Conservation of
PULHAMITE ARTIFICIAL ROCKWORK
Ramsgate, Kent

MADEIRA WALK

STAGE TWO REPORT

for

Ramsgate Heritage Action Zone
(HAZ) Partnership

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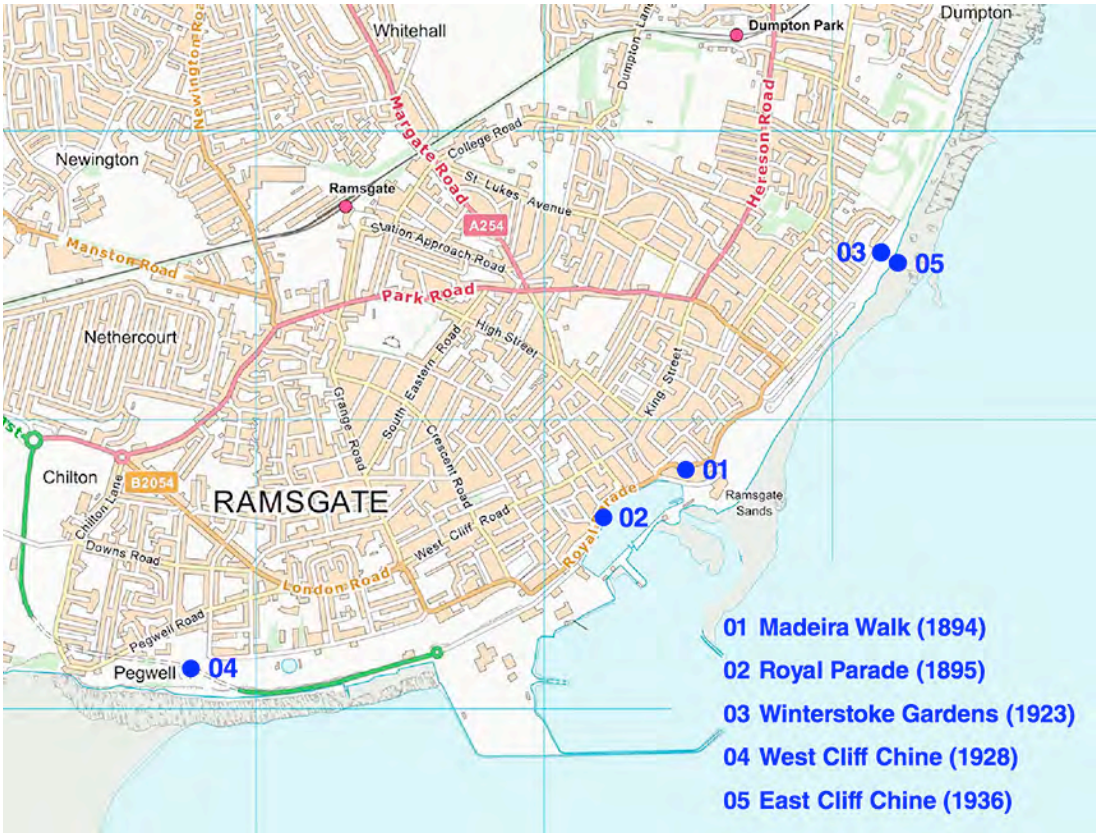
1. INTRODUCTION



1.01: RAMSGATE'S PULHAMITE ARTIFICIAL ROCKWORK SITES IN CONTEXT (MAP BASED ON OS OPEN DATA)

1.1 Background

1.1.01 Launched in March 2017, the Ramsgate Heritage Action Zone ('HAZ') is a five year, government–funded project which aims to support the regeneration of Ramsgate by harnessing its historic environment as a catalyst for economic growth. Coupled with new investment and development, heritage–related programmes of engagement and conservation are seen as key to strengthening the local economy for the benefit of the community. A grant from the MHCLG Coastal Revival Fund enabled the HAZ Partnership — Thanet District Council ('TDC'), Historic England ('HE'), Ramsgate Town Council ('RTC'), Ramsgate Community Coastal Team (who in 2018 successful bid for the grant) and community representatives — to fund a survey of the Pulhamite Artificial Rockwork that is a unique part of the late 19th century and interwar heritage of the town. RTC acting on behalf of TDC (the accountable body) comissioned The Morton Partnership ('TMP') to undertake the survey with CHRISTOPHER GARRAND BSc BArch GraDipCons(AA) RIBA AABC IHBC, the author of this report, invited to lead due to his knowledge and understanding of PAR. IRENE SEIJO BA (Hons) MA Public Art & Design was also appointed by TMP, her role being to assess the landscape element of the rockwork, and advise on vegetation and planting. Structural engineering advice was provided by Ed Morton BEng (Hons) CEng FICE IHBC CARE Accredited.

1.02: MADEIRA WALK (1894)

1.03: ROYAL PARADE (1895)

1.04: WINTERSTOKE GARDENS (1923)

1.05: WEST CLIFF CHINE (1928)

1.06: EAST CLIFF CHINE (1936)

1.07: ELLINGTON PARK (1893)

1.1.02 There are five Pulhamite Artificial Rockwork ('PAR') sites in Ramsgate:

01 Either side of Madeira Walk, a snaking road that rises from the Harbour to Wellington Crescent, the eastern part of a massive harbourside road improvement scheme of 1891–5; the PAR dates from 1894.

02 Within the brick arches that rise above Royal Parade, the inclined middle tier of the western part of the harbourside road scheme; the PAR followed–on from that of Madeira Walk and was completed in 1895.

03 Winterstoke Gardens at the northern end of Victoria Parade, opened in 1923.

04 Dating from 1926–8, a winding roadway in a gorge (chine) down through the cliff at the western end of Royal Esplanade Gardens; the PAR dates from 1928.

05 A chine down from Winterstoke Gardens to the base of the (east) cliff promenade and beach below, opened in 1936.

All sites were in February 1988 statutorily listed Grade II and are within (in one case next to) a designated conservation area. Madeira Walk is also part of the Grade II Registered Albion Place Gardens, first listed in July 1998.

1.1.03 Northwest of the Royal Harbour and Ramsgate town centre is Ellington Park, opened in 1893. A small formation of rockwork within the park has all the characteristics of near contemporary Pulhamite Artificial Rockwork, though its provenance as such is unproven; further research is needed. The site is not statutorily listed.

1.2 Purpose

1.2.01 The aim of the survey was to provide an assessment of the condition of Ramsgate's PAR, with a focus on defects that threaten its significance — defined in the National Planning Policy Framework ('NPPF') as its "value … to this and future generations because of its heritage interest" — and the resultant need for conservation ("The process of maintaining and managing change to a heritage asset in a way that sustains and, where appropriate, enhances its significance"). Prioritised maintenance and repair strategies to be implemented 'as and when' by volunteers, conservators and local contractors were (subject to detailed survey) required. The outcome would also inform an overarching conservation management plan for the HAZ, and possibly the revision of the Historic England ('HE') guidance *Durability Guaranteed: Pulhamite rockwork — its conservation and repair*, published in 2008.

1.3 Brief

1.3.01 In terms of the resources available for the survey, the order of priority was:

(a) Madeira Walk.

(b) Winterstoke Gardens.

(c) East Cliff Chine.

(d) West Cliff Chine.

(e) Royal Parade.

Initially, Madeira Walk, Winterstoke Gardens and the East Cliff Chine were surveyed in detail, with the West Cliff Chine and Royal Parade deferred pending funding.

1.3.02 Fundamental to the survey is the notion of 'informed conservation', a philosophy which requires decision on intervention — including maintenance and repair — to be based on evidence and justified need, i.e. 'understanding'. Hence the staged, methodical approach advocated in *Durability Guaranteed*, the basis of the brief:

A Drawing on a review of existing literature — including: a survey report on the Madeira Walk PAR prepared in 2000 by Simon Swann (1956–2018); a 1992 study of Royal Parade prepared by Donald W. Insall and Associates; and primary and secondary historic research — investigate and survey in outline the five sites culminating in Stage One (overview) reports on PAR generally, Royal Parade and the West Cliff Chine.

B Revisit and update the 2000 Madeira Walk survey — and where necessary and appropriate — its scope and format in light of subsequent work by Simon Swann and others on the conservation of Pulhamite Artificial Rockwork.

C Using the Madeira Walk methodology and format (as perhaps modified), survey in detail the PAR of Winterstoke Gardens and the East Cliff Chine.

D Bring together the outcome of each of the detailed surveys into a (Stage Two) report on the condition of the PAR and conservation issues to be addressed along with prioritised schedules of works; the latter to be clearly referenced to marked–up plans and photographic records that enable the location and nature of repairs (including site–specific constraints) to be easily identified.

E Following–on from the survey and schedules, produce cross–referenced generic specifications that describe the necessary types of repair, and the parameters under which they are to be executed, noting also site–specific guidance.

F Provide general and specific guidance on the maintenance and management of PAR including vegetation control, and the removal of graffiti and other soiling.

G If required, help arrange for the collection and analysis of further samples, and the execution of trial repairs (exemplars) to guide future repair. NOT REQUIRED.

H Assist in developing and supporting the training of volunteers (including as part of the survey), local contractors and others in the conservation of Pulhamite Artificial Rockwork.

Specialist advice on landscape and ecology was an integral part of the survey, as was collaboration with Ramsgate Town Council, HE and other interested parties.

1.3.03 Following–on from the review and update of the Simon Swann survey of 2000, this (detailed) Stage Two report on the Madeira Walk PAR is the outcome of paragraphs 1.3.02B & F and — in terms of volunteers — part of H. It provides a record and assessment of the rockwork as of the dates of survey (refer 5.1.01) along with prioritised guidance on maintenance and repair, a 'baseline' for the ongoing management of the Grade II listed Madeira Walk.

1.4 Methodology

BASIS

1.4.01 Using the approach employed by Simon Swann for the 2000 survey, the rockwork of Madeira Walk was divided into small, manageable survey zones (refer 5.1.01), each with the same unique identifier as the original key drawing, now referenced on a new drawing based on a topographical survey prepared in June 2019 by James Brennan Associates. Demarcation of zones followed the 2000 survey despite ambiguity around the waterfall area, and the need for some subdivision of zones on the south side.

PREPARATION

1.4.02 Copies were made of the hand–annotated Simon Swan survey sheets of 2000 as well as their typed–up counterparts; examples are provided as Appendix A. These were sorted and related to a set of elevational 'base' photos (non–rectified) that were prepared, one image per zone; each was selected on the basis of its coverage with in some cases a suitable image created by 'merging' two or more separate images using Adobe Photoshop. In order to be usable on site (for marking–up), shadows were removed or lessened, titles added and the (A3) photo sheets turned to greyscale (monochrome). An example is provided as part of Appendix B.

SURVEY

1.08: SURVEYING THE MADEIRA WALK PAR (JULY 2019)

1.4.03 Over a period of seven days (refer 5.1.01 for dates), each survey zone was, subject to the qualifications and limitations set out in 1.6.01, carefully inspected. The Simon Swann survey sheets from 2000 were back–checked with deterioration and damage recorded on the corresponding base photos. A detailed photographic record was also made (digital photos are typically 6,000 x 4,000 pixels resolution), including general as well as close–up shots with large, pre–printed labels used to relate images to survey zones. Inspections were primarily visual albeit metal tools — lightly dragged across surfaces — were used to test for hollowness, while cracks and fractures were probed (gauged) and in some instances measured. As a visual marker and to aid recording, each zone was (as in 2000) delineated with red–and–white hazard tape held in place by metal pegs. An example of a marked–up base photo is also provided as part of Appendix B.

1.4.04 Fully briefed volunteers — up to two at a time — provided assistance throughout the survey, including fielding questions from the general public, with many copies of a leaflet explaining the survey handed out. All those involved showed considerable interest in PAR and a willingness to learn about its history and conservation.

POST SURVEY

1.4.05 Survey sheets were collated and photographs batch re–named and sorted on a daily basis, the former being eventually (in the office) transposed onto a 'report' version of a new proforma survey sheet (copy included as part of Appendix A) based on the categories of deterioration set out in Section 7 of the Overview: Stage One report (soiling and discoloration; erosion and loss of coatings; defects in backings; cracks and fractures; previous repairs), a development of the Simon Swan methodology. The survey sheets form the basis of this report, to which end a full digital (PDF) set is provided separately, along a copy of the related photo archive of nearly 2,300 images in high resolution jpeg format. The key drawings which locate the survey sheets and photos are provided as Appendix C.

RESEARCH

1.4.06 HE provided copies of the most recent listing report for Madeira Walk (updated in 2019 as part of the HAZ programme) as well as images and catalogue entries from the Historic England Archive. Internet searches resulted in a large number of additional historic images, the most fruitful sources being the Thanet Online website maintained by the owner of Michael's Bookshop in Ramsgate, whose self–published collections of old postcards provided an even wider range of material. Use of the British Newspaper Archive website to explore back copies of *The Thanet Advertiser* (from 1930–44 the *Advertiser and Echo*) pinpointed articles relevant to the history and development of Madeira Walk.

1.5 Structure and content

1.5.01 Following this Introduction:

- **Form and fabric** (Section 2) describes the PAR in terms of its location and setting, design, materials and construction.
- **Planting** (Section 3) comprises a brief overview of how the PAR was at the time of the survey planted.
- **History and significance** (Section 4) outlines the origins and development of Madeira Walk and identifies the significance of its PAR.
- **Condition** (Section 5) presents and discusses a synopsis of the condition of the PAR as recorded on the survey sheets, and identifies any need for works.
- **Maintenance and repair plan** (Section 6) provides a practical strategy for the ongoing conservation of the Madeira Walk PAR. Covering inspection, routine and reactive maintenance, it ends with a prioritised schedule of repairs with reference to Outline Repair Specifications (Appendix D), with introductory notes on: procurement; health and safety; the implications of designation (listing and conservation area location) and records.

The report ends with **Bibliography** (Section 7) and a series of **Appendices** (A to F as referred to within the text of the report).

1.6 Qualifications and limitations

1.6.01 THIS REPORT MUST BE READ IN CONJUNCTION WITH OVERVIEW: STAGE ONE REPORT, IN WHICH CAN BE FOUND IN–DEPTH INFORMATION ON THE NATURE, HISTORY, DESIGN, MATERIALS AND CONSTRUCTION, AND PLANTING OF PULHAMITE ARTIFICIAL ROCKWORK ALONG WITH DETAILED BACKGROUND INFORMATION ON ITS DETERIORATION AND AN OVERARCHING APPROACH TO ITS CONSERVATION.

1.6.02 The following limitations also apply:

- The survey was conducted from ground level (above and below) using ladders to reach areas at height, albeit no access was gained to the plateau on top of the rockwork to the south side of Madeira Walk.
- No inspection could be made of any area of PAR obscured by vegetation including where covering the skyline of the rockwork (refer also 5.1.02).
- The pump chamber was not entered; nor the gated area beneath the waterfall or the three (locked) stores — one on the north side and two on the south.
- Access to the rockwork beyond the lower pool was limited to what could be observed from the pavement and the stepping stones, and the upper pool could only be viewed from the footbridge. For the purposes of survey, reliance is placed on the close inspection of high resolution photographs (refer also 5.1.02).
- The war memorial (Destiny) was not included in the survey.
- Balustrades, fixed seating, the structure of the footbridge, steps, railings, gates and other structures are excluded; other than where they directly impact on the PAR (the Albion Hill balustrade is briefly covered).
- Ecological considerations (including disturbance of protected wildlife) are as the March 2019 Scoping Survey Report prepared by Kent Wildlife Trust.

Planting and vegetation are only considered where of direct relevance to the condition of the PAR. WHERE NECESSARY, REFERENCE SHOULD BE MADE TO THE SEPARATE REPORT, SUPPORTING INFORMATION AND GUIDANCE ON PLANTING (MAINTENANCE AND MANAGEMENT) PREPARED BY IRENE SEIJO.

2. FORM & FABRIC

2.01: LOOKING WEST DOWN MADEIRA WALK

2.1 Location and setting

2.1.01 Starting just north of the inner basin of the Royal Harbour, Madeira Walk is a busy road (the B2054) that snakes approximately 200 metres east from the quayside (Harbour Parade) while rising some 12–13 metres up the start of the chalk cliff that stretches northeast from the historic centre of Ramsgate (Figure 1.01). At its foot is the Grade II listed former National Provincial Bank (now a restaurant) while at its top — the point where it flows into Wellington Crescent — is the Royal Albion Hotel, also Grade II listed. Madeira Walk lies at the heart of the Ramsgate Conservation Area, and mostly within the bounds of the Grade II Registered Albion Place Gardens (part of the rockwork on the south side is, for reason unclear, excluded). Other than at the top where it is possible to look out across rooftops to the Harbour and the English Channel, the road is contained and inward looking, barely visible from without and characterised by closed and unfolding views.

2.1.02 Albion Place Gardens sits on the north side of Madeira Walk. Roughly triangular in plan, a gently–sloping expanse of lawn with a gravel path skirting its perimeter is the setting for a central shrubbery within a square of four young trees. Continuous beds of planting dotted with small trees mark the northern extent of the Gardens, with dwarf brick walls and hoop–topped steel railings providing a hard edge to the parking bays and roadway beyond. Notwithstanding two large gaps and a run of modern infill, the brick and stucco, iron–balconied Regency terraces of Albion Place (mostly Grade II listed) provide the backdrop. A further run of hooped railings winds along the southern edge of the Gardens, marking the top of the PAR and the drop to the road which increases in steepness until — where it meets Albion Hill (the continuation of Albion Place) — it becomes a vertical face topped by a balustrade.

2.1.03 Other than the classically–styled elevation of the former bank, the south side of Madeira Walk is characterised by a variety of freestanding and retaining walls that form the rear boundaries of properties fronting the northern side of Kent Terrace and (mainly) the eastern stretch of Harbour Parade. A steep lane (Kent Place) and steps alongside the Oak Hotel provide direct access down to the edge of the Harbour.

2.02: ALBION PLACE GARDENS WITH REGENCY TERRACES OF ALBION PLACE

2.03: HOOPED RAILING ALONG SOUTHERN EDGE OF ALBION PLACE GARDENS

2.04: LOOKING DOWN ALBION HILL TOWARDS ROYAL HARBOUR

2.05: REAR OF BUILDINGS TO HARBOUR PARADE + FORMER BANK BUILDING

2.2 Design

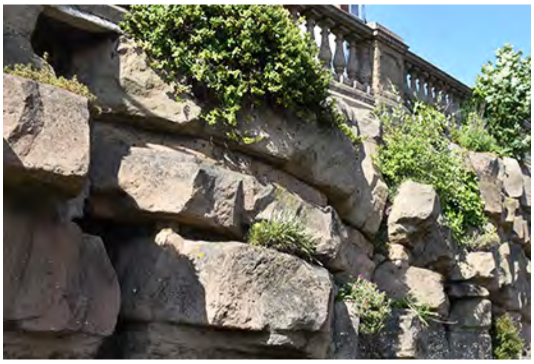
2.2.01 The PAR either side of Madeira Walk forms a theatrical urban ravine (gorge) that increases in height — from less than a metre to around 4.5 metres — as it descends, with low outcrops rising to near vertical cliffs. Rock formations tilt upwards with beds of varying thickness riding–up over each other so as to create the 'geology' of the dip slope, the craggy landscape emphasised by variations in the texture and colouring (pink, a sandy yellow and grey) of strata. Setbacks, fissures and overhangs add interest and drama with ledges, projections and fallen 'stones' incorporating an abundance of plant pockets of many shapes and sizes; the high tops of the 'escarpments' are also designed to accommodate planting.

2.06: LOOKING EAST UP MADEIRA WALK

2.07: 'DIP' SLOPE GEOLOGY

2.08: VARIATIONS IN TEXTURE & COLOUR

2.09: SETBACKS & OVERHANGS



2.10: PLANT POCKETS

2.2.02 On the northern side of the road, a cylindrical pier incorporating the coats of arms of Ramsgate and the Cinque Ports marks the foot of Albion Hill and the start of the PAR, at this point a craggy retaining wall crowned by a Venetian balustrade. The rockwork rises with the gradient of the hill before stepping down — and forward — to follow the line of Madeira Walk while the balustrade (interrupted by a small outcrop of PAR) gently curves towards its termination at the head of a wide, dogleg stair that cuts through the rockwork so as to link the two roads. North of the stair, a roughly rendered wall replaces the balustrade, the fragmentary remains of which continue to a lone rock alongside an entrance to Albion Place Gardens. Opening onto the lowest landing of the stair is the steel–faced iron gate of a small cave now used as a garden store; just below the stair, opening onto Madeira Walk, is a grotto recess containing a bench.

2.11: PIER AT FOOT OF ALBION HILL

2.12: BALUSTRADE INTERRUPTED BY PAR

2.13: UPPER FLIGHTS OF DOGLEG STAIR

2.14: RENDERED WALL ON ALBION HILL

2.15: STEEL–FACED GATE OFF LANDING

2.16: GROTTO RECESS WITH BENCH

2.2.03 East of the stair is a second grotto recess with seat, the rockwork at this point dipping down before stepping back to reveal an elongated, irregular pool fed — via a waterfall — by another, smaller pool at the level of the Gardens. The open edge of the lower pool is protected by a low metal railing on a PAR coping. Built into the cliff behind the PAR and reached by stepping stones, a deep cleft and a passage is the pump room that controls the flow of water; this can also be entered through the waterfall via a gated opening, above which is a Pulham face and the date 1894. Continuing around the upper pool and returning past the waterfall to create a short chasm, the PAR re–joins the line of the road, decreasing in height. After a recess containing a bench, it then steps back up before dropping to a flight of steps that leads to a footbridge (with PAR parapets) over the upper pool and thence into Albion Place Gardens.

2.17: POOL & WATERFALL (WITH GATE BELOW)

2.18: STEPPING STONES TO PASSAGE

2.19: FOOTBRIDGE OVER UPPER POOL

2.2.04 Just short of — and to the side of — the footbridge is a Grade II listed memorial to the fallen of the Great War, a partially–draped female figure called Destiny sculpted by Gilbert Bayes (1872–1953). Alongside (east) is a roughly oval area of paving (asphalt) bounded by a low wall, roughly–rendered in a crude approximation of PAR. Beyond the steps, the rockwork rapidly diminishes in height, recesses for another four seats being the principal interest over this stretch. The end of the rockwork is marked by a low, circular planter on the corner of Madeira Walk and Albion Place.

2.20: WAR MEMORIAL — DESTINY

2.21: CRUDE APPROXIMATION OF PAR

2.22: ROCKY RECESS WITH BENCH

2.23: CIRCULAR PLANTER TERMINATES PAR

2.2.05 Although of lesser extent, the PAR on the south side of Madeira Walk is equally dramatic — and shares many of the characteristics of its northern counterpart. It is a large 'island' of rockwork in three sections, each in essence a massive planter wrapped in rockwork. The smallest — a sizeable formation of stratified 'dip slope' rockwork — is at the bottom, hard–up to the former bank building, alongside which is an iron–and–timber gated 'cave' (a store). A two–flight stair rises through a rock arch to a short alleyway serving a doorway to the first floor of the former bank. The arch springs off the second section of rockwork which steadily climbs Madeira Walk; visible at the top and bottom of the first major fissure are Pulham faces, and (to the right at high level) what appears to be a crocodile. Roughly halfway along this section of rockwork the dip of the strata is suddenly reversed, the beds then following the slope of the pavement before levelling–out at a short tunnel, the upper strata continuing over and supported by corbels to form its roof. The retaining wall that forms the rear of the rockwork is only thinly rendered as PAR.

2.24: SECOND (CENTRAL) SECTION OF SOUTH SIDE OF MADEIRA WALK

2.25: PAR ALONGSIDE FORMER BANK

2.26: CRUDE ROCK ARCH OVER STAIRWAY

2.27: PULHAM FACE (L) & CROCODILE (R)

2.28 DIP & STRATA REVERSE

2.2.06 Beyond the tunnel (the entrance to a roadway serving rear of the buildings on Harbour Parade) — at a large fissure — the strata dip back down against the (now gentle) slope of the pavement before decreasing in height and petering out. Interrupting this third section of rockwork is a narrow, PAR–lined passageway alongside the rear wall of the gardens of the Oak Hotel, near the end of which is another gated 'cave'. A small, detached outcrop of rockwork punctuates the metal railings that continue alongside Madeira Walk as far as the Kent Steps (the head of Kent Place), on the corner of which is a final formation of PAR.

2.29: ROADWAY & REAR OF 'TUNNEL'

2.30: PASSAGEWAY TO REAR OF OAK HOTEL

2.31: DETACHED OUTCROP OF PAR

2.32: ROCKWORK AT HEAD OF KENT STEPS

2.3 Materials and construction

2.3.01 In terms of materials and construction, the Madeira Walk rockwork is typical of the work of James Pulham & Son as promoted by their brochure *Picturesque Ferneries* *and Rock–Garden Scenery* (Pulham, 1877), exhibiting many of the characteristics described in Section 4 of the Overview: Stage One report. The principal backing material is a rough concrete incorporating fragments of brick and other materials including a white–grey granite and blocks of what appear to be chalk. Retaining walls and plant pockets are of bricks laid in a hydraulic lime mortar. Overhangs, archways, etc. are of cantilevered or corbelled stone and slate slabs. At the end of the southern run of PAR is a coping of sandstone boulders. Exposed flints are packed into fissures, a typical feature of Ramsgate's PAR. The Albion Hill balustrade is of precast concrete with terracotta piers. Analysis (refer Appendix E) has revealed coatings to be based on a meso–Portland cement with a variety of aggregates. Red and yellow iron oxide, crushed charcoal (black) and calcium carbonate (white) pigments are present.

2.33: LOSS OF SURFACE EXPOSES ROUGH CONCRETE BACKING

2.34: GRANITE WITHIN BACKING REVEALED BY LOSS OF SURFACE

2.35: CANTILEVERED STONE SLABS CORBEL TO FORM ROOF OF TUNNEL

2.36: SANDSTONE BOULDER COPING TO PAR ON SOUTH SIDE OF MADEIRA WALK

3. PLANTING

3.01: TYPICAL ARRANGEMENT OF SHRUBS & ANNUAL PLANTING

3.1.01 The planting in Madeira Walk is extensive and diverse. A 2002 report by Land Use Consultants ('LUC') differentiates six planting types:

- Skyline trees and shrubs.
- Faces.
- Rock pockets.
- Scree.
- Water marginal.
- Close–up scree.

Recommended plants for each type are listed, which are drawing from planting lists "as recommended by Pulham" in Picturesque Ferneries, etc.

3.1.02 Most of LUC plant types are evident at Madeira Walk, along with a large array of additional plants, notably a large number of *Phormium cultivars*, *Valeriana officinalis* and *Photinia sp*. Common red and Californian poppies are present as well as grasses (including pampas) and bamboos. *Carpobrotus rossii* is creeping rapaciously over some rock faces and there are many herbaceous, annually–planted, half hardy plants at lower level (some appear on the LUC lists). Many plants have 'self seeded' and some are invasive and possibly damaging, e.g. *Quercus ilex* (Holm oak), Sycamore seedlings *(Acer pseudoplatanus)* and *Pyracantha sp*, especially where rooted in small plant pockets that leave little room for expansion.

3.02: PAMPAS GRASS

3.03: CARPOBROTUS ROSSII

3.04: SYCAMORE SEEDLING

3.05: PYRACANTHA

3.05: BUDDLEIA

3.06: QUERCUS ILEX

4. HISTORY & SIGNIFICANCE

4.1.01 The terraces of Albion Place were erected and Albion Place Gardens laid out in the 1790s, one of a number of speculative developments spurred by the rising popularity of Ramsgate as a seaside resort. Originally, the Gardens — which were opened to the public in 1840 — extended as far south as the cliff to the rear of the properties fronting Harbour Parade (formerly Goldsmid Place) and thus the top of Kent Lane (Steps) and the stepped alley alongside the Oak Hotel (refer 2.1.03). A clifftop walkway provided a pedestrian link between the East Cliff Promenade and — via a short piece of road — the top of Albion Hill, at the foot of which and also fronting the Harbour was the Albion Hotel.

4.01: 1873 (1871) OS MAP — BEFORE CONSTRUCTION OF MADEIRA WALK

4.02: 1898 (1896) OS MAP — RED = LINE OF CLIFF; GREEN = ORIGINAL GARDEN

4.1.02 Madeira Walk was driven through the southern half of Albion Gardens as an integral part of a massive Council project to improve connections between the Harbour and the cliff tops east and west, the existing roads being too narrow and steep for carriages, an obstacle to the continued prosperity of Ramsgate as a commercial port and holiday destination. Work on the scheme commenced in November 1891 under the direction of the Borough Engineer, William Valon (1838–1909) and was completed in 1895. The gross structural cost of £61,313 included: new roads; works to existing roads; alterations to the Harbour and new sea walls; a Harbourmaster's house; and a new Customs House (now the Town Council offices). The net cost of the scheme after adding non–structural costs (legal, compensation, interest, etc.) and offsetting against rents, land disposal, etc. was £56,325 — the full account for the project was presented by Valon at a Council meeting on 6th June 1985 as reported in *The Thanet Advertiser* of 8th June. William & Thomas Denne of Walmer was the contractor.

