

## Appendix 3: Baring Head Archaeological Survey

## **Baring Head, Ōrua Pouanui**

### **Archaeological Survey for Wellington Regional Council**



Kevin L. Jones  
Kevin L. Jones Archaeologist Ltd

3/17 Blackbridge Road  
Wellington 6012  
[kljarchaeologist@paradise.net.nz](mailto:kljarchaeologist@paradise.net.nz)

25 June 2010

## INTRODUCTION

Philippa Crisp of the Wellington Regional Council commissioned this survey of the surface archaeology of the lighthouse reserve at Baring Head. The objective has been to record and interpret the visible archaeological features especially those relating to the lighthouse and lighthouse settlement and the WW II military establishments.

The complex of keepers' houses, the enclosing fence, the coast and the headland escarpment are today in part a recreation reserve vested in the Wellington Regional Council. Within the complex there are two small reserves: 1) containing the lighthouse proper and the end of the headland (SO 20096) and 2) a small New Zealand Police radio facility on and by the south-western radio mast.

There are no pertinent New Zealand guidelines on the recording of lighthouses. However, the US National Register guidelines for historic aids to navigation recommends recording a full range of features, not only the light and tower but also sound signals, keepers' houses, garages and roads, landings, tramways, cemeteries, barns, hencoops, sheds and vegetable gardens (Delgado and Foster n.d.: 10).

### Brief history

Baring Head is Ōranui Pouanui in Maori tradition and was an important landscape feature in the earliest exploration of Cook Strait, Rāu Kawakawa or Raukawa Moana.

The chronology of the lighthouse's development is covered in Beaglehole (2006: 142-143). The Baring Head Lighthouse Reserve was surveyed and gazetted in 1931 (Fig. 1). Construction of the light started in 1934 and was completed by 1937. At the same time a radio beacon (to guide ships from afar) was also installed.

Baring Head was an important military and radar post in the course of WW II. The national chronology of wartime coast watching is complex and relies on complex technical developments. The following table summarises my reading of Cook (2000: 657-672), Beaglehole 2006: 142-143, 292), the *Appendices to the Journal of the House of Representatives* (AJHR), Ross (1955), Baigent (n.d.) and my own field observations on the developments at Baring Head.

Date	Form/equipment	Function	Personnel	Comment
1937-	Lighthouse completed. Low frequency radio beacon operational.	Coastal navigation aids.	Port lighthouse staff	
1937-	International Code flag signalling. Aldis lamp. Land	Shore/ship communication by flag, ship	Port lighthouse staff	

	telephone.	identification.		
1937-	PWSS (Port Watch Signal Station). Land telephone. Aldis lamp.	Shore/ship communication, ship identification.	Port lighthouse staff and/or Army	Part of defence system.
1937?-	Conventional range-finder and day visual watch. Land telephone.	Fire control (Palmer Head heavy guns) and coast watch.	Territorials? Army	Facilities at trig 600 m NW of lighthouse area.
1941-1942	Early form of RDF plus day visual watch. Land telephone.	Coastal warning.	Army/WAAC	RDF staff not good at visual coast watching. Building of first structure housing radar south of the Baring Head light.
1943-1944	10 cm RDF on rotating tower plus day visual watch. Land telephone.	Coastal warning and fire control. Army Fire Commander's Set (Palmer Head and Wrights Hill heavy guns).	Army/WAAC	Set re-located from Beacon Hill. Probably similar set-up to that at Sinclair Head (see Fig. 24).

Since the war Baring Head has been an important site for meteorological and atmosphere data sampling including ozone and CO<sup>2</sup> sampling to measure concentration and (for the latter) <sup>14</sup>C levels.

### Existing recorded sites

From a search of the New Zealand Archaeological Association's Archsite, there are two archaeological sites within the reserve area, both recorded at the foot of the cliff:

- R28/36: burial
- R28/37: cave with midden, named Oruapouanui (see also DOC file PAD-09-02-01, 20/8/1992).

We did not attempt to re-locate these two sites. The burial site area should be regarded as a wāhi tapu.

At the trig 500 m to the north-east of the reserve (in the area recently purchased by the WRC) is:

- R28/21: WW II observation post, engine room, telephone pole nearby the trig; further to the north, an accommodation house/barracks, ablution block foundations and water supply pipe.

The complex within the lighthouse recreation reserve has been allocated the Archsite number R28/48.

## **METHOD**

The reserve was visited on 20 May by Chris Edkins and Kevin L. Jones. Using tape and compass we recorded the length and orientation of the fences on the south-west and south-east sides of the settlement area. These particular fences are not original but they are on the original alignment. The position of the lighthouse base and the five exterior corner posts of the shelter belt were recorded by GPS (Appendix 1).

This information allows the true scale of the vertical photograph (17 February 1941) (Fig. 2), purchased for this project, to be determined and from that mapping of the position of original features. In addition the GPS points will allow the plan to be registered on the regional council GIS system.

There is a useful Whites Aviation 1950s oblique aerial in Archives New Zealand which shows the reserve area (Fig. 3).

The plan and orientation of the lighthouse base was mapped in and extended out to the current NIWA buildings (Fig. 4). The adjacent or underlying 1930s or WW II buildings and features were recorded. The small isolated barracks foundation off the south-western road alignment (outside the fence) was mapped in. Finally the plan details of the vehicle garage, the keepers' houses and outhouses, the generator house and the distance between the radio masts and their heights were measured. On another occasion the interior plans of the two houses and the generator (power) houses were recorded.

Figures 5 and 6 show oblique views of the lighthouse taken six decades apart.

## **RESULTS**

The key elements of the lighthouse settlement are:

- shelter belt and fences
- buildings and their curtilage (outhouses, yards) including sewage lines
- roads and paths
- quarry
- lighthouse
- radio masts
- signal mast and platform, signal hut

- WW II installations: radar and barracks

### **Shelter belt and fences**

In 1937 the lighthouse settlement was surrounded by two lines of approximately 2-m high post and rail fence or post and wire forming a corridor about 7 m wide. The two lines of fence had chain-link wire netting or wire laced with manuka bundles to stop the wind. By 1941 there was a distinct dark area of tall grass and shrub and tree plantings in the corridor (see Figs 2 and 5). There seems to have been interior cross fences as well, creating cells about 7.5 m square.

None of the original fences appears to have survived. As noted the southern and western fences are on the original alignments. At some point post-WW II possibly in the 1960s all fences were replaced with tanalised rough-sawn 100 x 100 *Pinus radiata* posts with wire or chain-link mesh. Near the keepers no. 2 house there are a few isolated *in situ* hardwood posts with mortices for rails. These are probably the original posts on their original alignment. The northern and eastern fence alignments have been extended outwards about 3 m probably to avoid encroaching trees. They now enclose the north-eastern radio mast.

