

## **Yorkshire Water**

# **AMP 5 Batch 9: Silkstone Bank Stabilisation Works**

Flood Risk Assessment

October 2011

AMEC Environment & Infrastructure UK Limited



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**Report for**

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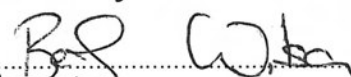
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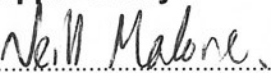
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Doc Reg No. 28412/Reports/rr001i1

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## Yorkshire Water

### Batch 9: Silkstone Bank Stabilisation Works

Flood Risk Assessment

October 2011

AMEC Environment & Infrastructure  
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## Document Revisions

| No. | Details | Date     |
|-----|---------|----------|
| 1   | Report  | 12/10/11 |



# Contents

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|            |                                                                                                     |           |
|------------|-----------------------------------------------------------------------------------------------------|-----------|
| <b>1.</b>  | <b>Introduction</b>                                                                                 | <b>1</b>  |
| 1.1        | Context                                                                                             | 1         |
| 1.2        | Sources of Data and Consultation                                                                    | 1         |
| 1.3        | Structure of Report                                                                                 | 1         |
| 1.4        | Return Periods and Flood Event Probability                                                          | 2         |
| <b>2.</b>  | <b>Site Description and Development</b>                                                             | <b>3</b>  |
| 2.1        | Site Description                                                                                    | 3         |
| 2.1.1      | Topography                                                                                          | 3         |
| 2.1.2      | Watercourses                                                                                        | 3         |
| 2.1.3      | Geology and Hydrogeology                                                                            | 3         |
| 2.2        | Development Proposal                                                                                | 4         |
| 2.3        | Planning Context                                                                                    | 4         |
| <b>3.</b>  | <b>Flood Risks</b>                                                                                  | <b>7</b>  |
| 3.1        | Fluvial                                                                                             | 8         |
| <b>4.</b>  | <b>Mitigation</b>                                                                                   | <b>9</b>  |
| 4.1        | Fluvial                                                                                             | 9         |
| <b>5.</b>  | <b>Conclusions</b>                                                                                  | <b>11</b> |
| Table 1.1  | Sources of Information                                                                              | 1         |
| Table 2.1  | Flood Risk Vulnerability and Flood Zone 'Compatibility' (reproduced from PPS25, Annex D, Table D.3) | 5         |
| Table 3.1  | Potential Sources of Flood Risk                                                                     | 7         |
| Figure 3.1 | EA Flood Map                                                                                        | 8         |

Appendix A Figures

Appendix B EA data and Correspondence

# 1. Introduction

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## 1.1 Context

AMEC Environment and Infrastructure UK Ltd (AMEC) have been commissioned by Yorkshire Water (YW) to undertake a Flood Risk Assessment (FRA) to support a planning application for proposed bank stabilisation works on the access road to Silkstone Sewage Treatment Works (STW). The site is located at national grid reference (NGR) 429461 406440, and is shown on Drawing 2010/D0023/10/3009 (Appendix A).

This FRA has been prepared in line with the requirements of national planning guidance in the form of *Planning Policy Statement 25 (PPS25): "Development and Flood Risk"*, and its accompanying practice guide. This assessment will consider the risk to the proposed works from all forms of flooding, as well as the impact of the proposed works on flood risk elsewhere. Strategies will then be developed in order to mitigate any flood risks identified.

## 1.2 Sources of Data and Consultation

Data and other sources of information collected during the assessment are listed in Table 1.1

**Table 1.1 Sources of Information**

| Topic               | Source of Information                                                                                                                                                           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sources of Flooding | Environment Agency (EA) Flood Map 2011                                                                                                                                          |
| Topography          | OS Explorer 1:25,000 Ordnance Survey Map 278, Sheffield and Barnsley.<br><br>Existing site survey (Drawings Ref E2010/D0023/10/1015, Appendix A)                                |
| Geology             | British Geological Society Geoindex<br><a href="http://www.bgs.ac.uk/geoindex/">http://www.bgs.ac.uk/geoindex/</a>                                                              |
| Hydrogeology        | EA What's in my Backyard Website<br><a href="http://www.environment-agency.gov.uk/homeandleisure/37793.aspx">http://www.environment-agency.gov.uk/homeandleisure/37793.aspx</a> |

