

Land to the East of Bicker Fen, Lincolnshire

Hydrological Analysis

Technical Note

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Introduction

1. Weetwood Services Ltd ('Weetwood') has been instructed by Axis PED to prepare a Technical Note in association with the proposed development of a solar farm at Bicker Fen, Lincolnshire.
2. The proposed solar farm development includes a maintenance track crossing Hammond Beck to link the eastern and western parcels (**Figure 1**).
3. This Technical Note presents an assessment of the flows expected along Hammond Beck in the location of the proposed channel crossing, and the dimensions of the proposed culvert.

Hydrological Assessment

4. LiDAR data has been used to develop a digital terrain model of the site and surrounding area, as illustrated in **Figure 3**. This indicates that levels across the site are generally shown to range between 1.0 and 5.0 m AOD. Ground levels in the area of the proposed Hammond Beck crossing are in the region of 2.28 to 2.44 m AOD.
5. LiDAR data has also been used to provide an indication of the channel bed profile and a section drawing is provided in **Figure 3**. The channel is approximately 19.5 m wide at top of bank and 4 m wide at bottom of bank. The channel bed level is also shown to be approximately 0.6 m AOD. The channel profile should be confirmed a topographical survey prior to undertaking the detailed design of the propose channel crossing.
6. The site falls within the Black Sluice Internal Drainage Board (IDB) area. The Black Sluice IDB website¹ provides pumping station and catchment information for the site. This indicates that at the proposed channel crossing is located at the boundary between three pumped catchments, as illustrated in **Figure 4** and described below:
 - Donnington North Ing pumping station - located approximately 2.5 km upstream of the site and pumps to the South Forty Foot Drain at a rate of 3.06 cumecs.
 - Bicker Fen pumping station – located 2.5 km downstream of the site and pumps water to the South Forty Foot Drain at a rate of 1.42 cumecs.
 - Swineshead pumping station – located 6.1 km downstream of the site and pumps water to the South Forty Foot Drain at a rate of 6.80 cumecs.
7. The Black Sluice IDB pumping station information indicates that water is pumped from Hammond Beck both upstream and downstream of the site. It is proposed to size the culvert to convey the largest pump rate in either direction. As such, the culvert should be sized to convey a peak flow rate of 8.22 cumecs (summation of Bicker Fen and Swineshead pumping station capacities).

Culvert Capacity

8. A box culvert with dimensions 3.0 x 1.8 m (width x height) has an approximately capacity of 10.00 cumecs².

¹ <http://www.blacksluiceidb.gov.uk/about/pumping-stations/>

² <https://fpmccann.co.uk/portfolio-items/box-culverts/>

9. LiDAR data has been utilised provide a channel cross section at the location of the proposed maintenance track. This indicates that a 3.0 x 1.8 m box culvert with a 10 cumecs capacity will comfortably fit within the channel and without throttling flow within Hammond Beck.
10. If the peak flow rate exceeds the pumped rate within the catchments, the water level within the network of ditches would be expected to increase uniformly until water overtops the bank and the proposed culvert is bypassed. Therefore, based on the way flood waters are routed between the network of ditches within the catchments to the South Forty Foot Drain, providing a freeboard on a peak flow rate is not considered necessary.

Summary and Recommendations

11. The proposed solar farm development located at land east of Bicker Fen includes the construction of a maintenance track crossing Hammond Beck to link the eastern and western parcels.
12. The proposed channel crossing is shown to be located at the boundary between three IDB pumping station catchments; Donnington North Ing located upstream, Bicker Fen and Swineshead located downstream. The combined pumping rate of the downstream pumping stations has been calculated to be 8.22 cumecs.
13. A 3.0 x 1.8 m box culvert has a capacity of approximately 10.00 cumecs and can be accommodated within the Hammond Beck channel.
14. Based on the way flood waters are routed between the network of ditches within the catchments to the South Forty Foot Drain, providing a freeboard on a peak flow rate is not considered necessary.