There is a 1950s era concrete post and wire fence on the edge of the cliff (see frontispiece) which creates two fields of pasture on the west and the south-east of the headland.

Tree species which appear to have been planted in 1937 and which have survived as an open tree land were macrocarpa (including a golden cultivar), *Pinus radiata* and pōhutukawa (Fig. 7). Norfolk pine may have been planted later. Significant specimen trees that survive today, such as the macrocarpa specimens, can be detected in the 1941 aerial photograph.

Small trees and shrubland that may have been planted later include karo, *Rhamnus* sp., and ngaio. There have been more recent plantings of tī kouka, *Olearia* sp. and akekake. Adventives from the original native cover that have survived include coastal flax, *Muehlenbeckia* sp., toitoi and taupata *Coprosma repens*.

Some ornamental garden survivors include century plants (*Furcraea* sp.) and other low-growing succulents.

The belts of trees including the individual specimens are a significant element of the reserve and the Baring Head landscape. Some sympathetic under-planting may be warranted. The exposed and wind-damaged belt of macrocarpa west of the entrance and running down to the cliff should be re-planted with macrocarpa with a sheltering native shrubland such as taupata *Coprosma repens*.

## **Buildings**

There are three major buildings within the shelter belt area and also a garage. The buildings were all extant in 1937. They have been described as the keeper's no. 1 house (nearest the lighthouse), keeper's no. 2 house, the generator (power) house and the garage.

Clues to the functions of buildings can be gained from a key board in the generator (power) house as follows:

*L[ight], house no. 1 no.2, Signal hut, Pumphouse, Gate, Power consul [sic, console], Garage, Garden shed, Power house, R.B. Cabinet, Dry stores, Medical chest, Filing cabinet, R.B. spares, Paint store*

'R.B.' may refer to Radio Beacon.

In addition, on the circuit board in the generator room are switches labelled as follows:

*Red light alarm, Lighthouse local circuit, Lighthouse navigation, DSIR hut, House one or two emergency power, Light, Power point, Radio beacon, Beacon, Radio room power point.*

Also in the generator room there is a panel marked '*Alarm and telephone connection*'.

We were not able to identify the signal hut. The latter may have been a building east of the no. 1 house and near the signal platform.

The two *lighthouse keepers' houses* are bungalows with a floor area of about 115 m<sup>2</sup> and corrugated asbestos sheet hip roofs. The windows have double-hung sash joinery with six lights in the upper sash and two in the bottom. Each house has a small pumphouse to the north-east over a subterranean concrete cistern; these replaced water tanks originally sited under the eaves (see Figs 9, 10). Each building had a rear concrete yard and an outhouse.

The interiors are more or less identical and have two bedrooms, a parlour and a living/dining room, kitchen, W.C., bathroom, box room and a washroom. The no. 1 house still has the original varnished wainscoting (wood panelling) in the parlour and living room.

The no. 2 house has been modified with 1980s wallpaper and painted wainscoting; a third bedroom is attached off the main entry porch. A similar bedroom was attached to the no. 1 house (see Fig. 3) but it has now gone. The no. 2 house differs from no. 1 in small details in the washroom and kitchen area and a small external porch has been built over the only external door at the rear.

There is a small Marine Department type storehouse behind the no. 2 outhouse (Fig. 11); this is lined with dressed timber inside and clad with corrugated iron. It may have been

brought in complete and, given that it came from another place, it will be the oldest building on the reserve.

There were other small sheds in the wider grassed yards behind the houses for hens, a *garden hut* (not identified) and a *signal hut*.

Waste water and possibly sewage from the no.1 house was piped south-east to the southern cliff edge. The no. 2 house was piped downhill west to the western cliff where there is still a substantial trench (Fig. 12).

The *generator house (power house) and radio room* is made of concrete poured into shuttering. It is a hip-roofed building of 70 m<sup>2</sup> with wooden window surrounds and the external appearance of a small bungalow (Figs 10, 13). The generator(s) fed accumulators/batteries for the light. Power in use included 110 volt DC and 240 volt AC. The interior has a loading bay, a radio room, a generator room and what is probably a battery and electrical equipment room (for ancillary equipment such as switch gear, converters, transformers and radiators for surplus power). There was also a radio room in the concrete power house.

The concrete construction may have been for fire protection and because the site had military functions. It is likely to have asbestos ceiling linings.

The weather board *garage* has two substantial bracing timbers on the northern side (Fig. 14).

The keeper(s) had a small *cow shed* and fenced yard adjacent to the western extension of the shelter belt. This was present in 1941 (see Fig. 2) and was re-built in concrete blocks more recently.

There are further interior photographs on file at the Pōneke Area Office Department of Conservation.

My impression is that the no. 1 keepers house, the concrete generator (power) house and the small Marine Department stores shed (behind the no. 2 keepers' house) are of more than average interest.

## **Roads and paths**

In 1941 there was a gravel road from the north into the lighthouse reserve (see Fig. 2). There was no road within the reserve but there was a garage (Fig. 14) with a double concrete pad. The northern road forked just north of the reserve and followed the western edge of the shelter belt past the lighthouse to the radar station buildings. The formation of this road is still visible on the western edge of the shelter belt. The barracks built post-1941 is beside this road.



Within the reserve area in 1941 there was a distinct light-coloured path from the entrance following the western internal margin of the shelter belt to the front (east) of the garage.

In 1941 there was a prominent horse-shoe shaped path to the west of the generator shed which passed around what is now an elevated mound with a succulent cover (see Fig. 2). The path and the mound may relate to the installation of the radio aerial which passed overhead.

In 1941 there was also a circular path about 25 m in diameter around the mound on which the south-western radio mast is sited (see Fig. 2). This leads out to the south-western corner of the shelter belt to the radar station road. It presumably relates to the raising and lowering of the aerial.

## **Quarry**

There is an oval area about 12 x 6 m of excavation and levelling at the cliff edge 100 m east of the keepers' no. 1 house (Fig. 15). There are large sections of bolted hardwood including some bracing timbers on the surface. This area is at the head of an open gully with an even, steep slope to the beach below.

It is possible that this is the spot where the first foundations for the light were explored and abandoned for want of solid bedrock (see Beaglehole 2006: 142-143). In this position a 12 m-tall light might not fully command the coast and it seems unlikely that it would have been planned for that site.

It is more likely that the site chosen first was where the signal platform (and NIWA tower) is today. Soil and gravel from the quarry may have been used to assist in superficially levelling the area around the signal platform.

Alternatively, the hardwood beams may be components of an aerial cable way station or gravel bin. Gravel for concrete and some goods may have been brought up here by an aerial cableway. However, nothing shows in the 1941 aerial photograph so this is unlikely.

