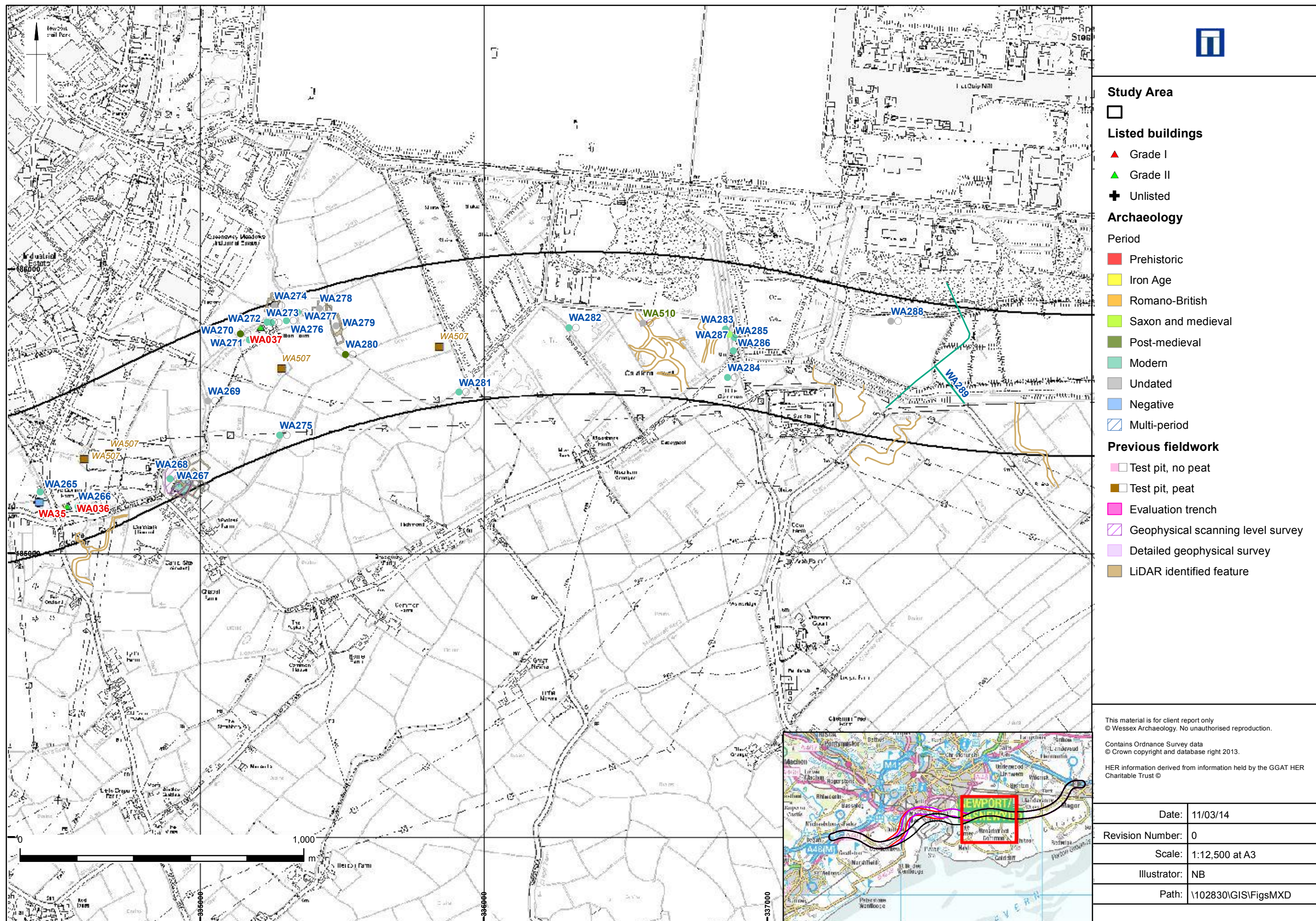


Central area: Option 3, the Wentlooge Levels and Alexandra Dock

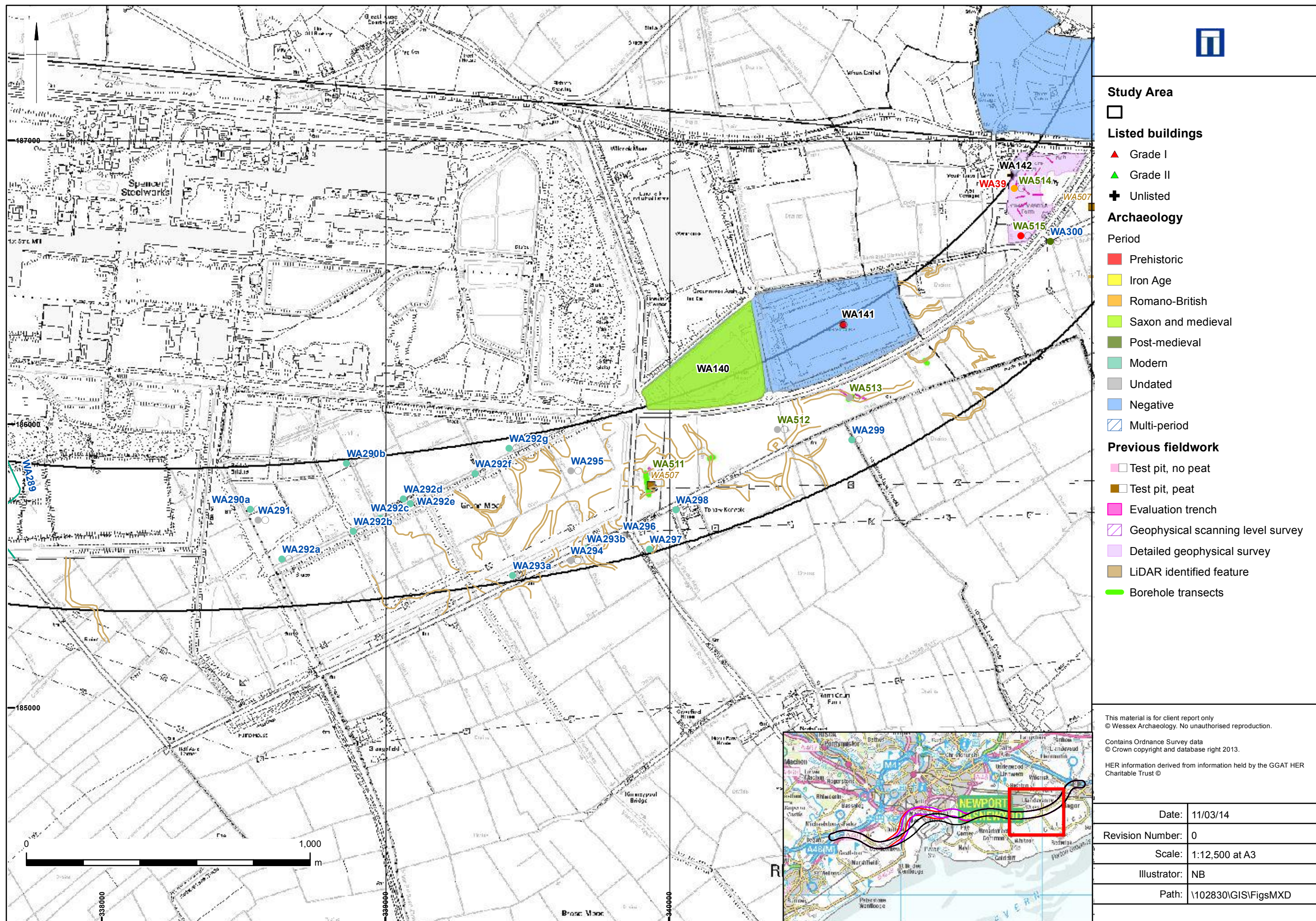


Central area: Option 3, east of the River Usk to Arch Farm

