

BONFIELD GILL AQUEDUCT,
POCKLEY MOOR, NORTH YORK MOORS

ARCHAEOLOGICAL SURVEY



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On behalf of

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1 INTRODUCTION

- 1.1 In April 2012, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by the North York Moors National Park Authority (NYMNP) to produce an archaeological management plan for the remains of the 18th century water races within the Bransdale Moors Higher Level Stewardship (HLS) agreement area, North York Moors National Park. The management plan was funded by Natural England, on behalf of the Bransdale Moor ESS Partnership.
- 1.2 As part of the preparation of this management plan, an archaeological survey of the remains of the Bonfield Gill aqueduct was carried out. This new survey was then used to produce a detailed specification for the consolidation and stabilisation of the structure.

2 BACKGROUND INFORMATION

The Foord Water Races

- 2.1 The 18th century water races are a network of gravity-fed water supply leats which were constructed by Joseph Foord (1714-1788) to carry water from the high moors to various farms and villages on their southern fringes. While the water races do not necessarily stand out as particularly prominent landscape features, they are a work of remarkable surveying skill. Their alignments can be traced across the landscape and in open moorland are visible across large distances. Where they survive, the races are represented by shallow ditches with low embankments, particularly on the downhill side, which closely follow the contours. In many places, they have structures associated with them, such as stone culverts or water smoots where they pass beneath field walls, and 'brigsons' where stone slabs are laid across them to carry paths and tracks.

Site Location and Summary Description

- 2.2 The Bonfield Gill aqueduct lies in the upper reaches of Bonfield Gill, between Bonfield Gill Bridge and Cinderhill Wath, on Pockley Moor (at NGR SE 61020 93835) (see figure 1). The Bonfield Gill bridge carries the unclassified Carlton-Bransdale road, and the aqueduct lies c.10km to the north of Helmsley.
- 2.3 The aqueduct forms part of the Nawton water race, which was one of Foord's major constructions, being 15.2km (9.4 miles) long, starting at Piethorn Spring and terminating at Nawton village; overall, the gradient was 1 in 90. Foord's intention was to supply water to the villages of Nawton and Beadlam, and the agricultural land in Nawton, Skiplam and Welburn townships, as well as two farms in Wombleton and the gardens and fishpond of Welburn Hall. The source spring, adjacent to Piethorn Farm, supplied a copious amount of water for the race; in 1904 it was said to yield 80,000 gallons every 24 hours. Additional water was obtained by constructing a dam across the Bonfield Gill upstream from the aqueduct, and from several springs along the route. The Nawton race and its associated Skiplam Rigg race were constructed by early 1760 (McLean 2005, 136-147). The majority of the alignment is shown on the Ordnance Survey 1st edition 6" maps (sheets 58, 73, 74, 89 and 90)
- 2.4 The aqueduct is formed by two stone-built piers or abutments positioned either side of the beck, which were connected by a wooden launder. Water was guided into the launder by carved stone channels. The aqueduct was built to take the

water from the Piethorn spring across the gill, to link with the main Nawton water race which ran along the east side of the gill.

Aims and Objectives

- 2.5 The primary aim of the archaeological survey work was to provide a photographic, drawn and written record of the aqueduct. The survey results would then help to inform the proposals for a restoration project, and would make appropriate recommendations for any mitigation work as part of the proposed restoration work, as part of a wider management plan for the water races within the Bransdale Moors HLS agreement area.

Survey Methodology

- 2.6 The archaeological recording comprised four main elements, namely documentary research, and drawn, photographic and written recording. Together, the four elements equate to a Level 3 analytical record as defined by English Heritage (2006, 13-14). The on-site drawn and photographic recording was undertaken on 11th July 2012.
- 2.7 A plan, the elevations of the north and south faces of the aqueduct's piers, and a profile across the east pier, were drawn at a scale of 1:50. A 1:5 scale section through a typical stone water channel was also drawn. All information for the drawings was captured using traditional hand measurement techniques, and the two piers were tied together by running a tape across the beck. A hand-held GPS was also used to obtain an approximate height AOD for the aqueduct, and this has been transferred to the site drawings. The resulting plan shows all significant structural detail such as openings (blocked or unblocked), fittings, sockets, stone troughs etc, while the elevations show all significant architectural and structural features such as construction detail, modifications and differences in fabric, any specific structural stones or dressings around openings and at corners, and the principal vulnerabilities of the structural remains; stone-by-stone drawings were not required to be produced. Final inked drawings were then produced by hand to publication standard and are presented as reduced versions of the full sized field drawings using conventions established by English Heritage (2006, 18-37).
- 2.8 The photographic record was achieved using a digital camera, with 10 megapixel resolution. Once again, English Heritage guidelines were followed (English Heritage 2006, 10-13). Subject to access, all photographs contain a graduated scale. The photographic record (see Appendix 1) includes a register detailing the location and direction of each shot, a figure showing the position and direction of each shot, and thumbnails of the photographs; selected larger prints accompany the main text of the report. A full set of photographic prints has been included with the project archive.
- 2.9 The full archive, comprising paper, magnetic and plastic media, relating to the project has been ordered and indexed according to the standards set by English Heritage (EDAS site code BGA 12). It was deposited with the NYMNP A on completion of the project.