Part of this area has also been used as a dump. The dump may go back to the first use of the station and, towards the bottom, could contain significant artefacts relating to the first period of use of the lighthouse settlement.

There was a foot path down the open gully below the quarry. It skirted the foot of the cliff and trended down to the coastal point (it shows in the 1941 photograph, bottom of Fig. 2).

## Lighthouse

The plan outline of the *lighthouse base* was mapped (see Fig. 4) and the lighthouse photographed (see frontispiece). With its 12 m height, its fine hexagonal form and external curved concrete ribs, it is an essential visual element to the lighthouse settlement theme of the Baring Head Recreational Reserve. As noted it lies on its own reserve area vested in the Maritime Safety Authority. No further recording has been done on the lighthouse.

## Radio beacon masts

There are two approximately 21 m tall *masts* on the recreational reserve: one in the south-western corner, the other on the north-eastern fence line (originally outside the fence) (Figs 16, 17, 18). They were for a radio beacon for ships to navigate at night and in fog. Only the masts remain.

The masts are made of angle iron sections. The lower part of each is a cross-diagonally braced box-girder construction with each of the five box sections being about 2 m square in plan and 1.8 m high. The middle and upper sections are formed of continuous vertical trusses with the diagonals staggered from one side to the next and tapering steadily to the top where the horizontal sections may be about 30 cm square.

The south-western mast is somewhat downslope from the other. It lies on top of a natural mound about 3 m tall. Its effective height above the general ground level is about 24 m and a line between the tops of the masts would be about level. The masts are 111 m apart (measured by tape) and the aerial fixed between them was orientated north-east/south-west. This mast is maintained within a small Police reserve and has New Zealand Police and other VHF antennae on it.

North-east of the north-eastern mast and about 25 m from the fence is a concrete block counter-weight (weighing about 500 Kg) and two *galvanised anchor stays* (Fig. 18). The cable from the aerial came down to a steel bracket (held by the stays) from which the counter-weight was suspended. South-west of the south-western mast is a *winch* with galvanised wire cable and a distinctive acute-angled wing of post and rail fence (presumably to keep stock from rubbing against the tensioning wire). There seems to have been no lateral stays to the towers.

Overall, this arrangement may be interpreted as: (1) a semi-static stay with counter-weight holding the cable over the north-eastern mast and (2) a live tensioning cable over a pulley or pulleys (the pulley shafts are still visible) atop the south-western mast to raise and lower the aerial.

The aerial is likely to have been a “Marconi T Antenna” with an effective antenna length of about 50 m (Leach pers. comm.). The central feeder wire would have been attached somewhere above the generator building. This building also functioned as the wireless

room (another reason for disguising/camouflaging it as a keeper's house). There is a twin galvanised pipe bracket on the northern elevation (see Fig. 13) which may have secured the lower part of the feeder wire. Figure 19 shows part of the 1936 plan for the antenna.

The installation of the beacon was problematic because of the proximity of Wellington transmitters (AJHR H-15, 1935, 1936).

A radio beacon provides a continuous transmission of an identifying morse signal at a low frequency for direction-finding by ships. The radio beacon's proposed specifications were for two AM transmitters consisting of CW (morse) with the letters ZLOA or ZLOG at 670 KHz. It is not exactly clear from the records what ultimately was installed. The gazette notice suggests one beacon putting out ZLOA at 297.5 KHz (1008 metres wavelength) (NZ Gazette 67: 2290, 7 Oct 1937. However, the antenna wire was designed to resonate at 680 KHz (Leach pers. comm.).

The lighthouse station was connected by telephone landline (AJHR H-15 1935, 1936), so there was no need for a radio telephone function.

The south-western mast is maintained and painted. The north-eastern mast is visibly rusted at many of the bolted joints and also on the concrete base which needs to be kept dry and clear of soil, grass and encroaching vegetation. The stability of this mast needs to be reviewed. It is unclear as to whether it is in the reserve area or in the adjacent land.

### **Signal mast (flagpole) and platform**

North of the lighthouse and within the fenced NIWA compound are a number of concrete structures. The 1941 photograph shows steps rising to a natural mound, a path and a square platform in a bright colour (new concrete) to the south-south-east of the lighthouse. This feature is still extant with two flights of 1.2 m wide steps and a path ('1939' marked in the concrete) which leads to a concrete platform overall 4 m square made up of four 2 m-square pads (Figs 20, 21).

On the north-eastern pad are three sets of two 7/8-inch bolts set in a radial triangular pattern with an impression on the concrete surface of a short length of steel RSJ held down by the bolts. This is probably the ground bracket for the white-painted steel or wood *signal mast* about 12 m tall with crosstrees which can be seen in Figure 3.

In the 1941 aerial photograph there is a pile of waste rock/soil at the foot of the cliff below this point. It seems likely that the area had unsound bedrock and that this was the first planned location for the light. The general area of the platform is buttressed by a concrete wall on the western and north-western sides (see below) and this again suggests that the ground was unstable.

As noted above there was a signal hut but its exact location is not known. It is probably a hut that stood just to the north of the signal platform.

## **WW II: radar station**

Immediately south of the lighthouse, the 1941 photograph (Fig. 2) shows a grey-roofed building about 12 x 4.5 m in plan, probably a barracks.

Adjacent and to the south of the barracks is a light-coloured concrete roof area about 7 m square with a light-coloured (concrete) roofed building with a bow front with large window apertures on either side of the frontage and small porch-like extensions at either side (see Figs 2, 3, 23). This was probably the housing for the radar. The bow front would be for visual observation, essential to determine the bearing of the target in early forms of radar.

The radar building can also be seen in the 1950s photograph (Fig. 3). There appears to be a radar transmitter and aerial still on the roof. The adjacent barracks is also visible in that photograph.

The radar building showing in 1941 and the 1950s is the surviving concrete building (now a NIWA lab) with the surrounding pad (see Figs 2, 3, 22, 23).

The porch-like extensions survive as: 1) a foyer/storage area on the east of the NIWA lab and 2) a section of truncated wall base on the west side. The north end of the concrete building has been infilled with sheet cladding and may have connected to the wooden barracks to the north.

In the 1941 aerial photograph, the south end of the concrete platform has a wall which is casting a distinct shadow. On the pad as we recorded it, there is a 100 mm wide concrete sill across the southern edge with light inset bolts and short lengths of returns on either side. Inside the returns in the concrete are shallow channels or gutters so that the pad would drain, i.e. there was no enclosed building over the pad.

The shadow in the 1941 aerial photograph, the sill with the returns, the guttering and the light bolts suggest that the front of the pad held a free-standing light wooden wall. Alternatively it may be the rear of a smaller structure which shows in the 1950s photograph (Fig. 3) which may be a mount for a small parabolic receiver for the radar.