4.1.03 The serpentine line of Madeira Walk was adopted so as to ease the gradient from Harbour Street to Wellington Crescent, Valon's original plan — described in a paper delivered on 17th August 1894 to a meeting of the Sanitary Inspectors Association at the Royal Hotel and published in *The Thanet Advertiser* of 25th August — having been for the road to rise up the cliff in a straight line, presumable to avoid the retaining wall and large volume of fill that was in the end necessary to accommodate the curve of the road. It was also decided to treat the change of level between Albany Place Gardens and the new road as a rocky gorge, the near vertical faces of which it was felt would be easier to maintain than otherwise steep banks, notwithstanding the need to retain Albion Hill following the demolition of buildings on its southern side.

4.03: MADEIRA WALK & ALBION PLACE GARDENS BEFORE 1901 (HEA ref. OP00661)

4.1.04 James Pulham & Son were in April 1894 contracted to build the rockwork for £770 (included in the £5,326 total structural cost of the eastern approach), though not without a Council meeting of 5th April raising questions as to why the work had not been competitively tendered, albeit the contract was sealed that day. Interestingly, the contractual address for "Pulham and Son" (sic) is 50 Finsbury Square in London (not Broxbourne; refer Section 3 of Overview: Stage One report); add to which the firm is described as "Terra Cotta Manufacturers" — it is possible that it also supplied the terracotta balustrades of Albion Hill and Royal Parade (refer separate report).

4.1.05 Set out in the contract (article one) is a detailed specification for the rockwork "to be formed by the Contractor's Pulhamite Stratified Rock" and "when done the rocks will appear massive and bold and form a picturesque naturalistic winding road through a split in the rock." The description of the overall form of the PAR, its features — including steps, shelters and the waterfall — and materials closely matches what can be observed today, noting the specific requirement for the rockwork on the south side to include retaining walls high enough so as "the unsightly backs of buildings may to a great extent be hidden from view" and to "rockify" the roadway ("cutting") along the backs of the buildings of Goldsmid Place. Pulham & Son were to provide all the skilled labour and the “Pulhamite Cements”; the Council (“Corporation”) would free of charge supply all other materials, unskilled labour, scaffolding, casting (presumed to mean the rough concrete of the backing), turfing, planting and protection.

4.1.06 Supplementary to the contract, the Front Improvements Committee responsible for the project ordered a sample of PAR up to the value of £100 to be first carried out, and approval of the Council sought as to its quality before the rockwork was adopted for the entirety of the new road. Acceptance of the sample was noted at a Council meeting on 3rd May 1894, by which time the work was far enough advanced for — according to *The Thanet Advertiser* — the May Queen “to be planted with scant ceremony on the highest dais of the Pulhamite rockwork.” The same Council meeting also authorised a payment on account of £80 with an additional £150 (third payment) sanctioned on 5th July, at which meeting it was also noted that that works to open the road would commence on 9th July.

4.1.07 However, not everyone was happy with the rockwork. In a letter printed in *The Thanet Advertiser* of 28th July 1894 ‘A Londoner’ disparagingly opined “How it can be contended that the removal of the Albion Hotel, the ruthless slicing and cutting up of your Albion Gardens, and the substitution of glaring–hued imitation rocks, are improvements is a marvel and a mystery to me.” And at a Council meeting on the 2nd August (press report dated the 4th), a Councillor Hart is quoted: “Anything more ridiculous that this sham rockwork he could not imagine. If a prize were offered for the ugliest thing of the kind, the Pulhamite rockery would win it. They [the Council] had been at enormous expense to make the east cliff approach wider; having made it wider they proceeded to make it narrow by blocking each side with rockery.”

4.04: THE WATERFALL WITH RUSTIC BRIDGE 1894–1901 (LOC ref. LOT 13415, no. 826)

4.1.08 It is not clear when exactly the PAR was finished, though late August or early September appears most likely, the contract having stipulated completion within six months, four if possible. The whole of the front improvement project was complete by June 1895, with the name Madeira Walk proposed and formally adopted at a Council meeting on 18th July. The (former) National Provincial Bank (refer 2.1.01) was in 1896 erected hard–up against the rockwork.

4.05: NORTH SIDE OF MADEIRA WALK SOON AFTER COMPLETION IN 1894 — NOTE RECENT PLANTING & TEMPORARY HURDLES

4.06: VIEW FROM ALBION HILL (BALUSTRADE INTACT) BEFORE 1901 (HEA ref. OP00657)

4.07: NORTH SIDE OF MADEIRA WALK FROM 'TUNNEL' — BEFORE 1901

4.1.09 Early photos of Albion Place Gardens after the completion of Madeira Walk — judged on the basis of the absence of tramlines, overhead lines and supporting masts to date from before early 1901 (trams started running on 4th April 1901 and ceased on 27th March 1937) — show the PAR not long after completion. Planting is sparse and not yet established. The presence of hurdles in one photo indicates that the banks above the rockwork are still being planted, indicating perhaps that the photo dates from 1894–5. Low railings front the planting on Madeira Walk, though the edge the Gardens is unprotected, fences at the top of the banks not being clearly evident until the 1930s (by which time the street–level railings appear to have gone). A rustic bridge spanned the head of the waterfall, though this had by the 1920s been replaced by the low rockwork parapets seen today, perhaps a part of the works associated with the war memorial (refer 4.1.10).

4.08: THE WATERFALL AFTER c.1920 OR AFTER — NOTE PARAPET (HEA ref. PC10917)

4.09: ROCKWORK REPLACED RUSTIC BALUSTRADE c.1920 (HEA ref. PC10915)

4.10: VIEW OVER ALBION PLACE GARDENS & MADEIRA WALK AFTER LIFTING OF TRAMLINES (RAILS) c.1937 (HEA ref. PC10063)

4.1.10 On 19th December 1920, the war memorial was unveiled by Dame Janet Stancomb–Wills (1854–1932), the statue Destiny (refer 2.2.04) having been erected at her expense; the oval of crude rockwork to the side likely dates from the same time. *The Thanet Advertiser & Echo* of 10th May 1924 reported a car having crashed through the balustrade on Albion Hill, damaging it for some 20 yards. This may explain the fragmentary remains described in 2.2.02, albeit an earlier article (7th October 1916) refers specifically to Pulham & Son carrying out repairs to the balustrade. Having avoided bomb damage in WW2 — a number of houses on Albion Place were destroyed — the only major change to the PAR came in 1990 when listed building consent was granted to demolish 25–30 metres of rockwork on the south side of Madeira Walk, seemingly to enable highway works (refs. L/TH/90/0262 and 0263).

4.11: EXTRACT FROM POSTCARD c.1920 SHOWING PAR DEMOLISHED IN 1990

4.12: EXTRACT FROM POSTCARD c.1970 (COMPARE PLANTING WITH 4.05)

4.1.11 Planting has over the years become thicker and more extensive, notwithstanding a refurbishment of the Garden in 1984 (LUC, 1998) as well as a Heritage Lottery and EU funded restoration project that in 2002 saw (amongst other works): the removal of three large trees at the foot of the south side of Madeira Walk; cutting back seedlings and saplings; some clearance of shrubs; new railings; and the restoration of the mechanism that powers the waterfall, the pump room having in 1995 been gutted by fire. There is no evidence of any major repair of the PAR though in the early 1990s most of the terracotta balustrade on Albion Hill was renewed in concrete.

SIGNIFICANCE

4.1.12 The rockwork of Madeira Walk is a distinctive element of a major piece of civil engineering that saw the historic heart of Ramsgate re–planned so as to open–up access to the clifftops east and west. Its sinuous line, planted rockeries, shady caves, scenic waterfall, rock arches and stepped changes in level combine to create a dramatic, picturesque design of much architectural interest — and a key element of Albion Place Gardens and the Ramsgate Conservation Area. In terms of the history of James Pulham & Son, Madeira Walk is ‘classic’ PAR on a grand scale, clearly reflecting the ideas set out in *Picturesque Ferneries and Rock Garden Scenery* though (along with Royal Parade) a unique example of the firm working in a wholly urban context. It is also a part of Ramsgate’s nationally important group of PAR structures, a record of the Pulham rock–building business over its last 42 years.

5. CONDITION

5.1 Introduction

5.1.01 Set out in this section is a detailed summary of the condition of the PAR of Madeira Walk as recorded in 2019, noting the limitations on access (refer 1.6.02). Its arrangement reflects the sequential description of deterioration used in Section 7 of the Overview: Stage One Report, which must be read in conjunction:

- Soiling and discolouration.
- Erosion and loss of coatings.
- Defects in backings.
- Cracks and fractures.
- Previous repairs.

Presented and discussed under each of these headings is what was observed, along with an assessment of the need for maintenance and repair. A concluding summary precedes the Works Plan set out in Section 6. REFERENCE SHOULD ALSO BE MADE TO THE REPORT, SUPPORTING INFORMATION AND GUIDANCE ON PLANTING (MAINTENANCE AND MANAGEMENT) PREPARED BY IRENE SEIJO, LANDSCAPE ARCHITECT.

5.1.02 Where attention needs to be drawn to specific locations, observation and discussion refer to the survey zones (key plans are provided as Appendix C). As noted in 1.4.05, a full set of survey sheets and the related photo archive — sorted and labelled in terms of zone references — is provided separately in digital format. Surveys were carried out on: 9th July (zones N01 to N10); 10th July (N11 to N18, N15A & N15B); 11th July (N29 to N32); 12th July (N33 to N37, S01 & S02); 13th July (N19 to N28 & N28A); 22nd July (S04 to S07); and 23rd July (S03, S08A, S08B, S08C, S09 to S12, and S11A). Access — and hence inspection of — zones N11, N12, N14, N2, and N19 to N26 & N28 was limited by extensive vegetation or water (refer 1.6.02).

5.1.03 Underpinning the survey (refer 1.3.02) — and therefore all advice on the maintenance and repair of the Madeira Walk PAR — is the PHILOSOPHY of 'informed conservation', the basis of which is understanding and justified need. This leads to a 'minimalist' way of thinking which aims to make the best use of resources, accepting things 'as found' and that — in the context of the rockwork — it is neither desirable or realistic to make good all instances of deterioration, i.e. the 'patina of age' is integral to special interest and no attempt should be made to present the PAR 'as new'. The aim is to preserve (and perhaps enhance) significance in the face of loss or damage due to lack of maintenance or want of repair, while avoiding needless renewal or restoration. It presumes that as much of the existing rockwork as possible (backing and coatings) should be retained, other than where removal is necessary to mitigate a threat to significance. Hence the reason why in many cases it is acceptable to 'leave alone' and simply maintain rather than attempt repair.

5.2 Soiling and discoloration

OBSERVATIONS

5.2.01 Apart from some fading (loss) of colour due to surface erosion — the norm for Ramsgate's PAR — the rockwork of Madeira Walk is light to moderately soiled:

- **Lichen** coverage was extensive but localised and light.
- **Moss** was in a few instances present (N01, N03, N05, N08, N13, N27, N28, N37, S02, S05, S06, S07, S10 & S11) notwithstanding extensive build-ups and associated biofilms (slim) on the rocks associated with the pools and waterfall (N22–N26); build-ups on S10 and S11 were especially heavy.
- **Airborne dirt** was universally albeit soiling was in the main light, other than in the grotto recesses (N12 & N16), tunnel (S08B) and passage (S11A) where the build–up of dirt was heavy.
- **Surface efflorescence** beneath overhangs and in other sheltered areas was often present, especially in the grotto recesses, tunnel and passage. In most cases, these had converted to a grey–black **sulfate** crust, instances of which were extensive (i.e. almost always present) and often heavy.
- **Biological deposits** were limited to almost imperceptible instances of bird fouling. Small concentrations of dog urine were observed in two locations, one a projection (N11) and the other a corner at the foot of steps (N32).
- **Graffiti** was light and mainly comprised chalk though relatively fresh aerosol paint was in once case noted (S04); minor instances of faded paint and thicker spots were also observed (N13, N15A, N15B, N16, N35, S07 & S08B). NO PARKING is painted onto the PAR retaining wall to the south of Madeira Walk (refer 2.2.05).
- **Metal staining** (runoff) was in a few instances associated with the embedded remnants of historic ironwork (e.g. N05, N07 & N08).

5.01: MOSS ON SKY FACING SURFACE (S06)

5.02: AIRBORNE DIRT + LICHENS (S02)

5.03: SURFACE EFFLORESCENCE (S08B)

5.04: SULFATE CRUST (S02)

5.05: GRAFFITI — SPRAY PAINT (S04)

5.06: IRON STAINING (N07)

DISCUSSION

5.2.02 Instances of mosses (and possibly damp, especially where surfaces are north–facing, i.e. S02, S05, S07, S10 & S11) apart, the level of soiling to the Madeira Walk PAR is as would be expected for an environment that has for over a century been intensively exposed to urban pollution, much of the airborne dirt being thin films of hydrocarbons associated with motor vehicles. It is in the context of pollution that the grey–back colour of the sulfate crusts needs to be understood. These are the result of chemical action and always associated with overhangs and other sheltered areas where salts from the sea air, ground and to an extent the chalk behind the PAR are not readily washed away, and which have over time formed crystalline layers that are stained by diesel fumes, soot and other pollutants (refer 7.2.01/04 of the Overview: State One Report). The white blooms of efflorescence — like the sulfation, most marked within the grotto recesses, the arch spanning S02 to S04 the tunnel and the passage — are the first stage of this process. While the crusts (which are almost certainly 'cross-liked' with the render coating and hence hard to remove) and blooms may eventually play a role in surface erosion, they are in the main benign and should be accepted as part of the historic aging of the rockwork. The only exception would be where cleaning is necessary to effect repairs, noting that within the grotto recesses, tunnel and passage airborne dirt and sulfation can be difficult to distinguish.

5.2.03 Given that graffiti removal (refer D3.08 of Appendix D) can itself be highly damaging, the few instances of paint are best left to continue to fade, especially as they are not obtrusive or offensive. The only exception might the relatively fresh graffiti to the rear of S04. Chalk is also best left. If rubbed too early it can permanently stain (especially if on top of other forms of soiling) and will eventually wash away, albeit light sponging may be employed in sheltered areas.

NEED FOR MAINTENANCE & REPAIR (CLEANING)

5.2.04 Soiling and discolouration of the Madeira rockwork is a minor issue and, other than where cleaning might be needed as part of any repair, there is no need for cleaning, notwithstanding graffiti control being an essential part of routine maintenance (refer 6.3.06 & 6.3.07). Nonetheless, mosses indicate damp and hence should be removed to enable the condition of the rockwork below to be examined.

5.3 Erosion and loss of coatings

OBSERVATIONS

5.3.01 Despite widespread — and fairly evenly distributed — isolated areas of pitting or minor loss (often with the backing grinning–through), the coatings of the Madeira Walk PAR are generally in good condition:

- Fading and light erosion is extensive, albeit tinted coatings are still relatively vivid, depending on the light and especially on the higher outcrops on the north side of the road, and within sheltered areas such as the S02–S04 arch, tunnel and passage where the original colouring is particularly rich despite overlays of airborne dirt and sulfation, and the 'flaking' of the finish coat.
- There are instances of surfaces that are more deeply scoured than the norm (e.g. at low level on the sandy-coloured strata of N08, N10 & S03). Patches of light granulation are sometimes present beneath overhangs.
- Areas of more intensive pitting mixed with hollowness and granulation leading to areas of total surface loss and exposure of the backing (rough brick and concrete) were noted in zones N09, N11 and N18. Complete loss of surface was also observed in zones S01, S02, S04, S05, S08C, S09, S10 and S11.
- Blistering and surface loss to the undersides and leading edges of stone–slab overhangs is extensive; almost all cantilevered plant pockets are affected.
- Hollowness and surface loss adjacent fractures are also evident (e.g. S02).

5.07: MINOR LOSS (N01)

5.08: DEEP SCOURING (N08)

5.09: PITTING & HOLLOWNESS (N09)

5.10: UNDERSIDE LOSS (N16)

DISCUSSION

5.3.02 The degree to which the rockwork has faded and been eroded is consistent with over a century of weathering. Likewise minor pitting and loss, often where vulnerable arises have been chipped or coatings were laid–on thin (‘skimmed’, e.g. N36); there is a sense that the eastern end of the rockwork (refer 4.1.08) was a rushed job. While not widespread, there is across the whole of the Madeira Walk PAR instances where edges are exposed so as to potentially increase wetting and hence decay: N01, N05 to N09, N11 to N15A, N16, N19, N27, N30 to N34, N36, N37, S01 to S07, S08B to S11 and S12. The losses in zones N16, N27, N33, N37, S02 & S06 are examples of impact, the latter clearly hit by a vehicle (there is also impact damage in zone 28A, the horseshoe of crude ‘rockwork’ that was added in 1920 — refer 4.1.10). There was little evidence of subsequent loss of surface, and in other areas the exposed edges of the coating are weathered–in and unlikely to deteriorate further.

5.3.03 Two of the observed instances of more widespread pitting, hollowness, granulation and surface loss (N09 & N11) appear to relate to orientation as well as salt build–up having reached the point where the render coating has been weakened by chemical action (refer 7.3.03/05 of the Overview: Stage One Report). Here, the light-coloured PAR — which is low down and hence relatively sheltered, i.e. not washed, similar to if it were beneath and overhang — faces the Harbour and hence is exposed to a prevailing wind that is laden with high levels of salt (sea spray) as well as fine grains of sand whipped–up from nearby beaches. Salt levels and abrasion will therefore be intensified making detached or friable surfaces more prone to erosion and loss. Hence the 'preferential' weathering.

5.3.04 The influence of orientation is also evident on north–facing areas of surface loss (S01, S02, S05, S09, S10 & S11) as well as two south facing — albeit often shadowed — instances (S02 & S08C). Here, the surface has cleanly 'sheared', indicating that while chemical action might play a part (initial cracking 'opening–up' surfaces) the principal cause of loss is likely to be frost action due to a higher exposure to wetting and low temperatures combined with reduced exposure to the warming effect of the sun. The apparently frost–shattered backings in some of these areas (refer 5.4.01) adds weight to this argument. Poor keying may also be a factor (applies also to granite).

5.11: SURFACE LOSS DUE — PREFERENTIAL WEATHERING DUE TO ORIENTATION (N09)

5.12: SURFACE LOSS — SHEARING FROM CHALK BLOCKS DUE TO FROST (S01)

5.3.05 Salts will also have exacerbated the loss of surface from the undersides of overhangs, albeit decay is slightly less prevalent in the top tier of plant pockets which — being 'one-sided' and part of the ground — have more capacity to carry water away from the vulnerable stone and slate cantilevers (refer 7.3.05 of the Overview: Stage One Report). It should be noted that horizonal hairline fractures are the first sign of underside loss (refer 5.5.03). Frost action will also be a factor in underside loss as well as the detachment of render adjacent fractures, albeit differential movement or settlement (of detached and dislodged portions of rockwork) might in such cases be a contributory factor).

5.13: LOSS OF SURFACE LEAVING COATING VULNERABLE TO WATER (N37)

5.14: PARTIALLY DETACHED AREA OF COATING AT HIGH LEVEL (S09)

NEED FOR MAINTENANCE & REPAIR

5.3.06 The general pitting and loss of rendered surfaces is a minor issue that warrants no more than regular inspection (refer 6.3.02 to 6.3.05), save perhaps work to mitigate the vulnerability of exposed edges and backings as discussed in 5.3.02. Dressing (careful trimming) the render to remove loose material and water traps would, where appropriate, be a practical short–term option. Beyond which, the skilfully–matched restoration of missing areas of coating would be the preferred method of repair.

5.3.07 Renewal and restoration of the hollowed, granulated and lost areas of surface as considered in 5.3.03 and 5.3.05 is also a possibility. However, as regards N09 and N11, the high exposure to salts and southwest orientation — key agents of decay — cannot be changed, the deterioration would in time be repeated; likewise the sometimes deteriorated chalk block backing to S01, S02, etc. In which context it would be prudent to continue to monitor and — in line with the philosophy set out in 5.1.03 — accept localised surface loss as part of the historic 'weathering' of the PAR, subject to review as part of the next quinquennial (five–yearly) survey update.

5.3.08 Underside loss does not visually detract from the Madeira Walk rockwork as a whole and is best accepted, given the inherent difficulty in ensuring that render coatings adhere to the edges and soffits of the stone slabs. However:

- Horizontal hairline fracture a the bases of plant pockets (refer 5.3.05) should be monitored as part of the inspection regime outlined in 6.3.03.
- Hollowed or lost surfaces adjacent fractures should be repaired in conjunction with repair (refer 5.5.05): sound surfaces can be re-attached by micro–-grouting and maybe pinning; lost areas should be repaired to match the original.

There is one instance (S09) where surface stabilisation is urgent: a partially detached area of coating at high level has the potential to fall onto the pavement.

5.4 Defects in backings

5.4.01 A few instances of impact damage to backings (that also affect coatings — refer 5.3.02) were observed. The decay (mainly delamination) of stone slab overhangs was also generally evident, e.g. N07, N08, N14, N15A, N29, N31, S01 and S08B. Frost damage to chalk blocks was present in zones N19, S08C, S09, S10 and S11 while to the rear of S04 the backing has been fractured by the expansion of the corroded end of an embedded iron handrail. Following the 1990 demolition of the eastern part of the southern formation of rockwork (refer 4.1.10), some two thirds of the backing of S11 was left broken and exposed, its weathering now dependent on the sandstone blocks which serve as a rough coping. Making good impact damage will by necessity be a precursor to the repair of the vulnerable areas as noted in 5.3.06. As in the case of coatings (refer 5.3.08), underside decay of stonework is best accepted, though ongoing loss should be monitored and if necessary pinning or consolidation might be considered; likewise any determination of the backing to S11. Defects in backings as a result of fracture and displacement are covered by 5.5.01 to 5.5.05 below.


5.15: IMPACT DAMAGE (N16)


5.16: FROST DAMAGED CHALK (S08C)

5.5 Cracks and fractures

OBSERVATIONS

5.5.01 Fine surface cracking was almost universally present, generally evident as crazing; most is weathered and overlain with dirt. Fractures (cracks that penetrate backings — refer 7.5.03 of the Overview: Stage One Report) were present across much of the rockwork, the highest concentration being in zones S01, S02, S03, S04 and S05:

- Significant hairline fractures up 1-3 mm in width present in zones: N03, N08 (2 no), N09 (2 no), N10 (2 no), N11, N13 (3 no), N14, N17, N18 (4 no), N20 (2 no), N21, N22, N29, N30, N31 (3 no). N32 (2 no), N33, N36 (2 no), N37, S01 (4 no), S02 (2 no), S03 (4 no), S04 (9 no), S05 (3 no), S07 (4 no), S08B, S08C

(2 no), S10 and S11 (2 no). Most of these fractures were vertical albeit with horizontal and diagonal components. Some continue as major fractures.

- Major fractures — mainly vertical or near vertical — were present in zones: N01, N05, N07, N08 (2 no), N11, N12, N13, N14 (2 no), N15 (3 no), N15A (2 no), N15B (2), N16, N18 (2 no), N19, N20, N24, N31, N33 (2 no), N34 (2 no), N37 (2 no), S02 (2 no), S03 (2 no), S04 (4 no), S05 (4 no), S07, S08A, S08B (2 no), S08C, S09 (2 no), S11 (3 no) and S11A (2 no).
- Wholesale displacement involving fractures was present in zones: N09, N19 (2 no), N22, N28A, N30, N33, S01 (3 no), S02 (3 no), S04 and S08C.
- In two cases fractures have led to the collapse of plant pockets: one (N04) since the 2000 survey; the other (N29) held together by a steel hawser. A horizontal fracture at the root of a cantilevers to S01 should be investigated further.

5.17: FINE SURFACE CRACKING (N03)

5.18: HAIRLINE FRACTURE (N14)

5.19: MAJOR FRACTURE (S07)

5.20: FRACTURE & DISPLACEMENT (N19)

DISCUSSION

5.5.02 Weathering and dirt means that much of the fine cracking is historic and, given that it is generally sound and does not appear to be worsening, probably dates back to soon after the application of the coating, i.e. the majority is due to overworking or initial drying shrinkage (refer 7.5.02 of the Overview: Stage One Report) and does not present a problem. Some of the coarser cracking is associated with friable surfaces and deterioration due to sulfates and orientation (refer 5.3.03).

5.5.03 While some hairline fractures — mainly horizontal and especially near the bases of plant pockets — maybe the first signs of underside loss (refer 5.3.05), the majority of fractures and associated displacement are due to unmanaged, woody vegetation, the greatest threat to the ongoing conservation of the Madeira Walk PAR; not just tree or shrub boles and root systems which have outgrown plant pockets (for example, the sycamore seedlings at high level in zones N07 and N08) but also ivy and other invasive plants that have self–sown in fissures and sometimes fake cracks.

5.5.04 Nearby trees are likely to also have contributed to fracturing, the most notable instances being a large holm oak just north of the steps up to Albion Hill that may be responsible for some of the fractures in zones N15, N15A and N15B, and the similarly sized pair of holm oaks on the south side — one of which is leaning — and is most likely the cause of fractures to the retaining wall S03. The extensive fracturing to zones S01, S02, S04 and S05 appears to be historic, photographs from the 2000 survey showing extensive tree cover which has since been removed albeit stumps are still present. One instance of fracturing (S04) has been caused by the corrosion of embedded ironwork, namely the end of the handrail to the east side of the steps linking Madeira Walk and the roadway above.

5.21: FRACTURE & COLLAPSE (N29)

5.22: FRACTURE — EMBEDDED IRON (S04)

NEED FOR MAINTENANCE & REPAIR

5.5.05 Although often highly visible and in some cases involving considerable displacement, there are no instances where cracks or fractures are of immediate need of repair

PROVIDED VEGETATION IS BROUGHT UNDER CONTROL AND MANAGED BY WAY OF ROUTINE MAINTENANCE, and that monitoring is an integral part of the inspection regime described over paragraphs 6.3.02 to 6.3.05. However, the removal of the sycamore seedlings from zones N07 and N08 should be treated a high priority, the loss of the plant pocket to N04 — which should in the medium to long term be restored — being a good example of the consequences of allowing woody vegetation to dominate. The rebuilding of the collapsed plant pocket of to N29 should also be treated as high priority; while it may having been held together by the steel hawser for the best part of twenty years, the situation is precarious.

5.5.06 Following–on, the repair of all but the most minor fractures should — by 'closing' the rockwork to the ingress of self-sown vegetation — arrest the ongoing penetration of roots and woody stems:

- **Hairline fractures** can in the main be left and monitored albeit micro-grouting would be a good way of filling the widest (up to about 3 mm).
- Depending on width, **major fractures** should be repaired by grouting or filling with a weak, lime mortar. All filling should be set back so as to avoid the need to cut into and match otherwise sound surfaces. Maintaining the 'shadow' of the fracture will also ensure an 'honest' repair; a 'matching' repair would — by obscuring the fact that the repaired rockwork has a subtly different shape as compared to the original — distort the intention of the rock builders.
- Where fractures have led to wholesale **displacement** the rockwork will need to be recorded, carefully taken down and rebuilt with original fabric eased back into position and where necessary surfaces skilfully repaired to match existing.
- Any areas of collapse will also need to be rebuilt using existing fabric or — if absent —photographic evidence and the 'archaeology' of that which survives.

Filling and rebuilding will in all cases require localised clearance of all vegetation and soil, and — in order to 'stitch' historic fabric — the introduction of short lengths of helical, stainless steel bar to the 'earth' side of the fracture. Arboricultural advice should be sought in respect of the management of the holm oaks (refer 5.5.04).

5.6 Previous repairs

5.6.01 Isolated examples of previous repair were observed in zones N01, N02, N05 to N07, N11, N14, N15, N16, N18, N19, N25, N31, N33, S01, S02, S04, S08B and S10. All are patch-repairs in a modern sand–cement mortar. Generally ill-matched in terms of colour and texture, they do not detract from the overall appearance of the PAR, albeit some are failing due to poor execution. While not urgent, loose and cracking render should be renewed as part of surface or fracture repairs (refer 5.3.06 & 5.5.06).

5.7 Albion Hill balustrade

5.7.01 The balustrade on Albion Hill is in serviceable condition despite the terracotta fire skin of the piers having in places come away, revealing rough concrete cores. Open joints should be mortar filled including where the balustrade sits directly on top of the rockwork (zones N01 to N11). Long term, consideration could be given to the restoration of the section that was destroyed in the 1920s (refer 2.2.02 and 4.1.10), there being clear evidence of its design including the survival of fragments of original material and a terracotta newel that could be replicated.