Figure 9

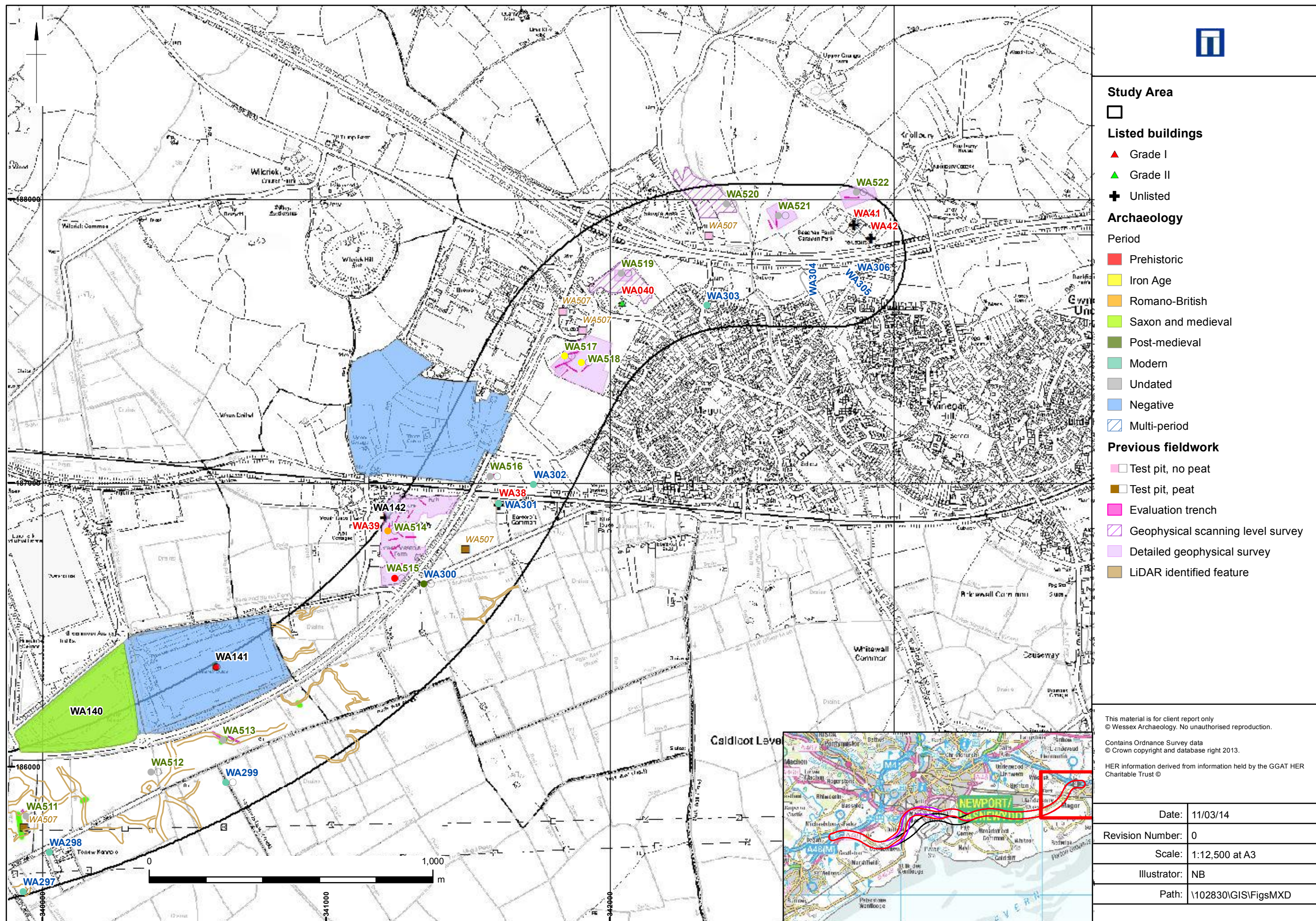


Eastern area: All routes, the Caldicot Levels



Eastern area: All routes, Green Moor

Figure 11

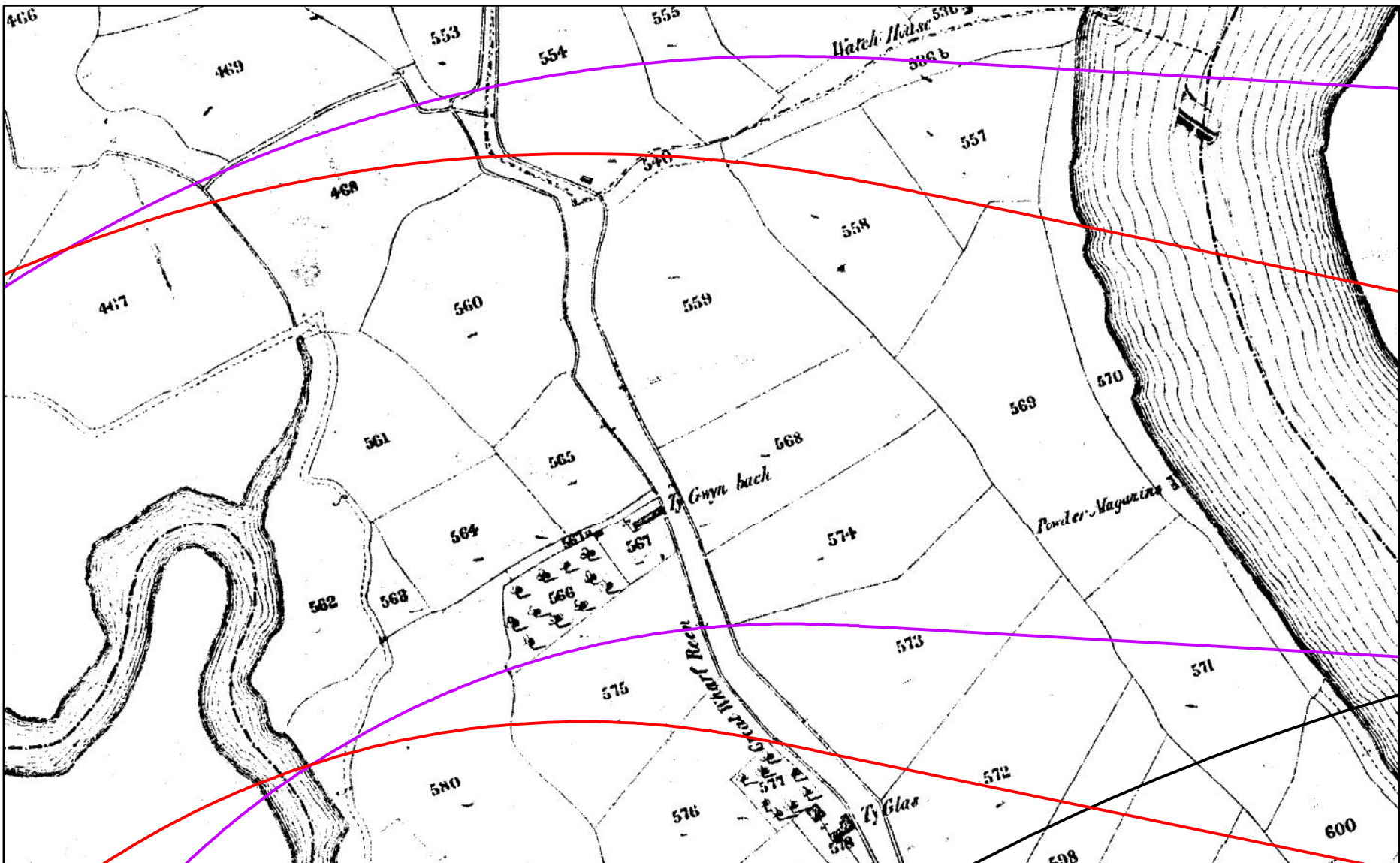


