CENTER FOR
HERITAGE CONSERVATION

TEXAS A&M UNIVERSITY
College of Architecture

Documentation and Conditions Assessment of Banks' Battery, St. Helena (CHC-2020-01-03)

Report prepared for the British Napoleonic Bicentenary Trust and St. Helena Government

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Introduction

Architectural documentation and preliminary conditions assessment were undertaken by Principal Investigator Brent R. Fortenberry, Associate Director of the Center for Heritage Conservation at Texas A&M University. Post-documentation conditions assessments were completed by Ashburn. Fortenberry spent one of the seven days of the field research period at Banks' Battery. Lower Banks' Battery including the ramparts and lime kiln were investigated as well as Upper Banks' including the firing platform and officer's quarters.

Banks' Battery is one of the oldest surviving components of the island's fortification landscape, and should be conserved as a ruined complex; it has great potential to be programmed as a part of a heritage trail system.

Objectives

1. Undertake comprehensive digital documentation of Banks' Battery as a part of ongoing heritage conservation management.

2. Complete a preliminary conservation conditions assessment of Banks' Battery in preparation for conservation costing from an architectural conservator and historic building structural engineer.

Assessment Methodology

Banks' Battery was visited one days during the research trip. A combination of documentation and assessment methodology was undertaken.

Photogrammetry

In addition to the laser scan data, the exterior of the fort was captured using 250 aerial photographs from a DJI Mavic Air Drone. These photographs were processed in Capturing Reality software to create 3D textured mesh models that were then combined with laser scan files to create the completed model.

Photography

Fortenberry also captured ground photos using a Sony a7 camera for detailed conditions photography.

Conditions assessments and recommendations were made by in-person visual inspect as well as a digital inspection of the 3D models.

Full Dataset Access

A full copy of the dataset can be view and downloaded using this Google Drive Link. Note that for the 3D and photogrammetric models, one needs a program specialized software. Static images and site report components, however, are easily viewed.

https://drive.google.com/drive/folders/106Ub6ZM-DujMzNI1q-Ooicajnk_gPf13?usp=sharing

Banks' Battery History

Two areas comprise Banks' Battery Sector–the Lower Banks' Platform which consists of a crenelated rampart wall with an arched tunnel leading from the sea into the complex. Accompanying the fortifications, are several support buildings including a barracks, a smaller building of unknown use, a magazine built into the cliff walls and a lime kiln further inland. The installation was constructed as early as 1678, and the Sellers Map of 1682 shows fortification. Lower Banks' is situated in a valley and when sailing from the north presents as the first area to land, as such it needed to be fortified. Still too, any progress to Jamestown from the north along the west side of the island would have to pass Banks'. Throughout this early period the curtain wall had a complement between 4 and 8 guns respectively. During the Napoleonic period inventories indicate there were seven guns on the curtain wall. Upper Banks' Battery was constructed six years after Lower Banks' between 1688 and 1702. Upper Banks' comprises a Half Moon Battery with support buildings scattered throughout the cliff projection, including an officers barracks at the peak of the hill. In 1777, it was remarked that there were six guns on the half-moon platform with an increase to eight during the Napoleonic period. The 1850 map and inventory indicates that Banks' fell into dis-use by the middle of the 19th-century. Its isolation has greatly contributed to its current state (Denholm 2006: 26).

Reference:
Denholm, Ken. 2006. "South Atlantic Fortress". Jamestown: St. Helena National Trust

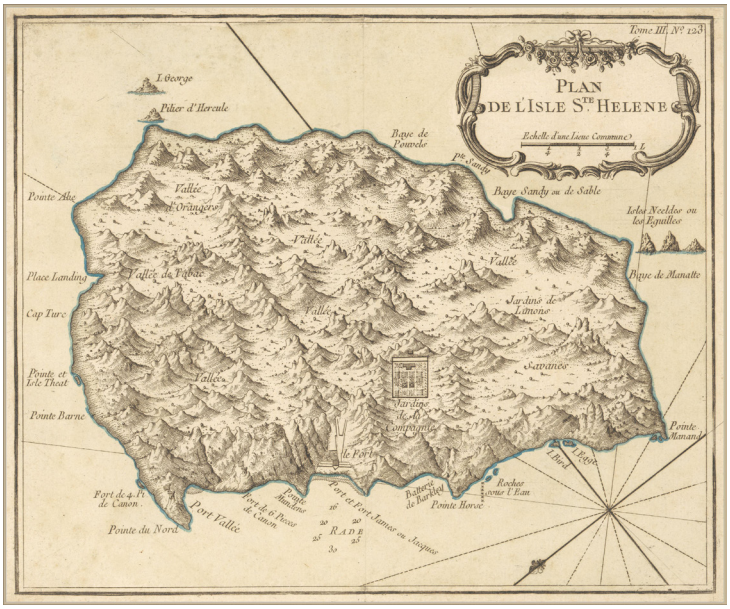

Figure 1 (Right): Late 18th-century Fortification map of St. Helena.

Figure 2 (Below): View of Jamestown with Banks' Battery to the far left of the image (Painting: National Gallery).

Location

Banks' Battery sits on the west coast of the island roughly two miles north Rupert's.

Figure 3: Google Earth imagery of Banks' Battery highlighted (Image: Google Earth).

Figure 4: Google Earth imagery of Banks' Battery (Image: Google Earth).

Figure 5: Detailed Google Earth Imagery of Banks' Battery (Image: Google Earth).

Digital Documentation

The following images represent the combined aerial- and ground-based photogrammetric data. Combined, the 3D model comprised over 250 million triangular mesh components, textured using the embedded photographic data, with an accuracy of 4 mm.

Raw digital data and completed digital models in various formats are available through the Google Drive link above. This combined model can also be programmed as a part of physical and digital exhibitions of the fort and other heritage sites. Digital models themselves can additionally be annotated with heritage building information and history.

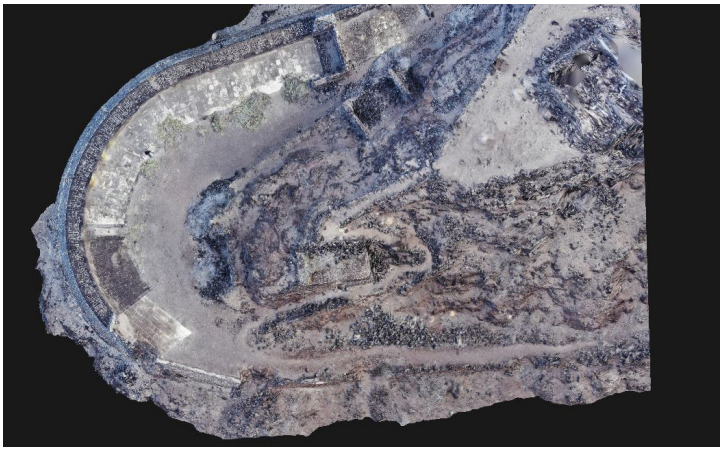

Figure 6:
Nadir image of Upper Banks' Battery (Model: B. Fortenberry)

