

# Principal Inspection Report

Middlewich Branch Canal  
Embankment 1  
Middlewich

North Wales & Borders  
Waterway

**SM-002-012-R**

March 2010

ESPI/0910/9200/SM-002-012-R

Carl Conwell  
Earth Structures Inspector

Earth Structure Inspection Team  
Fearn's Wharf  
Leeds



## SAP Executive Summary

### **SM-002-012-R Embankment 1 Towpath side**

**Key Data :** Condition Grade: C Serviceability: 2 C.O.F.: 3

**Dimensions :** Length: 220 m Height: 17 m max Slope Angle: 33° max

**Defects and Monitoring :** It is recommended that a slipped area above the headwall of Aqueduct 27A be monitored for any further deterioration, the crest, slope and toe should also be monitored for any increase in rabbit activity and signs of further settlement or instability. If evidence of any leakage/seepage or signs of instability occur like the development of settlement, backscars, leaning trees, tension cracks or toe bulges, these should be reported and suitable action taken.

PMO 3069712	Z2 11115397	Z4's 11095144, 11341175, 11341181, 11341187, 11341188
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# **BRITISH WATERWAYS** **EARTH STRUCTURE PRINCIPAL INSPECTION REPORT** **EXECUTIVE SUMMARY**

## **Structure Record**

**Functional Location Code :** SM-002-012-R  
**Structure Name :** Embankment 1, Middlewich  
**Location :** Middlewich  
**Grid Reference (to centre) :** SJ 695 658  
**Waterway Unit :** North Wales & Borders  
**Structure Type :** 9  
**Date of Previous Inspection :** N/A  
**Previous Condition Grade :** N/A  
**Previous Serviceability Score :** N/A  
**Previous Consequence of Failure :** N/A  
**Comments :**

## **Inspection Data**

**Date of Inspection :** 30 March 2010  
**Inspector :** Carl Conwell  
**Length Inspected :** 250 m  
**Structure Length :** 220 m  
**Height :** 17 m (maximum)  
**Slope Angle :** 5°- 33°  
**Freeboard :** 200 mm to 300 mm (effective)  
**Canal Width :** 10 m  
**Pound Length :** 1.3 km  
**Weather Conditions :** Dry & overcast

## **Inspection Outputs**

**Condition Grade :** C  
**Serviceability :** 2  
**Consequence of Failure :** 3  
**Known Date of Construction :**  
**Next Principal Inspection due :** As per AIP  
**Synopsis of Main Defects :** Displaced aqueduct headwall fence.  
A number of rabbit burrows on the slope face.  
A length of slight crest settlement.  
A small area of slipped slope face.

## **Summary Of Estimated Costs**

**Short Term (<1 yr) :** £1,000  
**Med. Term (1-5 yrs) :** £41,000  
**Long Term (5-10yrs) :** None

**Inspector : Carl Conwell**

Signature.....Date.....

Report Status	Revision	Prepared By/date	Checked By/date	Authorised By/date	Issue Date
Final	0	CC Oct 10	AC Oct 10	AC Oct 10	

# BRITISH WATERWAYS

## EARTH STRUCTURE PRINCIPAL INSPECTION REPORT

### **Note**

Please refer to the site plans for full details of this inspection. This report should comprise report text, site photographs and annotated plans.

All chainages given in this report have been referenced from an arbitrary position at Aqueduct 27B, Middlewich Aqueduct (SM-001-013) of ch-000.

Embankment 1, Middlewich was assumed to run from ch-005R to ch-027R and was situated on the towpath side.

### **1.0 Geology**

- 1.1 The British Geological Survey digital data on ArcGIS accessed October 2010 shows the site to be underlain by Northwich Halite Formation described as halite-stone and mudstone from the Triassic Period. Devensian Till deposits and Alluvium associated with the River Wheelock were shown to overlie the solid deposits.

### ***Middlewich Embankment 1 – Towpath side***

#### *Crest*

- 1.2 The crest of the embankment was between 2.6 m to 3.3 m wide and comprised of a 1 m wide gravel towpath and associated mown grass verges. The crest height was between 0.2 m above canal water level at the middle of the embankment, above Aqueduct 27A, and gradually increased to 0.3 m above canal water level as both ends of the embankment was approached. The path and crest were generally flat and even with evidence of slight historical settlement at the highest section of the embankment. Along the shoulder there was a 0.8 m high timber post and wire mesh fence with barbed wire in a poor condition, together with an overgrown hedge. The fence and hedge ran for approximately 25 m in length above the aqueduct. The shoulder was generally sharply defined and was vegetated with a moderate to high density of ground cover and a low to moderate density of canopy cover.

