SURVEY POINTS AT HIGHLAND HOUSE, SEAVIEW, CODRINGTON AND RIVER IN BARBUDA

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1. FOREWORD

Archaeologists from City University New York, CUNY, started working in Barbuda in 2000 and through the years teams of international archaeologists and environmental scientists have been invited to participate in the ongoing research program on the island. The project has been in close collaboration with National Parks Antigua and Barbuda and local scientists and scholars and it has been a fruitful venue for collaboration and combination of science, education and outreach.

Researchers from the Institute of Archaeology, Iceland, (Fornleifastofnun Íslands (FSI)) were invited to join in the 2011 season. The FSI team's main task was registration of archaeological sites, DGPS survey and participation in archaeological excavations.

The main purpose of the DGPS survey work of the FSI team was fourfold: 1) to establish a grid system for archaeological excavations and surveys, 2) to survey archaeological sites, 3) to build surface models of archaeological sites and their surroundings, 4) to measure in archaeological excavation trenches. The establishing of a grid system would facilitate the compiling of all survey and research data into a coherent database. The original idea was to tie the survey into the official national grid of Antigua and Barbuda for the benefit of interested parties such as surveyors, planners, cultural heritage management agencies, researchers and laymen. This, however, did not prove possible as explained below.

This report gives an overview of one aspect of the DGPS survey, which is the establishing of a base station and other reference points on Barbuda as well as the surveying of other points of importance.

2. INTRODUCTION

The first task was to obtain coordinates on the official grid system of Antigua and Barbuda. Ato Kentish, land surveyor at the Ministry of Agriculture and Lands, St John's, Antigua, kindly offered information on 4 stations around Barbuda (see Table 10). Japanese engineers constructing a fish factory in Codrington harbour also made available from their files coordinates of stations in Codrington surveyed in 2009 in preparation for the construction of the factory. A certain inconsistency was observed in the data and for reasons discussed in Appendix 1 this data was not used. Instead, new coordinates obtained from a 248 minute long run of DGPS base antenna at station Ba12 at Highland House were used for the base point. New height of Ba12 was established from station C1 on the jetty at Codrington harbour.

Points in Codrington and at Seaview and Highland House were surveyed using these coordinates and height of base station Ba12.

This decision, however, calls for a recalculation of data presented in this report when secure data of an official local grid is obtained.

The equipment used was Trimble R8 base and rover antennas and SU controller.

Names or numbers of old established points were not altered although given new coordinates and heights.

All horizontal coordinates are, unless otherwise stated, in UTM Zone 20N. All distances are in metres. Heights are given in metres above the zero sea level reference.

3. Base Point at Highland House

The coordinates for the base point, Ba12, at Highland House were established from a 248 minute run of the DGPS base antenna over Ba12 (centre of the iron pipe), antenna height measured from the top of the pipe. Height of Ba12 was calculated with the base antenna at Ba12 and rover antenna at station C1 on the jetty in Codrington harbour using the height of C1, 0,76m, as established in a 2009 survey carried out in advance of a construction of a fishing factory by the harbour. Reference to Ba12 hereafter, unless otherwise stated, is with the following coordinates and height.

Name	Description/Remarks	E	N	Height
Ba12	Concrete block with vertical iron pipe. 12,1 m SSE of structure J and 6,2 m W of structure H (Watters '85 number 5 and 6 respectively). Centre and on top of pipe.	628.312,117	1.953.610,452	37,165

Table 1. Coordinates and height of base point Ba12 at Highland House.

Figure 1. Station Ba12 at Highland House. A: Kite AP of Ba12 south east of house J. Arrow points at station and north. B: Close-up view of Ba12, looking east. (Photos FSI.)

4. CODRINGTON

4.1. On the Jetty in Harbour

Coordinates for station C1, a point on the concrete jetty in Codrington harbour, was established with the rover antenna and the base antenna at Ba12. Height taken from survey conducted in 2009 in preparation of fish factory construction.

Name	Description/Remarks	E	N	Height
C1	SS Steel screw in concrete jetty at Codrington harbour. 12,46 m W from shed and 3,9 m from each outer W corners of jetty.	624.207,616	1.950.989,464	0,760

Table 2. Coordinates of station C1 on jetty at Codrington harbour.