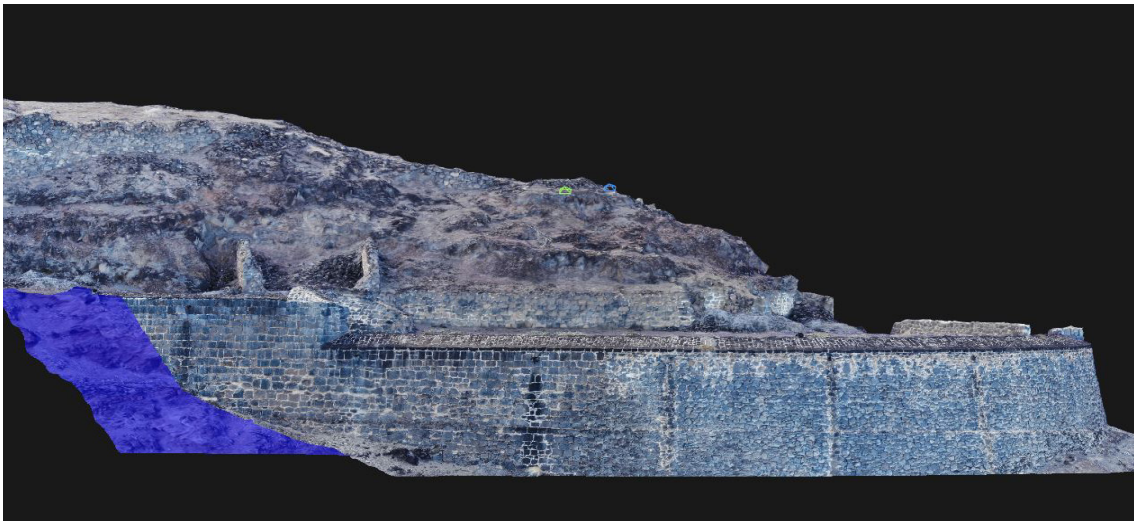

Figure 7:
Photogrammetric model, looking south toward Upper Bank's Battery Model: B. Fortenberry).

Digital Documentation

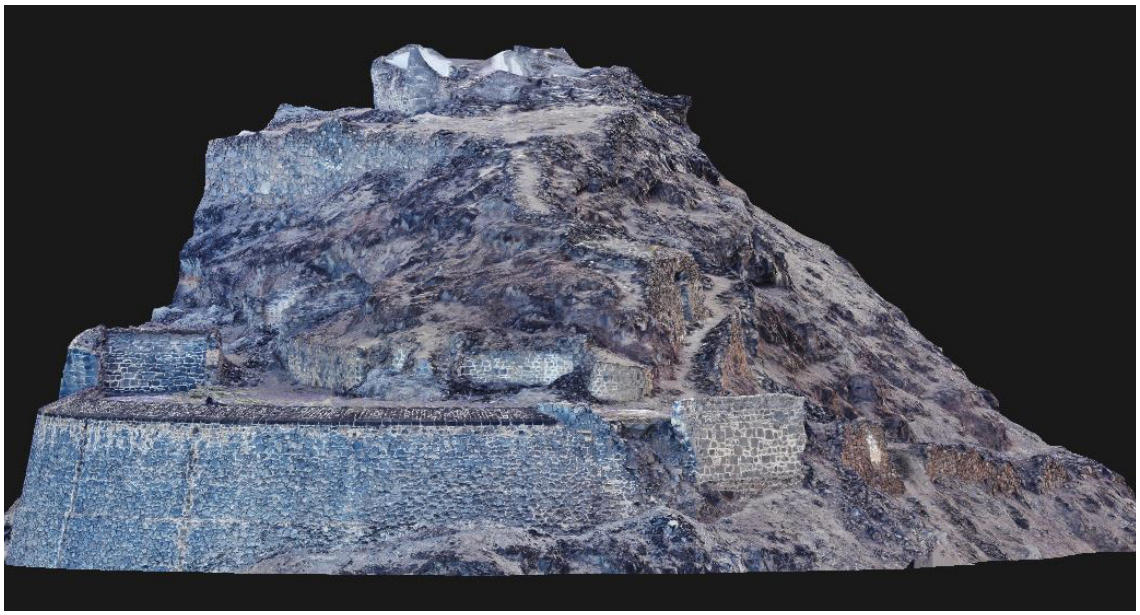

Figure 8:
Photogrammetric model, elevation view of Upper Banks' looking east (Model: B. Fortenberry).

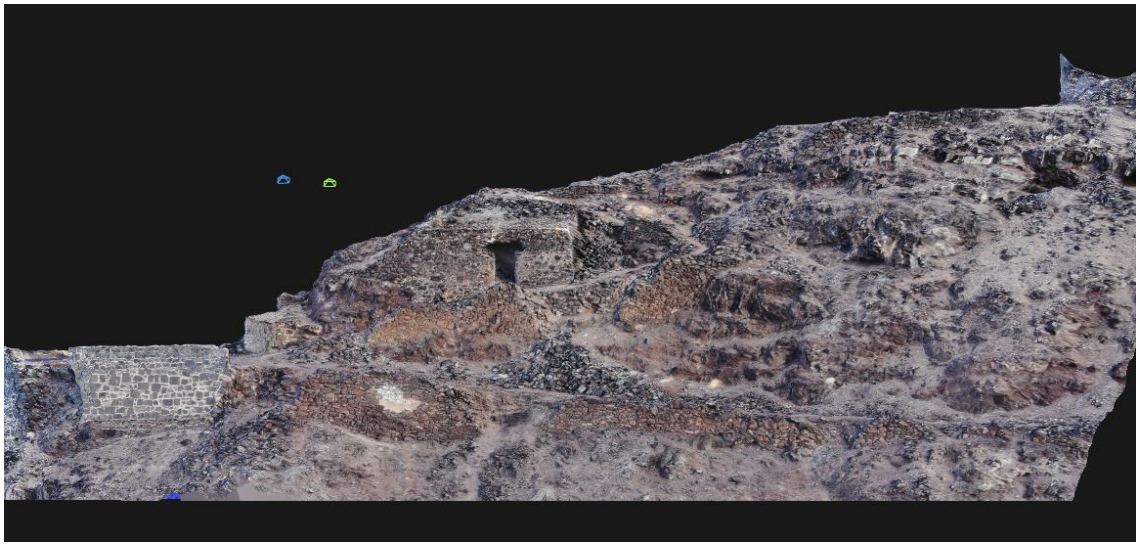

Figure 9:
Photogrammetric model, elevation view of Upper Banks' looking north (Model: B. Fortenberry).

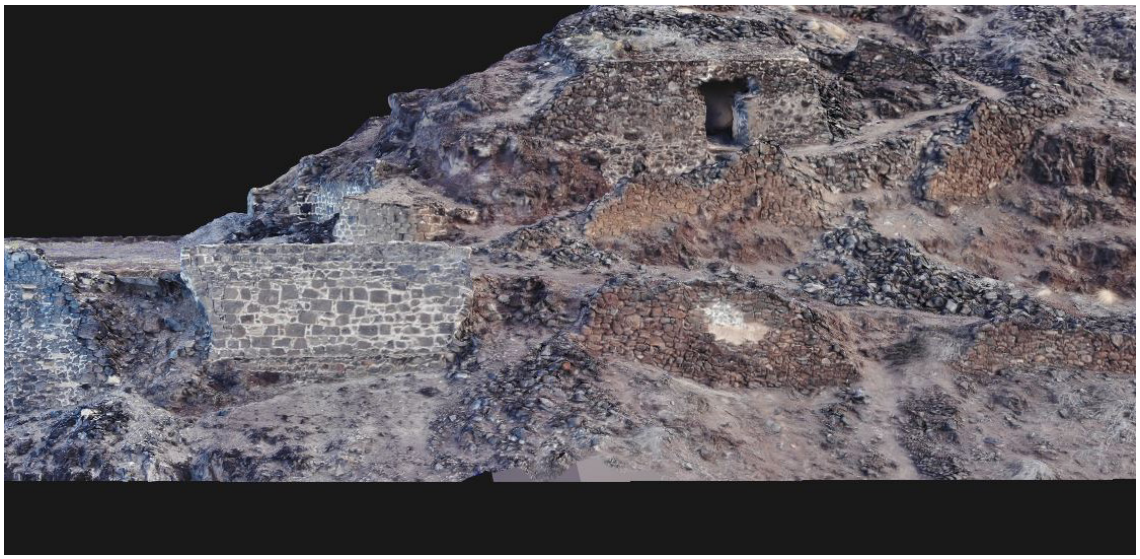

Figure 10:
Photogrammetric model, elevation view of Upper Banks' looking north (Model: B. Fortenberry).