#### *Slope Face*

- 1.4 The face of the embankment was generally concave to planar in profile and inclined between 5° and 33°, although it was more typically inclined between 15° and 32°. It was vegetated with a moderate to moderately high density of ground cover and a low to moderate density of canopy cover. A number of active rabbit burrows were noted throughout the slope face.

#### *Toe*

- 1.5 The toe of the embankment was generally gently inclined, though marked by an overgrown hedge with wasteland and woodland beyond the hedge east of the River Wheelock, and a 2 m high trimmed hedge with a pasture field beyond the hedge west of the river. The gently inclined toe was considered to be the result of historical soil creep, however no signs of recent movement were found. The toe varied in height between 1 m and 17 m below canal water level.

#### *Bank Protection*

- 1.6 The bank protection along the length inspected generally comprised of a cast in-situ concrete waterway wall, in a reasonable condition.

### *Slope Instability*

- 1.7 The embankment slope face generally exhibited no signs of major active instability. The generally sharply defined shoulder indicated that the embankment was in a reasonable condition. The gently defined toe and the slight crest settlement at the highest section of the embankment was considered to be the result of historical soil creep and settlement, however no signs of recent movement were found. The following points were noted:
- ch-017R – A 6 m long former slipped area of slope face with a 0.4 m high backscar, was located above a 1.5 m wide access path excavated across the top of the headwall of Aqueduct 27A. The path appeared to have been made some time ago to enable the installation of a fence above the headwall. The headwall fence has collapsed. The excavation for the path may have disturbed the unsupported upper layer of slope face above the path, thereby causing a slip to occur. Two small leaning trees with corrected growth appear to have been formerly affected by the slip, but were now supporting the slope face immediately above the slipped area. A 0.3 m high timber baulk retaining wall was positioned across the bottom of the slipped area beside the path. The area of the slip appeared stable apart from rabbit activity within the area.

### *Leakage*

- 1.8 No leakage or seepage issues were noted.

### *Other Defects*

- 1.9 ch-007R, ch-009R, ch-011R, ch-013R, ch-016R, ch-019R, ch-020R, ch-021R & ch-022R – Active rabbit burrows were noted along the slope face at the above locations.

## **2.0 Associated Structures**

- 2.1 The following structures were located along the length inspected:
- **SM-002-002 Aqueduct 27A, Stanthorne Aqueduct** – SAP records this structure as having a Condition Grade C established 1 November 2007. The arch ring appeared to be constructed from three leaves/layers of brick and a 0.6 m long x 0.3 m wide patch of brickwork had fallen from the outer layer.
  - **SM-002-003 Overflow Weir** – SAP records this structure as having a Condition Grade E established 3 March 2000.
  - **SM-002-TBC-L Unrecorded Embankment** – The principal offside embankment associated with Embankment 1 and Aqueduct 27A was not recorded in SAP. This was reported to the waterway on 21.07.2010.

## **3.0 Comments on Grade**

- 3.1 The embankment is generally in a reasonable to fair condition. An area of central crest settlement with a partial loss of effective freeboard, was considered to be historical long standing settlement. The effective freeboard however was considered to be at an operational minimum and monitoring for any further potential settlement is considered essential until crest raising works can be undertaken. A small area of slipped slope face above the aqueduct headwall was noted and any further failure could be sufficient to cause movement higher up the slope that may develop into an area of structurally significant instability. However this was not considered to be detrimental to the overall stability of the embankment at this time. Any further crest settlement or slope face deterioration could lead to instability in the medium to long term. As such a Condition Grade of C is considered to be appropriate for this structure.
- 3.2 The embankment is situated across the River Wheelock Valley and the towpath side of the true embankment is situated on a length of canal bounded by wasteland, woodland,

the River Wheelock and a pasture field, with gardens and fields beyond further up the river valley. Should a breach occur it may partially affect the adjacent waste/woodlands and pasture land before being directly lost to the River Wheelock and pass under Aqueduct 27A, heading down the valley on the offside of the canal. One riverside property named Watersmeet, the A530 road (which runs adjacent to the river for a short distance before the road crosses the river) and fields further down the valley may be affected, dependent upon the river level if a breach should occur. This structure is situated on a short to medium length pound (1.3 km in length) and any breach would therefore potentially discharge a moderate amount of water. A Consequence of Failure Grade of 3 is therefore considered to be appropriate for this structure.

