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Parliament Hill Lido, Hampstead Heath, North East Boundary Wall

Structural Assessment Report

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1.0 INTRODUCTION

1.1 Parliament Hill Fields Lido is a Grade II listed structure located at the southern edge of Hampstead Heath within the London Borough of Camden. Originally constructed in 1937-38, the lido consists of a 60 m by 27 m outdoor pool surrounded by concrete terracing and enclosed by brick boundary walls and buildings containing pool facilities and a café.

1.2 Various refurbishments to the lido pool and facilities have occurred since its construction, the most significant occurring in 2005 when the pool was re-lined with a stainless steel lining to stop a leakage problem. At this time a portion of the wall at the north-west corner was deconstructed to allow site access and later reconstructed like for like.

1.3 Following a severe storm in 2014 a portion of the north east boundary wall collapsed. Investigations were conducted by The Morton Partnership, AECOM, and Harrison Group Environmental, the wall was rebuilt, and the fencing was replaced with a version which would reduce the wind load. According to these investigations, the water table is near the ground surface level. The ground surface on the external side of the wall had been lowered considerably from original levels, and the wall has a corbelled base which sits on concrete strip foundations measuring 650mm wide by 300 mm deep, which extend to a depth of 300 mm below external ground level. It was proposed that the wall be reconstructed like for like with a new fence atop the wall which would reduce the wind loading and the external ground level should be raised a minimum of 250 mm.

1.4 Conisbee were appointed in November 2023 by Ulrike Wahl of the City of London Corporation to inspect the portion of the north east boundary wall corner which did not collapse in 2014 as it is leaning and cracking, both within the wall and in the concrete pavement surrounding it, and appears to have worsened within the last 12 months. Our inspection will inform recommendations to address the deterioration.

1.5 No intrusive investigations have been undertaken as part of our assessment and our recommendations are solely based on visual site inspections.

1.6 Whilst our investigations have been taken far enough to satisfy the requirements of the brief, they have, of necessity, not been exhaustive. Our findings cannot therefore be warranted to apply to areas of the structure not inspected or investigated.

2.0 CONSTRUCTION

2.1 Figure 01 shows the location of the wall and the different zones referenced later in this document.

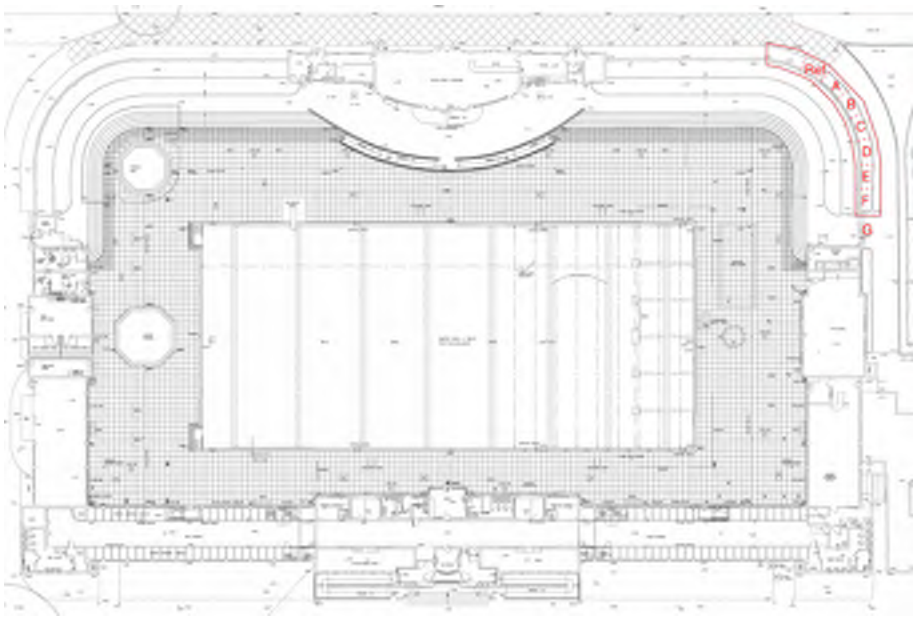


Figure 01 – Plan of the Lido showing area surveyed.

Figure 02 – Typical bay.

