Pawlett Hams Water Supply Pipeline Project 2017

Parrett Internal Drainage Board

Environmental Report - including Environmental Impact, Habitats Regulations and Water Framework Directive Assessments

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Version 3

Pawlett Hams supply pipeline failure after embankment slip in Oct 2015

Contents

1 Introduction

The Parrett Internal Drainage Board (IDB) proposes to restore the freshwater supply to Pawlett Hams, by using directional drilling to install a new pipeline below the bed of the River Parrett. This work is necessary to restore the established summer water supply from Cannington Brook to Pawlett Hams, which was irreparably damaged by a bank slip near Stallington's Clyse in October 2015. The water supply is essential to land management and the maintenance of SSSI favourable condition on the Hams. Without the supply, water levels on the Hams can be very low in summer months. This impedes the ability to manage the site by grazing, causes damage to the physical structure and function of ditches and directly impacts the aquatic flora and fauna. All SSSI units on Pawlett Hams are currently assessed as being in 'unfavourable declining' condition due to inappropriate water level management. Restoring the water supply is necessary for the SSSI units to return to 'favourable' condition.

The Parrett IDB has undertaken an Environmental Impact Assessment (EIA) to determine the likely environmental effects of the proposed project. The EIA includes a Habitats Regulation Assessment (HRA) and a Water Framework Directive (WFD) compliance assessment. The preparation of the EIA has been informed by ecological surveys of construction sites and access routes, and the project will be implemented in accordance with findings of EIA. An Environmental Action Plan has been prepared to control and mitigate potential construction impacts associated with pollution, disturbance and habitat and species protection. Ecological monitoring will be undertaken during the construction of the pipeline and water levels and water flows will be monitored during the operational phase of the project.

The EIA concludes that works associated with proposed water supply pipeline project are necessary to site management for nature conservation and are unlikely to have significant adverse effects on the Severn Estuary Marine Site, or the associated terrestrial habitats of the Severn Estuary Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar Site. The assessment confirms the project will have a beneficial effect on wetland nature conservation and preservation of the historic landscape of the area. The Parrett IDB considers the proposed project to be compliant with the Land Drainage EIA Regulations, Habitat Regulations and WFD legislation.

Based on the conclusions of the EIA, the Parrett IDB will publish a notice to confirm the proposed project is unlikely to have significant adverse effects on the nature conservation or historic landscape features of the area.

2 Economic case and outcome measures

Restoring the water supply to Pawlett Hams will make a significant contribution towards the Environment Agency Outcome Measure 4a and Defra Biodiversity 2020 Outcome 1a, by enabling 397 ha of water dependant habitat to be restored to 'recovering' condition and, in some instances, 'favourable' condition.

Defra Biodiversity 2020: A strategy for England's wildlife and ecosystem services

Outcome 1 – Habitats and ecosystems on land (including freshwater environments)

By 2020 we will have put in place measures so that biodiversity is maintained and enhanced, further degradation has been halted and where possible, restoration is underway, helping deliver more resilient and coherent ecological networks, healthy and well-functioning ecosystems, which deliver multiple benefits for wildlife and people, including:

1A. Better wildlife habitats with 90% of priority habitats in favourable or recovering condition and at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition.

Environment Agency: Flood and Coastal Erosion Risk Management Outcome Measures

Outcome Measure 4a - the number of hectares of water dependant habitat created or improved.

3 Links to strategies and other schemes

3.1 Water Level Management Plans

The Bridgwater and Pawlett Water Level Management Plans (WLMP) details the current water level management operational practices for Pawlett Hams and identifies a series of actions needed to sustain the special features of the area. The WLMP was comprehensively reviewed in 2007 to identify changes in water level management needed to achieve favourable condition for the SSSI. Improvements were made to Cobbs Leaze and West Clyse outfalls in 2009 and penning levels in the winter were increased to allow the ditch system to hold water throughout the year. These changes allowed all SSSI units on the Hams to be assessed as being in either 'recovering' or 'favourable' condition. The condition of SSSI on the Hams has deteriorated since the failure of the water supply in 2015 and units are now assessed as being in 'unfavourable declining' condition. The aim of the proposed project is to reinstate the water supply for Pawlett Hams, in order to return the SSSI to 'recovering' or 'favourable' condition.

The WLMP for Pawlett Hams will be updated to ensure water levels and water flows on the Hams continue to meet the requirements of conservation and farming, and to take account of the operation and maintenance requirements of the new pipeline. The WLMP will be the primary mechanism for safeguarding the water level requirements of the SSSI and internationally designated sites.

3.2 Flood and coastal risk management of the Parrett Estuary

Options for restoring the summer water supply to Pawlett Hams have been considered in relation to the Environment Agency Shoreline Management Plan and Flood Risk Management Strategy for the area. These documents broadly identify the type and timing of

flood risk management interventions that are anticipated to be required in the future taking account of asset deterioration and rising sea levels. The tidal banks for the Hams are in good condition and are expected to function well for some considerable time. At this stage, it does not appear that major realignment or removal of banks on Pawlett Hams would be a solution to issues arising from the Barrier project. Therefore, it is reasonable to expect there will be at least 20-30 years before a Steart-type realignment project would be considered for Pawlett Hams. The actual timing of a realignment scheme will be driven by the deterioration of the banks during that time period and the aims of landowners. Current policy is to only consider coastal realignments where they are supported by landowners.

Bank levels around Pawlett Hams are lower than for the more built up areas, so this means Pawlett Hams is likely to flood sooner than built-up areas in the event of an extreme tidal flood. Rising sea levels are likely to mean that tidal flood events are more likely in the future than they are today.

Through the Cannington Bends tidal banks project and the Bridgwater Barrier project, the Environment Agency is considering how to maintain the tidal banks now and in the future. The emerging thinking is that in some locations tidal banks may need to be moved inland by a few metres to ensure stability in the longer term. This has been considered and the proposed pipeline will be located away from Stallington's Clyse bank slip, and directional drilling below the embankments will not preclude future bank realignment or maintenance.

4 Preferred option

There is insufficient runoff from the small local catchment to meet the water supply requirements of nature conservation and land management on Pawlett Hams. In 1868, a pipeline was laid across the bed of the Parrett to supply water from Cannington Brook to the Hams and enhance agricultural productivity of the area. The ecology and land use of the Hams is dependent on this water supply. Failure to reinstate the supply will severely impact aquatic life and wetland features of the SSSI. All SSSI units on Pawlett Hams (397ha) have been reassessed as being in unfavourable condition due to inappropriate water level management. The condition of the SSSI will continue to decline if the water supply is not reinstated.

A wide range of options have been assessed and restoring the pipeline by directional drilling below the bed of the Parrett is considered to offer the best value, greatest durability (long-term security of supply) and highest likelihood of achieving the water level management objectives for the area (map 1).

The new pipeline will be at least 2m below the level of the hard geology (bedrock) and flood embankments. The alignment of the pipeline will be moved to the east of its current alignment, to avoid the bank slip at Stallington's Clyse and the deep erosion hole in the bed of the Parrett below the Stallington's Clyse outfall (map 2). A bathymetric survey of the river bed has been undertaken to confirm river bed levels. Boreholes have been drilled to confirm the underlying geology and soil profiles. Topographic surveys have been undertaken on both banks, to confirm bank levels and ground topography.

The pipeline, approx. 250m in length, will be connected to the Cannington Brook and the Pawlett Hams ditch system. The pipeline will be used to supply a similar volume of water during the summer pen season (1 April to 1 Dec) as the old pipeline. Flow controls will be fitted to the pipeline to enable water flows to be regulated and the pipeline to be closed, when required. The new pipeline will be a single continuous length of fusion welded HDPE pipe with an internal diameter of 290mm, installed by directional drilling below the bed of the

Parrett. This will restore the water supply function of the old pipeline, which consisted of twin cast iron 195mm diameter pipes, laid along the bed of the Parrett. The narrow bore, and large number of connections between the pipe sections, made the old pipeline vulnerable to siltation and leaks. The new pipeline will be more efficient, and reliable, and will be less prone to water losses though leakage or inefficiencies due to siltation in the pipe.

A weed screen will be fitted to the upstream end of the pipe (Cannington Brook) to reduce the risks of debris entering the pipe. The size of the areas to be fed by the new pipeline is 400 ha for Pawlett Hams and approx. another 300 ha for Pawlett Meads.

Water flows, water levels and water quality (conductivity) will be monitored to ensure the water level management objectives for the area are being met and to monitor any adverse effects of the scheme. The Water Level Management Plan for Pawlett Hams will be updated, following a period of monitoring, to incorporate operational protocols for the new pipeline into the plan.

Access routes to both construction sites have been identified (map 3) and these will be surveyed for environmental constraints, prior to the start of construction works. Access routes and site compounds will be reinstate after the works are complete. All waste material will be removed from site and suitable reuse, or disposal, will be sought.

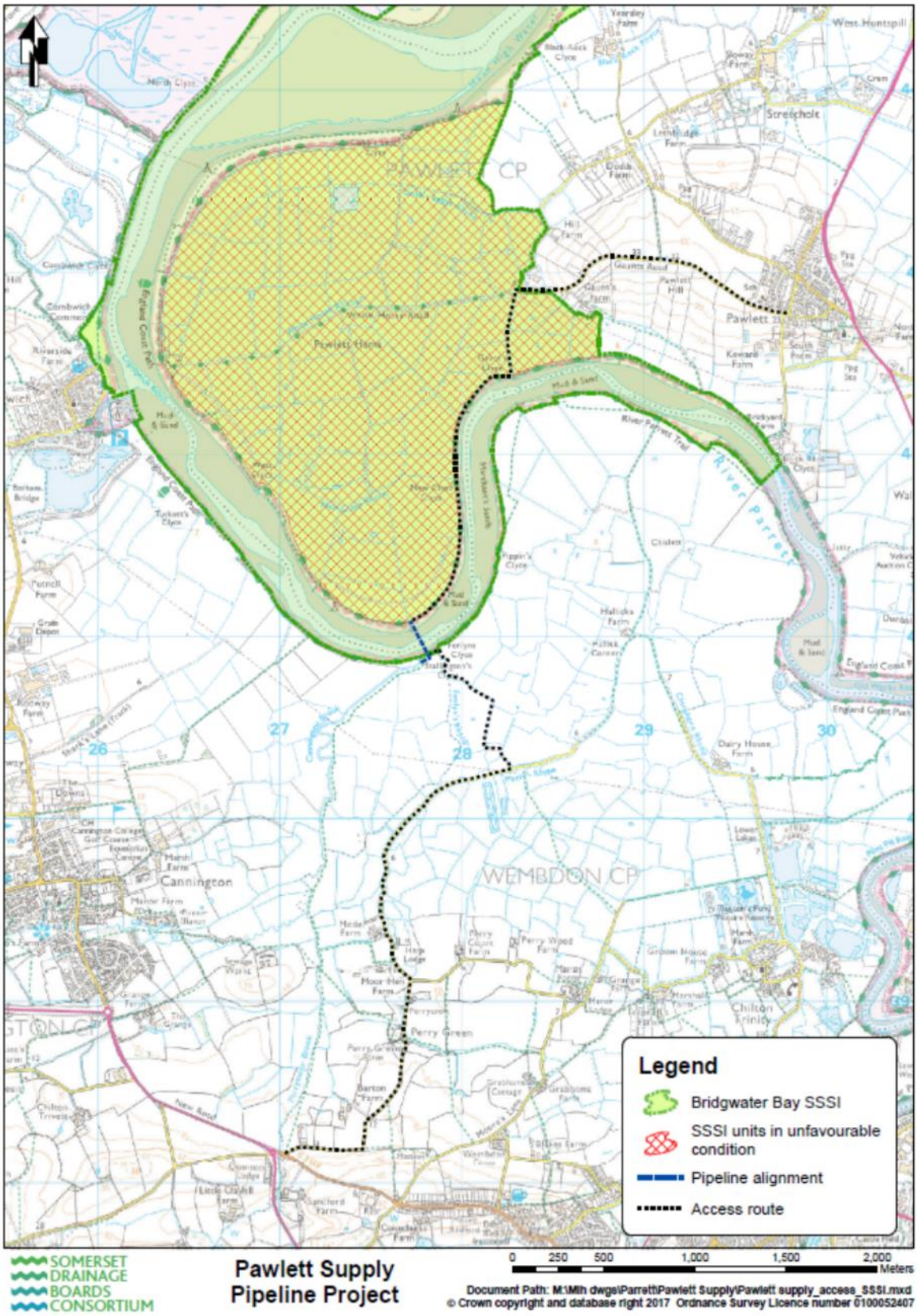
The following conditions have been identified by EA as being important:

- Pipeline a minimum of 1.5m below bed level
- No increase in the abstraction regime relative to that which existed before the previous pipeline failed
- Footprint of headworks as described, i.e. minimal man-hole cover extent

