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Archaeological Research and Mitigation Strategy:

S15/573, Duncan Road, Tamahere, Waikato.

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Contents

1 Introduction 1

2 Archaeological sites 2

3 Preamble 3
3.1 Pre-European Māori agriculture in the Waikato and notes on methodology 3

4 Research Questions 5
4.1 Maori horticulture 5
4.1.1 General research questions to which the Māori horticultural remains may contribute. 5
4.1.2 Specific research questions regarding Māori horticulture 5

5 Methodology 6
5.1 General: 6
5.2 Specific: Excavation method and data recording 6
5.2.1 - Excavation method and data recording 6
5.2.2 Radiocarbon sample collection and selection 7
5.2.3 Crop identification 7
5.2.4 Palaeo-environmental sample collection, selection and analysis 8
5.2.5 Geoarchaeology 8
5.2.6 Artefact analysis 8

6 Archaeological Monitoring 9

7 Reporting and Analysis 9
7.1 Material Culture Analysis 9
7.2 Sediment sample analysis 9
7.3 Reporting 9

8 Reference 9

1 Introduction

This research strategy and methodology concern the archaeological investigation of S15/573, Duncan Road, Pukeroro, Waikato, which will be affected by the development of the Waikato Thoroughbred Racing Greenfields Hub. Part of the site will be preserved within the back track, while the remaining area will be largely destroyed by residential development related to the broader horse racing and equestrian sports project.