5.8 Summary and conclusion

5.8.01 Overall, the Madeira Walk PAR is — with the exception of fractures due to unmanaged vegetation and two instances of collapse — in good condition:

- Soiling and discolouration are minor concerns.
- The deterioration of coatings is little more than the ‘patina of age’ and although widespread, underside loss is — due to the inherent vulnerability of overhangs — best accepted as an integral part of the history of the rockwork.
- Where loss of coating or backing damage makes the PAR vulnerable to water penetration; redressing or skilfully–matched surface repair (localised renewal) may be considered. Hollowed or lost surfaces adjacent fractures should be likewise repaired.
- Structurally sound with no evident issues with the backing or surface cracking, the only serious deterioration of the PAR is the fracturing of the rockwork due to unmanaged vegetation, with repair being a serious medium term (and in three instances immediate) consideration.
- Comparing with what was recorded by Simon Swann in 2000 reveals that — allowing for differences in the extent to which the rockwork is obscured by vegetation — the situation in 2019 was not significantly different, save fractures have in some instances propagated or widened, and cutting–back shrubs, etc. had revealed additional damage.

5.8.02 The PAR of Madeira Walk was at the time of survey 125 years old. It has performed exceptionally well and is despite all in relatively good condition, bearing out the Pulham strapline of ‘Durability Guaranteed’. Structurally sound with only minor deterioration of surface, the only serious damage is fractures — and in two cases collapse — due to unmanaged vegetation.

6. MAINTENANCE & REPAIR PLAN

6.1 Introduction

6.1.01 Set out in this section of the report is a prioritised maintenance and repair plan for the Madeira Walk PAR that — on the basis of its condition — identifies work that needs to be carried out to:

(a) mitigate (as far as possible prevent) the further deterioration of its fabric;

(b) where necessary, put it in a state where it is structurally stable; and

(c) ensure its long–term conservation.

Its purpose is to provide the HAZ Partnership — especially Thanet District Council, which owns the rockwork — with a practical conservation strategy that can be implemented as and when funds and resources permit, as well as the confidence to (where appropriate) 'do nothing'. While going into detail for the purposes of ensuring high standards of maintenance and repair — and to provide a basis for discussions with the local planning authority (Thanet District Council) and other interested parties — THE STRATEGY (ESPECIALLY APPENDIX D SUPPORTED BY APPENDIX E) IS NOT A SPECIFICATION OR SCHEDULE FOR THE IMPLEMENTATION OF THE RECOMMENDED WORKS AND MUST NOT BE USED AS SUCH. Other than maintenance (where the report can be used a basis for action), the strategy is merely a starting point for a fully–specified and scheduled programme of works.

6.2 Preamble

PROCUREMENT

6.2.01 It is assumed that maintenance will continue to be carried out by a mix of volunteers and Council staff or contractors. Repairs should generally be undertaken by conservators experienced in the treatment of PAR or similar surfaces (e.g. stonework, stucco and plasterwork) with some understanding of early and modern artificial cements. Building contractors specialising in historic buildings may also have access to the necessary skills. Some types of repair may be within the capabilities of general contractors subject to hands–on training aimed at widening the skills base.

HEALTH & SAFETY

6.2.02 Attention is drawn to the fact that future works of all types (including maintenance) are likely to fall within the remit of the *Construction (Design and Management) Regulations 2015*. These impose on those commissioning building works (Clients) a duty to make suitable arrangements for managing projects including: allowing sufficient time and resources; making sure that relevant information is provided by others duty holders; that designers and contractors carry out their duties; that welfare facilities are provided; and a Health & Safety File is kept. The main risks associated with work to the Madeira Walk PAR are (i) the close proximity of the public and heavy traffic; and (ii) access to maintain or repair rockwork at height and above water.

IMPLICATIONS OF HERITAGE STATUS

6.2.03 It is assumed that — after samples and trials as outlined in D1.01 of Appendix D and making use of the analyses provide as Appendix E — minor repairs will be carried out using the same materials and techniques as the existing fabric, and hence will not affect the significance of the Madeira Walk PAR as a designated heritage asset (Grade II listed building in a conservation area). Likewise routine maintenance. It is therefore unlikely that listed building consent will be required albeit if certainty is needed, a Certificate of Lawful Proposed Works could be applied for (refer paragraph 9 of *Historic England Advice Note 2: Making Changes to Heritage Assets* published in February 2016). Anything other than minor repair should be discussed with the local conservation officer and agreement sought on any need for consents. If works are to be carried out piecemeal over a period of time, as and when funds permit, the possibility of Listed Building Heritage Partnership Agreement could be explored, essentially a 'term' consent for routine works that removes the need or successive consent applications. IT MUST BE NOTED THAT NEARLY ALL TREES IN CONSERVATION AREAS ARE PROTECTED (refer 6.3.08).

RECORDS

6.2.04 The dates and a brief description of all maintenance and repair activities should be formally recorded in a dedicated register (which may be electronic); references to more detailed records and information should were appropriate be included.

6.3 Maintenance

DEFINITION

6.3.01 Regardless of any future repairs, the maintenance of the Madeira Walk rockwork should always be considered a **high** priority (refer 6.4.02). The Historic England (formally English Heritage) guidance document *Conservation Principles* published in April 2008 defines maintenance as "routine work regularly necessary to keep the fabric of a place in good order". This is distinct from periodic renewal, repair (refer 6.4.01) or restoration.

INSPECTION

6.3.02 The key to the maintenance of any building or structure — including those which are statutorily listed — is a planned inspection regime, tailored to circumstances and proportional to size, form, fabric, usage and significance. In which context, condition surveys are crucial, as is made clear in BS 7913:2013 *Guide to the conservation of historic buildings* and the *Conservation Basics* volume of the English Heritage (Historic England) *Practical Building Conservation* series.

6.3.03 Using this Stage Two survey, and the associated survey sheets and photos (refer 1.4.05) as a baseline and with reference to the key plans provide as Appendix C:

- An **initial** familiarisation inspection should be made, the aim being to ensure that those responsible for monitoring, etc. are able to readily spot new damage and other changes. The process will need to be repeated when anyone new becomes involved in the inspection regime.

- The condition of the Madeira Walk PAR should be monitored by way of a brief — albeit structured — **weekly** inspection.
- **Additional** inspections should be made out after any exceptionally heavy wind or rain (larger shrubs may be dislodged or soil might slip), vandalism (including graffiti), vehicular impact or other unforeseen potentially damaging event.
- More detailed check should be made **twice a year**, after die–back of planting in late autumn or early winter and before spring–summer regrowth.
- **Localised** inspections should follow any clearance of vegetation that reveals rockwork that hitherto has been concealed.

The baseline survey should be revisited and if necessary updated every **five years**, albeit the focus should be on that which has changed and not a resurvey.

6.3.04 Key points to note during inspections of the Madeira Walk PAR are:

- Early evidence of self–sown vegetation in cracks (real and fake), fractures, crevices and fissures.
- New instances of soiling especially graffiti or biological deposits; the effectiveness of any campaign to reduce the impact of dog urine should be monitored. Also the localised occurrence or spread of mosses.
- The lengths and widths of cracks and fractures, especially if new or recent (distinguished by sharp, clean edges). If there is any suspicion that cracks or fractures are propagating (getting longer and wider), simple monitoring should be put in place as Appendix D5.01.
- Impact damage, especially after vehicles have mounted the pavement or otherwise been driven close.

Notes and digital photographs should be dated and labelled by survey zone (the first image in each baseline photo set shows the zone boundaries) with use made of tablets and smart phones (useful when comparing ‘now’ and ‘then’). Full backups of all data must be kept on at least two desktop or laptop PCs which, along with any information in hard copy and the landscape guidance (refer 6.3.07), are accessible to all involved in caring for the Madeira Walk PAR; an archive should be established.

6.3.05 Information obtained via inspections should be used to inform and keep under review the need for maintenance or repair. New cases of deterioration should be assessed and classified as maintenance (6.3.06 & 6.3.07) or repair (6.4.01 to 6.4.03, as far as possible avoiding the expense of reactive maintenance (6.3.09).

ROUTINE MAINTENANCE

6.3.06 Beyond inspection, the primary focus of maintenance that is to be ‘carried out with forethought and control’ (planned maintenance) is vegetation control. As noted in 5.5.03, this is the biggest conservation challenge faced by those charged with caring for the Madeira Walk rockwork. Unmanaged vegetation is the principal cause of cracks and fractures, the greatest threats to the long–term survival of PAR generally (refer paragraphs 7.5.03 and 7.5.04 of the Overview: Stage One Report).

6.3.07 Aside from any clearance required to permit fracture repairs (refer 5.5.05), the first step in managing the planting of the Madeira Walk rockwork is to IMPLEMENT THE PROGRAMME OF REMOVAL **AND** SUBSEQUENT CONTROL AS RECOMMENDED IN THE SEPARATE REPORT AND SUPPORTING INFORMATION BY IRENE SEIJO, noting that any new planting should also accord with landscape architect's advice. Removal should also be in accordance with the guidance provided in Section D2 of Appendix D, it being essential that vegetation is not pulled or uprooted in a way that further damages the PAR (root systems may in places be holding the rockwork together); in many cases 'removal' will mean no more than cutting down to ground level and allowing roots, etc. to naturally decay (compost). Ongoing (future) management of planting is essential, and must extend to the: early elimination of self–sown growths from open cracks or fractures, fake cracks and fissures; and removal of moss (refer D3.02 of Appendix D); the exposed rockwork should be inspected for cracks and other water traps.

6.3.08 MADEIRA WALK IS IN A CONSERVATION AREA AND HENCE ALL WORKS TO TREES WITH A DIAMETER OF MORE THAN 75 MM MEASURED 1.5 METRES ABOVE GROUND LEVEL (100 MM IF TO ENABLE OTHER TREE TO GROW) REQUIRE FORMAL NOTICE TO BE SERVED ON THANET DISTRICT COUNCIL. Works cannot take place until consent has been given or a period of six weeks has elapsed, albeit there are exceptions: the Council's trees officer should be consulted prior to the instigation of any tree works. Different procedures apply when a specific tree is the subject of a tree preservation order (TPO), regardless of location (there are none on Madeira Walk or in Albion Place Gardens).

REACTIVE MAINTENANCE

6.3.09 Allowance should also be made for unplanned (reactive) maintenance, i.e. the need to respond to unforeseen events such as fresh graffiti or vehicular impact. While graffiti should always be removed as a matter of priority (as D3.08 of Appendix D) 'reactive' works may be deferred, provided no further threat to historic fabric.

6.4 Repair

6.4.01 Historic England's *Conservation Principles* (refer 6.3.01) defines repair as "Work beyond the scope of maintenance, to remedy defects caused by decay, damage or use, including minor adaptation to achieve a sustainable outcome, but not involving restoration or alteration". For the purposes of this report, surface renewal (refer 5.3.06) and rebuilding (refer 5.5.05) are classed as repair and not restoration.

6.4.02 In order to assist the HAZ Partnership and Thanet District Council with future planning for the Madeira Walk PAR, recommended works are prioritised:

- **High:** to be carried out as soon as possible — work to mitigate an immediate threat to historic fabric; also threats to the health and safety of persons.

- **Medium:** to be undertaken when resources permit — work which should be carried out as a matter of good practice in order to conserve PAR.
- **Low:** to be planned for long term — work to recover or enhance significance (including justifiable restoration) which can be deferred.

Prioritisation will help ensure that funds are targeted to greatest effect. However, these priorities are not rigid and works may be brought forward if funds are available, or if combining works is more efficient e.g. to make best use of temporary works.

Priority	Work(s) + survey zone(s) as identified in Section 5	Appendix D refs.
High	Remove moss + inspect: N01, N03, N05, N08, N13, N27, N28, N37, S02, S05, S06, S07, S10 & S11	D3.01
	Localised surface repair: S09	D4.01 & D4.03
	Hairline fracture repair: N08 (2 no)	D5.01 or D5.02 and D5.06
	Major fracture repair: N07 & N08 (2 no)	D5.03 or D5.04 and D5.06
	Rebuilding: N29	D5.05 & D5.06
	Further investigate fractured cantilever to S01	n/a
Medium	Localised surface repair + backing if also damaged: N01, N05 to N09, N11–N15A, N16, N19, N27, N30–N34, N36, N37, S01–S07, S08B, S08C, S11 & S12	D4.01 or D4.02 + maybe D4.03
	Hairline fracture monitoring + repair: N03, N09 (2 no), N10 (2 no), N11, N13 (3 no), N14, N17, N18 (4 no), N20 (2 no), N21, N22, N29, N30, N31 (3 no), N32 (2 no), N33, N36 (2 no), N37, S01 (4 no), S02 (2 no), S03 (4 no), S04 (9 no), S05 (3 no), S07 (4 no), S08B, S08C (2 no), S10 & S11 (2 no)	D5.01 or D5.02 and D5.06 + maybe D4.03
	Major fracture repair: N01, N05, N07, N08 (2 no), N11, N12, N13, N14 (2 no), N15 (3 no), N15A (2 no), N15B (2), N16, N18 (2 no), N19, N20, N24, N31, N33 (2 no), N34 (2 no), N37 (2 no), S02 (2 no), S03 (2 no), S04 (4 no), S05 (4 no), S07, S08A, S08B (2 no), S08C, S09 (2 no), S11 (3 no) & S11A (2 no).	D5.03 or D5.04 and D5.06 + maybe D4.03
	Rebuilding: N04, N09, N19 (2 no), N22, N28A, N30, N33, S01 (3 no), S02 (3 no), S04 & S08C	D5.05; D5.06 + maybe D4.03
Low	Surface renewal: N09, N11, N18, S01, S02, S04, S05, S08C, S09, S10 & S11	D4.02

6.4.03 This table can be expanded in terms of detail and — along with the key drawings (Appendix C) and Appendix D — form the basis of cost planning and thence action.

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[accessed via: https://www.britishnewspaperarchive.co.uk]

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Item ref. OP00653
A view looking down towards Ramsgate Harbour with water vessels, including small boats and sailing vessels. 1890–1910 [1901 or after].

Item ref. OP00654
A number 47 tram travels down New Road whilst people wait to board on the pavement. 1890–1910 [1901 or after].

Item ref. OP00657
A view of Abbots Hill in Ramsgate with a girl standing by the road. 1890–1910 [before 1901].

Item ref. OP00661
A view of Ramsgate from East Cliffe with a public garden in the foreground. 1890–1910 [before 1901].

Item ref. PC06919
General view showing the Madeira Waterfall. 1900–1930 [1901 or after].

Item ref. PC06926
General view looking across Albion Gardens. 1905–1910.

Item ref. PC08712
General view showing Madeira Walk. 1900–1920 [before 1901].

Item ref. PC10061
General view showing Madeira Waterfall. 1943–1948.

Item ref. PC10062
General view showing Madeira Waterfall. 1951–1956.

Item ref. PC10063 (also PC07954 & PC08264)
Elevated view looking across The Madeira Gardens. 1935–1955 [after 1937].

Item ref. PC10064
General view from the east looking towards the Harbour. 1910–1940 [before 1937].

Item ref. PC10914
General view showing Madeira Walk and tram. 1900–1920 [1901 or after].

Item ref. PC10915
View showing Madeira Walk. 1900–1950 [c.1920 or after].

Item ref. PC10916
View showing Madeira Waterfall. 1900–1930 [before c.1920].

Item ref. PC10917
View showing Madeira Waterfall. 1900–1930 [c.1920 or after].

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ORDNANCE SURVEY (OS)

25 inch (1:2500) County Series
https://maps.nls.uk/os/index.html
Kent XXXVIII.1
1873 surv.1871; 1898 rev.1896; 1907 rev.1905; 1933 rev.1931; 1946 rev.1939

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HASSALL, CATHERINE

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August 2000.

LAND USE CONSULTANTS

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SIMON SWAN ASSOCIATES (SWANN & ASSOCIATES)

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7.4 Policy and guidance

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APPENDICES

A **SURVEY PROFORMAS**

B **BASE PHOTO EXAMPLES**

C **KEY DRAWING**

D **OUTLINE REPAIR SPECIFICATIONS**

E **MATERIALS ANALYSIS REPORTS**

F **LIST ENTRIES**

APPENDIX A

SURVEY PROFORMAS

Swann and Associates Survey, May 2000

No. 3

Ramsgate Albion Place, Pulhamite Condition survey sheet.

Area identification:

N3

Principal material type:
PULHAMITE ROCK FACE BELOW BALUSTRADING.

Strata colour and position:
TOP STRATA - LIGHT GREY
MIDDLE STRATA - SANDY COLOURED
LOWER STRATA - LIGHT GREY.

Photo cross reference:

Failure type	Nos	Size	Comments and location.
Surface build up of dirt.			LIGHT DIRT + MOSS BUILD UP.
Blistered area			
Hollow and delaminating areas.	2	.15 x .15 m.	2 AREAS ARE IN SANDY STRATA
Surface erosion due to salt damage			
Surface erosion and water leaching to caves and undersides of passages.			
Lost surface area due to ~~impact~~. SURFACE EROSION. Exposed backing materials.	25-30		INCLUDES SOME AREAS OF BRICK BUR, BRICK / STONE.
Lost surface area, cause uncertain. Exposed backing materials.			
Small ~~horizontal~~ + VERTICAL surface crack(s)	16	AV: 0.1 → 0.5m	
Surface cracking due to iron expansion.			
Surface cracking due to possible material expansion.			
Cracking through structure-Horizontal Give dimensions and cause……………………			
Cracking through structure-Vertical Give dimensions and cause……………………			
Previously repaired cracks Give dimensions and condition………			
Dislodged sections of Pulhamite			
PLANT POCKETS.	2.		
WATER TRAP	2		AT TOP OF PULHAMITE, WHERE MEETS BALUSTRADE. 4 M OF CRACKING.
BOTTOM EDGE OF OVERHANGS	7	0.25 → 1.0M IN LENGTH.	EXPOSED BACKGROUND MAT - DELAMINATION. BLACK DEPOSITS
CRACKING ON SKY FACING AREA OF P.		4 m	BUILD UP OF ORGANIC MATTER. & FINE CRACKING.

General comments. Including general surface condition and other significant features.

LARGE VERTICAL FISSURE - (1M WIDE) (1.6 M HIGH). CONSISTS OF GRANITE, ~~STONE~~ PULHAMITE, FLINT, + CONCRETE.

F.F. AT DIVISION BETWEEN N3 + N4.

VEGETATION + BASE NEEDS CUTTING BACK AT DIVISION BETWEEN N3 + N4

ELECTRIC CABLE + 3 CLIPS NEED REMOVAL

CRACK AT BASE OF BALUSTRADE + TOP OF PULHAMITE.

EXTENSIVE AMOUNT OF BRICK BUR VISIBLE ON TOP LIGHT GREY STRATA.

2 HOLES IN THE PULHAMITE. (small).

No.3

Area identification:

N3

Principal material type: Pulhamite

Strata colour and position:
Top strata, light grey
Middle strata: sandy coloured
Lower strat light grey.

Photo cross reference:

Failure type	Nos	Size	Comments and location.
Surface build up of dirt.			Light.
Blistered areas			
Hollow, delaminating and loose areas.	2	0.15x0.15	In sandy strata.
Surface erosion due to salt damage			
Lost surface area, with lost background to build-up, greater than 0.2 x 0.2m and less than 0.5 x 0.5m.			
Lost surface area requiring recovering, up to 0.2 x 0.2m.	25		
Holes and hollows requiring filling, up to 0.05 x 0.05m Exposed backing materials.	4.		
Small surface crack(s) (< 3mm wide and upto 30mm long).	28.		
Surface cracking due to iron expansion.			
Surface cracking due to possible material expansion.			
Structural crack (> 3mm)-Horizontal .			
Structural crack (>3mm)-Vertical .	1	4m	Base of balustrading top pulhamite.
Previous Portland cement repairs. Give dimensions and condition..........			
Dislodged sections of Pulhamite			
Plants Pockets.			
Bottom Edge repairs requiring surface treatments. Measured in lengths up to 0.5m	7		
Bottom Edge repairs requiring pining.			
Remove electrical cable and 3 cable clips (safety!)			

General comments. Including general surface condition and other significant features.
The large vertical "fissure" consists of granite, pulhamite, flint, concrete.
Vegetation at base needs cutting back at division of N3 and N4.

Sheet Number: _____

Ramsgate: Madeira Walk PAR Survey

SOILING + DISCOLOURATION

☐ Algae + Lichens ☐ Mosses, etc. ☐ Airborne dirt ☐ Efflorescence
☐ Sulfate crusts ☐ Metal staining ☐ Biological deposits ☐ Graffiti

Comments+ cross reference to photos

EROSION + LOSS OF COATINGS

☐ Generally ☐ Hollowness ☐ Blistering ☐ Total loss

Comments including extent, likely cause + cross reference to photos

DEFECTS IN BACKING

Description + comments including extent, likely cause + cross reference to photos

CRACKS + FRACTURES

☐ Fine surface ☐ Fractures ☐ Displacement ☐ Collapse

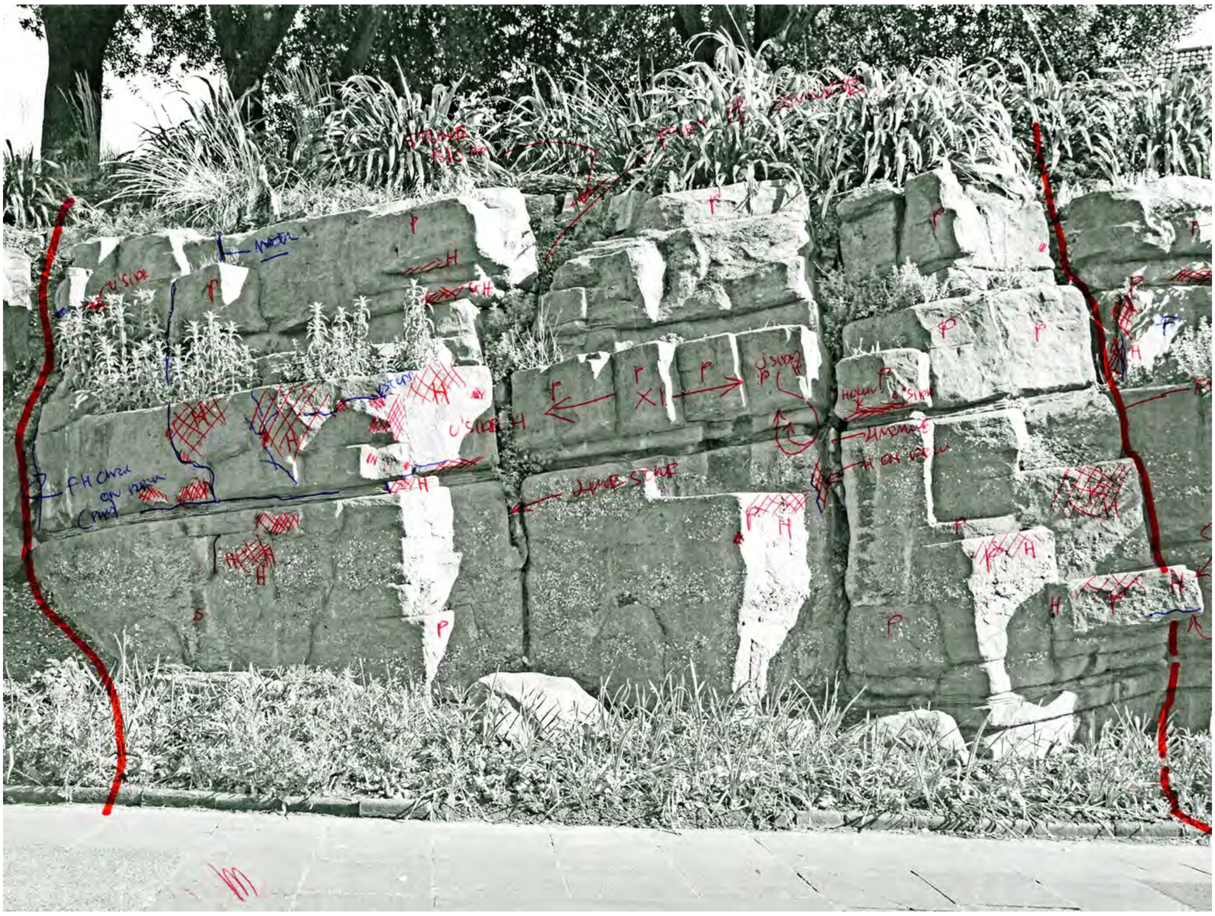
Comments including extent, likely cause + cross reference to photos

PREVIOUS REPAIRS

Description + comments including extent + cross reference to photos

APPENDIX B

BASE PHOTO EXAMPLES



BASE SURVEY PHOTO (TOP) & MARKED–UP COPY (BOTTOM)

APPENDIX C

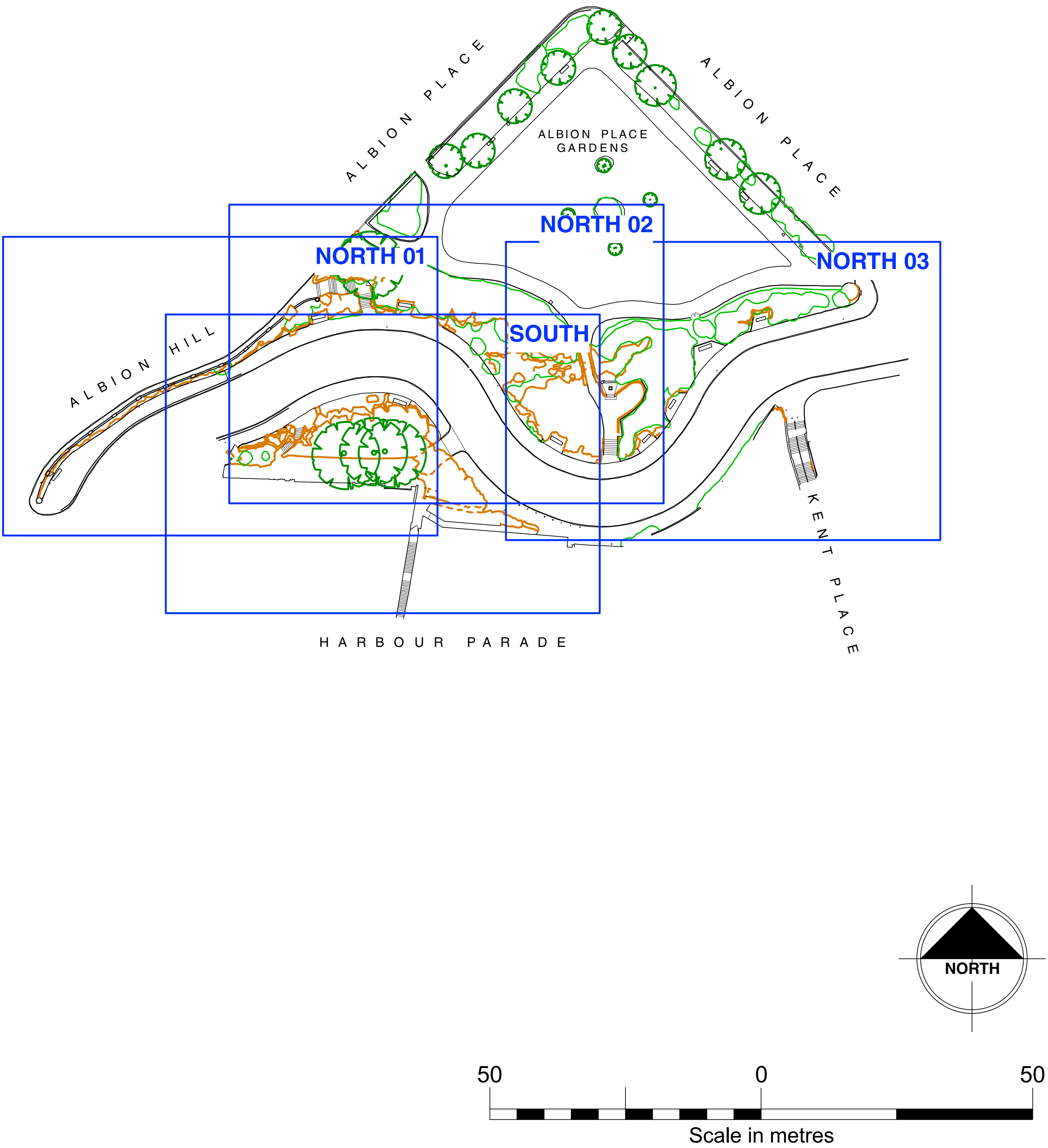
KEY DRAWINGS

Ramsgate Heritage Action Zone (HAZ) Partnership

Consevation of PULHAMITE ARTIFCIAL ROCKWORK

MADEIRA WALK Survey Zones KEY PLAN

scale: **1:1000 @ A4** date: **Jun 2020**



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APPENDIX D

OUTLINE REPAIR SPECIFICATIONS

D1 Preamble

D2 Vegetation removal

D3 Cleaning

D4 Surface repair

D5 Fracture repair

D1 Preamble

INTRODUCTION

Set out in this Appendix is technical information to guide the specification of repairs to Pulhamite Artificial Rockwork (PAR) of Madeira Walk. The approach is 'conservative' in that it presumes the maximum retention of historic fabric, and repair methods which are compatible with original materials and construction. It covers:

- Vegetation removal.
- Cleaning.
- Surface repair.
- Fracture repair.