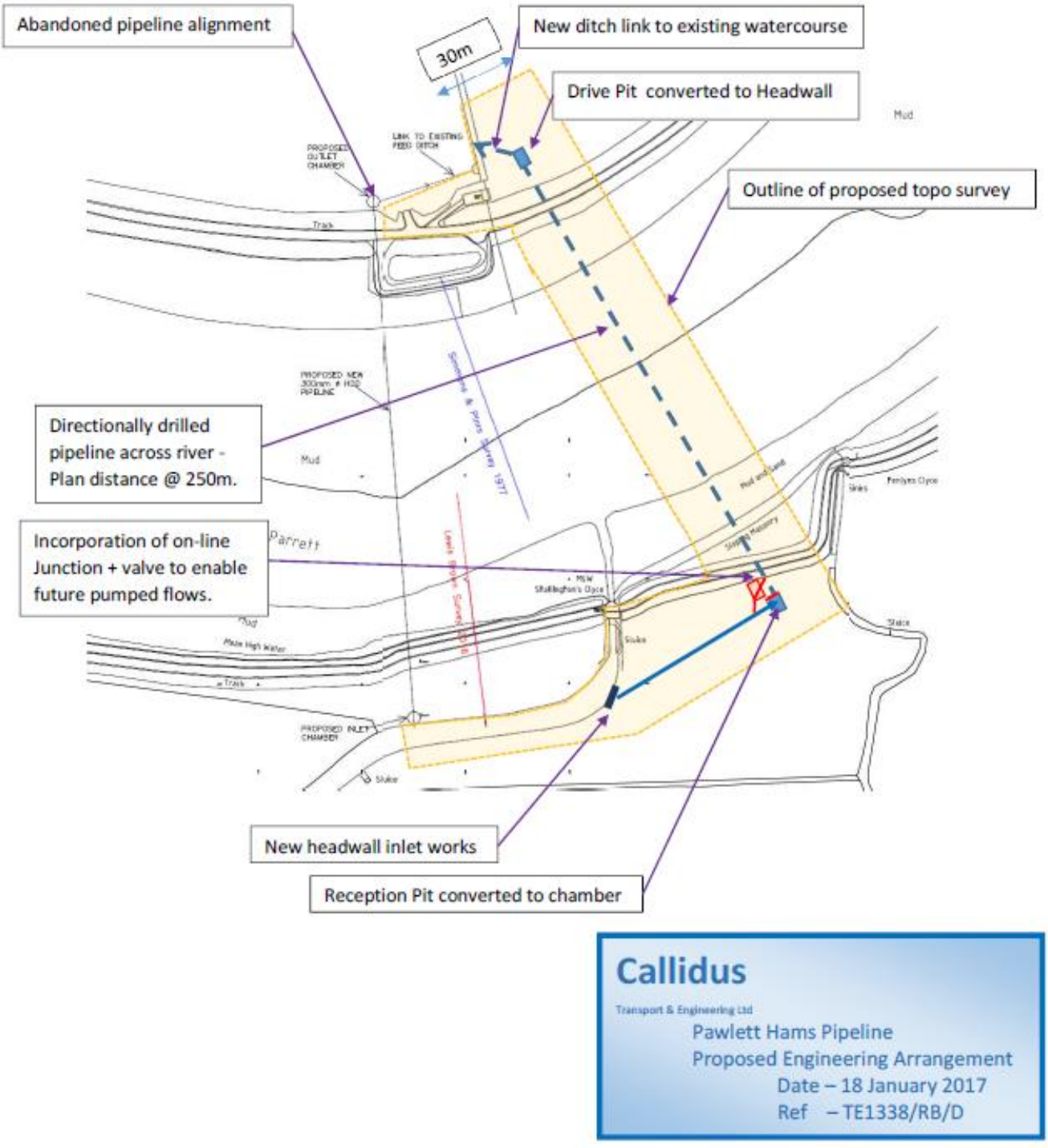
EA also advised that the proposed project should follow the conditions of the Flood Risk Permit exemption criteria for directional drilling:

FRA3 exemption guidance: https://www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits

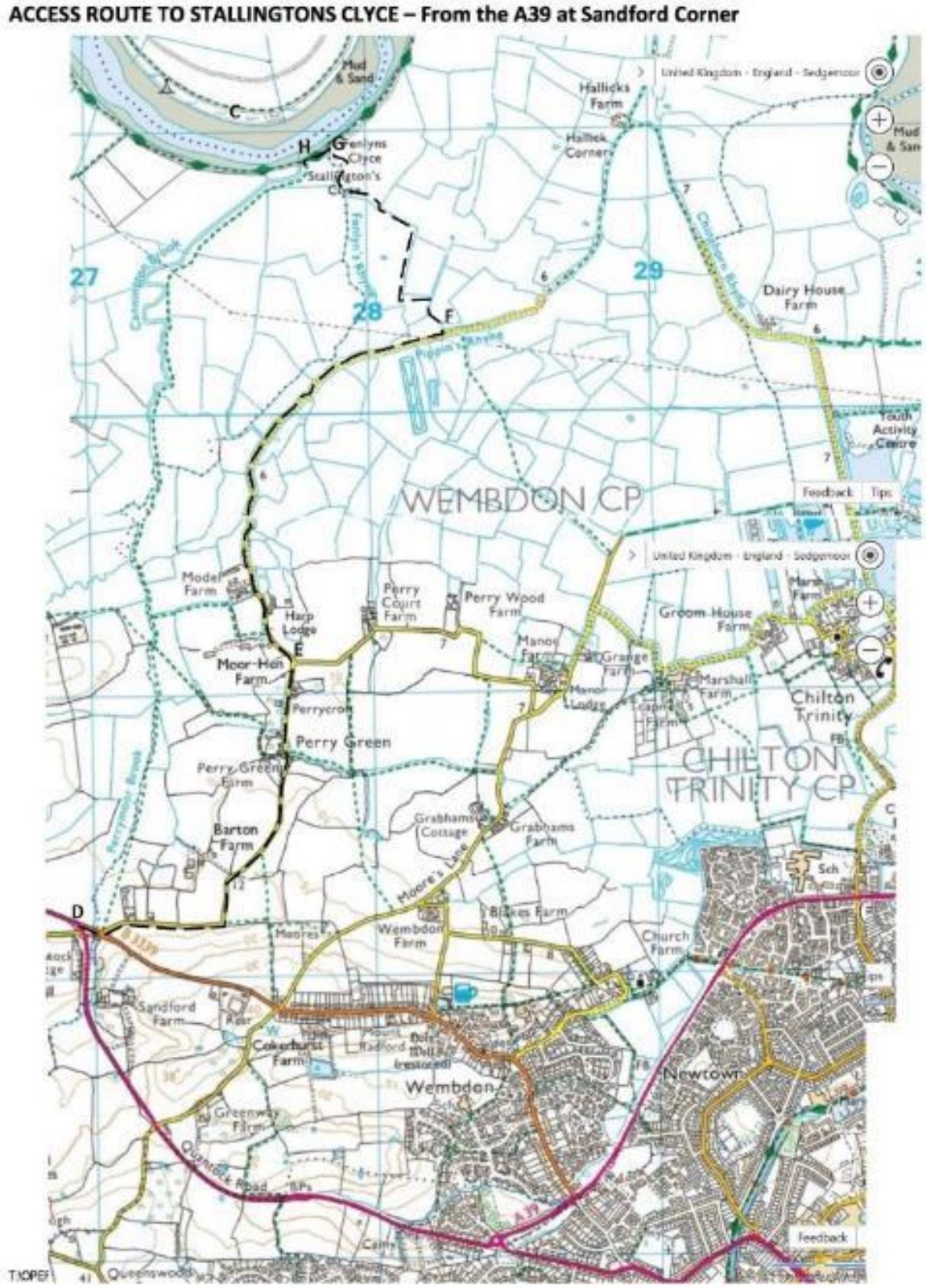
- the service crossing cannot be installed by excavating an open trench through the river and require the following conditions:
- the service crossing is within 10 degrees of perpendicular to the direction of flow in the main river
- the service crossing is at least 1.5m below the riverbed along its whole length, and the same height is maintained for at least 5m beyond each bank (measured from the top)
- the distance from the launch and reception pits to the landward side of each bank of the main river is:
    - 8m or more in the case of a non-tidal main river
    - 16m or more in the case of a tidal main river
- the service crossing does not pass through any bank, culvert, remote defence or river control works on the main river or through any sea defence
- the service crossing is 50m or more upstream of any impoundment or artificially raised channel
- you erect permanent hazard markers on both banks of the main river
- you remove from the flood plain all excavated material not re-used on the site of the works
- your works do not disturb the bed and banks of the main river



Map 1. Location and the new water supply pipeline and area of SSSI that will benefit from the project

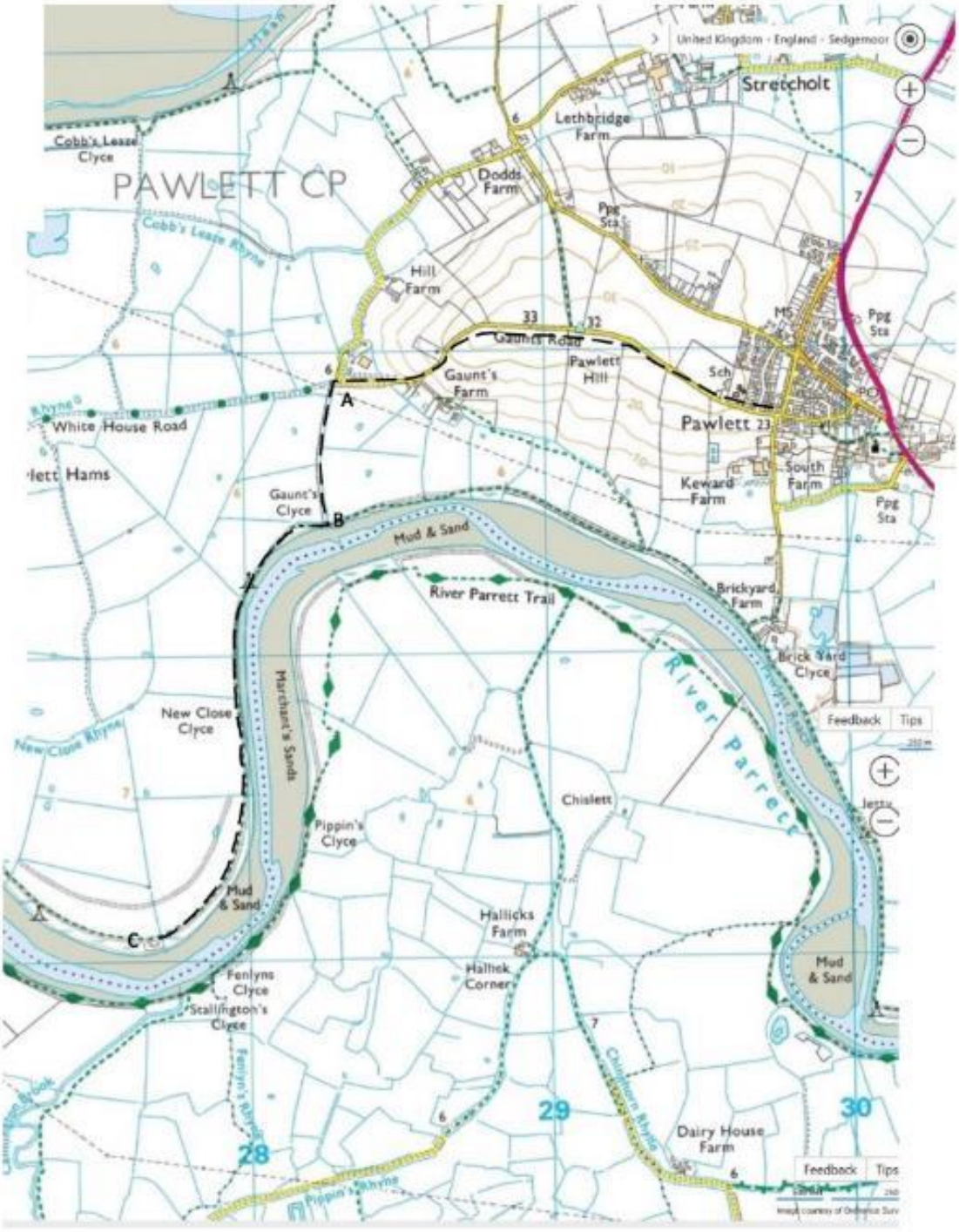


Map 2. Proposed engineering arrangement for the new Pawlett supply pipeline.



Map 3a. Access routes to construction site (south)

ACCESS TO PAWLETT HAMS PUMP HOUSE (Siphon discharge) from the A38 at Pawlett



Map 3b. Access routes to construction site (north)

5 Alternative options

A full range of alternative options has been considered.

5.1 Do nothing

The do nothing option would fail to achieve the water level management objectives for the area and has therefore been discounted.

Without a supply, water levels on the Hams can become very low in summer months and some ditches dry out completely. In the long-term, this leads to less ditch maintenance and more scrub growth, as ditches no longer serve a purpose as wet fences for grazing. There could also be a direct impact on the landscape and heritage value of the area, which includes the historic ditch network, and land drainage earthworks. There would also be a serious economic impact on local farm businesses, as water is needed for grazing and land management.

The long-term management options for Pawlett Hams have been considered in the assessment of the do nothing option (see: links to other strategies and schemes). Whilst there is some uncertainty over the long-term water level management requirements of the area, there remains an immediate and urgent need to reinstate the water supply to the existing freshwater SSSI habitat and to conserve the landscape, heritage and economic interests of the area. Restoring the water supply to the Hams will provide at least 20-30 years of water level management and high nature value farming. It is also worth noting that a freshwater supply will still be beneficial for transitional and inter-tidal habitat management, if a realignment scheme was to go ahead in the future. It is therefore reasonable to assume there will be an ongoing, long-term, nature conservation benefit from restoring the water supply to the Hams.

5.2 Do minimum

Three separate do minimum options were considered, which includes attempts in 2016 to repair the existing broken pipeline and investigations into whether an alternative supply could be provided from the River Huntspill. All the do minimum options proved to be unfeasible and have therefore been discounted.

5.2.1 Do minimum 1: Repair existing pipeline

Attempts were made in 2016 to repair the pipeline by reconnecting one of the broken pipes and installing a pump to lift water over the collapsed embankment. This was only partially successful, as the pipeline proved to be more damaged than initially thought and the pump was only able to supply a small volume of water for a few hours around high tide. At all other times, the external water pressure on the pipeline was too low and water was not reaching the Pawlett side. Attempts to reconnect the supply, and pump water through the remaining pipeline, were abandoned in late summer 2016.

This option was only partially successful and subsequent deterioration of the old pipeline now precludes any further attempts at repair.

5.2.2 Do minimum 2: Alternative supply

An alternative water supply from the River Huntspill was investigated in 2016. The amount of water required in a drought year is already limited and a supply from the Huntspill would be subject to negotiations with the Axe Brue IDB and the Environment Agency. The EA currently pump water out of the Huntspill River during the summer to supply the land on both sides of the river. If more water was required, then the pumping station may need upgrading along with any delivery pipework.

A survey to check possible alternative routes to feed water from the Huntspill to Pawlett Hams identified a route that runs past Yearsley Farm as the most suitable option. However, the water level at the source of the supply (by the Hunstpill River) is about 5.16m and the target summer level in Pawlett Hams is 5.42m, therefore, water would still have to be lifted up by pumping to get up to the higher level in the Hams. Any other route via Stretcholt would involve double pumping as the levels drop down to 4.33m by the A38. In addition to the pump from the Huntspill, further pumping would be required near the new Crematorium, and again near Dods Farm, to get the flow back through the long culvert along Ham Lane.

