River Severn to River Thames Transfer (STT)

Strategic regional water resource solution

Environmental Assessment Report: Biodiversity Net Gain and Carbon

July 2021

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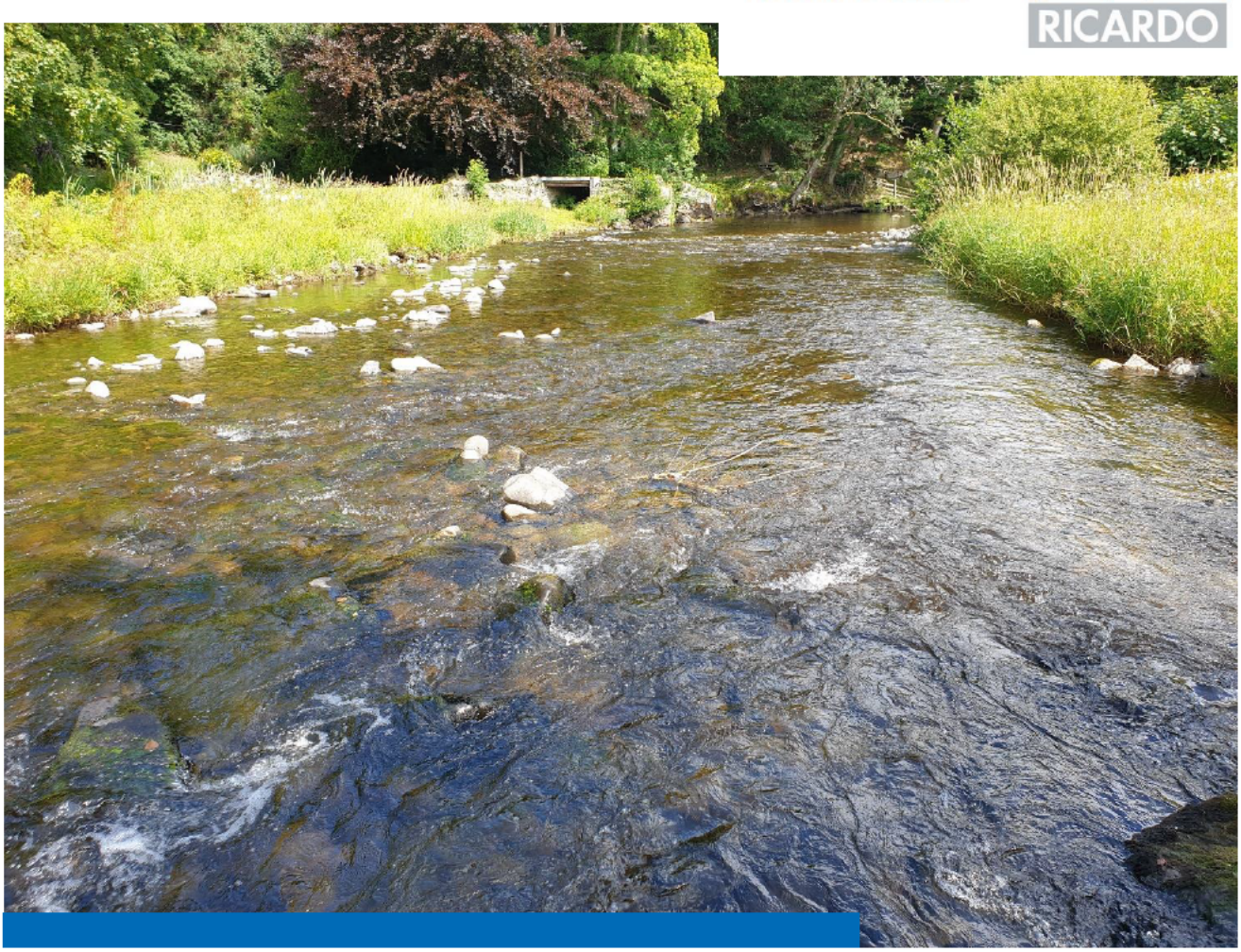

Severn to Thames Transfer SRO

Appendix B3.8 Biodiversity Net Gain and Carbon

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Report for United Utilities on behalf of the Severn Thames Transfer Programme

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Document history and status

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1	08/03/2021	Draft for STT review	[redacted]			
2	08/04/2021	Revised following comments				
3	21/05/2021	For issue to RAPID				

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Contents

Please note the accompanying spreadsheets to the Annex are separate to this document.

Tables

Appendix B.3.8 Biodiversity Net Gain and Carbon

1 Biodiversity Impacts

Introduction

The following tables present the biodiversity net gain (BNG) results using the DEFRA Metric from each of the proposed STT Scheme groupings. These groupings are as follows:

	Group	Elements included
Pipeline Conveyance Groupings	**Group 1 (without Minworth)**	• DeerhurstPipeline 300 • Mythe 15 • VyrnwyRelease_75 • NetheridgePipelineDeerhurst 35 • ShrewsburyRedeployment_25 • MiddleVyrnwyBypass_80
	Group 2 (with Minworth)	• DeerhurstPipeline_300 • Mythe_15 • VyrnwyRelease_75 • NetheridgePipelineDeerhurst_35 • ShrewsburyRedeployment_25 • MiddleVyrnwyBypass_80 • Minworth 115
Canal Conveyance Groupings	**Group 3 (without Minworth)**	• CotswoldCanals 300 • Mythe 15 • NetheridgePipelineCotswold 35 (*discharge to canal*) • VyrnwyRelease_75 • ShrewsburyRedeployment_25 • MiddleVyrnwyBypass 80
	Group 4 (with Minworth)	• CotswoldCanals_300 • Mythe_15 • NetheridgePipelineCotswold_35 (*discharge to canal*) • VyrnwyRelease_75 • ShrewsburyRedeployment_25 • MiddleVyrnwyBypass_80 • Minworth_115

Two groups relate to utilising the pipeline conveyance as the Interconnector and two utilising the canal conveyance as the Interconnector. Which STT source support elements have been identified in the groups as well as the order in which these sources become operational was determined through modelling undertaken by Jacobs. This modelling considered a number of factors including cost and resilience. Further details on the modelling undertaken and justification for the choice of the STT source support elements is provided in Jacob's work.

It is understood that the Minworth source support element could be made available as a water source to the Grand Union Canal (GUC) Strategic Resource Option (SRO). In the event that this source support element is chosen as part of the GUC then the Minworth source support element would not be available for the STT Scheme system. In consequence, for each of the conveyance alternatives one grouping includes for a number of source support elements including Minworth and the other grouping excludes the Minworth source support element.

A summary of the elements that form each of the four STT Scheme options that have been assessed as part of the STT SRO are identified in Table 1 2. The Natural Capital assessments have been undertaken for these STT Scheme option groups.

This document should be read in tandem with **Appendix B.2.8 Evidence Report Net Gain and Carbon Neutrality** and **B2.7 Evidence Report – Natural Capital**, which provide details of the approach undertaken together with relevant Annexes as outlined in this report.

Biodiversity Net Gain Summary Tables

This Assessment Report provides the results of the Defra Biodiversity Metric calculations for the elements, summarised into the groupings. Not all elements within each grouping have terrestrial construction impacts. Elements within each group which have terrestrial impacts were combined to provide an overall unit loss, for each grouping, post-mitigation. A detailed breakdown of habitat loss per element is provided in **Annex 1**. There are no operational impacts on habitats, all habitat loss will be during construction and mitigated through habitat re-instatement (other than for permanent structures). Therefore, the calculation of loss within the tables below is post-mitigation, as we already know habitat will be re-instated. This then gives the deficit for offsite compensation and opportunities for BNG. Therefore, the post-mitigation (pre-compensation) calculations provide a more useful calculations of biodiversity loss than pre-mitigation, particularly as habitat loss is temporary.

