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A2AT Natural Capital Assessment

Affinity Water and Anglian Water

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Quality information

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Introduction

This report provides an overview of a Natural Capital Assessment (NCA) conducted for Anglian to Affinity Transfer (A2AT) scheme and the two route variations named the Western Route and the Eastern Route. These are two alternative routes that would transfer water from the proposed South Lincolnshire Reservoir (SLR) to Water Resources Zone 5 (WRZ5) within Affinity Water's supply area. Both routes are considered as part of the same SLR to WRZ5 preferred option that emerged from gate one. A detailed description of the preferred option and the two routes is provided in section 01 Get Started of this report. The preferred option that emerged from the initial appraisal stage in gate two was further optimised through the gate two process, following the Regulators' Alliance for Progressing Infrastructure Development (RAPID) gated process by Ofwat for the proposed A2AT scheme.

The gated process requires water company partner organisations to evidence that a sufficient level of progression is being made with the development of Strategic Resources Option(s) (SRO(s)) to unlock development funding and enable the SRO(s) to be carried out to the next stage gate. A2AT scheme is a regional resource solution for the transfer of water from the Anglian Water region to supply Affinity Water customers.

Methodology

This assessment uses a bespoke methodology broadly following the four stages outlined in the 'Natural Capital Protocol'[1] (hereafter referred to as the Protocol), a standard approach developed by the Capitals Coalition to help organizations account for natural capital in their decision-making (Figure 1). In addition, this assessment aligns with:

- Gate one methodology and results used in the initial assessment of the four SROs;
- Gate two submission guidance;
- Water Resources Planning Guideline (WRPG)[2] and Supplementary Guidance (SG)[3]; and
- Water Resources Management Plans (WRMP) environment assessment guidance and applicability with SROs[4].

Initial assessments to support the gate one submission additionally followed the Water Resources South East (WRSE) Natural Capital & Biodiversity Net Gain Method Statement (Mott MacDonald, 2020) and the WRSE Regional Plan Environmental Assessment Methodology Guidance (Mott MacDonald, 2020). This gate two NCA follows the Water Resources East (WRE) Integrated Environmental Assessment Methodology (Mott Macdonald, 2021), which is broadly consistent with the WRSE guidance and does not invalidate the gate one assessment. In addition, as indicated in the WRE methodology, this assessment follows the Natural England logic chain to assess changes in natural capital metrics (ecosystem services) (Figure 2).

The main difference between this assessment for gate two and that undertaken at gate one is that this report presents an update at the solution level and is used to support identification of best value solutions, to reflect scheme changes and the updated Biodiversity Net Gain (BNG) calculations. It is built on gate one findings and improves the details of the assessment based on refined data.

[1] Capitals Coalition, 2022. Natural Capital Protocol. Available at: https://capitalscoalition.org/capitals-approach/natural-capital-protocol/?fwp_filter_tabs=training_material
[2] Environment Agency, Natural Resources Wales, and Office for Water Services, 2022. Water resources planning guideline. Available at: https://www.gov.uk/government/publications/water-resources-planning-guideline
[3] Environment Agency, 2021. Water resources planning guideline supplementary guidance – Environment and society in decision-making. External guidance: 18643.
[4] Mott MacDonald, 2020. All Companies Working Group: WRMP environmental assessment guidance and applicability to SROs.

The subsequent sections present the four stages of the Natural Capital Protocol, broken down into nine steps (Figure 1).

Figure 1. Overview of the stages of the Natural Capital Protocol

Figure 2. Natural England ecosystem services logic chain from WRE guidance

Frame Stage: Why?

01 Get started

Water companies must publish a Water Resources Management Plan (WRMP) every five years, setting out how they will manage water supplies. As part of the WRMP19, Affinity Water identified the A2AT SRO as a new potential solution to address long-term water deficits in Affinity Water's central region. The A2AT scheme comprises the abstraction and transfer of available water from the Anglian Water supply area to Affinity Water's central supply zones.

In response to WRMP19 submissions, Ofwat established the RAPID to help accelerate new water infrastructure development. As such, RAPID has set up a gated process for companies to submit information about their prospective solutions and ensure solution progress and development is being made.

For the gate one submission, four potential transfer routes were developed following a screening process which considered direct abstraction from the River Trent or using the proposed SLR or Fenland Reservoir, where water would be treated to potable standards and stored for distribution to customers in WRZ3 and WRZ5. The SLR was concluded to be the most suitable source of water for the A2AT, and Affinity Water's WRZ5 was identified as the most suitable location to receive the water. As a result, the SLR to WRZ5 option was put forward to undergo further assessment as part of the gate two submission.

The following describes how the preferred option that emerged from the initial appraisal stage in gate two was further optimised through the gate two process.

Preferred Option

The preferred option that emerged from the initial appraisal stage at gate two was the SLR to WRZ5 option that emerged from gate one. The SLR to WRZ5 option interfaces with the SLR scheme at the existing Etton Service Reservoir. A new break tank and pumping station at Etton Service Reservoir are designed to transfer the flow via a new pipeline to another new break tank and pumping station at an intermediate point along the route. From here, the water would be pumped via a new pipeline to a new conditioning plant and service reservoir in the Affinity Water resource zone WRZ5 at Sibleys Service Reservoir.

During the design process, the project team considered an additional route between SLR and WRZ5. This variant, known as the 'Western Route', takes the route via Grafham Water and offers additional operational flexibility to Anglian Water. The original SLR to WRZ5 route was named the 'Eastern Route' for clarity. Both routes are considered in this report as part of the same SLR to WRZ5 preferred option.