The physical works to provide an alternative supply would require tree and hedge removal, watercourse improvement and pumping of water at two separate locations. Furthermore, the water supply from the Huntspill may be of insufficient quality and quantity, and there is a significant risk of assisting the spread of invasive Zebra mussel, which is known to be present in the Huntspill.

5.2.3 Do minimum 3: Provide mains supply for farming

Providing a new mains water supply along White House Road would require approx. 2km of pipeline laid to a Wessex Water adoptable standard and then several spurs to take the water across to fields (approx. 4km of private pipes) with water meters for landowners to pay for their own water.

This option is not considered suitable as it would not achieve the water management objectives for the SSSI, and is not a sustainable solution.

5.3 Replace pipeline by trenching

There are several key risks that mean this option has been discounted as a suitable method:

- risks of the pipeline being damaged by large cargo ships sailing in and out of Dunball Wharf,
- the pipeline is likely to be exposed by sediment movement, within the dynamic river bed, which will increase the risk of pipe failure,
- risks that the works will create sediment plumes within the river channel, which may have a detrimental effect on the Estuary environment, and therefore the works might not be permitted under WFD and HRA assessments,
- risks associated with cutting through the flood defence bank are significant,
- risks associated with working within the river channel (rapid changes in water level and soft dangerous mud) are significant.

6 Legislative requirements

The proposed project will be undertaken using the Permitted Development Powers of the Parrett IDB and will therefore not require planning approval. An EIA has been carried out under the Land Drainage EIA Regulations, which includes a HRA of the likely significant environmental effects and a WFD compliance assessment. The following permits will be required: a Bespoke Flood Risk Activity Permit will be required from the EA and a suitable HRA, in support of the Notice for Assent, will be required from NE. The proposed project does not involve works within the tidal Parrett, and the IDB has established that a marine licence is not required. The Marine Management Organisation (MMO) will be informed of the works and consulted on the conclusions of the EIA.

6.1 Land Drainage Improvement Works EIA Regulations

Regulation 2(1) of the EIA (Land Drainage Improvement Works) Regulations (SI 1999 No. 1783) (as amended) defines improvement works', as works which are:

"the subject of a project to **deepen, widen, straighten or otherwise improve any existing watercourse** or remove or alter mill dams, weirs or other obstructions to watercourses, or raise, widen or otherwise improve any existing drainage work"

Under this definition, the proposed project to restore the water supply to Pawlett Hams is considered to be 'improvement works'. The Parrett IDB is therefore undertaking an EIA, under the Land Drainage EIA Regulations, to determine the likely environmental effects of the works. The long-term nature conservation benefits of the Pawlett supply pipeline scheme have also been considered.

6.2 Planning permission

The IDB is empowered to undertake the proposed project by the Land Drainage Act 1991. The works are considered to fall under the Parrett IDB's permitted development rights under Part 15 Class A(b) of the Town and Country Planning (General Permitted Development) Order 1995 (as amended):

> *"Development in, on or under any watercourse or land drainage works and required in connection with the **improvement**, maintenance or repair of that watercourse or those works."*

The proposed Pawlett pipeline renewal does not require '*making of any material change in the use of any buildings or land*', and does not constitute 'development' and therefore does not require planning permission.

7 Environmental Impact Assessment

An EIA has been carried out to assess the potential environmental effects of the proposed project, the main finding of which are summarised in this section. The EIA has been prepared in accordance with all relevant legislation and in consultation with technical specialists and statutory bodies.

7.1 Consultation

We have worked closely with Natural England and the Environment Agency in developing the objectives and work requirements for the project, which includes seeking screen opinions on the potential environmental effects of the work.

In addition we will:

- Consult landowners and farmers who may be affected by the project;
- publish EIA notices regarding the EIA determination for the project. These will contain information on how people can view and comment on the determination of the EIA;
- Consult authorities including the Sedgemoor District Council (the Port Authority) and the Marine Management Organisation.

7.2 Methodology

The EIA for the project includes three main elements that together provide a comprehensive assessment of both the construction and operational impacts of the proposed scheme:

1. **Screening and assessment of environmental impacts for the project – including HRA and WFD (Table 1)**
2. **Key environmental risks and mitigation measures (Table 2)**
3. **Environmental Action Plan for the scheme (Table 3)**
4. **Screening assessment for Habitats Regulations impacts (Table 4)**

A scoping assessment identified which environmental receptors could potentially be affected by the proposed project and would therefore need to be included in the EIA (Table 1).

The receptors scoped-in are:

- Population
- Recreation / tourism
- Land use
- Statutory designated sites
- Historic environment
- Flora and fauna
- Water
- Traffic and transport
- Waste

Environmental receptors considered not to be significantly affected by the project were scoped out of further assessment.

The receptors scoped-out are:

- Non-statutory designated sites and other habitats
- Soil, geology & hydro-geology
- Landscape character and visual amenity
- Air quality
- Noise and vibration

The assessment then considered how changes to the existing environment, as a result of the proposed project, would affect each of the environmental parameters scoped in to the EIA. The significance of impacts was assessed according to the predicted magnitude of the effects and the sensitivity of the receptors affected (Table 1). This broad assessment of likely significant effects was also used as the basis of the HRA for the project.

The EIA also contains a range of mitigation measures that will be implemented during the construction and operation phases to manage environmental risks. These measures have been incorporated in to an Environmental Action Plan (Table 3).

7.3 The existing environment

Appendix 1 provides a summary of the existing environmental conditions at the site. The SPA, SAC and Ramsar designations are summarised in in the HRA and the Appendix 2 includes the SSSI citation.

Table 1. EIA screening and assessment of likely environmental effects

Key: potential causes of environmental effects were identified and 'numbered' for ease of reporting in the table:

1. Changes in water levels
2. Machinery / vehicle movement
3. Construction compounds
4. Directional drilling

Table 1. EIA screening and assessment of likely environmental effects – Pawlett Hams supply pipeline project							
Resource / environmental receptor	**Cause of potential effect**	**Description of potential effect**	**Significant effect and scoping justification**	**✓: Scoped in X: Scoped out**	**Likely impact before mitigation**	**Mitigation**	**Residual significance**
1. Population							
1.1 People / economic	2,3	Risks to public health and safety.	The working environment is a remote rural area and the risks to public health and safety are low.	✓	Minor, adverse, temporary	Management of public health and safety risks will be required.	Negligible
	2,3	Minor disruption to glass eel fishery during the construction works.	Works will not be carried out during the glass eel season (14th February – 1st April) and no works will be undertaken within the river Parrett channel. Unlikely to be significant and therefore scoped-out of further assessment.	X			
1.2 Recreation / tourism	2,3	Minor disruption of recreation activities (e.g. fishing and walking) during the construction works. Potential short-term access restrictions to Public Rights of Way due to vehicle movements to and from site.	The working environment is a remote rural area and the risks associated with public access are low.	✓	Minor, adverse, temporary	Management of public access will be required. Wherever possible footpaths should not be closed or diverted, and instead a 'banksman' will be used to protect users of the paths from the works. If a temporary closure is required, this will be agreed with the Rights of Way team at Somerset County Council and alternative diversion routes will be agreed and signposted for users of the paths.	Negligible
	3	Effects on the quality of the bathing waters downstream at Burnham-on-Sea from the release of sediment and contaminants (over and above those experienced in the baseline conditions) as a consequence of pipeline construction.	No works will be permitted within the river Parrett channel and the new pipeline will be drilled below the bed of the river to minimise any risks of sediment release or contamination. Drilling will stop if any release of sediment or contaminant occurs within the river Parre tt channel. The risks of releasing sediment and contaminants are very low, with directional drilling methods.	X			
2. Land use							
2.1 Agricultural land - grazing	2,3	Minor disruption of farming activities during the construction works. Potential short-term access restrictions due to vehicle movements to and from site.	Management of access for farming will be required.	✓	Minor, adverse, temporary	Wherever possible maintain access for farming. Inform landowners and farmers of any access restrictions, or temporary closures, Alternative diversion routes will be agreed and signposted.	Negligible
	1	Short-term effects due of low water levels prior to and during construction, due to inadequate water supply to the area.	Restoration of the water supply to Pawlett Hams is required for farming and to facilitate HLS agreements (habitat management), in order to help sustain the economic interests of local agricultural business. Short-term impacts need to be mitigated until the water supply is restored. The long-term effects will be positive.	✓	Moderate, adverse, temporary	Manage water levels to reduce ongoing economic and environmental impacts of an inadequate water supply to the area. As far as practically possible, maintain ditch water levels on Pawlett Hams prior to, and during, construction.	Minor, adverse, temporary
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Effects will be positive and are therefore scoped out of further assessment.		Major, positive, permanent		

Table 1. EIA scoping and assessment of likely environmental effects – Pawlett Hams supply pipeline project

Resource / environmental receptor	Cause of potential effect	Description of potential effect	Significant effect and scoping justification	✓: Scoped in X: Scoped out	Likely impact before mitigation	Mitigation	Residual significance
3. Statutory designated sites							
3.1 Natura 2000 Sites (SAC, SPA & Ramsar sites)	2,3,4	Disturbance of SPA interest features, especially wildfowl and wading birds, in respect to high tide roost sites. Potential for short-term changes in water quality and sediment regime.	Scoped-in to assessment due to legal requirement to consider impacts on internationally protected sites. Outcomes of the HRA have informed the EIA.	✓	Minor, adverse, temporary	Pre-construction site checks and high tide roost monitoring (see HRA)	Negligible
	1	Short-term effects due of low water levels prior to and during construction, due to inadequate water supply to the area.	Short-term impacts are significant and will be mitigated through retention of water within the Pawlett Hams ditch system until the water supply is restored.	✓	Major, adverse, temporary	As far as practically possible, maintain ditch water levels on Pawlett Hams prior to, and during, construction.	Moderate, adverse, temporary
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Effects will be positive. Scoped-in to assessment due to legal requirement to consider impacts upon nationally protected sites.	✓	Major, positive, permanent	The Water Levels Management Plan for Pawlett Hams will enable water level management to achieve the nature conservation and farming objectives for the area.	Major, positive, permanent
3.2 Nationally protected sites (SSSI & NNR)	2,3,4	Disturbance of SSSI interest features, e.g. ground nesting waders. Potential for direct impacts such as habitat loss or degradation; or, indirect impacts such as changes to habitats as a result of changes in water quality and sediment regime.	Scoped-in to assessment due to legal requirement to consider impacts upon nationally protected sites.	✓	Minor, adverse, temporary	Pre-construction checks and monitoring	Negligible
	1	Short-term effects due of low water levels prior to and during construction, due to inadequate water supply to the area.	Short-term impacts are significant and will be mitigated through retention of water within the Pawlett Hams ditch system until the water supply is restored.	✓	Moderate, adverse, temporary	As far as practically possible, maintain ditch water levels on Pawlett Hams prior to, and during, construction.	Minor, adverse, temporary
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Effects will be positive. Scoped-in to assessment due to legal requirement to consider impacts upon nationally protected sites.	✓	Major, positive, permanent	The Water Levels Management Plan for Pawlett Hams will enable water level management to achieve the nature conservation and farming objectives for the area.	Major, positive, permanent
4. Non-statutory designated sites and other habitats							
4.1 Non-statutory sites and other conservation areas (including Local Nature Reserves and NERC Habitats of Principal Importance)	2,3	Habitat loss or degradation; or, indirect impacts such as changes to habitats as a result of altered water or sediment regimes. The habitats of principal importance that are present in the study area and most likely to be affected by the works are 'coastal floodplain grazing marsh' and 'rivers and streams'.	No construction effects anticipated, therefore scoped out of further assessment.	X			
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Effects will be positive and are therefore scoped out of further assessment.	X			
5. Fauna and flora (protected and notable species)							
5.1 All water dependent species including water vole, otter, great crested newt, fish, notable plants & invertebrates, ground nesting birds, wintering birds	1	Short-term effects due of low water levels prior to and during construction, due to inadequate water supply to the area.	Short-term impacts are significant and will be mitigated through retention of water within the Pawlett Hams ditch system until the water supply is restored.	✓	Moderate, adverse, temporary	As far as practically possible, maintain ditch water levels on Pawlett Hams prior to, and during, construction.	Minor, adverse, temporary
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Long-term effects will be positive and are therefore scoped out of further assessment.	X			

Table 1. EIA scoping and assessment of likely environmental effects – Pawlett Hams supply pipeline project

