
WRITTEN STATEMENT

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ON BEHALF Of

GWENT WILDLIFE TRUST

In the matter of:

**Public Local Inquiry into the M4 relief road around Newport: The effects of the proposed M4
extension across the Gwent Levels**

February 2017

INTRODUCTION

1. This proof of evidence has been prepared by David Boyce. I am a self-employed Ecologist specialising in invertebrate ecology and conservation. I have worked in nature conservation for 30 years. My first job was for the Nature Conservancy Council, undertaking an invertebrate survey of wetland sites in Wales, including the Gwent Levels. I have a special interest in the ecology of wetland invertebrates and have carried out many contracts, including three for the Countryside Council for Wales that involved aquatic invertebrate monitoring on seven of the Gwent Levels SSSIs. These have given me a particularly good understanding of the freshwater invertebrate fauna of this area. I have produced many reports, papers and articles on the ecology and conservation of invertebrates.
2. This report reviews the impact of the proposed M4 Corridor around Newport scheme (hereafter referred to as the pCaN) on the invertebrate fauna of that part of the Gwent Levels through which the proposed new route would pass. Both the direct effects of habitat loss along the proposed new route and indirect effects, such as run-off and habitat fragmentation are considered. Unless otherwise stated, comments relate to the corridor of land demarcated by the black line of the proposed route and the red line inner buffer shown on Maps 1 to 6.
3. The Gwent Levels are an area of coastal grazing marsh that are known to be of high ecological interest. This interest is primarily associated with the aquatic flora and fauna associated with the extensive network of drainage ditches (known locally as reens), though there are also a range of important terrestrial habitats, such as ditch edges, fens, neutral and marshy grassland and hedges with associated old trees. Because of their high ecological interest, much of the Gwent Levels have been notified as a series of eight Sites of Special Scientific Interest (SSSI). The diverse aquatic and terrestrial invertebrate fauna are one of the primary reasons for their notification.
4. Direct effects of the scheme would be felt on the Nash and Goldcliff SSSI, Redwick and Llandeenny SSSI, St Brides SSSI and Whitson SSSI, which will all be crossed by the pCaN. Indirect effects of the proposed scheme may still be felt on those Gwent Levels SSSIs lying off the proposed route, these being the Magor Marsh SSSI, Magor and Undy SSSI, Newport Wetlands SSSI and National Nature Reserve (NNR) and Rumney and Peterstone SSSI.
5. Section 2 of the report considers other issues relating to the overall impact of the M4 pCaN on the invertebrate fauna, including consideration of the compensation and mitigation measures proposed in the ES and some general recommendations of ways in which these could be used to maintain and enhance the high invertebrate interest of the area. Section 3 sets out conclusions based on the information presented in the preceding sub-sections.
6. The Appendix includes eight sub-sections, which summarise the invertebrate interest of each of the SSSIs listed above and lay out the main issues arising out of the pCaN. Each of these SSSI accounts begins with a brief statement of their invertebrate interest, based on both existing survey information and the citation and other SSSI

documentation. It also includes consideration of the invertebrate surveys and other relevant information included in the Environmental Statement (ES) prepared in support of this. Following this, there is an overview of the issues and impacts of the pCaN on the invertebrate interest with special reference to any ditches or other habitats known to support important invertebrate species.

DISCUSSION

7. Because of their high ecological interest, much of the Gwent Levels have been notified as a series of eight Sites of Special Scientific Interest (SSSI). **The diverse aquatic and terrestrial invertebrate fauna are one of the primary reasons for their notification.**
8. In 2014, an invertebrate survey of those areas that would be affected by the M4 pCaN was undertaken by consultants working for the Welsh Government (Welsh Govt., 2014b). **The 2014 survey fails to provide a sound basis for making decisions on the significance of the invertebrate fauna along the route of the M4 pCaN.**
9. While some important aquatic species were recorded, the samples were uniformly less diverse than in other freshwater invertebrate sampling exercises conducted on the Gwent Levels recently (Boyce, 2009, 2012 & 2013). Little detail is given on sampling methodologies, so it is difficult to either make comparisons with other datasets or to assess the importance of the aquatic fauna along the proposed route. **The aquatic invertebrate survey work commissioned in support of this scheme is inadequate as a baseline against which to assess the impacts of the M4 pCaN.**
10. **The 2014 aquatic survey has failed to record many of the most important species for which the area has been notified as a SSSI.** Examples include the dragonflies and soldierflies. Given that the aquatic invertebrates are of particular importance, gathering information on these important species should have been a key objective of the 2014 survey.
11. **The 2014 terrestrial invertebrate survey commissioned in support of the proposal gives a wholly inadequate baseline against which to assess impacts of the scheme.** Most of the terrestrial samples collected were very small and lacked any species of note. At many sites, no terrestrial samples were collected for reasons that appear spurious (relating to the lack of botanical diversity or of evident invertebrate activity). Given the quality of the terrestrial habitats (eg. ditch margins, grassland, hedges, trees and wet woodland) along parts of the route, the terrestrial samples should have been of much greater quality and quantity and it is not possible to make an informed assessment of the importance of the terrestrial invertebrate fauna based on this information.
12. The recommendations for future survey in the 2014 survey suggest that this work was intended to be an initial reconnaissance exercise, with more detailed surveys to be undertaken in 2015. **Only two of the recommendations for further invertebrate survey included in the 2014 report have been acted on.** These recommendations were as follows:

- *“Surveys along the Usk estuary and Newport Docks area. Access was difficult to obtain during 2014. This area has valuable ex-industrial land which is an excellent habitat for invertebrates. It is known that the Red Data Book (IUCN Endangered) ground beetle *Amara fusca* occurs at Newport Docks.*
- *Surveys of the ditches and ruderal habitats surrounding the M4 toll booth at Rogiet Moor. No access was given in 2014.*
- *Consecutive surveys of the species-rich sites covered in 2014, particularly land and reens within the Tata Steel site, the disused laboratory and other botanically diverse reens along the route. Species-rich sites include those with a good diversity of botanical species and those that support 20 or more species of terrestrial invertebrate and/or 15 or more species of aquatic invertebrate. Invertebrate populations can wax and wane and sampling over a number of seasons gives a better picture of the species assemblage present.*
- *Static collection techniques would increase the diversity and richness of the invertebrates collected. Sites should be found on which static techniques can be used. Alternatively, existing sites could be managed to allow static techniques, such as fencing an area off from cattle.”*

13. Of these recommendations for additional survey work, only the Newport Docks (point 1, element 2) and Tata Steel sites (point 3, element 1) were subject to further survey work (Welsh Govt., 2016a).
14. The surveys of the ABP Newport Docks and Tata Steel sites carried out in 2015 (Welsh Govt., *ibid.*) showed both of these areas to have a very rich invertebrate fauna that included many ecologically important species. These studies provide a satisfactory baseline for assessing the importance of these two sites.
15. **The M4 pCaN would cause significant mortality and habitat fragmentation for invertebrates.** Numerous studies have shown that roads represent a significant barrier to the free movement of invertebrates through increased mortality and/or behavioural avoidance (eg. Van der Ree et. al., 2015, Bhattacharya et. al., 2003). The M4 pCaN would therefore result in smaller and increasingly fragmented populations of important invertebrates. Negative impacts would be felt most acutely by those species, such as the shrill carder bee and brown-banded carder bee (both with important populations on the Gwent Levels) that require large areas of breeding and foraging habitat. The width and high traffic volumes associated with a motorway development will further exacerbate these damaging impacts.
16. **Artificial lighting at the junctions would result in increased mortality and reduced breeding success of many nocturnal invertebrates.** Artificial lighting is a well-known ‘ecological trap’ for many nocturnal insects, which are

attracted strongly to such light sources. A number of studies have shown that this can result in increased mortality, as well as disruption of normal breeding and foraging activity (Bruce-White & Shardlow, 2011).

17. **The road surface and associated motorway structures would prove attractive to flying aquatic insects, thus leading to increased mortality and reduced breeding success.** A third indirect impact of the M4 pCaN is that of polarised light pollution. To quote from Bruce-White & Shardlow (*ibid.*)
18. *“Polarised light pollution sources are also attractive to many invertebrates, including beetles, dragonflies and adult riverflies. Polarised light pollution is the process whereby light undergoes linear polarisation by reflecting off smooth surfaces or by scattering in the atmosphere or under water. Artificial lights are not necessarily part of this form of light pollution, but artificial lighting can make the situation worse. Adult mayflies are attracted to sources of polarised light as in nature they indicate a water surface on which the insects can breed and lay eggs. Artificial sources of polarised light such as smooth dark buildings, cars, road surfaces and solar panels can attract mayflies in the same way; however, any eggs laid on such surfaces will not develop.”*
19. Research suggests that polarised light pollution from roads may lead to increased mortality and a disruption of natural activity patterns that result in lower reproductive success (Horvath, et. al., 2010). It is therefore probable that the road surface and other hard, shiny structures associated with the proposed scheme may also be detrimental to invertebrates. Given that this is an issue that specifically relates to aquatic species, which are one of the main interest features of the Gwent Levels SSSIs, it is essential that it should be properly addressed in the ES.
20. **Pollutants in water treatment area (WTA) outfalls from the pCaN scheme would be detrimental to the aquatic invertebrate fauna.** An assessment of the risks of WTA outfalls containing variable or increasing pollutant levels is included elsewhere in the Gwent Wildlife Trust Water Treatment and Reen Pollution written statement and the additional statement provided by Prof Neil Ward from Surrey University. There is also additional concern that cumulative impacts will result from existing pollution in the TATA steelworks, Europark and Newport areas in combination with the M4 pCaN scheme. Heavy summer rainfall events in particular may put water quality at serious risk. A single severe pollution event could cause serious damage to the invertebrate fauna and potentially cause local extinctions of rare species. Many Freshwater invertebrates are known to be very sensitive to pollution (eg. Watson & Ormerod, 2004; Wright et. al., 2000). The scheme has provided no assessment of likely impacts of water pollution from the pCaN scheme on the specific rare invertebrates found on the Gwent Levels SSSI. Nor have the proposals provided an adequate baseline dataset or outlined a monitoring scheme designed to assess the impact of pollutants emanating from the scheme on the rare invertebrates. The ES is therefore deficient in these respects.

21. **Mitigation measures need to address the specific needs of the nationally important invertebrate assemblage.**

Though many of the measures outlined in the SSSI Mitigation Strategy (Welsh Govt., 2016) should be of benefit to the quality of habitats within the mitigation areas, there are no specific proposals for the nationally important invertebrate assemblage. This is especially important for the aquatic invertebrates that constitute one of the most important ecological features of the Gwent Levels.