Digital Documentation

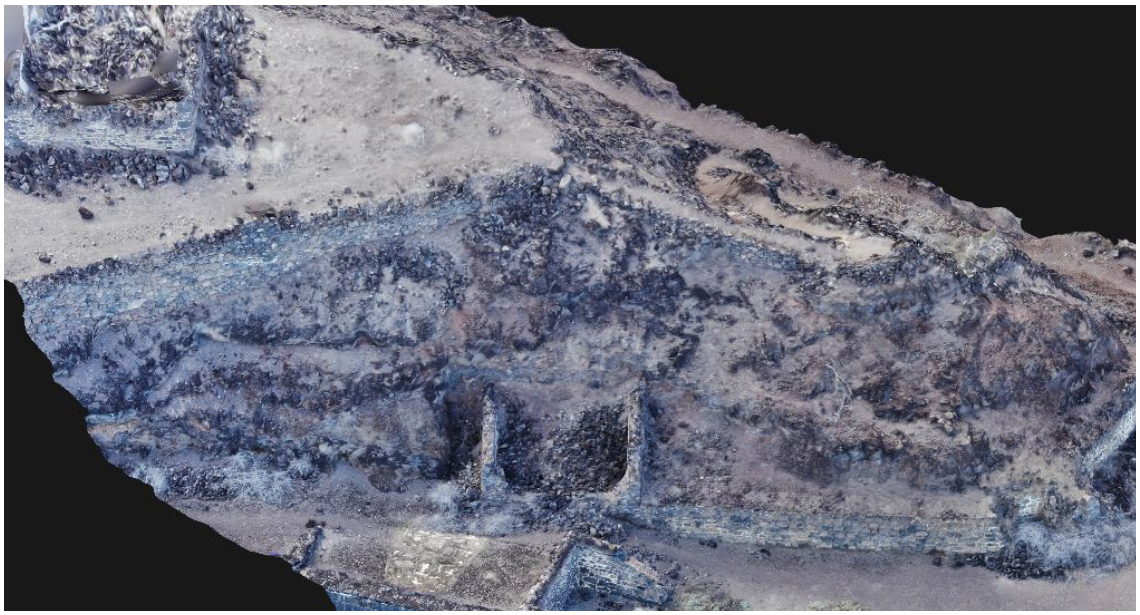

Figure 8: Photogrammetric model, oblique detail of upper banks with ruined officers' barracks (Model: B. Fortenberry).

Figure 9: Photogrammetric model, detail of wall collapse at Upper Banks' (Model: B. Fortenberry).

Figure 10: Photogrammetric model, east view of Lower Bank's Limekiln (Model: B. Fortenberry).

Digital Documentation

Figure 8: Photogrammetric model, west view of Lower Bank's Limekiln (Model: B. Fortenberry).

Figure 9: Photogrammetric model, south view of Lower Bank's Limekiln (Model: B. Fortenberry).

Figure 10: Photogrammetric model, east view of Lower Bank's Limekiln (Model: B. Fortenberry).

Digital Documentation

Figure 8: Photogrammetric model, nadir view of limekiln at Lower Banks' (Model: B. Fortenberry).

Figure 9: Photogrammetric model, west view of Lower Banks' battery (Model: B. Fortenberry).

Figure 10: Photogrammetric model, arch collapse detail at Lower Banks' Battery (Model: B. Fortenberry).

Digital Documentation

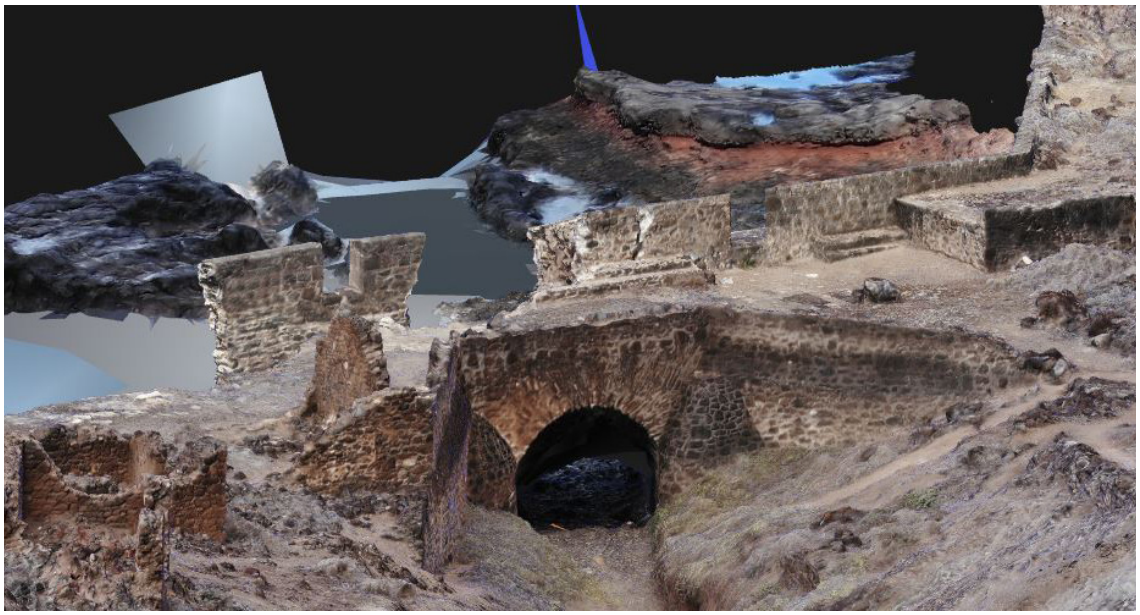

Figure 8: Photogrammetric model, view of Lower Banks' from the east (Model: B. Fortenberry).

Figure 9: Photogrammetric model, ruined barracks and support buildings at Lower Banks' Battery (Model: B. Fortenberry).

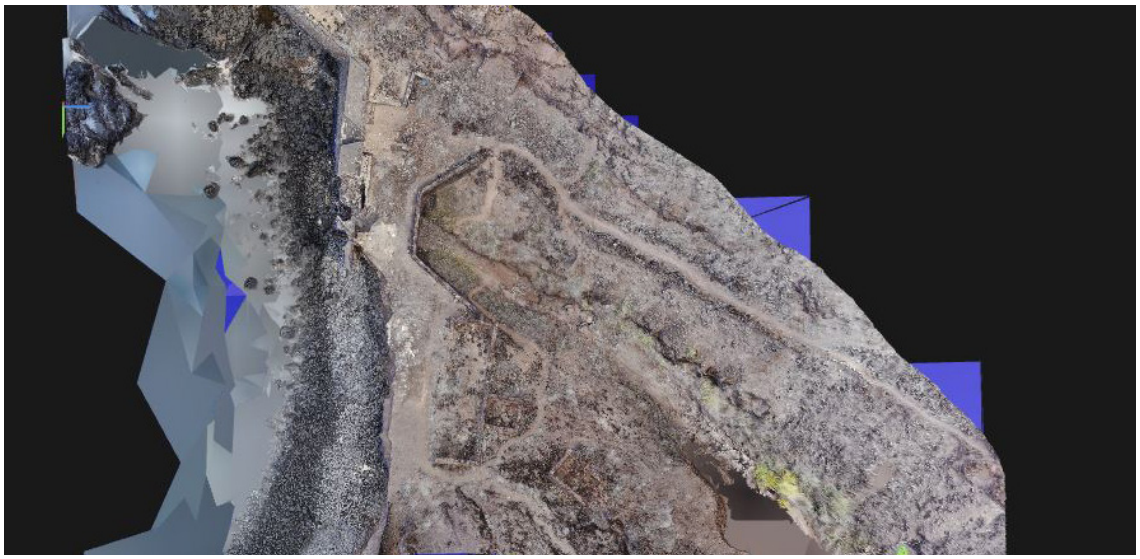

Figure 10: Photogrammetric model, nadir image view of Lower Banks' Battery (Model: B. Fortenberry).