South of the concrete pad there is a narrow path which runs to a steel RSJ post about 1.5 m high with a small steel plate on top.

North of the concrete pad is a low wall with buttresses and a distinctive setting of large tooth-like stones on top. This was a retaining wall holding the foot of the mound leading up to the signal mast (see previous section).

From its aerial position, some 20 m to the south of the lighthouse, the radar would have had an unimpeded sweep through about 240 degrees from north-north-east (Beacon Hill,

Palmer Head) to south-east (Cape Turakirae). This gave it coverage of all the marine area of eastern Cook Strait.

There is a more or less complete radar station at Sinclair Head (R27/182 observation post). This will have been similar to the Baring Head installation of 1943-1944 except that the former had its own power supply.

The Sinclair Head radar facility is next to and landward from a conventional observation post. The radar station there is a concrete-floored building about 5 m square in plan with an adjoining low (3 m high) rectangular tower (Fig. 24). The tower held a vertical hexagonal drive shaft made of steel plate for the rotating transmitter/receiver array. The shaft had a circular plate and adjusting brackets for the aerial at the top and, at the bottom, a petrol engine below ground level. (Baring Head had an independent supply of power from the generator.) The rotating mast for the array was about 7 m long and consisted of a lattice of bolted angle iron.

## **WW II: barracks**

There were probably *barracks incorporated with the radar room* at the radar station (there is a septic tank to the downhill to the west) and a second barracks built after 1941 near the entrance to the lighthouse reserve and west of the army road (see Fig. 4). The latter does not show in the 1941 aerial photograph. It does show as a foundation in Figure 3. It survives today as a concrete slab with a rim with bolts for the wooden frame (Fig. 25) similar to those by the radar station. It was probably a *Women's Auxiliary Army Corps (WAAC) barracks* for the women running signalling and the radar station in 1942-1945.

In addition, there is a barracks foundation with ablution block north of the trig and an observation post R28/21 (not in the recreation reserve).

## **CONCLUSIONS AND RECOMMENDATIONS**

Baring Head lighthouse was completed in 1937 and from its earliest conception must have had a coastal defence function. Although the keepers' houses are wooden, the generator shed is made of poured concrete and designed to look like a bungalow. This was primarily a precaution against fires. Concrete was also preferred by the military authorities because it did not shed splinters when struck by shrapnel.

Baring Head was an important military and radar post in the course of WW II. Interesting and easily interpreted relics of this era are still extant including the radar station building, barracks and the facilities that probably had a partly military function such as the generator building. The radio and generator facilities must have been shared between port staff and army staff prior to and during WW II. Again, the US National Register

guideline on historic aids to navigation stresses the significance of WW II facilities in the history of lighthouses.

The NIWA occupation and use of the WW II radar building and surrounds is now an historic and continuing function of the area.

### **Conservation issues**

From the point of view of ‘whole of government’ management the lighthouse complex needs to be managed as a whole. The overall management task has potentially been made difficult by the varying land tenures between the parts, including the NIWA buildings.

The layout of the shelter belt, the headland margin, the keepers’ houses and generator shed, the light, signal platform and the WW II structures and ruins form an integrated whole in terms of the theme of lighthouse settlement and WW II coastal defence.

The US National Register guideline on historic aids to navigation is clear that the integrity of design (form, plan, spaces, structure and style) of a lighthouse complex requires the retention of ‘keepers’ quarters’ amongst other features (Delgado and Foster n.d.: 8).

Further research or work should be done on the following topics:

1. Oral history from WW II staff (if possible, this is urgent), 1950-1960s port lighthouse staff and DSIR staff from the 1960s.
2. Recording of further detail of the generator building and the old concrete (NIWA laboratory) hut including its interiors, which may assist with determining radar and radio functions.
3. Recording of the elevations of the weather board lighthouse keepers’ no. 1 and no. 2 houses, the generator (power) house, ‘forensic’ examination of internal fittings that relate to WW II and radio functions, and an assessment of their architectural merit.
4. Archival research (if the records still exist) into the original drawings of the various houses and the lighthouse itself.
5. Investigation of the origin and history of the small stores hut at the rear of the lighthouse keepers’ no. 2 house.
6. Detailed safety check and maintenance schedule for the north-eastern radio mast which appears to be badly rusted; it also needs to be determined whether it is in the reserve area.
7. Protection of the quarry and dump area, at least until its potential as a source of artefacts relating to the early period of the lighthouse has been explored.
8. A plan needs to be prepared for maintenance, re-planting and historically appropriate inter-planting of the 1937 shelter belt, especially the western extension.

9. A plan needs to be prepared for interpretation and visitor safety in the reserve area.

## ACKNOWLEDGEMENTS

To Foss Leach, Chris Edkins, Gareth Cooper, Philippa Crisp and Paulette Wallace.

## APPENDIX 1

See Fig. 4.

Baring Head GPS points	NZTM	
	E	N
Lighthouse base	1756392	5414248
Post 1	1756376	5414283
Western cliff end of fence	1756287	5414408
Post 2	1756400	5414383
Post 2B (true boundary)	1756398	5414378
Main gate, western post	1756398	5414378
Post 3	1756482	5414360
North-eastern radio mast	1756501	5414334
Post 4	1756525	5414306
Post 5	1756438	5414233

## REFERENCES

Archsite. <http://nzaa.eaglegis.co.nz/NZAA/Default.aspx>

Baigent, A.J. n.d. Coastal Artillery Defences. (<http://www.riv.co.nz/rnza/hist/baigent1.htm>)

Beaglehole, Helen E. 2006. *Lighting the Coast: a History of New Zealand's System of Coastal Lighthouses*. Christchurch: Canterbury University Press.

Cook, P. 2000. *Defending New Zealand*. Part 2. Wellington, Defence of New Zealand Study Group.

Delgado, James P. and Kevin J. Foster. n.d. *Guidelines for Evaluating and Documenting Historic Aids to Navigation*. (U.S. National Register Bulletin 34.) U.S. National Park Service. ([www.nps.gov/history/nr/publications/bulletins/nrb34](http://www.nps.gov/history/nr/publications/bulletins/nrb34))

Galbreath, R. 1998. *Making Science Work for New Zealand*. Wellington, Victoria University of Wellington Press, in association with the Historical Branch, Department of Internal Affairs.

Leach, Foss. pers. comm. Radio ham, Ngakuta Bay, Marlborough Sounds.

Ross, J.M.S. 1955. *Royal New Zealand Air Force: Development of Radar*. Digital version on N.Z. Electronic Text Centre.