Eastern area: All routes, Magor

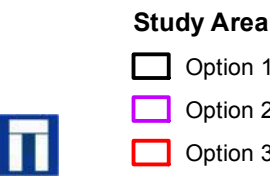
Figure 12



Map A: 1843 Coedkernew Tithe Map

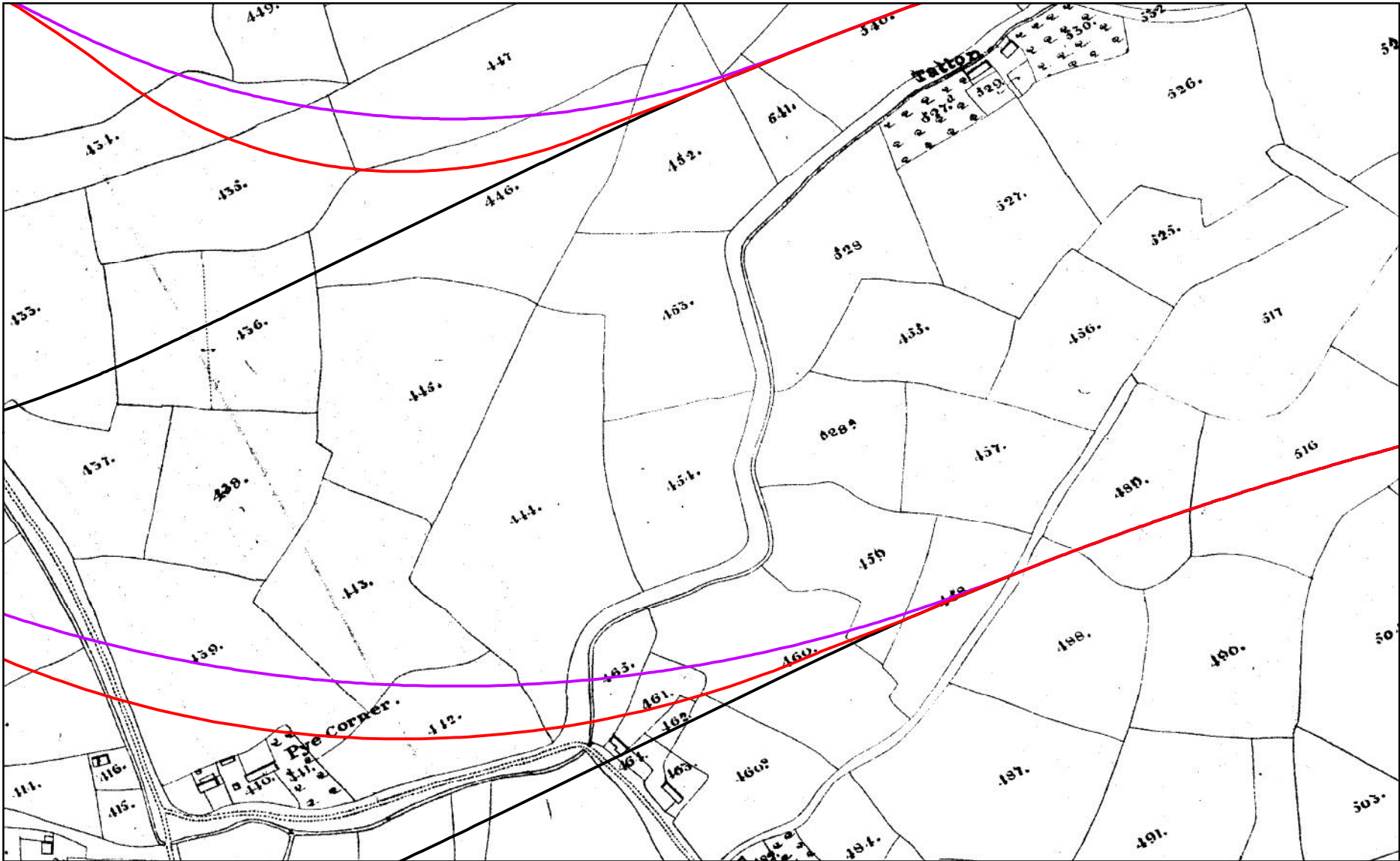