22. Despite its high importance, no monitoring of the impact the reen and SSSI mitigation measures might have on the invertebrate fauna is proposed. Given that this is one of the main features of importance for which the Gwent Levels were notified, this is essential. For watercourses in particular, the response of the aquatic invertebrate fauna will be of paramount importance in judging the success of mitigation measures. It would also be very valuable to monitor populations of shrill carder bee in response to grassland restoration works. The poor quality surveys from 2014 provide an inadequate baseline from which to assess the response of invertebrate species to mitigation.

CONCLUSIONS

23. As a baseline for assessing the impact of the pCaN, the 2014 invertebrate survey work is not fit for purpose, with the terrestrial survey being particularly poor. Only the two sites surveyed in 2015 and the shrill carder bee survey of the whole area constitute adequate information. Given the known importance of the land that would be destroyed along the proposed route and the wider long-term damage that is likely to result from factors such as habitat fragmentation and water, light and polarised light pollution, **it seems certain the proposed M4CaN scheme will cause significant damage to the nationally important invertebrate fauna that is one of the main reasons the areas have been notified as SSSI. The Gwent Wildlife Trust therefore urges the Inspector to recommend refusal of this application.**

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Appendix 1. SSSI accounts and review of M4 CaN Invertebrate surveys

The location of the eight SSSIs and other areas of habitat included in the 2014 invertebrate survey (Welsh Govt., 2014b) is shown on Maps 1 to 6 at the end of this Appendix.

Following the SSSI accounts, there are also descriptions of other areas of habitat outside the SSSI that have either been surveyed or are mentioned elsewhere in the ES in respect of invertebrates.

A1.1. Magor Marsh SSSI

A1.1.1. The Magor Marsh SSSI lies in the eastern Levels, just to the south of the settlement of Magor. It is off the line of the M4 pCaN, so will avoid the direct effects of the scheme. However, it might still suffer negative impacts from indirect factors arising out of the proposed development.

A1.1.2. The Site Management Statement for the SSSI lists the wetland invertebrate assemblage as one of the special features of the site.

A1.1.3. The terrestrial invertebrate fauna was surveyed in detail in 1988 by the Welsh Peatland Invertebrate Survey (WPIS, Holmes et. al., 1991). It found the site to support an extremely rich invertebrate fauna in association with the open sedge-dominated fen habitats. Both cattle grazed and ungrazed stands of pond-sedge were sampled, with the former being shown to have a particularly rich fauna that included a number of Nationally Scarce ground beetles and rove beetles, as well as the Nationally Rare rove beetle *Oxytelus piceus*.

A1.1.4. Though the WPIS was not aimed at sampling aquatic invertebrates, two Nationally Scarce freshwater species, the weevil *Bagous tempestivus* and the soldierfly *Odontomyia tigrina* were recorded.

A1.1.5. Other aquatic invertebrate surveys have taken place subsequently, which have shown the SSSI to have a rich freshwater fauna that includes the water beetle *Laccornis oblongus* at its only known site in Wales.

A1.1.6. No specific aquatic or terrestrial invertebrate surveys were undertaken on the SSSI for the M4 pCaN submission.

A1.1.7. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off¹ may all effect Magor Marsh SSSI. These indirect effects of the scheme are discussed in more detail in section 4.

¹ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.2. Magor and Undy SSSI

A1.2.1. The Magor and Undy Marsh SSSI is the most easterly of the eight Gwent Levels SSSIs, lying just to the south of the settlement of Magor/Undy. It is off the line of the M4 pCaN, so will avoid the direct effects of the scheme. However, it may still suffer negative impacts from a number of indirect factors arising out of the proposed development.

A1.2.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetles *Haliplus mucronatus* and *Agabus conspersus*, the hairy dragonfly *Brachytron pratense* and the soldierfly *Stratiomys singularior* are all aquatic invertebrates cited here, as is the invasive exotic water snail *Physa heterostrophica*.

A1.2.3. The citation also recognises the presence of a nationally important terrestrial invertebrate assemblages of hedgerows and reed margins as an additional feature of interest. Terrestrial species cited here are the snail-killing fly *Pherbellia brunnipes* and the big-headed flies *Pipunculus fonscolombei* and *Tomosvaryella minima*. It states that 43 Nationally Rare or Scarce invertebrates have been recorded from the SSSI.

A1.2.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna as two important features of the site, with more than 300 invertebrate species recorded from the SSSI, including the soldierfly *Odontomyia argentata*, and a rich water beetle assemblage that includes great silver water beetle. The third important feature of the SSSI is the presence of a strong population of the rare and threatened shrill carder bee *Bombus sylvarum*.

A1.2.5. Various aquatic invertebrate surveys have taken place that show the SSSI continues to have a rich freshwater fauna, with the most recent being in 2012 (Boyce, 2013).

A1.2.6. No specific aquatic or terrestrial invertebrate surveys were undertaken on the SSSI for the M4 pCaN submission.

A1.2.7. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off² may all affect Magor and Undy SSSI. These indirect effects of the scheme are discussed in more detail in section 4.

² Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.3. Nash and Goldcliff SSSI (Map 4)

A1.3.1. The Nash and Goldcliff SSSI lies just to the east of Newport. It is one of the four SSSIs on the Gwent Levels through which the pCaN would pass.

A1.3.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetles *Haliphus mucronatus* and *Hydaticus transversalis*, the hairy dragonfly *Brachytron pratense* and the soldierflies *Odontomyia ornata* and *Oplodontha viridula* are all aquatic invertebrates cited here, as is the invasive exotic water snail *Physa heterostropha*.