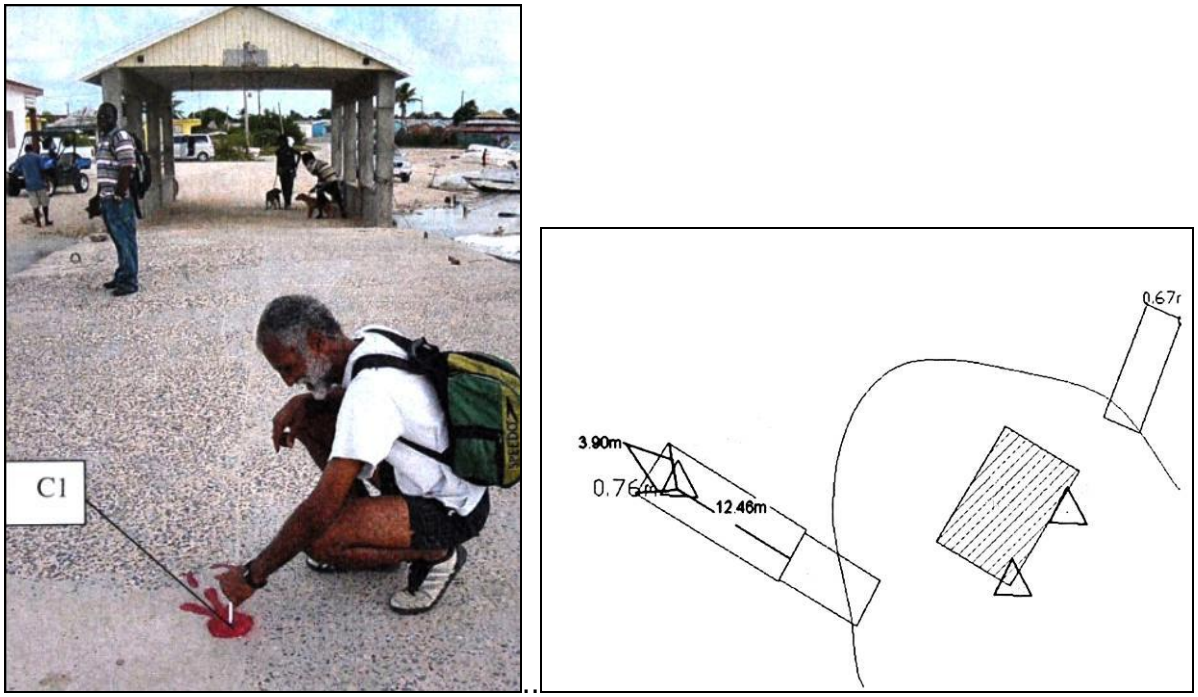

Figure 2. Station C1 on the jetty at Codrington harbour. (Figures from Survey at Project Site 2009.)

4.2. At the Brooklyn College Laboratory Building

A point by the Brooklyn College laboratory building in Codrington was also measured in with the rover antenna and the base antenna stationed at Ba12.

Name	Description/Remarks	E	N	Height
BCL01	Steel bolt in centre on “roof” of concrete “doorway” or “gate” adjacent to a cistern N of NW corner of lab building.	624.479,473	1.950.962,151	4,993

Table 3. Coordinates and height of BCL01 at the Brooklyn College laboratory building in Codrington.

Figure 3. Point BCL01 at Brooklyn College laboratory building. Looking south. (Photo FSI.)

5. POINTS AT THE SITE SEAVIEW, TWO FOOT BAY

5.1. Reference Points

Two points were established at Seaview using the Highland House base station Ba12.

Name	Description/Remarks	E	N	Height
SV1	Steel screw in bed rock about 110 m SSW of excavation area.	629.892,415	1.954.676,730	4,966
SV2	Steel screw in middle of concrete cistern just inside and about 25 m east of entrance gate to church recreation area. Ca. 250 m west of excavation area.	629.666,919	1.954.808,372	2,245

Table 4. Coordinates and height of stations SV1 and SV2 at Seaview.

Figure 4. Station SV1 at Seaview. Looking SE. (Photo FSI.)

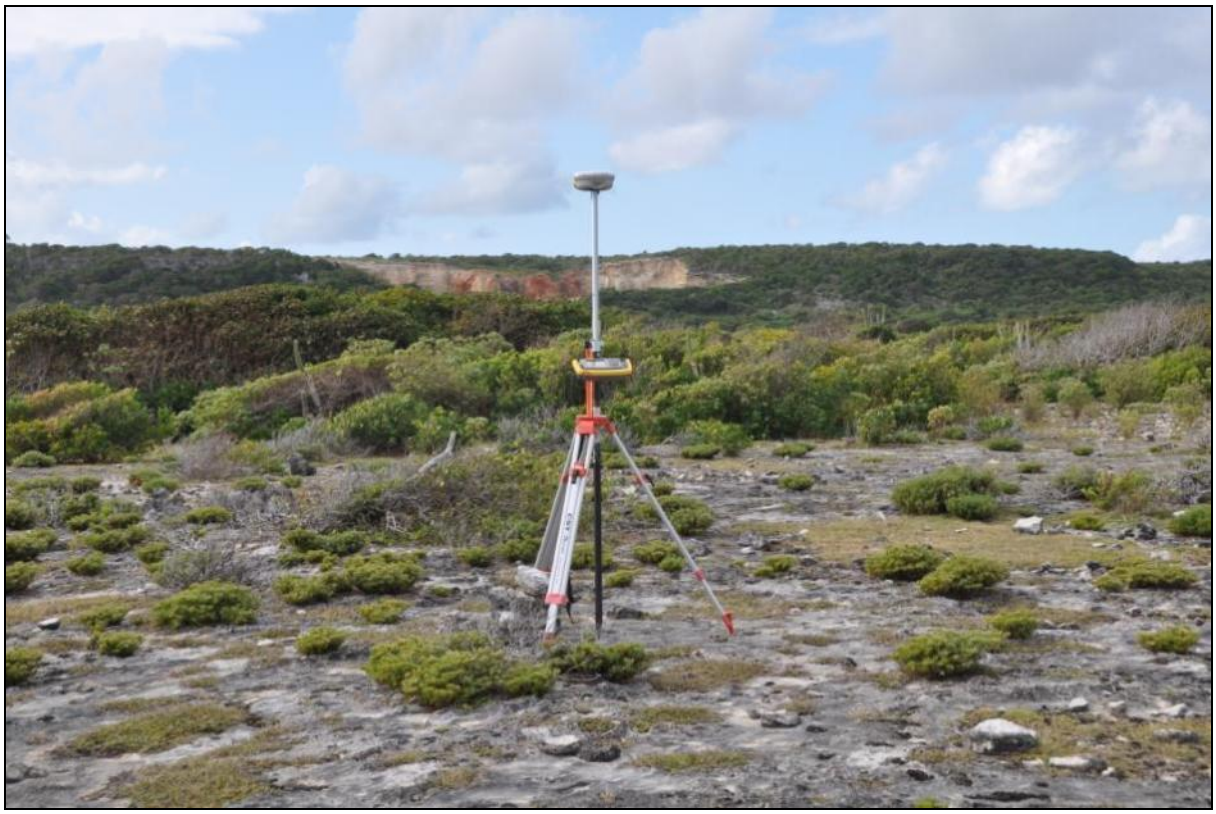

Figure 5. Station SV1 at Seaview. Looking SSW. (Photo FSI.)

