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PORT'S WATER RACE (D46/143), LONGWOOD RANGE, SOUTHLAND: THE ARCHAEOLOGY & INTERPRETATION OF AN EXTENSIVE WATER RACE SYSTEM.

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Introduction

Port's Water Race is situated in the Longwood Range west of Invercargill in Southland (Figure 1). It supplied water to the Round Hill goldfield where one of New Zealand's largest and longest running sluicing operations was carried out. Hamel (1983) recorded the race as site S176/68 (now D46/143). By necessity much of Hamel's recording involved the dead reckoning of location in the thick bush which is typical of the Longwoods. With the advent of readily available small GPS units in the late 1990s it became possible to carry out far more detailed survey work in this environment. In 1998, 1999 and 2000 three seasons of field surveying were commissioned by the Department of Conservation, and three corresponding reports were produced which discuss the race and other archaeological features at some length (Petchey 1998, 1999, 2000). A further period of work in 2003 is currently in preparation.

The detailed study of this nineteenth century water race system has allowed examination of race design and execution from an archaeological perspective, with contemporary sources used to interpret the surviving evidence. This paper presents some details of this examination and interpretation.

Environment & Description

The Longwood Range stretches for about 25 km north-south, bounded on the south by the old settlement of Round Hill and on the east by the Pourakino Valley. The Longwood trig is at a height of 764 m, and the hill slopes are generally quite moderate but broken by numerous gullies and stream courses. The vegetation cover is a mixture of virgin and regenerating cut-over forest (mixed podocarp, beech and rata) and some plantation forest.

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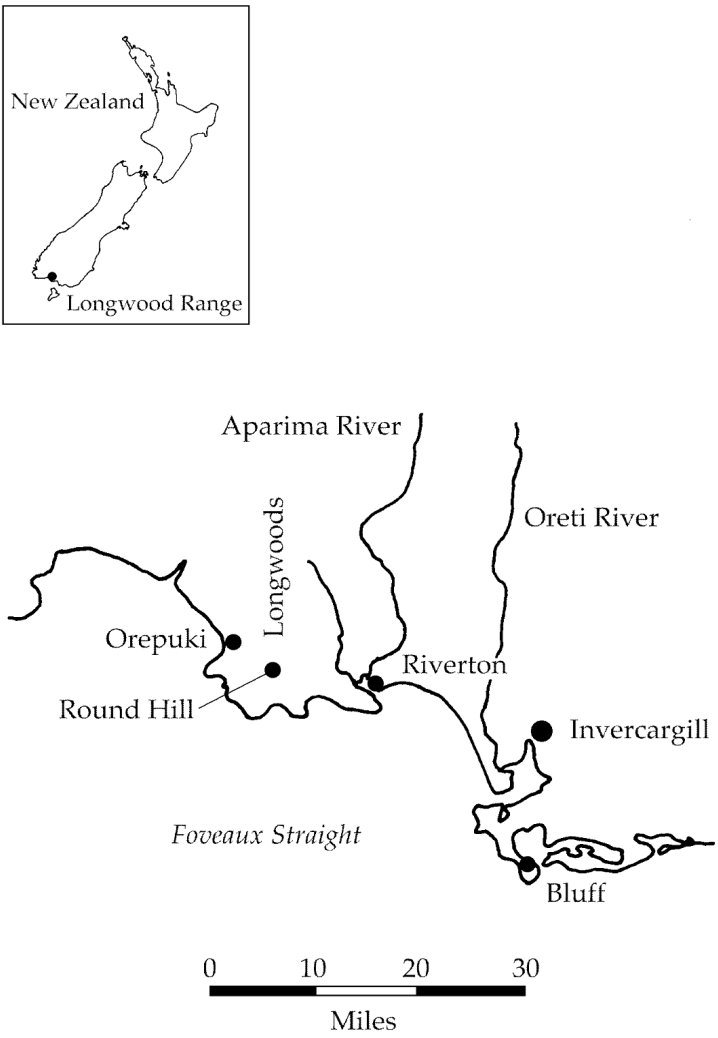

Figure 1. Location of Round Hill and the Longwood Range, Southland.

Several goldfields were located in the Longwoods, of which the Longwood field itself and the Round Hill field are of importance here. Port's water race supplied water to both of these fields at different times.

Port's Water Race in its final form ran for 39 km from Granity Stream in the north to Round Hill in the south (Figure 2). It picked up water from most or all of the intermediate streams, and had an ultimate quoted capacity of 27 government heads (1 head of water = 60 cubic feet [1.7 m^3] per minute).