The Eastern Route

Gate one work on the SLR to WRZ5 option identified that it would cross the Nene Washes SPA / SAC and that mitigation to overcome the impacts would be necessary. Further investigation during the gate two optioneering stage determined that the measures required (routing it through the existing road corridor north of Whittlesley) would be technically complex.

Instead, it was decided to avoid this impact altogether by routing the Eastern Route to the west of Peterborough, hence it runs from Etton Service Reservoir southwards towards Washingley and Folksworth. It then turns eastwards to join the original gate one SLR to WRZ5 route just north-west of Woodhurst. The pipeline route continues to a proposed intermediate pumping station located south-west of Duxord before continuing to the termination point at the existing Sibleys Service Reservoir.

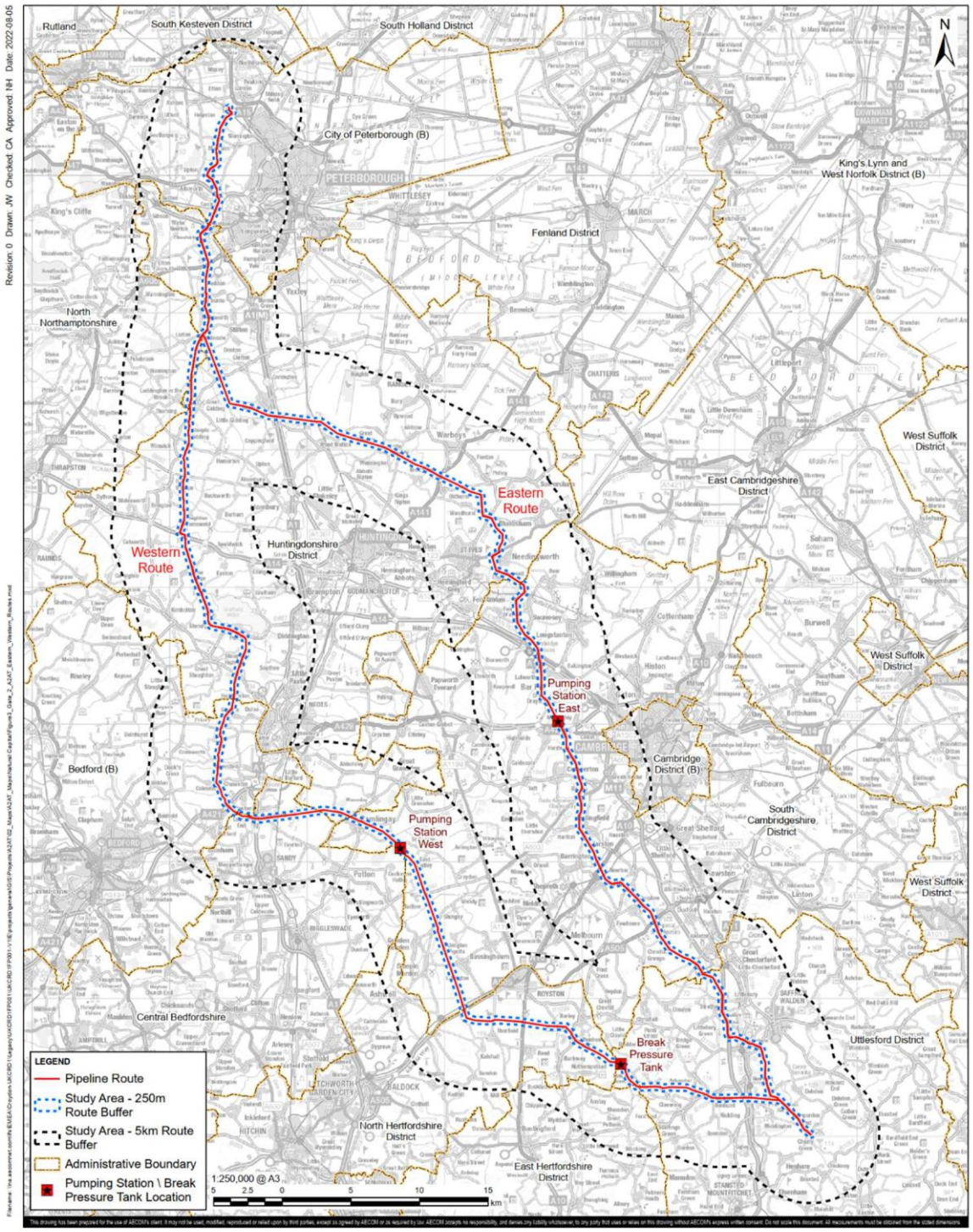
The Western Route

The Western Route initially follows the same corridor as the Eastern Route, passing west of Peterborough, towards Washingley and Folksworth. From this point the route continues southwards towards Anglian Water's existing Grafham Water site, passing through approximately 1km to the east.

From Grafham Water, the route continues south then south eastward to an intermediate pumping station near East Hatley and a break pressure tank near Langley Park Rally School before terminating to the southeast at the existing Sibleys Service Reservoir.

The preferred option, with both the Eastern Route and Western Route variants, is shown in Figure 3, below.

