

7. Analysis and discussion of results

The purpose of this section is to provide a summary analysis and brief discussion of the information collected in the field survey.

7.1 Newly located sites

Location of sites	Number of sites	% of total number of sites
Total number of sites located during field survey	161	100%
Sites found by this survey	83	52%
Sites previously located	78	48%

Table 1: Total numbers of sites located during field survey (not including the 14 sites identified during desk based assessment but not found during survey)

Location of sites	Number of sites	% of total number of sites
Sites within the intertidal zone	48	30%
Sites within intertidal zone found by this survey (percentage is of intertidal sites only)	39	81%

Table 2: Total numbers of sites located within the intertidal zone, with the number located during this survey

Over half of all the sites located during the survey were found during this survey. Many of the new discoveries were sites located within the intertidal zone (39 sites, or 47% of all newly located sites). The intertidal sites found by this survey accounted for 81% of all intertidal sites recorded.

7.2 Recommendations for sites

Recommendation for sites	Number of sites	% of total number of sites
N/A	13	8%
Nil	113	70%
Survey	35	22%

Table 3: Recommendations for future work at sites located during survey

The majority of sites located do not carry a recommendation for any further work. Further work was recommended at 35 sites (22% Of the total of all sites located), and these sites are listed in Table 9, together with a short explanation for the recommendation.

Of the 35 sites with a recommendation for positive action, 18 of them (12% of all sites located) were previously known and 17 of them (11% of all sites located) were discovered as part of this fieldwork.

7.3 Land sites adjacent to vulnerable or dynamic areas of the coast

The following tables give percentages based on the total number of sites on the land (113 sites) and exclude sites within the intertidal zone.

Location of sites	Number of sites	% of non-intertidal sites
Sites within 10m of High Water Mean Springs; coastline classified as eroding	3	3%
Sites within 25m of High Water Mean Springs; coastline classified as eroding	11	10%

Table 4: Total numbers of sites located within 10 metres and 25 metres of the High Water Mark on a stretch of coast classified as eroding

Location of sites	Number of sites	% of non-intertidal sites
Sites within 10m of High Water Mean Springs; coastline classified as eroding and depositing	1	1%
Sites within 25m of High Water Mean Springs; coastline classified as eroding and depositing	3	3%

Table 5: Total numbers of sites located within 10 metres and 25 metres of the High Water Mark on a stretch of coast classified as eroding and depositing

Location of sites	Number of sites	% of non-intertidal sites
Sites within 10m of High Water Mean Springs; coastline classified as depositing	3	3%
Sites within 25m of High Water Mean Springs; coastline classified as depositing	3	3%

Table 6: Total numbers of sites located within 10 metres and 25 metres of the High Water Mark on a stretch of coast classified as depositing

Location of sites	Number of sites	% of non-intertidal sites
Sites within 10m of High Water Mean Springs; all dynamic coastlines	7	6%
Sites within 25m of High Water Mean Springs; all dynamic coastlines	17	15%

Table 7: Total numbers of sites located within 10 metres and 25 metres of the High Water Mark on all dynamic stretch of coastline

The proximity of sites to the High Water Mark (HWM) as marked on a 1:25,000 Ordnance Survey map was measured within the GIS. Two measurements were taken, sites within 10m of the HWM and sites within 25m. The reason for this is that the HWM is itself dynamic and its position can change. The numbers of sites that lay

within either 10m or 25m of the HWM on either eroding; eroding and depositing; or depositing stretches of coastline are presented above (Tables 4 – 6), together with total numbers of sites on dynamic coasts (Table 7). This shows that 17 sites, or 15% of all land sites located, lie within 25m of the coast edge in dynamic areas.

7.4 *List of sites carrying recommendations for further work*

Table 8 (below) presents a list of all sites carrying a recommendation for further work. The site ID; report map number; name; type; and period are given, together with a brief explanation of the reason for the recommendation. It should be noted that these recommendations are those given by the surveyors in the field, and the list could be refined or augmented after analysis of the results of the survey on the GIS. The list of recommended sites has not been prioritised within this report.