A1.3.3. The citation also recognises the presence of a nationally important terrestrial invertebrate assemblages of hedgerows and reed margins as an additional feature of interest. Terrestrial species cited here are the big-headed flies *Pipunculus fonselai* and *Tomosvaryella minima*.

A1.3.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna as important features of the site, with the soldierfly *Odontomyia ornata*, and the hairy dragonfly specifically mentioned. The third important feature of the SSSI is the presence of a strong population of the rare and threatened shrill carder bee *Bombus sylvarum*.

A1.3.5. In 2012, a programme of invertebrate sampling was undertaken on Nash and Goldcliff as part of the Countryside Council for Wales' programme of SSSI Condition Assessment (Boyce, 2013). One of the sites included in that study was also surveyed in 2014 (Julian's Reed, IDB77, sample site 15).

2014 aquatic invertebrate survey

A1.3.6. Aquatic samples were taken in 2014 within the Nash & Goldcliff SSSI at sites C3-C4, 8-9, 11-15 and 41. This formed a part of the evidence gathering exercise in support of the M4 pCaN. With the exception of the two 'controls', these sites lie very close to the black line route and appear likely to be destroyed or disturbed by works associated with the proposed re-routing.

A1.3.7. The two control sites (C3 and C4) sampled in 2014 are both wide ditches that had a moderately diverse aquatic invertebrate fauna.

A1.3.8. 2014 Sample sites 8 and 9 both lie at the eastern end of the SSSI. They are deeply cut ditches with a wide fringe of tall vegetation up the bank sides. Both had a moderately diverse aquatic invertebrate fauna.

A1.3.9. Sample sites 11-15 include a group of reens in the western part of the SSSI, just to the south of Tatton Farm. The water in some of these appeared rather turbid at the time of the 2014 survey. Aquatic samples collected from this group of sites were mostly very species-poor, with no invertebrates of high conservation status recorded.

A1.3.10. The 2014 aquatic samples suggest this area is of rather low importance for freshwater invertebrates. However, in the case of the one site where there appears to have been duplicate sampling in 2014 and 2012 (site 15), the samples in the former year are species-poor compared to those in the latter (respectively 14 aquatic invertebrates including six water snails and four beetles) against 29 aquatic invertebrates with six snails and 14 beetles. As the methodology section of the 2014 report lacks any detail on the aquatic sampling techniques used, it is difficult to draw any firm conclusions, but it is surprising that three visits through the season have produced so few records, compared to the single sample collected in 2012.

2014/2015 terrestrial invertebrate survey

A1.3.11. Of the above sites, terrestrial invertebrate surveys were only undertaken at site 11, with the reasons for the omission of the remainder given being 'due to the limited botanical diversity and lack of terrestrial invertebrates observed at the ditch, even in optimum weather conditions'. On the former point, the photographs and descriptions both show at least some of these reens to be botanically diverse (eg. sites 8 and 9). On the latter point, without any sampling the lack of terrestrial invertebrates becomes a self-fulfilling prophecy. At least some of the omitted sites are likely to have an interesting terrestrial invertebrate assemblage and should have been sampled. For example, the Nationally Scarce beetle *Scirtes orbicularis* was recorded in good numbers at site 15 as casual records during aquatic sampling in 2012.

A1.3.12. The old TATA laboratory site (site 41) was also surveyed in 2014 for terrestrial invertebrates. No important species were recorded, which is surprising given the apparent quality of the habitats here. Follow-up surveys of the Tata Steel site in 2015 (Welsh Govt., 2016a) included two areas in this SSSI (sample compartments E and H). Both of these had good fen, reedbed and ruderal habitats and a rich terrestrial fauna that included shrill carder bee (both compartments), the long-headed fly *Dolichopus signifer* and the big-headed fly *Cephalops straminipes*.

A1.3.13. Though one important record (the horsefly *Hybomitra ciureai*) was made at site 11, the species richness and quality of the terrestrial samples in 2014 are very poor considering the amount of fieldwork undertaken and the quality of the habitats surveyed.

A1.3.14. There are a number of discrepancies between the aquatic invertebrate survey locations shown on Sheet 2 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a) and those in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 1). These are detailed on Map 2 at the end of this section of the report.

A1.3.15. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off³ may all affect Nash and Goldcliff SSSI. These indirect effects of the scheme are discussed in more detail in section 4.

A1.4. Newport Wetlands SSSI & NNR

A1.4.1. The Newport Wetlands SSSI & NNR is situated in the central part of the Gwent Levels, immediately to the east of the Usk estuary, just to the south of Newport. It is off the line of the M4 pCaN, so will avoid the direct effects of the scheme. However, it may still suffer negative impacts from a number of indirect factors arising out of the proposed development. No specific aquatic or terrestrial invertebrate surveys were undertaken on the SSSI for the M4 pCaN submission.

A1.4.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetle *Hydaticus transversalis* and the soldierfly *Odontomyia ornata* are all aquatic invertebrates cited here.

A1.4.3. The invertebrate fauna is diverse, with approximately 400 species recorded here. Terrestrial species noted on the citation are the spider *Tetragnatha striata*, which occurs in reedbeds and the shrill carder bee *Bombus sylvarum*. Both are Nationally Scarce, with the latter being a threatened species for which the Gwent Levels is one of its few remaining strongholds in Britain.