Figure 3. Anglian to Affinity Transfer (A2AT) map showing gate two Western Route and Eastern Route



The Eastern and Western routes have relatively similar requirements regarding new assets and scheme costings. Therefore, a natural capital approach can provide further insight into other important similarities or differences in the relative environmental benefits between both routes. A quantitative and

monetary valuation of these benefits can facilitate a comparison between the routes by assessing them using a common measure. A natural capital approach can facilitate a better understanding of the impacts and dependencies of the A2AT's scheme on the environment, society, and economy, resulting in more informed decisions and, ultimately, solutions that are more resilient and deliver best value for customers, regulators, other stakeholders, and the environment.

Scope: What?

02 Define the objective

This assessment aimed to measure and value the changes in natural capital impacts and dependencies of the Eastern and Western routes defined above (01 Get started) to inform decisions around long-term best-value solutions. It is important to recognise that natural capital impacts and dependencies can be found to provide either benefits or disbenefits. Results were reported in terms of total losses and gains within each option's Zone of Influence (ZoI), defined in Step 03 and as per the WRE guidance, and fed into recommendations in Step 09.

Specifically, this report aimed to answer the following questions:

- What are the likely material impacts and dependencies of the Eastern and Western routes on natural capital?
- How do the Eastern and Western routes affect natural capital in terms of physical and/ or monetary flows compared to a baseline 'do-nothing' scenario?
- What are the potential relevancies of these changes in natural capital on the long-term effectiveness and/or sustainability of the Eastern and Western routes?

03 Scope the assessment

The scope of this assessment was defined as per the Natural Capital Protocol through the following key considerations:

- **Organisational focus:** Project-level.
- **Value chain boundary:** The assessment considers each option's potential impacts from construction and operation phases. Downstream and upstream impacts are included where considered material.
- **Value perspective:** Both value to the businesses and value to society, considering impacts on the business and (external) stakeholders, as well as the business dependencies.
- **Types of costs and benefits:** Both impacts and dependencies on natural capital were considered. As such, financial costs were not included as they fall in the scope of a multi-capital assessment.
- **Value types:** Natural capital impacts and/or dependencies were first qualitatively assessed before being quantified and monetised where possible and appropriate, given confidence and reliability in values, and per the WRE guidance.
- **Other technical issues:**
  - Temporal boundary: results were reported over 40 years as this is the standard time horizon used to assess infrastructure. Construction start year was assumed to be 2030, with earliest deployable output in 2035, as per the assumption made in the gate one submission. As such, a construction period of five years was assumed, to be consistent with the estimated timeline in the Concept Design Report by Arup and the Preliminary Feasibility Assessment for gate one.
  - Spatial boundary: physical and monetary changes in natural capital metrics were assessed within the 'impact footprints' of the Eastern and Western routes, respectively. Impact footprints were defined through a ZoI set at a 250-meter buffer on either side of the pipeline routes. To be consistent with the WRE guidance, a ZoI should be created around the option to determine the impact footprint in which an effect may occur.
  - Baseline: Eastern and Western routes were compared to their baselines, defined as a 'do-nothing' pre-construction provision of ecosystem services.

- Discounting: as per the HM Treasury Green Book[5], a discount rate of 3.5%, declining after 30 years, was applied to discount future monetary benefits or disbenefits.

- Price years: values were adjusted to 2021 prices, using a CPIH[6] deflator with the base year 2015, sourced from the Office of National Statistics[7].

- Data requirements: the assessment is informed by the route types, descriptions, previous technical reports and open-source data where appropriate. Data sources per natural capital metric are presented in this report's Measure and Value chapter.

04 Determine the impacts and/or dependencies

In the first phase of the NCA, the impacts and/or dependencies on natural capital were identified and assessed qualitatively for each option. As part of this, the direction and the materiality of change in the provision of the ecosystem services associated with the natural capital assets were determined (see Table 1).

It is noted that materiality will depend on respective mitigation measures put in place. For instance, the change in carbon footprints or the provision of flood regulation services will be contingent on the implementation of decarbonisation methods or the restoration of ground levels post-construction, respectively. While mitigation measures were uncertain at this stage and therefore not considered, they should be reflected in future assessments.

The relative impacts/ dependencies on each natural capital metric for both routes and their baseline was assessed using the following qualitative ratings:

- ↑↑ significant positive impact
- ↑ minor positive impact
- → no overall impact
- ↓ minor negative impact
- ↓↓ significant negative impact
- ↑/↓ both positive and negative impacts

Based on this qualitative assessment, the materiality of impacts/ dependencies was categorised as:

- **High:** high positive or negative impact and likely to be of importance
- **Moderate:** moderate impact and potential to be of some importance
- **Low:** low impact and unlikely to be of importance (including those classified with no overall impacts)

From gate one, the following four natural capital metrics were considered as per the WRMP guidance:

- Climate regulation
- Biodiversity

[5] The Green Book (2022) - GOV.UK (www.gov.uk)
[6] CPIH: Consumers Prices Index including owner occupiers' Housing costs
[7] Office for National Statistics, 2022. CPIH INDEX 00: ALL ITEMS 2015=100. Available at: https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l522/mm23

- Natural hazard regulation
- Water purification

In addition, in line with the WRSE methodology, three additional metrics were considered:

- Recreation and amenity value
- Food production
- Air quality regulation

Table 1. Materiality assessment of the natural capital impacts and dependencies for the Western and Eastern routes compared to their baseline