## 1.3 Structure of Report

The structure of the report is as follows:

- Section 2 – description of existing site conditions;
- Section 3 – outline of potential flood risk issues for this site;
- Section 4 – discussion of the flood risk management and mitigation;

- Section 5 – recommendations and conclusions;
- Appendix A - Drawings;
- Appendix B – EA data and correspondence;

## 1.4 Return Periods and Flood Event Probability

Throughout this report “Annual Exceedance Probability” (AEP) terminology is used to describe the magnitude and return period of a flood event. AEP is the preferred terminology, as it expresses the probability of a flood occurring in a given year. For example, what is commonly referred to as a ‘1 in 50 year flood event’, is a flood with a 2% probability of occurring in any given year. Use of the AEP terminology makes it clearer that there is a risk of this magnitude of flooding occurring in any one year, not just once every 50 years.

In this report:

- 5% AEP – 1 in 20 year flood event (one of the definitions of PPS25 Flood Zone 3b);
- 1% AEP – 1 in 100 year flood event (defines PPS25 Flood Zone 3a where caused by fluvial flooding);
- 1% AEP + climate change – 1 in 100 year flood event including allowance for increase in flow due to climate change;
- 0.5% AEP – 1 in 200 year flood event (defines PPS25 Flood Zone 3a where caused by tidal flooding);
- 0.1% AEP – 1 in 1000 year flood event (defines PPS25 Flood Zone 2).

## 2. Site Description and Development

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### 2.1 Site Description

The proposed works are located at NGR 429461 406435 to the north east of Silkstone Village, in South Yorkshire. There is an existing gravel access track to Silkstone STW which is to the north east of the access track. To the north of the track there is a meander of the Banks Bottom Dike, which is a tributary of the Silkstone Beck. The south, east and west is bounded by wooded areas. A site location plan is provided on Drawing 2010/D0023/10/3009 (see Appendix A).

#### 2.1.1 Topography

Elevations were approximated from an existing site layout drawing, for the proposed works location and the area in the immediate vicinity (Drawings Ref E2010/D0023/10/1015, Appendix A).

The access track elevation is approximately 99.51mAOD and the bed level of the Banks Bottom Dike is approximately 95.86mAOD. The existing banking where the proposed gabions will be is a steep gradient of approximately 1 in 4, photos of the bank and details of the bank profile can be seen on drawings E2010/D0023/10/1011 and 1015 in Appendix A.

#### 2.1.2 Watercourses

The Banks Bottom Dike flows in an easterly direction to the north of the access track before joining the Silkstone Beck at the south east of the STW at NGR 429487 406434, as shown on drawing E2010/D0023/10/1015 in Appendix A. Review of version 3 of the FEH CD Rom shows the upstream catchment of the Banks Bottom Dike as being 3.91 km<sup>2</sup>. Correspondence from the EA which is included in Appendix B confirms that Banks Bottom Dike is classed as an ordinary watercourse.

#### 2.1.3 Geology and Hydrogeology

The BGS Geoindex<sup>1</sup> indicates that there are bedrock layers of Pennine Lower Coal measures and South Wales Lower Coal Measures. No superficial deposits are indicated as being in this area on the BGS Geoindex.

The Groundwater Aquifer Designation Map<sup>2</sup> of the region classifies the development site as being underlain by a Secondary A bedrock aquifer. This represents permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers representing a formation generally regarded as containing insignificant quantities of groundwater.

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<sup>1</sup> <http://www.bgs.ac.uk/geoindex/>

<sup>2</sup> Environment Agency Whats in your backyard Website <http://www.environment-agency.gov.uk/homeandleisure/37833.aspx>

## 2.2 Development Proposal

The proposed works to stabilise the river bank and prevent erosion undermining the access track will comprise the following;

- Placement of 50 gabion baskets within the river bank, care will be taken to ensure that the existing bank profile is maintained
- At the bottom the gabion baskets a concrete mesh reinforcement will be constructed to prevent scour, this will be placed below the bed level.

This Flood Risk Assessment is provided in support of Yorkshire Water's planning application for the proposed river bank stabilisation works.