3 HISTORICAL INFORMATION

- 3.1 The aqueduct is named and marked on both the Ordnance Survey 1857 6" map (sheet 58) and the 1912 25" map (sheet 58/15), with the Nawton water race depicted as crossing the Bonfield Gill (see figure 2). Some information on the

operation and management of the aqueduct can be obtained from the day book of George Wright, the waterman charged with looking after the Nawton and Beadlam water races between 1879 and 1899. His entries show that the aqueduct was out of action between 1879 and 1881, due to an adjacent landslip and damage to the aqueduct itself (McLean 2005, 142-143). In December 1880 he records: "*Manual Barr Bransdale, putting up the Budment, Eastmoors, that brings the water over from the Eastmoors into the Main Race, he finished it on 16th December 1880*". In April 1881 he notes: "*I put the Water a cross the Wood Trough from the East Moors. It had not run a cross the Wood Trough, very near two years[;] one pillar was down about a year, it comes over very well now*". In the same month he records: "[expenses] *Manuel Barr, Bransdale Bill, for putting up a Butment west side of Burnfield Gill ... £1.15sh ... I was helping him and William Handley, son, Mason, Spaw [in Sleightholme Dale]*". It also seems that the aqueduct was used to take water piped under pressure from the Piethorn Spring as part of an 1907 water supply improvement scheme - this presumably means that pipes were laid along the aqueduct.

- 3.2 The aqueduct was repaired again in the summer and autumn of 1964 by several members of the Ryedale Archaeological Society (Grayson 1965). It was reported that the damage had been caused by vandalism rather than erosion, that the east pier was less damaged than the west, and that the structure consisted of a stone casing with an earth and rubble fill. The top 4ft of the east pier needed to be completely rebuilt, using large stones recovered from the beck, the centre was re-filled with small stones and earth, the topmost course of stone was cemented into place, and a thin layer of soil was scattered on the top and seeded with grass. A similar procedure was followed for the west pier although, as much of the stone had washed away, new stone was brought from a nearby quarry, probably used by the original builders. The remaining stone trough sections which were found during the reconstruction were placed on the top of the final grassed-down soil fill. Wooden notice boards were also erected on either side. It is fortunate that some records of the repairs were kept, including photographs and a drawing (see figures 3 and 4).
- 3.3 McLean also notes that the aqueduct was restored again in 1982, by the North York Moors National Park and volunteers from the British Trust for Conservation (McLean 2005, 147). It is assumed that some of the stone trough sections were positioned on the tops of the piers then, although it is not known precisely how much work was done. At a public lecture in 1997 one of the volunteers said that a section of the eastern race was also cleared out, and a plaque that was erected unfortunately misdated the race and underestimated its length. McLean publishes a photograph of the repaired aqueduct (McLean 2005, 91 colour figure 10) (see figure 5), which was probably taken between 1995 and June 2005 (Graham Lee, NYMNP archaeologist, *pers. comm.*).
- 3.4 The aqueduct was recorded by the Helmsley Archaeological and Historical Society (Barbara Hickman and Tony Wright) on 24th February 2008. They note that the "*west pier [is] severely damaged - much missing (and carried tens of metres down the gill) and erosion is removing its base. The east pier is almost intact but is collapsing inwards, as it has been eroded beneath, and is being supported by a large fallen, wedged stone. The next flood could remove the structure entirely*". A number of photographs were taken (2008_02_24B nos 41-59) as part of the recording exercise (see figure 5). This damage was largely caused by a severe flood in June 2005.

4 SURVEY RESULTS

Introduction

- 4.1 In the following description, reference should be made to the plan and sections (see figure 6) and the illustrative plates. The photographic record appears as Appendix 1; photographs are referenced in the following text in bold type and square brackets, the numbers before the stroke representing the film number and the number after indicating the frame e.g. [1/32].

Description

- 4.2 The aqueduct is located in the narrow base of Bonfield Gill, a steep sided natural valley [1/627, 1/628 and 1/640] (see plate 1). The Piethorn branch of the Nawton water race [2/247] formerly ran up the west side of the valley to the west pier of the aqueduct. Water was then taken across the beck via stone channels on top of the piers and a wooden launder spanning the gap, to join with the main Nawton race running south along the east side of the valley [1/653].
- 4.3 Both piers are built of roughly coursed and squared sandstone, with dressed stone channels in sections to the upper part; there is a slight batter to both the north and south faces, but the west end of the east pier, which is relatively complete, is nearly vertical in profile [2/242]. It appears that the piers were originally built as drystone structures, but that extensive use of a sandy mortar was made during repairs carried out in the 1960s (and possibly subsequently?). The aqueduct, from end to end, has a total visible length (east-west) of 16.20m, the gap between the beck 'faces' of the piers currently measuring c.5.90m although it was obviously considerably less in the past, perhaps 3.50m (see below).