Natural capital metric	Direction of change		Rationale	Materiality of change
	Western Route	Eastern Route		
Climate regulation	↓↓	↓↓	The baseline position for each option includes various carbon sinks, which are almost all in good or at least fairly good condition with sequestration coming from large areas of woodland, hedgerows, orchards, grasslands, fens and wetlands. Sources of carbon emissions may be modified grasslands that are in fairly poor condition, and potential methane emissions from livestock and urban land from landfills and food, solid, and organic waste. Each option involves taking out most of these key habitats during the construction phase except the wetlands. This habitat clearance represents around 85% of the options' area, which is over five thousand hectares for each route. This will ultimately likely lead to a temporary loss of the amount of carbon sequestered. Although it is assumed that habitats will be reinstated to reach target conditions, there is a time lag for similar carbon benefits to be achieved, given the time taken for reinstated habitats to recover the full capacity to deliver benefits. Carbon from construction and operations is also significant for both options. The Western Route involves more embodied and operational carbon than the Eastern Route, given its less direct corridor. Operational carbon is the most significant component for both routes, with water treatment and pumping being relatively energy intensive. Carbon related to chemicals production used at the treatment works is also relevant. There is potential to reduce the net long-term impact on climate regulation through mitigation actions, including renewable energy generation, offsetting emissions on externally owned land, and entering agreements with local landowners, which could reduce the net long-term impact on climate regulation. However, the materiality of change in the provision of climate regulation services has been deemed moderate/high to account for the potential mitigation actions but also the remaining uncertainty around the feasibility at this stage. It is recommended to investigate further the technical consideration at gate three.	Moderate/High
Biodiversity	↓	↓	The baseline position for both options contains large areas of priority habitats, habitats of high distinctiveness and in good condition, likely supporting significant biodiversity. Both routes cross large National Priority Focus Areas, the Nene Valley Nature Improvement Area, and have various designated areas likely important for biodiversity, which may be affected by minor indirect impacts, including disturbance and damage of habitats, visual impacts, and noise and vibration during construction. Also, construction for both routes will likely result in lost BNG units from habitat clearance and additional time lags associated for reinstated habitats to reach target condition. While there is an associated time lag, it is assumed that all habitats lost during the construction of both routes will eventually be fully reinstated and reach full target condition. Therefore, the materiality of change for the provision of the biodiversity benefits has been deemed moderate.	Moderate
Natural hazard regulation	↑/↓	↑/↓	The baseline position for both options includes key habitats providing natural hazard regulation, such as wetlands and woodlands.	Moderate

Natural capital metric	Direction of change		Rationale	Materiality of change
	Western Route	Eastern Route		
(drought and flood)			Some areas vulnerable to water scarcity could exacerbate future drought-like conditions by water demands surpassing supply capacities. At the same time, likely positive long-term effects are expected from the scheme's operations which are designed to ensure the resilience of water supplies against future extreme drought. Under each option, wetlands are expected to be retained. Still, the woodland area within Flood Zones 2 and 3 is expected to be reduced, leading to adverse temporary residual effects on flood resilience. This is likely to be of greater concern for the Western Route, which has a large section (21km) liable to flooding from mainly pluvial sources, alongside some fluvial or groundwater elements. However, only a low percentage of both routes are within Flood Zones 2 and 3 (6% and 5% respectively for the Western Route and 8% and 7% for the Eastern Route), of which relatively small quantities of woodlands are expected to be lost. As such, and given that woodlands are expected to be reinstated, the materiality of change has been deemed moderate.	
Water purification	↑/↓	↑/↓	Water purification service is provided by the wetlands and woodlands located close to a watercourse and contained within the baseline of both options through their capacity to absorb pollutants or intercept run-off. With the exception of areas of wetlands retained, the loss of woodlands is likely to reduce dilution services temporarily. At the same time, construction may lead to sediment and pollutants increasingly entering watercourses. This is likely to be exacerbated in case of large fluvial events leading to erosion carrying material from the disturbed ground or construction debris into downstream waterbodies. Given that woodlands will be reinstated and the expected loss of a large area of croplands will likely counter these negative impacts through a decrease in nutrient loads, the materiality of change for water purification service has been deemed moderate. However, the reinstated woodlands will take time to reach their full potential regarding water purification, while cropland are assumed to be reinstated in one year.	Moderate
Recreation and amenity value	↓	↓	Operations of both routes would result in minor negative residual impacts on recreation and amenity value as the section of pipeline near Sundon, and the Sundon WTW would be located within the Metropolitan Green Belt which surrounds London, and the Chilterns Area of Outstanding Natural Beauty. Potential indirect impacts on other environmental designation areas as described under 'Biodiversity', may affect their potential recreational use/ public visits until habitats are fully reinstated. However, as the routes do not lead to additional or enhanced recreational visits and will not permanently impact recreational and amenity sites, the materiality of change has been deemed low and scoped out.	Low
Food production	↓	↓	Land cover within the baseline of both options is primarily composed of cropland used for cereal crops with a majority of grade 2 and 3 agricultural land, based on the Provisional Agricultural Land Classification[8].	Moderate

[8] Natural England, 2020. Provisional Agricultural Land Classification (ALC). Available at: https://data.gov.uk/dataset/952421ec-da63-4569-817d-4d6399df40a1/provisional-agricultural-land-classification-alc

Natural capital metric	Direction of change		Rationale	Materiality of change
	Western Route	Eastern Route		
			Both options will likely result in a substantial loss of croplands, causing a net loss of food production during construction. However, the materiality of change has been deemed moderate as the future value is not expected to be affected given the reinstatement of the arable land following construction.	
Air quality regulation	↓	↓	The baseline for both options includes key habitats providing air quality regulation, such as grasslands, heaths and woodlands located close to roads and built-up areas. Both options will likely lead to temporary negative effects due to habitat clearance during construction, more particularly through the loss of woodlands that have the greatest capacity to absorb pollutants from the atmosphere. There may also be minor effects on air quality from pollutants associated with earthworks and traffic during the construction of plants and pipelines. However, while there are Air Quality Management Areas (AQMAs) near the indicative location for the Eastern option, habitats that are expected to be lost do not fall within AQMAs. On this basis and given that lost habitats are assumed to be reinstated, the materiality of change has been deemed low and scoped out.	Low

Measure and Value: How?