**FIGURES**

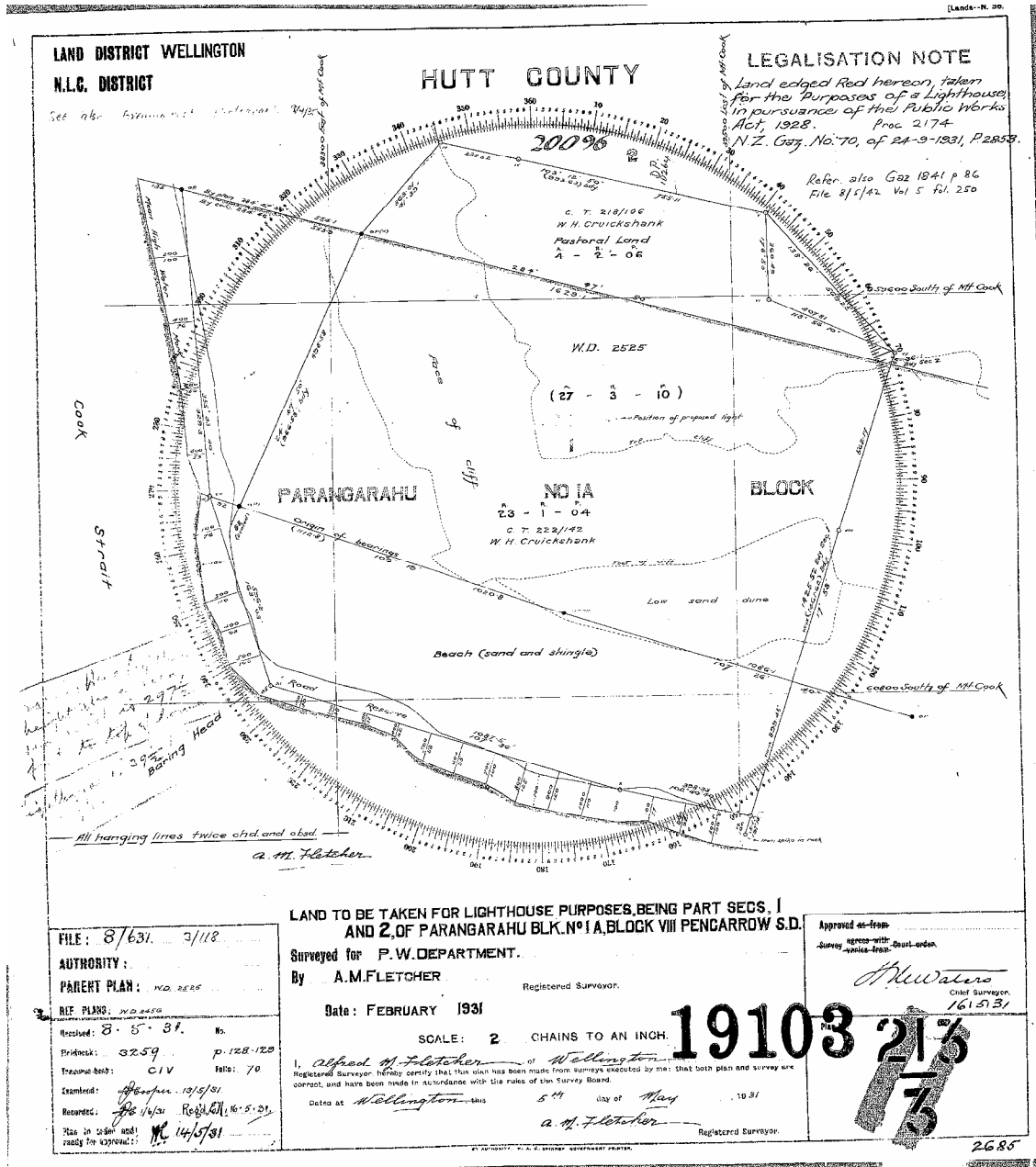


Fig. 1. Cadastral plan SO 19103 (1931) showing outline of reserve and proposed position of the lighthouse.



Fig. 2. Baring Head lighthouse reserve area 17 February 1941. North is to the top. Crown copyright photo New Zealand Aerial Mapping no. 24773. Note the waste rock at the foot of the cliff below the signal mast platform.



Fig. 3. Detail of Whites Aviation aerial oblique from the west. The date is estimated to be in the 1950s. Some salient features deserve note: 1) radar hut with possible aerial and barracks by the light, 2) signal mast, 3) signal hut (left of the mast)? 4) both no. 1 and no. 2 houses have small third bedrooms off the entry hall, 5) the second (WAAC?) barracks has been demolished. Courtesy National Library/National Archives ABPL W5221.