Map B: 1845 St Woolos Tithe Map

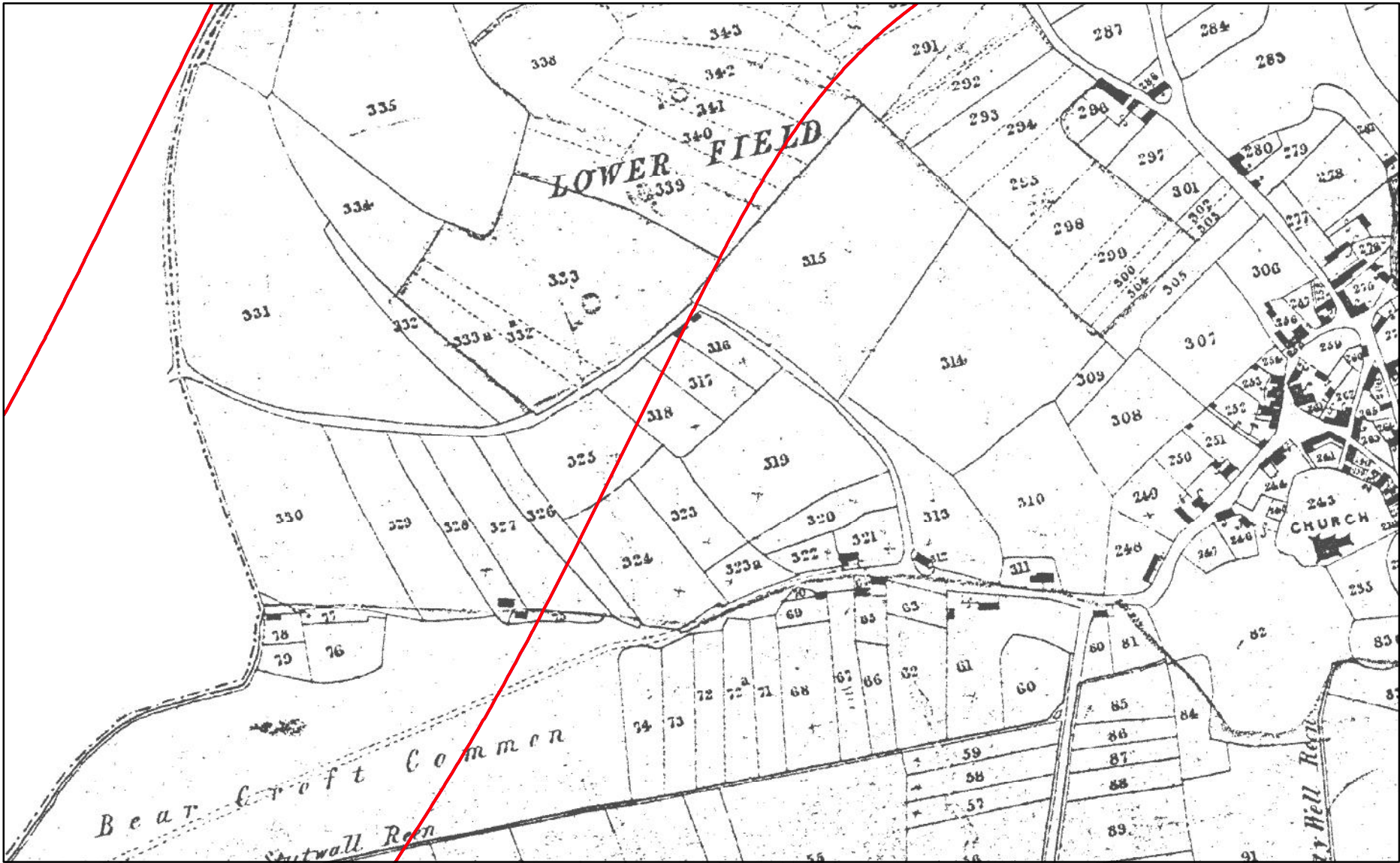


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Map C: 1842 Nash Tithe Map




Map D: 1847 Magor Tithe Map

Study Area