2.2 The north east boundary wall consists of 14 bays of single brick thick wall in English bond measuring 230 mm thick and 1.9 m tall (on the south west elevation) for the majority of its length and is divided by full height brick buttresses on the south west elevation of the wall, each topped with a sloping tile capping. Each buttress measures 120 mm deep and 345 mm wide keyed into the boundary wall. Mortar joints are largely composed of a cementitious mortar of varying ages. The boundary wall is topped by a grey coping stone which protrudes beyond the inner and outer faces of the wall by 65 mm. Atop the coping stone, a metal fence has been attached to limit entry and minimise wind loading on the wall (see Figure 02).

2.3 The concrete pool-side surface is terraced in several lifts up to the wall so that the ground level to the south west is higher than the ground level to the north east where the wall measures approximately 2.2 m from ground level to the coping stone, resulting in a level difference of 300 mm.

2.4 In some areas a damp proof course (DPC) is visible within a mortar bed joint, but for the majority of the wall no DPC is visible. It is possible in some areas that a DPC is present but covered over by more recent repointing.

2.5 Hedges are planted along the entire perimeter of the boundary wall, limiting access to and visibility of the north east elevation (see Figure 03).

Figure 03 – View of the north eastern elevation of the boundary wall.

3.0 INSPECTION & ASSESSMENT

3.1 Kevin Clark and Emily Painter of Conisbee undertook a visual inspection of the relevant areas of the boundary wall on the 15th November 2023. The inspection comprised a detailed visual inspection of the south west elevation of the wall and a limited visual inspection of the north east elevation of the wall due to extensive vegetation growth. Our inspection was conducted in the morning in dry, sunny weather, although it had recently rained.

3.2 A total of seven bays of the wall were inspected as indicated in Figure 01, measuring in total approximately 22 metres.

3.3 Each bay was photographed, cracks and damage were recorded, and the lean of each bay was measured using a plumb line.

3.4 Following our inspection, the lean of each bay was tabulated and their stability assessed.

3.5 The bricks are in generally good condition with minimal spalling or cracking (see Figure 04).

3.6 The pointing is of varying age, aspect and condition. Large areas of apparently recent cementitious repointing were observed on the south west elevation of the wall, presumably to replace deteriorated mortar and repair cracks. Where cracks have been repointed some have since reopened, while others remain closed (see Figure 04). This indicates that the mechanism causing the cracking is active.

Figure 04 – Representative area of south west elevation showing the relatively good condition of the bricks and variable age and condition of the pointing mortar.

3.7 Otherwise, recently repointed mortar joints are in generally good condition although in some cases the profile of the joint is such that accumulation of water is probable. Older mortar joints are in generally good condition although some locations of degraded mortar are present so removal of degraded mortar and repointing with a sympathetic mortar mixture is recommended.

3.8 Six out of the seven bays surveyed are leaning towards the north east (i.e. outwards) by between 0.3 and 1.5 degrees (9 and 51 mm) from the vertical, compared to the less than 0.1 degrees (1 mm) at the adjacent reference wall reconstructed in 2014. Bay G, closest to the eastern buildings, is leaning inwards by 0.5 degrees (18 mm) from the vertical. Bays C and D are considered unstable while the rest remain stable for the time being.

3.9 Vertical cracks, either open or recently repointed, are present across all inspected bays of the wall. In five of the seven inspected bays these cracks extend over at least half the height of the wall. Cracks are also present at most of the junctions between the buttresses and the wall.

Figure 05 – Typical vertical crack on the south west elevation of the wall (red line indicates location of crack).

Figure 06 – Typical vertical crack on north east elevation of the wall.

3.10 Vertical cracks are also present on the north east elevation of the wall which generally extend over its full height (see Figure 06), although they are fewer in number than on the south west elevation. The position of these cracks broadly aligns with the position of the buttresses on the opposite side of the wall.

3.11 Horizontal cracks are present across the entirety of the inspected length of the wall between the base and the concrete terracing. The latter is generally in poor condition with fragments of the concrete pushed upwards along the length of the wall (see Figure 07).

Figure 07 – Typical horizontal crack along the base of the wall showing uplift of concrete sections.

4.0 DISCUSSION & RECOMMENDATIONS

4.1 Concerning leaning and extensive cracking is present at the north east corner boundary wall. The largest cracks run both vertically over the full height of the wall and horizontally along the base of the wall.

4.2 The crack pattern and angle of lean indicates that the wall is rotating outwards, with the most severe rotation occurring in the central bays. Two of these bays have rotated to such an extent that they are classified as unstable and will eventually collapse unless action is taken.