For rivers, there are construction and operational impacts. The construction impacts take account of open cut methods for pipeline installation, for example, and operational impacts are in regard to habitat degradation of reaches downstream of abstraction and discharge locations. The assessment of the extent of these impacted reaches is described within the **Evidence Report 2.8 Net Gain and Carbon Neutrality**. Construction losses within the tables below are post-mitigation (habitat re-instatement), as the assessment presumes this will occur, and prior to offsetting.

Tables 1-1 represents the biodiversity deficit for offsite compensation following re-instatement (mitigation) as % loss of biodiversity units and **Table 1-2** of the overall units lost following re-instatement (mitigation).

Table 1-1 Summary of the percentage loss (post re-instatement and pre off-site compensation) for habitats, hedgerow and rivers for each grouping

	Percentage Biodiversity Change					
Option	**Loss of habitat units (construction)**	**Loss of habitat units (operation)**	**Loss of hedgerow units (construction)**	**Loss of hedgerow units (operation)**	**Loss of river units (construction)**	**Loss of river units (operation)**
Deerhurst pipeline						
1	-31.70%	0	-43.93%	0	-71.67%	-21.58%
2	-30.86%	0	-43.92%	0	-71.78%	-23.92%
Cotswold Canal						
3	-31.44%	0	-43.94%	0	-72.56%	-21.52%
4	-30.56%	0	-43.91%	0	-72.53%	-23.87%

For terrestrial loss (habitats and hedgerows) the assessment is based on construction impacts only as there will be no operational impacts. The river units are assessed on construction and operational impacts. The overall percentage loss for each STT Scheme element was combined to provide the loss for each grouping, see **Annex 1 and A1vii** for individual STT Scheme element percentage loss.

Certain priority habitats are unable to be assessed within the DEFRA Metric owing to their uniqueness and difficulty of re-creation and compensation. If lost they require a bespoke compensation strategy. The hectarage of this loss is shown in **Table 1-2** and these habitats should be avoided at the design stage where possible. The unacceptable loss habitats and their individual areas are given within the baseline metric data, provided within the Annexes for each element.

Table 1-2 Summary of the overall unit loss (post re-instatement and pre off-site compensation) for habitats, hedgerow and rivers for each grouping

	Net Biodiversity Unit Loss				
Option	**Loss of habitat units (construction)**	**Unacceptable habitat losses (hectares) (construction)**	**Loss of hedgerow units (construction)**	**River units (construction)**	**River units (operation)**
Deerhurst pipeline					
1	-710.92	9.22ha	-34.68	-6.10	-2,263.65
2	-805.09	10.26ha	-36.41	-7.10	-2,905.25
Cotswold Canal					
3	-641.33	5.69ha	-9.20	-2.74	-2,293.02
4	-735.5	6.73ha	-11.36	-3.74	-2,932.47

2 Biodiversity Opportunities

To achieve biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation. **Table 2-1** shows for each habitat type impacted by the scheme, the offsite hectarage /km of habitat enhancement or creation required for a minimum 10% net gain in habitats and hedgerows and the metric units that this achieves. As stated in the methodology the majority of habitats were assumed to be in moderate condition. Hectarage required can be halved if habitats are assumed to be in poor condition. The individual requirements per STT Scheme element are provided in **Annex 1** and highlights the specific percentage gain. It is important to also consider the need for bespoke mitigation / compensation or 'unacceptable loss habitats' (refer to **Annex 1**).

Table 2-1 Summary of the offsetting requirements to achieve an approximate 10% net gain for habitats and hedgerows for each grouping

Offsetting Requirements for 10% BNG					
		Deerhurst pipeline	**Deerhurst pipeline**	**Cotswold Canal**	**Cotswold Canal**
Habitat	**Enhancement or Creation**	**Group 1**	**Group 2**	**Group 3**	**Group 4**
Neutral grassland	Enhancement	194ha	220ha	167.4ha	193.4ha
Broadleaved woodland	Creation	61ha	71ha	76ha	86ha
Traditional Orchard	Creation	6ha	7ha	1ha	2ha
Lowland heathland	Creation	7ha	7ha	0.5ha	0.5ha
Lowland calcareous grassland	Enhancement	5ha	5ha	-	-
Native species rich hedgerow	Creation	8.6km	9.1km	2.24km	2.74km
Total (ha)	**Habitat**	**273ha**	**310ha**	**247.14ha**	**281.9ha**
	Hedgerow	**8.6km**	**9.1km**	**2.24km**	**2.74km**
Total (units)	**Habitat**	**+2,028.75**	**+2,303.94**	**+2,243.83**	**+2,519.02**

	Hedgerows	**+44.36**	**+47.04**	**+21.67**	**+24.35**

The overall habitat requirement for a 10% net gain is very similar for groups 1- 4 with regard to hectarage required, with a slightly higher requirement for Goups 2 and 4. Groups 3 and 4 which relates to the Cotswold Canal have a noticeable higher requirement compared to Deerhurst Group 1 and 2. As noted in **Table 2-1,** the Deerhurst Pipeline options have approximately 4ha more habitats which are categorised as 'unacceptable losses' which is a major consideration due to the requirement for a bespoke mitigation strategy. The Canal groupings require approximately 20% more woodland creation which is likely attributed to the higher abundance of woodland along the route compared to the Deerhurst pipeline. The Canal groupings however are not impacting lowland calcareous grassland whereas the loss within the Deerhurst groupings require 5ha of enhancement. The Deerhurst groupings require more hedgerow creation than the Canal groupings which is likely attributed to the higher number of field boundaries being intersected by the Deerhurst pipeline compared to the Canal route.

Within the current version of the Defra River Metric mitigation/compensation for 10% BNG cannot to be calculated for river habitat loss due to errors in the multipliers of the River Metric 2.0 and therefore are not included within our assessment. Therefore, a bespoke solution would need to be agreed with the regulators; however, version 3.0 is due for release in 2021 and is likely to resolve this issue.

Availability of land for offsetting per element has been summarised in **Annex 1**. Where available, the location of compensation (offsetting) land has been mapped with an example of this in **A1viii**.

