

# Duddington Mill Waterwheel Project

## Water Framework Directive Assessment



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## Document Control

Version	Date of Issue	Author(s)	Reviewed by
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## 1. Introduction

### Introduction to assessment

- 1.1. This document has been produced in connection with an abstraction licence application for a hydropower scheme at Duddington Mill on the River Welland.
- 1.2. The Environment Agency's 'Guidance for run-of-river hydropower: the Water Framework Directive, nature conservation and heritage' dated December 2013 has been followed as part of this assessment.
- 1.3. The assessment will review the potential effects arising from the proposed scheme in relation to:
  - flow patterns
  - sediment availability
- 1.4. The Water Framework Directive (2000/60/EC) (WFD) was passed by the European Union in 2000. It became part of UK law in 2003 with the issue of The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.
- 1.5. The WFD is implemented regionally by river basins. Each river basin has a River Basin Management Plan (RBMP) which is updated every six years. The RBMP documents the current status of the water bodies and the pressures affecting them. It outlines the improvements that can be made within the current management period and the programme of investigations to be carried out.
- 1.6. The fundamental objectives of the WFD that apply to surface water bodies are:
  - Prevent deterioration of the status of water bodies
  - Achieve at least good ecological status and good surface water chemical status by a set date
  - Reduce pollution from priority substances and eliminate priority hazardous substances as defined by the European Commission
- 1.7. In addition to the objectives above there are further standards and measures to be met in areas defined as protected areas. These areas are listed in the RBMPs.
- 1.8. Artificial or Heavily Modified Water Bodies (AWB, HMWB) cannot achieve good ecological status as they are unable to get close enough to the required natural conditions. Instead the aim is to achieve good ecological potential.
- 1.9. The RBMPs detail the Environment Agency (EA) objectives specific to each water body that are designed to meet the WFD objectives. The proposed measures to meet the objectives are also given.

### Purpose of assessment

- 1.10. This assessment has been undertaken to fulfil the requirements under the Water Framework Directive.

- 1.11. The EU Water Framework Directive requires environmental objectives be set for all surface and ground waters to enable them to achieve good status or potential for heavily modified water bodies by a defined date. One objective is to prevent further deterioration which can include changes to flow pattern, width and depth of channel, sediment availability/transport and ecology and biology.
- 1.12. This assessment looks at the current status of the water bodies that may be affected by the proposed hydropower system and discusses whether or not the proposal will deteriorate the ecological quality of the water bodies or prevent the water bodies from achieving good ecological status.
- 1.13. Any EA defined objectives and measures that are specific to the water body will be considered to determine if the proposed hydropower system will prevent these objectives and measures from being realised.
- 1.14. The assessment includes any cumulative or in-combination effects.
- 1.15. If this assessment finds that the proposal is likely to contravene the WFD, then further more detailed assessments will be recommended.

## Site description

- 1.16. The application site is located at Duddington Mill which is located on the River Welland within the village of Duddington, Stamford.

## Other schemes

- 1.17. There are no known hydropower schemes within 5km of the proposed development.

## Proposal summary

- 1.18. The proposal is for the installation of a hydropower Waterwheel scheme consisting of a modern waterwheel and associated infrastructure within an existing wheel pit at Duddington Mill as per the attached drawing Dudd\_HD1\_drawings-DUDDM\_02.
- 1.19. An application for planning permission and an Environment Agency Bespoke Permit will be made along with an abstraction licence application.
- 1.20. The scheme is expected to generate a peak power output of 9 kW and an average annual energy production of 45,915 kWh. This is sufficient to power 10 homes and provides an effective CO<sub>2</sub>e saving of around 22 tonnes per year.