Resource / environmental receptor	Cause of potential effect	Description of potential effect	Significant effect and scoping justification	✓: Scoped in X: Scoped out	Likely impact before mitigation	Mitigation	Residual significance
5.2 Water vole	3,4	Damage to water vole habitat within the working areas.	Water voles are known to be present in the local ditch system. Drilling works will not be carried out within 6m of any watercourse. The connecting ditches will be surveyed for water voles. The likelihood of construction effects on water voles is very low.	✓	Negligible, adverse, temporary	Pre-construction checks and monitoring	Negligible
5.3 Otter	2,3	Damage to resting places or any established otter holts within the working areas.	Preliminary site surveys have confirmed there are no otter holts or resting places in proximity to the working area. No vegetation clearance will be necessary. Otters are therefore scoped out of further assessment.	X			
5.4 Reptiles	2, 3, 4, 5	Killing or injury of reptiles (especially grass snakes) through destruction of hibernation and/or foraging and basking areas.	Reptiles may be present at the time of the works. The site compounds will be surveyed for reptiles. The likelihood of construction effects on reptiles is very low and therefore reptiles are scoped out of further assessment.	X			
5.5 Badger	2,3	Destruction of setts or disturbance to badgers as a result of vehicle movements, location of site compounds and construction.	Preliminary site surveys have confirmed there are no badger sets within the working area or along the access routes. Badgers are scoped-out of further assessment.	X			
5.6 Dormouse	2,3	Potential for killing or injury of dormice and/or damage to dormouse habitat as a result of vegetation clearance (in particular hedgerows).	No hedgerows will be removed (or managed) as part of the proposed scheme. 'Important' hedgerows are scoped-out of further assessment.	X			
5.7 Ground-nesting birds	2,3	Potential for killing or injury of ground-nesting birds and/or destruction of nests or eggs through clearance of ground vegetation and location of spreading and compound areas.	The proposed scheme will be undertaken in the summer. There is a low risk of disturbing ground-nesting birds, which are therefore scoped-in for further assessment.	✓	Minor, adverse, temporary	Pre-construction checks and monitoring for ground nesting birds.	Negligible
5.8 Breeding birds (other than ground-nesting species)	2,3	Breeding birds (their nests and eggs) are legally protected. Loss of nesting habitat (such as habitats used by sedge warblers, reed warblers and blackbirds) and/or damage to nests caused by clearance of vegetation for site access or compounds.	No scrub, reeds, hedges or trees will be removed (managed) for site access or establishing site compounds. Breeding birds (other than ground-nesting species) are therefore scoped-out.	X			
5.9 Overwintering birds and passage migrants	2,3,4	Disturbance to overwintering birds and passage migrants.	Wintering birds are scoped in and mitigation will be included within the HRA	✓	Minor, adverse, temporary	Pre-construction checks and monitoring of high tide roost monitoring (see HRA)	Negligible
5.10 Great crested newt	2,3	Killing or injury of great crested newt or impairment to their ability to breed; either through destruction of hibernation and/or foraging and commuting areas (including through rough grassland connecting breeding ponds). There is potential for ponds in the study area to support great crested newt.	Site access is via existing trackways and site compounds will not be within 250m of ponds where great crested newt might be present. Great crested newts are scoped-out of further assessment for access or construction risks.	X			
5.11 Bats	2,3	Loss of roosting habitat if trees used as bat roosts are removed. Bat roosting sites are legally protected.	No trees will be removed (or managed) as part of the water supply scheme. Bats are scoped-out of further assessment.	X			
5.12 'Important' hedgerows	2,3	Loss of habitat if 'important' hedgerows are removed to facilitate site access and storage areas. 'Important' hedgerows are legally protected.	No hedgerows will be removed (or managed) as part of the proposed scheme. 'Important' hedgerows are scoped-out of further assessment.	X			

Table 1. EIA scoping and assessment of likely environmental effects – Pawlett Hams supply pipeline project

Resource / environmental receptor	Cause of potential effect	Description of potential effect	Significant effect and scoping justification	✓: Scoped in X: Scoped out	Likely impact before mitigation	Mitigation	Residual significance
5.13 Fish (including eels)	3	Killing of fish as a direct effect of construction or as an indirect effect of sediment and contaminant release (over and above those experienced in the baseline conditions). Changes to turbidity and dissolved oxygen levels have the potential to damage to fish gills and may result in impacts on fish habitat quality and effect fish migration.	Prevention of sediment or contaminant release to watercourses will be required.	✓	Minor, adverse, temporary	Working areas will be located at least 6m from watercourses. No work will be carried out on the estuary side of the tidal embankments. No sediment or contaminants to be released to either the river Parrett or the Pawlett Hams ditch system.	Negligible
5.14 Notable/ nationally rare or scarce invertebrates	2,3	Damage to notable invertebrate species and their habitat as a consequence of site compounds or construction.	Notable invertebrate species are present in the local area.	✓	Minor, adverse, temporary	Local environmental records will be assessed and, if necessary, site surveys undertaken. Working areas will be small and located at least 6m from watercourses. No work will be carried out on the estuary side of the tidal embankments	Negligible
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Long-term effects will be positive and are therefore scoped out of further assessment.	X			
5.15 Notable/nationally rare or scarce plants.	2,3	Damage to notable plant species and their habitat as a consequence of site compounds or construction.	Notable plant species are present in the local area.	✓	Minor, adverse, temporary	Local environmental records will be assessed and, if necessary, site surveys undertaken. Working areas will be small and located at least 6m from watercourses. No work will be carried out on the estuary side of the tidal embankments. The known distribution of rare plants has been mapped (Map 6) and none are located with 400m of the working area. Site access and compound areas will be defined, agreed and assessed if necessary.	Negligible
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Long-term effects will be positive and are therefore scoped out of further assessment.	X			
5.16 Non-native invasive species and pathogens	2,3	Spreading of invasive species (including Himalayan balsam and Japanese knotweed) within the working area (and potentially beyond).	Site surveys have confirmed there are no invasive species within the working area or along the access routes. Non-native invasive species have been scoped out of further assessment.	X			
6. Water							
6.1 Water Framework Directive Compliance	4	WFD Compliance is based on 3 key issues: 1 - Ensuring 'no deterioration' in WFD status 2 – Ensure that meeting WFD objectives is not compromised or affect the implementation of WFD 'mitigation measures' for heavily modified water bodies as stated in the River Basin Management Plan. 3 – Related legislation for protected areas and species needs to be met, in addition to other Directives such as Bathing Waters.	The preferred option (directional drilling) avoids the need to work in the River Parrett Channel. This minimises risks of silt plume generations on effects on water quality or flow. No effect on the hydrology and ecology of Cannington Brook or the River Parrett. Long-term effects will be beneficial to WFD compliance, by restoring and sustaining water dependant habitats, including ditch habitats for eel. Restoring the water supply to the Hams can be regarded as a WFD mitigation measure. Scoped-in due to legal requirement to consider impacts upon nationally protected sites.	✓	Minor, adverse, temporary	Controlled through best construction practice and the Environmental Action Plan for the scheme. No work to be carried out on the estuary side of the tidal embankments. No sediment or contaminants to be released to either the river Parrett or the Pawlett Hams ditch system.	Negligible
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management and land management (grazing).	Long-term effects will be positive and are therefore scoped out of further assessment.	X			

Table 1. EIA scoping and assessment of likely environmental effects – Pawlett Hams supply pipeline project

Resource / environmental receptor	Cause of potential effect	Description of potential effect	Significant effect and scoping justification	✓: Scoped in X: Scoped out	Likely impact before mitigation	Mitigation	Residual significance
7. Soil, geology & hydro-geology							
7.1 Soil resource	2,3,4	Vehicle movements over saturated soils can cause long-term degradation to the structure of the soil. Ground cover removal to facilitate the works (including storage and site compounds) and vehicle movements could result in compaction and erosion, leading to changes to the soil structure and fertility and functionality of the soil resource.	Access routes are via stoned trackways. Vulnerable soils will be protected through standard ground protection methods (such as the use of ground protection matting). No effects on soils are anticipated, and therefore soil resource has been scoped out.	X			
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management	Short-term impacts will be mitigated through retention of water within the Pawlett Hams ditch system until the water supply is restored. Effects will be positive and are therefore scoped out of further assessment.	X	Major, positive, permanent		
7.2 Geology	3,4	Damage or degradation of underlying geology.	Borehole samples of the underlying soil and geology have been collected and detailed topographical surveys of river banks and the channel bed have been completed. No effects on underlying geology are anticipated, and therefore geology has been scoped out of further assessment.	X			
7.3 Hydro-geology	3,4	Changes to the hydro-geological regime; including changes to groundwater recharge and groundwater levels from site compounds and directional drilling.	No effects from site compounds or directional drilling on groundwater are anticipated. Effects on hydro-geology are scoped out of further assessment.	X			
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management.	The restoration of the water supply will enable water level management and will therefore have a direct benefit on the hydro-geological regime of Pawlett Hams. Effects will be positive and are therefore scoped out of further assessment.	X	Major, positive, permanent		
8. Landscape character & visual amenity							
8.1 Landscape character and visual amenity	2,3,4	Temporary visual intrusion of compound areas on landscape character. Potential for visual change and effects on landscape character.	Temporary visual intrusion due to construction will be negligible. Permanent works will be below ground and the existing pump building on the Pawlett Hams side of the river will no longer be needed and will therefore be removed from the SSSI. Effects on landscape character and visual amenity are scoped out of further assessment.	X			
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management	Short-term impacts will be mitigated through retention of water within the Pawlett Hams ditch system until the water supply is restored. Effects will be positive and are therefore scoped out of further assessment.	X	Major, positive, permanent		
9. Historic environment							
9.1 Sites of cultural heritage value (listed buildings and Scheduled Ancient Monuments).	2,3,4	Degradation or damage to listed buildings and known archaeological sites by vehicle movements, siting of compounds and construction.	No Scheduled Ancient Monuments, listed buildings or known archaeological sites have been identified along access routes or at construction sites. Therefore sites of cultural heritage value scoped out of further assessment.	X			

Table 1. EIA scoping and assessment of likely environmental effects – Pawlett Hams supply pipeline project

Resource / environmental receptor	Cause of potential effect	Description of potential effect	Significant effect and scoping justification	✓: Scoped in X: Scoped out	Likely impact before mitigation	Mitigation	Residual significance
9.2 Archaeology or heritage sites (known and potential)	2,3	Damage to known or potential heritage sites by vehicle movements, siting of compounds, or excavation of drilling reception pits.	Richard Brunning (County Archaeologist) advices that there are unlikely to any significant damage to known or potential heritage sites from the project, and therefore, there is no need for archaeological mitigation. However, due to uncertainty over unknown heritage sites, this receptor is scoped-in for further assessment.	✓	Minor, adverse, permanent	Landform features at construction sites will be identified and conserved. Excavation of drilling reception pits will be monitored and any items of archaeological interest will be recorded and the County Archaeologist notified.	Negligible
	1	Long-term effects due to restoration of water supply to Pawlett Hams and associated water level management.	Restoration of the water supply will help sustain groundwater levels, especially in summer, which will benefit the conservation of buried organic remains. Effects will be positive and are	X	Major, positive, permanent		
10. Traffic & transport							
10.1 Public highways	3	Temporary disruption to local traffic flow and tracking of debris onto roads.	The working areas are rural in nature and access to sites is along small rural roads. Access will be required for drilling equipment and removal of waste material from the Pawlett Hams works site.	✓	Minor, temporary, adverse	Vehicle movements on and off site will be managed. Mitigation measures will include: agreed delivery/haulage routes, locations for warning signs on local roads, delivery schedules to avoid peak traffic times, contingency plans for emergency access/egress, and measures to avoid debris being tracked on to roads. 'Banksmen' will be used to maintain public safety.	Negligible
11. Waste							
11.1 Waste	3	Approximately 50 m^3 of waste will be generating from directional drilling. This will be subsoil and clean clay for below the bed of the river.	The drilling waste will be removed from site and taken to the nearby Walpole landfill site for reuse or disposal.	✓	Minor, temporary, adverse	Drilling methods will minimise the quantity of waste. Transportation of waste will be minimised, as far as possible, and a suitable reuse for the material will be sought. All waste to be removed from site, unless otherwise agreed (subject to NE SSSI assent).	Negligible
12. Air quality							
12.1 Air quality	2,3,4	Emissions to air from machinery and vehicles required for the works and dust generation due to site access via stone tracks.	Effects will be negligible and temporary, and therefore air quality is scoped out of further assessment.	X			
13. Noise & vibration							
13.1 Local residents & businesses	2,3,4	Temporarily increased levels of noise and vibration associated with machinery/vehicle movements, including the location of the site compounds.	The working areas are rural in nature and receptors to increased levels of noise and vibration are few, and therefore noise and vibration is scoped out of further assessment.	X			

7.4 Potential environmental impacts

The EIA identified the following potential effects of the proposal:

- localised impacts to species and habitats as result of damage or disturbance during the construction phase of the works;
- disturbance of high tide wildfowl and wader roosts (including passage migrants);
- generation of silt plumes in the Parrett estuary channel;
- changes to flow regime, water levels and the extent and duration of surface water flooding, as a result of operational changes to water level management.

The likelihood and severity of these potential impacts has been assessed and design options and construction methods will be selected that minimise environmental risks. The requirement for ecological monitoring and mitigation measures, during the construction and operational phases of the project, has also been identified. The key environmental risks, and their mitigation, are summarised in Table 2.

Table 2: Key environmental risks and mitigation measures

Key construction risks	**Key mitigation**
Disturbance of overwinter birds and passage migrants	Construction is planned for early summer 2017. This will minimise impacts on wintering birds. The works will be located at least 1,000m from a known high tide roost.
Generation of silt plumes	The preferred option of directional drilling a new pipeline below the bed of the River Parrett will minimise the risk plume generation, as it avoids the need to work within the tidal channel.
Pollution of watercourses	Constructions sites (pipeline reception pits) will be at least 6m from all watercourse. Work will not be undertaken in the tidal Parrett channel. Pollution control measures will be in place.
Damage to rare plants	The known distribution of rare plants has been identified (map 6). Access routes and construction sites have been identified and surveyed.
Historic environment - known or potential heritage sites	The County Archaeologist has been consulted and there are unlikely to be any significant damage to known or potential heritage sites. Archaeological mitigation will not be required. Excavation of reception pits will be monitored for archaeological finds.
Damage to land or access routes	Ground protection will be used, if required, and restrictions on vehicle movements will be imposed if ground conditions are wet. Construction sites and access routes will be reinstated.
Protected species	Proposed access routes and construction sites have been surveyed for protected species (see EIA) and no significant constraints were found. The works will be been designed and programmed to avoid effects. Monitoring and mitigation requirements have been identified in the Environmental Action Plan.
Public and operator safety issues	Method statements and a safe management system will be developed and implemented as part of the Environmental Management Plan for the scheme.
Key operational risks	**Key mitigation**
Public engagement	The IDB will consult landowners and farmers, and liaise with authorities and partners.
Water management	Water flows through the pipeline will be controlled and it will be possible to close the pipeline if, for example, there is a pollution risk from Cannington Brook. Changes to water level management will be monitored and reviewed by the IDB, as part of the Water Level Management Plan.

7.1 Protected species

Water vole are known to present in the Pawlett Hams ditch system and the Cannington Brook. Ditch habitats and water levels are more suitable for water voles on the Pawlett Hams side of the river, where positive management measures are used to further the conservation of water vole, than on the Cannington Brook side, where intensive agriculture and suboptimal ditch management affect the quality of water vole habitat.

The proposed project will benefit water vole conservation on Pawlett Hams by providing an adequate and reliable water supply to ditch system: watercourses and water level management are essential components of water vole habitat requirements. The risk of disturbance during construction is very low, as the pipeline will be drilled away from any watercourses.