Brief History

Mining along the South Coast began in the mid 1860s, when James Kirton found gold in the beach at Orepuki, and by 1866 a town had been established there. By the 1870s gold mining had extended into the Round Hill area, but when the ground was abandoned by the European prospectors Chinese miners moved in and made a considerable profit. This was the only time in the New Zealand goldfields that the Chinese were the first to work a profitable goldfield (Bradley & Egerton 1996a, 1996b).

The Longwoods goldfield, situated on the eastern flank of the Longwoods Range north of Round Hill, had been discovered by Patrick and Morgan Hayes in April 1877 after eight or nine years of prospecting. The first section of Port's Race, built by Henry Horatio Port, was completed in 1877 to supply water to his mining claims in this goldfield. The race initially ran from Gorge Creek to the claim, later being extended to include Dawsons Creek.

As was common in the goldfields there was a good deal of prejudice against the Chinese miners, and in 1888 a suggestion that water rights at Round Hill should be withheld from Chinese miners prompted some of those Chinese to approach Port to ask him to extend his race to that field. As a result he entered into a partnership with one of the leaders of the Chinese community, Joe Park, and the race was brought to Round Hill using Chinese labour.

However, large mining companies eventually acquired all of the Round Hill water rights, and the Chinese were squeezed out. The Round Hill Mining Company carried out round the clock operations, and substantially upgraded Port's Race. This work included an enlargement of the lower part of the race, followed by extensions north to Cascade Creek, in 1896, and Granity Creek, in 1897.

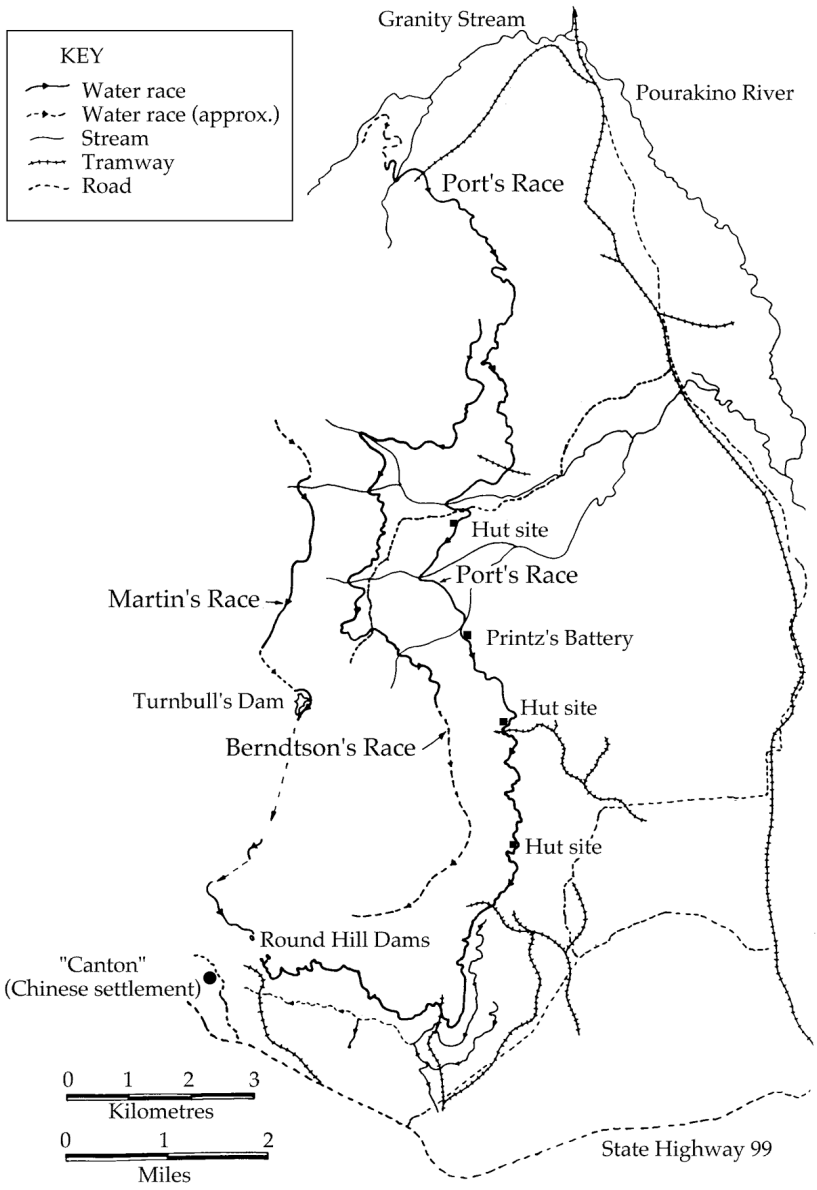

Figure 2. The main Longwood Range water races.