A1.4.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna they support as two important features of the site. The third important feature of the SSSI is the presence of a strong population of the shrill carder bee.

A1.4.5. Various aquatic invertebrate surveys have taken place that show the SSSI continues to have a rich freshwater fauna, with the most recent being in 2012 (Boyce, 2013).

A1.4.6. No specific aquatic or terrestrial invertebrate surveys were undertaken on the SSSI for the M4 pCaN submission.

A1.4.7. The distance of this site from the development makes it less likely that it will be affected by the M4 pCaN. However, it is possible that indirect impacts such as habitat fragmentation may still affect the Newport Wetlands SSSI and NNR. These indirect effects of the scheme are discussed in more detail in section 4.

³ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.5. Redwick and Llandevenuey SSSI (Map 5)

A1.5.1. The Redwick and Llandevenuey SSSI lies near the eastern end of the Gwent Levels, to the south-west of the Magor-Undy conurbation. It is one of the four SSSIs on the Gwent Levels through which the pCaN would pass.

A1.5.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetle *Haliplus mucronatus* and the hairy dragonfly *Brachytron pratense* are all aquatic invertebrates cited here, as is the invasive exotic water snail *Physa heterostropha*.

A1.5.3. The citation also recognises the presence of important terrestrial invertebrate assemblages associated with hedgerows and reed margins as an additional feature of interest. Terrestrial species cited here are the hoverfly *Parhelophilus consimilis*, the big-headed flies *Pipunculus fonscolombei* and *Tomosvaryella minima*, the Chalcid wasp *Chalcis sispeus* and the marsh beetle *Scirtes orbicularis*.

A1.5.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna as two important features of the site, with more than 200 invertebrate species recorded from the SSSI, including the soldierfly *Odontomyia argentata*, and a rich water beetle assemblage that includes great silver water beetle. The third important feature of the SSSI is the presence of a strong population of the rare and threatened shrill carder bee *Bombus sylvarum*.

A1.5.5. In 2011, a programme of invertebrate sampling was undertaken on Redwick and Llandevenuey as part of the Countryside Council for Wales' programme of SSSI Condition Assessment (Boyce, 2012). None of the nine sample stations monitored in that year were re-surveyed in 2014.

Aquatic invertebrate survey

A1.5.6. Aquatic samples were taken in 2014 within the Redwick and Llandevenuey SSSI at sites 2, 5, 6, 32-34. These sites lie on or very close to the black line route and appear likely to be destroyed or disturbed by works associated with the pCaN.

A1.5.7. 2014 sample sites 2, 5 and 6 appear to be in fairly good condition and have a moderately interesting aquatic invertebrate fauna that includes some local habitat specialists.

A1.5.8. The 2014 samples at sites 32-34 were quite deeply cut ditches with a well-developed fringe of tall vegetation. They had a moderately diverse aquatic invertebrate fauna, though with no species of particular conservation importance.

A1.5.9. The 2014 aquatic samples suggest this area is of rather low importance for freshwater invertebrates. The lack of detail given on the aquatic sampling techniques in the 2014 report, makes it difficult to make comparisons with earlier surveys, but the quality and quantity of records is rather low, given the description and photographs of at least some of the ditches.

Terrestrial invertebrate survey

A1.5.10. Terrestrial invertebrate surveys were undertaken at sites 5, 6, 32 and 33, with the reasons for the omission of 2 and 34 given being 'due to the limited botanical diversity and lack of terrestrial invertebrates observed at the ditch, even in optimum weather conditions'. On the former point, the photograph shows at least the latter to be worth sampling for terrestrial species. On the latter point, without any sampling the lack of terrestrial invertebrates becomes a self-fulfilling prophecy. At least site 34 should have been sampled.

A1.5.11. The species richness and quality of the terrestrial samples are very poor considering the amount of fieldwork undertaken and the quality of the habitats surveyed.

A1.5.14. There are a number of discrepancies between the aquatic invertebrate survey locations shown on Sheet 5 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a) and those in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 6). These are detailed on Map 5.

A1.5.15. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off⁴ may all adversely affect the Redwick and Llandeenny SSSI. These indirect impacts of the scheme are discussed in more detail in section 4.

⁴ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.6. Rumney and Peterstone SSSI

A1.6.1. The Rumney and Peterstone SSSI is the most westerly of the eight Gwent Levels SSSIs, lying adjacent to the eastern outskirts of Cardiff. It is off the line of the M4 pCaN, so will avoid the direct effects of the scheme. However, it may still suffer negative impacts from some indirect factors arising out of the proposed development.

A1.6.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetle *Haliphus mucronatus*, the reed beetle *Plateumaris braccata*, the variable damselfly *Coenagrion pulchellum* and the hairy dragonfly *Brachytron pratense* are all aquatic invertebrates cited here, as is the invasive exotic water snail *Physa heterostrophus*.

A1.6.3. The citation also recognises the presence of a nationally important terrestrial invertebrate assemblages of hedgerows and reed margins as an additional feature of interest. Terrestrial species cited here are the snail-killing fly *Pherbellia brunnipes*, the long-headed fly *Lamprochromus elegans* and the big-headed flies *Pipunculus fonscolombei* and *Tomosvaryella minima*. It states that 43 Nationally Rare or Scarce invertebrates have been recorded from the SSSI.