05 Measure impact drivers and/or dependencies

For those natural capital metrics scoped into this assessment in Step 04, the approach to quantifying and valuing the changes in the benefits derived from the ecosystem services provided by the natural capital stocks was defined through the impact pathway diagrams below. This included defining the impacts of the activity undertaken and describing the physical and monetary flow data with reference to receptors/beneficiaries and an indicator of robustness (confidence). Confidence is presented using High-Moderate-Low qualitative scoring and is function of the quality of the methodology for estimating the value of the service (with market price considered the most robust) and the accuracy of the data available to support the valuation.

Table 2. Impact pathway for climate regulation: land use change

Activity	Carbon sequestered by vegetation within the study area
Impact	Changes in balance of greenhouse gases entering the atmosphere associated with changes in habitat extent pre/post construction.
Receptor	General public
Physical flow data	• Extent (ha) of habitats pre and post-implementation • Carbon factors (tCO_{2e}/ha/yr) per unit area of habitat (drawn from Natural England 2021 study[9])
Monetary flow data	BEIS central non-traded carbon price[10]
Confidence	Moderate

Table 3. Impact pathway for climate regulation: construction and operation

Activity	Carbon emissions associated with construction and operations
Impact	Changes in balance of greenhouse gases entering the atmosphere
Receptor	General public
Physical flow data	• Total embodied, operational and construction carbon
Monetary flow data	• BEIS central non-traded carbon price[9] • BEIS central traded carbon price[11]

[9] Natural England, 2021. Carbon Storage and Sequestration by Habitat 2021 (NERR094). Available at: http://publications.naturalengland.org.uk/publication/5419124441481216#:~:text=This%20record%20was%20published%20by%20Natural%20England%20on%2020%20April%202021%20.&text=Achieving%20'net%20zero'%20greenhouse%20gas,for%20the%20UK%20and%20England.

[10] BEIS, 2021. Valuation of greenhouse gas emissions: for policy appraisal and evaluation. Available at: Valuation of greenhouse gas emissions: for policy appraisal and evaluation - GOV.UK (www.gov.uk)

[11] BEIS, 2019. Updated short-term traded carbon values used for UK public policy appraisal (2018). Available at: https://www.gov.uk/government/publications/updated-short-term-traded-carbon-values-used-for-uk-policy-appraisal-2018

Confidence	Moderate

Table 4. Impact pathway for biodiversity

Activity	Biodiversity benefits delivered by habitats within the study area
Impact	Changes in the amount of biodiversity units delivered associated with the changes in habitat extent pre/ post construction and the time lag for reinstated habitats to reach maturity
Receptor	General public
Physical flow data	• Extent (ha) of habitats pre and post-implementation • Number of biodiversity units calculated via Biodiversity Metric 3.1
Monetary flow data	• Average cost per biodiversity credit from various online sources[12]
Confidence	Low

Table 5. Impact pathway for natural hazard regulation

Activity	Wetlands and woodlands storing and slowing down water
Impact	Changes in wetland and woodland areas during construction changing their capacity to regulate water flows for flood risk
Receptor	Local residents
Physical flow data	• Extend (ha) of habitats pre and post-implementation • Volume of water stored per ha of woodland each year (m^3/ha/yr) (drawn from Broadmeadow *et al.*, 2018[13])
Monetary flow data	• Cost per m3 of a constructed reservoir (drawn from the 'Flood Regulation' tab in Services Databook in ENCA (Defra, 2021)[14]) • Average value of flood control and storm buffering by inland wetlands (drawn from the 'Flood Regulation' tab in Services Databook in ENCA (Defra, 2021)[12])
Confidence	Low

Table 6. Impact pathway for food production

Activity	Food production service delivered by agricultural land within the study area
Impact	Changes in extent of agricultural land pre/ post construction and associated changing level of food provision

[12] DEFRA, 2018. Net Gain Consultation proposals. Available at: Net gain Consultation proposals (defra.gov.uk) and DEFRA, 2019. Biodiversity net gain and local nature recovery strategies. Available at: Net gain impact assessment (publishing.service.gov.uk)
[13] Broadmeadow *et al.* (2018). Forest Research. Valuing flood regulation services of existing forest cover to inform natural capital accounts. Available at: (PDF) Valuing flood regulation services of existing forest cover to inform natural capital accounts (researchgate.net)
[14] DEFRA, 2021. Enabling a Natural Capital Approach. ENCA – Services Databook (updated October 2021). Available at: https://www.data.gov.uk/dataset/3930b9ca-26c3-489f-900f-6b9eec2602c6/enabling-a-natural-capital-approach

Receptor	Local residents and general public
Physical flow data	• Extent (ha) of agricultural land
Monetary flow data	• Value of food production using NEVO tool[15]
Confidence	Low

06 Measure changes in the state of natural capital

Following the impact pathways diagrams presented above, changes in the natural capital extent and condition pre and post-implementation for both routes were measured based on the Biodiversity Metric 3.1 results. This relates to changes in habitat type, area and condition for each route. Note that it was assumed that all baseline habitats lost during construction would be fully reinstated. As such, this is a static account. However, the time taken for each habitat to reach the target condition post-construction is included. Results are summarised in Tables 7 and 8.