SPECIFICATIONS ARE PROVIDED FOR GUIDANCE ONLY AND SHOULD NOT BE USED TO PROCURE ANY WORKS; THEIR PURPOSE IS TO INFORM THE SPECIFICATIONS OF OTHERS, TO WHICH END THEY SHOULD BE ADAPTED AND DEVELOPED TO SUIT THE CIRCUMSTANCES OF A SPECIFIC PACKAGE OF WORKS.

D1.01 FURTHER INVESTIGATION

In the light of the analyses carried out in 2000 (copes provided as Appendix E), there is no evident need for any further investigation.

D1.02 SAMPLES & TRIALS

For all types of repair, allowance should be made for samples and trials, with particular attention paid to cleaning and the quality of surface repairs. See also the introductions to Sections D3 an D4.

D1.03 RECORDING

All trials should be written up, and repairs should be fully recorded 'before' and 'after' with allowance included for written reporting by conservators and others. See also paragraphs 6.2.04 and 6.3.04 of the main body of the report.

D2 Vegetation removal

INTRODUCTION

Other than where removal is required to enable repairs, it is assumed that works to vegetation generally will be as set out in the SEPARATE REPORT, SUPPORTING INFORMATION AND GUIDANCE PREPARED BY IRENE SEIJO to which the guidance provided in this section is supplementary.

D2.01 YOUNG & SOFT ROOT GROWTHS

First shoots and soft–rooted plants can be carefully hand–plucked from cracks and open fissures, perhaps with the help of tools. Vegetation with soft roots may be carefully uprooted albeit cutting down to ground level and leaving the roots to decay (compost) into the ground is generally preferable.

D2.02 IVY & WOODY SHRUBS

Ground–rooted ivy and woody shrubs should be cut back to ground level, root balls loosened and as much bark as possible stripped, leaving the stumps to die as the roots decay. It may in some instance be necessary to also treat stumps with a suitable herbicide (e.g. Roundup Tough Ready by Monsanto UK Ltd.):

(a) Cut back stumps to expose a fresh surface immediate prior to treatment, and treat with herbicide brushed direct onto the freshly cut face.

(b) Do not apply herbicide on a windy or wet day, immediately after frost, or when the PAR is saturated following heavy rain noting that HERBICIDES ARE TOXIC.

Deeply–rooted ivy and woody shrubs to be removed from open fractures, fissures, etc. should also be cut back and if necessary treated with — in the case of ivy — a systemic herbicide applied to the leaves before cutting. Decayed roots, etc. should be carefully removed by hand, using a hook to reach deeply–embedded material; on no account should roots be pulled or jerked. In the case of large stumps, arboricultural advice should be sought.

D2.03 TREES

Full removal of trees should only ever be on the advice of an arboriculturalist (not a tree surgeon). Stumps should be treated to prevent regrowth and left to decay (compost) and not ground–out. Refer paragraph 6.3.08 of main body of the report for information on the PROTECTION OF TREES IN CONSERVATION AREAS.

D2.04 CLEARANCE OF PLANT POCKETS

Vegetation should be removed or cut–down to ground level as D2.01 to D2.03. The soil surrounding woody boles should be excavated by hand so as to expose the root ball, which must then be systematically cut into sections and removed piecemeal along with all additional soil. Roots that extend beyond the plant pocket should be cut, treated as D2.02 and left insitu; dismantling as D5.05 will ease clearance.

D3 Cleaning

INTRODUCTION

While cleaning of the Madeira Walk is not generally required (paragraph 5.2.05 of the main body of the report), there are instances when removal of soiling may be beneficial, e.g. when undertaking surface repair (refer D4.02) or when removing fresh graffiti. CLEANING SHOULD ONLY BE CARRIED OUT ON THE BASIS OF SUCCESSFUL, FULL DOCUMENTED TRIALS THAT CAN EASILY BE REPLICATED NOTING THAT UNDER NO CIRCUMSTANCES MUST 'JET WASHING' OR 'SAND BLASTING' BE USED; BOTH ARE LIKELY TO CAUSE IRREPARABLE DAMAGE WHILE BEING OF LIMITED EFFICACY.

When cleaning the PAR, it is important to provide all necessary protection to prevent water running–off over the surfaces of the rockwork generally. If it becomes necessary to use chemicals, avoid contact between chemical agents and any material or element other than that being cleaned, and ensure that chemicals are not flushed away via rainwater gullies, or allowed to pollute the ground or nearby water courses. PERSONS UNDERTAKING CLEANING MUST BE WEARING ALL NECESSARY PERSONAL PROTECTION.

D3.01 LICHENS

For small areas and the exposure of tinted surfaces, hand–brushing combined with a fine water spray will generally be sufficient. BRUSHES MUST BE NON–FERROUS; BRISTLE IS PREFERRED. An initial clean with an industrial vacuum cleaner can be useful for removing any loose material. Larger areas can be cleaned using the DOFF or THERMATECH systems of superheated water (steam):

(a) To activate the soiling, two complete passes of all surfaces to be cleaned, typically at a temperature of 130 degrees centigrade + 110 bar pressure.

(b) A final pass to remove soiling from specific working areas.

(c) Superheated water (steam) cleaning only should be carried out by trained and experienced operatives.

Treatment with biocides is not recommended as these may inhibit lichens from returning to (recolonise) surfaces following repair.

D3.02 MOSS

Other than where it can be simply lifted, moss should be gently removed using a wooden or plastic spatula, followed hand–brushing as D3.01.

D3.03 AIRBORNE DIRT

Generally, the same cleaning methods as for lichens can be used (refer D3.01) save that stubborn areas of soiling — especially build–ups of hydrocarbon — can be locally treated using an ammonium carbonate clay or paper based poultice applied strictly in accordance with the manufacture's instructions, with particular attention paid to dwell times, neutralisation and disposal.

D3.04 SURFACE EFFLORESCENCE

Removal of surface efflorescence is best achieved with DRY brushing or for large areas perhaps an industrial vacuum cleaner with soft brush attachment. UNDER NO CIRCUMSTANCES MUST WATER IN ANY FORM BE USED. Due to the permanent exposure of the rockwork to salts (refer paragraphs 5.2.03, 5.3.03 and 5.3.04 of the main body of the report), efflorescence will almost certainly reoccur.

D3.05 SULFATE CRUSTS

The cleaning of sulfate crusts from PAR is a difficult issue as the formations to be removed may well have cross–bonded (interlinked) with the binder–aggregate matrix of the render coating, meaning that removal brings with it a high risk of irreversible loss of historic surface. Methods to be considered would include:

(a) TORC (formerly JOS) or VORTECH which are wet, swirling air abrasive systems with a high degree of variability and control, ALBEIT ONLY WHEN USED BY TRAINED AND EXPERIENCED OPERATIVES.

(b) Clay or paper–based poultices.

(c) Softening (by wetting) and gradual removal, possibly using superheated water as described in D3.01 and light chiselling.

If removal is contemplated, then trials — ideally by a conservator specialising in stone and plaster surfaces — are especially critical. Attempts to remove sulfate crusts must be abandoned if trials prove unsuccessful.

D3.06 METAL STAINING

Ferrous and non–ferrous metal stains are best removed with a stain remover poultice used strictly in accordance with manufacturer’s instructions:

(a) Trowel–apply a heavy coating approximately 6–7mm thick to stained area.

(b) Allow poultice to remain on surface for 8–10 hours or until dry.

(c) Carefully lift the dried poultice from the treated surface using a trowel.

(d) Wash residual poultice from treated surfaces with fresh water and a stiff–fibred masonry brush.

(e) Allow surfaces to dry and repeat as necessary.

The required number of applications of the poultice to be established by controlled trials. Multiple applications may be needed albeit the complete removal of staining cannot be guaranteed as the repeated cleaning process will draw deep–seated salts to the surface. POULTICES DESIGNED TO REMOVE METAL STAINING ARE STRONG ALKALINE COMPOUNDS THAT CAN CAUSE IRRITATION, NECESSITATING SUITABLE GOGGLES, FACE SHIELD, PROTECTIVE CLOTHING GLOVES WHICH AVOID CONTACT WITH SKIN OR EYES AND POSSIBLY RESPIRATORY EQUIPMENT, DEPENDING ON WORKING CONDITIONS.

D3.07 BIOLOGICAL DEPOSITS

Other than lichens, mosses, etc. (refer D3.01 & D3.02), the principal type of biological deposit that is likely to need cleaning is guano, i.e. bird droppings. Light deposits can be left to be washed away by the rain. Heavy build–ups can be removed by judicious softening with water (soaking should be kept to the minimum) interspersed with rinsing, NOTING THAT GUANO IS HAZARDOUS TO HUMANS (it can cause respiratory diseases, especially when dry) and hence removal and disposal must be in accordance with current health and safety legislation and guidance. Contamination of the PAR by urine is a problem best dealt with my management (refer paragraph 5.2.06 of the main body of the report). Canine and other — including human — faeces should be immediately washed away using clean water; no reliance should be placed on dried faces being rapidly dispersed by rain.

D3.08 GRAFFITI

The two types of graffiti present on the Madeira Walk rockwork are chalk and aerosol paint, albeit future disfigurement by way of brush–applied paint, felt tip marker, ballpoint pen, wax crayon or lipstick cannot be discounted; also the possibly of fly posters and adhesive labels. Notwithstanding chalk — which will eventually wash away, other than in sheltered areas where light sponging may be employed (early rubbing can permanently stain, especially if 'blackboard' chalk, which is mainly of gypsum) — chemical treatment is the most effective way of cleaning graffiti, especially where on porous surfaces like the render coating of PAR. Chemical removes are generally of two types:

- **Alkaline** which break down oil–based films by means of 'saponification" (the conversion of a fat to a soap), following which they must be rinsed from the surface with hot water then neutralised with a weak acetic product, e.g. (vinegar) or a dilute hydrofluoric–acid based (use of which is by law restricted).
- **Solvent** which soften and swell binding media (paint strippers are solvent–based clearers) and dissolve soluble dyes. They are especially useful for removing felt tip markers. MUST ONLY BE USED ON DRY SURFACES.

There are many types of chemical cleaner on the market, available in a variety of forms including sprays, liquids, gels and poultices. Initially, the advice of specialist suppliers should be sought e.g. Tensid UK Ltd. (https://tensiduk.com) or Restorative Techniques Ltd. (https://www.restorative–products.com). A variety of products should then be trialled leading to a list of what may be used in which situation, noting that old and fresh graffiti may require differences in approach. Generally, gels and poultices will give more control, and are most effective if repeated applications are used.

Anti–graffiti coatings are not advised and rarely acceptable for historic buildings and structures. In–depth guidance on graffiti removal can be found in the Historic England advice note *Graffiti on historic buildings and monuments* published in October 1999 (https://historicengland.org.uk/images–books/publications/graffiti–on–historic–buildings–and–monuments/graffiti–historic–buildings–and–monuments).

D4 Surface repair

INTRODUCTION

Surface repair is the aspect of the PAR conservation that requires the most skilful ‘design’ and execution. It should only be undertaken by accredited conservators or other practitioners who can — by way of trials and exemplars — demonstrate they have the ability to carry out repairs that, as well as being technically sound, accurately match the texture and colour of the original rockwork. Offsite and insitu trials based on the 2000 analyses (Appendix E) are an essential precursor to surface repair, and should include:

- Assessments of colour and colour range (to reflect varying ‘tints’), surface aggregate types, the suitability and workability of mortar, and setting times.
- Sample boards that comparatively display varying textures and colours.
- Insitu trials which show the intended surface finish and detailing, and which may be used as exemplars.
- All samples and trials should be examined and matched to historic coatings in ‘wet’ and ‘dry’ states.
- On the basis of the properties revealed by the analyses, binders should generally be based on mix of natural hydraulic lime and natural cement, e.g. Prompt Natural Cement by the French company Vicat, which is widely available in the UK from specialist suppliers.

In designing mortars for surface repair, it is important to check suitability for in–use conditions: an exposed environment and high sulfate content backgrounds should be assumed. Colour is likely to require the addition of high quality, natural pigments.

D4.01 DRESSING

The purpose of ‘dressing’ is to locally — and lightly — cut–back and stabilise exposed edges resulting from lost areas of coating, and which may trap water or encourage further detachment. It is an approach to ‘repair’ that demands fine judgement:

(a) With the utmost care and with the gentlest touch, carefully remove loose and friable material using if necessary a fine, sharp mason’s chisel.

(b) Rub down by hand using a carborundum stone before finally using a stiff brush to remove all loose material and to ensure the removal of all pockets or ledges that might trap water.

(c) Edges are to be left as smooth as is practicable without any cutting back.

(d) Hollow but otherwise sound material adjacent the missing areas of coating can be re–adhered using grouting techniques as D4.03 and D5.02.

Eventually, the area of missing surface may need to be renewed as D4.02.

D4.02 RENEWAL

The renewal (or restoration) of PAR surfaces is a sequential process that should only be carried out in between spring and autumn (low temperatures will impede the set and result in premature failure):

(a) Preparatory work:

- All vegetation that may obstruct the repair must be removed, and surfaces brushed clean of soil and other organic deposits; treatment with a herbicide may be necessary, subject to discussion with the volunteer group and others involved in plant maintenance and management.
- Before any trials or repairs commence, some areas of PAR — including around areas to be repaired and as far back as the nearest fissure or other natural 'lines' in the rockwork — should be fully cleaned as D1. The purpose of cleaning is to reveal the true colour and texture (and any variation) of the surfaces to be renewed or restored, and to mitigate the tendency for repairs to create a 'patchy' appearance.
- Failing existing repairs (loose and friable material) must be entirely removed, using if necessary a chisel to ease from the surface.

(b) Background repair and preparation:

- Inspect exposed masonry or concrete backing and repoint, pack, pin, consolidated or otherwise repair so as to ensure a firm base.
- Using fine, sharp chisels make a neat cut to frame the area of coating to be repaired, cut back full depth with edges slightly undercut so as to avoid the subsequent 'feathering' of the coating.
- In order to provide a key for the new mortar, scabble ('roughen') the exposed surface of the backing with randomly drilled holes, peck marks, raked–out joints (in brickwork) etc.
- Use a water spray to clean all dust and debris from the area to be repaired
- Control suction of background by pre–wetting with water so brick, concrete, etc. is damp (not saturated) when mortar is applied.

(c) Mortar mixes:

- To be finalised following trials, etc. as above.

(d) Application:

- Repair (restoration) mortar is to be applied in two coats.
- Pack the backing repair mortar into the area to be repaired (restored), working from the edges of the cavity into the centre to ensure that the undercuts are entirely filled with no feather edges.
- Bring the mortar to an even distance of 3–4 mm from the face of the finished repair, taking care not to overwork. Score and leave to allow a preliminary

set, wetting the surrounding rockwork and protecting with plastic to control water loss and shrinkage and ENSURING THAT THE FACING MORTAR IS APPLIED AT AN EARLY STAGE — 'GREEN–ON–GREEN'.

- Similarly place the facing mortar, slightly overfilling (i.e. mortar slightly proud of the face of the adjacent surfaces). Re–compact by pressing after two hours if required. Wet the surrounding PAR and protecting with plastic or damp hessian to control water loss and shrinkage.

(e) Finishing:

- After surface hardening has commenced though while the mortar is still 'green', scrape back the surface to the finished line.
- Further compact using a still bristle brush, or similar, working the surface so as to bring out the aggregate to match the PAR, if needed modelling with fine tools to ensure a smooth transition between original surface and repair.

(f) Protection:

- Protect mortar from direct sunlight, wind and rain with damp hessian or plastic sheeting in close contact for at least one week after placing so as to assist surface curing and — where pigments are part of the mix — to ensure consistency of colour. In hot weather, prevent rapid drying out by wetting with a fine mist spray two or three times a day.

D4.03 CONSOLIDATION OF LOOSE SURFACES

Loose but sound PAR surfaces can in some cases be grouted in situ:

(a) Thoroughly flush the void behind surfaces with clean water to ensure removal of all loose materials.

(b) Undertake trials to establish the best method of delivering the grout.

(c) Ideally, most work will be gravity grouting, i.e. injected from above.

(d) Inject grout at holes provided at suitable centres, allow grout to flow through weep holes initially and then block holes. Build up grout levels gradually, without causing water pressure to force surface off.

(e) On vertical surfaces, consider applying grouts via temporary clay 'cups'.

(f) A natural hydraulic lime grout as D5.03 or a proprietary product may be used.

(g) For very fine interfaces nanolime grout as D5.02 may be considered.

(h) Protect the repair — which should initially be kept damp (not wet) using a hand spray — with damp hessian or plastic sheeting until the grout is cured.

D5 Fracture repair

INTRODUCTION

The Overview: Stage One Report (paragraph 7.5.04) identifies fractures due to unmanaged wood vegetation as the greatest threat to the ongoing conservation of PAR. Set out below are repair techniques that can be used to fill and stabilise fractures, depending on the extent of displacement, i.e. crack width or collapse.

D5.01 MONITORING

Fractures can be easily monitored by a number of simple methods including the routine inspection of grouting and filling as D5.02, D5.03 and D5.04 — opening–up at the edges or cracks forming in mortar parallel to the fracture are good indicators of possible further movement, save that allowance must be made for the possibility of the initial shrinkage. Photographic records (refer paragraph 6.3.04 of the main body of the report) can in this context be invaluable. A more sophisticated way of monitoring open fractures would be to adhesive–fix three small metal disks (e.g. one pence pieces) spot–marked with a centre punch, two one side of the fracture and one the other so as to form a triangle. The lengths of the sides can be measured at intervals with a simple, digital calliper: changes in dimension will indicate if the fracture is opening, and in which direction.

D5.02 MICRO GROUTING

Hairline fractures of up to 2–3 mm in width should be filled with grout comprising an isopropyl–based nanolime with a concentration of 5–10 g/litre such as CaLoSil IP5 by IBZ–Salzchemie GmbH & Co.KG (distributed in the UK by Hirst Conservation: http://www.hirst–conservation.com) blended with fine fillers (aggregates) such as crushed stone sand, and stone or marble dusts:

(a) Plant pocket to be cleared as D2.04 and stitched as D5.06.

(b) Fractures to be cleared of dust and debris using an industrial vacuum cleaner or other means of aspiration then rinsed with water until it runs clear.

(c) Bottom ends of all vertical fractures to be stopped externally with cotton wool (to prevent grout running–off over the face of the PAR); likewise the grout holes to horizontal fractures.

(d) On external faces, fractures to be temporarily stopped with clay (so as to retain grout while it develops an initial set) and internally backed–up with tape, clay or other temporary stopping that prevents loss of grout into the plant pocket.

(e) Fractures to be pre–wetted with alcohol (isopropyl) directly before grouting.

(f) Grout to be progressively applied with a syringe working sequentially from the bottom of the crack upwards so as to fill entirely the fracture, using a sponge to ensure that grout does not leach or dribble from grout holes.

D5.03 GROUTING

Fractures of 2–5 mm in width should be filled with natural hydraulic lime (NHL3.5) grout. Assuming gravity fill, the binder (lime) should be blended with a well washed sand at an approximate ratio of 1:2 and mixed with enough clean water to make a fluid paste (fluidity which can be improved by the addition of casein equal to about 1% of the weight of the lime which will also reduce the amount of water needed). Sand must be graded (sieved) to ensure grains are no larger than about 1/3 of the width of the fracture to be filled, with trials used to establish the optimum balance between sharp and soft sand. A proprietary ground may be used in lieu:

(a) Plant pocket to be cleared as D2.04 and stitched as D5.06.

(b) Fractures to be cleared of dust and debris using an industrial vacuum cleaner or other means of aspiration then rinsed using a hand sprayer with a fine jet of water until it runs clear.

(c) Grouting to be raised in maximum 300 mm ‘lifts’. Do not continue until previous lift is set and can support additional grout above.

(d) The bottom ends of each lift of grouting — which need to be left ‘open’ to allow the grout to flow — should be stopped with cotton wool to prevent grout running–off over the face of the PAR.

(e) External and internal faces of each lift to be temporarily stopped with clay to retain grout while it develops an initial set.

(f) Fractures to be flushed–through and pre–wetted directly before grouting.

(g) Grout to be progressively applied working sequentially from the bottom of the crack upwards so as to fill entirely the fracture, using a sponge to ensure that grout does not leach or dribble from the base of each lift.

(h) On completion, rake back and compact mortar using fine tools, and stipple with a stiff bristle brush so as to break the surface of the joint which should finish about 5 mm back from the surface of the PAR to as to create a shadow line.

(i) Protect the repair — which should initially be kept damp (not wet) using a hand spray — with damp hessian or plastic sheeting until the grout is cured.

D5.04 MORTAR FILLING

Fractures wider than 5 mm in width should be filled with 1:2–3 natural hydraulic lime (NHL3.5) mortar with a sand–chalk aggregate. Sand must be clean, well–washed and SHARP and conform broadly to Type S of BS 1200:1976 (replaced by BS EN 13139:2013 but still current) with a clay content not exceeding 1–2% and particle sizes between 2.36mm to 150 microns. Dried, crushed hard white chalk to be free from clay and silt and sieved to broadly to the same grading of the sand, though larger particles may be acceptable for wide joints. If necessary, the blended aggregate to be further sieved to ensure that when filling joints less than about 10 mm the largest particle size is a maximum of approximately 1/3 of the width of the joint; allow for grading on site to account for variations in the joint width. Sieved charcoal may be used to control colour. A premixed mortar be used in lieu:

(a) Plant pocket to be cleared as D2.04 and stitched as D5.06.

(b) Fractures to be cleared of dust and debris using an industrial vacuum cleaner or other means of aspiration then rinsed using a hand sprayer with a fine jet of water until it runs clear. Rinse all debris from surface of PAR.

(c) Wedge firmly against the rear face of the fracture a board or other surface against which mortar can be firmly pressed.

(d) Dampen fracture immediately prior to filling. Starting at the bottom, fill fracture with mortar, pressing well back with a pointing iron of the correct size. Bring joints flush or slightly proud of the surface of the surrounding PAR. Protect as necessary until finishing. DO NOT AT THIS STAGE REMOVE SURPLUS MORTAR.

(e) It may be necessary to fill in more than one application (to avoid slumping of the mortar or excessive shrinkage), pushing the mortar hard back into the joint with a tamping iron or similar tool and building–up in layers, allowing each application to dry (dewater) before applying the next.

(f) Allow the mortar to go off. Do not attempt to scrape fresh mortar from masonry surfaces. Rake out and compact mortar using fine tools, and stipple with a stiff bristle brush so as to break the surface of the joint which should finish about 10 mm back from the surface of the PAR to as to create a shadow line.

(g) Protect mortar from direct sunlight, wind and rain with damp hessian or plastic in close contact for at least one week after placing. In hot weather, prevent rapid drying out by wetting with a fine mist spray two or three times a day.

D5.05 REBUILDING

The purpose of rebuilding is to carefully take down and reconstruct unstable or falling areas of PAR, using as much original material as possible, following — and where necessary recreating — the original pattern of the rockwork, and replicating the texture and colour of existing surfaces:

(a) Clear plant pockets as D2.04.

(b) Allow for all necessary temporary works including any need for propping and provision for safe lifting, noting especially the requirements of *The Manual Handling Operations Regulations 1992* which limit the weight of what can be lifted by a single person to 20 kg.

(c) Before taking down, record the PAR as it stands, assigning a unique number to each fragment. Positions of fragments can be recorded on marked–up photos

(d) Carefully take down the PAR fragment–by–fragment, working sequentially top to bottom, numbering each fragment with chalk and placing registration marks prior to removal. The top, bottom and rear of each fragment must be marked. Store fragments in a systematic manner, laid out in sequence.

(e) Clear all fragments of extraneous mortar, dust and debris.

(f) Wetting fragments as work proceeds, rebuild PAR in the reverse sequence of taking down, working as far as possible in horizontal layers (courses) placing each numbered fragment back in its original location and in the correct orientation, albeit where necessary eased back into place.

(g) Bed fragments in mortar to match existing incorporating stitching as D5.06.

(h) Repair and consolidate surfaces as D4.02 and D4.03.

(i) Cover rebuilt PAR at the end of each day, and provide on–going protection generally as for surface repairs, though allowing for the rebuilt work being wetter and hence the possible need to remove protection earlier (to allow any free lime in the mortar to dewater and carbonate).

D5.06 STITCHING

Tie together brickwork either side of fracture using Grade 1.4401 (formerly Type 316) austenitic stainless steel, 6 mm diameter helical bars, e.g. HeliBar Remedial by Helifix Ltd. (https://www.helifix.co.uk/products/remedial–products/helibar–remedial/) held in place with a thixotropic epoxy anchor grout such as Webertec EP TAG by Saint–Gobain Weber Ltd. (https://www.uk.weber/webertec–ep–tag):

(a) Following clearance of plant pocket as D2.04 to expose rear face of brickwork, rake out mortar from every third bed joint.

(b) Clean raked joints of dust and debris using an industrial vacuum cleaner or other means of aspiration then rinse using a hand sprayer with a fine jet of water until it runs clear.

(c) by flushing with clean water, allow to dry and brush clear any loose mortar, soil or material.

(d) Set 900 mm long bars into cleared bed joints, taking note of temperature and curing time of epoxy grout.

(e) Repoint (fill) raked joints with natural hydraulic lime (NHL 3.5) mortar.

(f) Protect mortar with damp hessian or plastic sheet for at least a week.

Following completion of stitching, fractures may be grouted or filled as D5.02, D5.03 or D5.04 and the plant pocket eventually re–filled with soil.

APPENDIX E

MATERIALS ANALYSIS REPORTS

E1 **SANDBERG: Chemical + Microscopic Analysis — 20th November 2000**

E2 **IMPERIAL COLLEGE DURABILITY GROUP: SEM, etc. — Undated draft**

E3 **UNIVERSITY OF WALES: Petrographic Analysis — Undated**

E4 **CATHERINE HASSALL: Pigment analysis — August 2000**

REPORT 21189/C

ALBION PLACE GARDENS, RAMSGATE

ANALYSIS OF MATERIALS FROM PULHAMITE

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REPORT 21189/C

ALBION PLACE GARDENS, RAMSGATE

ANALYSIS OF MATERIALS FROM PULHAMITE

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This Report comprises
4 pages of text
Table 1 of 5 sheets
Table 2 of 1 sheet
Appendix A of 6 sheets
Appendix B of 6 sheets

20 November 2000

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REPORT 21189/C

ALBION PLACE GARDENS, RAMSGATE

ANALYSIS OF MATERIALS FROM PULHAMITE

References: Letter from Simon Swann dated 10 July 2000.
Thanet District Council Order No DTM 8951 dated 20 July 2000

1. INTRODUCTION

Samples of Pulhamite materials and a sample of salts deposit were received on 14 July 2000 for analysis.

We were asked to determine the types of binders and the compositions of the mortars and to ascertain the reasons for colour variations in the Pulhamite with particular reference to the aggregate colour.

2. SAMPLE DETAILS

Sandberg Reference	Client Reference	Description	Weight of sample received, g
C42576	APG1	1 flat piece up to 6mm thick, grey colour, hard and well compacted.	76
C42577	APG2	1 lump, yellowish brown colour, hard and moderately well compacted. Grey coloured backing concrete attached.	175
C42578	APG3	1 flat piece up to 5mm thick, brown colour, hard and moderately well compacted.	26
C42579	APG12	1 piece, red colour, hard and moderately well compacted.	118
C42580	APG19	Several pieces, beige colour, moderately hard and moderately well compacted.	29
C42581	APG5	Several pieces grey colour, hard and moderately well compacted.	85

Sandberg Reference	Client Reference	Description	Weight of sample received, g
C42582	APG2 Backing concrete	1 piece grey colour, hard and well compacted with large brick aggregate.	273
C42583	APG P15 S8 White deposit from ledge in underpass	Piece of white crystalline deposit.	3
C42585	APG BW1	1 flat piece up to 7mm thick, reddish brown colour, hard and well compacted.	36
C42586	APG BW2	Several flat pieces up to 5mm thick, yellow colour, hard and well compacted.	34
C42587	APG BW3 Balustrade 8 (damaged) N10	1 piece, dark grey colour, hard and well compacted.	14

Record colour photographs are given in appendix B.