Construction sites, access routes and connecting ditches have been surveyed and regular site checks will be carried out during the construction of the pipeline. Appropriate measures will be taken to avoid and mitigate potential impacts on protected species.

7.2 EIA conclusion

The likely environmental effects of the proposed project have been assessed and no significant adverse environmental impacts have been identified. Measures needed to manage the risks of environmental impacts during the construction and operational phases of the project, including site surveys, good working practices and mitigation requirements, have been identified and incorporated into the Environmental Action Plan for the project.

Table 3: Environmental Action Plan

Table 3: Environmental Action Plan – Pawlett Hams supply pipeline project						
Ref. No.	Objective	Action	Responsibility	Ref. to further information	Progress and further action	Sign off and date
1. Population						
1.1	Keep local community informed.	Inform local community about objectives and programme of works and provide contact names and numbers.	IDB	IDB communications plan	Issue press statement regarding project.	
		Liaise with landowners/tenants over nature and duration of works. Provide contact name and number.	IDB	IDB communications plan		
1.1	Maintain public health and safety	Risks to be managed through good construction site practices including the use of banksmen, appropriate signage and warning notices on site to restrict public access during the works.	Contractor	Method statements	Submit information to IDB.	
1.2	Minimise disruption to Public Rights of Way (PRoWs) and footpaths.	Include PRoWs and footpaths in construction and environmental constraints plans.	IDB	Method statements		
		If required, apply for and obtain permission for footpath closures, or gain agreement (from SCC footpath officer) that access can be maintained through use of banksman to maintain all safety requirements.	IDB	Parrett Trail and Coastal Footpath	Consult SCC and advertise footpath disruptions.	
		Erect signage before the works commence.	Contractor	Method statements		
		Collect information on access route condition prior to construction and reinstate PRoWs and footpaths to pre-construction condition if the works result in damage.	Contractor		Survey and reinstate access routes	
1.2	Avoid degradation to bathing water quality	No works will be permitted within the river Parrett channel and the new pipeline will drilled below the bed of the river to minimise any risks of sediment release or contamination.	Contractor	Method statements	Directional drilling will stop if any release of sediment or contaminant occurs within the river Parrett channel.	

Table 3: Environmental Action Plan – Pawlett Hams supply pipeline project						
Ref. No.	Objective	Action	Responsibility	Ref. to further information	Progress and further action	Sign off and date
2. Land use						
2.1	Access routes on roads and farms	Identify most suitable access routes to minimise impacts to trackways (droves) and fields, taking into account ground conditions during construction.	Contractor	Method statements	Submit information to IDB.	
		Liaise with landowners/tenants over site access routes and sighting of works compounds.	IDB	IDB communications plan		
		Pre-construction site inspection to assess condition of access routes, compounds and working areas.	Contractor	Pre-construction site check	Submit information to IDB.	
2.2	Water levels before, and during, construction	Keep landowners/tenants informed about effects on water levels and water supply prior to, and during, construction.	IDB	IDB communications plan	Establish the summer pen level on Pawlett Hams early (in March) to allow as much water as possible to be retained within the ditch system during the period prior to completion of the works.	
2.2	Reinstate compound areas and access routes	Post-construction site inspection to assess condition of access routes, compounds and working areas, to ensure reinstatement of access routes has been carried out to an acceptable standard.	Contractor	Post-construction site check	Submit information to IDB.	
3. Statutory designated sites						
3.3	Prevent adverse impacts to statutory designated sites (including Natura 2000 Sites, SSSIs and NNR)	Method statements to be produced to document construction activities.	Contractor	Method statements		
		Obtain SSSI Assent from Natural England for works within SSSIs. Supervision of all works in SSSI by IDB.	IDB	HRA & SSSI Assent required		
4. Non-statutory designated sites and other habitats						
No mitigation measures identified other than good practice.						
5. Fauna and flora (protected and notable species)						
5.1	Maintain ditch water levels on Pawlett Hams prior to, during construction.	As far as practically possible, maintain ditch water levels on Pawlett Hams until the work is complete and the water supply is restored.	IDB	Water Levels Management Plan	Ditch water levels on the Hams will be raised to at least summer level in March.	

Table 3: Environmental Action Plan – Pawlett Hams supply pipeline project						
Ref. No.	Objective	Action	Responsibility	Ref. to further information	Progress and further action	Sign off and date
5.2	Prevent killing or injuring water voles (including destruction of habitats)	Undertake pre-construction checks for water voles.	IDB	Pre-construction site check		
		If water voles are found within the working area at any time, stop work and review options for avoiding adverse effects. If required, vegetation will be strimmed to a short height to encourage displacement (relocation) from the working area.	Contractor	Method statements	Action subject to the outcome of water voles surveys.	
5.3	Avoid impacts to otters	Undertake pre-construction checks for holts and resting sites.	IDB	Pre-construction site check		
		If an otter holt or resting place is found, it will be left in-situ with a buffer zone.	Contractor	Method statements	Action subject to the outcome of otter holt surveys.	
5.5	Avoid impacts to badgers	Undertake pre-construction checks and map badger setts.	IDB	Pre-construction site check	Maintain GIS data of badger setts in the area.	
		If badger setts are found within the working area, use appropriate buffers to avoid disturbance. It working adjacent to badger setts is unavoidable, it may be possible to carry out the work under the conditions of the Badger Class Licence, held by the IDB.	Contractor	Method statements	Action subject to the outcome of badger sett surveys.	
5.7	Prevent killing or injuring ground nesting or breeding birds (including destruction of nests or eggs).	Undertake pre-construction checks for ground nesting birds.	IDB	Pre-construction site check		
5.9	Overwintering birds and passage migrants	Low risk of disturbance – monitor waterbird activity during high tides.	IDB	Pre-construction site check		
5.13	Avoid impacts to fish	Minimise mobilisation of silt within watercourses, especially when connecting pipeline to existing ditch system.	Contractor	Method statements	Water quality monitoring will not be required.	
5.14	Avoid impacts to notable/nationally rare or scarce invertebrates	Undertake pre-construction checks for notable/nationally rare or scarce invertebrates.	IDB	Pre-construction site check		

Table 3: Environmental Action Plan – Pawlett Hams supply pipeline project						
Ref. No.	Objective	Action	Responsibility	Ref. to further information	Progress and further action	Sign off and date
5.15	Avoid impacts to notable/nationally rare or scarce plants	Undertake pre-construction checks for rare plants	IDB	Pre-construction site check	The known distribution of rare plants has been mapped (Map 6) and none are located with 400m of the working area.	
		No work will be carried out on the estuary side of the tidal embankments. Site access and compound areas will be defined, agreed and assessed if necessary. Access only via predefined routes.	Contractor	Method statements		
6. Water						
6.1	Ensure compliance with the WFD	No work to be carried out on the estuary side of the tidal embankments. No sediment or contaminants to be released to either the river Parrett or the Pawlett Hams ditch system.	Contractor	Method statements		
7. Soil, geology & hydro-geology						
No mitigation measures identified other than good practice.						
8. Landscape character & visual amenity						
No mitigation measures identified other than good practice.						
9. Historic environment						
9.2	Protect archaeology or heritage features (known and potential)	Identify and conserve landform features at construction sites. Excavation of drilling reception pits to be monitored for items of archaeological interest. Record, and keep safe, any items found and notify the County Archaeologist.	IDB	Pre-construction site check		
		Contractor's method statements to include measures to avoid impacting upon features of archaeological and historic interest.	Contractor	Method statements		

Table 3: Environmental Action Plan – Pawlett Hams supply pipeline project						
Ref. No.	Objective	Action	Responsibility	Ref. to further information	Progress and further action	Sign off and date
		Report any archaeological finds immediately to the County Archaeologist. Any finds applicable to the Treasures Act 1996 to be reported to the Coroner in accordance with the Act (finds of gold, silver, groups of coins and base metal prehistoric objects). Also any fossils, antiquities, structures, remains or other objects of geological or archaeological interest or value to be reported to the County Museum Service.	IDB		Any discoveries are likely to be waterlogged. It is essential that they are kept immersed in water following discovery to avoid drying/breaking up.	
10. Traffic & transport						
10.1	Minimise disruption to public highways	Manage vehicle movements on and off site. Confirm requirements for mitigation measures, include: agreed delivery/haulage routes, locations for warning signs on local roads, delivery schedules, contingency plans for emergency access/egress, and measures to avoid debris being tracked on to roads. 'Banksmen' maybe required to maintain public safety.	Contractor	Method statements	Submit information to IDB.	
11. Waste						
11.1	Minimise generation of waste material	Minimise the quantity of waste generated by the drilling operation. Transportation of waste should be minimized, as far as possible, and a suitable reuse for the material should be sought. All waste to be removed from site, unless otherwise agreed by IDB. NE SSSI assent will be required for any waste reused on site.	Contractor	Method statements	Submit information to IDB.	
12. Air quality						
No mitigation measures identified other than good practice.						
13. Noise & vibration						
No mitigation measures identified other than good practice.						

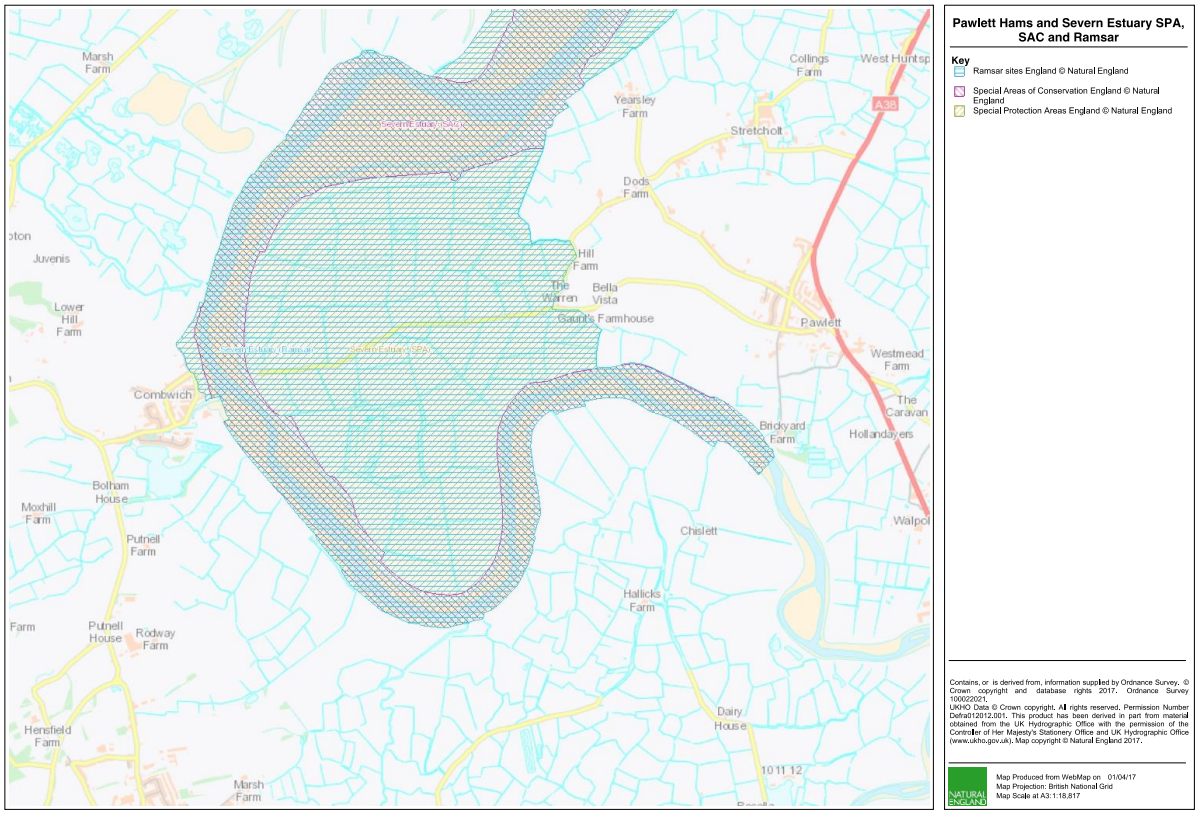
8 Habitat Regulations Assessment

Pawlett Hams forms part of the wider Severn Estuary Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar site (Severn Estuary Marine Site), and the proposed project is located within the Severn Estuary Marine Site (Map 4). The Hams are designated for the diverse invertebrate assemblages of the ditches, and are also used by wintering birds and breeding birds, and other important wetland species like eel, water vole and otter.

Natural England has confirmed that SSSI Assent will be required for the works, subject to the preparation of a suitable HRA in support of the Notice for Assent.

A HRA has been carried out as a separate, but associated, process to the EIA. The HRA takes the form of a management test, to determine whether the proposal is necessary to site management for nature conservation, and an associated assessment of likely significant effects on the internationally important interest features of the site, alone or in combination with other plans or projects (Table 4). This two stage assessment enables recognition of the nature conservation benefit of the proposal, for some of the interest features of the site, whilst taking full account of any potential construction and operational effects of the proposal for features whose management may not directly benefit from the proposal.

Since the proposal is necessary to site management for nature conservation, for some features of the site, and the construction and operation of the proposal are unlikely to have a significant effect on all the internationally important interest features of the site, alone or in combination with other plans and projects, an Appropriate Assessment of the implications of the effects of the proposal for the site's conservation objectives was not required.



Map 4. Map showing the areas covered by the SPA, SAC and Ramsar

8.1 Management test

The WLMP for Pawlett Hams demonstrates the importance of water level management to the conservation of interest features of freshwater wetland habitats on the Hams and is essential management tool in providing functionally linked habitats (coastal grazing marshes) for the Severn Estuary Marine Site. Restoring the water supply to the Hams is therefore regarded as necessary to site management for nature conservation. It is essential to maintain the condition of grazing marshes and, in particular, in providing areas surface water to sustain feeding and roosting habitats for wintering birds using the Marine Site. In addition, it will help improve the connectivity of water habitats and eel passage from the Estuary onto the Hams, by allowing water to over top the outfall structure at Cobbs Leaze. It will also have a direct benefit to fish habitat of the Hams by improving water flow, level and quality in the ditch system.