Introduction to Conditions

The following conditions were observed through on-site visual inspection and digital model analysis by Fortenberry and Ashburn. There are several instances in the following recommendations where additional expertise is required. Several experts have been recommended to the charity.

Where possible, it is recommended that local experts be consulted. While all recommendations are important, at the end of the report is a triaged list of conservation conditions provided. The triaged list are structural in nature and critical to ensuring the integrity of the site.

Figure 11: View of the crenelated ramparts at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

The curtain wall at Lower Banks at eight feet thick at their widest (where the storm water tunnel passes through), and are roughly fifteen feet in height. The fortifications

Structural Curtain Wall Collapse

There are several areas of failure along the curtain wall at Lower Banks', all a product of the natural erosion process and deferred maintenance. On the curtain wall the failures occur primarily along the southern half of the line where the stone wall is pulling out (west) from the face. It is likely that erosional processes are pushing sediment outward and down the hill to cause this failure. A second failure to the north of this primary failure, due to the same impacts. In the storm water tunnel the arched opening is also failing as wall movement is pulling the bonding apart. The top, west side (seaward) top of the archway is failing as well.

Ruined Structures

There are also several collapsed structures on Lower Banks' including a barracks building which sits parallel to the curtain wall. A smaller support building to the south, and lime kiln further to the east. These structures are all constructed of local stone and were originally bonded using lime mortars. Some cementitious mortar repairs have taken place however, not a large scale, owing to its isolation from Jamestown and accessibility only via the path from Rupert's or via watercraft.

Figure 12: Aerial image with failing Lower Bank's Battery visible (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 13: Lower Banks' Curtain Wall as viewed from the east (Image: B. Fortenberry).

Figure 14: Lower Banks' Curtain Wall and Ruined Support Structures (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

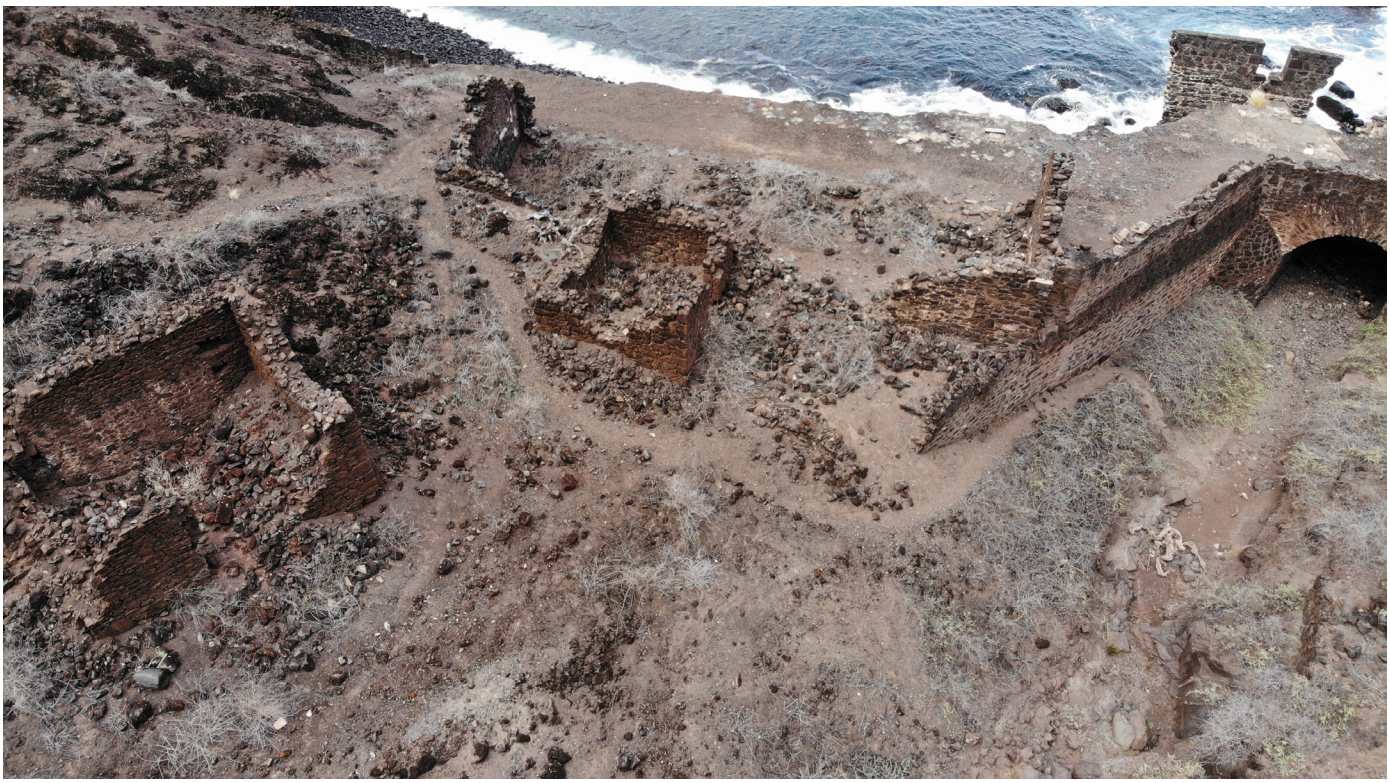

Figure 15: Detailed aerial view of support structures at Lower Banks' Battery (Image: B. Fortenberry).

Figure 16: Detail aerial view of surviving support structure at Lower Banks' (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 17: Aerial nadir image of failing curtain wall at Lower Banks' Battery (Image: B. Fortenberry).

Figure 18: Aerial image of curtain wall Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 19: Aerial image of failing curtain wall looking north Lower Banks' Battery (Image: B. Fortenberry).

Figure 20: Aerial image of failing curtain wall and lost rampart Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 21: Aerial image of failing curtain wall looking east at Lower Banks' Battery (Image: B. Fortenberry).

Figure 22: Aerial image of failing north wall and curtain wall at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 23: Aerial image of failing curtain wall, Lower Banks' Battery (Image: B. Fortenberry).

Figure 24: Aerial image of lost curtain wall due to erosion at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 25: Aerial image of surviving fabric at East Munden's Hill looking southwest (Image: B. Fortenberry).