A1.6.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna as two important features of the site, with more than 164 invertebrate species recorded from the SSSI, including the hairy dragonfly, variable damselfly soldierfly *Odontomyia ornata*, and a rich water beetle assemblage that includes *Hydaticus transversalis*. The third important feature of the SSSI is the presence of a strong population of the rare and threatened shrill carder bee *Bombus sylvarum*.

A1.6.5. Various aquatic invertebrate surveys have taken place that show the SSSI continues to have a rich freshwater fauna, with the most recent being in 2012 (Boyce, 2013).

A1.6.6. No specific aquatic or terrestrial invertebrate surveys were undertaken on the SSSI for the M4 pCaN submission.

A1.6.7. The distance of this site from the development makes it less likely that it will be affected by the M4 pCaN. However, it is possible that indirect impacts such as habitat fragmentation and likely decreases and fluctuations in water quality resultant from road run-off⁵ may still affect the Rumney and Peterstone SSSI. These indirect effects of the scheme are discussed in more detail in section 4.

⁵ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.7. St. Brides SSSI (Map 2)

A1.7.1. The St. Brides SSSI lies to the west of the Usk Estuary, immediately to the south-west of the Newport conurbation. It is one of the four SSSIs on the Gwent Levels through which the pCaN would pass.

A1.7.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetles *Haliphus mucronatus* and *Hydaticus transversalis* and the hairy dragonfly *Brachytron pratense* are all aquatic invertebrates cited here, as is the invasive exotic water snail *Physa heterostrophus*.

A1.7.3. The citation also recognises the presence of a nationally important terrestrial invertebrate assemblages of hedgerows and reed margins as an additional feature of interest. Terrestrial species cited here are the flies *Chrysogaster macquarti*, *Pipunculus fonscolombei*, *Tomosvaryella minima* and *Stenomacrus cognatus*.

A1.7.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna as important features of the site, with more than 164 invertebrate species recorded from the SSSI, including the soldierfly *Odontomyia ornata*, the hairy dragonfly, the variable damselfly *Coenagrion pulchellum* and a rich water beetle assemblage that includes *Hydaticus transversalis*. The third important feature of the SSSI is the presence of a strong population of the rare and threatened shrill carder bee *Bombus sylvarum*.

A1.7.5. In 2011, a programme of invertebrate sampling was undertaken on St. Brides as part of the Countryside Council for Wales' programme of SSSI Condition Assessment (Boyce, 2012). Two of the 15 sample stations established in this year (IDB35, sample site 21 and IDB37, sample site 20) were also surveyed as part of the 2014 study.

2014 aquatic invertebrate survey

A1.7.6. Aquatic samples were taken in 2014 within the St. Brides SSSI at sites C1-C2, 16-20, 21-24 and 37-40. With the exception of the two 'controls', these sites lie very close to the black line route and appear likely to be directly disturbed by works associated with the pCaN.

A1.7.7. The two control sites (C1 and C2) are both wide ditches that had a moderately diverse aquatic invertebrate fauna.

A1.7.8. Sample sites 16-20 include a group of interesting ditches that in general appear to have a good habitat structure. They had a reasonably diverse aquatic invertebrate fauna that included one Nationally Scarce species, the water beetle *H. transversalis*, this being found in all of this group of reeds, except for site 19.

A1.7.9. Sample sites 21-24 were all rather poor ditches that were had appeared to have rather poor water quality and/or were dominated by dense rafts of floating duckweeds *Lemna* spp., the latter being suggestive of eutrophicated water conditions. Sample sites 38-40 were also rather poor, with dense emergent tall-fen vegetation.

A1.7.10. The 2014 aquatic samples suggest this area has some importance for freshwater invertebrates, with the presence of *H. transversalis* in three of the reens being especially significant. However, the samples are rather species-poor compared to those collected here in 2011. So in sample site 21, 34 aquatic invertebrates were collected in 2011, this total including seven water snails, 22 water beetles and four water bugs. By comparison, the 2014 sample produced only 16 aquatic invertebrates, this including six snails, five beetles and three bugs. In sample site 20, the respective 2011/2014 figures for aquatic invertebrates, water snails and water beetles were: 40, eight and 23; against 31, ten and eight. - [Restructure as confusing](#) As the methodology section of the 2014 report lacks any detail on the aquatic sampling techniques used, it is difficult to draw any firm conclusions, but it is surprising that three visits through the season have produced so few records, compared to the single sample collected in 2011.

2014 terrestrial invertebrate survey

A1.7.11. Terrestrial surveys were only undertaken in sites 20 and 40 with the reasons for the omission of the remainder given being 'due to the limited botanical diversity and lack of terrestrial invertebrates observed at the ditch, even in optimum weather conditions'. On the former point, the photographs and descriptions both show at least some of these reens to be botanically diverse. On the latter point, without any sampling the lack of terrestrial invertebrates becomes a self-fulfilling prophecy. At least some of the omitted sites (eg. sites 16 and 19) are likely to have an interesting terrestrial invertebrate assemblage and should have been sampled. Two Nationally Scarce species were found here in 2014 (the rove beetle *Paederus fuscipes* and the picture-winged fly *Dioxyna bidentis*, both found in site 20).

A1.7.12 Notwithstanding the presence of these two invertebrate species, the species richness and quality of the terrestrial samples are very poor considering the amount of fieldwork undertaken and the quality of the habitats surveyed.

A1.7.13 There are a number of discrepancies between the aquatic invertebrate survey locations shown on Sheet 2 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a) and those in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 1). These are detailed on Map 2.