8.2 Likely significant effect test

Consultation with Natural England, on the scope of the HRA, identified the need to assess the likely significant effects of the proposal on the following internationally important interest features of the site:

1. Potential sediment plume or water quality impacts, which might have an effect on migratory fish (in particular eel)
2. Potential impacts on waterbirds
3. Potential impacts on rare plants

8.2.1 Potential sediment plume or water quality impacts

The preferred design option, of directional drilling a new pipeline below the bed of the River Parrett, avoids the need to work within the tidal channel and therefore minimises the risk of sediment plume generation. Directional drilling will not affect water levels or water quality on the Hams or in Cannington Brook.

The operation of the pipeline will not affect the hydromorphology and ecology of Cannington Brook. The abstraction point for the pipeline will be located upstream of the outfall to the tidal Parrett. There will be no change in the operation of the pipeline, which will supply water by gravity to Pawlett Hams during summer months. The pipeline abstraction is substantially less volume than the minimum flows in Cannington Brook, which are sustained by compensation flows from upstream reservoirs. The pipeline will be fitted with flow controls that will regulate abstraction rates and enable to pipeline to be closed off in case of pollution, flow issues or tidal ingress. The pipeline will not impede fish passage.

8.2.2 Potential waterbird impacts

There is increasing evidence to suggest that high tides are the most likely time for significant disturbance to occur to non-breeding waterbirds of the Severn Estuary Marine Site. Consequently, the HRA for the proposed project focuses on the impact on waterbirds using high tide roosts. The 2016 BTO High Tide Roost Study has been used to assess the likely effects on high tide roosts.

Natural England advises that a distance of 200m and less, from any of these high tide roosts, is used as an indicative guide for the visual disturbance distance, where a likely significant

effect cannot be ruled out without suitable mitigation measures.

With reference to Maps 23 and 24 of the BTO study, roosts 14A, 14B, 14C and 14D are the nearest to the project. The map below shows the distances to the two nearest roosts (14A and 14D) to construction sites and access routes for the project. These roost sites are considerably more than 200m from these areas. It is therefore possible to conclude that the construction of a new water supply pipeline is unlikely to lead to a significant effect on waterbirds.

Site monitoring, including waterbird activity during high tides, will be undertaken to increase confidence in this conclusion, and to help avoid construction impacts on other bird species including ground nesting waders.

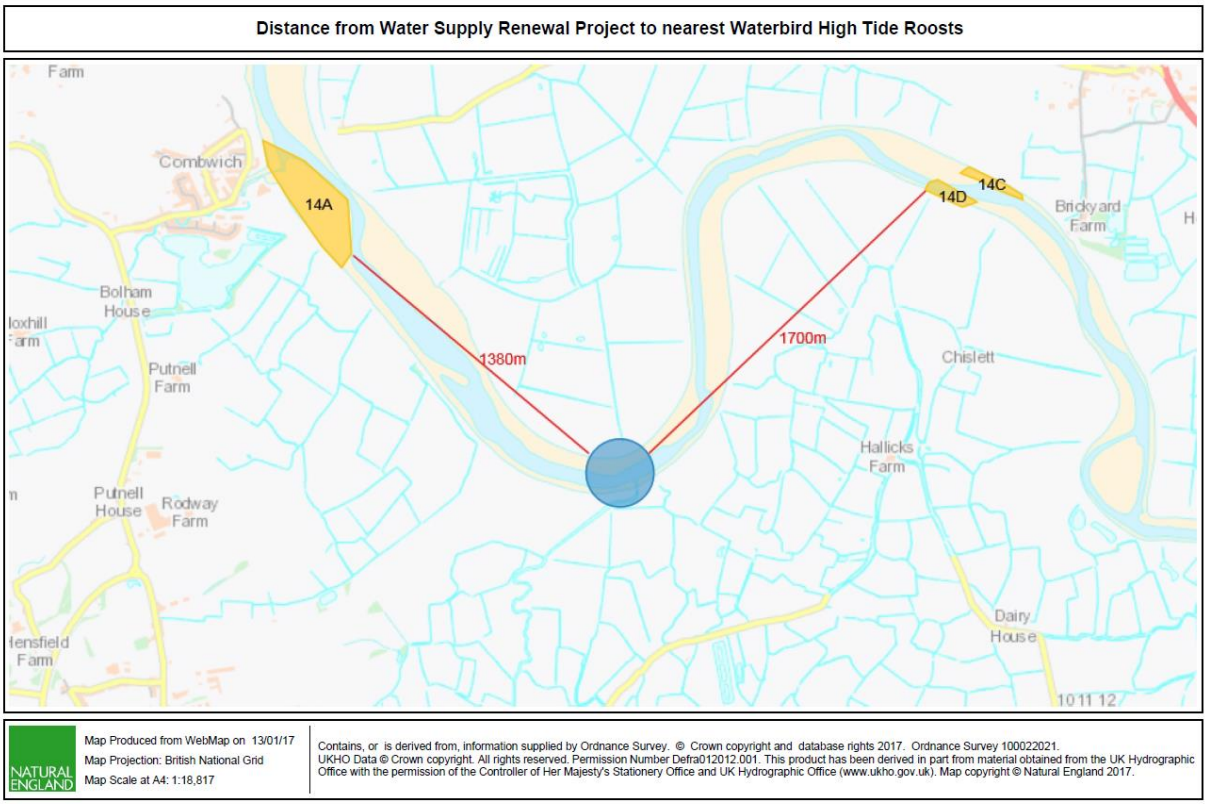
8.2.3 Potential impacts on rare plants

The known location of rare plants have been mapped (Map 6). This information will be used to ensure construction sites and access routes do not impact this areas. These locations are outside the proposed working areas and access routes. Additional ecological surveys will be undertaken to manage construction risks in relation to rare plants.

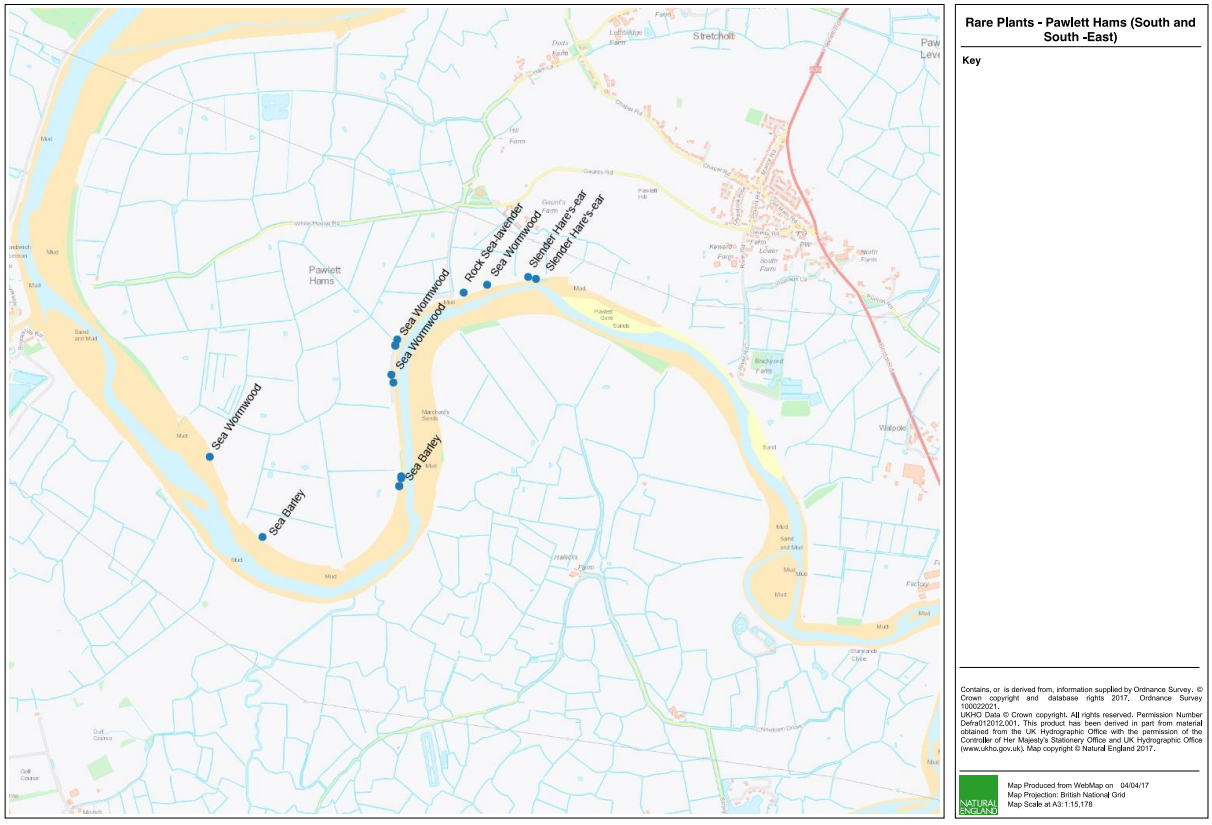
8.1 HRA conclusion

The HRA concludes that the proposal to restore the water supply to Pawlett Hams is necessary to site management for nature conservation (including favourable status of the Severn Estuary Marine Site and the wider Severn Estuary SPA, SAC and Ramsar Site, as well as favourable conditions of Bridgwater Bay SSSI) and is unlikely to have a significant effect on the internationally important interest features of the site.

The Parrett IDB Water Levels Management Plan for Pawlett Hams will provide a framework for monitoring and review, to ensure the nature conservation objectives for water level management are achieved.



Map 5. Distance of the proposed pipeline to the nearest waterbird high tide roosts



Map 6. Location of rare plants

Table 4. Habitats Regulations Assessment of likely significant

1. European site name(s) and status:	• Severn Estuary SAC • Severn Estuary SPA • Severn Estuary Ramsar site • Severn Estuary European Marine Site (comprises the SAC, SPA and Ramsar)
2. Is the proposal directly connected with or necessary to the management of the site for nature conservation?	**Yes** The proposal to restore the fresh water supply to Pawlett Hams will directly benefit the management of the coastal floodplain grazing marshes and some of the interest features of the **Severn Estuary Marine Site**

3. What potential hazards are likely to affect the interest features? (Refer to relevant sensitivity matrix and only include those to which the interest features are sensitive). **Are the interest features potentially exposed to the hazard?**

Sensitive Interest Feature:								**Potential hazard:**	**Potential exposure to hazard and mechanism of effect/impact if known:**
Estuarine & intertidal habitats	Submerged marine habitats	Anadromous fish	Birds of lowland wet grasslands	Birds of lowland freshwaters	Birds of farmland	Birds of estuarine habitats	Assemblage of invertebrates		
								Habitat loss	Potential for vehicle movements along the river bank to effect rare plants of inter-tidal habitats. Vehicles will not be permitted (or required) to access these areas and risk of habitat loss is very low.
								Changes in physical regime (geomorphology)	No hazard to sensitive features No work within the inter-tidal zone. Minimal disturbance of watercourses and no change in established water management regime.
								Turbidity	No hazard to sensitive features The preferred option of directional drilling avoids the need to work within the River Parrett channel, which substantially reduces the risk of generating a silt plume or releasing contamination.
								Habitat/community simplification	No hazard to sensitive features No work within the inter-tidal zone. Minimal disturbance of watercourses and no change in established water management regime.
X			X	X	X	X		Disturbance	Potential for vehicle movements along the river bank to disturb overwintering birds, and passage migrants, using the high tide roosts of the Parrett Estuary. Areas used as high tide roosts have been identified. The risk of disturbance is very low as the known roost sites are at least 1,000m from the construction sites. Works are scheduled to take place in the summer months, which substantially reduces the likelihood of disturbance to roosting (high tide) or feeding (low tide) waterbirds during construction.
								Competition from non-native species	No hazard to sensitive features No increase in existing risk as a consequence of the proposal
								Changes to water chemistry	No hazard to sensitive features No work within the inter-tidal zone. Minimal disturbance of watercourses and no change in established water management regime.

5. Is the potential scale or magnitude of any effect likely to be significant?	
a) Alone?	**No** **It can be concluded that there will be no likely significant effect from the activities associated with the Pawlett Hams Water Supply Pipeline Project on Severn Estuary SPA, SAC, Ramsar site.**
b) In combination with other permissions and/or other plans or projects?	**No** The following projects and plans were assessed: River Parrett Maintenance Dredging, Parrett Tidal Barrier Cannington Bends Flood Risk Management Project Stallington's Clyse Flood Defence Scheme Bridgwater Bay Tidal Lagoon Shoreline Management Plan Flood Risk Management Plan **The Pawlett Hams Water Supply Pipeline Project will enable appropriate water level management for wetland nature conservation. A mechanism cannot be foreseen by which the potential impacts of other projects interact with predicted effects of the proposal, in a manner that produces a cumulative negative effect. The overall effect of the proposal will be a positive benefit to conservation, which could have a mitigating effect for any potentially negative impacts from other associated projects that are not directly linked to the management of water for nature conservation.**

6. Conclusion: Is the proposal likely to have a significant effect 'alone and/or in combination' on a European site?

No

The assessment of likely significant effect concludes that there will be no likely significant effects on the features of the Severn Estuary Marine Site from the proposal acting alone or in combination with any other plan or project.

2. List of interest features:

1.12 Estuarine & intertidal habitats
1.13 Submerged marine habitats
2.5 Anadromous fish
2.6 Non-migratory fish & invertebrates of rivers
3.4 Birds of lowland wet grasslands
3.6 Birds of lowland freshwaters and their margins
3.7 Birds of farmland
3.9 Birds of estuarine habitats

Severn Estuary Special area of Conservation (SAC)

Annex I Habitats:

- Estuaries (1.12)
- Mudflats and sandflats not covered by seawater at low tide (1.12)
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (1.12)
- Sandbanks which are slightly covered by sea water all the time (1.13)
- Reefs (1.13).

Annex II Species:

- Sea lamprey (2.5)
- River lamprey (2.5)
- Twaite Shad (2.5).