West pier

- 4.4 The water race approaching the west pier was very overgrown at the time of the survey, but measures c.1.0m across the top, with steeply sloping sides and a relatively flat bottom. The east side is embanked and, where it approaches the pier, the inner scarp is up to 0.40m in height. Close to the pier, the northern side is edged with upright stones, which guide the water around and into the stone channel set on the top of the pier [1/652]. More of this kerbing is visible on a colour photograph taken after the 1982 restoration (see figure 5).
- 4.5 The stone channel on the west pier is constructed in sections [1/648 to 1/650]. There are currently two surviving sections (see plate 3), but the colour photograph taken after the 1982 restoration works shows a third section, now lost; all parts of the channel were positioned here during the 1964 works (see below). Of the surviving sections, both are on average 0.45m to 0.50m wide, and stand 0.35m in height. The base of each section is 0.20m deep, leaving a channel 0.15m deep with sides 0.10m wide. The longest of the surviving sections measures 1.30m in length, and both have prominent diagonal tooling marks to their external and internal faces. The stone channel is not located centrally on the pier below.
- 4.6 The surviving section of the western pier has a maximum visible length of 2.80m and a maximum width of 2.0m across the base, and it stands up to 2.0m in height (excluding the stone channels), both the north [1/643, 1/644, 2/248 and 2/249] and south [1/651] faces being much reduced (see plate 4). A report accompanying the 1964 works notes that: "*On the western pier, a similar procedure was followed, but here, as most of the original stone had been washed downstream and was*

missing, we had to bring new stone from a nearby site probably quarried by the original builders. On this side, also, the remaining stone trough sections which were found during the reconstruction were placed on top of the final grassed-down soil fill” (Grayson 1965).

- 4.7 The construction technique used during the 1964 restoration works (roughly coursed and squared facing stones with an infill of stone rubble set with sandy mortar, rather than the earth suggested in the 1964 account), visible on the photographs taken at that time, is clearly evident in the collapsed beck face of the pier [2/250 and 2/251] (see plate 5). Comparison with photographs taken in 1964 and the subsequent post 1982 colour photograph referred to above suggest that a length of up to 2m has been lost from the west pier in the intervening years (see figures 3 to 5); this would make the gap between the piers after the 1964 works something in the order of 3.50m. A large sub-rectangular tilted stone in the west bank of the beck presumably represents a former foundation from 1964.

East pier

- 4.8 The east pier is far more substantial and better preserved than the west pier. The 1964 account states that: *“Repairs were carried out first upon the eastern pier, which was less severely damaged than the other. The structure consisted of a stone casing with an earth and rubble fill. Much of this had been thrown down into the stream and the top four feet of the pier needed to be completely rebuilt. To do this, large stones had to be recovered from the stream and lifted into position on the pier. The centre was then filled with earth and small stones, and the topmost course of stone was cemented into place to try to prevent the damage recurring. A thin layer of soil was then scattered over the top and seeded with grass” (Grayson 1965).*
- 4.9 The remaining section (which still closely resembles that shown in 1964 and on the post-1982 colour photograph) has a maximum visible length of 7.50m and a maximum width of 1.70m across the base, and it stands up to 2.90m in height (excluding the stone channels). Both the top of the pier, and the tops of the stone channel, are set very slightly lower than those to the west side of the gill. Although the 1964 account notes that the top four feet of the pier were rebuilt, it is not clear from the 1964 photographs how far this rebuilding progressed to the east, although the post-1982 colour photograph clearly shows that the top was reset and capped with mortar as described [1/633]; some of this work may date to the latest, 1982, repair works. However, there are indications in both faces of possible former repair work, or alternatively phases of earlier repair.
- 4.10 On the north face [1/622 to 1/624, 1/626, 2/236 and 2/239], the western 0.90m end of the pier has been pushed south as a result of pressure from floodwaters, opening a ragged vertical crack in the pier face (see plate 7). It is possible that this crack reflects a weakness resulting from a joint between two different phases of repair or reconstruction. Further to the east, there is a short section of the north face where the courses dip markedly downwards from west to east, and may be overlain by the wall immediately to the east [1/625]. To the south face [1/636 to 1/639, 2/244 and 2/245], c.3m to the east of the west end, there may be one or more relatively straight vertical joints, again perhaps resulting from a joint between two different phases of repair work or reconstruction (see plate 6).
- 4.11 To the immediate south of the east pier, there are several flat stones visible in the ground surface, approximately in line with these vertical joints. Although it is possible that they might represent the remains of a crude buttress, it is considered

more likely that they once capped a culvert draining off the water course to the east. Several large flat fallen stones in the beck at the base of the pier appear to have gathered here since the post-1982 colour photograph was taken [1/646, 2/222, 2/224, 2/225 and 2/235].