Figure 6. Station SV1 at Seaview. Looking N towards the excavation area. (Photo FSI.)

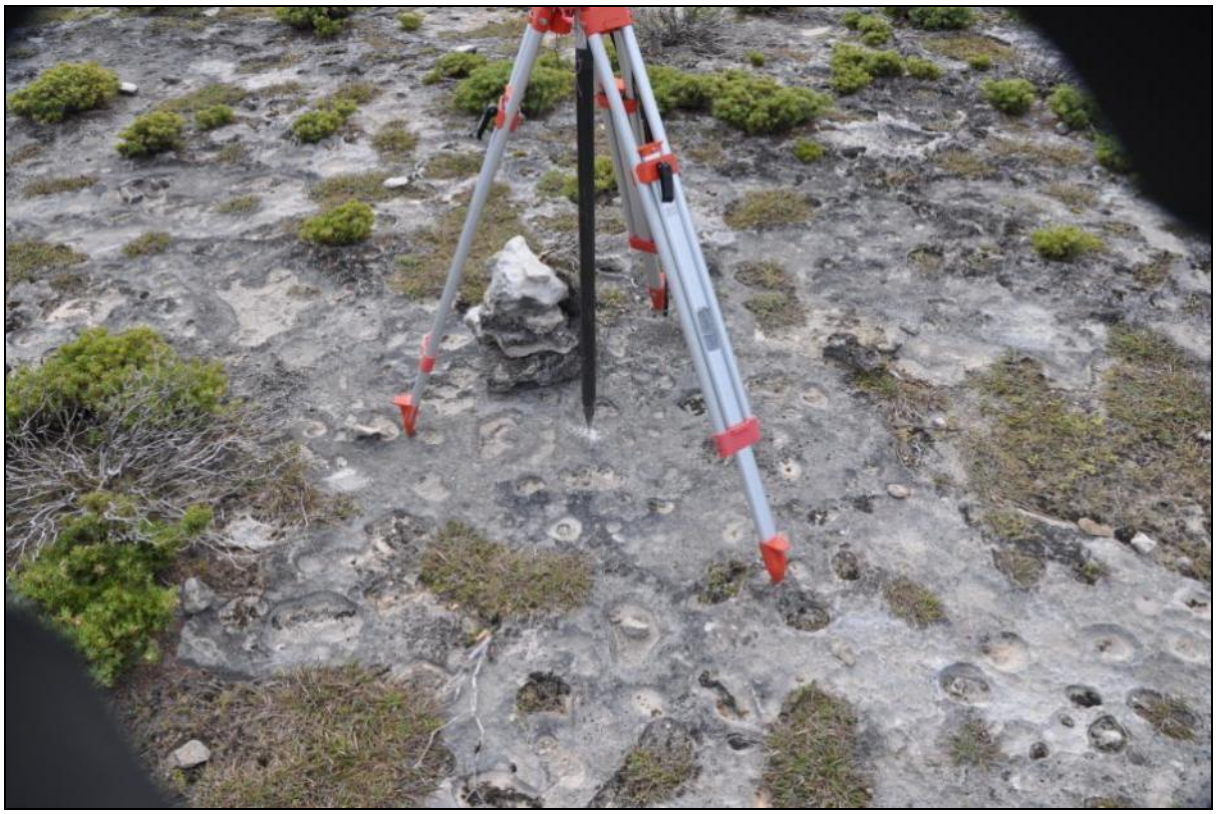

Figure 7. Station SV1 at Seaview. Close up of point. Looking SSW. (Photo FSI.)

5.2. Other Reference Points

Further 5 points were measured in at Seaview as reference points using SV1 as base station. Points SV3-4 are intended as back-up points for SV1 and points SV5-7 as potential reference points for a total station orientation at site.

Name	Description/Remarks	E	N	Height
SV3	Steel bolt in bed rock N of track and about 130m SE along it from entrance gate to church recreation area towards excavation area.	629.749,226	1.954.734,501	2,163
SV4	Steel screw in bed rock 5,05m NNW (330° true) from SV1.	629.889,821	1.954.681,095	4,903
SV5	Steel rod W of excavation, one of group of 3.	629.868,630	1.954.768,896	3,457
SV6	Steel rod S of excavation, one of group of 3.	629.873,711	1.954.749,902	3,065
SV7	Steel rod S of excavation, one of group of 3.	629.889,742	1.954.757,818	3,239

Table 5. Coordinates and height of points SV3-SV7 at Seaview.

Figure 8. Station SV3 at Seaview. Looking N. (Photo FSI.)

Figure 9. Station SV3 at Seaview. Close up of point. Looking N. (Photo FSI.)