For each element, a desk study was undertaken to review any policies or mapped areas in relation to land that has been identified as providing opportunities for terrestrial habitat enhancement or creation. All terrestrial habitat impacts lie within England, and therefore Welsh strategic opportunities were not considered for terrestrial habitats. If an element crossed multiple counties, a review was undertaken in each local authority it fell in along with search engine key word searches. These areas can have varying names and can be summarised as Biodiversity Opportunity Areas (BOAs) in England. Not all county's and local authorities had relevant policies or maps in relation to BOAs, so they are not necessarily found along the entire length of an element. Instead, BOAs were mapped where they fell within the same county as an element and were considered in close proximity to provide offsetting. In most cases this was between 0-5km from the element, however in some cases more than 5km where BOAs were less abundant. The main focus was not on how close the BOAs were to each element but availability within the same county or landscape along with variety of habitat types. The main source of BOA information used for Gate 1 came from Local Nature Partnerships as these groups usually map at a landscape scale for habitat creation and connectivity and provide a high-level assessment of availability of land which could be utilised for mitigation. Where the information was available the specific habitat type was also noted, such as area for woodland creation, however in some cases such as in Oxfordshire the specific habitat type was not available. For all groupings there are enough BOAs to provide the required mitigation to achieve a 10% net gain. As the study continues into Gate 2 these specific BOAs will be refined and surveyed to identify the optimal areas to focus on. In addition to BOA's, Local Nature Recovery Strategies (LNRS) are being developed by each county, which are currently pilots but will be rolled out across the country once the Environment Bill receives royal assent and will form part of the Nature Recovery Network. These are local strategies for restoration and several counties have commenced these strategies by mapping their most valuable sites and habitats for wildlife alongside their priorities for linking up and restoring nature. Where available, these LNRS will be reviewed at Gate 2, or subsequent Gate, as they come available. Natural England have also produced a spatial dataset that describes the geographic extent and location of Habitat Networks for 18 Priority Habitats[1]. The data includes the locations of various zones identified as suitable for restoration that would provide better resilience and connectivity for priority habitats. Therefore, these zones provide opportunities for offsetting and net gain in relation to impacts on priority habitats from the proposed components, as well

[1] https://magic.defra.gov.uk/magicmap

as non-priority habitats and can be assessed at Gate 2 to provide opportunities where local strategies are unavailable.

Opportunities for delivering BNG for rivers was identified from published information on Priority Rivers for Restoration[2] and BOAs for relevant counties within England, as described in **Appendix 2.8 Evidence Report - Net Gain and Carbon Neutrality**. Datasets for Wales were also reviewed for opportunities with respect to offsetting along the River Vyrnwy; however, no online data sources were available for rivers and further assessment will be required at Gate 2, as detailed within **Appendix 2.8 Evidence Report - Net Gain and Carbon Neutrality**. The data set for Priority Rivers for Restoration identifies reaches targeted for restoration. The length and location of reaches located within 1km of the elements are given in **Annex 1** and summarised by their group in **Table 1-4**. The data also provided information on whether the restoration related to physical or hydrological opportunities. Rivers within BOAs also present potential opportunities for restoration and the length of rivers within 1km of the impacted reaches for each element were measured and given in **Annex 1** and summarised by their groupings in **Table 2-2.** Groups 1-4 show increasing opportunities for restoration, with the canal groups providing nearly three times that of the Deerhurst groupings. These opportunities lie within 1km and so and extended search can be undertaken if required. There are advantages in terms of units scored for identifying restoration within the same waterbody and therefore Gate 2 will investigate suitable locations as well as proximity.

Table 2-2 Summary of the offsetting opportunities for BNG for rivers for each grouping, within 1km

Offsetting Opportunities for BNG				
	Deerhurst pipeline	**Deerhurst pipeline**	**Cotswold Canal**	**Cotswold Canal**
	Group 1	**Group 2**	**Group 3**	**Group 4**
Priority Rivers for Restoration (within 1km)				
Physical restoration requirements	9.7km	9.7km	9.7km	9.7km
Hydrological restoration requirements	3.37km	3.6km	5.42km	5.65km
Rivers within BOAs (within 1km)				
River length for restoration	37.89km	37.89km	71.54km	106.47km
Total	**50.96km**	**51.19km**	**84.39km**	**108.39km**

3 Carbon

The tables below shows the potential carbon sequestration that is likely to be lost as a result of construction. It also shows the benefit that could be accrued following BNG uplift related to each land use stock, in terms of both area and value. Baseline natural capital assessment is provided in **Appendix 2.7** and should be read in conjunction with **Table 3-1 and Table 3-2** below. Details of how carbon has been assessed and the implications/recommendations for Gate 2 can also be found in **Appendix 2.7** together with associated annexes and working calculation spreadsheets both of which link to **Appendix 3.8**.

[2] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

Table 3-1 Summary of carbon sequestration lost related to construction and potential gain following BNG uplift for the Deerhurst pipeline

	Metric	Habitat	Group 1		Group 2	
			C seq (t/CO2e/yr)	Value (£2019)	C seq (t/CO2e/yr)	Value (£2019)
Deerhurst pipeline	Stocks lost	Arable land	25.67	£4,630	30.62	£4,926
		Pastoral land	79.08	£4,070	86.51	£4,505
		Woodland (deciduous)	3.48	£216	3.48	£216
		Woodland (mixed)	0.00	£1	0.00	£1
		Heathland	1.54	£94	1.54	£94
		Total	*109.77*	*9,010.9*	*122.15*	*9,741.6*
	BNG uplift	Arable land	0.64	£38	0.75	£45
		Pastoral land	0.00	£0	3.97	£2,969
		Woodland (deciduous)	303.17	£18,111	303.17	£18,111
		Woodland (mixed)	0.00	£0	0.00	£0
		Heathland	3.50	£209	3.50	£209
		Total	*307.31*	*18,358.3*	*311.39*	*21,333.7*

Table 3-2 Summary of carbon sequestration lost related to construction and potential gain following BNG uplift for the Cotswold Canals

Metric	Habitat	Area (Ha)	Group 3		Group 4	
			C seq (t/CO2e/yr)	Value (£2019)	C seq (t/CO2e/yr)	Value (£2019)
Cotswold Canals	Stocks lost	Arable land	24.03	£1,468	28.98	£1,764
		Pastoral land	61.26	£2,971	68.68	£3,406
		Woodland (deciduous)	51.69	£3,099	51.69	£3,099
		Woodland (mixed)	0.00	£20	0.00	£20
		Heathland	1.54	£94	1.54	£94
		Total	*138.52*	*7,651.7*	*150.88*	*8,382.3*
	BNG uplift	Arable land	0.21	£12	0.32	£19
		Pastoral land	0.00	£0	3.97	£2,969
		Woodland (deciduous)	427.42	£25,533	427.42	£25,533
		Woodland (mixed)	0.00	£0	0.00	£0
		Heathland	3.50	£209	3.50	£209
		Total	*431.13*	*25,754.8*	*435.21*	*28,730.2*

Annex 1

Please note the accompanying spreadsheets are separate to this document.

River Vyrnwy Mitigation Option 5 – Net Loss

River Vyrnwy Mitigation – Vyrnwy Bypass release (Option 5) (see also Annex Ai biometric bypass 5 Defra BNG metrics)

Table 1 - Estimated maximum areas of direct terrestrial habitat loss within bypass option 5 (2b)

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Non-irrigated arable land	Cropland - Cereal crops	5.04
Pastures	Grassland - Other neutral grassland	37.07
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	0.02
Purple moor-grass and rush pastures*	Wetland - Purple moor grass and rush pastures	1.05

**Priority Habitat*

Table 2 - Estimated maximum km of direct hedgerow loss within bypass option 5 (2b)

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	1.26
TOTALS		**1.26**

Applying the DEFRA Biodiversity Metric to the habitat (**see Annex 1i**) areas in **Table 1 & 2** results in the following biodiversity units that could be lost to development in the absence of any mitigation (**Table 3**):

Table 3 Indicative biodiversity units potentially lost within bypass option 5(2b) (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric units	Proposed habitat mitigation
Non-irrigated arable land	Cropland - Cereal crops	11.09	Neutral grassland enhancement
Pastures	Grassland - Other neutral grassland	326.22	Neutral grassland enhancement
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	0.18	Grassland succession
Purple moor-grass and rush pastures	Wetland - Purple moor grass and rush pastures	N/A (bespoke mitigation required)	Unacceptable loss – bespoke compensation required

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure 1** shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain.