A1.7.14. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off⁶ may all effect the St. Brides SSSI. These indirect effects of the scheme are discussed in more detail in section 4.

⁶ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.8. Whitson SSSI (Maps 4 & 5)

A1.8.1. The Whitson SSSI lies to the west of the Usk Estuary, immediately to the south-west of the Newport conurbation. It is one of the four SSSIs on the Gwent Levels through which the pCaN would pass.

A1.8.2. The SSSI citation identifies the aquatic invertebrate assemblage as one of the important features for which the site has been notified. The great silver water beetle *Hydrophilus piceus*, the water beetles *Haliphus mucronatus* and *Hydaticus transversalis* and the hairy dragonfly *Brachytron pratense* are all aquatic invertebrates cited here, as is the invasive exotic water snail *Physa heterostrophus*.

A1.8.3. The citation also recognises the presence of a nationally important terrestrial invertebrate assemblages of hedgerows and reed margins as an additional feature of interest. Terrestrial species cited here are the flies *Chrysogaster macquarti*, *Pipunculus fonscolombei*, *Anthomyza bifasciata* and *Coptophlebia volucris*. In all, it states that 65 Nationally Rare or Nationally Scarce species have been recorded from the SSSI.

A1.8.4. The Site Management Statement for the SSSI specifically mentions reed and ditch habitats and the invertebrate fauna as two of the important features of the site, with more than 400 invertebrate species recorded from the SSSI, including the soldierfly *Odontomyia argentata*, the hairy dragonfly and the variable damselfly. The third important feature of the SSSI is the presence of a strong population of the rare and threatened shrill carder bee *Bombus sylvarum*.

A1.8.5. In 2009, a programme of invertebrate sampling was undertaken on Whitson as part of the Countryside Council for Wales' programme of SSSI Condition Assessment (Boyce, 2010). None of the 12 sample stations monitored in that year were re-surveyed in 2014.

2014 aquatic invertebrate survey

A1.8.6. Aquatic samples were taken in 2014 within the Whitson SSSI at sites 1, 3, 4, 7 and 10. All of these sites lie on or very close to the black line route and appear likely to be directly disturbed by works associated with the pCaN.

A1.8.7. Sites 1, 3 and 4 are all high-quality ditches, with abundant submerged vegetation. The 2014 sample showed them to have a diverse aquatic invertebrate fauna, including two of particular importance, the diving beetle *Hydaticus transversalis* (site 3) and the great silver water beetle (sites 3 and 4).

A1.8.8. Sample site 10 is a rather dull-looking ditch with markedly turbid water. The aquatic sample here was very species-poor, which is unsurprising given the seemingly poor quality of the habitat.

A1.8.9. The 2014 aquatic samples from the four sites are thought to give a fair representation of the high importance of this area for freshwater invertebrates, with the presence of *Hydaticus transversalis* and a breeding population of the great silver water beetle being especially significant.

2014/2015 terrestrial invertebrate survey

A1.8.10. Of the above sites, terrestrial surveys were undertaken at all except site 7, which was omitted 'due to the limited botanical diversity and lack of terrestrial invertebrates observed at the ditch, even in optimum weather conditions'. On the former point, the site does appear from the description and photograph to be dominated by common reed *Phragmites australis*, but species-poor reedbeds can nonetheless support a rich invertebrate fauna, including many of high ecological importance. On the latter point, without any sampling the lack of terrestrial invertebrates becomes a self-fulfilling prophecy.

A1.8.11. Though a reasonable number of terrestrial species were recorded, none of these were of high conservation status, which is surprising, given the seemingly high quality of some of the habitats surveyed.

A1.8.12. Some areas of this SSSI (survey compartments A, B and G) were included in the 2015 survey of the Tata Steel site in 2015 (Welsh Govt., 2016a). This survey was much more successful in locating important species, amongst which were the shrill carder bee, brown-banded carder bee *Bombus humilis* and the Nationally Rare hoverfly *Sphaerophoria loewi*.

A1.8.12 There are a number of discrepancies between the aquatic invertebrate survey locations shown on Sheet 2 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a) and those in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 1). These are detailed on Maps 4 and 5.

A1.8.13. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off⁷ may all effect the Whitson SSSI. These indirect effects of the scheme are discussed in more detail in section 4.

⁷ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

OTHER SITES

In addition to those invertebrate sample sites situated within the SSSIs, there were a number of samples collected by the 2014 survey (Welsh Govt., 2014b) or invertebrate survey locations mapped in the Ecological Survey Site Selection Report (Welsh Govt., 2014a) that are located outside SSSI designated land. These are assessed in the following sub-sections.

A.1.9. Land north-west of Castleton (Map 1)

A1.9.1. Situated at the western end of the pCaN, there are a cluster of sample sites (28-30, 35 and 36) immediately to the north-west of Castleton.

2014 aquatic invertebrate survey

A1.9.2. The 2014 survey found there to be a moderately diverse aquatic invertebrate fauna that includes one Nationally Scarce species, the water beetle *Peltodytes caesus*. It was found in the newly excavated pond at site 28.

2014 terrestrial invertebrate survey

A1.9.3. Terrestrial samples were collected from sites 28, 35 and 36. No important species were recorded.

A1.9.4. Some of these sites lie very close to the black line route and appear likely to be directly disturbed by culvert extensions and possibly other works.

A1.9.5. The aquatic samples suggest this area has some importance for freshwater invertebrates, with the presence of *P. caesus* in the pond at site 28 being especially significant. This Nationally Scarce species is omitted from the results section of the invertebrate survey report (Welsh Govt., 2014b; sub-section 3.5).