- 4.12 The stone channel [1/630, 1/631, 1/634, 1/635 and 1/641] surmounting the east pier has a total length of 3.90m and comprises three sections, decreasing slightly in length individually from west to east, but of the same overall dimensions as described to the west pier above (see plate 2); the westernmost section has lost its north side, which has fractured off leaving a regular break, while there is a small shallow recess cut into the top of the south side that might be an original feature. The western section does not appear on the post-1982 photograph. All three sections have prominent diagonal tooling marks to their external and internal faces, and the stone channel is located approximately centrally on the pier below. The post-1982 colour photograph appears to show the pier extending east beyond the stone channel into the adjacent water race, but this feature is no longer visible due to greatly increased vegetation cover.
- 4.13 The water race itself is very overgrown. Directly opposite the stone channel, it is represented by a shallow flat-bottomed depression, some 1.20m in width across the top, although it narrows considerably to the north. A stone, apparently set on edge, to the immediate south of the channel may be the remains of a stone lining to the leat.

5 BIBLIOGRAPHY

Primary Sources

1857 Ordnance Survey 1st edition 6" map sheet 58 (surveyed 1854)

1912 Ordnance Survey 2nd edition 25" map sheet 58/15 (resurveyed 1889)

Secondary Sources

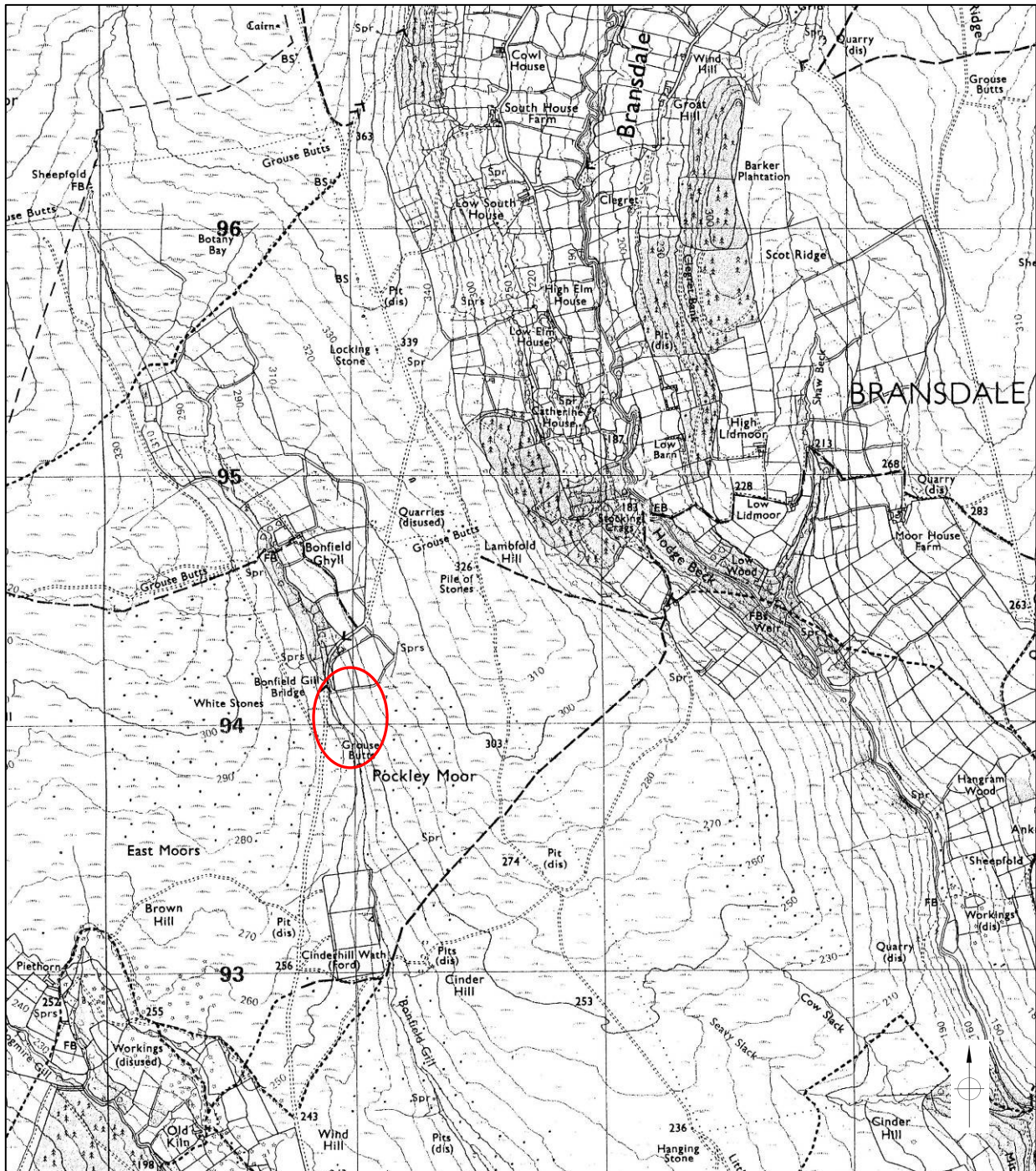
English Heritage 2006 *Understanding Historic Buildings: A Guide to Good Recording Practice*