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-95.01
	Hedgerow units	-4.87
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-28.15%
	Hedgerow units	-43.93%
	River units	0.00%

Figure 1 – Biodiversity deficit (post re-instatement)

Purple moor grass and rush pastures are identified as being an unacceptable loss within the DEFRA Metric. It is therefore not considered further within the Metric calculations. However a bespoke compensation strategy will need to be provided if these habitats are lost with consultation with Natural England. This can present challenges in habitat creation and identifying suitable locations. The first stage of the mitigation hierarchy is to avoid and therefore this should be a key consideration within the design.

The results for the river metric calculations are within the summary table in Annex A1vii.

River Vyrnwy Mitigation Option 5 – Net Gain Opportunities

To achieve biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 4-6. Tables 4 and 5 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. As stated in the methodology the majority of habitats were assumed to be in moderate condition for a 10.40% for habitats. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve an 11.89% hedgerow net gain the following creation will be required, see Table 5.

Table 4. Required mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to good condition)	34	284.77	Shropshire Environmental Network (Over 35ha of habitat identified for enhancement/creation)
Woodland and forest - Other woodland; broadleaved	Creation (grassland succession)	1	5.23	Shropshire Environmental Network (Over 35ha of habitat identified for enhancement/creation)

Table 5. Required mitigation for 10% BNG for hedgerows

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native species rich hedgerow	Creation	1.2	6.19	Shropshire Environmental Network (Over 35ha of habitat identified for enhancement/creation)

Table 5 identifies opportunities for delivering BNG for rivers, from published information on Priority Rivers for Restoration[3]. These reaches are targeted for restoration and the location and length of river reaches within 1km of the scheme are given in Table 5. The data also provided information on whether the restoration related to physical or hydrological opportunities. The number of units/km required for 10% BNG for rivers cannot be calculated at present due to errors in the metric 2.0 and in advance of version 3.0, a bespoke solution would need to be agreed with the regulators.

No rivers within Biodiversity Opportunity Areas were identified within 1km of the impacted reaches.

Table 6. Priority River Habitats for Restoration within 1km of impacted reach

Priority river habitat for restoration	WFD reference	Targeted restoration	Length (km)
Afon Vyrnwy DS of Banwy confluence	GB109054049852	Physical	9.7
Hartlebury Bk - source to conf R Severn	GB109054044460	Hydrological	1.46

[3] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

River Vyrnwy Mitigation Option 7 – Net Loss

River Vyrnwy Mitigation – Vyrnwy Bypass release (Option 7) (see also Annex Aii biometric bypass 7 Defra BNG metrics)

Table 7 - Estimated maximum areas of direct terrestrial habitat loss within bypass option 7 (2c)

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Non-irrigated arable land	Cropland - Cereal crops	8.07
Pastures	Grassland - Other neutral grassland	60.52
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	0.02
Purple moor-grass and rush pastures*	Wetland - Purple moor grass and rush pastures	1.05

*Priority Habitat

Table 8 - Estimated maximum km of direct hedgerow loss within bypass option 7 (2c)

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	1.60
TOTALS		**1.60**

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 6** results in the following biodiversity units (**see Annex 1ii**) that could be lost to development in the absence of any mitigation (**Table 8**):

Table 9 - Indicative biodiversity units potentially lost within bypass option 7 (2c) (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric units	Proposed habitat mitigation
Non-irrigated arable land	Cropland - Cereal crops	17.75	Neutral grassland enhancement
Pastures	Grassland - Other neutral grassland	532.58	Neutral grassland enhancement
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	0.18	Grassland succession
Purple moor-grass and rush pastures*	Wetland - Purple moor grass and rush pastures	N/A (bespoke mitigation required)	Unacceptable loss – bespoke compensation required

*Priority Habitat

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure 2** shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-157.09
	Hedgerow units	-6.19
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-28.54%
	Hedgerow units	-43.93%
	River units	0.00%

Figure 2 – Biodiversity deficit (post re-instatement)

Purple moor grass and rush pastures are identified as being an unacceptable loss within the DEFRA Metric. It is therefore not considered further within the Metric calculations. However a bespoke compensation strategy will need to be provided if these habitats are lost with consultation with Natural England. This can present challenges in habitat creation and identifying suitable locations. The first stage of the mitigation hierarchy is to avoid and therefore this should be a key consideration within the design.

The results for the river metric calculations are within the summary table in Annex A1vii.

River Vyrnwy Mitigation Option 7 – Net Gain Opportunities

To achieve 10% biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 10-12. Tables 10 and 11 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. As stated in the methodology the majority of habitats were assumed to be in moderate condition for a 10.40% for habitats. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve an 11.02% hedgerow net gain the following creation will be required, see Table 11.

Table 10. Required mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to good condition)	56	469.03	Shropshire Environmental Network (Over 35ha of habitat creation land identified)
Woodland and forest - Other woodland; broadleaved	Creation (grassland succession)	1	5.23	Shropshire Environmental Network (Over 35ha of habitat creation land identified)

Table 11. Required mitigation for 10% BNG for hedgerows

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native species rich hedgerow	Creation	1.5	7.74	Shropshire Environmental Network (Over 35ha of habitat creation land identified)

Table 12 identifies opportunities for delivering BNG for rivers, from published information on Priority Rivers for Restoration[4]. These reaches are targeted for restoration and the location and length of river reaches within 1km of the scheme are given in Table 12. The data also provided information on whether the restoration related to physical or hydrological opportunities. The number of units/km required for 10% BNG for rivers cannot be calculated at present due to errors in the metric 2.0 and in advance of version 3.0, a bespoke solution would need to be agreed with the regulators. No rivers within Biodiversity Opportunity Areas were identified within 1km of the impacted reaches.

Table 12. Priority River Habitats for Restoration within 1km of impacted reach

Priority river habitat for restoration	WFD reference	Targeted restoration	Length (km)
Hartlebury Bk - source to conf R Severn	GB109054044460	Hydrological	1.46
Weir Bk - source to conf R Severn	GB109054049940	Physical	1.05

[4] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

Canal conveyance – Net Loss

Canal conveyance, including piping to Culham (300 Ml/d) (see also Annex iii biometric Canal- Defra BNG metrics)

Table 11 - Estimated maximum areas of direct terrestrial habitat loss

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Non-irrigated arable land	Cropland - Cereal crops	136.7
Pastures	Grassland - Other neutral grassland	64.05
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	36.09
Mixed forest	Woodland and forest - Other woodland; mixed	1.25
Conifer woodland	Woodland and forest - Other coniferous woodland	0.10
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	38.99
Lowland meadows*	Grassland - Lowland meadows	4.64
Land principally occupied with agriculture with significant areas of natural vegetation	Cropland - Temporary grass and clover leys	0.71
Industrial or commercial units	Urban - Developed land; sealed surface	5.47
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	12.70
Urban	Urban - Suburban/ mosaic of developed/ natural surface	10.99
Sport and leisure facilities	Urban - Amenity grassland	0.96
Young trees	Woodland and forest - Other woodland; Young Trees planted	1.65
Traditional orchard*	Cropland – Traditional Orchard	0.64
Mineral extraction sites	Urban - Sand pit quarry or open cast mine	1.50
Arable field margins	Cropland - Arable field margins pollen & nectar	0.50
TOTALS		

*Priority Habitat

Table 13- Estimated maximum km of direct hedgerow loss

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	1.08
TOTALS		**1.08**

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 11 & 12** results in the following biodiversity units (**see Annex 1iii**) that could be lost to development in the absence of any mitigation (**Table 13**). Where priority habitats could be added into the metric calculations a habitat condition of 'good' was used to distinguish between non-priority habitats with an overlapping metric habitat.