## 2.3 Planning Context

The basic principle underpinning PPS25 is that spatial planning policy should be used to minimise flood risk wherever possible. The two key mechanisms for achieving this are the Sequential and Exception Tests. Planning authorities are required to apply these tests when considering applications for new developments. Briefly, the Sequential Test seeks to steer new development to areas of lowest possible flood risk. The Exception Test is applied only in cases where development has to proceed in flood risk areas. This seeks to demonstrate that the flood risk has been satisfactorily mitigated, and that the wider benefits of development in this location outweigh the flood risk.

Requirements for Sequential and Exception testing are based on a joint assessment of the probability of flooding (based on EA Flood Zones or, if available, a Strategic Flood Risk Assessment), and the vulnerability classification of the proposed development (full details are provided in Annex D of PPS25).

In this case, the development site is shown within Flood Zone 2 and 3 according to the EA Flood Map, signifying a medium to high risk of flooding with respect to the Banks Bottom Dike. The flood zone compatibility from PPS25 is provided below in Table 2.1 (Table D.3 from PPS25 - Annex D). As a STW, the upgrade works would be classified as 'Less Vulnerable' within the context of PPS25. This type of development is appropriate in Flood Zones 1, 2 and 3a therefore no Exception Test will be required as shown in Table 2.1.

**Table 2.1 Flood Risk Vulnerability and Flood Zone 'Compatibility' (reproduced from PPS25, Annex D, Table D.3)**

| <b>Flood Risk Vulnerability Classification</b> | <b>Essential Infrastructure</b>     | <b>Water Compatible</b> | <b>Highly Vulnerable</b> | <b>More Vulnerable</b>  | <b>Less Vulnerable</b> |
|------------------------------------------------|-------------------------------------|-------------------------|--------------------------|-------------------------|------------------------|
| Flood Zone 1                                   | ✓                                   | ✓                       | ✓                        | ✓                       | ✓                      |
| Flood Zone 2                                   | ✓                                   | ✓                       | Exception Test Required  | ✓                       | ✓                      |
| Flood Zone 3a                                  | Exception Test Required             | ✓                       | ✗                        | Exception Test Required | ✓                      |
| Flood Zone 3b 'Functional Floodplain'          | Exception Test Required             | ✓                       | ✗                        | ✗                       | ✗                      |
| ✓                                              | Development is appropriate          |                         |                          |                         |                        |
| ✗                                              | Development should not be permitted |                         |                          |                         |                        |

The development footprint of the bank stabilisation works is approximately 30m<sup>2</sup>. As per PPS25 guidance, this is classified as a Minor Development" and as such is not subject to the Sequential or Exception Tests.



### 3. Flood Risks

The potential sources of flooding that have been considered within this assessment are summarised in Table 3.1.

**Table 3.1 Potential Sources of Flood Risk**

| Flooding Source                                 | Risk Identified | Source            | Pathway                                                                                                                                                                                                                                                                   |
|-------------------------------------------------|-----------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fluvial                                         | Potential       | Banks Bottom Dike | Overland from the Banks Bottom Dike, the gabion baskets are however permeable and will be set back from the river bank and will therefore increase the available bankside storage. Care will be taken to ensure that the gabion baskets follow the existing bank profile. |
| Tidal                                           | No              |                   | The site is not affected by tidal flood risk given that its location is far removed from the coastline                                                                                                                                                                    |
| Groundwater                                     | No              |                   | Groundwater levels are thought to be in hydraulic continuity with the Banks Bottom Dike, the development will not be affected by groundwater flooding.                                                                                                                    |
| Sewers                                          | No              |                   | Overtopping of the STW infrastructure. Not a flood risk given that the STW has been designed appropriately to avoid flooding. This development will also not affect the STW.                                                                                              |
| Surface Water Run on                            | No              |                   | The access track is gravel and will allow flows to percolate into the ground, the proposed works will not increase surface water run on.                                                                                                                                  |
| Surface Water Run off                           | No              |                   | The gabion baskets are permeable and will therefore not increase surface water runoff, they will provide a slight increase surface water storage due to their permeable nature.                                                                                           |
| Reservoirs, Canals and Other Artificial Sources | No              |                   | Review of the EA online reservoir map indicates that there reservoirs within the vicinity of the site, and therefore no predicted flood risk from reservoir breach.                                                                                                       |

The potential sources of flood risk to the site that will be elaborated upon in the remainder of this section are:

- The fluvial flood risk caused by the gabion baskets being placed by the Banks Bottom Dike watercourse.

The EA's Flood Map covers the whole of England and Wales. It is based on relatively broad scale modelling. An extract of the Flood Map provided by the EA is presented in Figure 3.1.