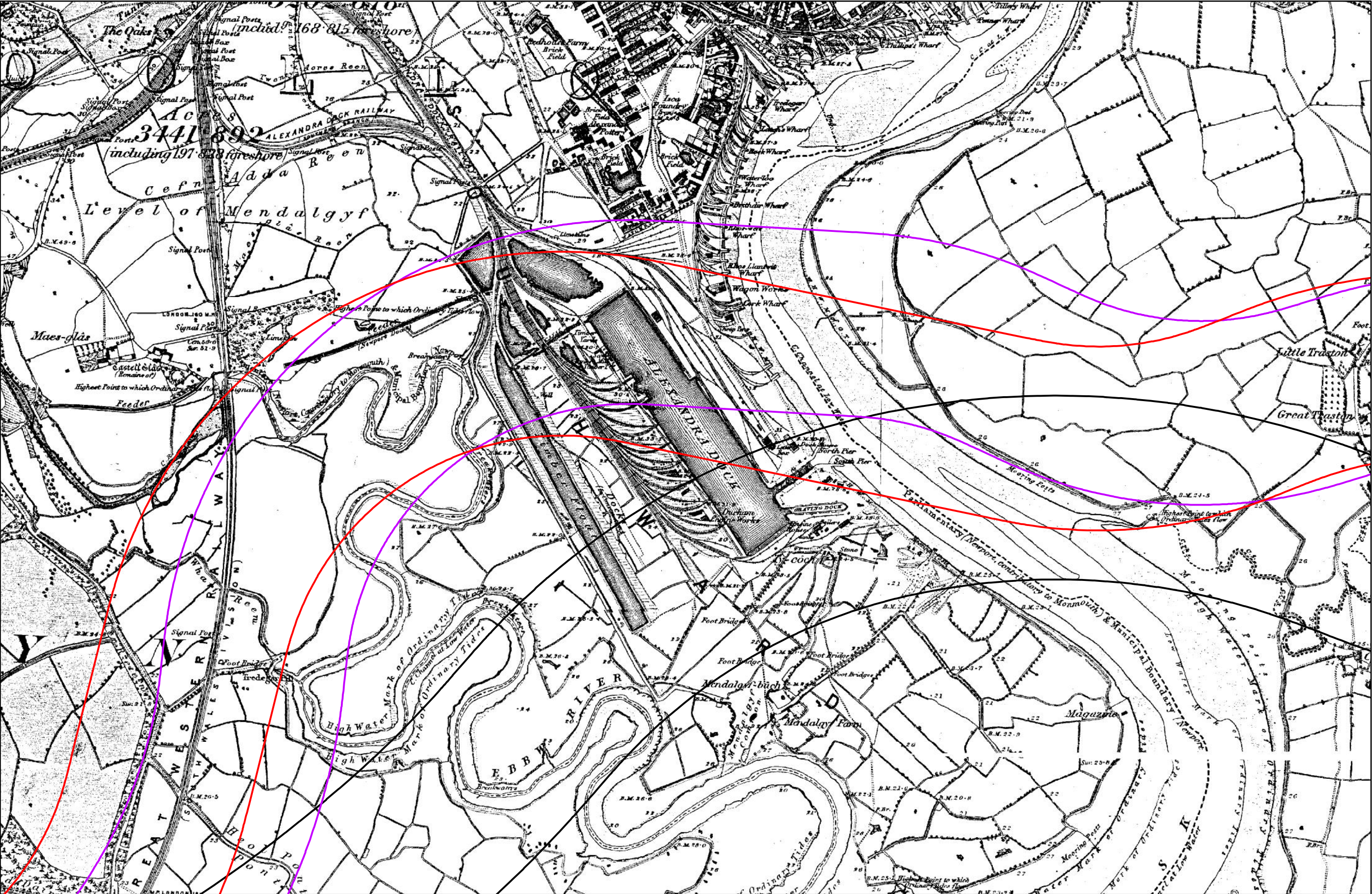
 Option 1





 Option 2

 Option 3

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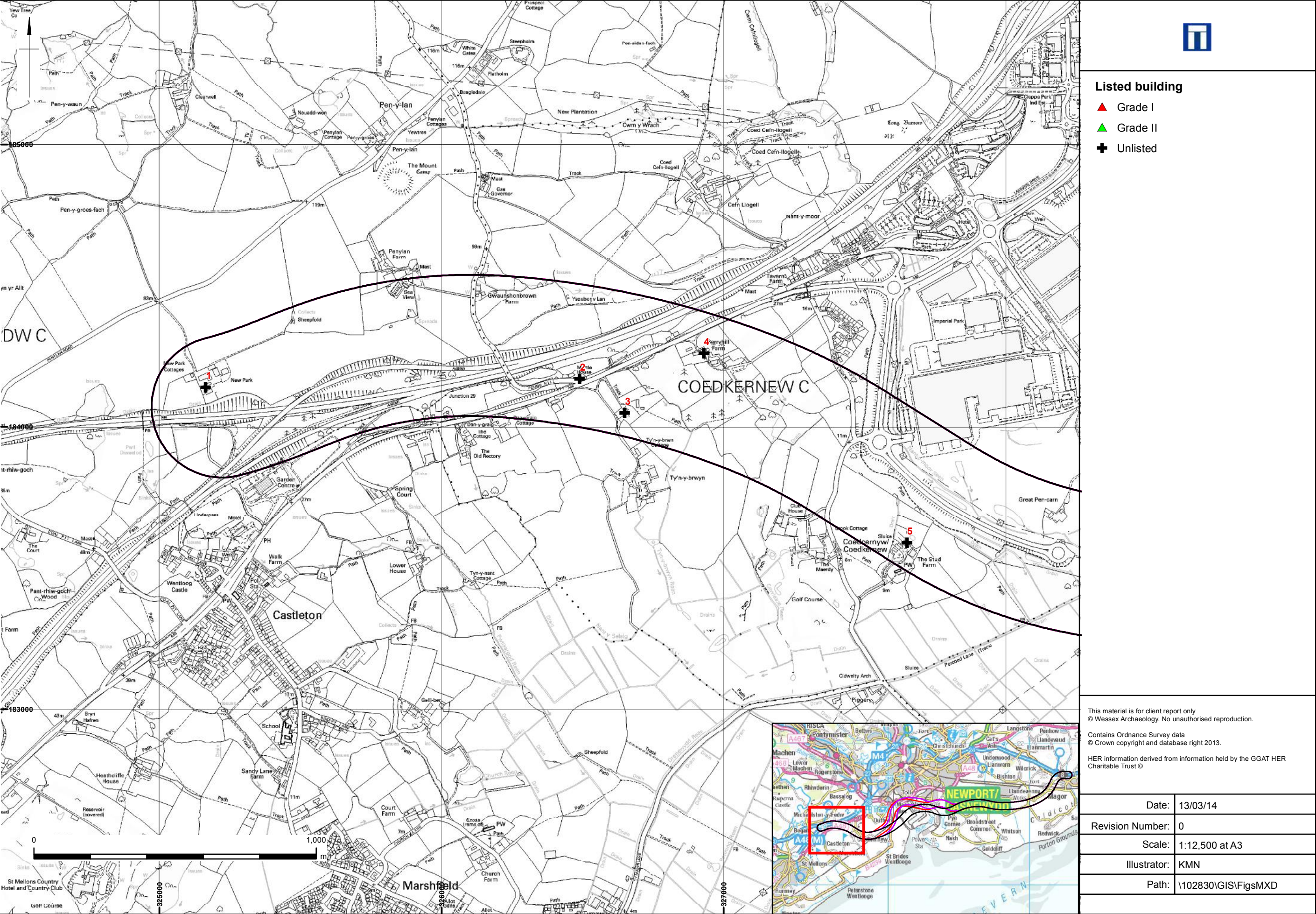