The race continued in intermittent use (work largely ceased between 1925 and 1932) until the 1950s. It was then abandoned, but much of its length continues to be used by hunters and to a limited extent as a recreational walking route.

Archaeological Description

As mentioned above, the race runs for a distance of some 39 km from north to south. This distance (24 miles) is known from two contemporary plans showing the chainage of the race that survived in the possession of the late Charles Port, the great-grandson of Henry Port, and copies are held by the Department of Conservation. Some 37 km of this distance was covered during the 1998 and 1999 surveys.

The race still passes though it original 1877 destination in the Longwoods Goldfield. It runs just above the site of Printz's Battery (site D46/150), a six-stamp steam powered stamper battery. This battery site and associated gold mine was surveyed in detail in 1998 (Petchey 1998).

The race is generally large and well constructed. The channel of the race itself varies somewhat according to the nature of the ground being traversed, but typical dimensions are 1090 mm wide and 660 mm deep near the northern end, and 1270 mm wide and 890 mm deep at the southern end. Cuttings up to 2.4 m deep were encountered where the race was cut through undulating ground. For most of its length the race ran in a plain earth channel, but in areas where the ground was more friable timber boxing was used in the cut. Several good examples of this survive. A maintenance track ran along the berm on the outside of the race, this path continuing in limited use as a walking track.

Tunnels were frequently used to pass the race through or under obstacles such as ridges, tree roots, and in one place a saddle in a ridgeline. The tunnels that survive were typically no bigger in cross section than the race dimensions given above, with arched roofs. Long tunnels had access portals or shafts cut into them at regular intervals, presumably both to facilitate construction, and to allow blockages to be easily cleared.

Water was channelled into the race using feeder races from large creeks, or simple weirs on small creeks. The small weirs acted as stream crossings as well as collection mechanisms. Large creeks could not be similarly treated, as flood flows would soon destroy a simple log weir. Instead, they were crossed using timber flume structures, a number of which are still standing but in a very derelict

Figure 3. Timber aqueduct over Taylor's Creek.

state. Figure 3 shows the best preserved of the surviving aqueducts, over Taylor's Creek.

Excess water was shed by control sills placed at intervals along the formation. These typically were a cut through the outside berm and were fitted with a basic timber sluice gate (Figure 4). The water level in the race could be adjusted by varying the height of the gate timbers. Examination of a surviving example of

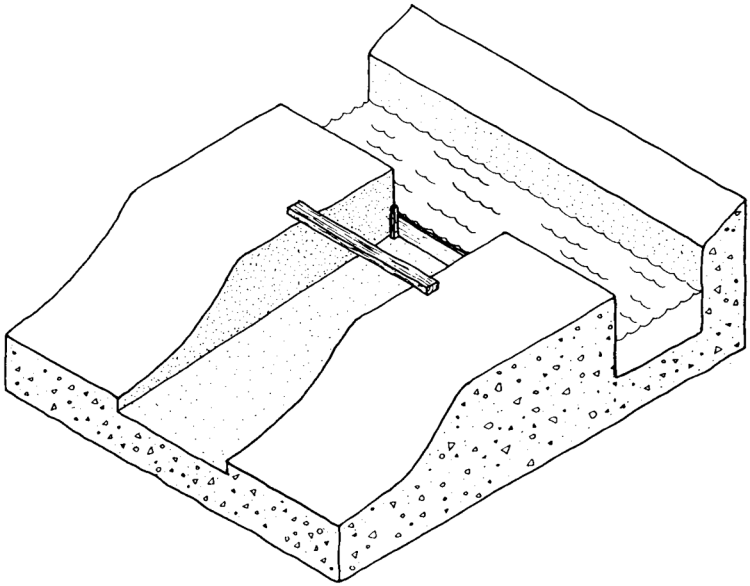

Figure 4. Isometric Sketch of typical overflow sill on Port's Race.

one of these structures was used as a basis for determining the actual maximum carrying capacity of the race, which is discussed below.