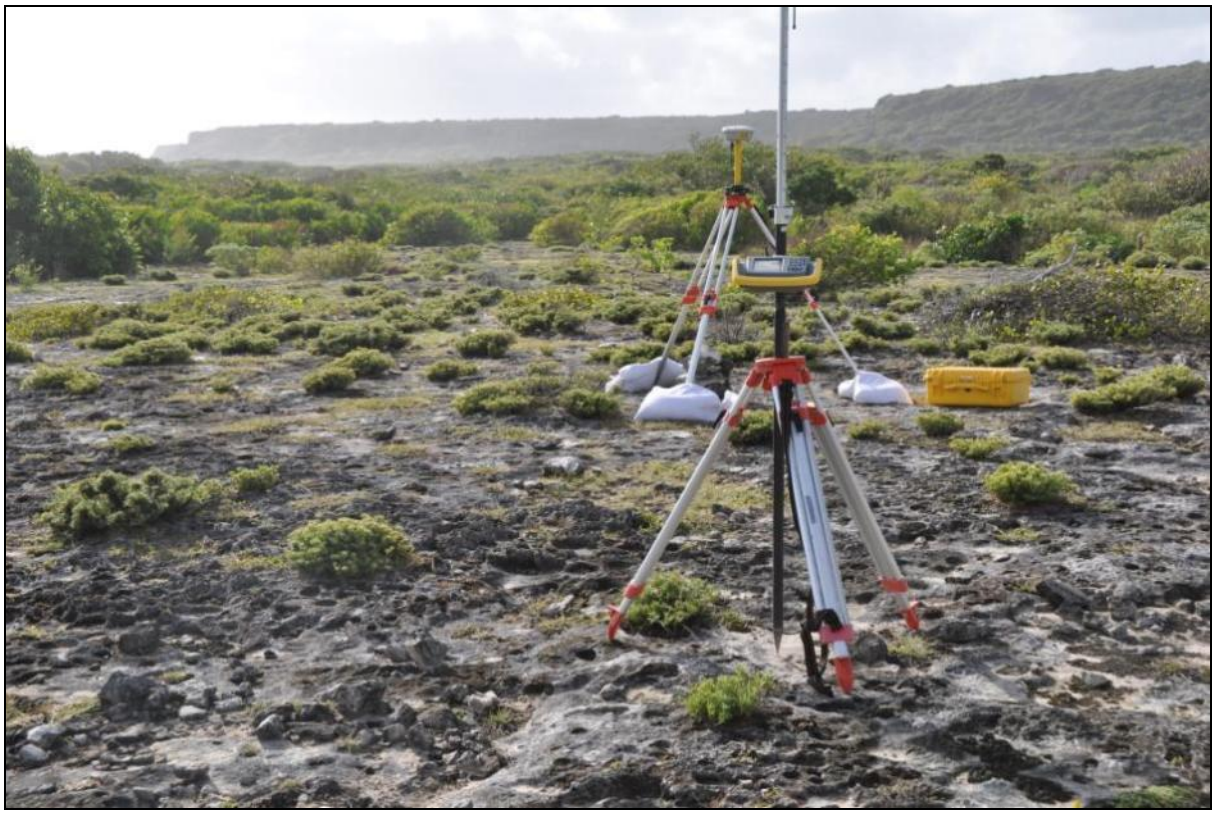

Figure 10. Station SV4 at Seaview. Looking SSE. SV1 in background. (Photo FSI.)

Figure 11. Station SV5 at Seaview. Looking SE. (Photo FSI.)

Figure 12. Station SV6 at Seaview. Looking NE. (Photo FSI.)

Figure 13. Station SV7 at Seaview. Looking NW. (Photo FSI.)

Figure 14. Stations near the excavation trench at Seaview. Points superimposed on a kite aerial photograph imported into Google Earth. Scale not accurate. (Photo FSI/Google Earth.)