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 Study Area  Option 1  Option 2  Option 3	Reproduced from the 1887 Ordnance Survey © Crown Copyright. This material is for client report only © Wessex Archaeology. No unauthorised reproduction.		Date: 11/03/2014	Revision Number: 0
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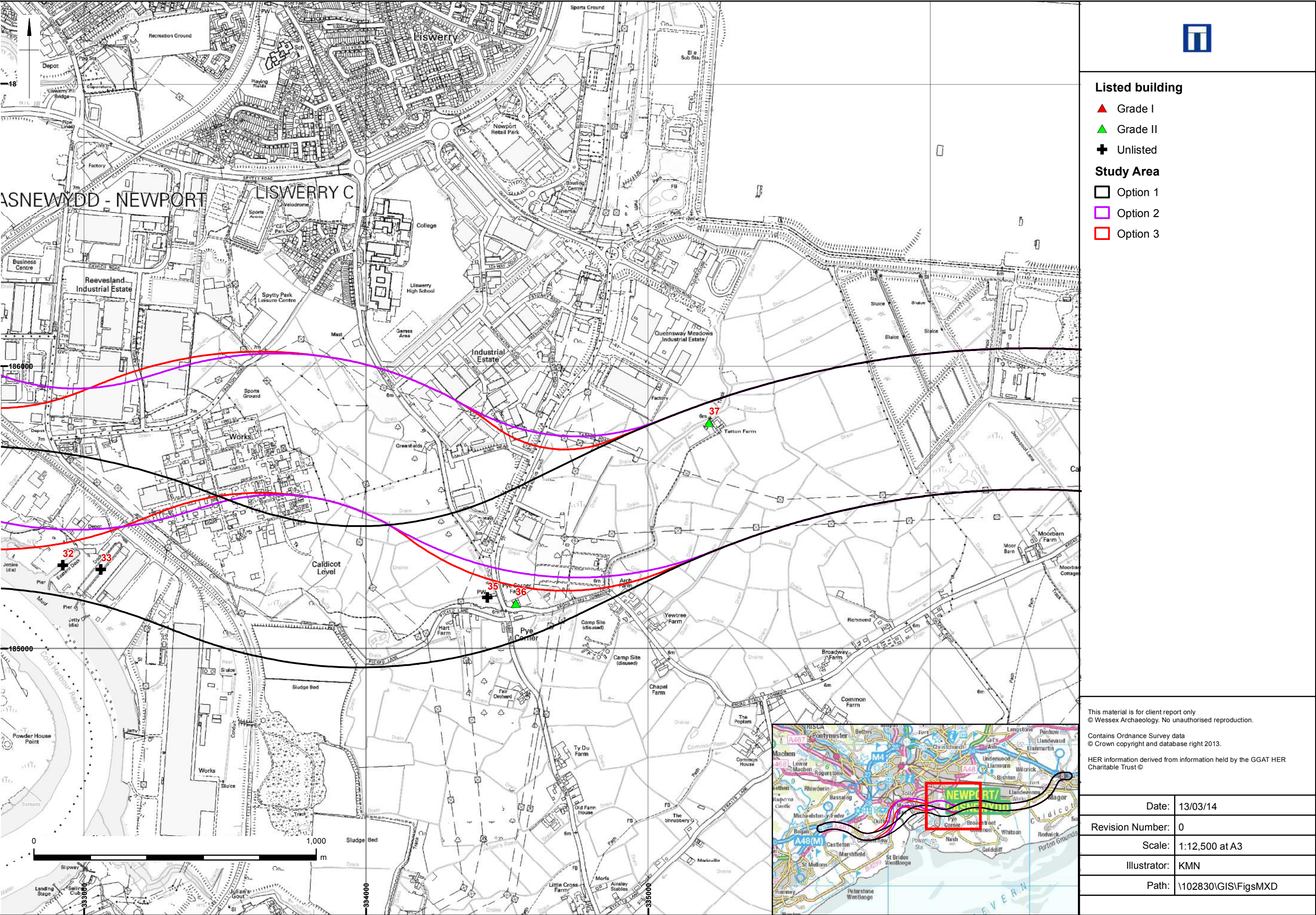
1887 OS: Detail of Alexandra Dock