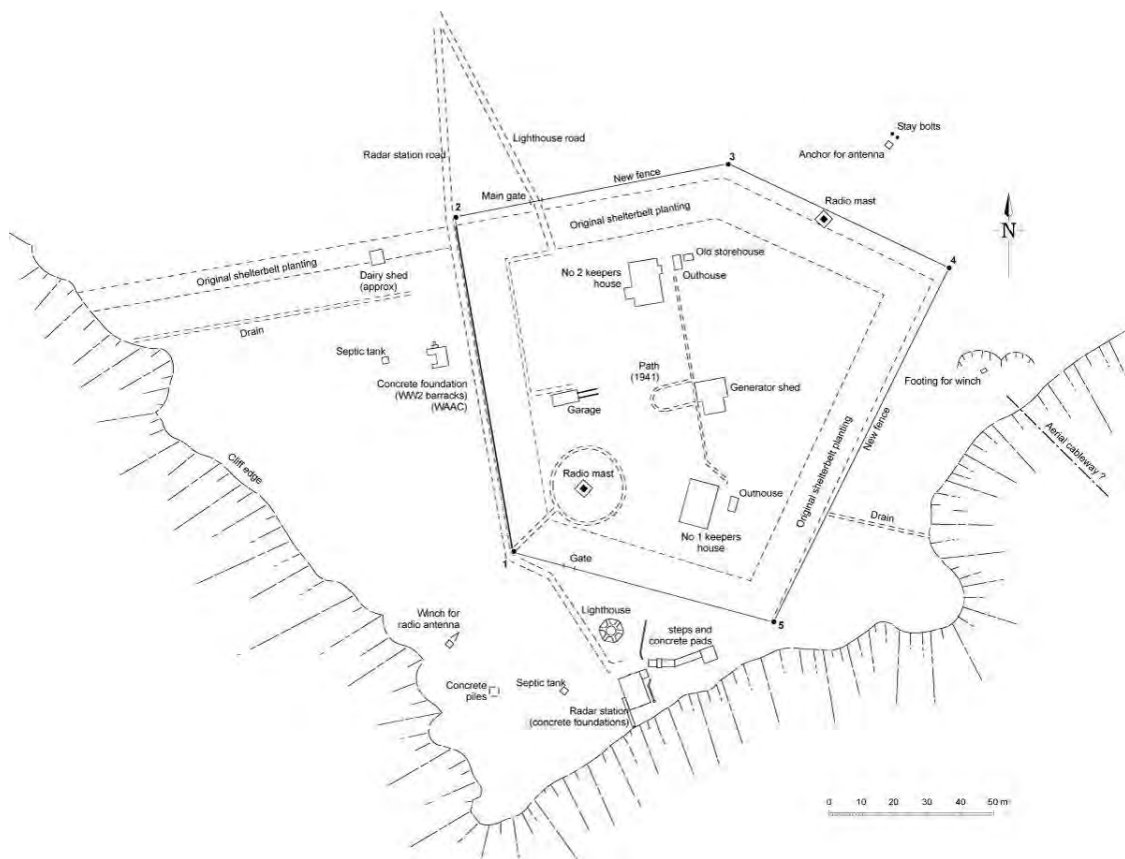


Fig. 4. The Baring Head lighthouse settlement area R28/48. Tape and compass plan, based on the 1941 aerial photograph (see Fig. 2). Numbered GPS points are in Appendix 1. The radar station area is shown in detail in Fig. 22. Kevin L. Jones and Chris Edkins May 2010.



Fig. 5. A view from the north-east, 1937. National Library of New Zealand



Fig. 6. Similar view May 2010.





Fig. 7. Open *Pinus radiata* treeland with taupata and flax understorey in northern part of shelter belt. The trees are over 70 years old.



Fig. 8. Keepers' houses and the generator (power) building (centre right) from the south. The garage is at left.



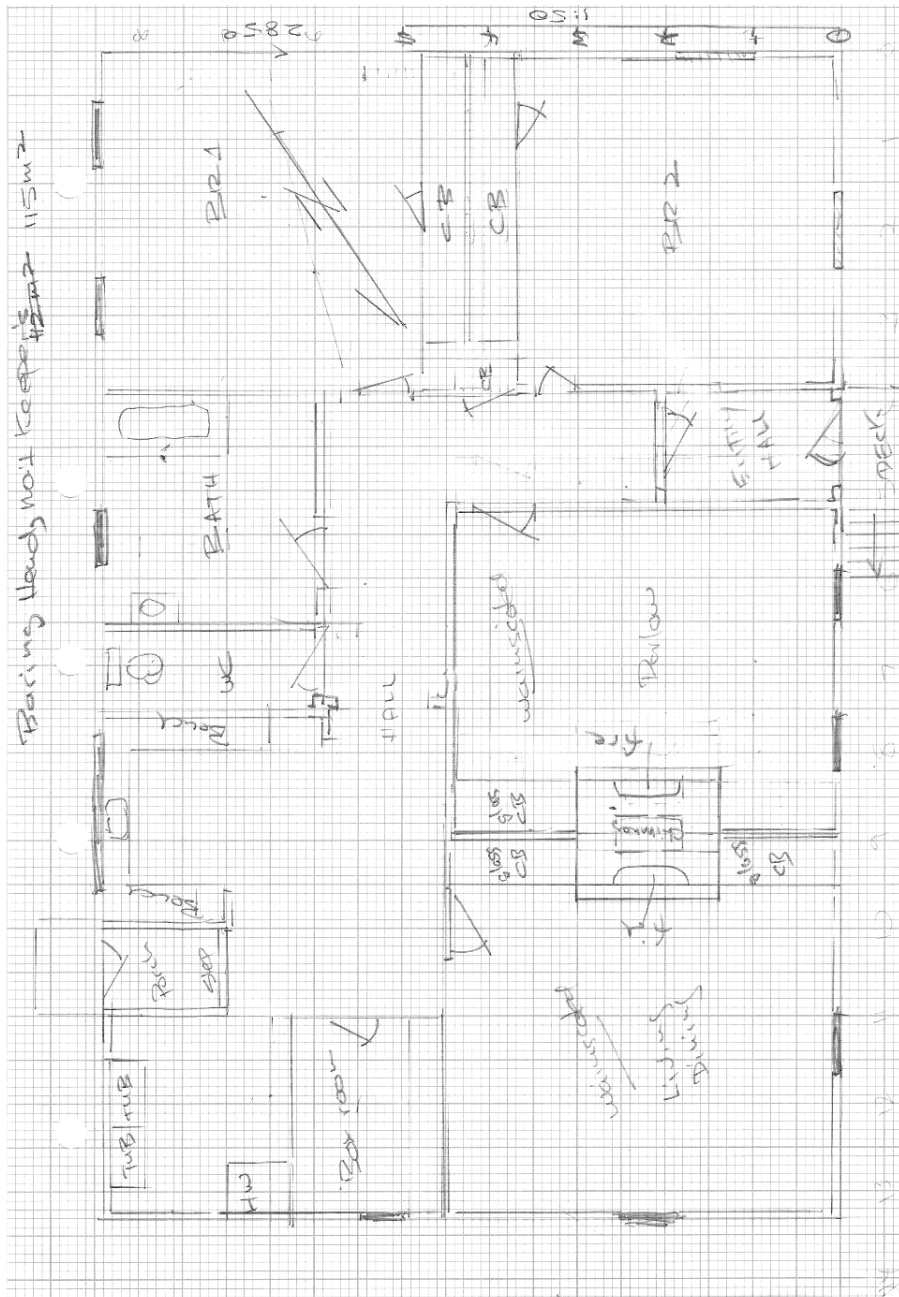


Fig. 9. Interior plan of the no. 1 keepers house.