Table 14 - Indicative biodiversity units potentially lost within pipeline (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric units	Proposed habitat mitigation
Non-irrigated arable land	Cropland - Cereal crops	300.74	Neutral grassland enhancement
Pastures	Grassland - Other neutral grassland	563.64	Neutral grassland enhancement
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	317.59	Grassland succession
Mixed forest	Woodland and forest - Other woodland; mixed	11.00	Grassland succession
Conifer woodland	Woodland and forest - Other coniferous woodland	0.44	Grassland succession
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	343.11	Neutral grassland enhancement
Lowland meadows*	Grassland - Lowland meadows	N/A (bespoke mitigation required)	N/A
Land principally occupied with agriculture with significant areas of natural vegetation	Cropland - Temporary grass and clover leys	1.56	Neutral grassland enhancement
Industrial or commercial units	Urban - Developed land; sealed surface	0.00	N/A
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	55.88	Neutral grassland enhancement
Urban	Urban - Suburban/ mosaic of developed/ natural surface	48.36	Neutral grassland enhancement
Sport and leisure facilities	Urban - Amenity grassland	4.22	Neutral grassland enhancement
Young trees	Woodland and forest - Other woodland; Young Trees planted	7.26	Grassland succession
Traditional orchard*	Cropland – Traditional Orchard	9.29	Traditional orchard creation
Mineral extraction sites	Urban - Sand pit quarry or open cast mine	6.60	Neutral grassland enhancement
Arable field margins	Cropland - Arable field margins pollen & nectar	2.20	Neutral grassland enhancement
Hedgerow	Native species rich hedgerow	9.50	Hedgerow creation

*Priority Habitat

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure 3** shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-536.76
	Hedgerow units	-4.18
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-32.11%
	Hedgerow units	-43.93%
	River units	0.00%

Figure 3 – Biodiversity deficit (post re-instatement)

Lowland meadows are identified as being an unacceptable loss within the DEFRA Metric. It is therefore not considered further within the Metric calculations. However a bespoke compensation strategy will need to be provided if these habitats are lost with consultation with Natural England. This can present challenges in habitat creation and identifying suitable locations. The first stage of the mitigation hierarchy is to avoid and therefore this should be a key consideration within the design.

The results for the river metric calculations are within the summary table in Annex A1vii.

Canal conveyance – Net Gain Opportunities

To achieve 10% biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 15-17. Tables 15 and 16 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. As stated in the methodology the majority of habitats were assumed to be in moderate condition for a 10.68% for habitats. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve an 10.34% hedgerow net gain the following creation will be required, see Table 16.

Table 15. Required mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to good condition)	130	1088.81	944ha of neutral grassland identified in 'Biodiversity South West' nature map.
Woodland and forest - Other woodland; broadleaved	Creation (grassland succession)	75	391.95	Over 1000ha of woodland identified in 'Biodiversity South West' nature map.
Cropland – Traditional Orchard	Creation	1	7.44	944ha of neutral grassland identified for orchard planting in 'Biodiversity South West' nature map.

Table 16. Required mitigation for 10% BNG for hedgerows

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native species rich hedgerow	Creation	1	5.16	944ha of neutral grassland identified in 'Biodiversity South West' nature map.

Tables 17 and 18 identify opportunities for delivering BNG for rivers, from published information on Priority Rivers for Restoration[5] and Biodiversity Opportunity Areas for relevant counties. Priority Rivers for Restoration are reaches targeted for restoration and the location and length of river reaches within 1km of the scheme are given in Table 17. The data also provided information on whether the restoration related to physical or hydrological opportunities. Table 18 identifies the length of river reaches within BOAs within 1km of the impacted reach. The number of units/km required for 10% BNG for rivers cannot be calculated at present due to errors in the metric 2.0 and in advance of version 3.0, a bespoke solution would need to be agreed with the regulators.

Table 17. Priority River Habitats for Restoration

Priority river habitat for restoration	WFD reference	Targeted restoration	Length (km)
Thames (Waterhaybridge to Cricklade) and Chelworth Brook	GB106039022960	Hydrological	1.69

Table 18. River Biodiversity Opportunity Areas

Waterbody (within 1km)	Length (km)	County
Gloucester and Sharpness Canal	8.89	Gloucestershire
Epney Rhyne - source to conf R Severn Estuary	2.19	Gloucestershire
Frome - Ebley Mill to conf R Severn	8.12	Gloucestershire
Stroudwater Navigation (Pike Lock to Ebley)	1.98	Gloucestershire
Thames and Severn Canal	3.59	Gloucestershire
Frome - source to Ebley Mill	5.15	Gloucestershire
Churn (Baunton to Cricklade)	8.16	Wiltshire
Thames (Waterhaybridge to Cricklade) and Chelworth Brook	2.4	Wiltshire
Ampney and Poulton Brooks (Source to Thames)	2.71	Wiltshire
Thames (Churn to Coln)	13.05	Wiltshire
Share ditch	0.3	Wiltshire
Coln (from Coln Rogers) and Thames (Coln to Leach)	4.093	Wiltshire
Dudgrove Brook	1.6	Wiltshire
Thornhill Ditch and Tributaries at Cotswolds Water Park	1.46	Wiltshire
Cole (Bower Bridge to Thames) including Coleshill	0.19	Wiltshire
Radcot Cut	0.75	Oxfordshire
Thames (Leach to Evenlode)	1.51	Oxfordshire
Childrey Brook and Norbrook at Common Barn	1.53	Oxfordshire
Ock and tributaries (Land Brook confluence to Thames)	2.39	Oxfordshire
Frilford and Marcham Brook	0.48	Oxfordshire
Thames (Evenlode to Thame)	0.5	Oxfordshire

[5] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

Pipeline conveyance, Deerhurst to Culham– Net Loss

Pipeline conveyance, Deerhurst to Culham

Table 19 - Estimated maximum areas of direct terrestrial habitat loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Non-irrigated arable land	Cropland - Cereal crops	219.33
Pastures	Grassland - Other neutral grassland	106.10
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	3.1
Mixed forest	Woodland and forest - Other woodland; mixed	1.21
Conifer	Woodland and forest - Other coniferous woodland	0.02
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	5.56
Deciduous woodland*	Woodland and forest - Other woodland; broadleaved	0.05
Good quality semi-improved grassland*	Grassland - Other neutral grassland	5.55
Lowland calcareous grassland*	Grassland - Lowland calcareous grassland	0.76
Lowland meadows*	Grassland - Lowland meadows	1.42
Traditional orchard*	Cropland - Traditional orchards	0.50
Fens*	Wetland - Fens (upland and lowland)	0.54
Lowland Meadow and Pastures*	Grassland - Lowland meadow	6.21
Industrial or commercial units	Urban - Developed land; sealed surface	0.50
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	0.54
Sport and leisure facilities	Urban - Amenity grassland	1.7
Moors and heathland	Heathland and shrub - Lowland Heathland	0.18
Arable field margins	Cropland - Arable field margins pollen & nectar	2.65
TOTALS		**355.5**

*Priority Habitat

Satellite imagery was used to approximately calculate the number of hedgerows the pipeline route intersects. The estimated intersections were calculated at 288 which was multiplied by the proposed work area of 8m^2.