Grayson, J N 1965 "Repairs to the Aqueduct at Bonfield Gill". *Ryedale Historian* vol 1, 45-46

McLean, I A 2005 *Water from the Moors: the Life and Works of Joseph Foord*

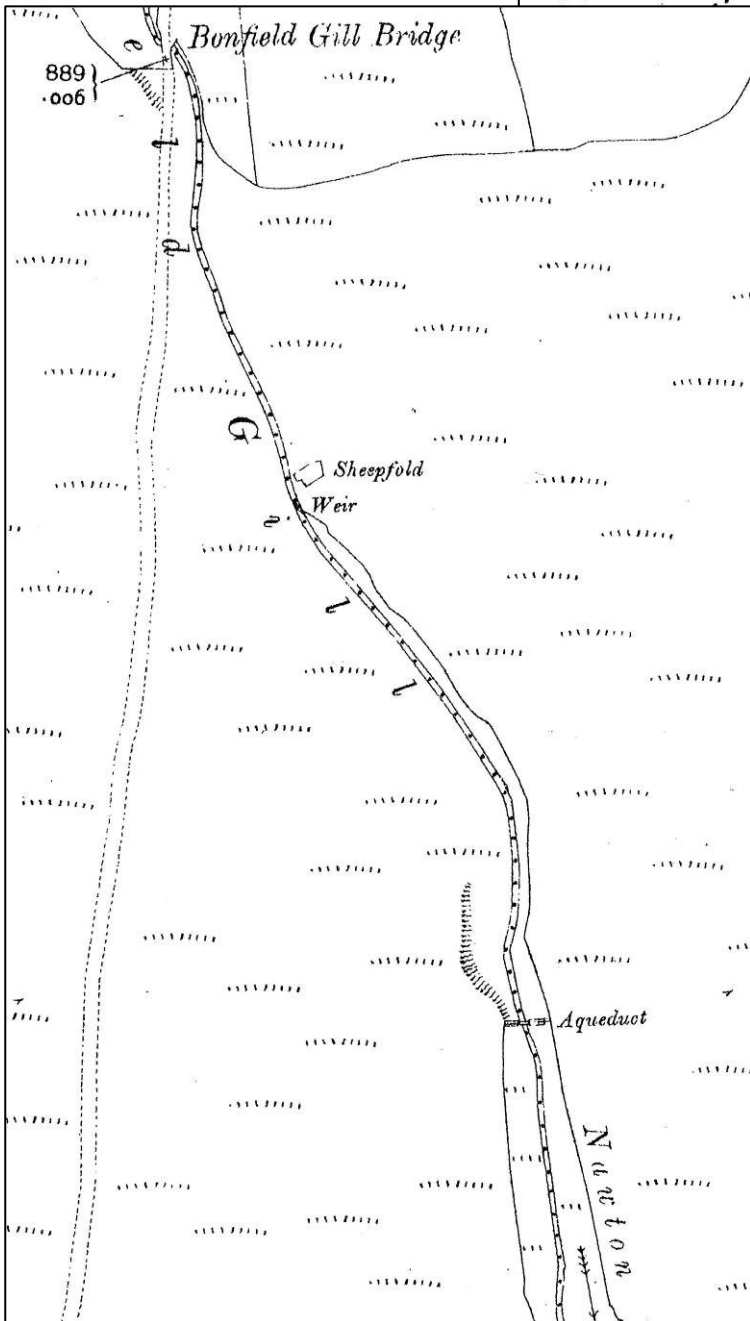
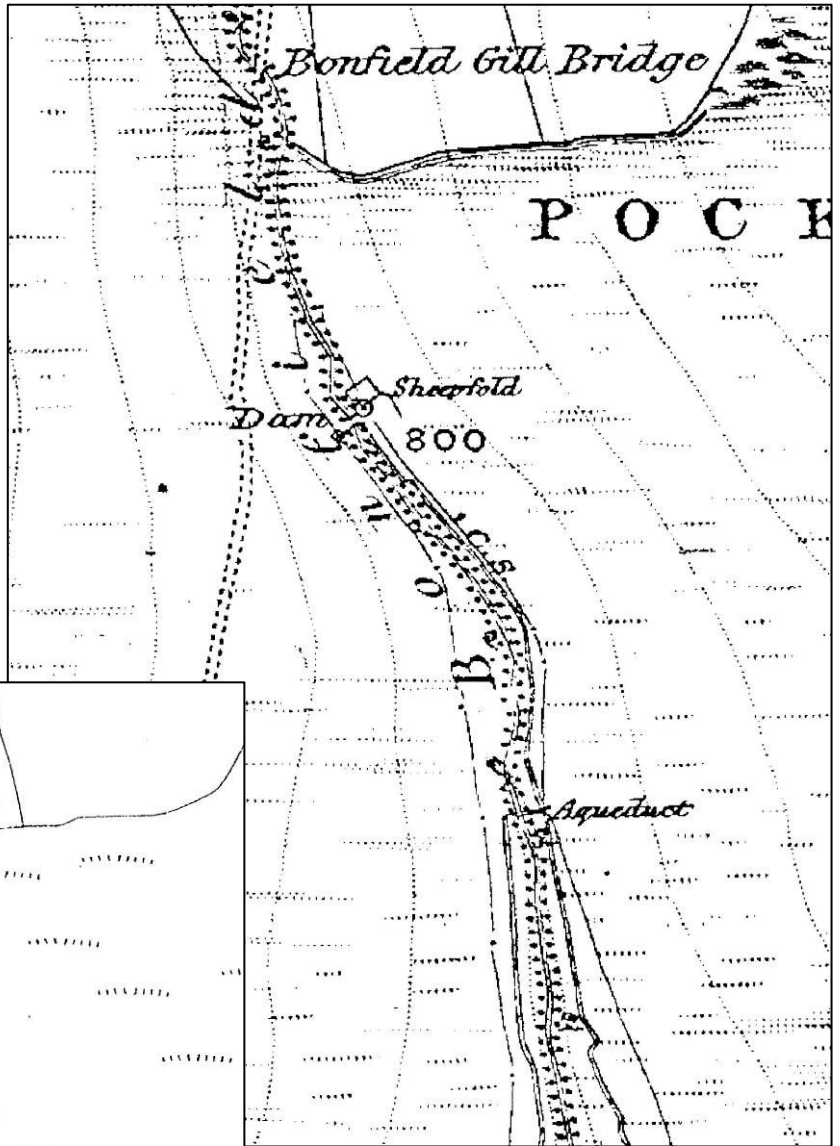
6 ACKNOWLEDGEMENTS