Figure 26: Aerial image of failing curtain wall and support buildings at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

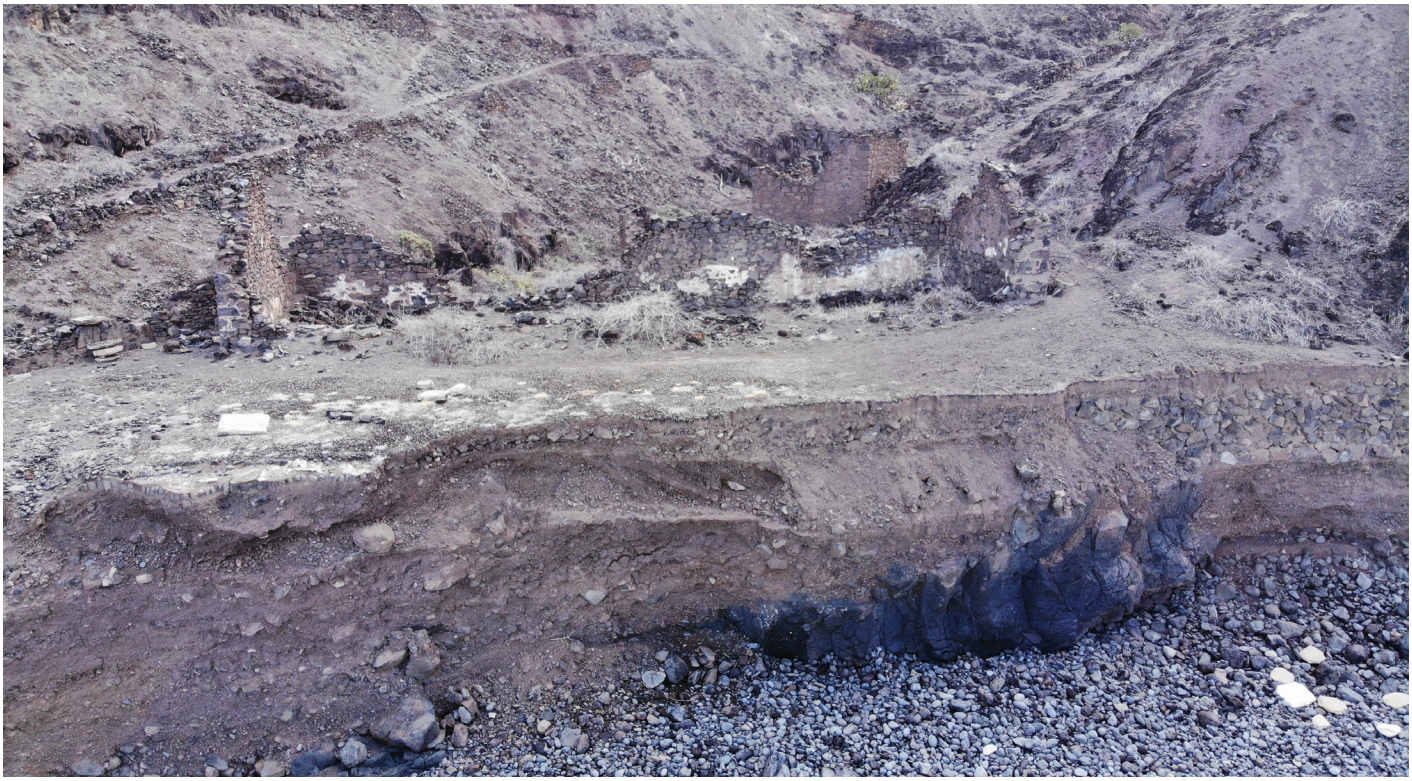

Figure 27: Detail aerial image of support buildings looking east at Lower Banks' Battery (Image: B. Fortenberry).

Figure 28: Aerial section image of failing curtain wall at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 29: Aerial oblique image of failing curtain wall at Lower Banks' Battery (Image: B. Fortenberry).

Figure 30: Detail section view of failing curtain wall at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 31: Detail image of northern failure of north curtain wall at Lower Banks' Battery (Image: B. Fortenberry).

Figure 32: Detail of failing arch at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse

Figure 33: Detail of failing arch at Lower Banks' Battery (Image: B. Fortenberry).

Figure 34: Detail of failing arch at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Battery–Structural Collapse Recommendations

1. The multiple wall curtain wall and arch failures at Lower Banks' Battery are the most pressing condition that needs to be addressed, and a structural engineer specializing in historic buildings should be consulted prior to any conservation work taking place. The engineer should examine the photographs, drone images, 3D models, and drawings to make preliminary determinations of the scope of rehabilitation and repair. An on-site visit is preferable for detailed inspection (The ruined buildings could best be conserved as ruins. As such, no roof structures would need to be constructed).

2. Concurrent with the engineer's inspection, all surviving wall fragments from the curtain walls and ruined structures from the collapses should be recorded and documented in situ, and recovered from being used a part of the reconstructions of the walls.

3. While the structural engineer will address the historic fabric, a geologist or environmental engineer should also be consulted to discuss how current erosion conditions contributed to the collapses and how they might be mitigated as a part of site rehabilitation.

4. Immediate action should be taken to segregate this area from the public areas of the site. There are no barriers, permitting individuals potential access to hazardous areas in and around the collapse of the curtain wall. The area needs to be marked using health and safety guidelines.

5. Identify and test in-context, identified historic mortars. Samples should be taken from the curtain wall and the ruined structure's walls and tested through aggregate analysis and acid digestion to identify appropriate historic composition. This should be done by an architectural conservator.

6. In consultation with an architectural conservator, the dry-laid sections of the wall should be monitored to ensure their long-term integrity, consultation with a conservator and historic building contractor should a dry-laid wall collapse is recommended.

7. Do not remove inappropriate mortars without oversight from an architectural conservator. Monitor these areas for mortar failure and repair with historically appropriate mortar composition derived from mortar analysis (Recommendation 5). Mortar replacement should be completed in consultation with an architectural conservator.

Upper Banks' Battery–Structural Collapse

Upper Banks' comprises the Half Moon Battery which has a radius of fifty-five feet; the breastworks are six feet in depth. It has a fifteen-foot wide cut stone platform.

There are is one major structural wall failure on the south wall at Upper Banks' along with five ruined structures: the officer's barracks, two support structures on the north side set into the cliff, a ruined privy, and a collapsing magazine cavern on the south edge of the installation.

Structural Wall Collapse

A large section of the southern battery wall has collapsed due to deferred maintenance and erosion. The section is eleven feet wide. It shows the cross section of the wall in the area to be five feet deep set directly into the hill side. The irregularly laid stones are local and are bonded together using a historic lime mortar. There does not appear to be later cementitious mortar repairs here.

Ruined Structures

The ruined buildings are in various states of decay, however they all are constructed of worked local stone bonded by lime-based mortars. In some cases, repairs have been made with cementitious mortars. Of note is that some interior plaster survives at the officers' barracks.

Figure 35: Oblique aerial view of Half Moon Battery at Upper Banks' Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 36: Oblique aerial view of Half Moon Battery at Upper Banks' Battery looking south (Image: B. Fortenberry).

Figure 37: Oblique aerial view of Half Moon Battery at Upper Banks' Battery looking south (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 38: Oblique aerial view of Half Moon Battery at Upper Banks' Battery looking east (Image: B. Fortenberry).

Figure 39: Oblique aerial view of Half Moon Battery at Upper Banks' Battery looking east, southern wall collapse in partial view (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 40: Oblique aerial view of wall collapse at Upper Banks' Half Moon Battery (Image: B. Fortenberry).