The race at its maximum extent ended above the Round Hill Diggings, but in its later years it fed into two large holding reservoirs slightly to the south-east of its original terminus (Figure 5). These reservoirs supplied water to the nearby large hydraulic sluicing and elevating claims via long pipelines. While they no longer hold water, these two reservoirs are in excellent condition. The eastern reservoir (site D46/159) was formed in 1912 by constructing a large earth dam across Californian Gully just below the confluence of three small creeks. It was linked to the older western reservoir (site D46/158) by a tunnel, and water then flowed out through an underground pipe to the start of the main pipeline to the mining operation. Both the tunnel and the underground pipe are still intact and carry the water that naturally flows through the dams.

The main pipelines to the sluicing operation on the Ourawera Flats were lifted once mining ceased, although a few minor lines were simply abandoned. In the

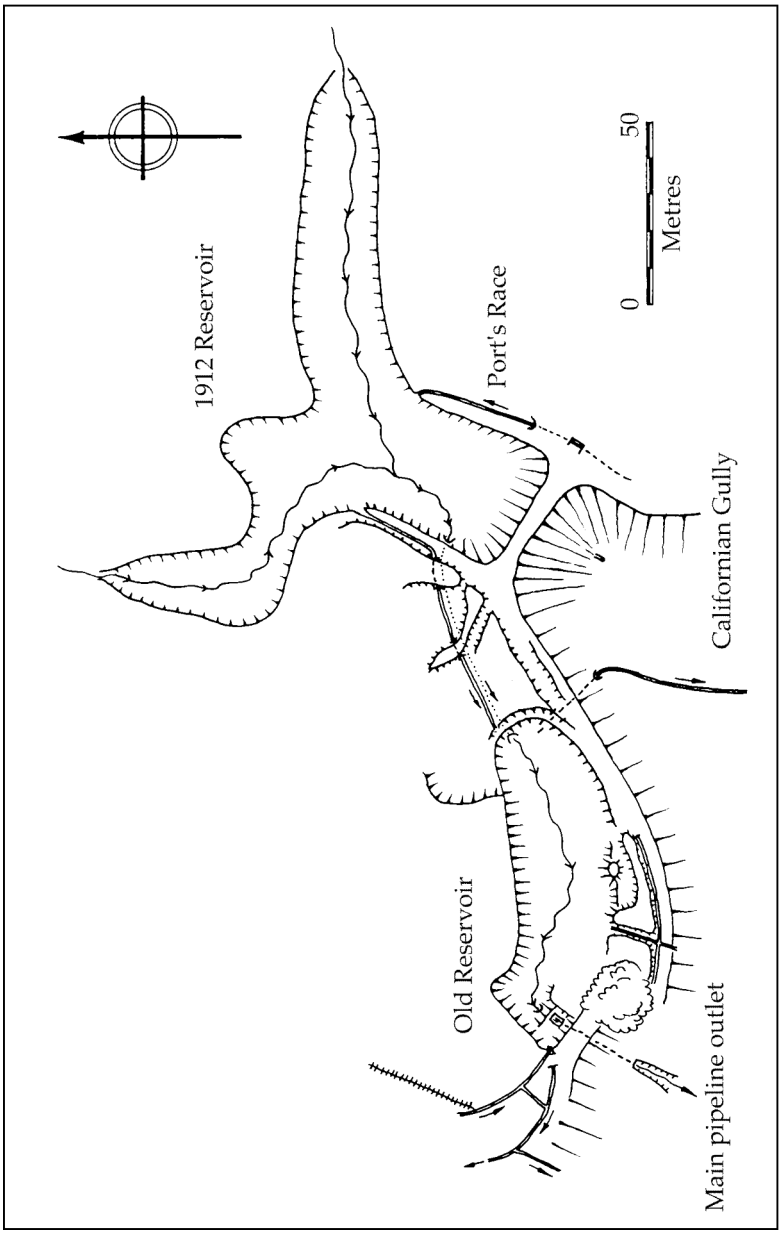

Figure 5. The main Round Hill resevoirs.

wet Longwoods environment these have generally rusted almost completely away. The line of the main pipeline that was used in the 1950s can still be seen onaerial photographs, cut through the bush, and its route can just still be followed on the ground.

Carrying Capacity

The amount of water supplied by a race was critical to a mining operation, while the amount that could be legally taken by a race was determined by the terms of the necessary water race licence. In some cases multiple parties held rights to water from certain streams, and litigation over water rights was common in the Warden's Courts. Accurate calculation of flow was therefore necessary, and here the contemporary formula provided by the mining engineer H.A. Gordon (1906: 307) is applied to Port's Race. Measurement of an overflow sill was used as a basis of the calculation of water race capacity, as the sill dimensions provide the best indication of the operational water levels in the race.