Table 20 - Estimated maximum km of direct hedgerow loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	5.76
TOTALS		**5.76**

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 16 & 17** results in the following biodiversity units that could be lost to development in the absence of any mitigation (**Table 18**). Where priority habitats could be added into the metric calculations a habitat condition of 'good' was used to distinguish between non-priority habitats with an overlapping metric habitat.

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure 4** shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain

Table 21 - Indicative biodiversity units potentially lost within pipeline (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric Units	Proposed habitat mitigation
Non-irrigated arable land	Cropland - Cereal crops	482.53	Neutral grassland enhancement
Pastures	Grassland - Other neutral grassland	933.68	Neutral grassland enhancement
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	27.28	Grassland succession
Mixed forest	Woodland and forest - Other woodland; mixed	10.65	Grassland succession
Conifer	Woodland and forest - Other coniferous woodland	0.09	Grassland succession
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	73.4	Neutral grassland enhancement
Deciduous woodland*	Woodland and forest - Other woodland; broadleaved	0.66	Grassland succession
Good quality semi-improved grassland*	Grassland - Other neutral grassland	73.26	Neutral grassland enhancement
Lowland calcareous grassland*	Grassland - Lowland calcareous grassland	16.55	Calcareous grassland enhancement
Lowland meadows*	Grassland - Lowland meadows	N/A Bespoke Compensation Strategy Required	N/A
Traditional orchard*	Cropland - Traditional orchards	10.89	Traditional orchard creation
Fens*	Wetland - Fens (upland and lowland)	N/A Bespoke Compensation Strategy Required	N/A
Lowland Meadow and Pastures*	Grassland - Lowland meadow	N/A Bespoke Compensation Strategy Required	N/A
Industrial or commercial units	Urban - Developed land; sealed surface	0.00	N/A
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	2.38	Neutral grassland enhancement
Sport and leisure facilities	Urban - Amenity grassland	7.48	Neutral grassland enhancement
Moors and heathland	Heathland and shrub - Lowland Heathland	2.38	Heathland creation
Arable field margins	Cropland - Arable field margins pollen & nectar	11.66	Neutral grassland enhancement
Hedgerow	Native species rich hedgerow	50.69	Hedgerow creation

*Priority Habitat

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-514.87
	Hedgerow units	-22.27
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-31.15%
	Hedgerow units	-43.93%
	River units	0.00%

Figure 4 – Biodiversity deficit (post re-instatement)

Lowland meadows and fens are identified as being an unacceptable loss within the DEFRA Metric. It is therefore not considered further within the Metric calculations. However a bespoke compensation strategy will need to be provided if these habitats are lost with consultation with Natural England. This can present challenges in habitat creation and identifying suitable locations. The first stage of the mitigation hierarchy is to avoid and therefore this should be a key consideration within the design.

The results for the river metric calculations are within the summary table in Annex A1vii.

Pipeline conveyance, Deerhurst to Culham– Net Gain Opportunities

To achieve 10% biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 22-24. Tables 22 and 23 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. As stated in the methodology the majority of habitats were assumed to be in moderate condition for an 10% for habitats. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve a 14.07% hedgerow net gain the following creation will be required, see Table 23.

Table 22. Required habitat mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to moderate condition)	135	1130.69	944ha of neutral grassland identified in 'Biodiversity South West' nature map.
Heathland and shrub - Lowland Heathland	Enhancement (moderate condition to good condition)	2	36.32	Over 1000ha of upland heathland identified in 'Biodiversity South West' nature map.
Grassland - Lowland calcareous grassland	Enhancement (moderate condition to good condition)	5	83.24	Suitable grassland available in Oxfordshire Nature Recovery Network (Over 1600ha of habitat creation land identified)
Traditional Orchard	Creation (moderate condition)	5	33.84	Suitable habitat available for orchard planting in Oxfordshire Nature Recovery Network (Over 1600ha of habitat creation land identified)
Woodland and forest - Other woodland; broadleaved	Creation (grassland succession)	50	261.29	Suitable grassland available in Oxfordshire Nature Recovery Network (Over 1600ha of habitat creation land identified)

Table 23. Required hedgerow mitigation for 10% BNG for hedgerows

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native Species Rich Hedgerow	Creation	5.7	29.40	944ha of neutral grassland identified in 'Biodiversity South West' nature map

Tables 24 and 25 identify opportunities for delivering BNG for rivers, from published information on Priority Rivers for Restoration[6] and Biodiversity Opportunity Areas for relevant counties. Priority Rivers for Restoration are reaches targeted for restoration and the location and length of river reaches within 1km of the scheme are given in Table 24. The data also provided information on whether the restoration related to physical or hydrological opportunities. Table 25 identifies the length of river reaches within BOAs within 1km of the impacted reach. The number of units/km required for 10% BNG for rivers cannot be calculated at present due to errors in the metric 2.0 and in advance of version 3.0, a bespoke solution would need to be agreed with the regulators.

Table 24. Priority River Habitats for Restoration within 1km of impacted reach

Priority river habitat for restoration	WFD reference	Targeted restoration	Length (km)
Ock and tributaries (Land Brook confluences to Thames)	GB106039023430	Hydrological	0.88
Chalvey Ditches	GB106039023550	Hydrological	1.39

Table 25. River Biodiversity Opportunity Areas

Waterbody (within 1km)	Length (km)	County
Severn - conf R Avon to conf Upper Parting	2.12	Gloucestershire
Isbourne - source to conf R Avon	0.58	Gloucestershire
Coln (Source to Coln Rogers)	8.46	Gloucestershire
Radcot Cut	0.39	Oxfordshire
Thames (Leach to Evenlode)	1.49	Oxfordshire
Childrey Brook and Norbrook at Common Barn	1.5	Oxfordshire
Ock and tributaries (Land Brook confluence to Thames)	2.438	Oxfordshire
Cow Common Brook and Portobello Ditch	0.414	Oxfordshire
Frilford and Marcham Brook	0.54	Oxfordshire
Thames (Evenlode to Thame)	0.5	Oxfordshire

[6] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

Minworth STW effluent diversion – Net Loss

Minworth STW effluent diversion (115 Ml/d)

Table 26 - Estimated maximum areas of direct terrestrial habitat loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Non-irrigated arable land	Cropland - Cereal crops	41.84
Pastures	Grassland - Other neutral grassland	15.40
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	5.43
Young trees	Woodland and forest - Other woodland; young trees planted	0.25
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	2.36
Deciduous woodland*	Woodland and forest – Lowland mixed deciduous woodland	0.17
Good quality semi-improved grassland*	Grassland - Other neutral grassland	0.02
Lowland meadows*	Grassland - Lowland meadows	1.04
Traditional orchard*	Cropland - Traditional orchards	0.39
Industrial or commercial units	Urban - Developed land; sealed surface	2.89
Dump site	Urban - Suburban/ mosaic of developed/ natural surface	1.79
Road and rail networks and associated land	Urban - Suburban/ mosaic of developed/ natural surface	2.46
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	9.24
Sport and leisure facilities	Urban - Amenity grassland	0.22
Arable field margins	Cropland - Arable field margins pollen & nectar	0.24
TOTALS		**83.74**

*Priority Habitat

Satellite imagery was used to approximately calculate the number of hedgerows the pipeline route intersects. The estimated intersections were calculated at 28 which was multiplied by the proposed work area of 8m^2.

