CONDITION REPORT

HAYES CANAL WALL SURVEY

NESTLE FACTORY, HAYES

CANAL WALL SURVEY

Client:	**CAPITA**
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Rev 1 DRAFT

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H.S.E. **Compliant Diving Contractor**

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Synopsis

The condition survey revealed the sheet pile section of river wall to be in a reasonable condition, although multiple hairline cracks were observed in the concrete capping beam above. These hairline cracks appear to be full penetration cracks and are also visible on the back face of the capping beam adjacent to the Nestle factory roadway. The capping beam also features several areas of spalling above the out pans of the sheet pile wall, probably due to the de-lamination of the steel. From chainage 234m the construction of the wall changes from sheet pile to a brick built wall with concrete coping stones above. The brick built wall features several large areas of missing brick work creating large voids in the wall below the waterline. No scour or undercut was reported at any point along the structure.

1.0 INSTRUCTIONS

1.1 Instructions were received from Paul Edwards of Capita to carry out a condition survey of the retaining canal wall adjacent to the Nestle factory site in Hayes to establish the following;

- Determine the construction of the canal wall.
- Record canal wall height and water depths.
- Provide details, extent and location of any wall defects and features.
- A CCTV and photographic survey.
- Cygnus thickness gauge readings of sheet pile wall.
- Plan/elevation drawings identifying defect locations to be submitted in CAD format.

2.0 GENERAL DESCRIPTION

Location Plan

2.1 The survey included a close visual inspection of the steel sheet pile section of the canal wall including pile thickness readings and an inspection of the capping beam above, along with a close visual inspection of the brick built section of wall.

2.2 The canal retaining wall adjacent to the Nestle factory site is located on the southern side of the Grand Union Canal. The inspected retaining wall adjacent to the site is approximately 298m in length with the eastern boundary, (chainage 0m) formed by the North Hyde Gardens Bridge abutment and the western boundary being formed by the Western View Railway Bridge, (chainage 298m). For the purpose of the report the structure was inspected travelling west from the North Hyde Gardens Bridge, (chainage 0m). The river wall is formed using two different construction methods with the initial 234m being constructed from steel sheet piles of which the first 9m is an unknown pile and the further 225m being constructed from what appears to be Larrsen 1CB type piles. The capping beam features a wooden slat type fence bolted to the top face of the beam. The following 56m of retaining wall is of a brick built construction topped with concrete coping stones and appears to have formed part of the foundations of a railway feature with rail tracks still in situ on the hardstand adjacent to the wall. The final 8m is formed of large format concrete scour bag work with a cast concrete wall behind forming the western boundary of the Nestle factory.

2.3 The riverbed consisted of soft silts to a depth of between 500mm and 600mm. Water flow rate past the structure was low.

3.0 INSPECTION AND ACCESS METHODS

Date of inspection: 29th & 30th October 2014

3.1 The following personnel undertook the inspection works;

Mark Taylor	HSE Pt 1, ADC Supervisor
Steven Kent	HSE Pt 1
Lee Jennings	HSE Pt 1
James Johnson	HSE Pt 1

3.2 The structure was accessed via the Nestle site.

3.3 Diving operations were conducted from the car park adjacent to the river wall using Surface Demand Diving Equipment (SDDE) in conjunction with the Commercial Diving Projects Inland/Inshore, Diving at Work Regulations 1997 and under Permit enforced by Canals Rivers Trust.

3.4 Underwater visibility was very poor during the inspection and inhibited the acquisition of underwater photographic and video footage. A tactile survey of the wall was conducted below the waterline.

3.5 The Grand Union Canal remained open to navigation for the duration of the survey and all relevant permits were obtained to undertake the works.

4.0 GENERAL OBSERVATIONS

4.1 Ch 0m – Chainage 0m was set up adjacent to the North Hyde Gardens Bridge abutment on the western boundary of the Nestle factory site.

Photograph 1: Ch 0m – Location picture of chainage 0m.

4.2 Ch 0m – 9m – The initial 9m of the retaining wall structure is formed of Frodingham "Z" type piles with 2# external waling beams with a concrete capping beam above. There is 1# waling beam at the waterline and 1# directly below the capping beam. The waterline waling beam appeared to be welded to the wall with "L" shaped brackets and the upper beam bolted through.

Photograph 2: Ch 0m – 9m – Initial 9m of the unknown sheet pile.

4.3 Ch 1m – There is a 30mm Ø hole in the sheet pile wall directly above the waterline waling beam. Note – the hole is adjacent to the waling beam fixing point.