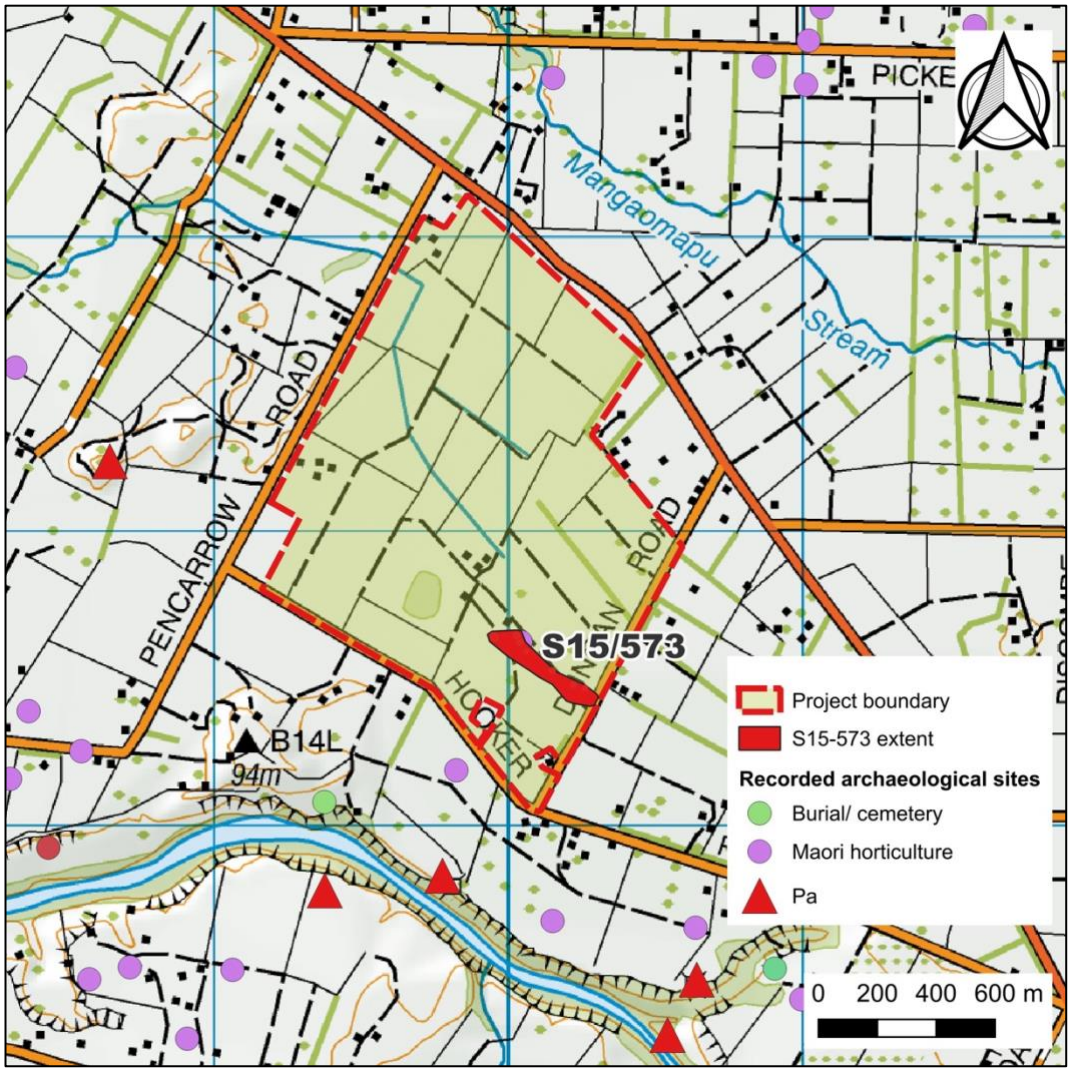


Figure 1. Plan showing the location of S15/573 in relation to the other archaeological sites recorded locally.



Figure 2: Map showing the identified estimated extent of the archaeological site S15/573 and its relationship to surrounding aspects of the project as an overlay with the Master Plan dated 18/8/2026. The northwestern part of the site is to be preserved and protected by a covenant, while the southern part will be subject to an archaeological investigation prior to the commencement of development.

2 Archaeological sites

A single recorded archaeological site, S15/573, is affected by the proposed development. It is a Māori horticultural site associated with the Waikato Horticultural Complex.

The archaeological deposits are discrete within the development area, although their precise extent has not yet been determined. Most of S15/573 will be protected through the development and into the future via a covenant. However, a part of the site will be affected by the development of the back track and, to a minor extent, by the neighbouring associated residential lots. Therefore, the affected part of the site will be subject to an archaeological investigation prior to the commencement of development work. The management of the remaining part of the site is detailed in the associated Archaeological Management Plan.[1]

The site is 800 m distant from the Waikato River, whereas similar sites and associated pā cluster strongly to the river. Horticultural sites commonly include the remains of seasonal

[1] Archaeological Management Plan: S15/573, Duncan Road, Pukeroro, Waikato. Prepared by Dr W. Gumbley. August 2026

kāinga, and the site's relative remoteness from the river and pā suggests that the remains of one or more kāinga are likely to be present within the site.

3 Preamble

The archaeology of the Waikato has only recently begun to be examined in detail, both at the level of individual sites and from a wider perspective on inter-site and intra-regional relationships. Knowledge gained from archaeological investigations is accumulating but remains patchy and incomplete, and understanding of agronomic techniques and chronology is only slightly more than embryonic. At this stage in the study of the archaeology of the inland Waikato, each archaeological investigation has the potential to make a useful contribution to our understanding of the timing and nature of the archaeology of the Tamahere district, which has been badly affected by subdivision over the last 30 years, and, more broadly, to the historical change and development of the material culture of the Waikato's inhabitants.

Adaptation to New Zealand is a significant theme in the archaeological study of Māori and European settlements. The interrelationship between human settlement and the environment is central to this. This site represents a part of the story of the adaptation of a tropical Polynesian horticultural system to a challenging temperate climate.

3.1 Pre-European Māori agriculture in the Waikato and notes on methodology

In the history of Polynesian settlement in New Zealand, and indeed across the rest of Polynesia, the Waikato is unusual, possibly unique. The Waikato, and to some extent the Rotorua Lakes, constitute an area of concentrated inland settlement not found elsewhere in New Zealand, much less in the rest of Polynesia. This reflects Aotearoa/New Zealand's comparatively massive geography in the Oceanic context and the associated challenging climate and environment.

The concentration of archaeological sites in the Waikato relating to the pre-European history of Aotearoa/New Zealand is similar to parts of coastal northern New Zealand. This is particularly true in the Middle Waikato Basin, which neighbours the Waikato River and its tributaries. Here, the archaeological landscape is dominated by pā and their associated horticultural sites. In this sense, the Waikato is also unusual because the horticultural sites are so explicitly visible in the landscape, and therefore their physical relationships with pā and other sites are equally explicit. This is because of the notably intensive practices associated with the Waikato Horticultural Complex.

Consequently, the archaeology of the Waikato lends itself to examining regional, national, and international themes surrounding the settlement of Polynesia. In many ways, the horticultural sites are central to this. The Waikato Horticultural Complex exemplifies a highly intensified swidden agricultural system, distinct in both nature and scale within Polynesia.