Table 7. Habitat type (UK Hab[16]), extent (ha), condition, and time to target condition post-construction for Western Route (years)

Habitat type (UK Hab)	Extent (ha)	Condition	Time to target condition (years)
Fens (upland and lowland)	0.59	Good	N/A*
Lowland mixed deciduous woodland	22.15	Fairly good	30+
Other neutral grassland	1.08	Moderate	5
Cereal crops	4265.85	Condition assessment N/A	1
Developed land; sealed surface	31.08	N/A – other	0
Fens (upland and lowland)	10.66	Good	N/A*
Lowland heathland	10.01	Fairly good	25
Lowland mixed deciduous woodland	83.80	Fairly good	30+
Modified grassland	171.03	Fairly poor	2
Other coniferous woodland	7.24	Fairly poor	10
Other neutral grassland	785.38	Fairly poor	3
Floodplain wetland mosaic	28.03	Fairly good	15
Lowland meadows	26.96	Good	N/A*
Lowland mixed deciduous woodland	135.77	Fairly good	30+
Other coniferous woodland	0.68	Fairly poor	10
Other neutral grassland	10.54	Moderate	5
Traditional orchards	1.53	Fairly good	25
Total	5592.39	-	-

**Note: Habitats of very high distinctiveness were assumed to be avoided during construction and were therefore not assigned a time to target condition.*

[15] Natural Environment Valuation Online (NEVO). Available at: https://www.leep.exeter.ac.uk/nevo/?x=405000&y=410000&z=1
[16] UK Habitat Classification. Available at: https://ukhab.org/

Table 8. Habitat type (UK Hab[14]), extent (ha), condition, and time to target condition post-construction for Eastern Route (years)

Habitat type (UK Hab)	Extent (ha)	Condition	Time to target condition (years)
Floodplain wetland mosaic	125.02	Fairly good	15
Cereal crops	3933.47	Condition assessment N/A	1
Developed land; sealed surface	24.27	N/A – other	0
Fens (upland and lowland)	12.08	Good	N/A*
Fens (upland and lowland)	0.02	Good	N/A*
Fens (upland and lowland)	4.87	Good	N/A*
Lowland heathland	18.34	Fairly good	25
Lowland heathland	0.92	Fairly good	25
Lowland mixed deciduous woodland	74.94	Fairly good	30+
Lowland mixed deciduous woodland	23.97	Fairly good	30+
Lowland mixed deciduous woodland	0.45	Fairly good	30+
Lowland mixed deciduous woodland	95.82	Fairly good	30+
Modified grassland	176.65	Fairly poor	2
Other coniferous woodland	2.01	Fairly poor	10
Other neutral grassland	605.88	Moderate	5
Other neutral grassland	0.08	Moderate	5
Other neutral grassland	3.85	Moderate	5
Other neutral grassland	7.76	Moderate	5
Purple moor grass and rush pastures	0.14	Good	N/A*
Traditional orchards	7.69	Fairly good	25
Vacant/ derelict land/ bare ground	0.93	Fairly poor	2
Total	5119.17	-	-

**Note: Habitats of very high distinctiveness were assumed to be avoided during construction and were therefore not assigned a time to target condition.*

07 Value impacts and/or dependencies

Headline results from the monetary valuation for 50 and 100 million litres of water transferred per day (ML/d) are presented in Figures 4 and 5 and Tables 9 and 10, respectively. The difference between the two charts is only driven by the difference in carbon emissions, as the other metrics were not broken down by the water abstraction levels.

Figure 4. Comparison between the Western and Eastern Routes across the present values per natural capital metric for 50 ML/d abstraction (40 years, £2021 prices, millions)