Photograph 3: Ch 1m – Hole in sheet pile wall.

4.4 0m – 9m – The piles in the initial 9m section of the structure exhibit de-lamination of the steel in the splash zone to a varying thickness of between 5mm to 30mm. Refer to Appendix A for confirmation of pile thickness readings in this area.

Photograph 4: Ch 0m – 9m – De-lamination of the steel in the splash zone.

4.5 Ch 5m – 9m – There appears to be a render layer covering the cast concrete capping beam which has de-laminated and is failing in this location.

Photograph 5: Ch 16.5 – De-lamination of the render layer.

4.6 Ch 9m – At the interface between the differing sections of sheet pile wall there is void extending from bed level to below the capping beam which is approximately 300mm wide. The void is back filled with loose rubble. The construction joint in the capping beam structure above extends to a defect on the back face of the capping beam. See item 4.7 below for defect details.

Photograph 6: Ch32 – Void back filled with loose rubble.

4.7 Ch 9m – As above – The construction joint between the 2# structures appears to have suffered movement causing the back face of the capping beam to crack and spall away. The defect has been previously repaired, this repair has failed. There are cracks a number of cracks migrating away from the defect on the hard stand.

Photograph 7: Ch 40m – Vertical crack running full height of wall.

4.8 Ch 9m – 234m – The retaining wall between the stated chainage is constructed from Larrsen "U" type steel sheet pile with a cast reinforced concrete capping beam above.

Photograph 8: Ch 9m – View of the canal retaining wall looking West along the structure.

4.9 Ch 10m – 234m – The capping beam features mooring rings at approximate 5m intervals along the structure. These rings are recessed into the beam and are bolted through to the back face.

Photograph 9: Ch 10m – Mooring ring recessed into the capping beam.

4.10 As above – Approximately 10# mooring rings are missing.

Photograph 10: Ch 176m – Missing mooring ring.

4.11 As above – Approximately 6# mooring ring recesses exhibit damage around the perimeter. On a number of these the structural re-bar has become exposed.

Photograph 11: Ch 65m – Damage to mooring ring recess with re-bar exposed.

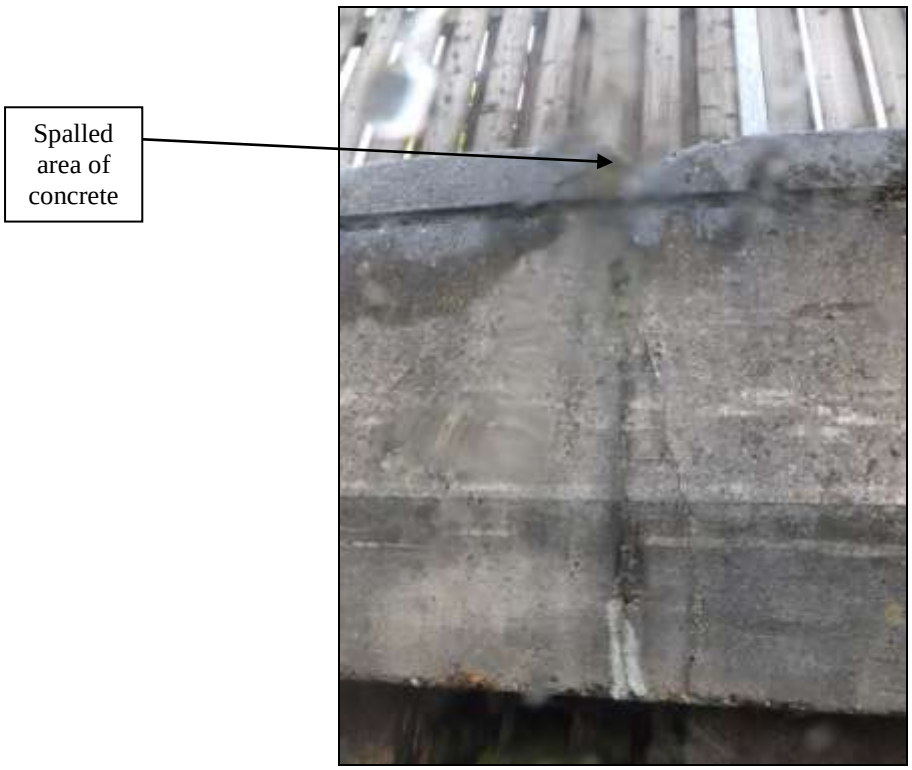
4.12 Ch 11m – There is an outfall pipe of 160mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in an open position at the time of our inspection.