Archaeological investigations to date have shown that the Waikato Horticultural Site Complex is archaeologically intricate, with evidence suggesting at least two agronomic processes were practised in connection with this system. One of these was first identified in 1999 (Gumbley & Higham 2000, Higham & Gumbley, Gumbley et al. 2004) and involves a series of regularly spaced bowl-shaped depressions in the ground filled with sand and gravel quarried from nearby borrow pits. These features are known as bowl-shaped hollows. The second form is characterised by a layer of soil enriched with sand and gravel that overlays a

modified upper unit of the B horizon, which appears darker with noticeable charcoal inclusions and sometimes clearly shows charred root systems. This form of garden development is known as the Transported Alluvium Layer (TAL). The interface between the created soil horizon and the modified B horizon is distinct yet wavy in profile, and upon excavation, the surface of the B horizon is best described as 'pock-marked'. (Gumbley 2021).

To date, research into the palaeo-environment using charcoal and plant microfossils (e.g., pollen) has gradually provided a clearer picture of the landscape's vegetation history and a better understanding of the taphonomic processes related to charcoal use and deposition. This progress has improved radiocarbon sampling methods, both in the species chosen and the locations sampled. From this, we know that the Waikato Horticultural Complex was an active swidden system, likely with a short garden cycle—that is, gardens that last only briefly before new forest is cleared. Once abandoned, the vegetation that replaced the gardens mainly consisted of ferns, primarily bracken, with occasional signs of shrub regeneration, mainly mānuka, and rare instances of tutu. Evidence for the reuse of gardens appears to be uncommon.

The question about how the transported alluvium was applied in the gardens remains unsettled. This is partly an inherent problem because the medium in which tubers are grown must be disturbed for harvesting. If this involved mounds, as described in the 19th Century literature, they would need to be dismantled, leaving few clear traces of the mounds. However, experience with kūmara cultivation and observations of archaeological remains suggest that remnants of the mounds might still be present. New techniques, such as soil micromorphology, could help address this if well-designed sampling strategies are employed. Additionally, understanding the agronomic process involves determining whether sand and gravel were re-applied to the gardens. Particle-size analysis to assess the amount of transported material in the made soils will assist in this understanding.

Effectively addressing these problems and maximising results from different methodologies is greatly improved on well-preserved sites. It is important to establish the site's condition early and to target the areas that are better preserved.

Developing a reliable chronology based on radiocarbon dating in the New Zealand context is challenging under any circumstances, but horticultural sites can be especially problematic. The main issue relates to the nature of these sites, where the soil is cultivated and turned over, disturbing sediments and any material within them. This makes it difficult to determine when the charcoal (or other materials) was created and originally deposited. While little can be done to address issues with the calibration curve, other strategies to reduce uncertainty can be employed. The standard practice of using charcoal from short-lived plant species is accepted. Equally important is understanding the taphonomic processes that have led to the dated item arriving in its sampled location in the field. This understanding also informs field sampling protocols. An understanding of taphonomic processes, combined with recognition of stratigraphic relationships, can be leveraged in Bayesian analyses of radiocarbon dates; these approaches can improve the precision of radiocarbon dating.

4 Research Questions

4.1 Māori horticulture

4.1.1 General research questions to which the Māori horticultural remains may contribute.

- The settlement of the inland Waikato represents a significant migration of people whose culture was primarily coastal. What adaptations resulted from this?
- Were similar settlement patterns to those on the coast replicated in the inland area?
- Did the Waikato River and its tributaries become substitutes for the coast, with settlement focused here, or did it take other forms?
- What was the process of this over time? Did settlement first focus on the rivers and then spread from there, or was another path followed?
- Was settlement of the Middle Waikato Basin rapid, with Cambridge and Taupiri occupied at the same time, or was it more gradual and systematic?
- What was the inter-relationship between domestic activities and horticultural sites?
- What and when were the inter-relationships between pā as central places in the cultural landscape and horticultural sites (gardens) as economic and societal foci within those landscapes?