- 6.1 The archaeological survey of the Bonfield Gill aqueduct was commissioned and funded by the North York Moors National Park Authority (NYMNPA). EDAS would like to thank Graham Lee and Mags Waughman of the NYMNPA for their co-operation in carrying out the work. EDAS would also like to thank Paul Harris for the prompt supply of photographs from the Helmsley Archive and Tony Wright for his thoughts and expertise, and use of his photograph.
- 6.2 The site recording was undertaken by Shaun Richardson and Ed Dennison of EDAS. Shaun Richardson produced the fieldwork records and took the site photographs. Ed Dennison produced the final report and drawings, and the responsibility for any errors or inconsistencies remains with him.



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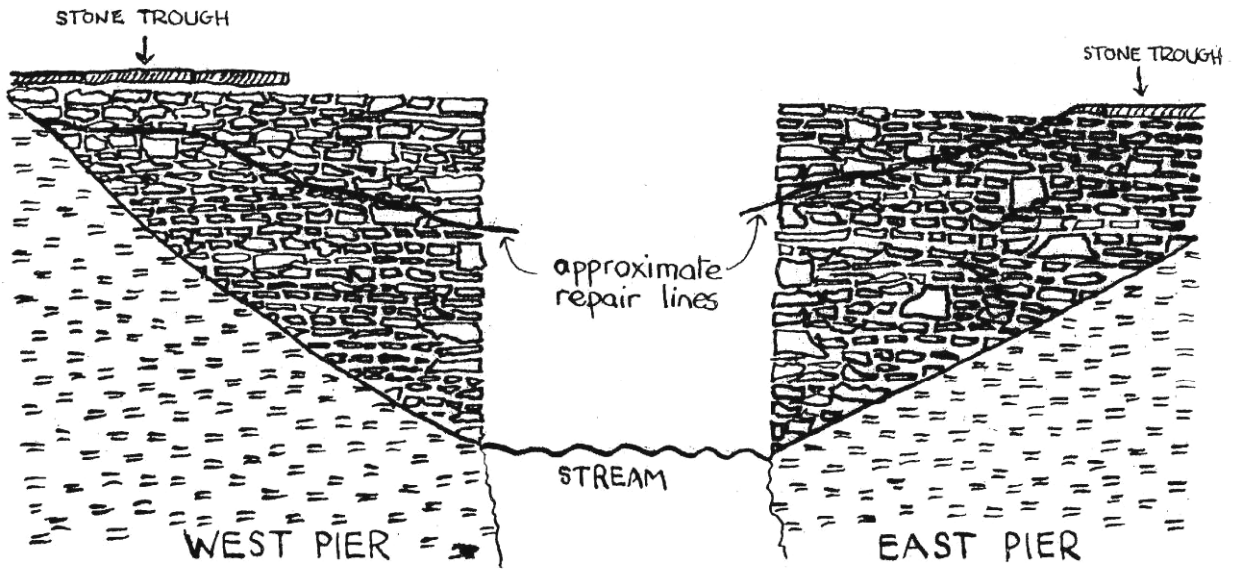
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TITLE		GENERAL LOCATION	
SCALE	NTS	DATE	SEPT 2012
	EDAS	FIGURE	1



Top: Ordnance Survey 1857 6" map
(sheet 58), surveyed 1854.