Figure 2: Site 63, Boddin Point Lime Kiln



Figure 3: Site 11, Dowrie Burn Chemical Works

Table 8: Sites carrying recommendations for further work

ID	Map	Site name	Site type	Reason for recommendation	Period
11	3	Dowie Burn Chemical Works	Chemical works	Record ad hoc costal defence	19th century
24	5	Forbidden Cave	Cave	Bone found in 1949 excavation, site liable to erosion	Prehistoric?
28	5	Lud Castle	Promontory fort	Castle midden described as eroding	Prehistoric
30	5	Auchmithie Harbour	Harbour	Eroding feature	Modern
51	7	Red Castle, Lunan	Castle and midden	To obtain information about midden before it is destroyed	Medieval
55	7	Lunan Bay	Fish Trap	Site discovered by this survey, under immediate threat	Modern
61	7	Boddin Harbour	Harbour	Long term survival unlikely	Modern
63	7	Boddin Point Lime Kiln	Lime kiln	Site under severe threat from coastal erosion	Post Medieval
65	7	Boddin	Row of derelict cottages	On cliff edge and liable to erode	Post Medieval
66	7	Boddin, Chapel of St Skae	Burial ground / chapel	Threat to preservation is high	Medieval
68	8	Pebble Rock	Derelict building	Previously unrecorded structure in derelict state	Modern
71	8	Fishtown of Usan	Channel	Survey together with salt pan to see if related	Post Medieval
72	8	Fishtown of Usan, ice house	Icehouse/saltpan	Investigate what remains of original salt pan	Post Medieval
79	1	Barry Sands	Concrete structure	Previously unrecorded	World War II?
80	1	Buddon Ness Ice House	Icehouse	May be recently uncovered from sand	Post Medieval
81	1	Barry Sands	Military shelter	Previously unrecorded site	World War
87	2	Buddon Ness	Anti tank blocks	Site discovered by this survey, under immediate threat	World War II
88	2	Buddon Ness	Anti tank blocks	Site located by this survey, previously unknown	World War II
90	2	Barry Buddon	Training trenches	To record area before it is buried	World War I
91	2	Barry Buddon	Training trenches	To record area before it is buried	World War I
97	2	Carnoustie, Barry Sands	Linear feature	Site discovered by this survey, under immediate threat	World War II?
102	8	Usan	Ruined cottages / tower	To record extant structures	Post Medieval
105	8	Usan, Chapel Mill	Ruined mill complex	To record extant structures	Post Medieval

ID	Map	Site name	Site type	Reason for recommendation	Period
111	8	Scurdie Ness, East Beacon	Beacon	Eroding beacon of relative antiquity	18th century
128	10	Montrose Bay	Anti tank blocks	Recently exposed due to erosion	World War II
129	10	Montrose Bay	Anti tank blocks	Recently exposed due to erosion	World War II
131	10	Fisherhills	Anti tank blocks	Recently exposed due to erosion	World War II
139	10	Fisherhills	Concrete structure	Site located by this survey	World War?
142	11	Kaim of Mathers	Castle	Check for recent indications of erosion	15th century
144	11	Heughs of St Cyrus	Structures	New site located by this survey	Post Medieval
145	11	Heughs of St Cyrus	Structure	New site located by this survey	Post Medieval
151	5	Arbroath, Victoria Park	Human remains	Human remains have been disturbed in area on several occasions	Medieval
153	5	St Ninian's Well, Arbroath	Well	Associated with chapel and graveyard	Medieval
154	7	Boddin	Wall	Eroding wall exposed at coast edge	Post Medieval
165	8	Craig Braes, Montrose Basin	Salt pans	Rare example of well surviving salt pans.	19th century

7.5 A comparison of the expected and observed physical characteristics and erosional status of the coast edge

The desk-based assessment report provided a detailed gazetteer description of the hinterland and foreshore geology, geomorphology, coast edge and expected erosional status of the survey area, and this information was available to the surveyors in the field survey phase. Only occasional and minor differences were noted between the expected and actual geological and geomorphological attributes of the survey area. The hinterland geology of the area of Victoria Park (Maps 4 and 5) were mapped as till in the DBA and blown sand in the field survey. It is likely that the field observation is correct as blown sand does overlie the till in this area. The eastern 'coast' of the Montrose Basin (Map 8) and the estuary of the North Esk river (Maps 9 and 10) also show minor differences between the DBA and field survey assessments, although it is not known which is correct. There is very close agreement between the coastal geomorphology information presented in the two surveys reports.

When the reported expected erosional status of the coast edge and the actual erosional status as recorded in the field are compared, more differences are apparent, although they too are broadly similar and give similar information. Discrepancies of an observed stable coast edge at Barry Sands (Map 2) and southern Montrose (Map 8), mapped as areas of definite erosion in the DBA can be explained by the presence of extant coastal defences in these areas. Lunan Bay (Map 7) is mapped as generally stable in the field survey report, but generally eroding in the DBA. However, the gazetteer entry in the DBA report explains that in terms of net longshore sediment transport, Lunan Bay is likely to be in a state of dynamic equilibrium, with the problem of dune erosion most likely due to high numbers of visitors and resultant destabilisation and vulnerability to wind erosion. Elsewhere the field survey observations are generally of a more varied and localised erosional state along the coast edge than that reported in the DBA. This is a reflection of the different temporal and spatial scales of the information sources of the surveys. The field survey information provides a snapshot of the state of the coast edge; the desk-based assessment provides an overview of the evolutionary trend of sections of the coast, based upon an understanding of the coastal processes operating in the area. Both sets of information are necessary for an understanding of the erosional status of the coast edge.