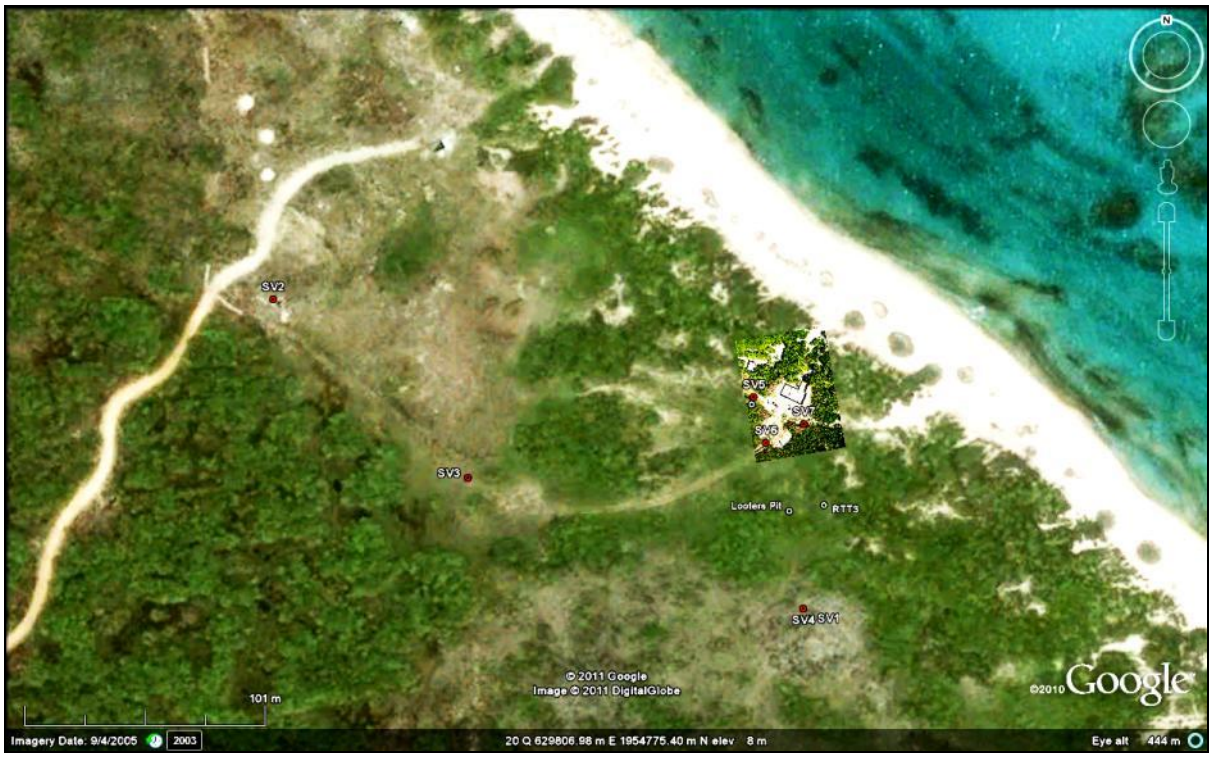

Figure 15. Stations around the excavation trench at Seaview. Points imported into Google Earth. Scale not accurate. (Photo FSI/Google Earth.)

5.3. Extent of Excavation

The extent of the 2011 excavation area was measured in with SV1 as base point. The outline of a test pit from 2008, believed to be the number 5 pit, partly exposed in the northern section of the excavation area was also surveyed. Coordinates and height (3,549) for the back sight point for the 2011 excavation were established.

Name	Description/Remarks	E	N	Height
511/501	Extent of 2011 Excavation	629.892,252	1.954.776,005	~~5,155~~
511/504	Extent of 2011 Excavation	629.889,598	1.954.777,298	~~5,214~~
505/504	Extent of 2011 Excavation	629.887,168	1.954.771,962	~~4,486~~
505/510	Extent of 2011 Excavation	629.881,636	1.954.774,348	~~4,454~~
500/510	Extent of 2011 Excavation	629.879,594	1.954.769,838	~~3,919~~
500/500	Extent of 2011 Excavation	629.888,675	1.954.765,714	~~4,041~~
505/500	Extent of 2011 Excavation	629.890,719	1.954.770,242	~~4,573~~
505/501	Extent of 2011 Excavation	629.889,888	1.954.770,741	~~4,548~~
TP5.08-1	Extent of ´08 Test Pit 5?	629.890,241	1.954.776,918	~~4,959~~
TP5.08-2	Extent of ´08 Test Pit 5?	629.889,800	1.954.776,827	~~4,007~~
TP5.08-3	Extent of ´08 Test Pit 5?	629.889,880	1.954.775,591	~~3,986~~
BS11	Back sight	629.867,846	1.954.765,818	3,549

Table 6. Coordinates and height of points marking the extent of 2011 excavation, extent of 2008 test pit 5 and back sight point for 2001 excavation. Note height of extent of excavation points is irrelevant.

Figure 16. Points marking the extent of the excavation area at Seaview and shovel test pits. Points superimposed on a kite aerial photograph imported into Google Earth. Scale not accurate. (Photo FSI/Google Earth.)

5.4. Shovel Test Pits

So called shovel test pits, 12 in all, to the south and east of the 2011 excavation area were surveyed in.

Name	Description/Remarks	E	N	Height
STP1	BAR11-22	629.880,790	1.954.767,793	~~3,664~~
STP2	BAR11-22	629.884,482	1.954.765,834	~~3,720~~
STP3	BAR11-22	629.886,216	1.954.765,301	~~3,792~~
STP4	BAR11-22	629.888,004	1.954.764,540	~~3,812~~
STP5	BAR11-22	629.887,297	1.954.759,798	~~3,283~~
STP6	BAR11-22	629.888,169	1.954.761,579	~~3,602~~
STP7	BAR11-22	629.888,944	1.954.763,413	~~3,802~~
STP8	BAR11-22	629.889,918	1.954.765,141	~~3,982~~
STP9	BAR11-22	629.890,544	1.954.767,068	~~4,185~~
STP10	BAR11-22	629.891,177	1.954.768,981	~~4,338~~
STP11	BAR11-22	629.892,106	1.954.771,203	~~4,461~~
STP12	Bar11-21	629.892,797	1.954.772,737	~~4,645~~

Table 7. Coordinates of shovel test pits. Height of points is irrelevant.

5.5. Looters Trench and Pit RTT3 from 2008

An alleged location of a looters trench and a test trench, presumably RTT3 from 2008 were surveyed in.

Name	Description/Remarks	E	N	Height
LT1	Looters trench	629.883,554	1.954.721,711	~~3,283~~
RTT3	Test trench from 2008 RTT3	629.898,060	1.954.724,267	~~3,660~~

Table 8. Coordinates of a “looters trench” and a test trench from 2008, RTT3. Height of points is irrelevant.

6. POINTS AT THE RIVER SITE

A grid system was established in connection with a small scale rescue excavation at a site called River, approximately 150 m east of the causeway to the harbour on the southern coast of Barbuda. This grid was not tied into the local grid system. A base station was established with a 25 minute run of a DGPS base antenna at a point ca. 160 cm south of the centre of the south site of a house foundation near the excavation site. A proxy height of the base station was calculated from measured sea level height in the nearby harbour, tide tables from St John's harbour, Antigua, and time difference between the two harbours estimated. The base point at River is believed to be within 50 cm accuracy on the east and north axis and within 20 cm for the height. Points in area C were not measured in but added to figure 16 manually.