Figure 15



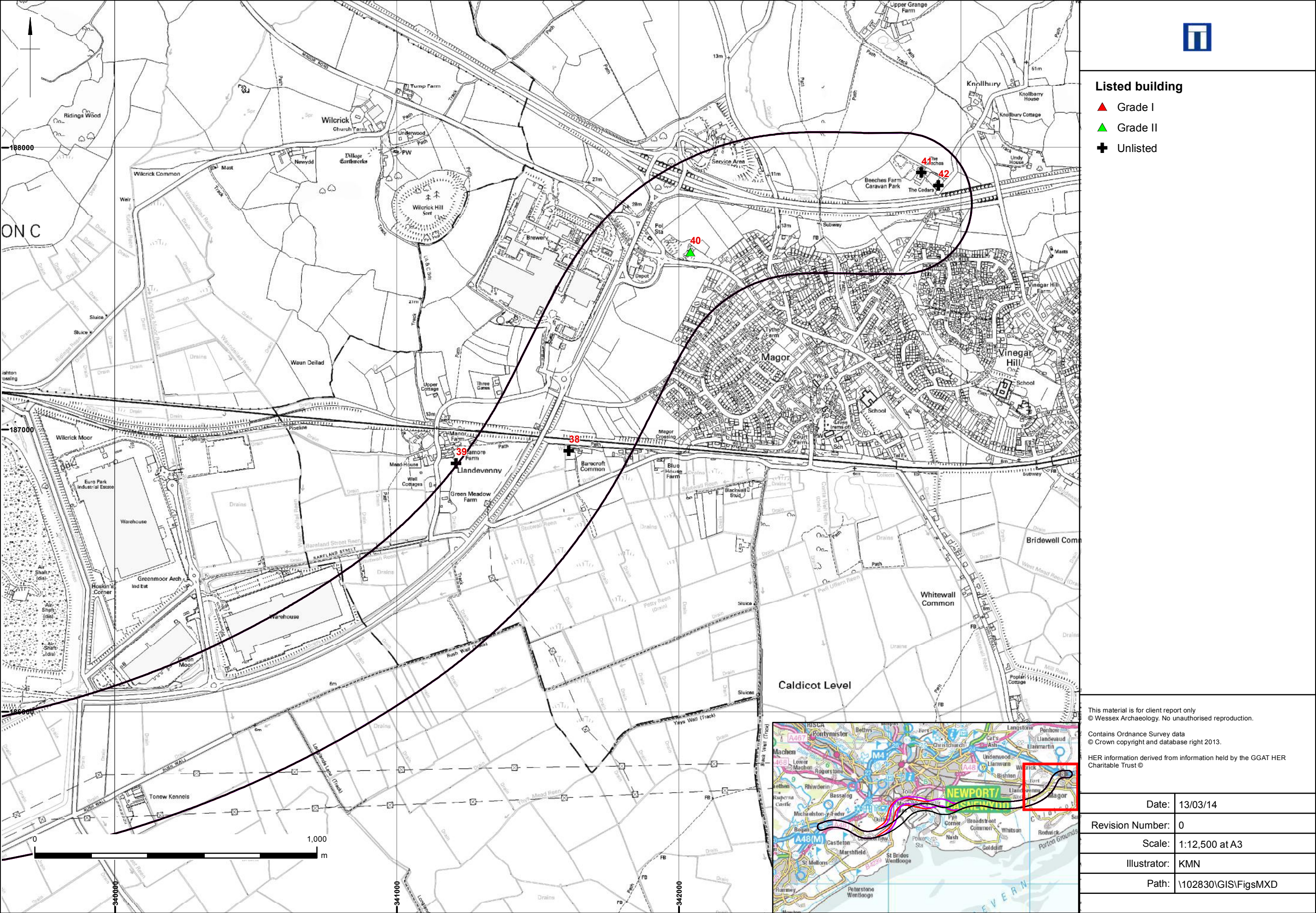
Built heritage on the western part of the route (all options)

Figure 16



Built heritage in the central area of the route

Figure 18



Built heritage on the eastern part of the route (all options)

Figure 19



Plate 1: Ruins of post-medieval barn



Plate 2: Old Dairy Reen


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Plate 3: Oak trees marking post-medieval boundary



Plate 4: Culvert taking Old Diary Reen under the railway


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Plate 5: Green lane, possible medieval route



Plate 6: WWII pillbox


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Plate 7: WA 34. Newport Transporter Bridge – Grade I listed



Plate 8: WA 36. Pye Corner Farm – Grade II listed


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Plate 9: WA 37. Tatton Farm – Grade II listed



Plate 10: WA 40. Magor Vicarage – Grade II listed


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Plate 11: WA 10. Newport Docks. Dock Manager's office- unlisted



Plate 12: WA 23. Newport Docks. Railway engineering sheds – unlisted



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Plate 13: Early 20th century western bank taken from the transporter bridge. In the background the four jetties WA446, WA450, WA452, WA455, the ferroconcrete wharf (WA443) and northern access to Alexandra Docks (source <http://www.newportpast.com>)



Plate 14: Photo taken in 2014. From the left the northern access to Alexandra Docks, the ferroconcrete wharf (WA443), the four jetties WA446, WA450, WA452, WA455, and modern jetty WA459

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