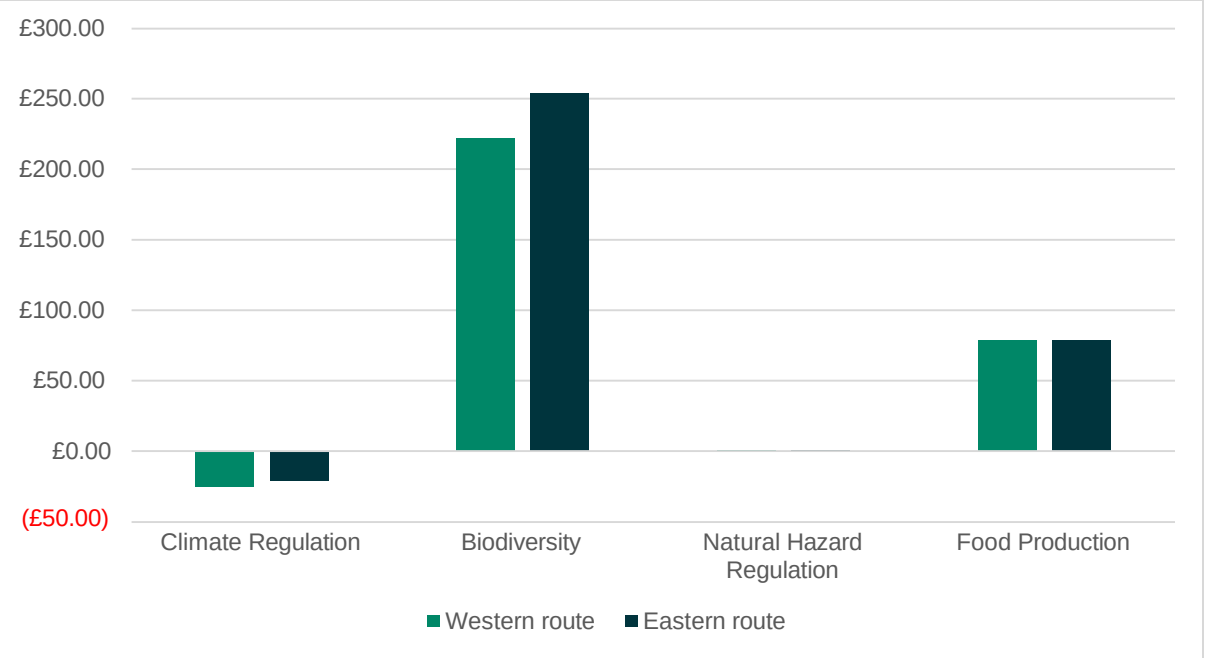


Figure 5. Comparison between the Western and Eastern Routes across the present values per natural capital metric for 100 ML/d abstraction (40 years, £2021 prices, millions)

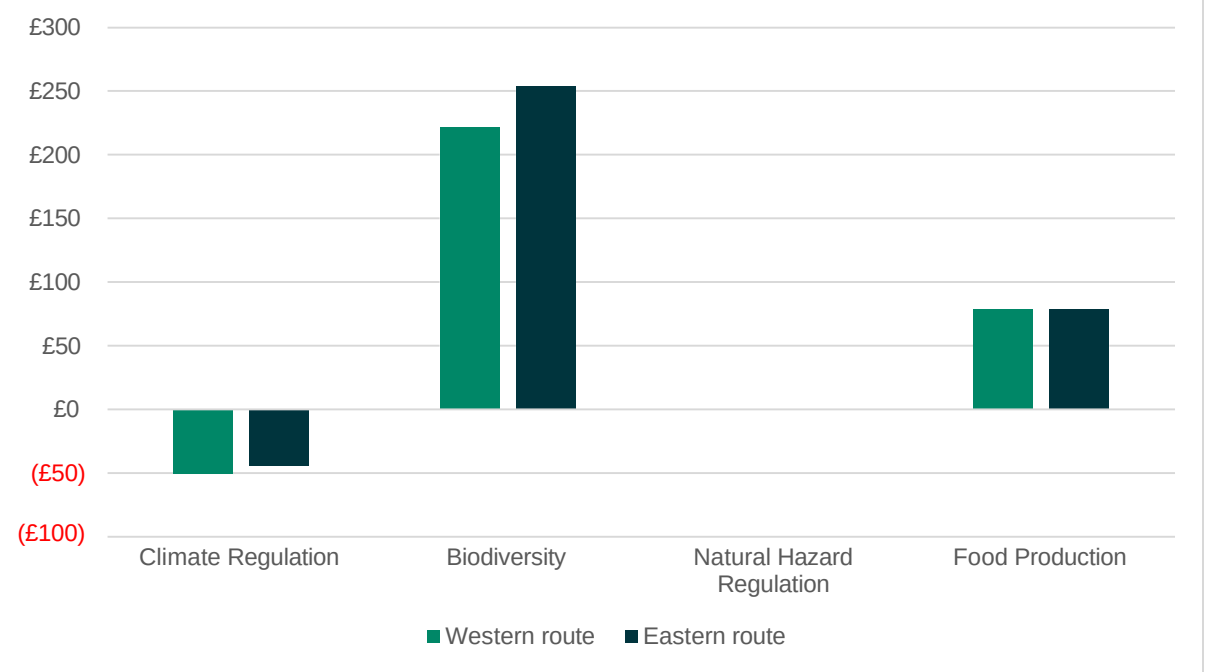


Table 9. Headline monetary valuation results from the NCA for 50 ML/d water abstraction (40 years, £2021 prices, millions)

Code	Natural capital metric	Baseline - Western Route	Baseline - Eastern Route	Western Route	Eastern Route	Confidence
NC1	Global climate regulation	15	15	-25	-21	Moderate
NC2	Biodiversity	225	224	222	254	Low
NC3	Natural hazard regulation (Flood regulation)	0.87	0.83	0.46	0.50	Low
NC5	Food production	90	90	79	79	Low
NPV	Present Value	330	331	276	312	
Value relative to baseline				**-17%**	**-6%**	

Note: values have been rounded up for clarity.

Table 10. Headline monetary valuation results from the NCA for 100 ML/d water abstraction (40 years, £2021 prices, millions)

Code	Natural capital metric	Baseline - Western Route	Baseline - Eastern Route	Western Route	Eastern Route	Confidence
NC1	Global climate regulation	15	15	-50	-45	Moderate
NC2	Biodiversity	225	224	222	254	Low
NC3	Natural hazard regulation (Flood regulation)	0.87	0.83	0.46	0.50	Low
NC5	Food production	90	90	79	79	Low
NPV	Present Value	330	331	250	289	
Value relative to baseline				**-24%**	**-13%**	

Note: values have been rounded up for clarity.

In summary, both routes have a positive Present Value, whether water abstraction is 50 or 100 ML/d, but they both lead to a decreased value relative to their baseline. This is mainly because for the value of climate regulation, carbon emissions were factored alongside carbon sequestration to give a more accurate appreciation of the overall value. A small portion of the loss in value is also due to the time taken for the lost habitats to be reinstated and for the benefits to be established, which varies from 2 to 30+ years according to habitat type. Therefore, the loss is higher when large portions of woodlands are removed as they take 30+ years to be fully reinstated and are particularly important in delivering climate regulation, biodiversity and natural hazard regulation. This partly explains why, for both water abstraction levels, the decreased value relative to the baseline is lower for the Eastern Route, which is assumed to have a smaller area of woodlands reinstated relative to the baseline.