3. ANALYSIS METHODS AND RESULTS

The samples were prepared and analysed using documented in-house methods, Section 34.1, supported by qualitative chemical analysis where appropriate.

Examination of the analysis data in conjunction with the appearance, tactile properties, petrographic data where available and available background information for the samples suggested that the mixes consisted as follows:

Samples APG1, APG2 APG3, APG12, APG5, APG2, APG BW1 and APG BW3

Portland cement and aggregate.

Samples APG19 and APG BW2

Moderately/eminently hydraulic lime and aggregate.

The mix proportions were therefore calculated accordingly following documented in-house methods.

Portland cement contents were calculated from the soluble silica contents and the lime contents were calculated from the acid soluble calcium contents using assumed values for the calcareous material in the sand.

The approximate volume mix proportions were calculated using typical bulk densities for the constituents as indicated in the analysis tables.

Details of the analyses are given in Table 1 of this report, including details of the assumptions made in the calculations. The mix proportions are summarized below:

Sample No.	Mix Constituents	Ratio binder : sand	
		by weight	by volume
APG1	Portland cement : sand	1 : 2.2	1 : 2
APG2	Portland cement : sand	1 : 1.3	1 : 1
APG3	Portland cement : sand	1 : 1.5	1 : 1¼
APG12	Portland cement : sand	1 : 2.3	1 : 2
APG19	Moderately hydraulic lime : sand	1 : 0.6	5 : 1
APG5	Portland cement : sand	1 : 2.7	1 : 2¼
APG2	Portland cement : sand	1 : 4.4	1 : 3¾
APG BW1	Portland cement : sand	1 : 4.6	1 : 4
APG BW2	Eminently hydraulic lime : sand	1 : 4.7	1 : 1½
APG BW3	Portland cement : sand	1 : 3.3	1 : 2¾

4. ANALYSIS OF CRYSTALLINE DEPOSIT

The crystals were subjected to a general chemical analysis using documented in-house methods. The results were as follows:

Sample APG P15	% by weight
Sodium (Na_2O)	22.20
Potassium (K_2O)	0.06
Sulphate (SO_3)	30.47
Calcium (CaO)	0.54
Chloride (Cl^-)	0.55
Fine siliceous material	Balance

Date of test: 20-21 July 2000.

From the analysis it is apparent that the crystals are of sodium sulphate.

5. SOLUBLE SALTS CONTENT OF PULHAMITE

The two selected Pulhamite samples, APG P2 and APG P12 were analysed for water soluble salts using documented in-house methods based on BS 3921: 1985 'Clay Bricks'.

The results are given in Table 2.

6. PETROGRAPHIC EXAMINATION

The eight selected samples were subjected to examination in general accordance with the procedures described in ASTM C856[1].

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1 ASTM C856. Standard Practice for Petrographic Examination of Hardened Concrete.

The samples were first subjected to macroscopical and low-power microscopical examination supported by simple physical and chemical tests, then impregnated with fluorescent epoxy resin and used to prepare a thin-section which was examined under a high-power petrological microscope. The results are detailed in Appendix A.

From the examination, six of the samples were confirmed to contain Portland cement. Samples APG19 was thought to have a moderately hydraulic lime binder and Sample APG BW2 was thought to have an eminently hydraulic lime binder.

The sands were variable, often containing limestone and shell fragments. A number of samples had pigment present.

7. REMARKS

7.1 Binders

These were mostly of Portland cement in often quite rich mixes which may have been subject to some shrinkage cracking.

In two instances, hydraulic limes were identified, Samples APG19 and APG BW2.

7.2 Sands

The sands used were natural quartz/quartzite type. The variety of colours found is attributed to the use of yellow and red pigments.

7.3 Crystal Deposit

This comprised sodium sulphate which is quite soluble and potentially aggressive to cement bound materials.

7.4 Sulphate Attack

Of the samples examined petrographically, only Sample APG2 had evidence of an acicular material in the voids. The overall sulphate level in this sample is high enough to suggest some sulphate attack is taking place.

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For Sandberg

J L Pickering

J L Pickering
20 November 2000

JLP/Geochem/bp

Materials, samples and test specimens are retained for a period of 2 months from the issue of the final report. Your attention is drawn to the enclosed sample retention form and we would be grateful if you could complete the form and return it within one month from the date of the report.

Tests reported on sheets not bearing the UKAS logo in this report/certificate are not included in the UKAS accreditation schedule for this laboratory.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

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CONSULTING, INSPECTING
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UKAS TESTING 0262

MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS

Documented in-house Methods based on BS4551: Part 2: 1998

Sandberg Reference: Client Reference: Details:	C42576 APG1 mortar	C42577 APG2 mortar
CHEMICAL ANALYSIS		
	% by mass	
Insoluble Residue	56.02	35.58
Soluble Silica, SiO_2	5.49	6.83
Acid soluble Alumina, Al_2O_3	1.77	2.35
Acid soluble Total Iron, Fe_2O_3	0.75	2.14
Acid soluble Calcium, CaO	19.23	22.62
Acid soluble Magnesium, MgO	0.49	3.98
Acid soluble Sulphate, SO_3	0.62	1.64
Loss on Ignition	15.42	23.80
TOTAL	99.79	98.94

	Assumptions (see text for calculation route)
Sand	
- Sol, SiO_2	0.0
- CaO	0.0
- bulk density kg/m³	1675
Portland Cement:	
- Sol, SiO_2	20.2
- CaO	64.5
- bulk density kg/m³	1450
Hydraulic Lime:	
- CaO	62.0
- SiO_2	20.0
- bulk density kg/m³	1000
Non-Hydraulic Lime:	
- CaO	75.6
- SiO_2	0.0
- bulk density kg/m³	575

CALCULATIONS OF MIX PROPORTIONS			
Assumed composition to nearest 0.5%	% by mass of dry mass		Remarks
Portland cement:sand:			
- Portland cement	31.5	43.5	
- Sand	68.5	56.5	
- Volume proportions	1 : 1.9	1 : 1.1*	*possibly some lime present
Hydraulic lime:sand:			
- Hydraulic lime	-	-	
- Sand	-	-	
- Volume proportions	-	-	
Non-Hydraulic lime:sand:			
- Hydrated lime, dry $Ca(OH)_2$	-	-	
- Sand	-	-	
- Volume proportions	-	-	
Given as % by mass of cement:			
- Sulphate, SO_3	2.3	4.9	
Probable Cement Type:	Portland	Portland	OPC, SRPC etc

- = not determined or not applicable

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MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS

Documented in-house Methods based on BS4551: Part 2: 1998

Sandberg Reference: Client Reference: Details:	C42578 APG3 mortar	C42579 APG12 mortar		Assumptions (see text for calculation route)
CHEMICAL ANALYSIS			Sand - Sol, SiO_2 - CaO - bulk density kg/m^3	 0.0 0.0 1675
	% by mass			
Insoluble Residue	40.86	49.17	Portland Cement: - Sol, SiO_2 - CaO - bulk density kg/m^3	 20.2 64.5 1450
Soluble Silica, SiO_2	6.94	5.30		
Acid soluble Alumina, Al_2O_3	2.24	1.45		
Acid soluble Total Iron, Fe_2O_3	0.95	0.77	Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m^3	 62.0 20.0 1000
Acid soluble Calcium, CaO	27.82	21.94		
Acid soluble Magnesium, MgO	0.41	0.69		
Acid soluble Sulphate, SO_3	0.68	0.31	Non-Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m^3	 75.6 0.0 575
Loss on Ignition	19.81	19.40		
TOTAL	99.71	99.03		
CALCULATIONS OF MIX PROPORTIONS				
Assumed composition to nearest 0.5%	% by mass of dry mass		Remarks	
Portland cement:sand: - Portland cement - Sand - Volume proportions	 40.5 59.5 1 : 1.3	 30.5 69.5 1 : 2.0		
Hydraulic lime:sand: - Hydraulic lime - Sand - Volume proportions	 - - -	 - - -		
Non-Hydraulic lime:sand: - Hydrated lime, dry $Ca(OH)_2$ - Sand - Volume proportions	 - - -	 - - -		
Given as % by mass of cement: - Sulphate, SO_3	 2.0	 1.2		
Probable Cement Type:	Portland	Portland	OPC, SRPC etc	

- = not determined or not applicable

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MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS

Documented in-house Methods based on BS4551: Part 2: 1998

Sandberg Reference: Client Reference: Details:	C42580 APG 19 mortar	C42581 APG 5 mortar		Assumptions (see text for calculation route)
CHEMICAL ANALYSIS			Sand - Sol, SiO_2 - CaO - bulk density kg/m³	 0.0 5.0/0.0 1675
	% by mass			
Insoluble Residue	30.88	58.96	Portland Cement: - Sol, SiO_2 - CaO - bulk density kg/m³	 20.2 64.5 1450
Soluble Silica, SiO_2	2.60	4.86		
Acid soluble Alumina, Al_2O_3	0.91	1.66		
Acid soluble Total Iron, Fe_2O_3	0.31	3.04	Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m³	 62.0 20.0 575
Acid soluble Calcium, CaO	34.95	17.19		
Acid soluble Magnesium, MgO	0.41	0.73		
Acid soluble Sulphate, SO_3	0.48	1.12	Non-Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m³	 75.6 0.0 575
Loss on Ignition (less combustible)	29.32	12.22		
Combustible material	-	20.66		
TOTAL	99.86	99.78		
CALCULATIONS OF MIX PROPORTIONS				
Assumed composition to nearest 0.5%	% by mass of dry mass		Remarks	
Portland cement:sand: - Portland cement - Sand - Volume proportions	 - - -	 27.0 73.0 1 : 2.3		
Hydraulic lime:sand: - Hydraulic lime - Sand - Volume proportions	 64.0 36.0 5 : 1	 - - -	 moderately hydraulic lime rough estimate only	
Non-Hydraulic lime:sand: - Hydrated lime, dry $Ca(OH)_2$ - Sand - Volume proportions	 - - -	 - - -		
Given as % by mass of cement: - Sulphate, SO_3	 -	 4.6		
Probable Cement Type:	Portland	Portland	OPC, SRPC etc	

- = not determined or not applicable

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MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS

Documented in-house Methods based on BS4551: Part 2: 1998

Sandberg Reference: Client Reference: Details:	C42582 APG 2 mortar	C42585 APG BW1 mortar		Assumptions (see text for calculation route)
CHEMICAL ANALYSIS			Sand - Sol, SiO_2 - CaO - bulk density kg/m^3	 0.0 0.0 1675
	% by mass			
Insoluble Residue	69.63	73.76	Portland Cement: - Sol, SiO_2 - CaO - bulk density kg/m^3	 20.2 64.5 1450
Soluble Silica, SiO_2	3.36	3.44		
Acid soluble Alumina, Al_2O_3	0.96	0.69		
Acid soluble Total Iron, Fe_2O_3	0.35	0.33	Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m^3	 62.0 20.0 1000
Acid soluble Calcium, CaO	12.89	13.12		
Acid soluble Magnesium, MgO	0.28	0.16		
Acid soluble Sulphate, SO_3	0.20	0.30	Non-Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m^3	 75.6 0.0 575
Loss on Ignition	12.01	7.84		
TOTAL	99.68	99.64		
CALCULATIONS OF MIX PROPORTIONS				
Assumed composition to nearest 0.5%	% by mass of dry mass		Remarks	
Portland cement:sand: - Portland cement - Sand - Volume proportions	 18.5 81.5 1 : 3.8	 18.0 82.0 1 : 3.9		
Hydraulic lime:sand: - Hydraulic lime - Sand - Volume proportions	 - - -	 - - -		
Non-Hydraulic lime:sand: - Hydrated lime, dry $Ca(OH)_2$ - Sand - Volume proportions	 - - -	 - - -		
Given as % by mass of cement: - Sulphate, SO_3	 1.2	 1.8		
Probable Cement Type:	Portland	Portland	OPC, SRPC etc	

- = not determined or not applicable

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MORTAR - CHEMICAL ANALYSIS
DETERMINATION OF MIX PROPORTIONS

Documented in-house Methods based on BS4551: Part 2: 1998

Sandberg Reference: Client Reference: Details:	C42586 APG BW2 mortar	C42587 APG BW3 mortar
CHEMICAL ANALYSIS		
	% by mass	
Insoluble Residue	61.12	60.28
Soluble Silica, SiO_2	3.31	4.29
Acid soluble Alumina, Al_2O_3	1.13	0.82
Acid soluble Total Iron, Fe_2O_3	0.47	0.64
Acid soluble Calcium, CaO	17.64	16.51
Acid soluble Magnesium, MgO	0.16	1.46
Acid soluble Sulphate, SO_3	0.46	0.68
Loss on Ignition	15.68	13.89
TOTAL	99.97	98.57

	Assumptions (see text for calculation route)
Sand - Sol, SiO_2 - CaO - bulk density kg/m^3	 0.0 10.0/0.0 1675
Portland Cement: - Sol, SiO_2 - CaO - bulk density kg/m^3	 20.2 64.5 1450
Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m^3	 62.0 20.0 1000
Non-Hydraulic Lime: - CaO - SiO_2 - bulk density kg/m^3	 75.6 0.0 575

CALCULATIONS OF MIX PROPORTIONS			
Assumed composition to nearest 0.5%	% by mass of dry mass		Remarks
Portland cement:sand: - Portland cement - Sand - Volume proportions	 - - -	 23.5 76.5 1 : 2.8	
Hydraulic lime:sand: - Hydraulic lime - Sand - Volume proportions	 17.5 82.5 1 : 1.6	 - - -	possibly eminently hydraulic lime
Non-Hydraulic lime:sand: - Hydrated lime, dry $Ca(OH)_2$ - Sand - Volume proportions	 - - -	 - - -	
Given as % by mass of cement: - Sulphate, SO_3	 -	 3.2	
Probable Cement Type:	Portland	Portland	OPC, SRPC etc

- = not determined or not applicable

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SOLUBLE SALTS CONTENT ANALYSIS

Documented In-House Methods Based on BS3921:1985

Sandberg Sample Reference	C42577	C42579			
Client Sample Reference	APG2	APG12			
Details	mortar	mortar			

Soluble Salts Content, % by weight					
- water soluble magnesium , Mg^{++}	<0.001	<0.001			
- water soluble potassium, K^{+}	0.015	0.007			
- water soluble sodium, Na^{+}	0.044	0.017			
- water soluble sulphate, SO_4	0.467	0.220			
- water soluble chloride, Cl^{-}	0.621	trace			
- water soluble nitrate, NO_3	0.124	0.022			

\- = Not Determined.

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MICROSCOPICAL EXAMINATION OF HARDENED MORTAR
Based on ASTM C856-1995

Sandberg Sample Reference:	C42576
Client Reference/Site Mark:	APG 1 Grey Pulhamite
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	3.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A representative portion from the mortar sample was impregnated with an epoxy resin and used to prepare a large area thin section.
Microscope Details: *(type, magnification used)*	Olympus SZ stereoscopic microscope and BH2 high-power petrological microscope employing magnifications up to x800
Position of Specimen: *(relationship to sample)*	The slice was taken through several pieces of the mortar sample
MORTAR COMPOSITION AND FEATURES	
Fine Aggregate: *(incl. particle size, grading, distribution, shape and composition)*	Natural sand comprising quartz/quartzite, shell pieces, flint/chert, and sporadic limestone and glauconite. The shell was mainly of bivalve fragments. The shell and limestone were estimated (ball park estimate) to be up to 10% by volume.
Colour of Cement Matrix:	Grey in hand specimen and grey/brown in thin section
Cement Type: *(Portland, lime etc)*	Probably Portland cement type
Unhydrated grains: *(incl. size, abundance and degree of hydration)*	Occasional unhydrated and hemihydrated cement grains up to 300µm across.
Mineral Additives:	None positively identified
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of $Ca(OH)_2$)*	The cement matrix was carbonated throughout.
Compaction and Void Details: *(incl. microporosity and void types, sizes, distribution)*	The sample was very small for a reliable assessment of compaction
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Information: *(incl. any evidence of deterioration, chemical attack, surface coatings, multiple layering etc.)*	-

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MICROSCOPICAL EXAMINATION OF HARDENED MORTAR
Based on ASTM C856-1995

Sandberg Sample Reference:	C42577
Client Reference/Site Mark:	APG 2 Sandy coloured Pulhamite
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	3.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A representative portion from the mortar sample was impregnated with an epoxy resin and used to prepare a large area thin section.
Microscope Details: *(type, magnification used)*	Olympus SZ sterescopic microscope and BH2 high-power petrological microscope employing magnifications up to x800
Position of Specimen: *(relationship to sample)*	The slice was taken through the mortar sample
MORTAR COMPOSITION AND FEATURES	
Fine Aggregate: *(incl. particle size, grading, distribution, shape and composition)*	Natural sand comprising quartz/quartzite, shell pieces, flint/chert, and sporadic limestone and glauconite. The shell was mainly of bivalve fragments. The shell and limestone were estimated (ball park estimate) to be up to 10% by volume.
Colour of Cement Matrix:	Yellow/pink shades in hand specimen and yellow/brown in thin section
Cement Type: *(Portland, lime etc)*	Probably Portland cement type
Unhydrated grains: *(incl. size, abundance and degree of hydration)*	Occasional unhydrated and hemihydrated cement grains up to 400μm across.
Mineral Additives:	Yellow pigment and probably lime
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of $Ca(OH)_2$)*	The cement matrix was carbonated up to 10mm in depth from the apparent exposed surface below which was uncarbonated with occasional fine portlandite up to 20μm across.
Compaction and Void Details: *(incl. microporosity and void types, sizes, distribution)*	The sample was very small for a reliable assessment of compaction
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	An acicular material infilled voids
Other Information: *(incl. any evidence of deterioration, chemical attack, surface coatings, multiple layering etc.)*	The acicular deposits are indicative of somewhat moist conditions

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MICROSCOPICAL EXAMINATION OF HARDENED MORTAR
Based on ASTM C856-1995

Sandberg Sample Reference:	C42578
Client Reference/Site Mark:	APG 3 Sandy Grey Pulhamite
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	3.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A representative portion from the mortar sample was impregnated with an epoxy resin and used to prepare a large area thin section.
Microscope Details: *(type, magnification used)*	Olympus SZ stereoscopic microscope and BH2 high-power petrological microscope employing magnifications up to x800
Position of Specimen: *(relationship to sample)*	The slice was taken through several pieces of the mortar sample
MORTAR COMPOSITION AND FEATURES	
Fine Aggregate: *(incl. particle size, grading, distribution, shape and composition)*	Natural sand comprising quartz/quartzite, shell pieces, flint/chert, and sporadic limestone. The shell was mainly of bivalve fragments. The shell and limestone were estimated (ball park estimate) to be up to 10% by volume.
Colour of Cement Matrix:	Light brown/grey in hand specimen and grey/brown in thin section
Cement Type: *(Portland, lime etc)*	Probably Portland cement type
Unhydrated grains: *(incl. size, abundance and degree of hydration)*	Occasional unhydrated and hemihydrated cement grains up to 300μm across.
Mineral Additives:	Possibly some pigment
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of $Ca(OH)_2$)*	The cement matrix was carbonated throughout.
Compaction and Void Details: *(incl. microporosity and void types, sizes, distribution)*	The sample was very small for a reliable assessment of compaction
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Information: *(incl. any evidence of deterioration, chemical attack, surface coatings, multiple layering etc.)*	-

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MICROSCOPICAL EXAMINATION OF HARDENED MORTAR
Based on ASTM C856-1995

Sandberg Sample Reference:	C42579
Client Reference/Site Mark:	APG 12 Pink Pulhamite
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	3.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A representative portion from the mortar sample was impregnated with an epoxy resin and used to prepare a large area thin section.
Microscope Details: *(type, magnification used)*	Olympus SZ stereoscopic microscope and BH2 high-power petrological microscope employing magnifications up to x800
Position of Specimen: *(relationship to sample)*	The slice was taken through the mortar sample
MORTAR COMPOSITION AND FEATURES	
Fine Aggregate: *(incl. particle size, grading, distribution, shape and composition)*	Natural sand comprising quartz/quartzite, shell pieces, flint/chert, and sporadic limestone. The shell was mainly of bivalve fragments. The shell and limestone were estimated (ball park estimate) to be up to 10% by volume.
Colour of Cement Matrix:	Pink in hand specimen and pink/grey/brown in thin section
Cement Type: *(Portland, lime etc)*	Probably Portland cement type
Unhydrated grains: *(incl. size, abundance and degree of hydration)*	Occasional unhydrated and hemihydrated cement grains up to 300μm across.
Mineral Additives:	Red pigment
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of $Ca(OH)_2$)*	The pigment masked the appearance of the cement matrix
Compaction and Void Details: *(incl. microporosity and void types, sizes, distribution)*	The sample was very small for a reliable assessment of compaction
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Information: *(incl. any evidence of deterioration, chemical attack, surface coatings, multiple layering etc.)*	-

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MICROSCOPICAL EXAMINATION OF HARDENED MORTAR
Based on ASTM C856-1995

Sandberg Sample Reference:	C42580
Client Reference/Site Mark:	APG 19 Mortar
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	3.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A representative portion from the mortar sample was impregnated with an epoxy resin and used to prepare a large area thin section.
Microscope Details: *(type, magnification used)*	Olympus SZ stereoscopic microscope and BH2 high-power petrological microscope employing magnifications up to x800
Position of Specimen: *(relationship to sample)*	The slice was taken through the mortar sample
MORTAR COMPOSITION AND FEATURES	
Fine Aggregate: *(incl. particle size, grading, distribution, shape and composition)*	Natural sand comprising quartz/quartzite, shell pieces, flint/chert, and sporadic limestone. The shell was mainly of bivalve fragments. The shell and limestone were estimated (ball park estimate) to be up to 10% by volume. The sand was sparsely distributed.
Colour of Cement Matrix:	Cream in hand specimen and light brown in thin section
Cement Type: *(Portland, lime etc)*	Lime possibly semi hydraulic
Unhydrated grains: *(incl. size, abundance and degree of hydration)*	Occasional partially burnt and unburnt limestone particles.
Mineral Additives:	None positively identified
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of $Ca(OH)_2$)*	The cement matrix was carbonated throughout.
Compaction and Void Details: *(incl. microporosity and void types, sizes, distribution)*	The sample was very small for a reliable assessment of compaction
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Information: *(incl. any evidence of deterioration, chemical attack, surface coatings, multiple layering etc.)*	-

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MICROSCOPICAL EXAMINATION OF HARDENED CONCRETE
ASTM C856-95

Sandberg Sample Reference:	C42581
Client Reference/Site Mark:	APG 5 Backing concrete
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	7.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A slice specimen was diamond-sawn from the sample and was impregnated with an epoxy resin containing a fluorescent dye and then used to prepare a large area thin-section.
Microscope Details: *(type, magnification used)*	Olympus SZ stereoscopic microscope and BH2 high power petrological microscope employing plane polarised, cross polarised and ultra violet light and magnifications up to x800.
Position of Specimen: *(relationship to sample)*	The slice specimen was taken across a piece up to 35mm across.
CONCRETE COMPOSITION AND FEATURES	
Coarse Aggregate:	Natural gravel containing flint, sandstone and limestone. Furnace slag pieces were also present.
Fine Aggregate:	Natural sand comprising mainly quartz and quartzite, lesser amounts of shell pieces, some flint/chert and limestone. Furnace slag fines were also present.
Colour of Cement Matrix:	Light grey in hand specimen and pale grey/brown in thin section
Cement Type:	Portland cement type
Unhydrated grains: *(incl, size, abundance and degree of hydration)*	Occasional unhydrated and hemihydrated cement grains up to 700µm.
Mineral Additives:	None positively identified
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of Ca(OH).)*	The cement matrix was carbonated throughout
Compaction and Void Details: *(incl. microporosity and void types, sizes distribution)*	The concrete was very small for a reliable assessment of the compaction to be carried out.
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Features Indicative of Distress or Deterioration: *(incl. any evidence of alkali-reactivity, chemical attack, etc.)*	-

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MICROSCOPICAL EXAMINATION OF HARDENED CONCRETE
ASTM C856-95

Sandberg Sample Reference:	C42582
Client Reference/Site Mark:	APG 2 Backing concrete
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	7.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A slice specimen was diamond-sawn from the sample and was impregnated with an epoxy resin containing a fluorescent dye and then used to prepare a large area thin-section.
Microscope Details: *(type, magnification used)*	Olympus SZ stereoscopic microscope and BH2 high power petrological microscope employing plane polarised, cross polarised and ultra violet light and magnifications up to x800.
Position of Specimen: *(relationship to sample)*	The slice specimen was taken across a piece up to 45mm across.
CONCRETE COMPOSITION AND FEATURES	
Coarse Aggregate:	Crushed brick
Fine Aggregate:	Natural sand comprising mainly quartz, lesser amounts of shell pieces and flint/chert and some limestone.
Colour of Cement Matrix:	Light grey in hand specimen and grey/brown in thin section
Cement Type:	Portland cement type
Unhydrated grains: *(incl, size, abundance and degree of hydration)*	Sporadic unhydrated and hemihydrated cement grains up to 150μm.
Mineral Additives:	None positively identified
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of Ca(OH)₂)*	The cement matrix was carbonated throughout
Compaction and Void Details: *(incl. microporosity and void types, sizes distribution)*	The concrete was very small for a reliable assessment of the compaction to be carried out.
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Features Indicative of Distress or Deterioration: *(incl. any evidence of alkali-reactivity, chemical attack, etc.)*	-

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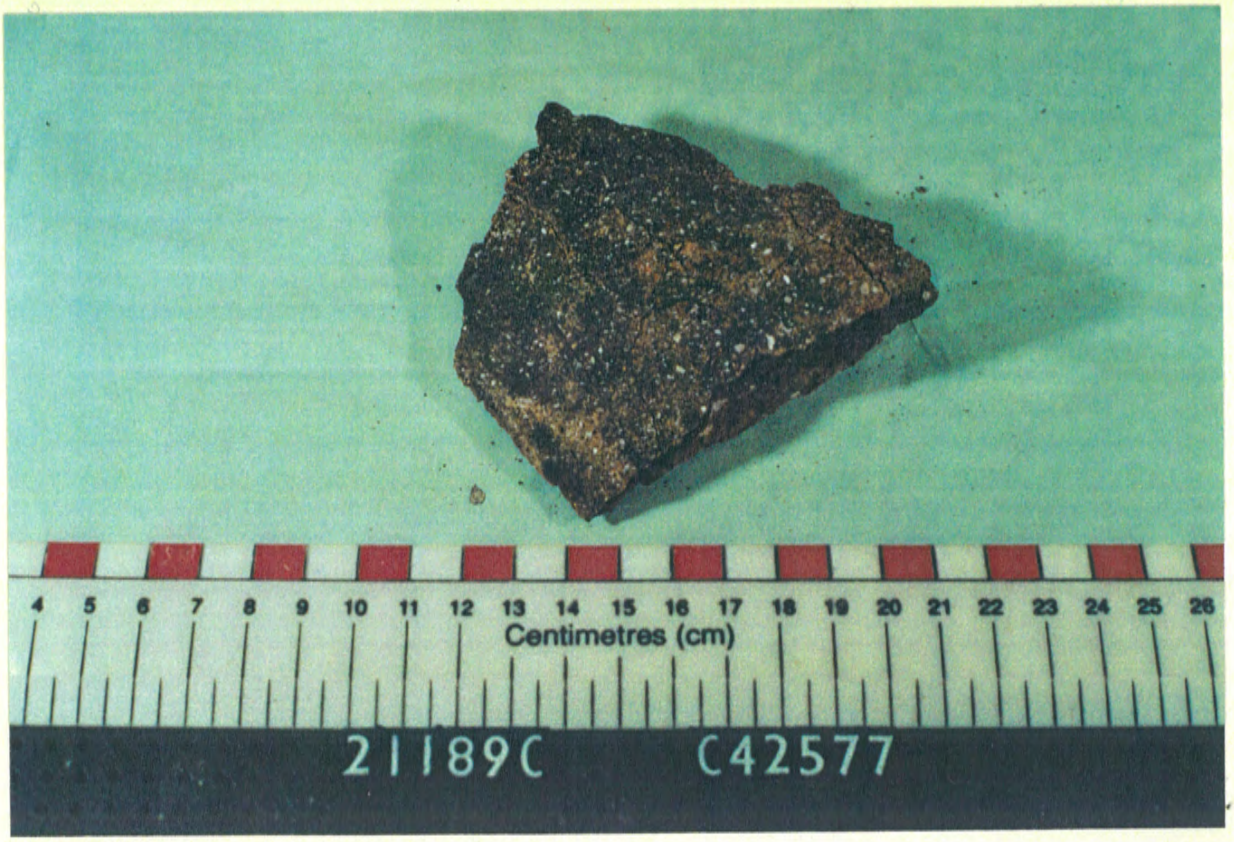
MICROSCOPICAL EXAMINATION OF HARDENED MORTAR
Based on ASTM C856-1995