## Current WFD status

Water body name	Welland – conf Langton Bk to conf Gwash
Water body ID	GB105031050580
Management Catchment	Welland
Operational Catchment	Welland Upper
River Basin District	Anglian
Hydromorphological Designation	Not designated artificial or heavily modified
<b>Overall Classification for 2016</b>	<b>Moderate</b>

*Fig. 1: Cycle 2 Classification*

- 1.21. The upstream waterbodies are: Medbourne Brook, Welland – conf Jordan to conf Langton Bk, Chater – Lower, Langton Brook, Stoke Albany Brook, Stonton Brook, Eye Brook, Fineshade Brook, Uppingham Brook.
- 1.22. The downstream waterbody is Welland – conf Gwash to conf Greatford Cut.

## 2. Expected impact on WFD objectives

2.1. The following table reviews the RBMP plan and specifically for the Welland – conf Langton Bk to conf Gwash of the River Welland.

Receptor	Current status (2016 C2)	Objective	Potential impact	Assessment	WFD compliance	Further assessment
<b>Element – Biological Quality</b>						
Fish	Good	Good 2015	No impact	The scheme will not change any of these parameters significantly. No change – neutral impact on delivery of WFD	Yes	No
Macrophytes and Phytobenthos Combined	Moderate	Moderate 2015	No impact	The scheme will not change any of these parameters significantly. No change – neutral impact on delivery of WFD.	Yes	No
<b>Element – Hydromorphological Supporting Elements</b>						
Hydrological Regime	Supports Good	Supports Good 2015	No impact	The scheme will not change any of these parameters significantly. No change – neutral impact on delivery of WFD.	Yes	No
<b>Element – Physico-chemical quality elements</b>						
Overall	Moderate	Good 2021	No impact	The scheme will not change any of these parameters significantly. No change – neutral impact on delivery of WFD.	Yes	No

<b>Element – Specific pollutants</b>						
Overall	High	High 2015	No impact	No change – neutral impact on delivery of WFD.	Yes	No
<b>Element – Supporting elements – EA not assessed</b>						
<b>Element – Chemical – Overall</b>						
Overall	Good	Good 2015	No impact	The project and its construction will not release, generate or disturb any elements or Substances not currently present in the river body. No change – neutral impact on delivery of WFD.	Yes	No
<b>Element – Chemical</b>						
Other Pollutants	Good	Good 2015	No impact	The project and its construction will not release, generate or disturb any elements or Substances not currently present in the river body. No change – neutral impact on delivery of WFD.	Yes	No
<b>Element – Chemical – Priority hazardous substances – Does not require assessment</b>						
<b>Element – Chemical</b>						
Priority substances	Good	Good 2015	No impact	No change – neutral impact on delivery of WFD.	Yes	No

2.2. All conditions assessed above are shown to have no impact on each individual WFD element.

### 3. Detailed review

3.1. Duddington Mill is located within the Welland – conf Langton Bk to conf Gwash section of the Welland Upper Operational Catchment Area. The Management catchment area is Welland within the Anglian River Basin District.

#### Management catchment summary

- 3.2. The Welland catchment is largely rural, but includes Market Harborough, Stamford, Spalding, north Peterborough, and Bourne. Mixed farming predominates in the catchment, but below Stamford arable and market gardening predominates on the fenland.
- 3.3. The Rivers Welland and Glen are popular with anglers, containing typical coarse fish populations and trout. Otters are becoming increasingly common.
- 3.4. During the 1970s, much of the Welland catchment was altered as part of a flood alleviation and land drainage programme. This changed the natural flow of the river and the efficient land drainage has led to loss of habitat. Due to these modifications it has been hard to achieve good status; however, improvements can be made.<sup>1</sup>
- 3.5. According to the Welland MC Plan 85% of the water bodies in the Upper Welland catchment should have a long term objective of achieving good status/potential.

#### Operational catchment summary

3.6. The Upper Welland catchment includes the River Welland and its tributaries upstream of the Gwash / Welland confluence at Stamford. It is predominately rural with mixed arable and livestock farming.