Photograph 12: Ch 11m – Outfall pipe fitted with a seized flap valve.

4.13 Ch 19m – 234m – There are approximately 100# cracks in the concrete capping the majority of which are hairline cracks. There efflorescence type deposits leeching from several of the cracks.

Photograph 13: Ch 56m – Hairline crack with efflorescence leaching at its base.

4.14 As above – Approximately 10# of the cracks are between 2mm and 5mm in width with the pictured crack below exhibiting an area of spalled concrete with re-bar exposed. Note – This defect is directly adjacent to an outfall pipe through the sheet pile wall below.



Photograph 14: Ch 114m – Open crack with spalled concrete adjacent to an outfall pipe.

4.15 Ch 39.5m – There is an outfall pipe of 160mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was operational at the time of our inspection.

Photograph 15: Ch 39.5m – Outfall pipe with operational flap valve.

4.16 Ch 9m – 234m – There is general de-lamination of the steel around the clutch and web area of the sheet piles above the waterline.

Photograph 16: Ch 30m – De-lamination of the steel adjacent to the pile clutch.

4.17 Ch 70.5m – There is an outfall pipe of 160mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in a closed position at the time of our inspection.

Photograph 17: Ch 70.5m – Outfall pipe fitted with a seized flap valve.

4.18 Ch 86m – 234m – There are a number of areas of steel de-lamination at the top of pile outpan's which has resulted in the concrete capping beam spalling away.

Photograph 18: Ch 86m – Spalling of the concrete capping beam as a result of steel de-lamination.

4.19 As above.

Photograph 19: Ch 100m – Spalling of the concrete capping beam, probably as a result of steel de-lamination.

4.20 As above – There are a number of areas where the capping beam has cracked above the pile outpan with the probable cause being de-lamination of the underlying steel pile. In time it is probable these sections of concrete will spall away exposing the upper section of pile.

Photograph 20: Ch 95m – Cracking of the pile capping beam due to de-lamination of steel.

4.21 Ch 98m – There is an outfall pipe of 160mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in a closed position at the time of our inspection.

Photograph 21: Ch 98m – Outfall pipe fitted with a seized flap valve.

4.22 Ch 113m – There is slight misalignment of the piles. Note – there are no open clutches in the vicinity of the misaligned piles.

Photograph 22: Ch 113m – Misalignment of piles.

4.23 Ch 114m – There is an outfall pipe of 160mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in an open position at the time of our inspection.

Photograph 23: Ch 114 – Outfall pipe fitted with a seized flap valve.

4.24 Ch 136m – There is an outfall pipe of 120mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in a closed position at the time of our inspection.

Photograph 24: Ch 136m – Outfall pipe fitted with a seized flap valve.

4.25 Ch 159m – There is an open pipe 100mm Ø, directly below the capping beam.

Photograph 25: Ch 159m – Open pipe.

4.26 Ch 162m – Vegetation growing in the capping beam causing spalling to the adjacent concrete.

Photograph 26: Ch 162m – Vegetation causing spalling.

4.27 Ch 175m – There is an outfall pipe of 120mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in an open position at the time of our inspection.

Photograph 27: Ch 175m – Outfall pipe fitted with a seized flap valve.

4.28 Ch 185m – There is a 30mm Ø and 40 mm Ø hole in the sheet pile wall above the waterline.

Photograph 28: Ch 180m – 2# holes.

4.29 Ch 190m – There is an outfall pipe of 250mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was operational at the time of our inspection but the pipe was blocked with debris resulting in the flap valve not closing fully.

Photograph 29: Ch 190m – Outfall pipe blocked with debris..

4.30 Ch 190m – As above – The capping beam above the outfall pipe is cracked with sections of concrete spalling away.

Photograph 30: Ch 210m – Defective area of concrete above capping beam.

4.31 Ch 196m – There is an outfall pipe of 120mm Ø with a flap valve fitted over, directly below the capping beam. The flap valve was seized in an open position at the time of our inspection.

Photograph 31: Ch 196 – Outfall pipe fitted with a seized flap valve.

4.32 Ch 230m – There is an open pipe 100mm Ø, directly below the capping beam. The pipe appears to have featured a flap valve previously which is missing.

Photograph 32: Ch 230m – Outfall pipe with missing flap valve.

4.33 Ch 234m – The construction of the retaining wall changes to a brick built format with a void present from bed level to below the capping beam which is 200mm in width and 300mm penetration and back filled with loose rubble. Note there is a 60mm Ø hole on the final inpan at the waterline.