Name	Description/Remarks	E	N	Height
Base	160 cm S of the centre of S wall a house foundation near excavation site	625319.423	1945328.986	1.074
NW A	NW corner of area A	625323.081	1945308.608	0.345
NE A	NE corner of area A	625324.032	1945308.526	0.268
SE A	SE corner of area A	625323.905	1945306.038	0.093
SW A	SW corner of area A	625322.910	1945306.128	0.185
S edge B	S edge of area B	625334.321	1945310.619	0.293
N edge B	N edge of area B	625336.069	1945312.183	0.382
Wood B	Wood-trunk in area B	625335.855	1945311.387	0.136

Table 9. Coordinates of points at River.

Figure 17. The base station at River. Looking N. (Photo FSI.)

Figure 18. Points at River. Points superimposed on a kite aerial photograph imported into Google Earth. Scale not accurate. (Photo FSI/Google Earth.)

7. ACKNOWLEDGMENTS

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Gratitude is also truly due for local support, help and hospitality, but not least for generosity to share knowledge and information: Dr. Reg Murphy, head of archaeology for National Parks Antigua and Barbuda, Mr. Calvin Gore, Barbuda council, Mr. Kelly Burton manager of the Codrington Lagoon National Park, Ato Kentish, land surveyor at the Ministry of Agriculture and Lands, Mr. Chad Alexander, architect and Mr. John Mussington, headmaster of Sir McChesney Georg High School.

8. REFERENCES

Barbuda, Lesser Antilles, Map 1:10.000, Series: D.O.S. 257, Edition 1-D.O.S. 1970, Sheets 1D and 2A, Published by Directorate of Overseas Survey. © Crown Copyright 1970.

Survey at Project Site for the Construction of Artisanal Fisheries Facilities, Barbuda. January 2009. Unpublished report. (only part of the report observed).

APPENDIX 1

As stated above it was decided not to make use of coordinates obtained from Ato Kentish, land surveyor at the Ministry of Agriculture and Lands and from the 2009 survey carried out in preparation for a construction of a fish factory in Codrington supplied by Japanese engineers at the site. A certain consistent discrepancy was observed in the data from Ato Kentish and this also applies to some of the coordinates from the 2009 survey on the one hand and the coordinates obtained by initial DGPS measurements by the FSI team and the UTM 20Q grid presented in Google Earth on the other hand (see figures 17 and 18). The position of the points from Ato Kentish and the 2009 survey relative to same stations as seen in Google Earth is consistently ca. 220 m and 199°. The nature of the discrepancy suggests it to be a matter of difference between projections or calculations. Under the circumstances it proofed impossible to clarify the root of this problem and rectify it. The FSI's DGPS point measurements were in good agreement with the Google Earth grid. Google Earth, although not accurate down to a metre level, is a useful "safety net" to verify coordinates.

Observation of four points from the 2009 survey show that points JI and GPS#7 are at the same distance and angle from same stations as seen in Google Earth. The error in the location of the other two points suggests, however, a misprint (see figure 18). The height given to C1 on the Codrington jetty in the 2009 survey was more convincing at 0,76 m than the height, 1,651, surveyed in using Ba12 as base and the height of Ba12 (38,056) from Ato Kentish.

In this light new coordinates for station Ba12 were obtained with a long run of a base antenna at the station and used as a base point for further survey work. New height was "fetched" from the 2009 survey of point C1 at Codrington harbour.

Station name	E	N	Height
Ba1 Martello Tower	624.151,247	1.945.549,751	4,905
Ba1 Lat/Long	17°35´ 41.88´´ N	61°49´ 45,44´´ W	4,90
Ba12 Highland House	628.241,369	1.953.399,289	38,056
Ba13 All in Well	626.116,022	1.952.232,409	3,19
Ba18 Beazels Well	626.337,007	1.948.880,373	5,912

Table 10. Coordinates of points from Ato Kentish.

Figure 19. Discrepancy between stations with coordinates from Ato Kentish, with manually measured coordinates from 1970 maps and the location of same stations in Google Earth. Be12 at Highland House left, Be13 at All in Well centre and Ba1 at Martello Tower right. (Photo FSI/Google Earth.)