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FIGURES

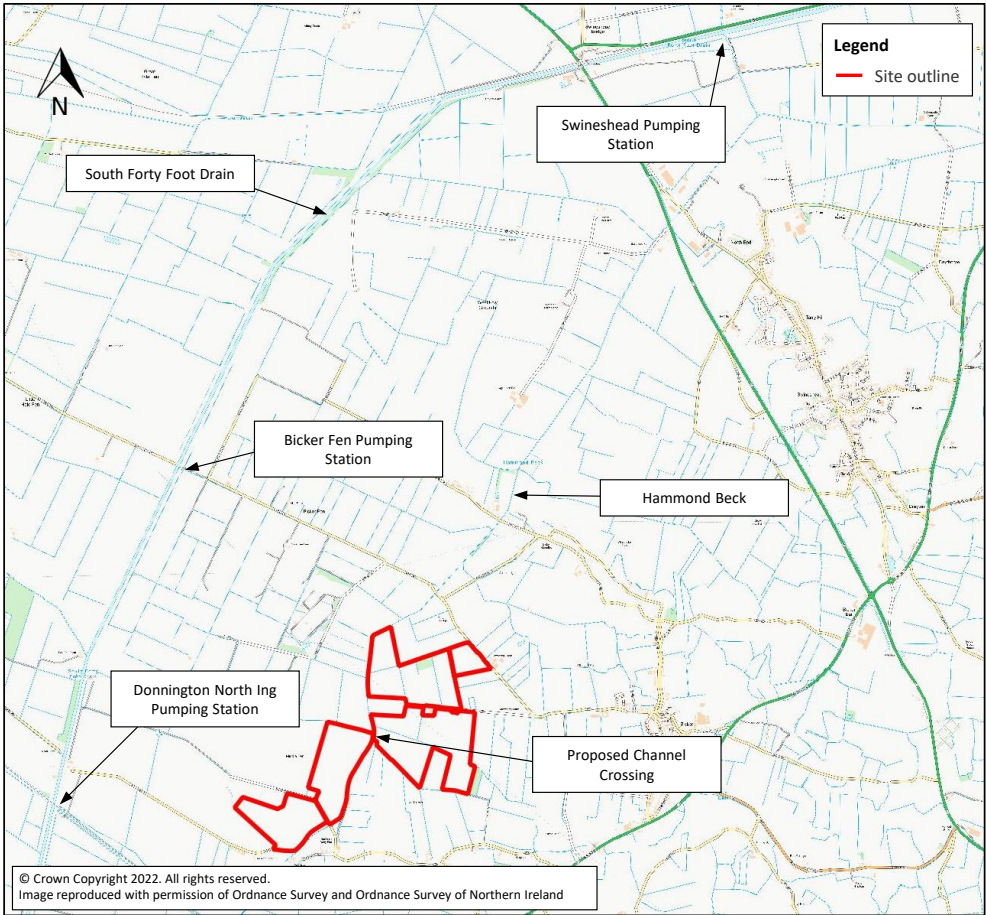


Figure 1: Site Location

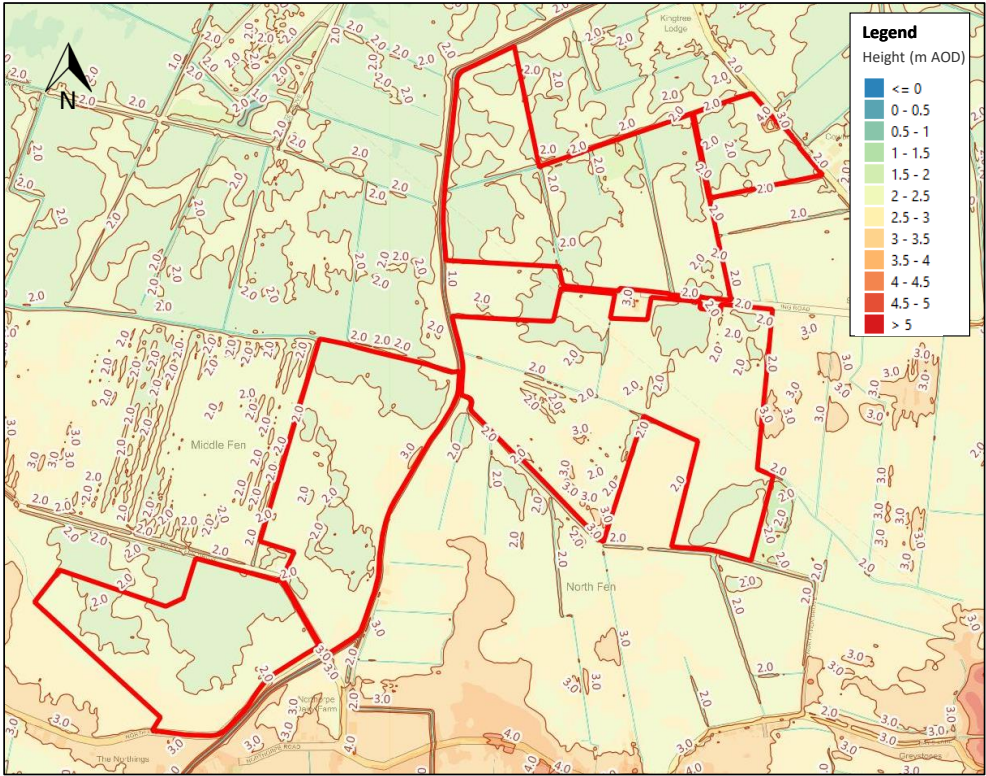


Figure 2: Digital Terrain Model from LiDAR Data

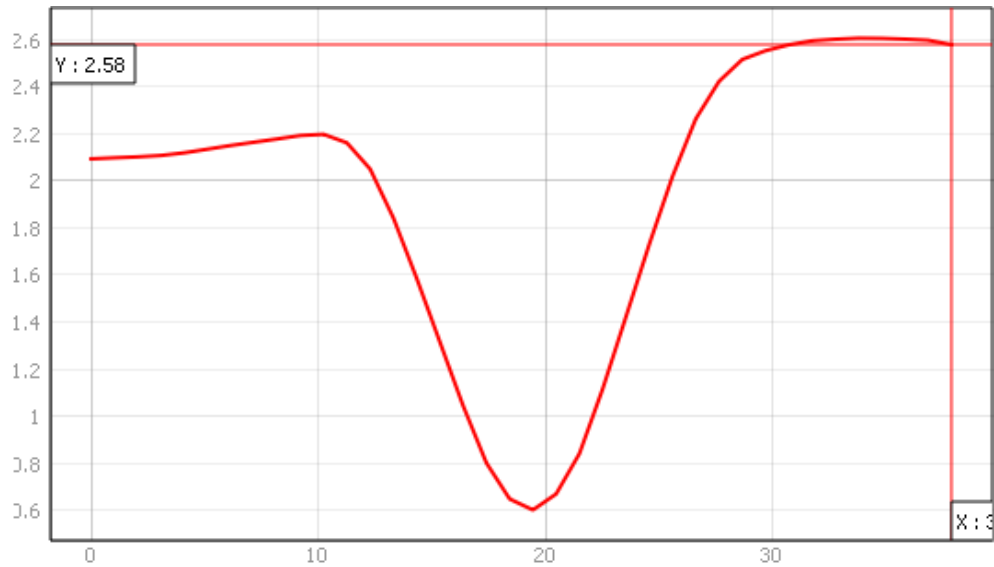