Bottom: Ordnance Survey 1912 25" map
(sheet 58/15), resurveyed 1889.

PROJECT		BONFIELD GILL AQUEDUCT	
TITLE		ORDNANCE SURVEY MAPS	
SCALE	NTS	DATE	SEPT 2012
EDAS		FIGURE	2



Side view of the restored aqueduct in Bonfield Gill. The piers stand 10' above the beck, and the water flowed over it from west to east.



Top: Drawing by Grayson (1965).

Bottom: Photograph of repairs in progress (courtesy Helmsley Archive, HA 02461).

PROJECT		BONFIELD GILL AQUEDUCT	
TITLE		1964 REPAIR WORK	
SCALE	NTS	DATE	SEPT 2012
EDAS		FIGURE	3



Photographs of repairs in progress
 (courtesy Helmsley Archive, HA 02455 &
 HA 02462).

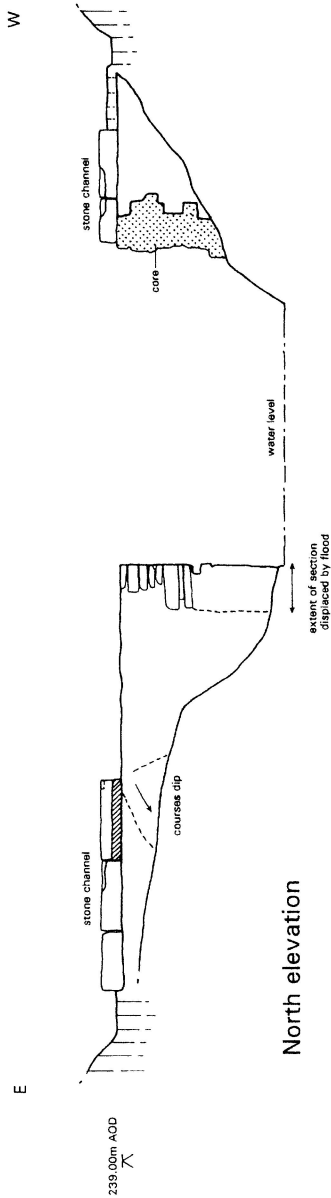
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TITLE		1964 REPAIR WORK	
SCALE	NTS	DATE	SEPT 2012
EDAS		FIGURE	4



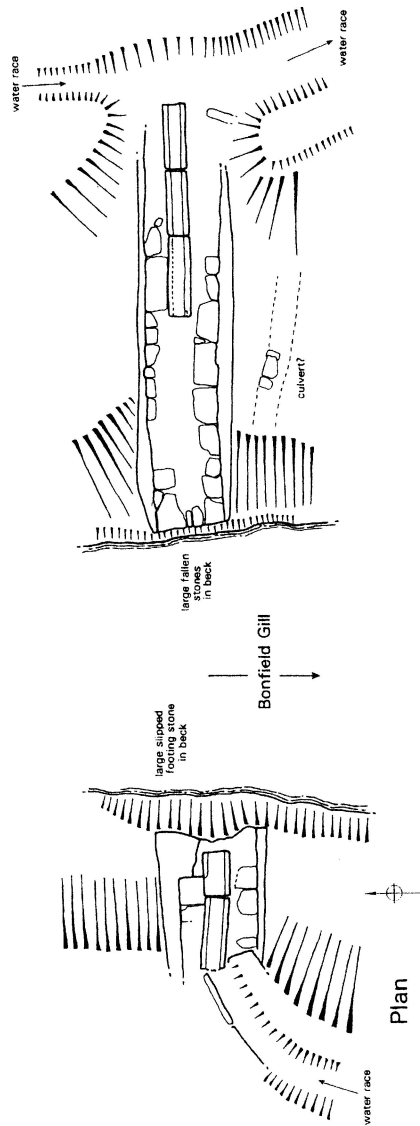
Top: McLean photograph, looking NW (undated but taken between 1995 and June 2005).

Bottom: Tony Wright photograph, looking NE (February 2008) (2008_02_24B, 48).