Sandberg Sample Reference:	C42586
Client Reference/Site Mark:	APG BW2 Mortar
Sample Location Details:	Albion Place Gardens
Date of Test/Petrographer:	7.8.2000/PS
Specimen Preparation Details: *(size, impregnation)*	A representative portion from the mortar sample was impregnated with an epoxy resin and used to prepare a large area thin section.
Microscope Details: *(type, magnification used)*	Olympus SZ sterescopic microscope and BH2 high-power petrological microscope employing magnifications up to x800
Position of Specimen: *(relationship to sample)*	The slice was taken through several pieces of the mortar sample
MORTAR COMPOSITION AND FEATURES	
Fine Aggregate: *(incl. particle size, grading, distribution, shape and composition)*	Natural sand comprising quartz/, ooliths, shell pieces, flint/chert, and some limestone. The shell was mainly of bivalve fragments. The ooliths, shell and limestone were estimated (ball park estimate) to be up to 30% by volume.
Colour of Cement Matrix:	Grey in hand specimen and grey/brown in thin section
Cement Type: *(Portland, lime etc)*	Possibly eminently hydraulic lime
Unhydrated grains: *(incl. size, abundance and degree of hydration)*	Occasional unhydrated and hemihydrated cement grains up to 200µm across.
Mineral Additives:	None positively identified
Carbonation and Portlandite: *(incl. depth and degree of carbonation, size and distribution of $Ca(OH)_2$)*	The cement matrix was carbonated throughout.
Compaction and Void Details: *(incl. microporosity and void types, sizes, distribution)*	The sample was very small for a reliable assessment of the compaction to be carried out.
Cracks and Microcracks: *(incl. sizes, abundance, distribution relationships to other features)*	Not applicable
Secondary Deposits:	None seen
Other Information: *(incl. any evidence of deterioration, chemical attack, surface coatings, multiple layering etc.)*	-

SANDBERG CONSULTING, INSPECTING AND TESTING ENGINEERS	21189/C
	Appendix/Sheet B/1

RECORD COLOUR PHOTOGRAPHS

Sample No. C42576



Sample No. C42577

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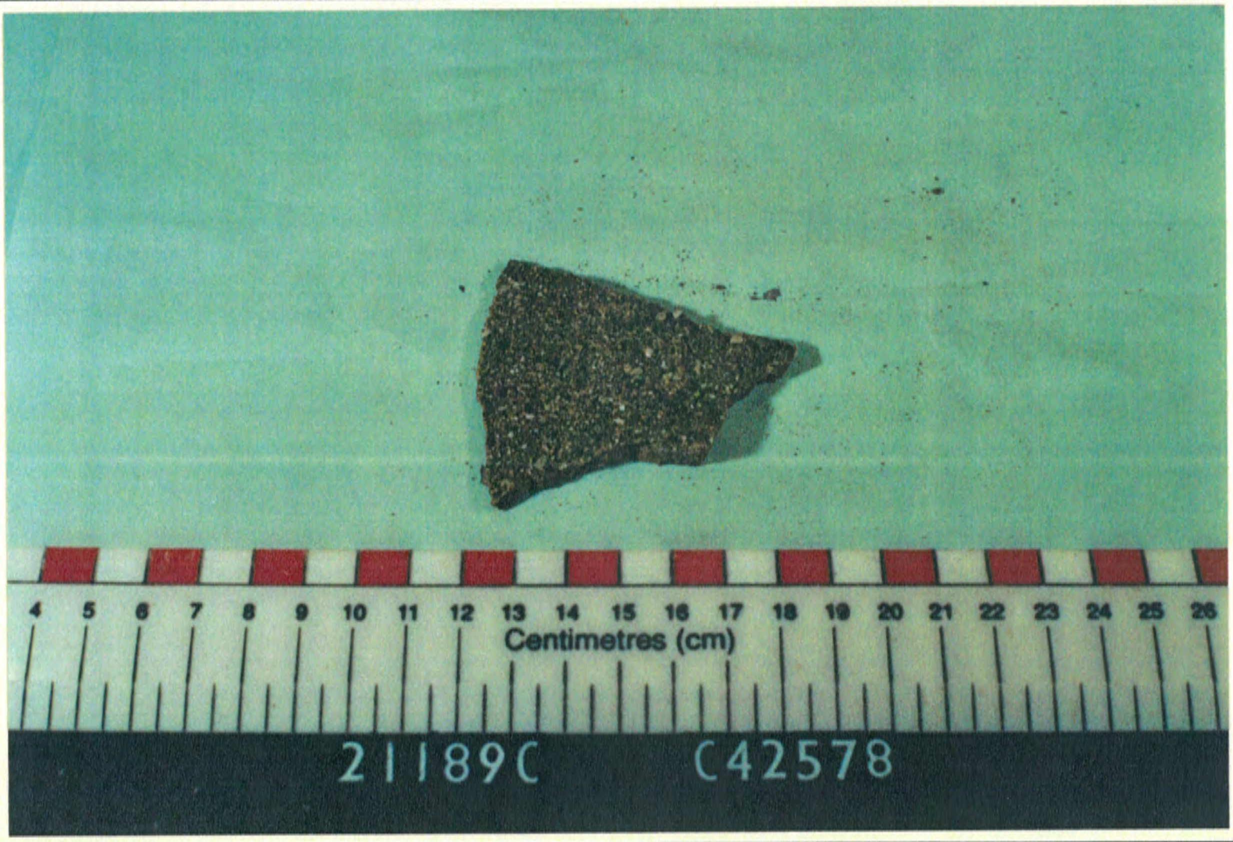
Appendix/Sheet

B/2

RECORD COLOUR PHOTOGRAPHS



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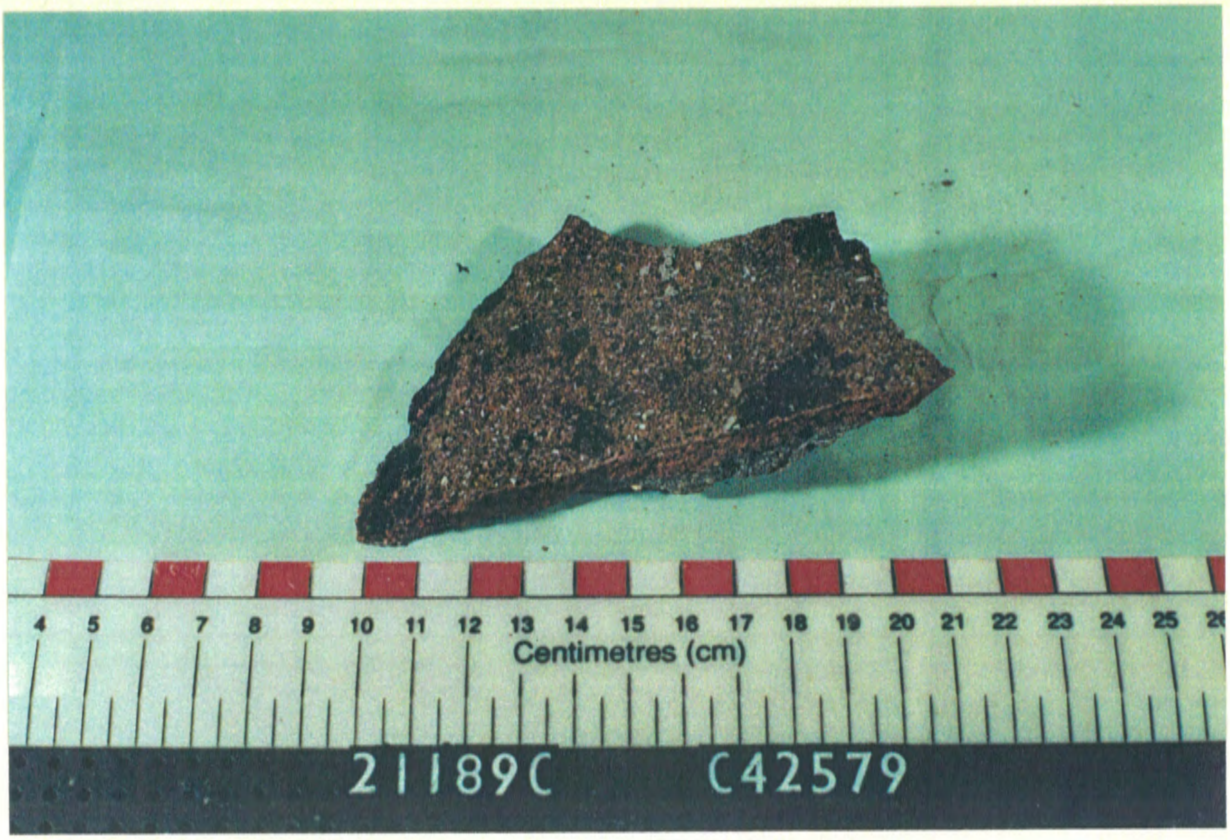

Sample No. C42579

RECORD COLOUR PHOTOGRAPHS

Sample No. C42580

Sample No. C42581

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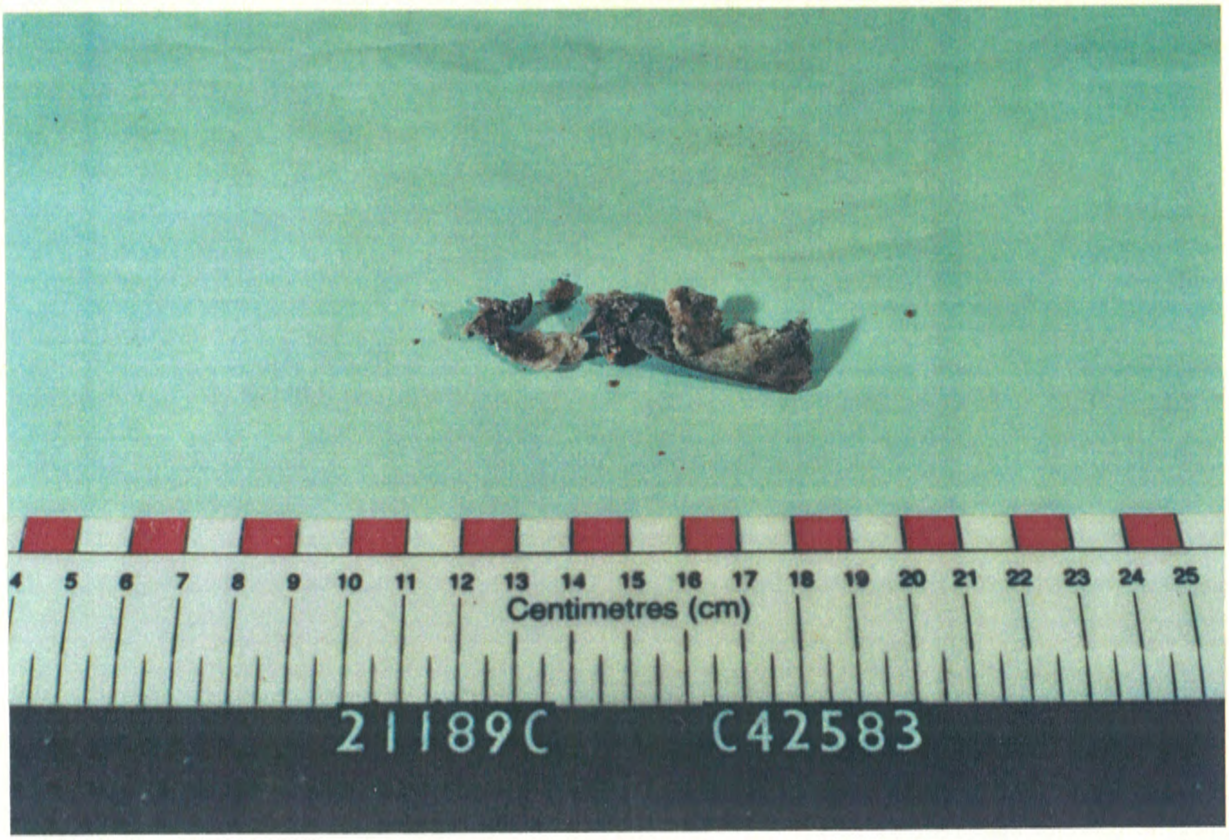
AND TESTING ENGINEERS

RECORD COLOUR PHOTOGRAPHS

Sample No. C42582



Sample No. C42583

SANDBERG

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AND TESTING ENGINEERS

21189/C

Appendix/Sheet
B/5

RECORD COLOUR PHOTOGRAPHS

Sample No. C42585

Sample No. C42586

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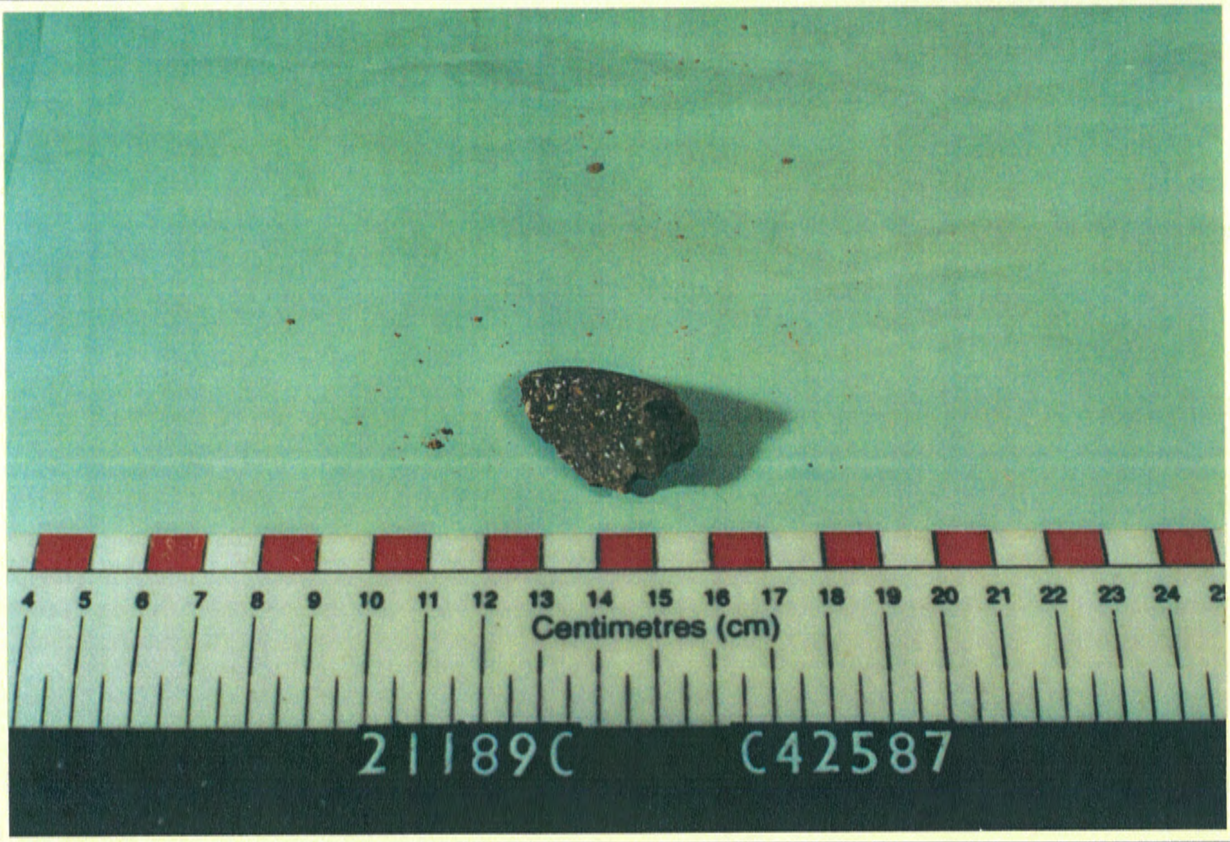
AND TESTING ENGINEERS

21189/C

Appendix/Sheet

B/6

RECORD COLOUR PHOTOGRAPHS



Sample No. C42587

Analysis report from Imperial College Durability group (Yang and Buenfeld).

The following report is written by Simon Swann following a meeting with Dr. Yang at Imperial College. Dr Yang has summarised his findings in Tables 1&2, and has also made ammendmants to the text of this report. Dr. D. Hughes (Bradford University) has been called upon for advise concerning Natural cements and his own work with English Roman cements. Reference has been made to the work by Blezzard in 1981, Technical Aspects of Victorian cements (Chemistry and Industry) and various other references.

Dr. Yang has studied the collected samples for two main purposes. Firstly to try and characterise the mortar samples for duplication purposes and secondly to try identify the principal causes of decay. The analysis techniques employed included examination by SEM and some XRD work. The sample cataloguing and a brief summery of the microstructural examination are summarised in tables 1&2.

Characterisation of the mortar types.

The mortars with one exception were found to be clinker based. The exception appears to be an outer layer *(2-5 mm thick)* of sample *N9* which appears to have a predominantly calcite matrix. Clinker is defined as being any compound formed during firing of cements that results from the reaction of calcium with silica, alumina, iron or other element. Dr Yang makes a distinction between mortars that have carbonate based microstructures (which would appear to included *hydraulic lime or air lime* mortars and those with clinker based structures which would included cements. Where exactly Roman or Natural cements fall within the categorisation is still being debated.)
The micro structure of the mortar matrix was uncharacteristic of modern portland cements. The pulhamite microstructures were characterised by large clinker particles, some still unhydrated after a hundred years since initial application. The size of the clinker particles implies that the cement was coarse ground, and not the finely ground material that is characteristic today. *Significant amount of the pulhamite cement particles (estimably more than 20%) are coarser than 100 μm diameters in comparison with 0-4% of the particles coarser than 90 μm in the modern Portland cement (Taylor's <Cement Chemistry> pp98),* Another feature of the unhydrated clinker particles was the crystal size *of the ferrite and aluminate phases* within these particles. This would tend to indicate a slow cooling and might provide some evidence to indicate the type of kiln and calcination process the materials may have undergone. In the present day, Portland cements are quenched fairly rapidly giving small sized crystals, while the slow cooling processes typical of vertical kilns allowed larger crystal growth.

The matrix was also characterised by large pore sizes and frequent voids (a hundred μm to mm*)* In certain areas of dense hydrated matrix, CaO could be seen in *a state of calcium hydroxide. Renhe, you told me something about an inner hydration product ring and an outer but I cant remember what the relavence of this was, could you write something in here to explain it, please? (Simon: the inner product is a side-evidence of alite presence.)*

The analysis of the anhydrous clinker indicates a hydration chemistry based predominantly around belite (C2S), Ferrite (solid solutions with varying Al/Fe), and the aluminate phases CA2 and C2AS. Alite (C3S) was also detected but was not dominant (*Renhe, can you add any quantification to these results, ie comparative C2S/ C3S quantities or other data? Simon, No, any quantification is difficult at the moment. We have little data of historic cements in hands.)*

Interpretation of results and implications for binder selection in repair mortars.

Hydraulic mortars from the nineteenth century are extremely difficult to analyse and to reach definite conclusions about the precise product which may have been utilised in the manufacture. This is partially because insufficient research has been conducted on the wide range of hydraulic cements available in the Victorian period. Without a good knowledge of their raw materials, their production methods, and samples with which to make comparison it is almost impossible to positively identify the product name of cements from historic mortars samples. However, broader categories or characteristics can help us classify the general types of binders. Accepting the need for much more substantial research into the different Victorian cements, we have made a comparison of the hydration chemistry of various historic binder types and some modern available binders. This information appears below in table 3.

An examination of this table leads to the conclusion that the French Natural cement (Rapide) or the Rapide plus (Rapide with the addition of pozzolanic filler) might be the most closely related binder material. This cement is fired in a traditional vertical kiln in a temperature range of 800-1200 degrees C. Unlike hydraulic limes, it has only a very small percentage of free lime. The combination of lime and silicates, alluminates etc. occurs within the kiln at these temperatures in the solid state because of their intimate association within the natural rock, ie the materials do not vitrify (according to manufacturers literature). Unlike Portland cements, the hydration is dependent on aluminates for the rapid set and dicalcium silicates for its long term strength development. Portland cement is predominantly dependent on retarded aluminates and accelerated tri calcium silicates for initial strength and twenty eight day compressive strength. The rapid set of Rapide may be adjusted with either citric acid or the addition of Portland cement. Rapide may also be mixed with lime binders if required. The main criteria that Rapide does not fulfill is the small presence of C3S found in the pulhamite mortars. "Rapide plus" has a small content of C3S but we are not sure how this is achieved at present (as it is only rapide with the addition of pozzolanic material), and will need to investigate this further.

The limitations of this type of comparison, particularly as a method of selecting a repair binder should be noted. The hydration chemistry, especially when not precisely quantified, can only be an indication of how the binder might perform during hydration and subsequently. Other factors such as the physical characterisation of the mortar's microstructure and the existing condition of the environment in which the new replacement mortars must survive are important considerations. The physical microstructural characteristics of 19^{th} century hydraulic mortars are not well documented. Although this is a potential valuable resource in the characterisation of hydraulic mortars, in our present state of knowledge we can only offer some general observations based on our findings. While the environmental conditions in which the new mortars must survive are to some extent documented below, in the discussion of the decay mechanisms found within the microstructure.

From the physical characteristics of the microstructure we can conclude the following points. The coarse ground cement material is indicative of a material produced before the introduction of ball mill grinding to the manufactory. These begun to be introduced towards the end of the C19th. Similarly, calcination in traditional beehive, shaft kilns or other kiln types prior to the introduction in England of the rotary Kiln (Thurrock , Essex, 1900) generally meant slow cooling and subsequent larger crystal growth. The characteristic heterogenous character of the earlier cements compared to the mineral homogeneity (compound assemblage and crystal characteristics) of modern Portland cements, is primarily a function of these and other technical developments in the production of Portland cements post 1900. In many ways the different cements prior to 1900 would appear to have more in common with each other than the Portland cements developing after this date. They certainly have very different characteristics to modern Portland cements.

Table 1. Pulhamite Mortars (1894) from Ramsgate

Sample	Location	Description	Examination
U1	underpass	rock+pulhamite (red)+decay	cut+impreg+SEM
U2	underpass	red pulhamite cover	
U3	underpass	yellow pulhamite+decay	cut+impreg+SEM
U4	underpass	pulhamite brick joint	
U5	underpass	white grey deposit	XRD+impreg+SEM
U6	underpass	yellow pulhamite+decay	
PR1	pumproom door	pink pulhamite+decay	
PR2	pumproom door	grey pulhamite+ weathering	cut+impreg+SEM
PR3	pumproom door	sandy grey pulhamite+weathering	
PR4	pumproom door	yellow pulhamite+brick	cut+impreg+SEM
WF1	waterfall	decayed layer of pulhamite	impreg+cut+SEM
WF2	waterfall (B)	pulhamite+wet decay	cut+impreg+SEM
WF3	waterfall (A)	red pulhamite+wet decay	
FS	first seat sourthside	black deposit+pulhamite+decay	impreg+cut+SEM
N9	N9	Roman cement+concrete	cut+impreg+SEM
N11	N11	concrete+pulhamite+brick	

SEM --- scanning electron microscopy
XRD --- x-ray diffraction
impreg. --- resign impregnation

Summary of Microstructural Examination

Samples	Examination Results by SEM and XRD		
	cement	hydration	decay
U1	large clinker grains	less hydrated Al, Fe	Carb+light SA
U3	belite, ferrite	highly hydrated	Mg, gypsum, KCS, SA
U5			Na2SO4, carb
PR2	alite, belite, ferrite, CA2	less hydrated, CH	carb, ett, Cl, light SA
PR4		highly hydrated	gyp, Mg, ett, SA
WF1	alite, belite, ferrite, CA2	less hydrated, CH	carb, Cl
WF2	alite, belite, ferrite, CA2,C2AS, CS	moderate, high hydration	carb
FS	clinker not seen	highly hydrated	gyp, Mg, ett, Cl, SA
N9	belite, ferrite, CSAF	highly hydrated, lime based mortar in surface region	gyp, ett, Cl, alkali, light SA

CH --- calcium hydroxide
gyp. --- gypsum
ett. --- ettringite
KCS --- potassium calcium sulfate
carb. --- carbonation
SA --- sulfate attack

Table 3. Hydration chemistry. Based on the examination of anhydrous hydraulic compounds in the historic pastes.							
Product	CaO	B-C2S Belite	C3S Alite	C2AS	C3A	CA2	Ferrite phases
Pulhamite materials,	Very low, a carbonated band in some samples.	Present as the dominant calcium silicate	Present in small quantities.	Present		present	Ferrites present.
Roman cement(After Parkers 1796 patent). (source, Dr.D Hughes, unpublished work).(note 1)	Probably similar carbonated banding at surfaces. Hughes trial cements: CaO 3% CaCO3 0-3%	Dominant calcium silicate	Not usually present?	Present (increases with firing temperature)	Trace	Not detected.	Ferrites present, including C4AF, C6A2F, C2F and CF
Meso Portland cement. (as defined by Blezzard 1981)	?	Dominant silicate	Present C3S/C2S=0.4	Present Also CAS	Present	present	Present, C4AF
Comparative Hydration chemistry of modern available binders, unhydrated cement Source manufacturers literature unless stated otherwise..							
Castle NHL3.5 Hydraulic lime, from Izaourt, France. Source:Castle cement. Calculated. Note 2.	Combined Cao and CaCo3= 66%	26.5%	Not present	1.2%	1.2%		C4AF 1.7%
Jura-Kalk Note 3.	Combined Ca(OH)2 and CaCO3= 12%	Strong Presence.	Not present	Strong presence.			
French Natural cement, Rapide.	2.5% free lime.	present			Present, also C12A7		C4AF
Rapide-plus, Rapide with the addition of a pozzolan filler.	?	present	Present, But we are not sure why.		Ditto		Ditto.
Modern							

Portland cement.							

Note 1. These figures/findings are variable according to the source of the raw materials, the temperature of calcination (850-1100 degrees c band), and the duartion of calcination. Hydration phases derived from XRD analysis of trial cements. Also recorded are Spurite (a carbonated form of C2S,(particularly at lower temp. calcinations) , anhydrite (CaSO4) and traces of pure silica..

Note 2. Gypsum recorded as 0.4%.

Note 3. Source Swann and Hughes 1998. Alpha SiO2 also had a strong presence and gypsum (CaSo4 2 H20) a medium presence. It is believed this is added as a retarder.

Decay Mechanisms found in the Pulhamite mortars from Madeira Walk, Ramsgate.

Dr Yang concludes that the principal forms of deterioration of the mortars are weathering and sulphate attack. *Weathering means that surface of pulhimite stucco is gradually worn out by wind, rain, etc. The microstructural characteristics of weathering are leaching, carbonation and paste losing from the surface regions.*

The samples from the underpass (tunnel S8) are particularly prone to sulphate attack, with a range of soluble salts being present including Potassium, Sodium, Magnesium, and sulphate based salts. Bands of *potassium calcium sulfate (Simon: I am probably able to suggest a formula after the quantitative analysis)* can clearly been seen in sample U3, and it is likely that these are giving rise to the delamination in these areas. While the principal cause of sulphate attack in the mortars is gypsum formation and magnesium silicate formation. Ettringite formation was not noticed in the underpass, though it was observed in the other pulhamite mortars but is not a principal cause of decay.

Gypsum formation results from the reaction of suplhate salts with calcium in the matrix and frequently leads to detrimental expansion. Magnesium silicate formation results from the substitution of the *Ca* in the CSH gel with magnesium, forming magnesium silicate and the resultant loss of the cementing properties of the gel. *This type of attack was noticeable to develop deeply, even throughout the paste of the pulhamite stuccoes,* but we could not determine the effect it was having on the strength of the mortars.

Some carbonation was also noticed in the underpass mortars and this implies that the calcium element of the C-S-H gel is being robbed by this process with a potential resultant weakening.

The noticeable white surface deposits (U5) seen in the underpass proved to be sodium sulphate *and carbonates.*

The origins of these various salts is likely to be sea water, presumably this has been deposited in wind and rain on the surface of the ground above the tunnel and been transported to the mortar and masonry by further rain. Herbicides might also have added to this salt content. Still a further consideration, is that sea water was known to be used as a retardant for Roman cements, and if these tunnel materials (particularly the red and yellow mortars were based Roman cement binder this could be a further cause of the problem.

The areas of decay and soft mortar associated with the waterfall and the water feature WF1 and WF2 from area N22) appear to be have resulted from leaching of calcium and carbonation of the C-S-H. Both these processes have left the C-S-H cementing matrix calcium deficient and weak.