Ecological and chemical classification for surface waters | 2016 Cycle 2

2016 Cycle 2 ▼

Number of water bodies	Ecological status or potential					Chemical status	
	Bad	Poor	Moderate	Good	High	Fail	Good
20	3	8	8	1	0	0	20

Summary of ecological status or potential and chemical status and objectives for surface water bodies (number of water bodies) including those with less stringent objectives and extended deadlines (blue shaded cells)

	Ecological status or potential						Chemical status		
	Bad	Poor	Moderate	Good	High	Total	Fail	Good	Total
By 2015	0	2	6	2	0	10	0	20	20
By 2021	0	0	0	0	0	0	0	0	0
By 2027	0	0	6	4	0	10	0	0	0
Beyond 2027	0	0	0	0	0	0	0	0	0
Total	0	2	12	6	0	20	0	20	20
	Less Stringent						Less Stringent		

<sup>1</sup> Welland Management Catchment Plan

- 3.7. Within this Management Catchment the ecological status is currently primarily **moderate** with an objective of 6 waterbodies **achieving good** status by 2027. The chemical objective of **good** has been achieved.
- 3.8. Environment Agency analysis suggests that 85% of the water bodies in the Upper Welland catchment should have a long term objective of achieving good status/potential.<sup>2</sup>
- 3.9. The main reason for the Welland Upper catchment not achieving a good ecological water status fall under the Agriculture and rural land management and the Water Industry sector.
- 3.10. Issues impacting the Upper Welland operational catchment have been identified through the Welland Valley Partnership. All of these measures are considered to be needed to improve the water environment to as near to good status/potential as practicable. The following measures to improve the water environment are:

Improve modified physical habitats

- Removal or easement of barriers to fish migration
- Improvement to condition of channel/bed and/or banks/shoreline
- Vegetation Management
- Improvement to condition of riparian zone and /or wetland habitats

Managing pollution from waste water and from towns, cities and transport

- Reduce diffuse pollution at source
- Reduce point source pollution pathways (i.e. control entry to the water environment)
- Mitigate/remediate point source impacts on receptor
- Reduce point source pollution at source

Improve the national flow and level of water

- Control pattern / timing of abstraction

Manage invasive non-native species

- Building awareness and understanding (to slow the spread\_
- Mitigation, control and eradication (to reduce the extent)

Manage pollution from rural areas

- Reduce diffuse pollution at source
- Reduce diffuse pollution pathways (i.e. control entry to water environment)
- Mitigate/remediate diffuse pollution impacts on the receptor

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<sup>2</sup> Welland Management Catchment Plan

**Welland – conf Langton Bk to conf Gwash**

3.11. The 2016 cycle 2 classification for the Welland – conf Langton Bk to conf Gwash is **moderate**. The waterbody is working towards a 2027 objective of good status under the biological classification, its chemical status achieved **good** in 2027. There has been a decline in classification from Cycle 1, in 2014 the ecological status achieved was ‘good’.

**Cycle 2 classifications**

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Classification Item		2013	2014	2015	2016
▼	Overall Water Body	Moderate	Moderate	Moderate	Moderate
▼	Ecological	Moderate	Moderate	Moderate	Moderate
▼	Biological quality elements	Moderate	Moderate	Moderate	Moderate
	Macrophytes and Phytobenthos Combined	<u>Moderate</u>	Moderate	Moderate	Moderate
	Fish	Good	High	-	-
	Invertebrates	-	High	High	High
▶	Hydromorphological Supporting Elements	Supports Good	Supports Good	Supports Good	Supports Good
▼	Physico-chemical quality elements	Good	Moderate	Good	Good
	Ammonia (Phys-Chem)	High	High	High	High
	Biochemical Oxygen Demand (BOD)	High	-	-	-
	Dissolved oxygen	High	High	High	High
	pH	High	High	High	High
	Phosphate	Good	Moderate	Good	Good
	Temperature	High	High	High	Good
▶	Specific pollutants	High	High	High	High
▼	Chemical	Good	Good	Good	Good
▶	Priority substances	Good	Good	Does not require assessment	Does not require assessment
▶	Other Pollutants	Does not require assessment			
▶	Priority hazardous substances	Good	Good	Does not require assessment	Does not require assessment

3.12. The Reasons for Not Achieving Good Status (RNAGS) are due to livestock, sewage discharge (continuous) and poor nutrient management from the agriculture and water industry. The classification elements are Macrophytes and Phytobenthos Combined.