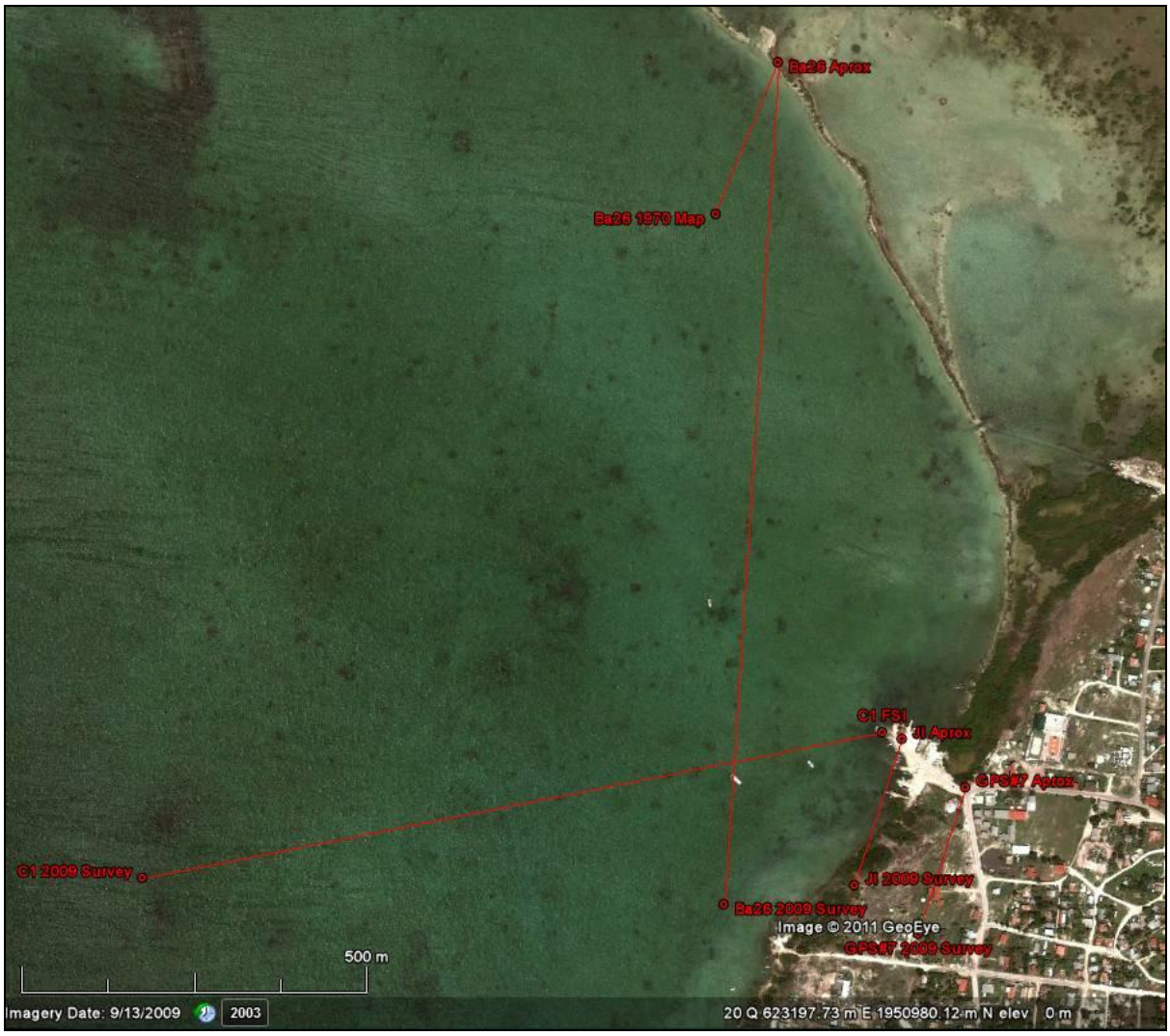
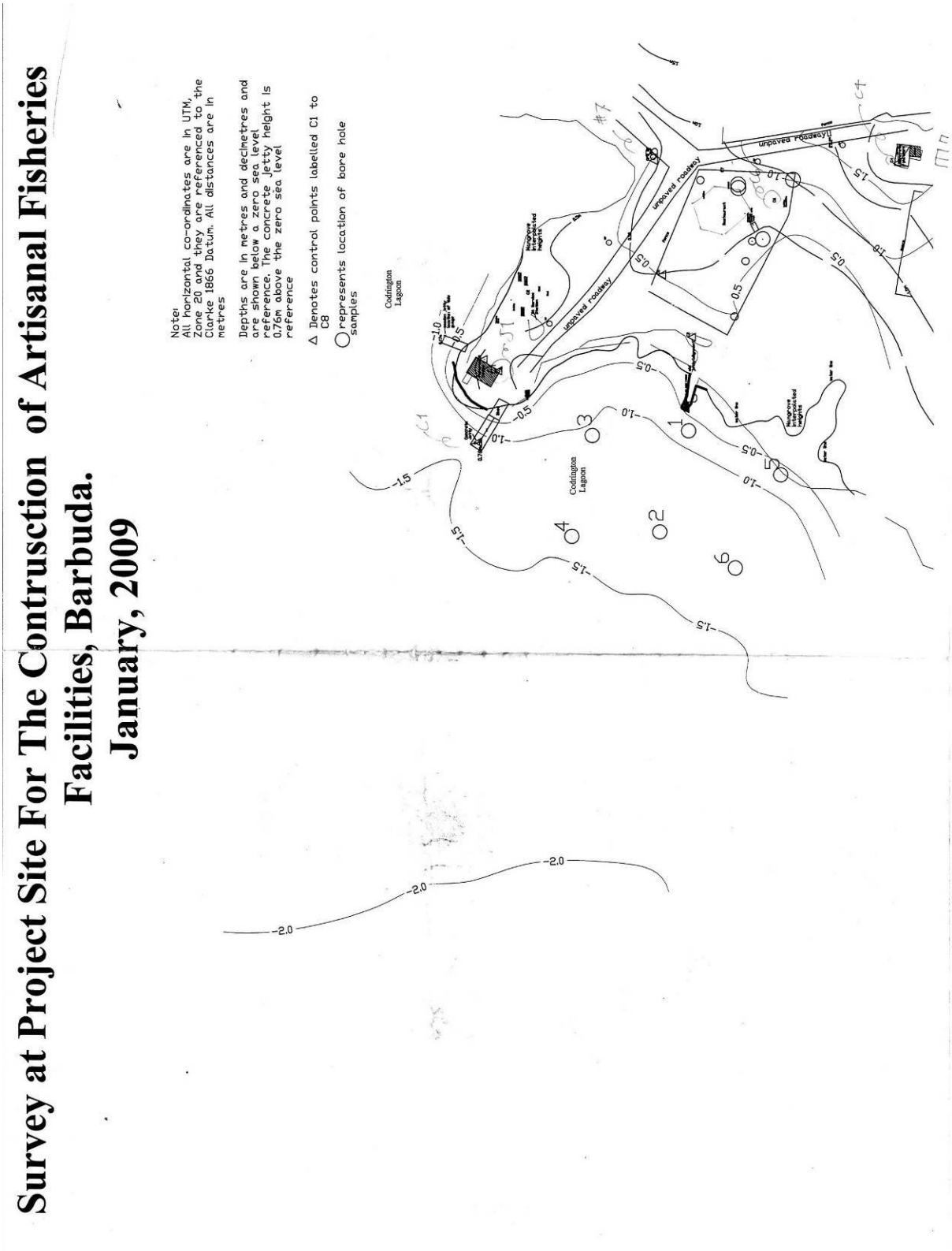


Figure 20. Comparison of location of points, in and near Codrington, according to coordinates from the 2009 survey, 1970 map and FSI's point C1 in Google Earth. (Photo FSI/Google Earth.)