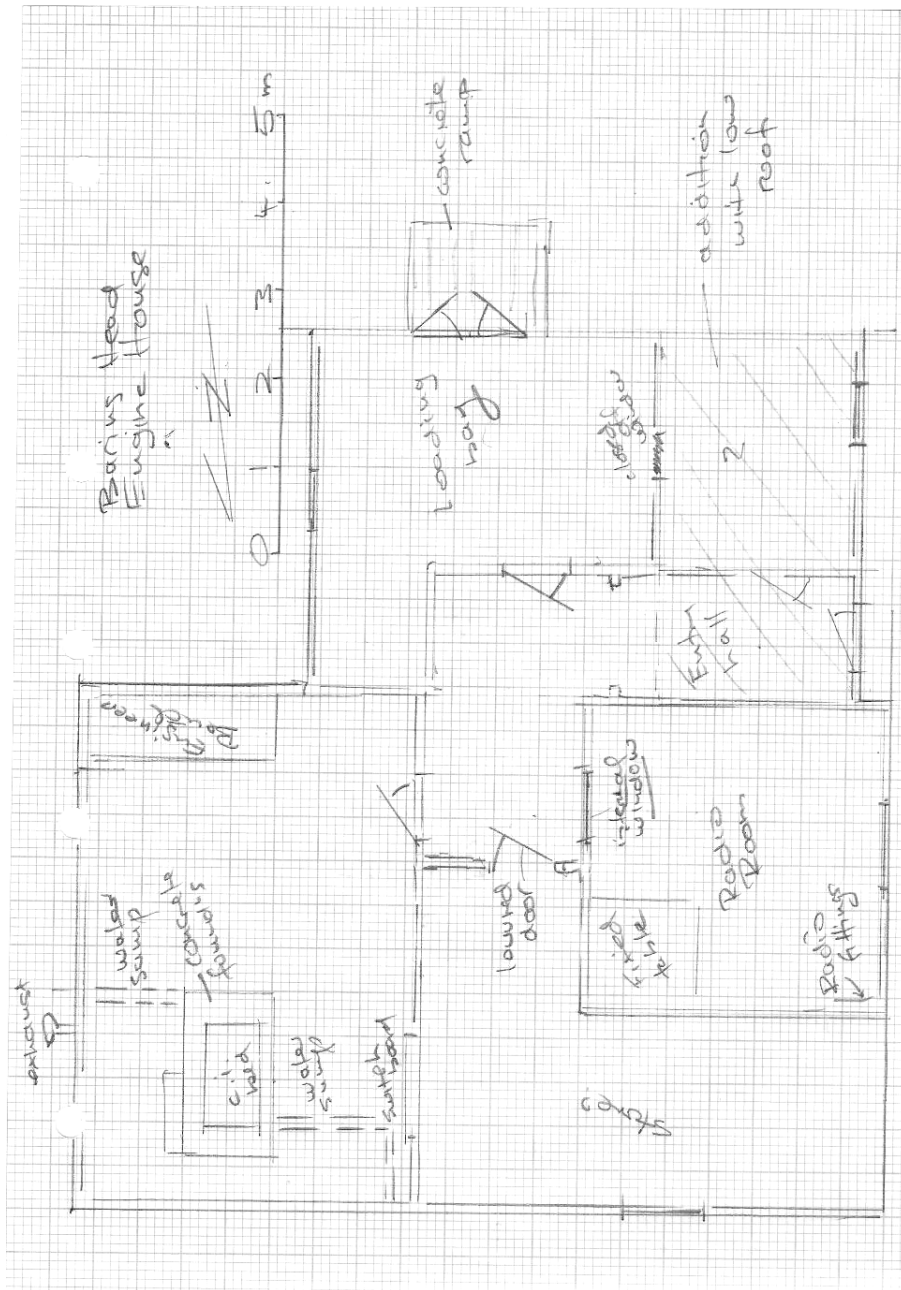


Fig. 10. The generator or power house incorporating the radio room.



Fig. 11. The Marine Department type store behind keeper's house no. 2.



Fig. 12. The drain from the no. 2 keeper's house.





Fig. 13. North elevation of the concrete generator building. Note twin galvanized pipes under the eaves (upper right) which may have held a bracket for the feeder wire to the radio antenna.



Fig. 14. North elevation of the garage with later buttresses.





Fig. 15. The quarry area with wooden relics and bracing timbers.



Fig. 16. The north-east aerial mast.





Fig. 17. The winch with the wing fence to keep stock away from the tensioning cable running across the top of the south-west mast to the Marconi T-antenna positioned between the masts.



Fig. 18. Concrete counter-weight for the static tensioning stay to the north-eastern mast. It was originally suspended in a steel frame (see Fig. 19).



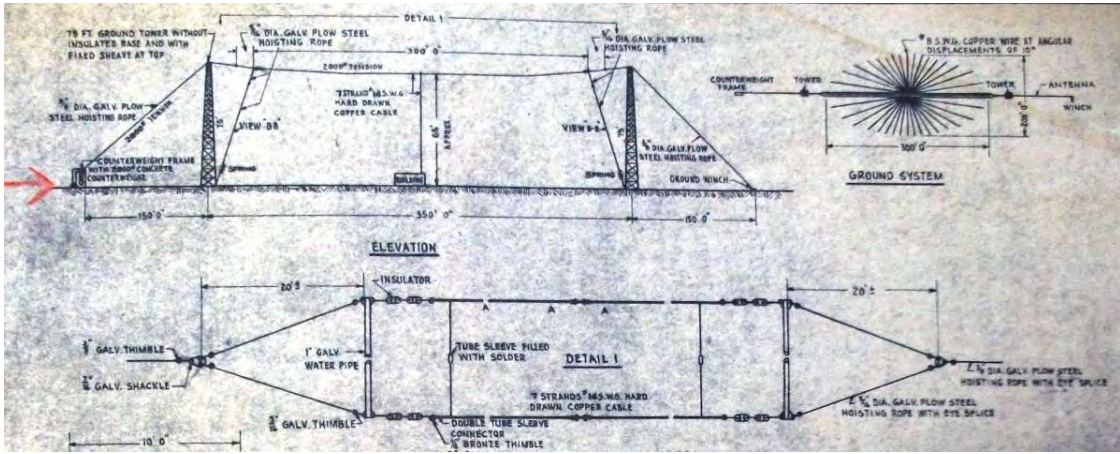


Fig. 19. Masts and Marconi T-type antenna as designed (P. and T. Department W.6649 A, 19 August 1936).



Fig. 20. The signal platform (at bottom), path and steps dated 1939 and the concrete radar building centre top. The WW II barracks would have extended out to the right where the near NIWA hut stands.





Fig. 21. The radial arrangement of bolts for the brackets holding the signal mast.