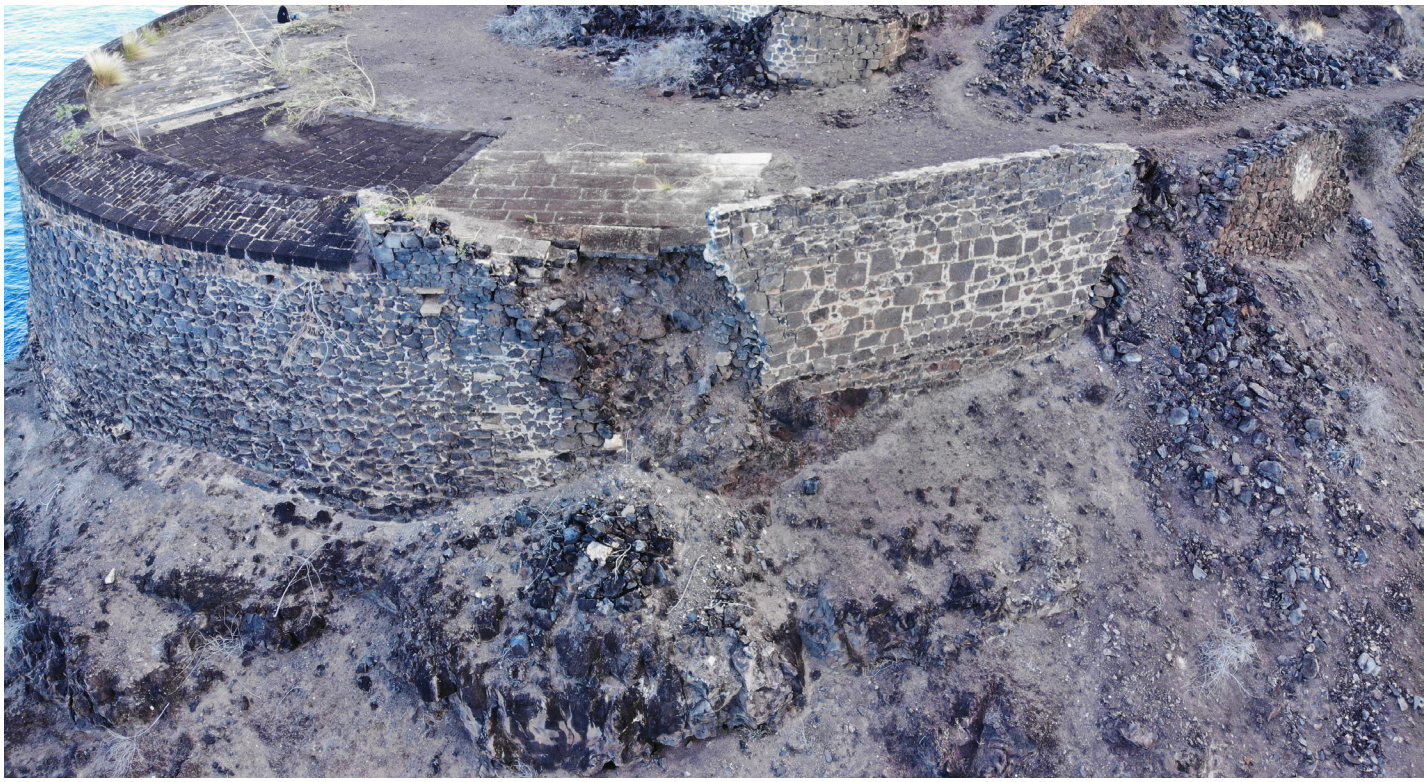

Figure 41: Oblique aerial view of wall collapse at Upper Banks' Half Moon Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

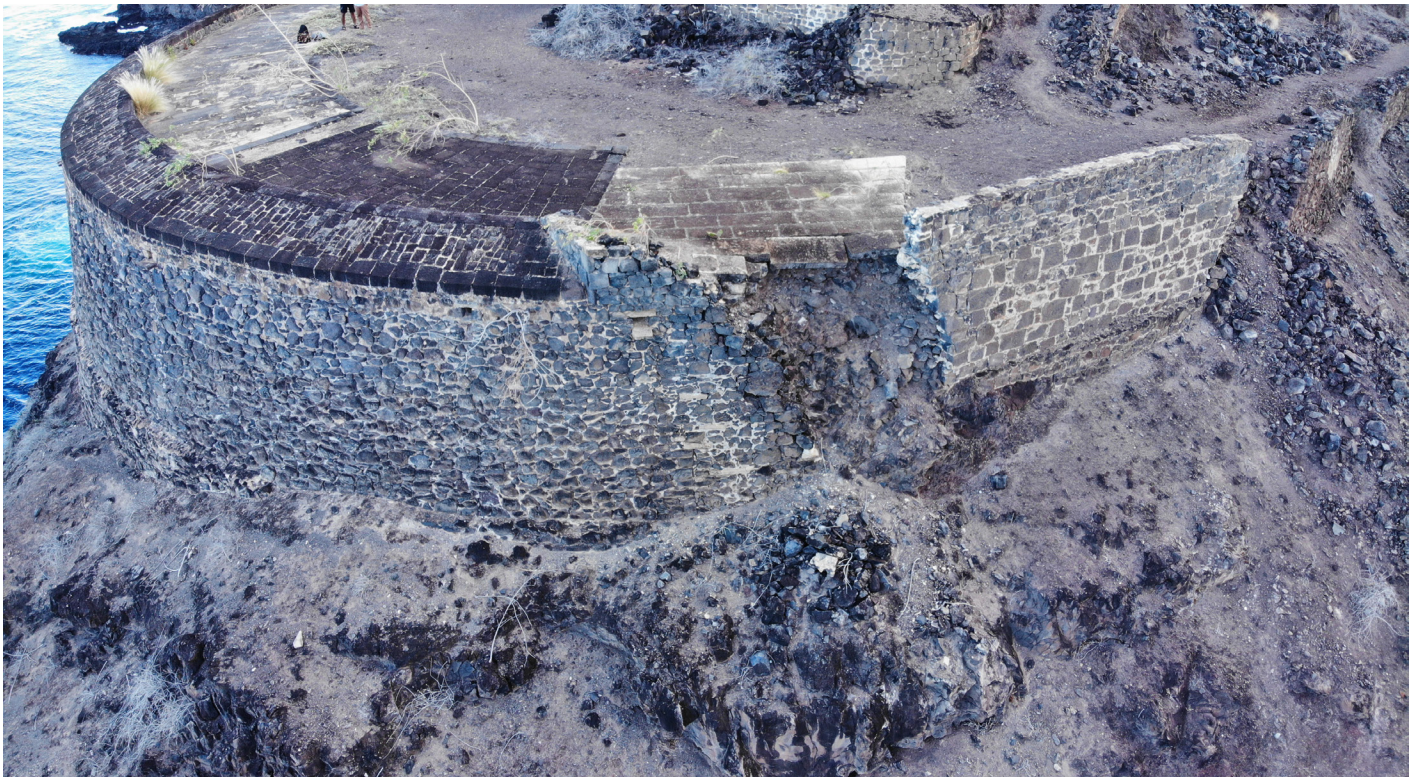

Figure 42: Oblique aerial view of wall collapse at Upper Banks' Half Moon Battery (Image: B. Fortenberry).

Figure 43: Oblique aerial view of wall collapse at Upper Banks' Half Moon Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 44: Oblique aerial view of ruined structures at Upper Banks' (Image: B. Fortenberry).

Figure 45: Oblique aerial view of ruined structures at Upper Banks' (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 46: Oblique aerial view of ruined structures at Upper Banks' (Image: B. Fortenberry).

Figure 47:Oblique aerial view of ruined structures and wall collapse at Upper Banks'(Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 48: Oblique aerial view of wall collapses on the south side of Upper Banks' Battery (Image: B. Fortenberry).