Table 27- Estimated maximum km of direct hedgerow loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	0.56
TOTALS		**0.56**

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 21 & 22** results in the following biodiversity units that could be lost to development in the absence of any mitigation (**Table 23**). Where priority habitats could be added into the metric calculations a habitat condition of 'good' was used to distinguish between non-priority habitats with an overlapping metric habitat.

Table 28. Indicative biodiversity units potentially lost within pipeline (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric Units	Proposed habitat mitigation
Non-irrigated arable land	Cropland - Cereal crops	92.05	Neutral grassland enhancement
Pastures	Grassland - Other neutral grassland	135.52	Neutral grassland enhancement
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	47.78	Grassland succession
Young trees	Woodland and forest - Other woodland; young trees planted	1.10	Grassland succession
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	20.77	Neutral grassland enhancement
Deciduous woodland*	Woodland and forest – Lowland mixed deciduous woodland	2.47	Grassland succession
Good quality semi-improved grassland*	Grassland - Other neutral grassland	0.19	Neutral grassland enhancement
Lowland meadows*	Grassland - Lowland meadows	N/A Bespoke Compensation Strategy Required	N/A
Traditional orchard*	Cropland - Traditional orchards	5.66	Traditional orchard creation
Industrial or commercial units	Urban - Developed land; sealed surface	0.00	N/A
Dump site Road and rail networks and associated land Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	59.36	Neutral grassland enhancement
Sport and leisure facilities	Urban - Amenity grassland	0.97	Neutral grassland enhancement
Arable field margins	Cropland - Arable field margins pollen & nectar	1.06	Neutral grassland enhancement
Hedgerow	Native species rich hedgerow	4.92	Hedgerow creation

*Priority Habitat

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure** 5 shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain.

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-94.17
	Hedgerow units	-2.16
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-25.66%
	Hedgerow units	-43.93%
	River units	0.00%

Figure 5 – Biodiversity deficit (post re-instatement)

Lowland meadows are identified as being an unacceptable loss within the DEFRA Metric. It is therefore not considered further within the Metric calculations. However a bespoke compensation strategy will need to be provided if these habitats are lost with consultation with Natural England. This can present challenges in habitat creation and identifying suitable locations. The first stage of the mitigation hierarchy is to avoid and therefore this should be a key consideration within the design.

The results for the river metric calculations are within the summary table in Annex A1vii.

Minworth STW effluent diversion – Net Gain Opportunities

To achieve 10% biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 29-31. Tables 29 and 30 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. As stated in the methodology the majority of habitats were assumed to be in moderate condition for a 10.12% for habitats. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve an 10.50% hedgerow net gain the following creation will be required, see Table 30.

Table 29. Required habitat mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to good condition)	26	217.76	Warwickshire, Coventry and Solihull Green Infrastructure Map provides over 1000ha of strategic grassland habitat for creation
Traditional Orchard	Creation (moderate condition)	1	7.44	Warwickshire, Coventry and Solihull Green Infrastructure Map provides over 1000ha of strategic grassland habitat that could be utilised for orchard planting
Woodland and forest - Other woodland; broadleaved	Creation (grassland succession)	10	49.99	Warwickshire, Coventry and Solihull Green Infrastructure Map provides over 1000ha of strategic woodland habitat for creation

Table 30. Required hedgerow mitigation for 10% BNG for hedgerows

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native Species Rich Hedgerow	Creation	0.52	2.68	Warwickshire, Coventry and Solihull Green Infrastructure Map provides over 1000ha of strategic grassland habitat

Tables 31 and 32 identify opportunities for delivering BNG for rivers, from published information on Priority Rivers for Restoration[7] and Biodiversity Opportunity Areas for relevant counties. Priority Rivers for Restoration are reaches targeted for restoration and the location and length of river reaches within 1km of the scheme are given in Table 31. The data also provided information on whether the restoration related to physical or hydrological opportunities. Table 32 identifies the length of river reaches within BOAs within 1km of the impacted reach. The number of units/km required for 10% BNG for rivers cannot be calculated at present due to errors in the metric 2.0 and in advance of version 3.0, a bespoke solution would need to be agreed with the regulators.

Table 31. Priority river habitats for restoration within 1km of element

Priority river habitat for restoration	WFD reference	Targeted restoration	Length (km)
Piddle Bk - conf Whitsun Bk to Home Fm, Pinvin	GB109054039450	Hydrological	0.23

Table 32. River Biodiversity Opportunity Areas

Waterbody (within 1km)	Length (km)	County
Gog Bk - source to conf R Avon	4.35	Warwickshire and Solihull
Avon (Wark) conf R Leam to Tramway Br, Stratford	4.04	Warwickshire and Solihull
Grand Union Canal, Warwick to Solihull	5.81	Warwickshire and Solihull
Blythe from Temple Balsall Brook to Patrick Bridge	6	Warwickshire and Solihull
Blythe from Patrick Bridge to R Tame	4.57	Warwickshire and Solihull
Cole from Hatchford-Kingshurst Brook to R Blythe	4.68	Warwickshire and Solihull
Tame - R Rea to R Blythe	4.5	Warwickshire and Solihull
Birmingham and Fazeley Canal upper section	0.98	Warwickshire and Solihull

[7] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

Netheridge STW effluent diversion (Netheridge Pipeline Deerhurst) – Net Loss

Netheridge STW effluent diversion (35 Ml/d)

Table 33 - Estimated maximum areas of direct terrestrial habitat loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Non-irrigated arable land	Cropland - Cereal crops	23.09
Pastures	Grassland - Other neutral grassland	5.08
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	5.29
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	4.32
Deciduous woodland*	Woodland and forest – Lowland mixed deciduous woodland	0.30
Good quality semi-improved grassland*	Grassland - Other neutral grassland	0.59
Traditional orchard*	Cropland - Traditional orchards	0.52
Industrial or commercial units	Urban - Developed land; sealed surface	2.71
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	4.81
Moors and heathland	Heathland and shrub – lowland heathland	1.81
Arable field margins	Cropland - Arable field margins pollen & nectar	0.5
TOTALS		**49.02**

*Priority Habitat

Satellite imagery was used to approximately calculate the number of hedgerows the pipeline route intersects. The estimated intersections were calculated at 92 which was multiplied by the proposed work area of 20m^2.

Table 34 - Estimated maximum km of direct hedgerow loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	1.84
TOTALS		**1.84**

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 26 & 27** results in the following biodiversity units that could be lost to development in the absence of any mitigation (**Table 28**). Where priority habitats could be added into the metric calculations a habitat condition of 'good' was used to distinguish between non-priority habitats with an overlapping metric habitat.