4.3 The observed movement and defects can be attributed to any or a combination of the following:

- Insufficient foundations leading to overstress of the soil
- Insufficient ground level at the north east elevation, resulting in insufficient passive pressure
- Excessive water levels within the ground (due to surrounding vegetation) and/or water runoff from the Heath which would weaken the strength of the soil and cause swelling and heave leading to movement of the foundations

- Desiccation and shrinkage of the soil due to surrounding vegetation leading to movement of the foundations

4.4 It does not appear that the wall is in immediate danger of collapse, however deterioration is ongoing and measures must be taken in the short term to stabilise it.

4.5 There are several possible options to address the problems.

- Option 1: No action – This option is not recommended because, if left alone, the wall would eventually collapse due to the instability of two out of the seven bays of the wall and the ongoing cracking.
- Option 2: Demolish the wall and rebuild on new foundations – New foundations would be built to a lower level on soil with a higher bearing capacity and strength. It may be difficult to reuse the original bricks without damage or loss because of the use of cementitious mortars in the original wall construction.
- Option 3: Strengthen the wall and underpin the foundations – Retaining the existing wall and using HeliBars to stitch cracks could improve the cohesion of the wall and allow it to act as a single unit. To underpin the foundations, the wall would be propped, and mass concrete strip footings would be poured beneath the existing foundations to an appropriate depth and width to allow sufficient bearing capacity.
- Option 4: Combine Options 2 and 3 on a bay-by-bay basis – Stable bays would only need strengthening and underpinning to ensure continued stability. Bays which are unstable would be demolished and rebuilt as, even with new underpinned foundations, the walls are already leaning too much to be reparable in-situ.

4.6 Based on the current condition of the wall, Option 1 can be immediately eliminated. Option 3 is not recommended as the two unstable bays would continue towards collapse even if the foundations were strengthened. Option 2 is possible but not recommended as the majority of the bays are stable and this approach would likely destroy considerable original material due to the difficulty in removing the cementitious mortar from the bricks. Thus, Option 4 using a combination of Options 2 and 3 on a bay-by-bay basis is recommended to both ensure the stability of the wall and retain as much historic fabric and character as possible.

5.0 NEXT STEPS

5.1 Temporary Exclusion Zone

5.1.1 The north east corner boundary wall shows significant cracking and leaning to an extent that some bays have been determined unstable. This is clearly a concern in relation to the health and safety of staff and members of the public visiting the site, consequently we recommend that a temporary exclusion zone demarcated by Heras fencing is put in place at the south west and north east sides of the wall to prevent people approaching the wall or standing in an area that might be at risk should the wall collapse. We advise that the exclusion zone remains in place until the wall is stabilised.

5.2 Stable Bays

5.2.1 Crack Remediation – To remediate the vertical cracks that have formed on the south west and north east elevations, Helibar reinforcing bars are to be installed within the mortar bed joints at suitable intervals.

5.2.2 Underpinning – An investigation of the soil beneath the existing foundations is recommended to determine the soil properties and identify a suitable depth for new foundations to be installed at to achieve sufficient soil strength to avoid foundation movement in future. A new strip footing is to be installed beneath the existing wall and footing from mass concrete. The existing wall and footing and the adjacent areas of concrete terracing should be propped during construction of the foundation.

5.3 Unstable Bays

5.3.1 Wall Demolition – Sections of wall which are unstable are to be deconstructed carefully so as to minimise disturbance of adjacent wall bays and allowing for bricks in good condition to be salvaged for re-use where possible. Mortar should be carefully removed from the salvaged bricks to minimise damage to the bricks. Adjacent wall bays may need temporary propping while deconstruction is occurring.

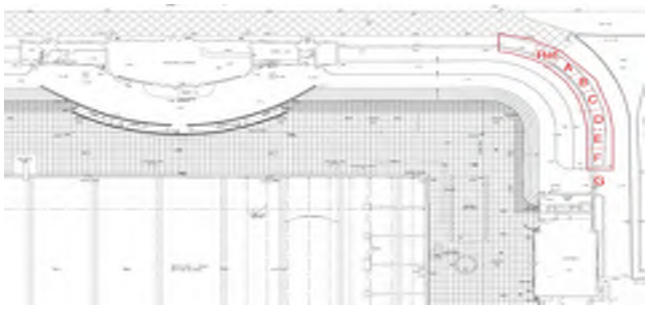
5.3.2 New Foundation Construction – Following soil investigations, new strip footings from mass concrete should be constructed beneath the areas of deconstructed wall. These footings should be integrated with the underpinning added to the stable bays to prevent differential movement between wall bays. Propping of adjacent bays and the concrete terracing will be required during foundation construction.