Figure 3: Hammond Beck Channel Cross-section

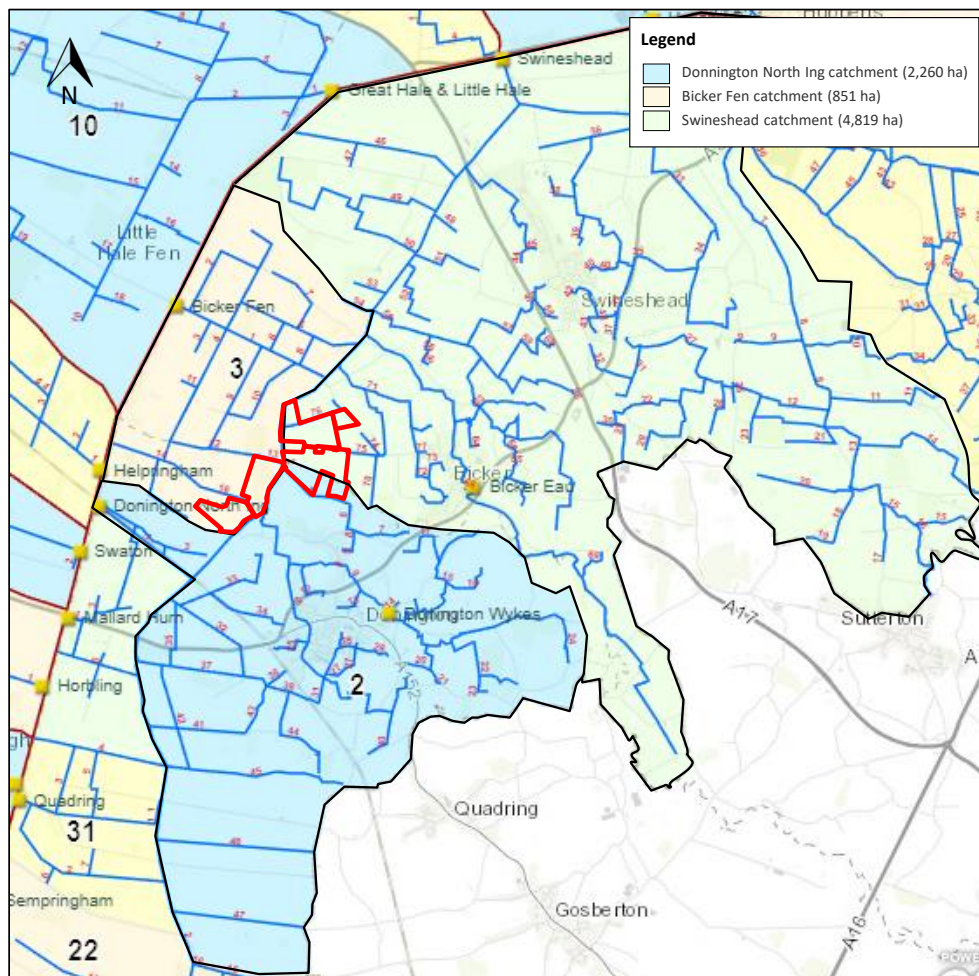


Figure 4: IDB Catchments

Source: Black Sluice Internal Drainage Board website; Accessed: May 2022

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