Severn Estuary (SPA)

Species qualifying under article 4.1 of the Wild Birds Directive (Directive 2009/147/EC):
Bewick's swan *Cygnus columbianis bewickii* (over winter) [3.4, 3.6, 3.7]

Species qualifying under article 4.2 of the Wild Birds Directive (Directive 2009/147/EC):

- Gadwall *Anas strepera* [3.6]
- White fronted goose *Anser albifrons* [3.6, 3.7, 3.9]
- Dunlin *Calidris alpina* [3.4, 3.7, 3.9]
- Shelduck *Tadorna tadorna* [3.6, 3.9]
- Redshank *Tringa totanus* [3.4, 3.7, 3.9]

Internationally important assemblage of birds: over winter the area regularly supports 84,317 waterfowl (5 year peak mean 01/04/1998) including Bewick's swan, white-fronted goose, shelduck, gadwall, dunlin and redshank.

Additional features identified by 2001 SPA review (see note for Somerset Levels and Moors SPA):

- Ringed plover *Charadrius hiaticula,* (on passage) [3.6, 3.8*, 3.9]
- Curlew Numenius arquata (wintering) [3.1*, 3.4, 3.7, 3.8*, 3.9]
- Pintail *Anas acuta,* (over winter) [3.6, 3.8*, 3.9].

Severn Estuary Ramsar site

The Severn Estuary qualifies under Ramsar criteria 1, 2, 4, 5, 6 and 8 for the following reasons:

- Criterion 1: Immense tidal range (second-largest in world), this affects both the physical environment and biological communities.
- Criterion 2: Unusual estuarine communities, reduced diversity and high productivity.
- Criterion 4: important for the run of migratory fish between sea and river via estuary. Species include Salmon *Salmo salar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *A. fallax*, and eel *Anguilla anguilla*. It is also of particular importance for migratory birds during spring and autumn.
- Criterion 5: Assemblages of international importance: Species with peak counts in winter: 70919 waterfowl (5 year peak mean 1998/99-2002/2003).
- Criterion 6: Species/populations occurring at levels of international importance: Bewick's swan Eurasion teal, Greater white-fronted goose, common shelduck, gadwall, dunlin, common redshank.
- Criterion 8: The fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Salmon, sea trout, sea lamprey, river lamprey, allis shad, twaite shad, and eel use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species particularly allis shad and twaite shad.

Designation Notes

Sites qualify to be an SPA under Article 4.1 of the Wild Birds Directive (Directive 2009/147/EC) if they are used regularly by 1% or more of the Great Britain populations of species listed on Annex 1 of the Directive in any season.
Sites qualify to be an SPA under Article 4.2 of the Wild Birds Directive (Directive 2009/147/EC) if they are used regularly by 1% or more of the biogeographical populations of regularly occurring migratory species (other than those listed under Annex 1), and/or regularly support an internationally important assemblage of waterbirds (waterbirds as defined by the Ramsar Convention) in any season.

Sites qualify to be an SAC under the Habitats Directive (92/43/EEC) if they support internationally important examples or populations of habitats listed on Annex I of the Directive and/or species listed on Annex II of the Directive.
Sites qualify as a wetland of international importance under the Ramsar Convention if they meet one or more of nine criteria used to identify wetlands of international importance.

9 Water Framework Directive Assessment

A WFD compliance assessment has been undertaken by the Parrett IDB for the proposed water supply pipeline project for Pawlett Hams. The assessment identified no pathways by which impacts from the works would affect WFD interest features, or hinder achieving WFD objectives. Also, there are no conflicts with proposed RBMP mitigation measures for Cannington Brook. The HRA for the project fulfils the requirement, under WFD, to consider impacts upon nationally protected sites. The assessment concludes that the proposed project will make a positive contribution towards achieving the WFD objectives for these waterbodies.

The relevant WFD waterbodies are the Cannington Brook and the tidal Parrett. These are both classified as heavily modified waterbodies, which recognises that the rivers have been modified for the purposes of flood risk and water level management. This means the ecological potential of the rivers is assessed in the context of this modification.

The preferred option of directional drilling a new pipeline below the bed of the River Parrett will minimise the risk of sediment plume generation and avoids the need to work within the tidal channel. Directional drilling will not affect water levels or water quality on the Hams or in Cannington Brook.

The operation of the pipeline will not affect the hydromorphology and ecology of Cannington Brook. The abstraction point for the pipeline will be located upstream of the outfall to the tidal Parrett. There will be no change in the operation of the pipeline, which will supply water to Pawlett Hams during summer months. The pipeline abstraction is substantially less volume than the minimum flows in Cannington Brook, which are sustained by compensation flows from upstream reservoirs. The pipeline will be fitted with flow controls that will regulate abstraction rates and enable to pipeline to be closed off in case of pollution, flow issues or tidal ingress.

The pipeline will operate by gravity and will not impede fish passage. Restoring the water supply to Pawlett Hams will improve eel passage from the Estuary onto the Hams, by allowing water to over top the outfall structure at Cobbs Leaze. It will also have a direct benefit to fish habitat of the Hams by improving water flow, level and quality in the ditch system. Long-term effects will be beneficial to WFD compliance, by restoring and sustaining water dependant habitats, including ditch habitats for eel. Restoring the water supply to the Hams can be regarded as a WFD mitigation measure for the Cannington Brook and the River Parrett, as it will improve connecting water habitats and eel passage to Pawlett Hams.

Appendix 1 Environmental baseline for Bridgwater Bay SSSI

Receptor	Key Features / Attributes
Flora and fauna	The Pawlett Hams (450ha) forms part of the Bridgwater Bay SSSI (5822ha) and the Severn Estuary Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) and Ramsar site. The site was designated as a SSSI in 1989 for a variety of features (Natural England, 2008) including; • Nationally restricted plants such as the Rootless Duckweed *Wolffia arrhiza*; • Well developed invertebrate communities including five Red Data Book species and a number of nationally scarce species. • A number of wildfowl and waders overwinter in the Severn Estuary and use the Pawlett Hams as a feeding and roosting site. Pawlett Hams also contain the UKBAP habitat 'Coastal and floodplain grazing marsh'. Water Voles are known to be present within the rhyne and ditch system.
Fisheries	Locally important glass eel fishery on the river Parrett (14th February – 1st April)
Water quality and water level management	Pawlett Hams has a small local catchment that supplies only a limited volume water in the summer, which is insufficient to meet the requirements of farming and nature conservation on the Hams. Up to Oct 2014, the area was supplied from the Cannington Brook to the west of the River Parrett via twin 200mm (8") diameter pipes laid under the river. The restoration of this water supply, for farming and nature conservation, is the subject of the proposed scheme. There are no other significant water resource issues that directly influence, or are influenced by, water level management within the catchment. There are no licensed abstraction points. The site is not within a Nitrate Vulnerable Zone or a Nitrate Sensitive Area.
Geology / soils	The Pawlett Hams lies close to the estuary of the River Parrett on alluvial deposits.
People	The Pawlett Hams is a kidney-shaped area of land (371ha) situated in a loop on the River Parrett close to the estuary. It lies approximately 4.5-5 kilometers north north-west of Bridgwater as the crow flies and less than two kilometres west of the village of Pawlett. There are no houses on Pawlett Hams however there are a handful of farms and associated buildings on the Western edge of the SSSI between the SSSI and Pawlett Hill. There is a Public Right of Way (PROW), taking the form of a footpath that runs around the edge of the site along the bank of the River Parrett. Current background noise levels in the vicinity of the site are likely to be low and typical of a rural locality.
Landscape	Although the Pawlett Hams are a part of the Severn Estuary SPA and the Bridgwater Bay SSSI, it is also contiguous with the Somerset Levels and Moors SPA. The land is very low lying, with some areas in the center rising just 5.5 meters above sea level. This low-lying land is surrounded by flood banks of between 7.5 and 8.5 meters. The landscape is typical of the Somerset Moors and Levels with small rural settlements nearby

Receptor	Key Features / Attributes
	and with small to moderate sized pasture fields bounded by wet fences (i.e. rhynes and ditches) and droves (or tracks).
Land use	Agriculture is the primary land use. Most of the land is divided into numerous small fields which are separated mostly by watercourses or a combination of hedge and watercourse. The watercourses are used to provide drinking water for livestock and as wet fences. Livestock farming is the primary land use, covering about 70% of the farmed area. The remaining 30% is arable, often in mixed farms with livestock. A large proportion of Pawlett Hams is managed under Environmental Stewardship HLS agreements. The environmental outcomes of these agreements are often dependent on water level management and the supply of water in the summer for grazing and habitat management.
Archaeology and heritage	There are no known ancient monuments or important archaeological features on the site however there is evidence of a settlement on and around Pawlett Hill dating back to Roman times (http://www.british-history.ac.uk/report.aspx?compid=18676) The wetlands of the Somerset Levels and Moors contain a wealth of archaeological information often hidden under layers of peat and clay that have built up over many millennia. This has had three significant affects: a) Organic remains such as wood and leather are preserved because the waterlogging excluded oxygen and prevented the normal types of decay which destroy these materials on normal archaeological sites b) The waterlogged conditions also preserve pollen grains, plant material, insects, snails and even macroscopic plant and animal remains. These constitute a unique record of the past natural and man made environment stretching back over the last 6,000 years. They can also provide information concerning human activity on the neighbouring dryland, and past changes in climate and sea level. c) The normal methods of archaeological detection do not work well in wetland areas where sites can be deeply buried. The number of known archaeological sites is therefore only a small fraction of the existing total. It is extremely likely that all the river valley wetlands in Somerset contain a wealth of important archaeological sites. In addition there are several types of sites such as fisheries, medieval flood defences and small river ports of which we know very little, but may exist in considerable numbers. The organic archaeological remains from the Somerset Moors depend for their continued survival on an anaerobic waterlogged burial environment. If the surrounding peat or clay dries out the organic material will shrink considerably and crack apart. The presence of oxygen will also allow bacterial and fungal decay to resume and eventually completely destroy the artefacts. Water level management that benefits the continued preservation of wetland archaeological features is a key objective of the proposed scheme and the WLMP.
Air & climate	Air quality in the area is generally good due to the rural location and lack of heavy industry in the vicinity. Most of the pollutants in the air are likely to be derived from traffic.

Appendix 2

SSSI Citation

SITE NAME: BRIDGWATER BAY

COUNTY: SOMERSET
DISTRICT: WEST SOMERSET

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 (as amended)

Local Planning Authority: Sedgemoor District Council, West Somerset District Council, Somerset County Council

National Grid Reference: ST 290480 Area: 3574.1 (ha) 8831.6 (ac)
Ordnance Survey Sheet 1:50,000: 181 182 1:10,000: ST 14 NE, 24 SW, NW, SE, NE, 25 SW, SE, NE, 34 NW, 35 SW

Date Notified (Under 1949 Act): – Date of Last Revision: –
Date Notified (Under 1981 Act): 1989 Date of Last Revision: –

Other Information:

The site includes Bridgwater Bay National Nature Reserve declared under Section 23 of the National Parks and Access to the Countryside Act 1949 and designated a wetland of international importance under the Ramsar Convention. A Nature Conservation Review Grade 1* site. The site is contiguous with the Brean Down, Berrow Dunes and Blue Anchor to Lilstock Coast SSSIs.

Description and Reasons for Notification:

Bridgwater Bay comprises a succession of habitats ranging through extensive intertidal mudflats, saltmarsh, shingle beach and grazing marsh intersected by a complex network of freshwater and brackish ditches. It supports internationally and nationally important numbers of over-wintering and passage migrant waders and waterfowl. The ditches and ponds contain a diverse invertebrate fauna including six nationally rare species and eighteen nationally scarce species. The site is an integral part of the Severn Estuary system and is ecologically linked to the Somerset Levels which provide alternative winter feeding grounds for waders and wildfowl.

The Bay occupies the sweeping arc of coastline between the wave-cut platform of Jurassic Blue Lias at the northern tip of the Quantock Hills and the cliffs of Carboniferous Dolomites and Limestone at Brean Down which project into the Severn Estuary and provide some degree of protection from the erosive tidal currents. This has allowed the deposition of an extensive area of intertidal mud which nonetheless remains highly mobile. Strong prevailing westerly winds have thrown up sand dunes and a shingle ridge
at Barrow and Steart, respectively. On the landward side of these features is the marine/estuarine alluvium of Pleistocene and geologically recent times. The River Parrett meanders across this plain, its final loop encircling Pawlett Hams before entering the Bay and flowing out between Stert and Berrow Flats. The Hams are a hydrologically discrete area with water provided by the Cannington Brook which originates in the Quantock Hills.

The site contains the most extensive area of saltmarsh within Somerset and one of the largest Common Cord-grass *Spartina anglica* swards in the Severn Estuary. This is located on a spit at the mouth of the River Parrett, occupies a wide coastal band from Wall Common to Stert Island and fringes the mouth of the Brue. Common Cord-grass dominates much of the seaward edge of the marsh, having vigorously invaded and consolidated the fronting mudflats. Higher up, Common Saltmarsh-grass *Puccinellia maritima* increases in abundance with Sea Aster *Aster tripolium*. Where

ungrazed, Common Reed *Phragmites australis* frequently forms a zone above this. Grazing of the upper marsh tends to encourage Red Fescue *Festuca rubra* and Creeping Bent *Argostis stolonifera*. Sea Couch *Elymus pycnanthus* and Sea Club-rush *Scirpus maritimus* occur at the landward edge of the marsh. Other members of this community include Sea Wormwood *Artemisia maritima*, Saltmarsh Rush J*uncus gerardi*, Common Sea-lavender *Limonium vulgare*, Common Scurvy-grass *Cochlearia officinalis*, Spear-leaved Orache *Atriplex prostrata* and Sea Purslane *Halimione portulacoides*. High level sheep-grazed marshes carry populations of the nationally scarce Bulbous Foxtail *Alopecurus bulbosus*, Slender Hare's-ear *Bupleurum tenuissimum* and Sea Barley *Hordeum marinum* while Stert Island is known to support the nationally rare Compact Brome *Bromus madritensis* and nationally scarce Ray's Knotgrass *Polygonum oxyspermum*.

The development of shingle ridges and construction of sea defences has prevented tidal inundation and encouraged a transition from saltmarsh to grazing marsh on Pawlett Hams, Wick Moor, Catsford and Wall Common. The majority of Pawlett Hams is semiimproved, permanent neutral grassland with Perennial Rye-grass *Lolium perenne* and Crested Dog's-tail *Cynosurus cristatus* abundant. Some fields have been converted to arable.