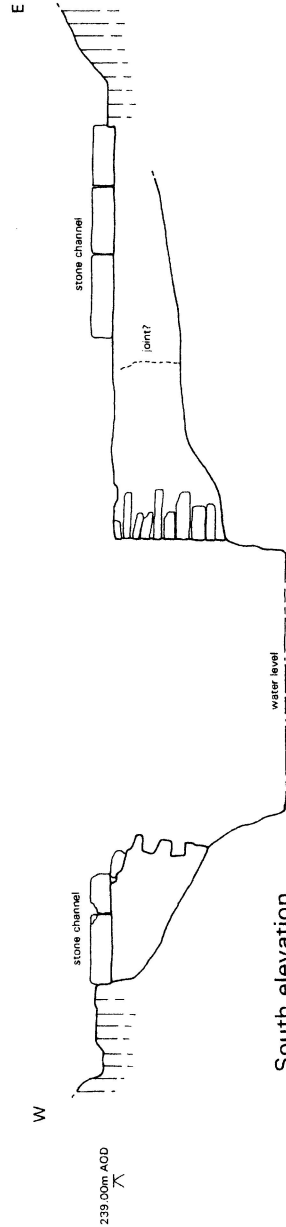
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TITLE			
PHOTOGRAPHS			
SCALE	NTS	DATE	SEPT 2012
EDAS		FIGURE	5



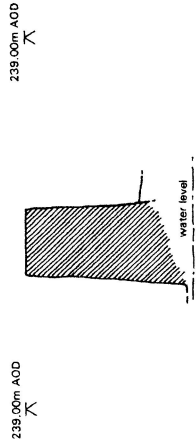
North elevation



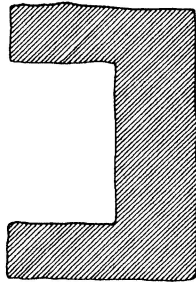
Plan



South elevation



Profile through west end of east pier



Profile through typical stone channel



PROJECT	BONFIELD GILL AQUEDUCT		
TITLE	SURVEY RESULTS		
SCALE	AS SHOWN	DATE	SEPT 2012
	EDAS	FIGURE	6



Plate 1: General view of aqueduct, looking SW (photo 1/628).



Plate 2: Stone channel to east pier, looking W (photo 1/634).



Plate 3: Stone channel to west pier, looking E (photo 1/648).



Plate 4: Collapsing west pier, looking NE (photo 1/650).



Plate 5: Exposed core in west end of west pier, looking W (photo 2/248).



Plate 6: South face of east pier, looking N (photo 1/638).



Plate 7: East pier, looking SE (photo 2/239).

APPENDIX 1

APPENDIX 1: PHOTOGRAPHIC RECORD

Film 1: Colour digital photographs taken 11th July 2012

Film 2: Colour digital photographs taken 11th July 2012

Film	Frame	Subject	Scale
1	622	West end of north face of east pier, looking S	1m
1	623	West end of north face of east pier, looking S	1m
1	624	Central part of north face of east pier, looking S	1m
1	625	Central part of north face of east pier, looking S	1m
1	626	North face of east pier, looking S	1m
1	627	Aqueduct, looking SW	1m
1	628	Aqueduct, looking SW	1m
1	630	Stone channel to east pier, looking SW	1m
1	631	Stone channel to east pier, looking E	1m
1	633	East pier showing 1964/1982 capping, looking W	1m
1	634	Top of east pier, looking W	1m
1	635	Top of east pier, looking W	1m
1	636	South face of east pier, looking N	1m
1	637	South face of east pier, looking N	1m
1	638	South face of east pier, looking N	1m
1	639	South face of east pier, looking N	1m
1	640	Aqueduct, looking NW	1m
1	641	Stone channel to east pier, looking E	1m
1	643	North face of west pier, looking S	1m
1	644	North face of west pier, looking S	1m
1	646	East pier, looking SE	-
1	648	Stone channel to west pier, looking E	1m
1	649	Stone channel to west pier, looking E	1m
1	650	Stone channel to west pier, looking NE	1m
1	651	South face of west pier, looking N	1m
1	652	Lining stones of Nawton race to west pier, looking N	1m
1	653	Nawton race on east slope of gill, looking S	-
2	222	East pier, looking SE	-
2	224	East pier, looking NE	-
2	225	East pier, looking E	-
2	235	Large stones at base of east pier, looking E	-
2	236	East pier, looking SE	1m
2	239	East pier, looking SE	1m
2	242	East pier, looking E	1m
2	244	East pier, looking NE	1m
2	245	East pier, looking NE	1m
2	247	Nawton race on west slope of Gill, looking S	1m
2	248	West pier, looking W	1m
2	249	West pier, looking SW	1m
2	250	West pier, looking W	1m
2	251	West pier, looking W	1m



1-651.JPG



1-652.JPG



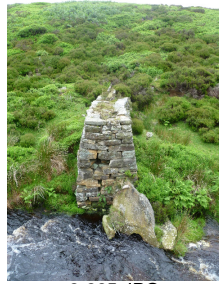
1-653.JPG



2-222.JPG



2-224.JPG



2-225.JPG



2-235.JPG



2-236.JPG



2-239.JPG



2-242.JPG



2-244.JPG



2-245.JPG



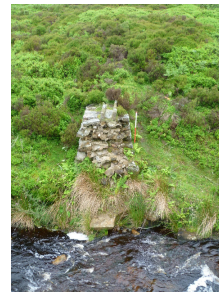
2-247.JPG



2-248.JPG



2-249.JPG



2-250.JPG



2-251.JPG