4.1.2 Specific research questions regarding Māori horticulture

1. What are the sites' dates (radiocarbon), and how do they relate to the radiocarbon dates of corresponding horticultural sites in the Waikato?
2. What cultivation-related archaeological features are present? And what is their specific relationship to the made soils? What cultivation strategy was used (BSH and/or TAL, or something different)?
3. What was the degree of soil modification (i.e. how much material was added to the parent soil)? Does the nature of the garden and associated soil modification vary from other sites belonging to the Complex?
4. What was the local environment immediately prior to, during and after the establishment of the horticulture sites?
5. What are the dimensions (volume) of the borrow pits, and what is their internal structure (are they single pits or a conglomeration of smaller pits)? What can this inform us about the amount of alluvium quarried from each pit and its consequent scale of use? Is there evidence for annual re-use?
6. Are the borrow pits deliberately back-filled during use, or is this a result of erosion/deposition processes after abandonment?
7. Can individual garden plots be recognised? If so, what was their individual extent, along with their spatial and temporal relationships?
8. Is there any remaining evidence for the above-ground growing mounds?
9. What is the scale and nature of the evidence for domestic activities associated with the horticulture sites?
10. Are crop storage structures (pits) present? If so, how do they relate to the sequence of garden use?
11. What crops were grown at the site?

5 Methodology

5.1 General:

Fieldwork will proceed in two phases. Initially, a coarse-grained series of trenches (at low density) will be excavated across the site with a hydraulic excavator to characterise the distribution of archaeology and to determine areas to be targeted for intensive investigation (Phase 2). The resulting surfaces shall be cleaned by hand if needed.

In the areas selected for detailed investigation (Phase 2), features, deposits, or areas identified through this initial trenching will be thoroughly investigated, including, for example, the excavation of further trenches. Close examination of archaeological features will then be undertaken through hand excavation and recording, carried out in accordance with accepted archaeological practice (e.g., field descriptions, scale drawings, photography, and sampling).

Spatial data will be recorded using an RTK GPS, and, where necessary, through hand-drawn plans and profile drawings.

5.2 Specific: Excavation method and data recording

5.2.1 Excavation method and data recording

The same basic methodology will be applied generally.

It is important to note that orthodox excavation methodologies are ill-suited to examining expansive pre-European Māori horticultural sites. Therefore, for most investigations, the archaeological field methodology will emphasise the examination, recording, and sampling of soil profiles through trench excavation. The investigation areas will be laid out as a series of trenches designed to examine variation both down through the soil profile and across the areas to be affected by the project. As appropriate, some trenches will be expanded to examine archaeological features in context.

All archaeological features will be photographed and, where appropriate, drawn to scale.

Following examination of the soil profiles, samples will be taken from secure stratigraphic contexts and from individual archaeological features.

Where evidence of domestic activities is identified, these will be investigated using accepted excavation techniques.

Affected borrow pits (i.e. those not to be protected by covenant) will be excavated by machine and examined in detail. Emphasis will be on recording the relationship between alluvium excavation and contemporaneous re-filling with reworked material. Records and samples relating to the local environment at the time of the pit’s use and abandonment will be a focus.

Rectangular storage pits will be fully excavated and recorded in detail.

Excavation of underground bell-shaped pits presents a technical challenge due to the soils at these sites. Because of the light and friable nature of the B horizon (tephra) and the sandy-gravelly nature of the underlying C horizon, there is a risk that the features could collapse, resulting in the loss of archaeological information. Therefore, if such pits are encountered, they will be examined using a hydraulic excavator to slice off sections from top to bottom. This method enables documentation of the pit shape while still allowing internal stratigraphy to be recorded and samples to be taken based on stratigraphy.

5.2.2 Radiocarbon sample collection and selection

Samples for radiocarbon dating will be recovered from secure contexts, where the taphonomic processes can be understood.

Issues of in-built age, 'outlying' dates, and large probability ranges are problems in New Zealand archaeology. In order to address these problems, the following strategy will be applied:

- Charcoal from short-lived species or from young growth on longer-lived species will be selected.
- Priority will be given to dating samples from species that live to less than 50 years.
- The dating of mixed-species samples will be avoided to minimise the effect of in-built age.
- There is good reason to suspect that twig material from long-lived species is problematic to date, and these will be avoided as much as possible. Again, this is to minimise the potential for in-built age.
- Multiple samples from a single context will be submitted for radiocarbon assay to address issues of outlying dates and to reduce probability ranges through Bayesian analysis.