The mortars sampled (PR2 and PR4) from near the pump room door (N21) exhibited no particular signs of decay when collected. Under examination they exhibit signs of light sulphate attack, with gypsum and ettringite being present, some carbonation and magnesium silicate formation and the presence of chlorides. The presence of chlorides indicates that the metal elements within the cement mortars may be subject to corrosion.

Sample FS (note this is N12) had heavy black deposits on the surface, here again sulphate attack was recorded with the presence of gypsum, magnesium and ettringite. Chlorides were also found. This would indicate that the black surface deposits are probably not beneficial to the pulhamite. (*Renhe, can you make any comparison of the condition of the samples without black surface deposits PR2 and PR4? And those with surface deposits, Please?).*

Sample N9, was taken from the lower sandy coloured strata in N9. This strata is subject to decay that is thought to originate in the background concrete materials. Dr. Yang's examination is on the surface pulhamite only. Here he found light sulphate attack (gypsum and ettringite), chlorides and alkali. (*Renhe, would you explain the significance of the alkali here please??)*

Report for: **Simon Swann, Architectural Conservator**
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Wrentham
Suffolk NR34 7NF

Petrographic Report on Pulhamite and Background Masonry from the Esplanade at Ramsgate, Kent

by

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1. Introduction

1.1. Scope of report

This report contains the results of petrographic study of the Pulhamite and the included stonework that has been used in the construction of the facsimile rock outcrop at Ramsgate. It answers specific questions that were raised in the Commissioning Schedule of July 10, and makes other comments with a view to achieving as full as possible an understanding of the materials that were used in the original construction. Comments on weathering and decay mechanisms are also offered.

1.2. Material

Five samples (APG.P.1, APG.P.2, APG.P.3, APG.P.6, APG.P.12) were of Pulhamite coating material, submitted with a view to replicating the mortars.

Three samples (APG.P.7, APG.P.21, APG.P.14) were background materials needing reconstruction or requiring analysis because of potential decay.

One sample (APG.P.22) was a weathering product, apparently deposited over the finished Pulhamite surface.

1.3. Preparation of samples

Each specimen has been studied in plane polarised light and crossed polars using the polarising microscope (Leitz 12 Pol). Samples were dried and impregnated with clear epoxy resin under vacuum and sectioned perpendicular to the surface (in the cases of the cement-based material), and across the sedimentary lamination (where this could be determined) in the case of the stones, to produce a standard 30 micron thin-section. Colour slide photographs were taken on a Leitz micrographic camera system and reproduced as computer-scanned images.

1.4. Additional Treatments

Sample APG.P.1 was immersed in 5% HCl in order to view rates of effervescence (dissolution of calcium carbonate) and to look for evidence of silica-based gels.

2. Description of the samples: a) Pulhamites

2.1. Pulhamites; general remarks

All 5 Pulhamite samples were very similar in terms of their aggregate compositions which suggests that they came from a single source, so these are described together here. The aggregate consists of:

1. Quartz sand; 0.3 mm - 0.6 mm subangular to well-rounded monocrystalline or oligocrystalline grains; many of the quartz crystals are slightly strained (undulose extinction).

2. Calcium carbonate (calcite and aragonite) shell fragments; 0.3mm - 0.6mm subangular to well-rounded. Derived mainly from molluscs; some material from echinoderms, barnacles, and foraminiferans also present.

These two components vary in abundance from about 80% sand : 20% shell, to about 60% sand : 40% shell, and together make up 90 - 95 % of the total aggregate composition.

Also present are minor amounts of angular flint grains, phosphate grains, and glauconite grains, all of which are likely to be derived from breakdown of Chalk outcrops. The overall mix of components indicate that the Pulhamite was mixed with beach sand. The composition of the fauna and the minor amounts of Chalk-derived material strongly suggest that they are of local origin.

All 5 samples have granular matrices, with the largest of the cementitious particles approaching 0.3 mm across. There is no indication from the petrography as to whether the matrix is an artificial or a natural cement but silica-based cementitious minerals are undoubtedly present.

2.2. Sample APG.P.1.
Proportion of shell in aggregate: c. 20%. Ratio of cement matrix to aggregate: c. 2:1. Otherwise as described in **2.1**.

Rate of effervescence in HCl: slow, principally deriving from shell grains.

2.3. Sample APG.P.2.
Pinkish buff Pulhamite; outer 4 mm darker in colour. Proportion of shell in aggregate: c. 40%. Ratio of cement matrix to aggregate: c. 4:1. There are a few dark, iron oxide cemented particles which contribute to the colour. Otherwise as described in 2.1. The darker outer layer has the same aggregate characteristics as the inner layer, so it appears that the darker colour, which derives entirely from the darker matrix, is a weathering feature.

There is a thin layer of adherent grey backing coat along one side of the sample which appears to have the same aggregate content as the Pulhamite but is otherwise a porous cement.

2.4. Sample APG.P.3.
Proportion of shell in aggregate: c. 30%. Ratio of cement matrix to aggregate: c. 2:1. Dark, opaque phosphatic lumps somewhat more common than in the previous samples. 0.3 mm granules of cementitious material locally prominent in the matrix. Otherwise as described in 2.1.

2.5. Sample APG.P.12.
Proportion of shell in aggregate: c. 40%. Ratio of cement matrix to aggregate: c. 2:1. Otherwise as described in 2.1. The pink colour clearly lies in the cementitious matrix rather than in the aggregate. It is likely to be iron oxide, but it is not evident as discreet grains in the thin section. The pores in the matrix (up to 1.5 mm across) are from entrainment of air during mixing, not from dissolution of any component.

The specimen shows that the pink Pulhamite has been applied to a backing of concrete. Part of one of the lumps in the concrete appears in the thin section, and is a highly porous cement lump (possibly a fragment of broken cement block) with a fine-sand sized angular quartz aggregate.

2.6. Sample APG.P.6.
Proportion of shell in aggregate: c. 25%. Ratio of cement matrix to aggregate differs across the field of view of the thin section, from c. 1:1 to c. 2:1. Otherwise as described in 2.1.

The large shell fragments are those of bivalve and gastropod molluscs (clams and sea-snails), and barnacles. The obvious snail is a dog-whelk (*Nassarius*); the clams are too fragmented to be identifiable with certainty, though one appears to be a piece of a Gaper (*Mya*). Two points are important: they are very abraded and give the impression of having been rolled around on a beach; and they represent different ecologies (one rocky shore: the other sandy mud). The shell fragments in the other Pulhamite samples similarly represent different living environments, and have clearly been brought together and mixed on the beach. I infer that the larger shell similarly represent beach debris, rather than have been specifically collected from a different source.

The large pebble in this sample is a beach-rounded flint fragment.

A sliver of the cement backing coat included in the thin section shows unburnt and part-burnt Chalk fragments in the matrix, and an aggregate composed of beach sand to which a considerable quantity of vesicular slag or forge waste has been added. Apparently a lime burnt from Chalk with added pozzolan.

3. Description of the samples: b) Masonry

3.1. Sample APG.P.7.
Pale cream pure limestone. Composed of grain-supported, well-winnowed lime sand composed of ooliths (with cortical micritisation), peloids and some shell fragments (echinoderm and mollusc). Average grain size fine sand. Well-developed calcite spar cement filling all the primary porosity. This looks like Portland except that the cement is too pervasive, and therefore I am certain that this is either Purbeck Portland

(i.e. Portland age stone from the Purbeck region), or possibly one of the variants of Purbeck itself.

Schedule asks for comment on decay. A large layer of Pulhamite has pulled away from the stone sample, but the stone itself shows little sign of decay. There is no sign in this sample that water and salt have penetrated its fabric or caused scaling or flaking, and well-cemented low porosity stones of this sort would be the most suitable stone type for exposed coastal use such as this. There is minor lichen growth on one side, but this doesn't seem to have penetrated the stone or to have promoted any decay either.

3.2. Sample APG.P.21.
Grey calcareous fossiliferous marl. Shows plentiful calcitised formerly-aragonitic bivalve molluscs in a fine matrix of recrystallised calcite microspar. A recrystallised calcite mud. The permeability is likely to be high, and rocks of this sort weather very badly from frost and salt weathering. (they are almost never used in masonry). This is a very typical Purbeck rock fabric, often forming the beds in between the layers of good quality Purbeck Stone. Flakes and scales of this type of lithology can therefore sometimes be found adhering to the surfaces of slabs of good stone which are entirely sound within (see APG.P.14 below, for example). The site evidence will throw light on this.

3.3. Sample APG.P.14.
Not, as per schedule, a sandstone, but a laminated shelly ferruginous limestone with interlaminations of material like that in APG.P.21 above. The limestone is predominantly composed of micritised mollusc shells up to several mm in length) with subordinate pellets in a grain-supported fabric. The shells are bivalve molluscs, formerly aragonite but now calcitised. Some show minor silicification. There is a well-developed calcite spar cement between the grains. Rocks of this sort are susceptible to delamination along the soft, more microporous interlayers which draw in water with dissolved salts. Salt crystallisation on drying causes the delamination. This type of mollusc-rich slabby limestone, in which aragonite has been replaced by a calcitisation process, is a typical Purbeck lithology.

4. Description of the samples: c) Weathering products

4.1. Sample APG.P.22.

This is crystalline calcite speleothem, deposited in layers from superficial water on top of the Pulhamite. This is the same material as makes up kettle scale and stalactites, formed in the same way. The water of the waterfall (or other seeping water) contains dissolved carbonate and bicarbonate, picked up from the Chalk bedrock and (probably to a lesser extent) from the mortar and underlying concrete. When the water comes out to the surface in drips or splashes, it loses CO_2 to the atmosphere and this promotes precipitation of calcite. It can be removed mechanically if necessary, or with acids though these will also damage the masonry and Pulhamite beneath. It is probably best left.

5. Figure Captions.

All taken in plane polarised light unless designated XP (crossed polars).

1. APG.P.22. Width of View = 3.8 mm. Calcite speleothem deposited from water-splash over Pulhamite. XP.
2. APG.P.7. Width of View = 3.8 mm. Oolitic, peloidal limestone with shells and well-developed calcite cement filling intergranular pore space. Probably Purbeck Portland.
3. APG.P.21. Width of View = 2.2 mm. Calcitised bivalves in groundmass of calcite microspar. Microporosity and permeability likely to be high, therefore durability poor. Purbeck, but may be adherent to bedding surface of more durable limestone.
4. APG.P.14. Width of View = 3.8 mm. Calcitised bivalves in calcite spar-cemented limestone with ferruginous colouration. Purbeck.
5. APG.P.6. Width of View = 3.8 mm. Pulhamite general view showing aggregate of quartz and shell sand in cementitious matrix.
6. APG.P.12. Width of View = 3.8 mm. Pulhamite general view showing aggregate of quartz and shell sand in cementitious matrix.
7. APG.P.1. Width of View = 2.2 mm. Pulhamite general view showing aggregate of quartz and shell sand in cementitious matrix. XP.
8. APG.P.1. Width of View = 1.0 mm. Coarse granules of cementitious material in Pulhamite matrix.

PULHAMITE MORTARS
Albion Place Gardens, Ramsgate
Artificial rock landscape, constructed 1894

Six samples sent by Simon Swann	1	"grey"
	2	"sandy"
	3	"sandy grey"
	12	"pink" or "mauve"
	14	"sandy", from damp area, now a brighter yellow.
	17	"pink", from damp area, now a deep red.

Examination - A number of small fragments were mounted in resin, then cut as cross sections to see the stratigraphy. Material from coloured lumps seen in the sections was dispersed on glass slides and examined with a polarising light microsope.
A scanning electron microscope was used to analyse material from close to the surface of 14, and from lower down in the section.. The results were compared. The SEM was also used to examine a lump of white from sample 1 and a lump of red from sample 12.

Pigments

The different colours of the pulhamite is due to the addition of red, yellow, black and white colouring matter. The colouring is not due to dirt and natural earths associated with the sand and grit added to the mortar. It is in the form of clean, purified pigment.

The reds and the yellows are iron oxides. These have the small, regular particles, and even colouring of synthetically produced material. The red was analysed and found to contain some barium sulphate, a common extender for paint and pigments since the early nineteenth century.

The black is crushed charcoal. This was probably not bought from a colour merchant as it is of indifferent quality. The larger fragments appear pure black, but where it has been reduced to single wood fibres it has a greenish caste, and the wood was obviously not fully carbonised.

The white is mostly calcium carbonate, presumably from the lime, but some of the larger lumps have a slightly fibrous appearance in section, and the SEM analysis records more sulphur than calcium - a ratio of approximately 2:1. [This is different from the general mixture which showed more calcium than sulphur]. In dispersion there are particles that resemble calcium sulphate, but they are not typical of native gypsum. The large amount of sulphur detected may be due to sulphation of the calcium carbonate. [The XRD analysis has identified gypsum silicate].

Colour mixing

The different colour of the mortars is due to the addition of pigments in different proportions.

The "sandy" samples contain yellow iron oxide, white and a small amount of black.

The "pink" samples contain red iron oxide, white, black and small amounts of yellow

The "grey" sample contains white, large amounts of black and a small amount of red.

The "sandy grey" shows a series of layers: one just grey, one grey with red pigment and one grey with yellow pigment. This is probably due to uneven mixing and suggests that colours were mixed up on site.

Effect of damp

The sandy sample 13 from a damp area was compared with sample 2 from a dry area, and the pink sample 17, also from a damp area, was compared with sample 12.

The samples from damp areas have less white in them than the samples from dry areas, furthermore, there appears to be more white in the mixture in the lower part of the section, and less near the surface of the mortar. Possibly the lumps of sulphated calcium carbonate have become partially dissolved and the material has been deposited on the surface in the form of salts. If the white in the mixture has been slightly reduced, this will have contributed to a darkening of the colour.

This distinction between the upper part of the sample and the lower part is backed up by the SEM results which show far more calcium in the lower part of the section.

The red iron oxide, the yellow iron oxide and the charcoal black are the same in the damp samples as in the dry samples, and are clearly unaffected by the conditions.

If the surface of the mortars in these areas is wet this will increase the strength of colour. Water will fill any voids left by salt erosion thus reducing the amount of light refraction, and allowing greater transmission of red or yellow, but the darkening in these samples is present even when they are dried out.

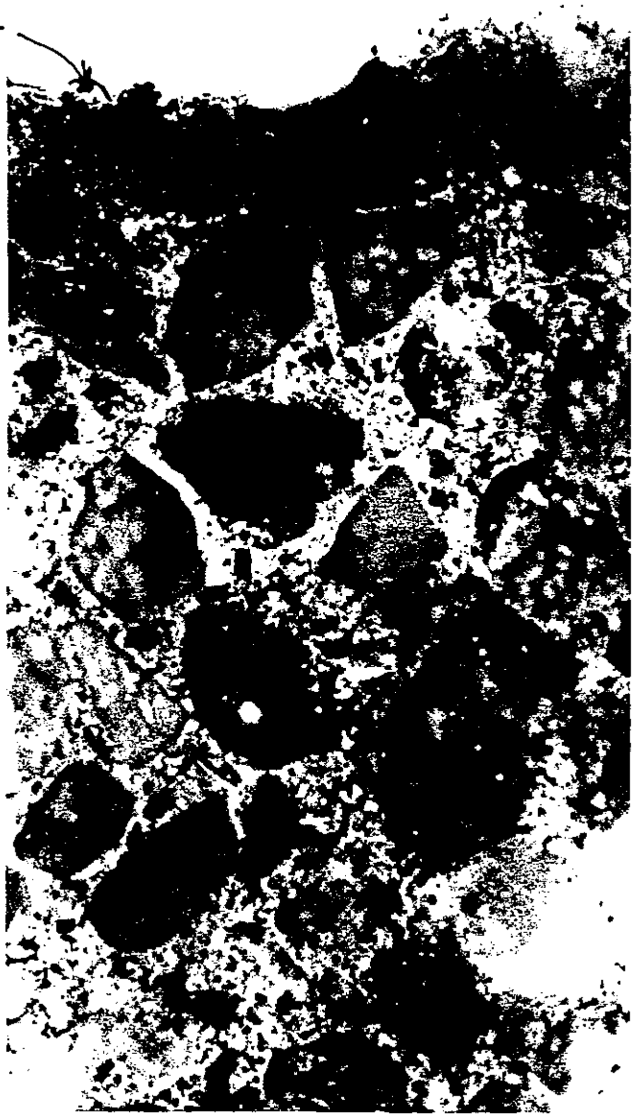
Surface dirt and algae

All the samples show a heavy build-up of dirt and small patches of green algae. Some of the dirt is in the form of black carbon particles, and general dust and grime, but there are also the characteristic globules left by woodsmoke.

SAMPLE 1
Grey

The yellow lumps in this fragment are some sort of crushed stone or grit and are not the yellow pigment seen in sample 2. There are a few particles of red iron oxide, but the principal additive is charcoal black.

[x100]



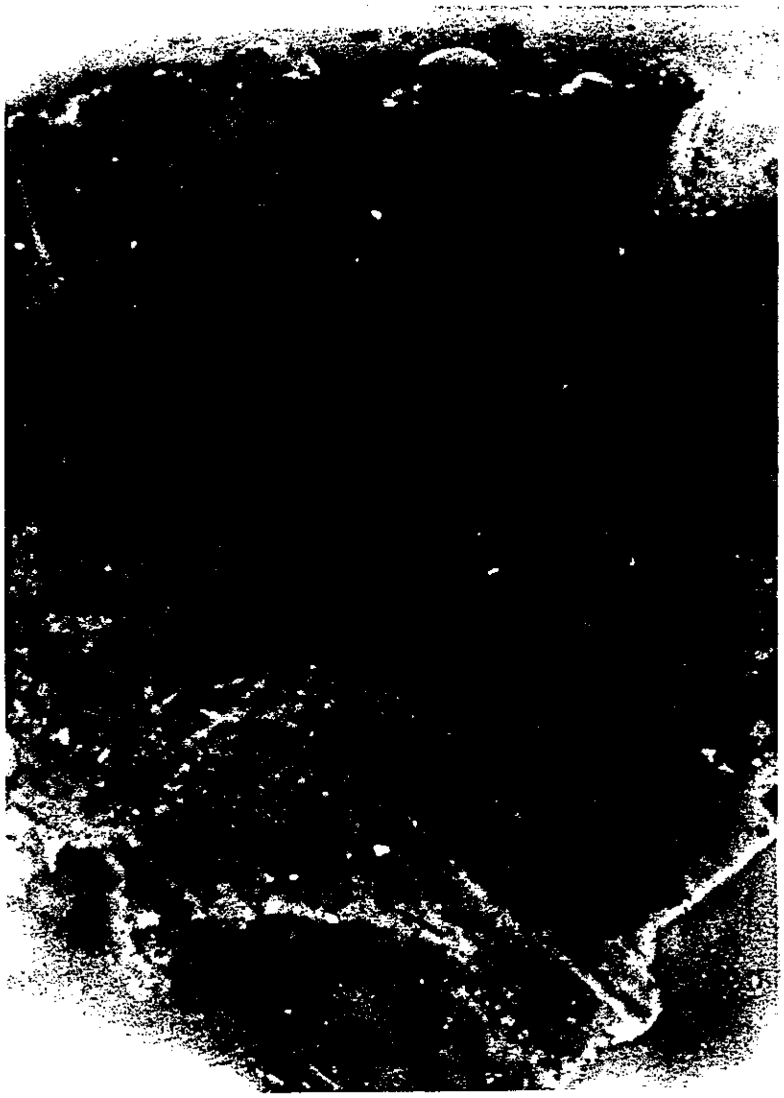
Detail showing a lump of charcoal which is pure black. The more finely crushed particles are a greenish brown, and the wood was not properly carbonised. There is also a very small lump of red iron oxide.

[x500]

SAMPLE 2
Sandy coloured mortar

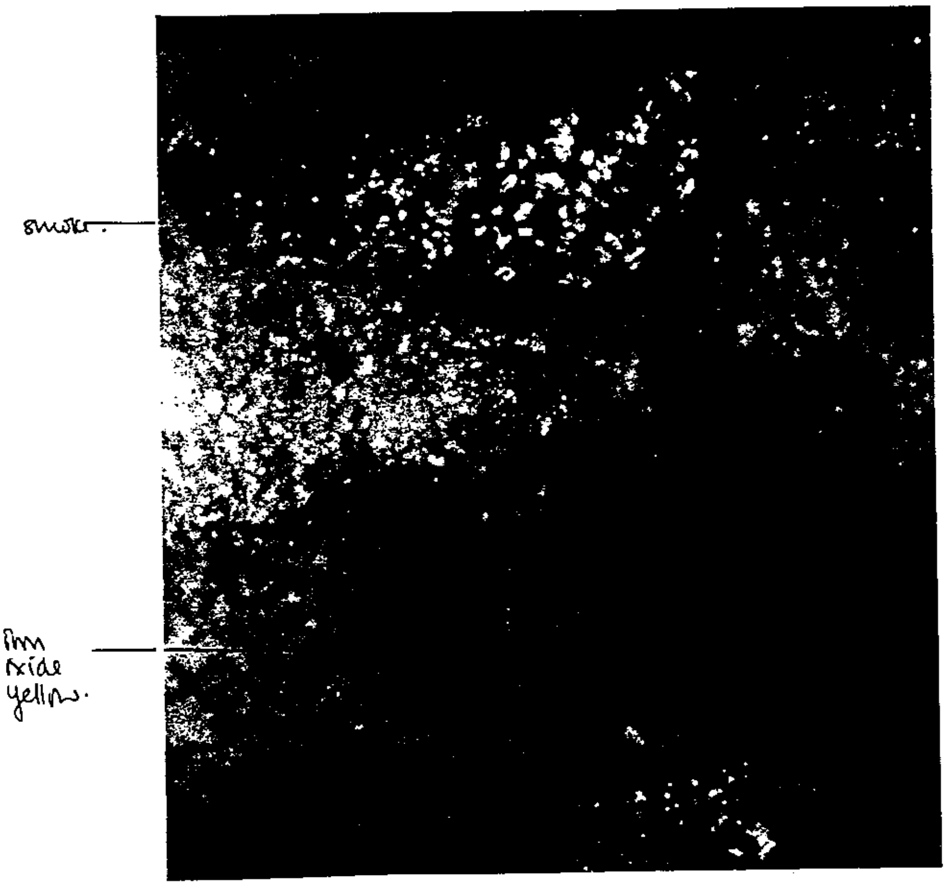
There is a small amount of black, but the principal pigment is iron oxide yellow, a large lump of which can be seen near the surface.

[x100]



Detail of the surface, showing algae and wood smoke deposits.

[x500]



SAMPLE 3
Sandy grey

Unlike the grey of sample 1, this contains distinct amounts of both red and yellow iron oxide. The fragment illustrates the uneven mixing which took place: there are fine particles of red in the upper surface, and fine particles of yellow lower down. In the middle there are large lumps of pure red in an otherwise grey area.

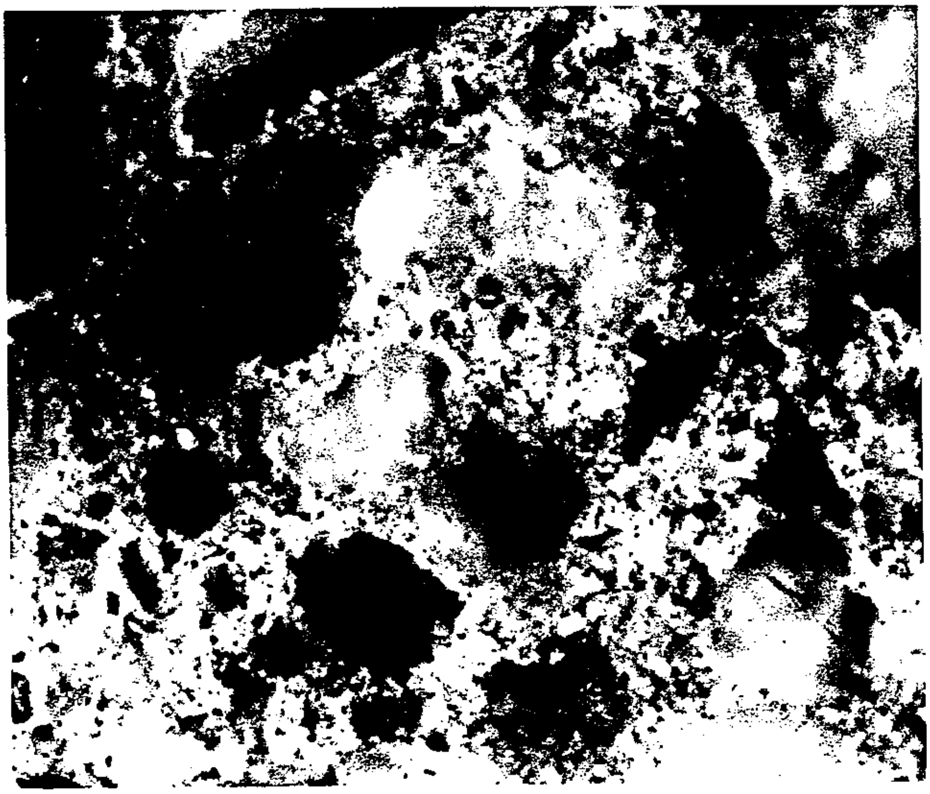
[x100]

SAMPLE 12

Pink sample.

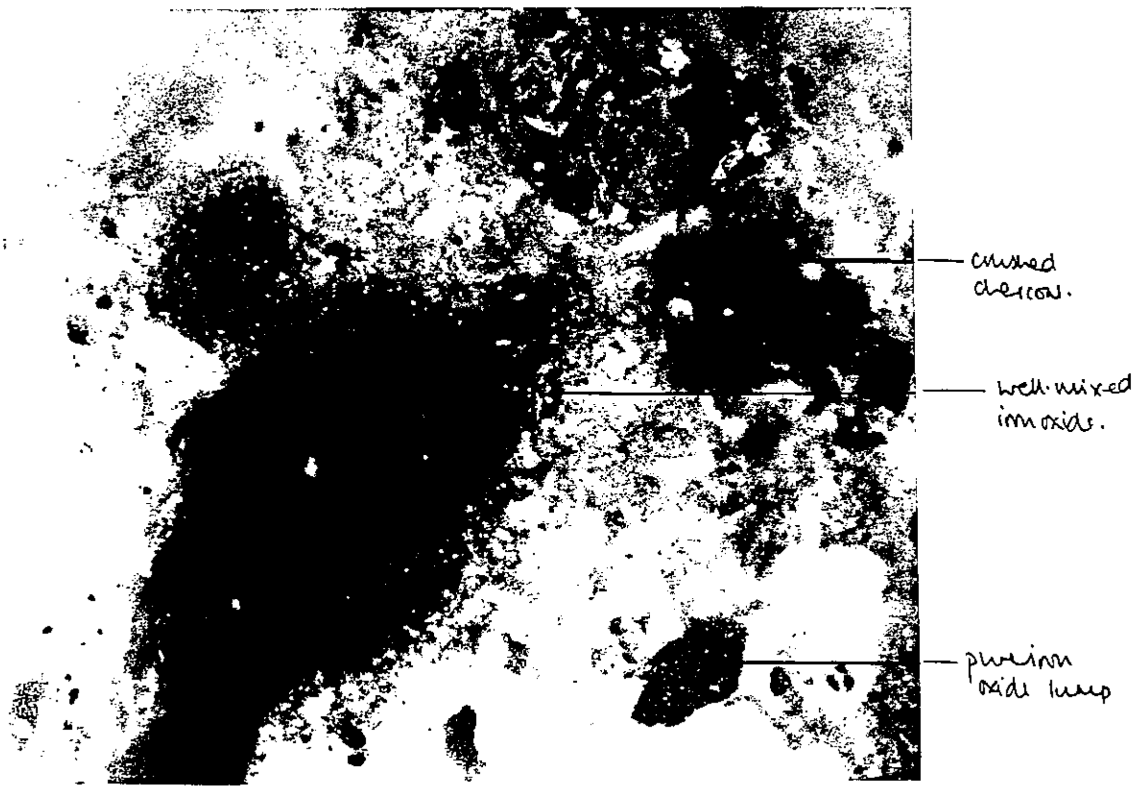
The pigments are red ochre and charcoal black. One can see how the mortar has been unevenly mixed. At the left side of the section there is more red than white, at the right hand end the white predominates.

[x100]



Detail showing a lump of pure red iron oxide. In dispersion one can see that the red is synthetically produced, and SEM analysis shows that it is mixed with a small amount of barium sulphate, a common additive to paint.

[x500]



SAMPLE 14

Sandy colour, from damp area, with brighter appearance than sandy colour in dry area.

It may be a coincidence, but there appears to be less white generally than in sample 2, and white seems to be almost absent close to the surface of the section.