Photograph 32: Change in construction to Larssen No. 2 sheet piles.

4.34 Ch 234m – 290m – Brick built construction with a coping stone above. The wall exhibits heavy vegetation growing from the mortar joints and hard stand.

Photograph 34: Ch 235m – Vegetation.

4.35 As above – Vegetation growing from the retaining wall. Note – Pipe blanked with pipe stopper.

Photograph 35: Ch 265.5m – Vegetation and blanked pipe.

4.36 Ch 235m – The is a large void in the brickwork below the waterline 500mm wide x 250mm high with a penetration depth of >1000mm.

Photograph 36: Ch 235m Void in wall below the waterline.

4.37 Ch 234m – 290m – A large proportion of the brickwork mortar joints are missing and recessed up to 75mm both above and below the waterline. The joint between the top of the brickwork wall and coping stone is also missing and spalled with large voids present.

Photograph 37: Ch 260m – Missing mortar joints.

4.38 Ch 234m – 290m – The hard stand adjacent to the retaining wall exhibits heavy vegetation growth. The top layer of concrete is fragmenting and breaking up. Note – Rail tracks on hard stand indicating this section of wall was previously utilised as a loading area for trucks or narrow boats.

Photograph 38: Ch 241m – Cracking to corner section of capping beam.

4.39 Ch 240.5m – 100mm Ø open pipe located in the base of the coping stone. There is a similar pile at Ch 257m.

Photograph 38: Ch 240.5m – Open pipe.

4.40 Ch 241m – 290m – There are large sections of missing brickwork below the waterline running the length of the wall between the stated chainage. The voids are between 200mm and 500mm in height with a maximum penetration depth of 500mm.

Photograph 40: Ch 280m – Missing brickwork below the waterline.

4.41 Ch 250m – There are 2# open pipes located below the coping stone of 70mm and 160mm Ø.

Photograph 41: Ch 250m – 2# open pipes

4.42 Ch 287m – There is an outfall pipe with a flap valve fitted over. The flap valve was operational at the time of our inspection.

Photograph 42: Ch 287m – Outfall pipe with flap valve.

4.43 Ch 290m – 298m – The final 8m of the structure is form of a cast concrete wall with concrete anti-scour bags positioned in front. No defects or scour were report on this section of wall. Note – Build up of heavy vegetation on bag work.

5.0 CONCLUSION

The closed visual inspection (CVI) revealed the sheet pile section of the river wall to be in reasonable condition. There are multiple hairline cracks that extend through in the concrete capping beam and some spalling evident.
From chainage 234m the construction of the wall changes to a brick built structure in which several large areas of missing brick work were found below the waterline.

No scour or undercutting was reported at any point along the structure.

Subject to the scope of redevelopment and intended usage we suggest that the minor repairs are carried out from chainage 0m to 234m including a panel repair and grout infill at chainage 9m to prolong the expectancy of the sheet pile wall.
Consideration should be taken to the removal of the redundant flap valves with welded plates fitted over the resultant apertures and pipe ends.

At the time of the survey, the design criteria and loading specification of the sheet pile walls were unknown. The design and condition of the ground anchors and the solidity of the ground into which they are sited is also unknown. The design and condition of the tie bars are unknown and if the section of sheet pile were found to be of a cantilever design, to what depth the piles have been driven.
In our opinion with light loading there would appear to be no reason for the wall to remain in its present condition for a considerable number of years as there are no signs of significant misalignment or movement.
This is assuming that there is no disturbance to the ground anchor arrangement during any redevelopment.
Due to the age of the wall (informed circa 1935) we cannot locate records for the pile profile in order to ascertain the as built thicknesses, however the above and below water reading would indicate generally the corrosion levels are low as would be expected in a fresh water environment with no signs of localised or full penetration corrosion.
From chainage 234m to 300m the brick built section of the wall will require at least immediate short term repairs and in the long term total replacement in accordance with the usage of the adjacent canal bank.