Pawlett Hams, Steart and Wick Moor are divided by networks of ditches which act as a drainage system in winter and as stock barriers and drinking water supplies in the summer. A wide variety of aquatic and bankside plant species occur in the ditches. Freefloating species include the nationally restricted Rootless Duckweed *Wolffia arrhiza*, together with uncommon species such as Frogbit *Hydrocharis morsus-ranae* and Water Fern *Azolla filiculoides*. Amongst the submerged waterweeds, Rigid Hornwort *Ceratophyllum demersum* and Spiked Water-milfoil *Myriophyllum spicatum* are common. Emergent species include Flowering Rush *Butomus umbellatus*, Common Reed and Water-plantain *Alisma plantago-aquatica*, while Brookweed *Samolus valerandi* and the local Parsley Water-dropwort *Oenanthe lachenalii* are found on the banksides. The slightly brackish nature of the water is indicated by the presence of plants such as the nationally restricted Brackish Water-crowfoot *Ranunculus baudotii*, Sea Clubrush *Scirpus maritimus*. Fennel Pondweed *Potamogeton pectinatus*, Lesser Pondweed *P. berchtoldii* and Grey Clubrush *Schoenoplectus tabernaemontani* form part of the community here. Many of the fields contain ponds which have well developed communities of plants and invertebrates very similar to those of the surrounding ditches.

The invertebrate interest is associated with the brackish and freshwater rhyne systems and ponds of Pawlett Hams and Wick Moor and the saltmarsh communities within the site. Five Red Data Book species have been recorded from Pawlett Hams: the Great Silver Water Beetle *Hydrophilus piceus*, the water beetle *Hydrovatus clypealis*, the hover fly *Lejops vittata* and the soldier flies *Odontomyia ornata* and *Stratiomys singularior*. A water mite new to Britain, *Diplodontus scapalaris*, has recently been recorded here. Nationally scarce species include the aquatic snail *Cyraulus laevis*, the Hairy Dragonfly *Brachytron pratense* and a ladybird *Coccidula scutellata*. The Rhyne system of Wick Moor supports a Red Data Book water beetle *Haliplus mucronatus*. Other nationally scarce species include the water beetles *Rhantus suturalis*, *Enochrus bicolor*, and *Berosus affinis*, the ladybird *Coccidula scutellata* and a soldier fly *Odontomyia viridula*. The insect fauna of the ungrazed saltmarshes include the nationally notable beetles *Bembidion normannum*, *Phaedon concinnus* and *Tachyporus atriceps*. Two nationally scarce Diptera have also been recorded; *Nemotelus notatus* and *Thinophilus flavipalpis*. Common saltmarsh specialists include the Dipteran species *Scatomyza litorea* and *Dolidropus griseipennis*, and the beetles *Pogonus chalceus* and *Reichenbachia helferi*. Bridgwater Bay is a critical feeding ground for passage and over-wintering waders and wildfowl. In its own right it supports internationally important numbers of Whimbrel *Numenius phaeopus* and Black-tailed Godwit *Limosa limosa* on passage. Of the overwintering species it attracts nationally important numbers of Dunlin *Calidris alpina* and Wigeon *Anas penelope*. Shelduck *Tadorna tadorna* use the Bay as a moulting ground and are also present in nationally important numbers. The Bay forms an integral part of the Severn Estuary system and is used by a substantial proportion of the overall waterfowl population which is of international importance. The assemblage of wildfowl and waders contains individual populations present in internationally important numbers including Dunlin, Shelduck, Wigeon, Curlew *Numenius arquata,* Redshank *Tringa totanus* and Teal *Anas crecca*. Populations of national importance are those of Ringed Plover *Charadrius hiaticula* and Grey Plover *Pluvialis squatarola*. Significant numbers of Knot *Calidris canutus*, Turnstone *Arenaria interpres*, Common Snipe *Gallinago gallinago* and Mallard *Anas platyrhynchos* also occur.

Severn Estuary - SPA Designation

This site qualifies under **Article 4.1** of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

Over winter;
Bewick's Swan *Cygnus columbianus bewickii*, 280 individuals representing at least 4.0% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
This site also qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

On passage;
Ringed Plover *Charadrius hiaticula*, 655 individuals representing at least 1.3% of the Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)

Over winter;
Curlew *Numenius arquata*, 3,903 individuals representing at least 1.1% of the wintering Europe - breeding population (5 year peak mean 1991/2 - 1995/6)
Dunlin *Calidris alpina alpina*, 44,624 individuals representing at least 3.2% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6)
Pintail *Anas acuta*, 599 individuals representing at least 1.0% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
Redshank *Tringa totanus*, 2,330 individuals representing at least 1.6% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Shelduck *Tadorna tadorna*, 3,330 individuals representing at least 1.1% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

Assemblage qualification: A wetland of international importance.
The area qualifies under **Article 4.2** of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl

Over winter, the area regularly supports 93,986 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Gadwall *Anas strepera*, Shelduck *Tadorna tadorna*, Pintail *Anas acuta*, Dunlin *Calidris alpina alpina*, Curlew *Numenius arquata*, Redshank *Tringa totanus*, Bewick's Swan *Cygnus columbianus bewickii*, Wigeon *Anas penelope*, Lapwing *Vanellus vanellus*, Teal *Anas crecca*, Mallard *Anas platyrhynchos*, Shoveler *Anas clypeata*, Pochard *Aythya ferina*, Tufted Duck *Aythya fuligula*, Grey Plover *Pluvialis squatarola*, White-fronted Goose *Anser albifrons albifrons* , Whimbrel *Numenius phaeopus*.

Severn Estuary - Ramsar designation

Site: Bridgwater Bay (part of Severn Estuary)		**Designation date:** 05/01/1976
Coordinates: 51°13'N 003°04'W	**Elevation:** no information	**Area**: 2,703 ha

Location: The Bridgewater Bay site is located on the north Somerset coast within Bridgewater Bay, which lies on the south side of the Severn Estuary, and the eastern edge of the Bristol Channel. The site is situated in the southwest of the United Kingdom, in the Atlantic biogeographic region. The nearest town is Weston-Super-Mare. This site now forms part of the Severn Estuary Ramsar Site (7UK088).

Criteria: (3c): **6**

Importance: Over winter, this site regularly supports large numbers of the Northwestern European population of the shelduck *Tadorna tadorna* (an average of 2,552 individuals representing 0.9% of the Northwestern Europe population. Count data from the Severn Estuary Ramsar Site (7UK088)). The fish *Petromyzon marinus* occurs here at an internationally important level.

Wetland Types: G (69.8%), H (17.9%), D (3.7%), E (1.1%), other (7.4%)
The site contains extensive areas of intertidal sand and mudflats and intertidal rock platforms. There are some areas of vegetated shingle beach. Maritime grasslands contain freshwater and brackish ditches.

Biological/Ecological Notes: The mudflats are sometimes lined with zones of *Spartina anglica*. There are also saltmarsh areas with a range of vegetation types, including higher zones with *Phragmites australis* and *Bolboschoenus maritimus*. *Puccinellia maritima*, *Festuca rubra*, *Glaux maritima* and *Triglochin maritima* dominate the middle marsh. The lower marsh is dominated by *Aster tripolium*. The maritime grasslands are dominated by *Agropyron pungens*. The intertidal areas support high densities of invertebrates and marine algae, and nationally important plant species. The site supports nationally important numbers of wintering and passing migrant waterbirds, and nationally important plant species.

Hydrological/Physical Notes: The area is part of a coastal landscape with an estuary, intertidal rocks and sediments, lowland and a bay. It plays an important role in the recharge and discharge of groundwater, in shoreline stabilisation and dissipation of erosive forces.

Human Uses: The site is public/communal property. The surroundings are owned by the local authorities or the national government, while other parts are private or public/communal property. In the immediate surroundings, tourism, recreation, recreational fishing, agriculture, grazing, recreational hunting, flood control measures and industry take place. A harbour/port occurs and urban development is taking place. There are also non-urbanised settlements. Tourism, recreation, research, commercial fishing, gathering of shellfish, bait collection, recreational hunting, provision of industrial water supply, industry, and flood control measures take place at a small scale on the site. There are also small-scale harbour/port facilities on site. Nature conservation and grazing take place at a large scale on site. Tourists are provided with bird watching hides, and there are fixed interpretation panels. The Reserve Warden gives guided walks and talks. There is a nature trail in the National Nature Reserve. The numbers of waterbirds are being monitored regularly as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, the Wildfowl and Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee. Other kinds of research are also carried out at the site.

Conservation Measures: The site has been designated as a National Nature Reserve, an EU Special Protection Area and a Site of Special Scientific Interest. There is a management plan for the National Nature Reserve, reviewed and revised every five years, which

addresses a large proportion of the Ramsar Site. Since June 1995, the Severn Estuary Strategy, which includes Bridgwater Bay, has been working towards the sustainable management of the site, through the involvement of local authorities, interested parties and local people. This integrated approach is being further developed in conjunction with a candidate Special Area of Conservation management scheme for the nature conservation interest of the estuary.
Adverse Factors: No adverse factors currently reported.
Site Management: English Nature. Northminster House. Peterborough PE1 1UA.
Based on the 1999 Ramsar Information Sheet and the 2002 National Report to the Ramsar Convention. Please see “Site Descriptions” in the Introduction for more details about the structure and content of Directory descriptions.

EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

Citation for Special Area of Conservation (SAC)

Name: Severn Estuary/ Môr Hafren

Unitary Authority/County: England: Bristol City, Gloucestershire, Bath & North East Somerset, Somerset, South Gloucestershire.

Wales: Bro Morgannwg/Vale of Glamorgan, Caerdydd/Cardiff, Casnewydd/ Newport, Sir Fynwy/ Monmouthshire.

SAC status: Designated on 10 December 2009 ST321748

Grid reference: ST321748

SAC EU code: UK0013030

Area (ha): 73715.40

Component SSSI: Upper Severn Estuary SSSI, Severn Estuary SSSI, Bridgwater Bay SSSI.

Site description:
The Severn Estuary lies on the south west coast of Britain at the mouth of four major rivers (the Severn, Wye, Usk, and Avon). The immense tidal range (the second highest in the world) and classic funnel shape make the Severn Estuary unique in Britain and very rare worldwide. This tidal range creates strong tidal streams and high turbidity, producing communities characteristic of the extreme physical conditions of liquid mud and tide-swept sand and rocks.

The Estuary includes a wide diversity of habitats including Sandbanks which are slightly covered by sea water all the time, Mudflats and sandflats not covered by sea water at low tide, Atlantic salt meadows, and Reefs, which are identified as Annex I habitat types in their own right.

The intertidal zone of mudflats, sand banks, rocky platforms and saltmarsh is one of the largest and most important in Britain. The estuary has a diverse geological setting and a wide range of geo-morphological features, especially sediment deposits. It is important for the interpretation of coastline dynamics and land-forms, and also past changes, in sea level, sediment supply, climate and river flow. The estuary's overall interest depends on its large size, and on the processes and interrelationships between the intertidal and marine habitats and its fauna.

The fluctuating salinity and highly mobile sediments with consequent high turbidity limits the benthic invertebrates of the mud and sandflats to relatively few species. Those which are tolerant of such conditions occur in very high densities on the more stable mudflats. Beds of eel-grass *Zostera* spp. also occur on some mudflats. A greater variety of invertebrates occurs on the intertidal rock platforms, a more stable habitat with rock pools and a relatively high cover of seaweeds.

The estuary fringes have large areas of saltmarsh. These are often grazed by sheep and/or

cattle, a significant factor determining the plant communities. A range of saltmarsh types is present, with both gradual and stepped transitions between bare mudflat and upper marsh. The estuarine fauna includes: invertebrate populations of importance (especially as a food resource for a wide range of bird and fish species), internationally important populations of waterfowl; and large populations of migratory fish, including Sea lamprey *Petromyzon marinus*, River lamprey *Lampetra fluviatilis* (both of which spawn in freshwater but complete part of their life cycle in the sea), Twaite shad *Alosa fallax* and the nationally rare and endangered Allis Shad A*losa alosa*.

Qualifying habitats: The site is designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Estuaries
- Sandbanks which are slightly covered by sea water all the time. (Subtidal sandbanks)
- Mudflats and sandflats not covered by seawater at low tide. (Intertidal mudflats and sandflats)
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Reefs

Qualifying species: The site is designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Sea Lamprey (*Petromyzon marinus*)
- River Lamprey (*Lampetra fluviatilis*)
- Twaite Shad (*Alosa fallax*)

10 References

1. Bridgwater and Pawlett Water Level Management Plan (2000) Bridgwater and Pawlett Internal Drainage Board.

2. Bridgwater and Pawlett area Water Level Management Plan (Draft 2008) Parrett Internal Drainage Board.

3. Pawlett Hams Water Level Management Plan Review (2007) Parett Internal Drainage Board.

4. English Nature – Bridgwater Bay Natural Profile). http://www.english-nature.org.uk/science/natural/profiles%5CnaProfile115.pdf

5. Natural England (2001-present). SSSI units for Bridgwater Bay, http://www.english-nature.org.uk/Special/sssi/unitlist.cfm?sssi_id=1001145

6. Environmental Impact Assessment (Land Drainage Improvement Works) Regulations. 1999. Number 1783.

7. Environmental Impact Assessment (Land Drainage Improvement Works) (Amended) Regulations 2006 (SI 2006 No 618).

8. The Secretary of State (2005). The Environmental Impact Assessment (Land Drainage Improvement Works) (Amended) Regulations 2005. SI2005. No 1399.

9. A History of the County of Somerset: Volume 6 - Andersfield, Cannington, and North Petherton Hundreds (Bridgwater and neighbouring parishes) R W Dunning, C R Elrington (Editors), A P Baggs, M C Siraut (1992) http://www.british-history.ac.uk/report.aspx?compid=18676

10. The Secretary of State for the Environment (1995). The Town and Country Planning (General Permitted Development) Order. SI1995. No. 418.

11. BTO (2016). BTO Research Report 683. Identification of Wintering Waterfowl High Tide Roost on the Severn Estuary SSSI/SPA. Phase 2 (Clevedon to Oldbury) & Phase 3 (Bridgwater Bay) http://publications.naturalengland.org.uk/publication/5645233772036096