[x100]

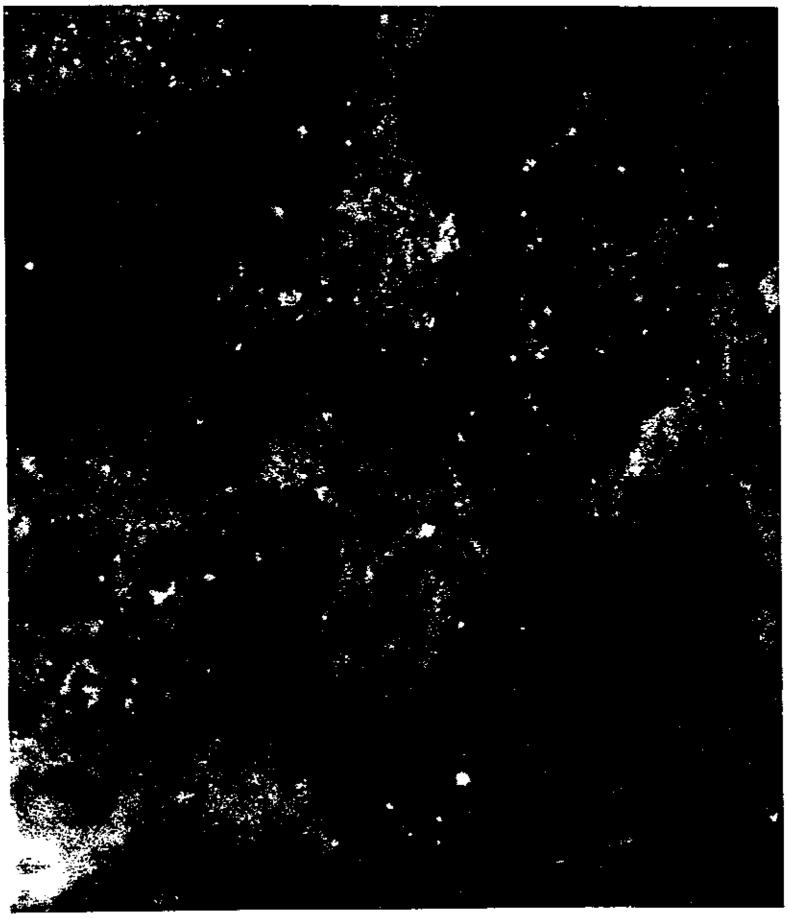
detail of sample 14

Top surface

[x500]

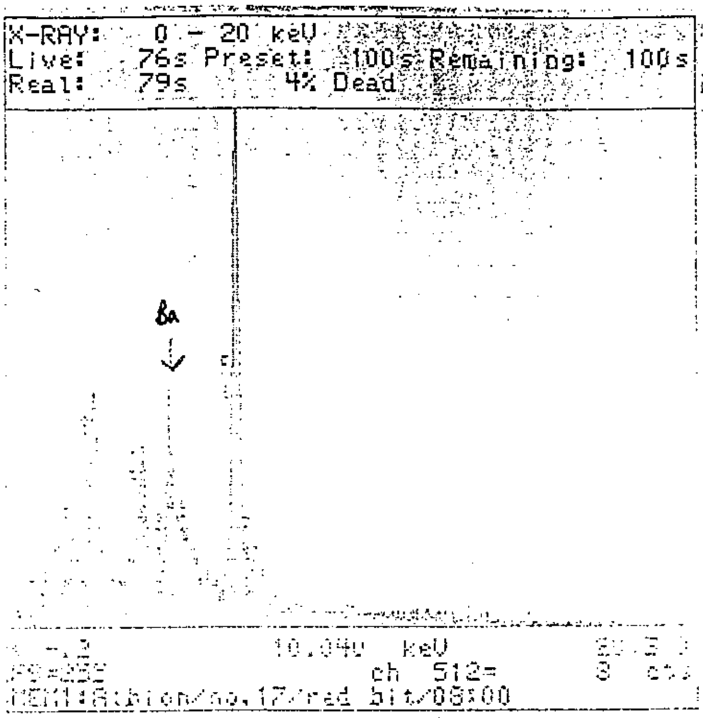
lower down in the section.

[x500]



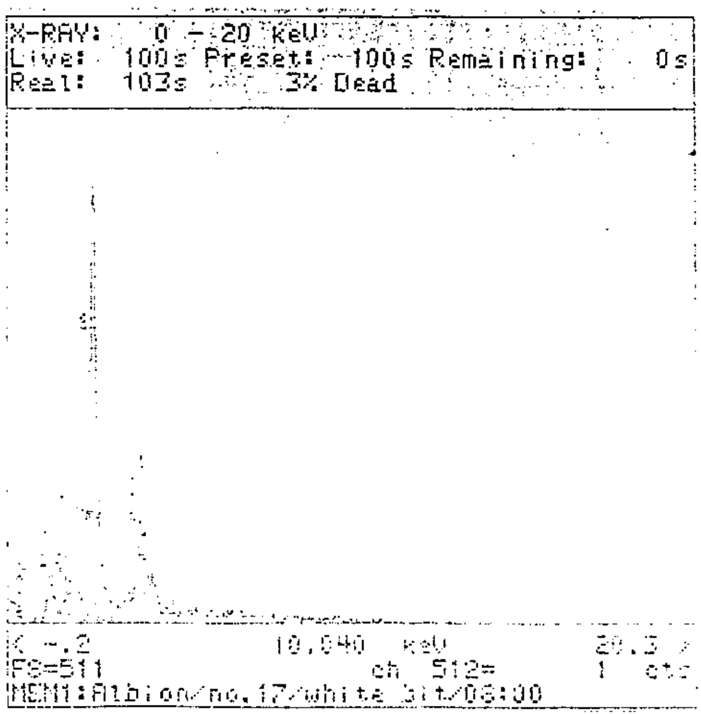
SEM ANALYSIS of a red lump

The major element is iron
There is also calcium and sulphur from sulphated lime, and barium from barium sulphate



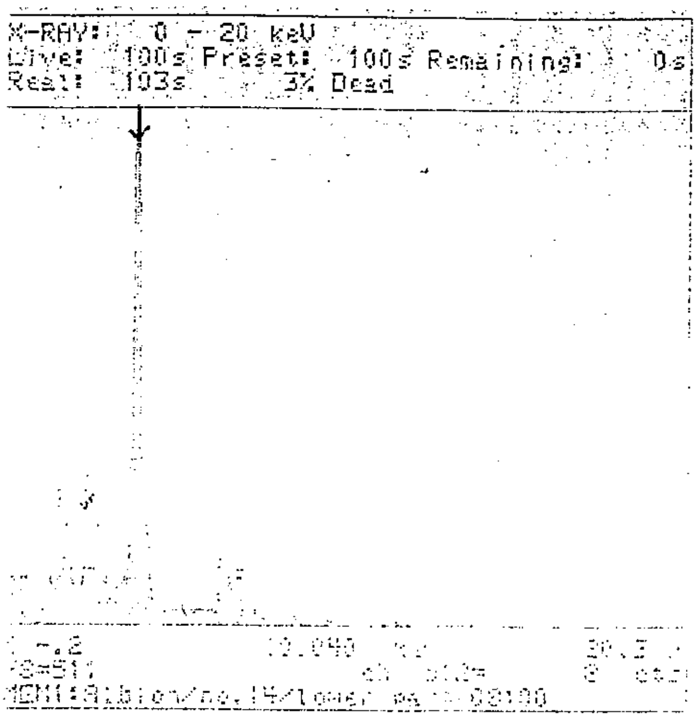
SEM ANALYSIS of a white lump.

There is some calcium, but the major element is sulphur. This is the reverse of what is found in the general mixture [see next page]



SEM ANALYSIS of the **lower part** of section 14.

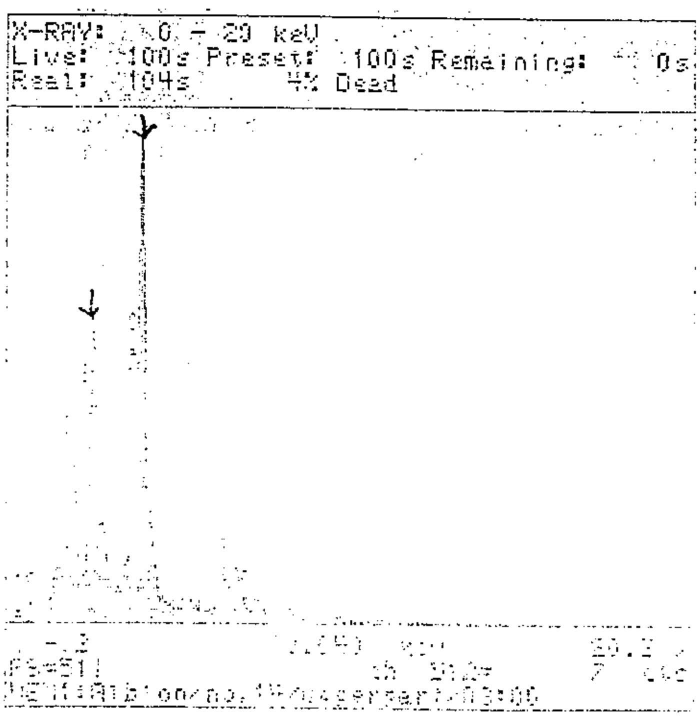
Calcium is the major presence. Its ratio to sulphur is about 6:1



SEM ANALYSIS of the **upper part** of section 14

Comparing this spectrum with the one from deeper in the sample, we can see that although calcium is still the major element, its ratio to sulphur is about 3:2

It suggests that calcium in some form has been leached out of the surface layers of the mortar.



APPENDIX F

LIST ENTRIES

F1 LISTED BUILDING (MADEIRA WALK)— 22nd May 2019

F2 REGISTER OF PARKS & GARDENS (ALBION PLACE) — 20th July 1998

Rock Gardens and Cascade, Madeira Walk

Overview

Heritage Category:
Listed Building

Grade:
II

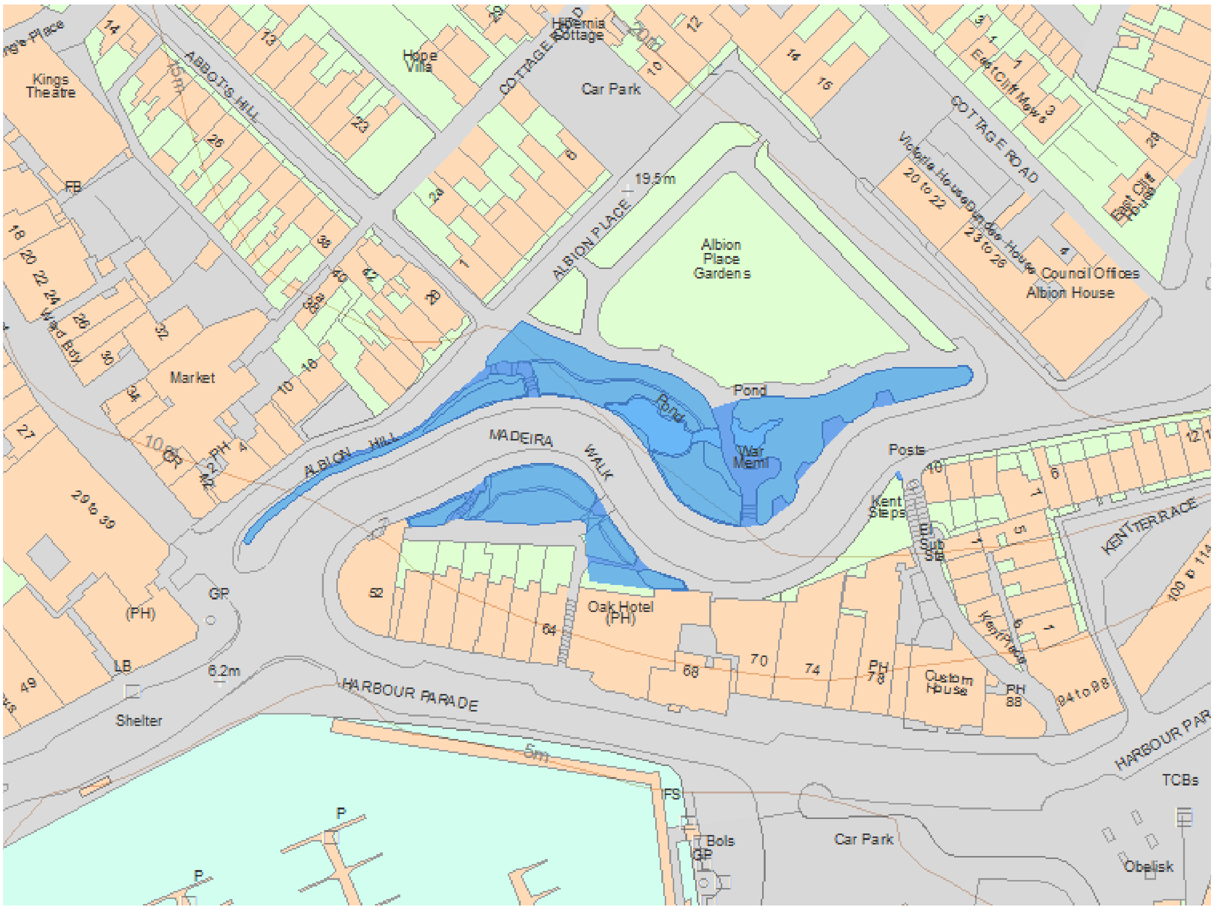
List Entry Number:
1336691

Date first listed:
04-Feb-1988

Date of most recent amendment:
22-May-2019

Statutory Address:
Madeira Walk, Ramsgate

Map



The above map is for quick reference purposes only and may not be to scale. For a copy of the full scale map, please see the attached PDF - **1336691.pdf** *(http://mapservices.HistoricEngland.org.uk/printwebservicehle/StatutoryPrint.svc/531833/HLE_A4L_Grade|HLE*

The PDF will be generated from our live systems and may take a few minutes to download depending on how busy our servers are. We apologise for this delay.

This copy shows the entry on 22-Jun-2020 at 18:24:06.

Location

Statutory Address:
Madeira Walk, Ramsgate

The building or site itself may lie within the boundary of more than one authority.
County:
Kent

District:
Thanet (District Authority)

Parish:
Ramsgate

National Grid Reference:
TR3846364843

Summary

Rock gardens and cascade designed in 1892-1893 by the Borough Engineer, W A McIntosh Valon with James Pulham and Son.

Reasons for Designation

The Rock Gardens and Cascade, Madeira Walk, Ramsgate is listed for the following principal reasons:

Architectural interest: * they are comparable in interest to other designated examples of Pulhamite structures and representative of the Pulhams' innovative design and construction of garden and park structures.

Historic interest: * this forms part of an important grouping of Pulhamite structures which are spaced along the seafront at Ramsgate and which were built in the period between 1893 and 1936. Group value:

* with several houses grouped around Albion Gardens, including the Memorial to the Great War, and with the former National Westminster Bank, Harbour Parade (all listed at Grade II).

History

From the mid-C18 Ramsgate became increasingly popular as a seaside resort, its expansion being accelerated by road improvements and faster sea passage offered by hoys, packets and steamers. An assembly room, warm water baths, subscription libraries and places of worship were joined by new streets such as Effingham Street and speculative crescents and squares on the East and West Cliffs such as Albion Place of around 1791-1798 and Nelson Crescent of around 1800-1805. During the Napoleonic Wars Ramsgate became a busy garrison town and a major port of embarkation. Ramsgate's importance in the 1820s is attested by its patronage by the British and European royal families and the creation of a separate parish by Act of Parliament, served by the large Church of St George (1824-1827). The harbour is the only one in the British Isles which has the designation 'Royal', granted by George IV.

The arrival of the South Eastern Railway's branch line in 1846 opened up Ramsgate to mass tourism and popular culture, bringing a range of inexpensive, lively resort facilities intended for the sorts of middle- and working-class holidaymakers depicted in WP Frith's painting 'Ramsgate Sands' of 1854 (Royal Collection). Wealthier visitors were accommodated at a respectable distance from the town in developments such as EW Pugin's Granville Hotel of 1867-9. Competition with other Kentish resorts stimulated a series of large-scale improvements in the late-C19 and early-C20 including the construction of Royal Parade and landscaped stairs and pathways at the eastern and western ends of the seafront to join the upper promenades to the Undercliff walks. New schools, hospitals and services were also built. The thriving town attracted diverse faith communities; Moses Montefiore founded a synagogue and a religious college at East Cliff Lodge, while AWN Pugin St Augustine's Church and the Grange as part of an intended Catholic community on the West Cliff.

In 1940 the harbour was the point of return for many of the small boats involved in the evacuation from Dunkirk and war-time precautions included the digging of extensive air raid shelter tunnels in the chalk beneath the town. Ramsgate remained a popular holiday destination until the advent of cheap foreign travel in the post-war decades. Falling visitor numbers were exacerbated by the decline of the town's small trades and industries, fishing and boat-building. However, a ferry and hovercraft port and the large marina created in the inner harbour in the 1970s have continued to bring life to the area.

Rock gardens first seem to have appeared in England from the C17 as a suitable setting for exotic plants. The influential landscape designers Humphry Repton (1752-1818) and John Claudius Loudon (1783-1843) both promoted the idea of naturalistic rock formations in a landscape and this coincided with the importation of new species of plants into England from mountainous areas.

From the 1840s a number of companies began experimenting with cements to cover a base of hard core in imitation of large-scale rock formations. James Pulham and Son of Broxbourne in Hertfordshire were amongst several such makers, and also specialised in terracotta ornaments. The longevity of their company which lasted from around 1845 to 1945 under the leadership of three generations of Pulham, all named James, marked them out, as did the quality of their products. Their work and patrons included relatively modest suburban villas as well as bankers, ship and railway owners and the royal family. Work at Sandringham, Windsor and Buckingham Palace earned the company a royal warrant in 1895. 'Durability Guaranteed' was one of the company's claims, and this has largely proved to be true. Whether real stone or artificial, an aim of designers was to replicate the appearance of genuine rock formations with geological strata. Pulhams was noted for this and from the 1880s they experimented with different colours and textures of cement. The structure of their designs was a core of over-burnt bricks, waste stone and slag, or other industrial waste that was locally available. Overhangs were of real slate or sandstone and the whole structure was finished with two coats of render, between 6mm and 15mm thick. Their manufacturing methods also enabled the firm to produce stone-like terracotta.

The various constructions of rockwork at Ramsgate, realised by Ramsgate Corporation from the 1890s, with the last work on the Winterstoke Chine in 1936, form one of the largest groupings of their designs and provides a good cross-section of their work and the compositional possibilities offered by different locations and gradients.

The land occupied by Albion Place Gardens, known as Crow Hill and later as Mount Albion, was open, unenclosed cliff top until the late C18. In 1789, the development of the East Cliff began, with Albion House, on the east corner of the gardens, being built that year by a Mr Simmons, an alderman of Canterbury. Further houses were gradually added to form the present L-shaped terraces, six properties being available by 1792. The desirability of Albion Place was confirmed by the frequent visits of Princess Victoria, who stayed at Albion House in 1830, and of Jane Austen, who mentions the address in her novel Mansfield Park. Albion Place remained unenclosed until the early C19 when a plan of 1822 (Collard and Hurst) shows the gardens, which were referred to as being open to the public in 1840 (Mirams 1984). A cliff-top walk along the south side of the gardens provided the link between Ramsgate's East and West Cliffs until 1891 when, following the passing of the Improvement Act of 1878, the Corporation began construction (under the direction of the Borough Engineer, Valon) of the present main road, Madeira Walk. The Walk, with its massive retaining walls of Pulhamite rockwork was begun in 1893. The project required the demolition of part of the former Royal Albion Hotel. It also included the Royal Parade ascent to the west cliff, the arched retaining wall and the warehouses along the north side of the harbour. The cost of the whole project was close to £60,000 and the waterfall was nicknamed 'ratepayers' tears' as a consequence (see SOURCES, Thanet Advertiser). Completed and opened in April 1895, Madeira Walk was designed to take both pedestrian and vehicle traffic and, supplemented in 1901 by a tram route. The gardens were replanted in 1984 to celebrate the centenary of the granting of the Charter of Incorporation of Ramsgate by Queen Victoria in 1884; they remain in the care of the local council.

Details

Rock gardens and cascade designed in 1892-1893 by the Borough Engineer, W A McIntosh Valon with James Pulham and Son.

MATERIALS and PLAN: Pulhamite of varied colours in imitation of geological strata, overlaying a base of mixed masonry hardcore, with terracotta embellishments. The Pulhamite forms the sides of an artificial gorge, through which the roadway of Madeira Walk follows a sinuous route as it climbs uphill for a distance of approximately 180metres. The Pulhamite rockwork is arranged at either side of the road and varies in height from approximately 1 to 4m.

EXTERIOR: the northern range begins at the junction of Madeira Walk, Harbour Parade and Albion Place with a cylindrical terracotta capped pier bearing coats of arms (the Cinque Ports, Ramsgate etc.). From here a mid-C20, concrete balustrade (replacing the terracotta original) follows up along the south side of Albion Place for approximately 70m, with Pulhamite rock formations stepping down beneath it to connect with the Madeira Walk roadside. Where Albion Gardens begins at the end of this run there is a second capped pier and a dog-legged stair gives access back down to Madeira Walk. The final section of balustrade after the stair is missing, due to damage. Grottos containing benches sit either side at the base of the stair on Madeira Walk. To the near centre of the northern range is a cascade which flows from Albion Gardens under a short bridge, also of Pulhamite, down to a pond by Madeira Walk. Behind the cascade, and towards the end of Madeira Walk, further small outcrops of Pulhamite shelter seating areas. The War Memorial, which stands to the south-east of the cascade, was erected in 1920 and designed by Gilbert Bayes and is separately listed (LE 1085348).

The southern range also has large boulder formations of differently-coloured strata, including some genuine sandstone boulders, as well as short tunnel and archway openings, along with a stair, providing pedestrian and vehicular access to the rear courtyards of the Harbour Parade properties which lie behind. The inner faces of the tunnel, archway and the courtyard side of the range are similarly constructed in Pulhamite. The western end of the southern side abuts the Portland stone side wall of Number 52, Harbour Parade at ground floor level. A small outlier of rock sits at the top of Kent Steps. The Pulhamite structures were designed to incorporate planting troughs and both ranges contain various bedding plants and shrubs.

This list entry was subject to a Minor Amendment on 04/05/2020

Legacy

The contents of this record have been generated from a legacy data system.

Legacy System number:
171885

Legacy System:
LBS

Sources

Books and journals
Newman, J, The Buildings of England. Kent: North-East and East, (2013), 505
'Madeira Walk' in Thanet Advertiser, (20 July 1895), 8

Legal

This building is listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest.

End of official listing

ALBION PLACE GARDENS

Overview

Heritage Category:
Park and Garden

Grade:
II

List Entry Number:
1001386

Date first listed:
20-Jul-1998

Map

The above map is for quick reference purposes only and may not be to scale. For a copy of the full scale map, please see the attached PDF - **1001386.pdf** *(http://mapservices.HistoricEngland.org.uk/printwebservicehle/StatutoryPrint.svc/1422/HLE_A4L_Grade|HLE_A*

The PDF will be generated from our live systems and may take a few minutes to download depending on how busy our servers are. We apologise for this delay.

This copy shows the entry on 22-Jun-2020 at 18:27:23.

Location

The building or site itself may lie within the boundary of more than one authority.

County:

Kent

District:

Thanet (District Authority)

Parish:

Ramsgate

National Grid Reference:

TR 38463 64860

Details

This list entry was subject to a Minor Enhancement on 5 July 2017.

An early C19 public garden, embellished in the late C19 along its southern boundary with extensive Pulhamite rockwork.

HISTORIC DEVELOPMENT

The land occupied by Albion Place Gardens, known as Crow Hill and later as Mount Albion, was open, unenclosed cliff top until the late C18. In 1789, the development of the East Cliff began, with Albion House, on the east corner of the gardens, being built that year by a Mr Simmons, an alderman of Canterbury. Further houses were gradually added to form the present L-shaped terraces, six properties being available by 1792. The desirability of Albion Place as a residence was confirmed by the frequent visits of Princess Victoria, who stayed at Albion House in 1830, and of Jane Austen, who mentions Albion Place in her novel Mansfield Park. Albion Place remained unenclosed until the early C19 when a plan of 1822 (Collard and Hurst) shows the gardens, which were referred to as being open to the public in 1840 (Mirams 1984). A cliff-top walk along the south side of the gardens provided the link between Ramsgate's East and West Cliffs until 1891 when, following the passing of the Improvement Act of 1878, the Corporation began construction (under the direction of the Borough Engineer, Mr Valon) of the present main road, Madeira Walk. The Walk, with its massive retaining walls of Pulhamite rockwork (begun in 1893), was designed to take both pedestrian and vehicle traffic and, in 1901, a tram route. Several properties on both terraces of Albion Place were destroyed during the Second World War; the gaps are now (1997) laid out as car parks. The gardens were replanted in 1984 to celebrate the centenary of the granting of the Charter of Incorporation of Ramsgate by Queen Victoria in 1884; they remain (1997) in the care of the local council.

DESCRIPTION

LOCATION, AREA, BOUNDARIES, LANDFORM, SETTING Albion Place Gardens lie in the centre of Ramsgate, on the cliffs north-west above Kent Terrace and the harbour-front buildings below on Harbour Parade, and immediately to the north of the main east/west road leading inland from the harbour to the High Street. The 0.36ha registered site, which is roughly triangular in shape and slopes very gently from east to west, is bounded to the north-west and north-east by internal belts of tall, dense, largely evergreen shrubbery and trees which are fenced from the roads serving the enclosing terraces of Albion Place (nos 1-6, 10-15, and Albion House listed grade II) by lengths of aluminium railings, these replacing earlier iron railings shown surrounding the entire gardens in an engraving of 1854 (reproduced in LUC 1997). The south side of the gardens is bounded by the rockwork gorge (listed grade II) containing Madeira Walk.

ENTRANCES AND APPROACHES The main approach to the gardens is from Madeira Walk which snakes its way gently uphill in a series of curves in an easterly direction from the its junction with Harbour Parade and Albion Hill (nos 24-26 listed grade II). On its north side the Pulhamite rock, which rises to 3-4m at its highest point, is laid in massive blocks of several different colours, including a light, textured band containing crushed shells, to resemble natural patterns of geological strata. Some 80m eastwards from the junction, a double flight of steps leads northwards from the footway, up through the rock face to a war memorial (a life-size female nude by Gilbert Bayes, erected 1920, listed grade II) and onto a path which enters the gardens across a rustic bridge over a cascade linking an east to west chain of pools, the lowest pool being level with the road below. The pools and cascade are now (1997) dry due to the destruction of the pump room by fire in 1995 (LUC 1997). The fissures and pockets in the irregular rock face are planted with a range of evergreen and deciduous shrubs and small trees, including bay which may survive from the original layout, which reflects the recommendations by James Pulham (1820-98), although there is no evidence that the Pulham company carried out the planting; most of the smaller pockets designed for Pulham's proposed alpines are now empty. A number of small patches of bedding are planted at the foot of the rocks alongside the footway, onto which also open several arched niches containing seats. There are further entrances to the gardens from Albion Place at the west and east ends of the gardens, that at the west end overhung on the south side by a mature holm oak which may survive from the planting carried out in association with the rockwork.

The south side of Madeira Walk is similarly faced with Pulhamite and planted with over-hanging trees and shrubs, access to the mews court and housing behind it to the south being gained through arched openings of various sizes in the rock face.

GARDENS AND PLEASURE GROUNDS The triangular-shaped garden, from which there are intermittent sea views through the boundary belts of shrubbery, is laid out to open lawns surrounded by a low post and rail fence and a perimeter path edged, along the shrubbery side, with rustic rock edging. The lawns are planted with a geometric pattern of small circular and triangular beds of annuals with a larger, circular bed of low shrubs as a central focus. The engraving of c 1854 and a photograph prior to 1887 (in LUC 1997) show the gardens with a similarly open central lawn, surrounding path, and perimeter shrubbery.

REFERENCES Ramsgate Town Trail, guide leaflet, (Ramsgate Society nd) M D Mirams, Old Ramsgate (1984) Albion Place Gardens and Wellington Crescent, Historic Landscape Survey and Restoration Management Plan, Draft Report, (Land Use Consultants 1997)

Maps R Collard and G Hurst, Map of Ramsgate, 1822 (Ramsgate Library)

OS 25" to 1 mile: 1st edition published 1872 2nd edition published 1898 3rd edition published 1907 1939 edition

Description written: December 1997 Register Inspector: VCH Edited: November 2003

This listing was enhanced in 2017 to mark the bicentenary of Jane Austen's death.

Legacy

The contents of this record have been generated from a legacy data system.

Legacy System number:

4044

Legacy System:

Parks and Gardens

Legal

This garden or other land is registered under the Historic Buildings and Ancient Monuments Act 1953 within the Register of Historic Parks and Gardens by Historic England for its special historic interest.

End of official listing