3.13. Appropriate pollution prevention measures will be implemented to protect the River Arrow from leakages of fuels or lubricants from vehicles and equipment and from siltation and run off during the construction period. The Environment Agency’s Pollution Prevention Guidance series is currently under review and at this time is not classed as ‘good practice’. In lieu of any other interim advice or guidance, however, these documents are still considered to provide useful advice on avoiding or minimising the risk of pollution events. There is no requirement to store chemicals, oils of fuels onsite.

3.14. Provided the pollution prevention measures are implemented, the water quality will not be significantly adversely affected by the proposal.

- 3.15. The proposed development will not introduce any chemicals or pollutants into the waterbody and therefore will not have a negative impact on the waterbodies chemical status. In addition the development will not contribute towards further Macrophytes and Phytobenthos intrusion.

## Biodiversity and fish passage

- 3.16. A fish pass and gravity fed eel pass was installed by the Environment Agency in 2013 at Duddington Mill Weir to comply with the Eel Regulations 2009, the Salmon and Freshwater Fisheries Act 1975, and the Water Framework Directive. The River Welland Monitoring Report<sup>3</sup> concludes that following monitoring during 2014 the passes at Duddington have provided effective fish passage over previously unassailable barriers. Despite the fact that the monitoring was undertaken outside of the peak migration periods for the main species in the River Welland, the results clearly show a range of species can utilise the passes in both an upstream and downstream direction.
- 3.17. The proposal includes the installation of an eel pass next to the waterwheel. A bywash channel is located immediately adjacent to the scheme which will provide an alternative downstream route for fish.
- 3.18. The existing fish pass is successful, in part, due to the low flows over the weir as any significant flow over the weir would attract fish to the weir rather than the fish pass, during low flows the weir is currently running dry. Due to this, it is proposed that the development will take less than the mean flow (Q90 HOF) to ensure that the fish pass gets plenty of flow for the higher-flow half of the year.
- 3.19. Between the water wheel start-up and maximum flow rate it will keep the upstream (leat) water level constant, which will mean that there will be no overflow over weir until the water wheel reached maximum flow rate, then the upstream water level would begin to increase and the excess flow flowing over the weir. This should prevent a 'distractant' flow over the weir and actually help the fish pass.
- 3.20. The water wheel will be screened in-line with EA guidance. These screens will be manually raked. Generally waterwheels are 'fish friendly'.
- 3.21. The site is located 1.5km west from Collyweston Great Wood and Easton Hornstocks Site of Special Scientific Interest and National Nature Reserve. Luffenham Heath Golf Course SSSI is located 2.5km north west.
- 3.22. The proposed scheme is not expected to have an adverse impact on the nearby designated sites.

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<sup>3</sup> River Welland fish pass update and monitoring report 2014

- 3.23. Overall the hydropower scheme will not compromise the effectiveness of the existing fish pass or eel pass.

## Hydromorphology

- 3.24. It is anticipated that there will be no significant changes in sediment transfer and/or composition of the river bed and banks downstream due to the low speed flows through the waterwheel. In major flood events the HEP will shut down and the bypass will remain open so during the periods of greatest geomorphological change, the site will be almost as-existing.
- 3.25. There will be no significant impacts to the hydrology during construction. The construction will take place within the existing channel, and flows will be unaltered until the turbines are commissioned.
- 3.26. In summary, the proposed development is deemed highly unlikely to result any significant hydromorphological changes.

## 4. Conclusion

- 4.1. Overall, this proposal is not expected to impact negatively on the current status of the water body and will not have an adverse impact on meeting future WFD objectives.