Table 35 - Indicative biodiversity units potentially lost within pipeline (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric Units	Proposed habitat mitigation
Non-irrigated arable land	Cropland - Cereal crops	55.88	Neutral grassland enhancement
Pastures	Grassland - Other neutral grassland	44.70	Neutral grassland enhancement
Broadleaved woodland	Woodland and forest - Other woodland; broadleaved	46.55	Grassland succession
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	38.02	Neutral grassland enhancement
Deciduous woodland*	Woodland and forest – Lowland mixed deciduous woodland	4.36	Grassland succession
Good quality semi-improved grassland*	Grassland - Other neutral grassland	5.19	Neutral grassland enhancement
Traditional orchard*	Cropland - Traditional orchards	7.55	Traditional orchard creation
Industrial or commercial units	Urban - Developed land; sealed surface	0.00	N/A
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	21.16	Neutral grassland enhancement
Moors and heathland	Heathland and shrub – lowland heathland	26.28	Heathland creation
Arable field margins	Cropland - Arable field margins pollen & nectar	2.20	Neutral grassland enhancement
Hedgerow	Native species rich hedgerow	16.19	Hedgerow creation

*Priority Habitat

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure 6** shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain.

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-101.04
	Hedgerow units	-7.11
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-40.11%
	Hedgerow units	-43.93%
	River units	0.00%

Figure 6 – Biodiversity deficit (post re-instatement)

The results for the river metric calculations are within the summary table in Annex A1vii.

Netheridge STW effluent diversion (Netheridge Pipeline Deerhurst) – Net Gain Opportunities

To achieve 10% biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 39-38. Tables 36 and 37 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. As stated in the methodology the majority of habitats were assumed to be in moderate condition for an 11.33% for habitats. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve an 10.22% hedgerow net gain the following creation will be required, see Table 37.

Table 36. Required habitat mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to good condition)	25	209.39	Over 1000ha of grassland identified in 'Biodiversity South West' nature map.
Traditional Orchard	Creation (moderate condition)	1	7.44	944ha of neutral grassland identified for orchard planting in 'Biodiversity South West' nature map.
Woodland and forest - Other woodland; broadleaved	Creation (grassland succession)	10	52.26	Over 1000ha of grassland identified in 'Biodiversity South West' nature map.
Heathland and shrub – lowland heathland	Creation (moderate condition)	5	12.28	Over 1000ha of upland heathland identified in 'Biodiversity South West' nature map.

Table 37. Required hedgerow mitigation for 10% BNG for hedgerows

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native Species Rich Hedgerow	Creation	1.7	8.77	944ha of neutral grassland identified in 'Biodiversity South West' nature map

Table 38 identifies opportunities for delivering BNG for rivers, from published information on Biodiversity Opportunity Areas. No Priority Rivers for Restoration[8] were identified within 1km of the impacted reaches. The number of units/km required for 10% BNG for rivers cannot be calculated at present due to errors in the metric 2.0 and in advance of version 3.0, a bespoke solution would need to be agreed with the regulators.

[8] https://data.gov.uk/dataset/e0165747-8368-4ff7-a644-df9aeb27bb0b/priority-habitat-creation-and-restoration

Table 38. River Biodiversity Opportunity Areas

Waterbody (within 1km)	Length (km)	County
Severn (E Channel) - Horsebere Bk to Severn Est	1.14	Gloucestershire
Leadon - conf Preston Bk to conf R Severn (W Channel)	0.39	Gloucestershire
Severn - conf R Avon to conf Upper Parting	6.68	Gloucestershire
Horsebere Bk - source to conf R Severn	2.53	Gloucestershire
Wotton Bk - source to conf Horsebere Bk	0.96	Gloucestershire
Hatherley Bk - source to conf R Severn	3.03	Gloucestershire
Chelt - M5 to conf R Severn	1.42	Gloucestershire
Leigh Bk - source to conf R Chelt	0.65	Gloucestershire

Netheridge STW effluent diversion (Netheridge Pipeline Canal) – Net Loss

Netheridge STW effluent diversion (35 Ml/d)

Table 39 - Estimated maximum areas of direct terrestrial habitat loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (ha)
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	1.12
Good quality semi-improved grassland*	Grassland - Other neutral grassland	0.34
Industrial or commercial units	Urban - Developed land; sealed surface	2.71
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	2.88
Moors and heathland	Heathland and shrub – lowland heathland	0.36
TOTALS		**7.50**

*Priority Habitat

Satellite imagery was used to approximately calculate the number of hedgerows the pipeline route intersects. The estimated intersections were calculated at 2 which was multiplied by the proposed work area of 20m^2. There are no arable fields and therefore no arable field margins associated with this pipeline.

Table 40 - Estimated maximum km of direct hedgerow loss within pipeline

Habitat	Translated habitat to UKHab	Loss to pipeline (km)
Hedgerow	Native species rich hedgerow	0.04
TOTALS		**0.04**

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 39 & 40** results in the following biodiversity units that could be lost to development in the absence of any mitigation (**Table 41**).

Table 41 - Indicative biodiversity units potentially lost within pipeline (pre re-instatement)

Habitat	Translated habitat to UKHab	Metric Units	Proposed habitat mitigation
Coastal and floodplain grazing marsh*	Grassland - Other neutral grassland	9.86	Neutral grassland enhancement
Good quality semi-improved grassland*	Grassland - Other neutral grassland	2.99	Neutral grassland enhancement
Industrial or commercial units	Urban - Developed land; sealed surface	0.00	N/A
Discontinuous urban fabric	Urban - Suburban/ mosaic of developed/ natural surface	12.67	Neutral grassland enhancement
Moors and heathland	Heathland and shrub – lowland heathland	5.23	Heathland creation
Hedgerow	Native species rich hedgerow	0.35	Hedgerow creation

*Priority Habitat

One assumption made during the calculation was that all pipeline habitat loss would be temporary and habitat would be reinstated after construction, either naturally or re-created. **Figure 7** shows the net biodiversity unit lost based on this assumption. Mitigation will be still required to achieve biodiversity net gain.

Figure 7 – Biodiversity deficit (post re-instatement)

Net project biodiversity units (including all on-site & off-site habitat retention/creation)	*Habitat units*	-9.52
	Hedgerow units	-0.15
	River units	0.00
Total project biodiversity % change (including all On-site & Off-site Habitat Creation + Retained Habitats)	*Habitat units*	-30.95%
	Hedgerow units	-43.93%
	River units	0.00%

The results for the river metric calculations are within the summary table in Annex A1vii.

Netheridge STW effluent diversion (Netheridge Pipeline Canal) – Net Gain Opportunities

To achieve 11.05% biodiversity net-gain there are opportunities locally for the following habitat enhancement and creation shown in Tables 42. Tables 42 and 43 show for each habitat type impacted by the scheme, the area (hectares/km) of habitat enhancement or creation required, the metric units that this achieves and the strategic location of where this could be delivered. Hectarage required can be halved if habitats are assumed to be in poor condition. To achieve an 12.14% hedgerow net gain the following creation will be required, see Table 43.

Table 42. Required habitat mitigation for 10% BNG for terrestrial habitats

Habitat	Creation or Enhancement	Hectarage	Metric Units Gained	Strategic land identified for delivery
Grassland - Other neutral grassland	Enhancement (poor condition to good condition)	3.4	28.48	Over 1000ha of grassland identified in 'Biodiversity South West' nature map.
Heathland and shrub – lowland heathland	Creation (moderate condition)	0.5	1.23	Over 1000ha of upland heathland identified in 'Biodiversity South West' nature map.

Table 43. Required hedgerow mitigation for 10% BNG

Habitat	Creation or Enhancement	Km	Metric Units Gained	Strategic land identified for delivery
Native Species Rich Hedgerow	Creation	0.04	0.20	944ha of neutral grassland identified in 'Biodiversity South West' nature map

There are no river crossings associated with this pipeline and therefore no net gain requirements.

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