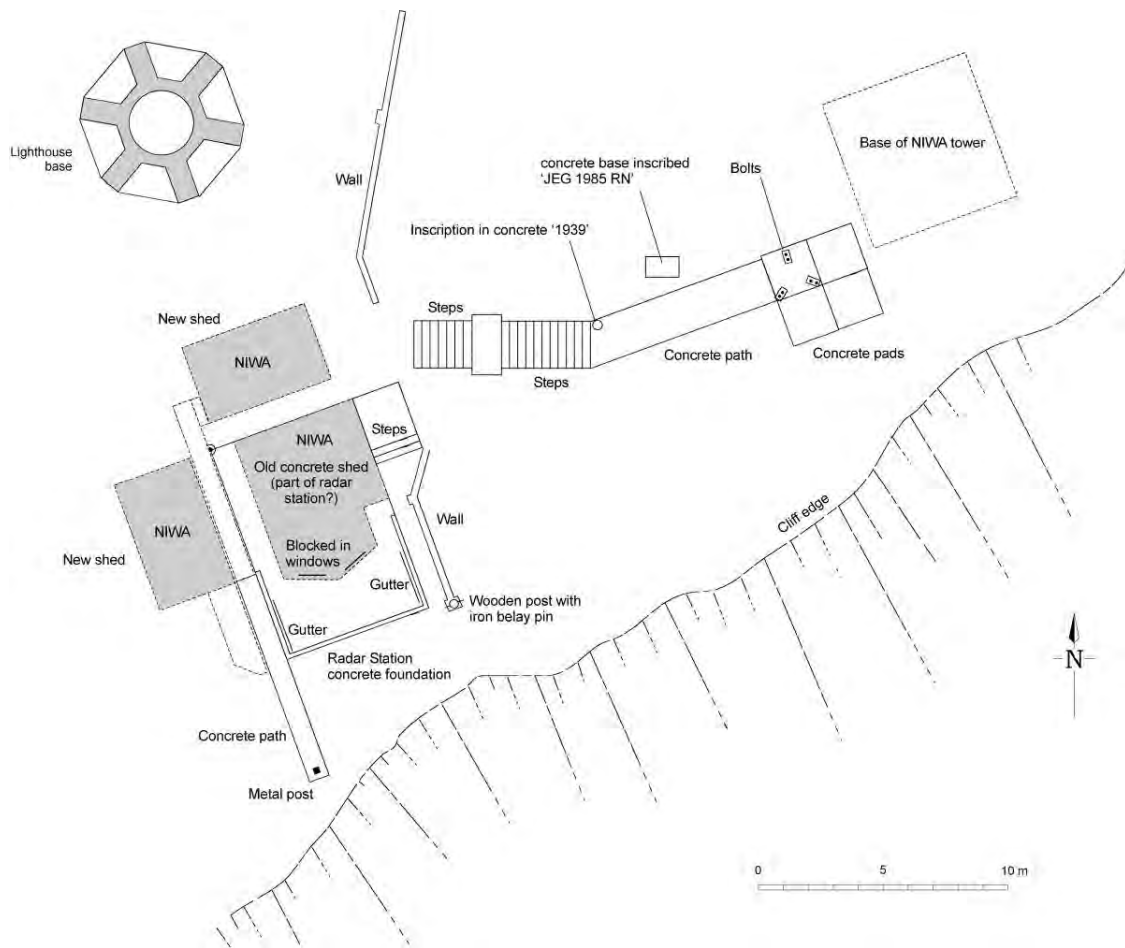


Fig. 22. The radar station and signal platform area. Tape and compass plan. Kevin L. Jones and Chris Edkins May 2010.



Fig. 23. The WW II radar building from the south-west with the blocked-in bow window and other window apertures.

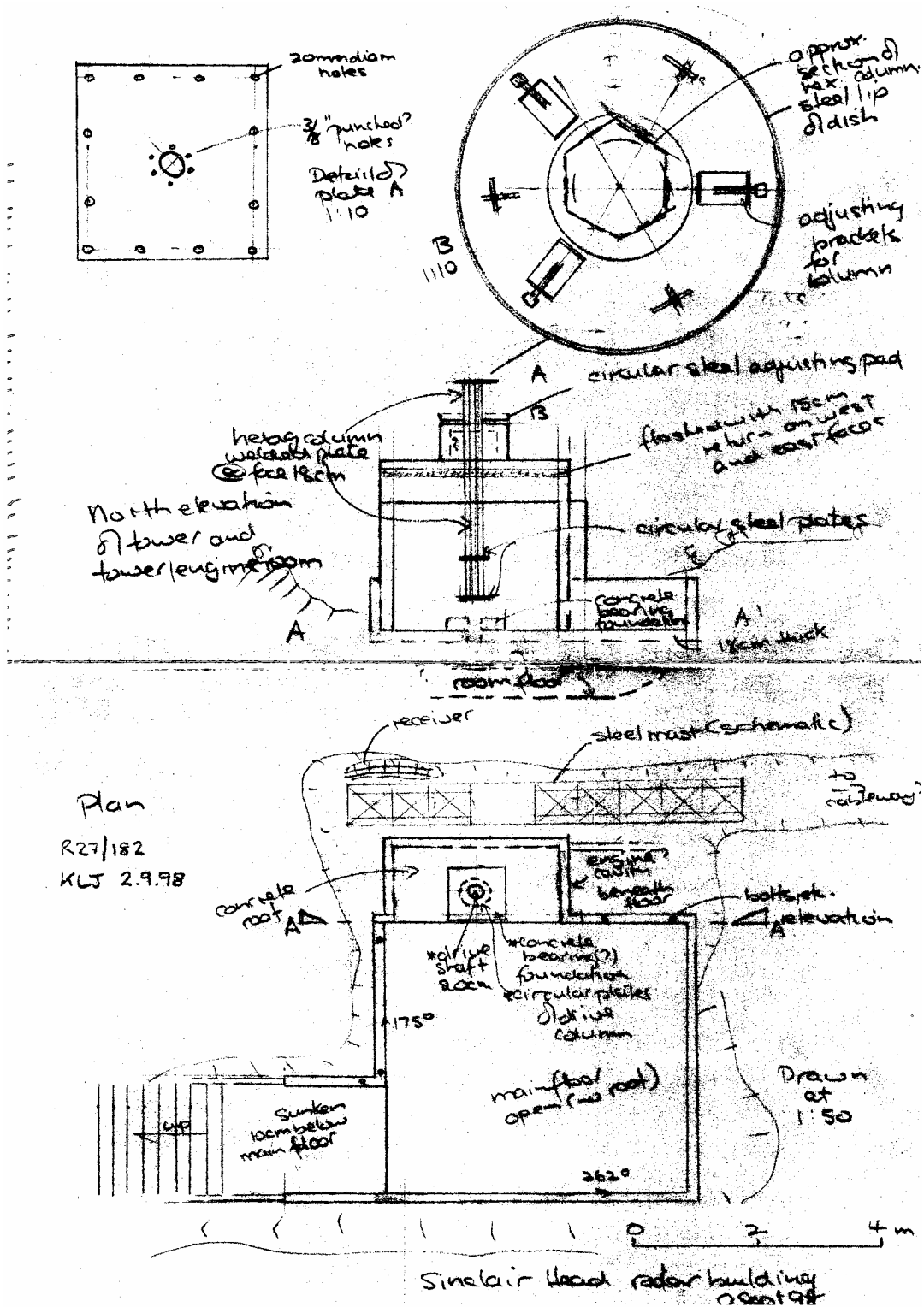


Fig. 24. Ruins of army radar station at Sinclair Head 1942-1943(?), probably similar in concept to that built at Baring Head.





Fig. 25. Foundations of the WAAC barracks, western extension of shelter belt beyond Sinclair Head and western Cook Strait in the distance.