A1.9.6. No terrestrial surveys were undertaken in sites 29 and 30 with the reason given at the former being 'due to the lack of terrestrial invertebrates observed at the pond'. No reason is given for not sampling at site 30. Without any sampling the lack of terrestrial invertebrates becomes a self-fulfilling prophecy. The photograph suggests that the habitat quality was good and the weather appeared very suitable for terrestrial sampling.

A1.9.7. The mature trees around the pond at site 29 should have been sampled, as dead wood associated with old willows can host an important invertebrate fauna.

A1.9.8. Even on those sites where terrestrial sampling was undertaken, the species richness and quality of the samples seems very poor considering the amount of sampling undertaken and the quality of the habitats surveyed.

A1.9.9. There is a discrepancy between the aquatic invertebrate survey locations shown on Sheet 1 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a) and that in the 2014 Invertebrate Survey (Welsh Govt., 2014b), with one extra survey site shown on the former.

A1.9.10. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off⁸ may all effect this area. These indirect effects of the scheme are discussed in more detail in section 4.

A1.10. Land west of Newport (Map 1)

A1.10.1. Situated in the western part of the pCaN, there are two sites (25 and 26) on the western edge of Newport. These sites lie very close to the black line route and appear likely to be directly disturbed by works associated with the pCaN.

2014 aquatic invertebrate survey

A1.10.2. The 2014 survey found there to be a moderately diverse aquatic invertebrate fauna that included some local habitat specialists such as the water beetles *Haliphus immaculatus* and *Rhantus grapii*, these both being found in the pond at site 25.

A1.10.3. No terrestrial surveys were undertaken in sites 25 and 26 with the reason given at both being 'due to the limited botanical diversity and lack of terrestrial invertebrates observed at the ditch, even in optimum weather conditions'. On the former point, the photograph and description both show this to be a quite botanically diverse area, with the stands of tall *Typha* in site 25 in particular having the potential to support important invertebrates. On the latter point, without any sampling the lack of terrestrial invertebrates becomes a self-fulfilling prophecy. These areas appear likely to have an interesting terrestrial invertebrate assemblage and should have been sampled.

A1.10.4. There is a discrepancy between the aquatic invertebrate survey locations shown on Sheet 1 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a: Sheet 1) and that in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 1), with two extra survey sites shown on the former.

A.1.11. Land in Newport to east of R. Usk (Map 3)

⁸ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

A1.11.1. Three aquatic invertebrate survey locations are marked on Sheet 3 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a). One of these is a pool lying adjacent to the River Usk SAC/SSSI and the other two are on the south-western edge of Caldicot Level. These sites lie on or very close to the black line route and will be destroyed or disturbed by works associated with the pCaN.

A1.11.2. There is a discrepancy between the above report and that in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 1), with none of them appearing to have been surveyed.

A1.12. Land to north of Whitson SSSI (Maps 4 & 5)

A1.12.1. Three aquatic invertebrate survey locations are marked on what appear to be brownfield sites to the north of the Whitson SSSI on Sheets 4 and 5 of the Ecological Survey Site Selection Report (Welsh Govt., 2014a). One of these is to the north of the electricity sub-station and the other two are on or adjacent to the Elver Pill Reen and the other two are on the south-western edge of Caldicot Level. These sites lie on or very close to the black line route and will be destroyed or disturbed by works associated with the pCaN.

A1.12.2. There is a discrepancy between the above report and that in the 2014 Invertebrate Survey (Welsh Govt., 2014b: Map 1), with none of them appearing to have been surveyed.

2015 terrestrial invertebrate survey

A1.12.3. In 2015, the invertebrate survey of the Tata Steel land (Welsh Govt., 2016a) looked at ruderal brownfield and wetland habitats in this area (survey compartments C, D and F). A diverse invertebrate assemblage was recorded here, with this including two important species, the Nationally Rare long-headed fly *Hydropohorus viridis* in association with sparsely vegetated mud and the shrill carder bee.

A1.13. Land to the north and west of Magor/Undy (Map 6)

A1.13.1. This area lies outside the Gwent Levels SSSIs. A single sample was taken from the St. Bride's Brook (site 31). Both the terrestrial and aquatic invertebrate fauna here were of no more than moderate interest. However, as was the case with the much of the 2014 sampling programme, the quality and quantity of the samples collected was poor.

A1.13.2. There is a discrepancy between information in the ES, with two other sites lying to the east of Magor/Undy being marked on the Ecological Survey Site Selection Report (Welsh Govt., 2014a) as aquatic invertebrate survey locations. However, there is no evidence of these having been surveyed in the 2014 or 2015 invertebrate reports.

A1.13.3. Various negative impacts of the M4 pCaN, such as habitat fragmentation, the role of artificial junction lighting and the road surface as 'ecological traps' and likely decreases and fluctuations in water quality resultant from road run-off⁹ may all effect this area. These indirect effects of the scheme are discussed in more detail in section 4.

⁹ Gwent Wildlife written submission 'Drainage Strategy: Water Treatment and Pollution Issues'

MAP ARCHIVE:

The maps below show the 2014 invertebrate sampling stations (blue numbers) and note discrepancies between the Ecological Survey Site Selection Report (Welsh Govt., 2014a) and those in the 2014 Invertebrate Survey, these being shown in red with the letters 'NS' (= no survey).