Present Values for both routes are lower when water abstraction is 100 ML/d. However, it is important to note that the difference in results between 50 ML/d and 100 ML/d scenarios is only driven by the difference in embodied, construction and operational carbon emissions (valued through the climate regulation metric – construction and operation) associated with each scenario. Further benefits or disbenefits may be identified if the other metrics (other than climate regulation – construction and operation) were also assessed for each water abstraction level. As such, a full natural capital assessment should be undertaken for both 50 ML/d and 100 ML/d scenarios to better appreciate the effect of the water abstraction level.

Key assumptions and limitations

This assessment is subject to the following key assumptions and limitations:

- At this design development stage, no biodiversity post-implementation enhancement was considered.
- To be consistent with the gate one assessment and following the WRMP guidance and the WRE methodology, this assessment was based on a limited set of natural capital metrics and does not provide a complete picture of the total impacts and dependencies on natural capital of each option. As such, the Present Value obtained for both routes should only be used to compare the options.
- The calculation of impacts considers the estimated time for the project to be developed and for lost habitats to be reinstated. It is assumed that the benefits of habitat reinstatement start straightaway after the option is entirely constructed and grow continuously until the capacity to deliver full benefits over time is reached, which is a simplifying assumption.
- As per the WRE methodology, the calculation of the climate regulation service is first based on carbon factors provided by the methodology; otherwise, Natural England (NE) when considered to be more appropriate. It is assumed to be more appropriate when the NE habitat classification aligns better with the UK habitats classification used to categorise the pre and post-implementation habitats. For instance, while 'Fens (Upland and Lowland)' do not have an equivalent in the WRE methodology, it was assumed to be 'Near natural fen (undrained)' as per the NE classification. As such, the carbon factor associated with 'Near natural fen (undrained)' was used in the calculation. In order to avoid any underestimation or overestimation of carbon benefits, the most conservative choice was made when both the WRE and NE classifications provided a suitable equivalent to the UK habitat.
- Natural Hazard Regulation was qualitatively assessed through the ability of the habitats to mitigate drought and flood risks. However, as no common approaches to assessing the value of natural capital assets in terms of drought resilience are currently available, only flood regulation was quantified and monetised as per the WRE methodology. Although the methodology focuses on the approach to valuing the flood regulation service of woodland, the service provided by wetlands was also valued as per the Wider Industry National Environment Programme (WINEP) metrics, given the presence of wetlands in both option footprints. However, as wetlands were assumed to be retained for both routes, there was no change in the flood regulation value provided by wetlands compared to their baseline. The WINEP metrics align and complement the WRE methodology regarding natural hazard regulation.
- The impacts of both routes on water purification were assessed through the capacity of wetlands and woodlands to absorb pollutants and intercept run-off pre and post-implementation. Only a qualitative assessment was undertaken as valuing water purification services of different natural capital assets is not considered appropriate according to the WRE methodology. For the sake of going deeper in the natural capital assessment, it is recommended to explore the alternative approach to value water purification provided by the WINEP metrics at gate three. The WINEP metrics were developed by the Environment Agency (EA) to support the water industry in considering natural capital in options appraisal.
- Although only the materiality of change for climate regulation was deemed high, all natural capital metrics were quantified and/ or monetised where possible, except those scoped out, as per the WRE methodology. Valuation of natural capital metrics for which the materiality of change was deemed moderate, informed how the value of ecosystem services provided by the natural capital stocks was affected by the loss of habitats during construction and the time lag for habitats to be reinstated.

Apply: What Next?

08 Interpret and test the results

At gate one, the original SLR to WRZ5 resulted in the greatest loss of biodiversity units among the four options assessed at this stage. In this assessment, the additional Western Route considered with the Eastern Route as part of the same SLR to WRZ5 preferred option was found to generate fewer biodiversity units lost than the Eastern Route (see A2AT Environmental Assessment Report Appendix C: Biodiversity Net Gain). As such, the present value of benefits lost during construction is higher for the Eastern Route (£234 Mn) than for the Western Route (£227 Mn) as shown in Appendix A. However, the decreased value relative to the baseline is lower for the Eastern route than for the Western route, meaning that the best option from a natural capital perspective would be the Eastern route.

This step will be further refined as more information becomes available, i.e., beyond gate two and into gate three.

09 Take action

Any considerations for biodiversity enhancement at gate three would likely further improve the benefits and increase the overall value of each option.

Assessment could be improved by refining the results when further information is available. This could involve for instance, including the current exclusions made from the carbon assessments (e.g. pumping equipment associated with chemical treatment, power requirements associated with chemical treatment, pump station building, roads and access to the pump stations and treatment works, etc.), which would further increase carbon emissions and ultimately lead to a lower climate regulation value.

Appendix A

Table 11. Present value of benefits lost during construction for both the Western and Eastern Routes (£2021 prices, millions)

Code	Natural capital metric	Western Route	Eastern Route
NC1a	Climate Regulation (LUC)	-3	-3
NC2	Biodiversity	- 213	-219
NC3	Natural hazard regulation (Flood regulation)	-0.14	-0.11
NC5	Food production	-11	-11
Total present value of benefits lost during construction:		**-227**	**-234**

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