A sill with surviving timbers close to the half mile point on the race was chosen for measurement, as it was near the end of the race and should theoretically be representative of the race at its maximum capacity. It was also the most intact sill structure found. The condition of the sill only allowed rough dimensions to be measured, but this was still enough to work out approximate carrying capacity. The formula used was that given by Gordon for the carrying capacity of a tolerably straight and smooth sided race:

$$\text{Carrying capacity} = 6a \sqrt{2grs}$$

Where: g = the acceleration of gravity
r = the hydraulic mean depth
a = the sectional area
s = the sine of inclination

The race as measured, with parallel sides and timbering in place on the sill, has the following dimensions:

Width: 5 ft (1525 mm)
Depth: 23 in (585 mm)
Gradient: 13.25 ft per mile (2.5 m/km) (see Petchey 1998: 10)

This allows the calculation of the following figures:

r = 1.085
a = 9.5833
s = 0.0025

When following Gordon's calculations, this gives the carrying capacity of the race as 24.07 sluice heads, equivalent to roughly 1450 cubic feet (41 m^3) of water per minute. This agrees well with contemporary accounts that state that the race was enlarged to carry 27 heads of water in 1897. The slight discrepancy between the two figures is easily accounted for by both contemporary errors in estimated capacity and by modern errors in measuring a decaying and incomplete structure.

Discussion

Port's Race is a large and long race, which represents an enormous amount of work over many years. It remained in use for an unusually long time, only finally being abandoned in the 1950s after nearly 90 years of use in some sections. The substantial construction and relative late date of abandonment have meant that much of the race has survived reasonably well, and detailed archaeological examination is possible from visible surface evidence alone.

When the race was in use it was one of the main sources of water for the Round Hill gold mines, and its efficient and reliable operation would have been essential to the economic viability of the mining. Several racemen were employed to carry out maintenance on the race, and the sites of three raceman's huts have been recorded. One of these was still standing when recorded by Jill Hamel in 1983, but has since been burnt down. The racemen would have carried out regular inspections of the race, repaired any leaks, controlled vegetation, and set the control sills and intake structures to regulate the flow. Once set, the race would have been self-regulating, the intake races and weirs collecting water, and the control sills and weirs shedding any excess water. All of these technological features would have been typical on races of this length and type, and similar design elements can be found on the other main races in the Longwoods, notably Martin's Race and Berndtson's Race. However, as the longest, largest and most accessible of the races, Port's Race is of considerable historic, archaeological and interpretive value.

As well as an important archaeological and historic site in its own right, Port's Race also forms part of an extremely complex archaeological landscape, which includes dozens of water races both major and minor, numerous dams and reservoirs, and large areas of gold workings. A further layer of historical interest is provided by the extensive network of bush tramways that ran through the area serving the local sawmills. One of these tramways, Buchanan's Tram, has previously been described (Petchey 2001), but dozens of others are unrecorded. Many were in use contemporaneously with the main race systems, and the remains

of basic timber bridges that carried the tramlines over the race cuts can still be found in places.

It is unlikely that all of the Longwoods and Round Hill archaeological landscape will ever be fully recorded or interpreted. It is simply too large, too complex and too overgrown. Current logging operations in parts of the Longwoods are destroying some of the bush tram systems, which largely post-date 1900 and therefore do not enjoy Historic Places Act protection. Without the HPA protection, there has been no requirement for survey or recording of these features prior to their destruction. A nomination as an historic area made some years ago is still awaiting processing.

A number of discrete systems and areas have been examined, although the focus has been largely on the gold mining systems within the Department of Conservation administered land area. What has emerged is a well-preserved, highly complex, and very important archaeological landscape. The proximity of the sites to public access and the generally easy nature of the low hills makes this area ideal for the development of recreational walking tracks with associated historic interpretation. A week of fieldwork in 2003 was carried out to examine track options that would provide access to the main reservoirs at the end of Port's race.

The southern Longwoods has the potential to be a very important area for both visitor interpretation and public awareness, and for the academic study of a complex industrial archaeological landscape. As the examination of theoretical water flow in Port's Race based on archaeological observations shows, there is potential for a great deal of detailed research into nineteenth and early twentieth century mining technology, and into the degree to which the historical record matches the field experience.

Acknowledgements

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