**Detailed FRA Map Centred on Silkstone - Date Created 27/06/2011 [Ref: 17352]**

The map shows the River Don flowing through the town of Silkstone. A pink line indicates the 'Main River' section. A black box with an arrow points to a specific location on the river, labeled 'Approximate location of proposed works'. The map includes various landmarks such as Hill House Farm, Upper Noicroft, Lower Noicroft Farm, Banks Hall Farm, and Silkstone Golf Club. A scale bar indicates 1:10,000. A legend identifies the 'Main River' with a pink line. An inset map shows the location of the study area within the Yorkshire region, with major cities like York, Leeds, Manchester, and Sheffield marked.

**Environment Agency**  
www.environment-agency.gov.uk

Scale: 1:10,000

when reproduced @ A3

**LEGEND**

— Main River

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Light blue - Flood Zone 2 Fluvial: Extent of flood from rivers with a 0.1% (1 in 1000) chance of happening in any given year

The STW is identified by the Flood Map as being located in Flood Zones 2 and 3. Flood Zones 2 and 3 represent an area with a medium to high probability of flooding. PPS25 guidance indicates that development is appropriate within Flood Zone 3b as it is classified as being water-compatible development. In the absence of specific guidance, Flood Zone 3b is generally represented by a 5% AEP event. Care should however be taken to ensure that the development does not increase flood risk by reducing flood plain storage and as a result cause an increase in flood risk, this is discussed further in section 4 of this report.

## 4. Mitigation

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### 4.1 Fluvial

The proposed works lie within Flood Zone 2 and 3, described as having a medium to high risk of flooding, with respect to the Banks Bottom Dike. There is a potential to increase upstream flood risk by intruding into the existing flood plain and reduce flood plain storage which could cause flows to back up and cause an increase in flood risk upstream.

The initial design proposed that the gabion baskets would be placed within the watercourse, this has been revised to ensure that the gabions follow the existing bank profile as shown in drawing 2010/D0023/10/1011 in appendix A. The works will remove part of the existing river bank to allow the placement of the gabion baskets. This will increase the bankside flood plain storage due to the permeable nature of the gabion baskets.

The nearest buildings are approximately 240m upstream, which are the disused buildings from a former mine workings which are predicted as being within flood zone 2 according to the EA flood maps. As noted the proposed works are unlikely to impact upon the flood plain storage and will therefore not affect these buildings. Based on OS mapping and aerial maps there are no other properties upstream of the buildings within the vicinity of the Banks Bottom Dike. The EA have been contacted and have confirmed that they agree with the findings of this FRA as detailed in the e-mail in Appendix B.

As an alternative to gabion baskets natural river restoration techniques were also explored such as willow spiling and log toe reinforcement. These were considered to be inappropriate due to the proximity of the existing access track and the structural load placed on this by site traffic to and from the STW.

All works will be undertaken from the bank and existing access track, machinery will not be placed within the watercourse. As part of the construction works the contractor will prepare a construction method statement (CMS) to demonstrate which measures will be undertaken to ensure that the risks to the water environment are minimised in terms of water quality and flood risk. At construction stage an application will be made to the EA for consent for works affecting watercourses and/or flood defences, works will not commence until the EA have given formal consent for this work to progress. It should be noted that a consent for works can take up to two months to be processed by the EA.



## 5. Conclusions

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A Flood Risk Assessment has been carried out for the proposed bank stabilisation works to the gravel access track at Silkstone STW according to the requirements of PPS25. The FRA reviewed all potential sources of flooding and found that, fluvial flooding, associated with the nearby Banks Bottom Dike, posed the most significant flood risk to the site.

Care has been taken when designing the gabion basket placement to follow the existing bank profiles, to ensure that flood plain storage is not reduced as a result of the proposed works. Excavation of the existing river bank will cause a slight increase in the floodplain storage due to the permeable nature of the gabion baskets. There are no inhabited properties upstream of the proposed development, the only property being buildings for an abandoned mine working, it is considered that these will not be affected by the proposed works. Appendix B contains an e-mail from the EA confirming that the FRA meets with the EA's requirements.

Before any works progress an application will be made to obtain a consent for works affecting watercourses, which can take up to two months to be processed by the EA.. The proposed works are considered appropriate at this location from a flood risk point of view.