3.3

#### 4.0 Recommendations of Works and Monitoring

##### *Recommendations of Works*

##### *Short Term (<1 yrs)*

- 4.1 **Reinstate the fence above the aqueduct headwall. Estimated cost £1,000.** It is recommended that the collapsed safety fence above the headwall of Aqueduct 27A be replaced with a suitable structure.

##### *Medium Term (1-5 yrs)*

- 4.2 **Raise existing concrete waterway wall. Estimated Cost £13,000.**

- 4.3 **Raise the crest and puddle clay within the crest. Estimated Cost £28,000.** Raising the crest with a compacted puddle clay trench and compacted fill to protect the clay lining and provide a new towpath surface is recommended. Crest settlement has occurred along a 150 m central section of the embankment. The effective freeboard was 0.3 m along both ends of the embankment crest and this was considered to be typical of the original freeboard throughout the crest. The effective freeboard along the central section ranged from 0.2 m to 0.25 m and settlement of the clay lining within the crest has probably occurred. It is recommended that the canal water level be lowered and the puddle clay lining (along the 150 m long central section) within the embankment crest be exposed. After the removal of the crest surface the clay lining immediately below the crest should be examined for soft spots, cracks, desiccation and settlement. The crest should also be excavated to remove any tree root fissured clay. Where necessary the clay lining should be exposed to a depth of 0.5 m and replaced where required. It is recommended that the compacted puddle clay lining/trench be raised to at least 250 mm above water level. The fill cover to protect the clay and a new towpath surface should have a finished minimum crest height of 350 mm (to fully protect the clay and allow for potential further settlement). This clay lining and crest raising work should be incorporated with the bank protection installation work.

*Long Term (5-10 yrs)*

4.4 None

*Investigations/Monitoring*

- 4.5 **Monitor slope for instability from rabbit activity. No additional costs.** It is recommended that the slope be monitored for signs of instability from an increase in rabbit activity. If signs of instability occur like an increase in rabbit digging or the development of settlement, backscars, leaning trees, tension cracks or soil bulges, these should be reported and suitable action taken.
- 4.6 **Monitor slope/toe for instability and the crest for settlement. No additional costs.** It is recommended that a 6 m long area of slipped slope face located above an access path excavated across the top of the headwall of Aqueduct 27A and also throughout the crest be monitored during the normal inspection process for any further signs of instability. If signs of instability occur like the development of further crest settlement or backscars, leaning trees, tension cracks or bulges on the slope face, these should be reported and suitable action taken.

**SAP FUNCTIONAL LOCATION CLASSIFICATION RECORD**  
**FOLLOWING PRINCIPAL INSPECTION**

**Functional Location :** SM-002-012-R  
**Description :** Embankment 1 – Middlewich  
**Class Type :** 003

<b>Characteristic Description :</b>	<b>Value</b>
<b>BW Owned Asset :</b>	Yes
<b>Include Asset in AIP :</b>	Yes
<b>Alternative Names :</b>	
<b>Short Name for LI Sheet</b>	
<b>Date of Condition Grade :</b>	30.03.2010
<b>Condition Grade :</b>	C
<b>Consequence of Failure :</b>	3
<b>Mechanised Asset :</b>	
<b>Serviceability :</b>	2
<b>GIS Object Available :</b>	Yes
<b>Proximity to Wildlife Site :</b>	
<b>% Residential Occupancy :</b>	
<b>TRIM Reference :</b>	
<b>Topographic Identifier :</b>	
<b>Type of Technical Object :</b>	009
<b>Listed or Scheduled Structure :</b>	
<b>Type of Construction :</b>	True Embankment
<b>Type of Material :</b>	
<b>Full Length :</b>	220.000 m
<b>Max Height Original GL Below C :</b>	17.000 m
<b>Max Slope Angle :</b>	33°
<b>Min Freeboard at NWL :</b>	200.000 mm
<b>Min Width Crest to Water :</b>	2.600 m
<b>Min Navigation Width of Canal :</b>	10.000 m
<b>In Buildings at Risk Register :</b>	No
<b>BBP Index :</b>	
<b>BBPI Failure Factor :</b>	
<b>BBPI Customer Factor :</b>	
<b>BBPI External Impact Factor :</b>	
<b>BBPI Business Factor :</b>	
<b>BBPI Service Factor :</b>	
<b>BBPI Neighbour Factor :</b>	