Specifically, it has been found that samples retrieved from the fill of both borrow pits and storage pits are often associated with the forest clearance phase, and suitable material from securely understood contexts can be used to date that event. Dense charcoal layers are commonly identified on top of the original refill units of both pit types. These layers typically consist of charcoal from short-lived species (such as bracken) re-colonising the site after abandonment of these features. Dates from these two contexts can be combined in Bayesian analysis to more precisely date the gardens.

The site includes a series of borrow pits, and it is proposed to focus on these to develop the site's primary chronology using the sampling rationale outlined above. If rectangular storage pits are present, a similar regime will be applied.

5.2.3 Crop identification

Crop identification is possible through the analysis of plant microfossils, particularly relict starch grains. Plant pollen and phytoliths from cultivated plants have also been identified, including those from taro and kūmara. Isolated examples of Cordyline terminalis and Dioscorea spp. (yam) have also been found from sites belonging to the Waikato Horticultural Complex.

To establish a dependable understanding of plant cultivation patterns within and between sites, multiple samples from suitable contexts across each site will be collected and submitted for analysis.

5.2.4 Palaeo-environmental sample collection, selection and analysis

Understanding the local environment and people's interaction with it is a major theme in the settlement of the inland Waikato.

Two forms of analysis contribute to the understanding of the local environment: plant microfossils and relict charcoals.

The use of alluvial material from the substrate is common at Waikato horticultural sites. This material contains ancient plant microfossils that reflect the vegetation environment at the time of sediment erosion that contributed to the alluvial deposits, or at the time of alluvium deposition. In either case, these microfossils pertain to environments that are 15,000 years or older than the date of Māori settlement in the inland Waikato. This renders any samples that may contain this material valueless for reconstructing the local environment at the time the sites were occupied. Pollen, in particular, may be transported some distance for wind-pollinated species, and there are issues with the under-representation of species known to be common in the Waikato (e.g. tawa).

For these reasons, charcoal analysis is preferred, as it is considered to represent the local environment more reliably. However, pollen and phytolith samples may be analysed if suitable material is available, and this is often a routine step in identifying cultigens.

Reconstruction of the interrelationship between horticulture and the environment will require the recovery of samples relating to the vegetation at the time the gardens were being developed. These samples will be recovered from relict remains of tree root systems and from other stratigraphically early features, such as buried topsoil horizons.

5.2.5 Geoarchaeology

Subject to the level of prior disturbance at the site, there may be an opportunity to examine the structure of the deposits with a view to understanding the process that has led to the re-deposited alluvium found at these sites.

Samples may be recovered for soil microstratigraphy analysis, soil particle-size analysis, and any other sampling method as appropriate.

5.2.6 Artefact analysis

Each artefact will be photographed and measured.

Sourcing analyses will be carried out where appropriate for lithic (stone) artefacts.

6 Archaeological Monitoring

At the discretion of the project archaeologist, archaeological monitoring of topsoil stripping may be carried out following the initial investigation phase and during development earthworks.

The archaeologist must be contacted prior to the commencement of earthworks.

Any archaeological evidence encountered during the earthworks will be recorded and analysed, at the project archaeologist's discretion, in accordance with accepted archaeological practice. This may require works to halt until the archaeologist has completed recording and sampling. This may include:

- Cleaning and viewing soil profiles;
- Photography;
- Written records;
- Hand-excavation of features;
- Producing measured drawings; and/or
- Collecting material samples for faunal or radiocarbon analysis.

7 Reporting and Analysis

7.1 Material Culture Analysis

All recovered material culture items (e.g., artefacts) will be curated in cooperation with Waikato Tainui, in accordance with Waikato Tainui tikanga.

Following completion of fieldwork, a review of the recovered material culture items will be conducted, and a programme of analysis will be determined. This will ensure that the analysis is carried out in accordance with current archaeological practice and meets the reporting requirements outlined by the Authority. It is anticipated that some of this material may be sent to specialists for detailed analysis.

7.2 Sediment sample analysis

Material designated for soil analysis, charcoal identification and plant microfossil analysis will be transferred to specialists following initial sample preparation.

7.3 Reporting

Reports on the archaeological work will be completed as required by the authority granted by HNZPT for the project.

8 Reference

Gumbley, W. 2021. The Waikato Horticultural Complex: an archaeological reconstruction of a Polynesian horticultural system. Volumes 1 and 2. PhD thesis, The Australian National University.