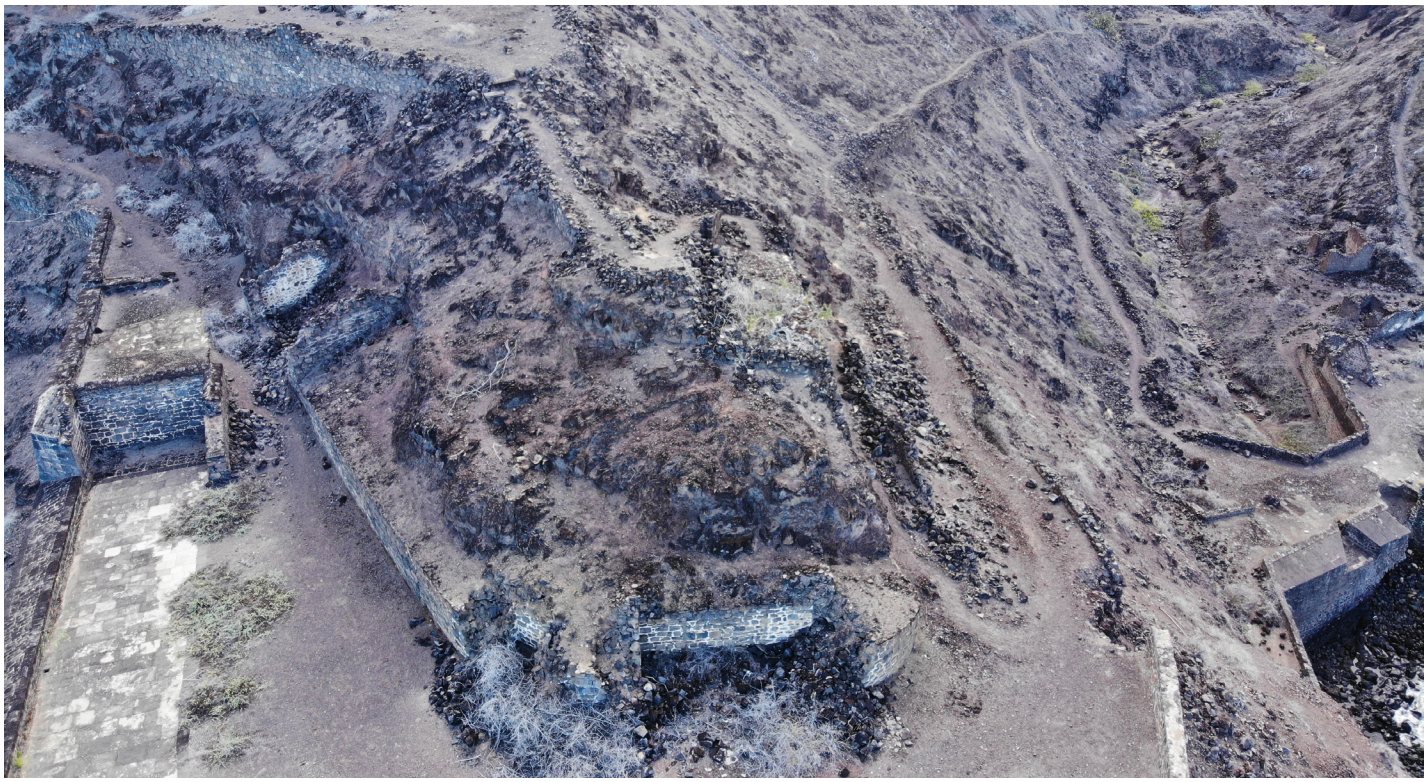

Figure 49: Oblique aerial view of ruined structures including magazine at Upper Banks' Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 50: Oblique aerial view of ruined structure at West Munden's Hill looking northwest (Image: B. Fortenberry).

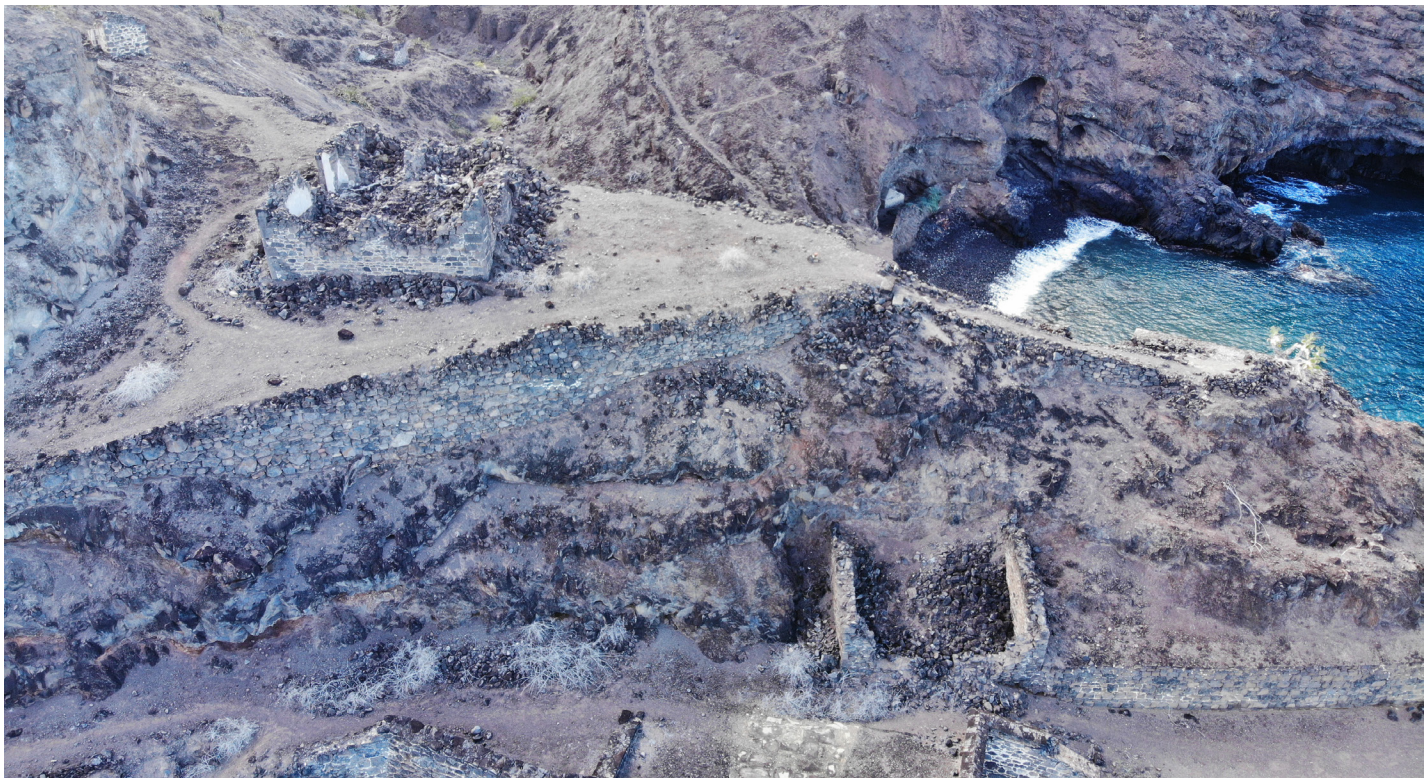

Figure 51: Oblique aerial view of ruined structures including Officer's Barracks at Upper Banks' Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 52: Detail view of ruined Officer's Barrack's at Upper Banks' Battery (Image: B. Fortenberry).

Figure 53: Historically repaired wall on the north edge of Half Moon Battery at Upper Banks' (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 54: Collapsed support structure on the north edge of Half Moon Battery at Upper Banks' (Image: B. Fortenberry).

Figure 55: Detail view of ruined Officer's Barrack's at Upper Banks' Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse

Figure 56: Privy remains at Upper Banks' Battery (Image: B. Fortenberry).

Figure 57: Wall corner collapse at support structure at Upper Banks' Battery (Image: B. Fortenberry).

Upper Banks' Battery–Structural Collapse Recommendations

1. The multiple wall curtain wall and arch failures at Upper Banks' Battery are the most pressing condition that needs to be addressed, and a structural engineer specializing in historic buildings should be consulted prior to any conservation work taking place. The engineer should examine the photographs, drone images, 3D models, and drawings to make preliminary determinations of the scope of rehabilitation and repair. An on-site visit is preferable for detailed inspection (The ruined buildings could best be conserved as ruins. As such, no roof structures would need to be constructed).

2. Concurrent with the engineer's inspection, all surviving wall fragments of the ruined structures should be recorded and documented in situ, and recovered from being used a part of the reconstruction of the walls.

3. While the structural engineer will address the historic fabric, a geologist or environmental engineer should also be consulted to discuss how current erosion conditions contributed to the collapses and how they might be mitigated as a part of site rehabilitation.