Appendix A

Pile Thickness readings

LAESSEN STEEL SHEET PILING

HAYES PILE THICKNESS READINGS

LOCATION (m)		INPAN (mm)	WEB (mm)	OUTPAN (mm)
Bed Level	0m	6.7	6.9	7.3
	1m	7.2	7.1	7.1
Below Waterline	2m	7.1	6.7	7.1
	3m	5.9	5.9	7.0
Above Waterline	4m	6.9	6.8	7.1
	5m	7.0	6.6	5.8
Below Capping	6m	6.7	6.8	6.9
	7m	6.9	7.0	7.0
Bed Level	8m	6.9	7.6	7.0
	-			
CHANGE IN PILE TYPE				
Bed Level	10m	8.4	6.2	8.5
	20m	8.5	5.6	9.3
	30m	8.5	6.5	8.3
	40m	8.1	6.1	8.3
Below Waterline	50m	8.4	6.6	8.7
	60m	9.5	6.4	9.5
	70m	9.1	5.8	8.8
	80m	8.7	5.8	8.8
Above Waterline	90m	8.2	5.9	8.3
	100m	8.5	5.6	9.0
	110m	8.5	5.6	9.0
	120m	8.7	6.5	8.8
Below Capping	130m	9.4	6.4	9.2
	140m	8.8	5.9	9.3
	150m	8.3	6.2	8.3
	160m	8.7	6.8	8.3
Bed Level	170m	7.7	6.2	8.3
	180m	8.1	5.9	9.3
	190m	8.5	7.6	7.9
	200m	8.7	6.2	9.4
Below Waterline	210m	7.7	6.7	8.9
	220m	7.7	6.6	8.9
	230m	7.7	6.0	8.2
	-	-	-	-

Appendix B

Bed level readings

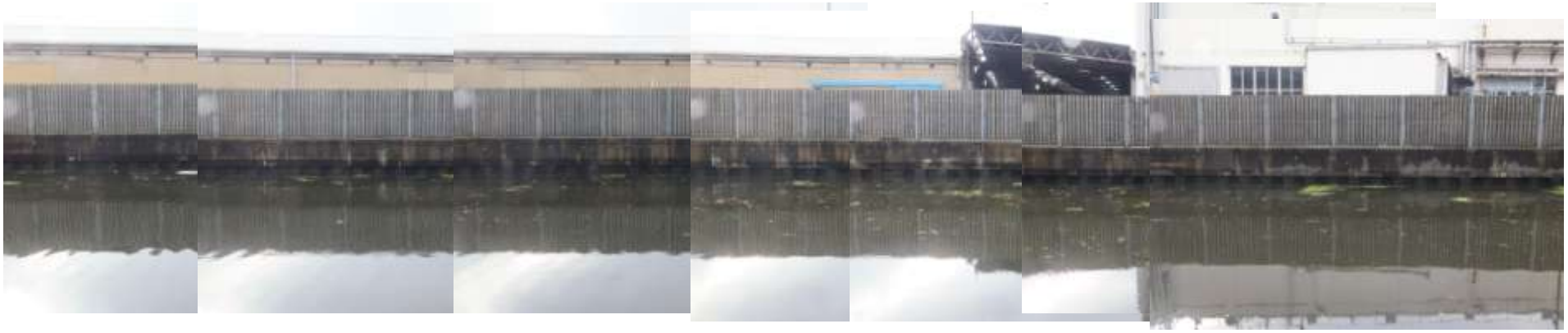
HAYES BED LEVEL READINGS

LOCATION (m)	BED TO WATERLINE (mm)	BED TO TOP COPE (mm)	HEIGHT OF COPE (mm)
0	600	1800	400
9	900	2100	400
9m Change in pile type and capping beam height.			
10	950	2200	1000
20	1050	2300	1000
30	1050	2300	1000
40	1100	2350	1000
50	1150	2400	1000
60	1050	2300	1000
70	1300	2550	1000
80	1300	2550	1000
90	1150	2400	1000
100	1150	2400	1000
110	1350	2600	1000
120	1300	2550	1000
130	1350	2600	1000
140	1500	2750	1000
150	1450	2700	1000
160	1400	2650	1000
170	1400	2650	1000
180	1550	2800	1000
190	1380	2630	1000
200	1600	2850	1000
210	1400	2650	1000
220	1190	2440	1000
230	1200	2450	1000
234m Change in construction to brick built wall.			

LOCATION (m)	BED TO WATERLINE (mm)	BED TO TOP WALL (mm)	NOTES
240	900	2440	
250	1000	1520	
260	1100	1620	
270	1400	1900	
280	1100	1660	
290	550	1150	
290m Change in construction to anti-scour bag work.			
LOCATION (m)	**BED TO WATERLINE (mm)**	**BED TO TOP BAG WORK (mm)**	**NOTES**
291	800	1100	
298	1300	1580	

Note - There was a 300mm – 400mm layer of soft silt and detritus on top of a gravel type bed. All of the above readings were taken from the solid bed.

Nestle Factory - Hayes, River Wall Overview Photograph & Chainage Layout October 2014



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