APPENDIX 2

Relevant information from the report on the 2009 survey carried out in preparation for the construction of a fish factory at Codrington harbour.



Appendix II_ Additional Marks requested by client

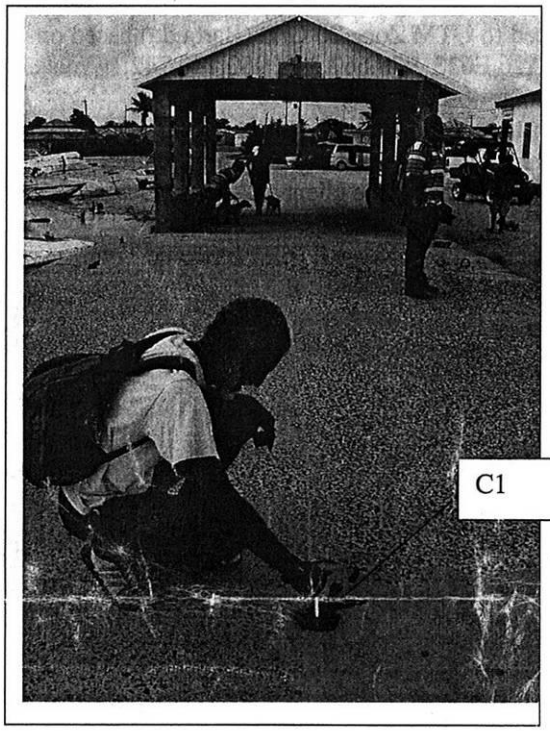
Points which may be recoverable for future surveys are described below.

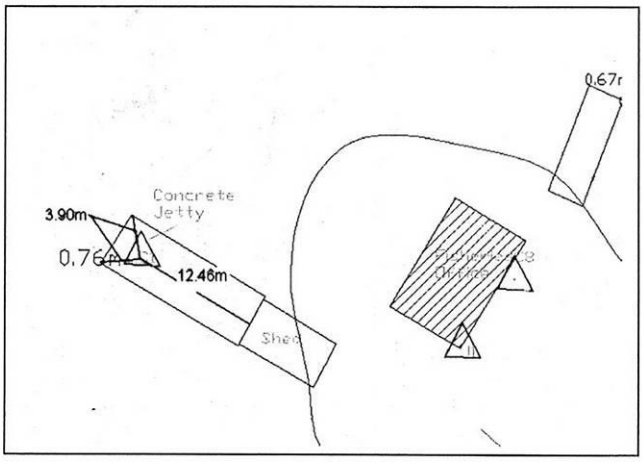
Notes:

1. Horizontal co-ordinates are referenced to UTM Zone 20 Grid (Barbuda) based on Survey Department control mark BA26 E623, 978.667, N1, 950,740.742.
2. Orientation is UTM Grid based on solar observations.
3. All values are metres.
4. Topographic observations were made using a Sokkia SET6F Electronic Total Station

C1

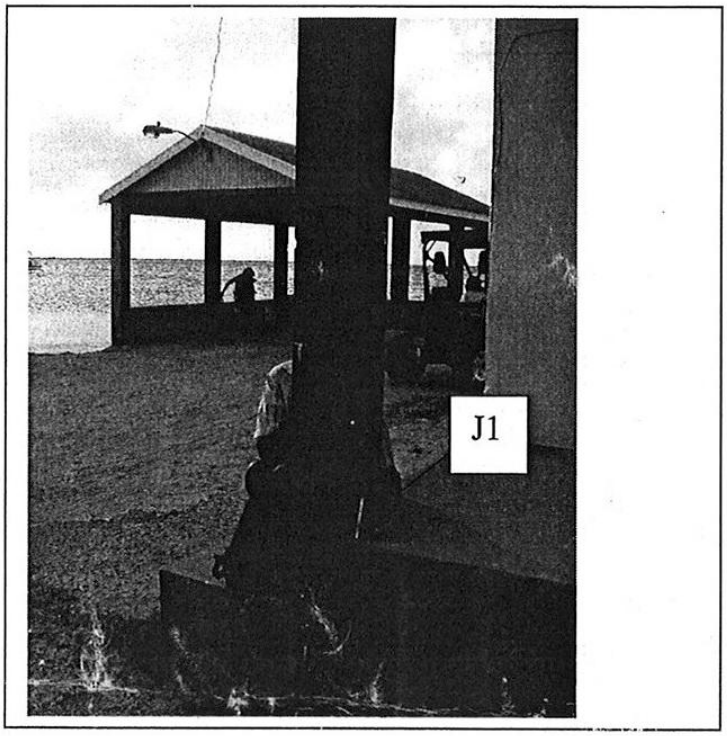
E *623136.62* ***N*** *1,950, 778.11*
Height: 0.76m





JI (Mark at SE corner of Fisheries building)

E 624, 167.78, **N** 1,950,769.22



GPS #7 (PVC pipe painted yellow)

E 624,259.96 **N** 1,950,700.74