4. Immediate action should be taken to segregate this area from the public areas of the site. There are no barriers, permitting individuals potential access to hazardous areas in and around the collapse of the Half Moon Battery wall. The area needs to be marked using health and safety guidelines.

5. Identify and test in-context, identified historic mortars. Samples should be taken from the Half Moon Battery wall and the ruined structures and tested through aggregate analysis and acid digestion to identify appropriate historic composition. This should be done by an architectural conservator.

6. In consultation with an architectural conservator, the dry-laid sections of the walls should be monitored to ensure their long-term integrity, consultation with a conservator and historic building contractor should a dry-laid wall collapse is recommended.

7. Do not remove inappropriate mortars without oversight from an architectural conservator. Monitor these areas for mortar failure and repair with historically appropriate mortar composition derived from mortar analysis (Recommendation 5). Mortar replacement should be completed in consultation with an architectural conservator.

Lower Banks' Lime Kiln Structural Collapse

To the east of the Lower Banks' installation a 19th-century lime kiln sits in ruin. The structure was originally square with a conical interior for firing lime. Handmade fire bricks are still present in the firing hole on the east side of the structure. The lime kiln has the potential to add a non-military focus to the site's interpretation and can illustrate the elements of historic building technology to visitors. If ultimately rebuilt, lime firing demonstrations could be performed by local heritage stakeholders.

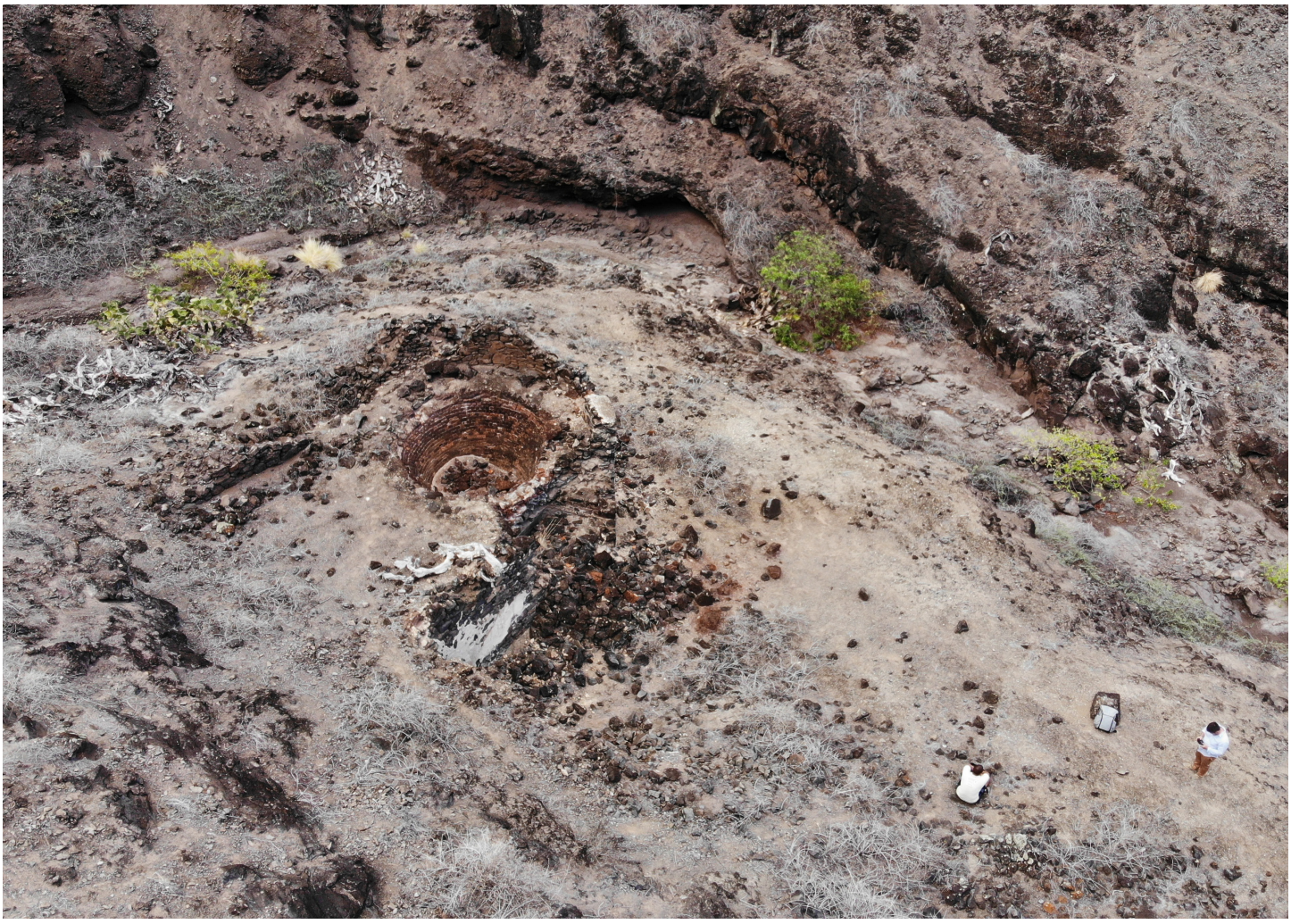

Figure 58: Oblique aerial view of the Lime Kiln at Lower Banks' Battery (Image: B. Fortenberry).

Lower Banks' Lime Kiln Structural Collapse

Figure 59: Oblique aerial view of east side of lime kiln with firing hole detailed (Image: B. Fortenberry).

Figure 60: Oblique aerial view of north side of lime kiln with ash shoot detailed (Image: B. Fortenberry).

Lower Banks' Lime Kiln Structural Collapse

Figure 61: Detail of firing hole of lime kiln (Image: B. Fortenberry).

Figure 62: Ruined west wall of Lower Banks' Lime Kiln. (Image: B. Fortenberry).

Lower Banks' Lime Kiln Structural Collapse Recommendations

1. The collapse of the lime kiln outer walls should be addressed as a part of the site's conservation, and a structural engineer specializing in historic buildings should be consulted prior to any conservation work taking place. The engineer should examine the photographs, drone images, 3D models, and drawings to make preliminary determinations of the scope of rehabilitation and repair. An on-site visit is preferable for detailed inspection.

2. Concurrent with the engineer's inspection, all surviving wall fragments of the ruined lime kiln walls should be recorded and documented in situ, and recovered from being used a part of the reconstruction of the walls.

3. Immediate action should be taken to segregate this area from the public areas of the site. There are no barriers, permitting individuals potential access to hazardous areas in and around the collapse of the outer lime kiln walls The area needs to be marked using health and safety guidelines.

4. Identify and test in-context, identified historic mortars. Samples should be taken from the exterior walls and tested through aggregate analysis and acid digestion to identify appropriate historic composition. This should be done by an architectural conservator.

5. In consultation with an architectural conservator, the dry-laid sections of the wall on the kiln's exterior should be monitored to ensure their long-term integrity, consultation with a conservator and historic building contractor should a dry-laid wall collapse is recommended.

6. Do not remove inappropriate mortars without oversight from an architectural conservator. Monitor these areas for mortar failure and repair with historically appropriate mortar composition derived from mortar analysis (Recommendation 5). Mortar replacement should be completed in consultation with an architectural conservator.

Triage Recommendations

1. IMMEDIATE: Isolate the collapsed wall elements at Upper and Lower Banks from the public, these areas are dangerous and could cause health and safety issues on the sites.

2. SHORT TERM: Consult an architectural engineer for wall rehabilitation of the structural collapse on the Curtain Wall and the Half Moon Battery

3. MEDIUM TERM: Conserve the ruins in place with minimal wall reconstruction.

Figure 63: Upper Banks' Half Moon Battery from the north (Image: B. Fortenberry).