5.3.3 New Wall Construction – Once the new footings have cured, new wall sections can be constructed in-kind to match the existing wall and reusing as many bricks from the deconstructed wall sections as possible. New bricks should be sourced to match the material properties and appearance of the existing bricks. New sections of wall should be constructed with a sympathetic mortar and keyed into the adjacent wall sections.

Appendix 1 Calculation of Degree of Rotation and Determination of Stability

conisbee	Project	Project No	Sheet No
London • Cambridge • Norwich 1–5 Offord St London N1 1DH Telephone 020 7700 6666 www.conisbee.co.uk	Parliament Hill Lido	231038	1
		Date	By
	Title	22.11.23	EP
	Out of Plane Calculation		

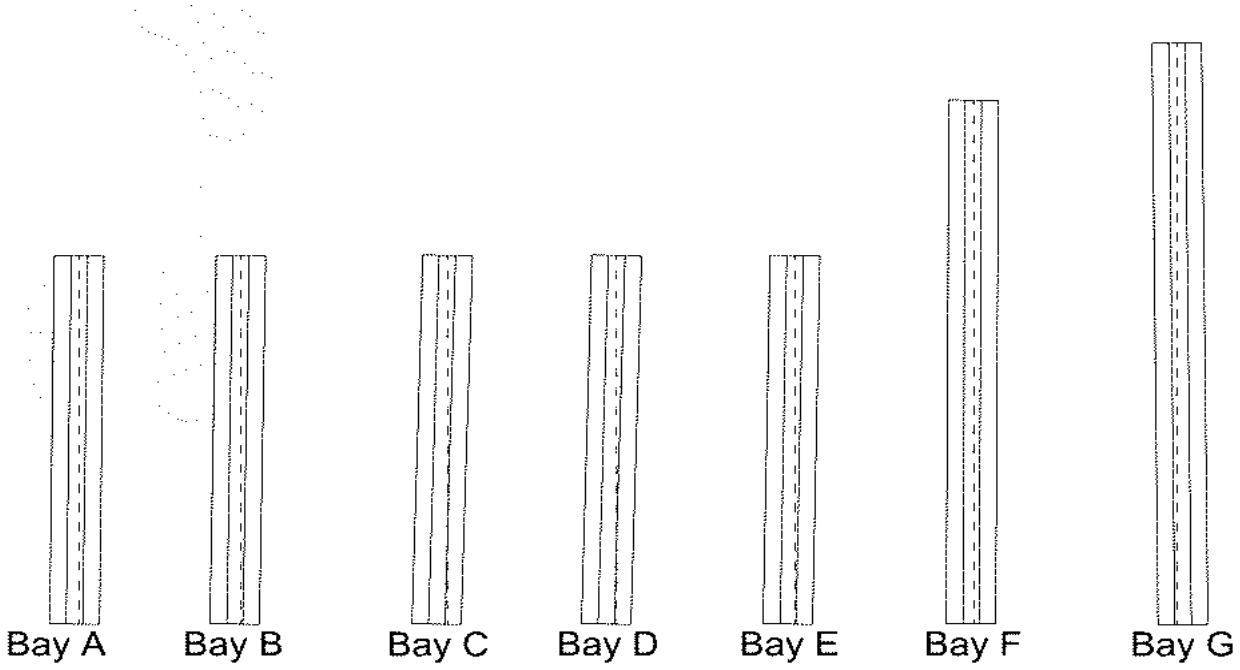
Bay Key



Notes

+ve angle = outward leaning
-ve angle = inward leaning
Top and bottom measurements taken at approximately the same height across all bays.
Reference bay is closest of the bays reconstructed in 2014 to the portion of the wall under consideration.

Bay	Ref.	A	B	C	D	E	F	G
Wall Height (mm)	1900	1900	1900	1900	1900	1900	1900	1900
Top (mm)	19	39	44	70	67	50	21	0
Bottom (mm)	18	16	15	19	18	17	12	18
Difference (mm)	1	23	29	51	49	33	9	-18
Angle - Vertical (°)	0.03	0.69	0.87	1.54	1.48	1.00	0.27	-0.54
Stability	Stable	Stable	Stable	Unstable	Unstable	Stable	Stable	Stable



Appendix 2 Damage Maps