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Tē Whare Wānanga o Waiāto

THE UNIVERSITY OF WAIKATO
CSMAX570-25A: COMPUTER SCIENCE MASTERS

**Lake Waikare Digital Library: A
Cultural and Environmental
Preservation Platform**

Final Project Report

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Group 10

Developed in partnership with the Lake Waikare community and local iwi

Abstract

EXECUTIVE SUMMARY

The Lake Waikare Digital Library represents a comprehensive digital preservation platform designed to safeguard the cultural heritage and environmental history of the Lake Waikare region in New Zealand. This report presents the final outcomes of an innovative solution that addresses the critical intersection of Māori cultural preservation and environmental awareness through community-centered technology development.

Project Essence: The platform integrates interactive mapping technology, authentic multilingual content presentation (te reo Māori and English), and innovative age-appropriate learning interfaces to serve diverse community needs while respecting traditional knowledge protocols.

Key Innovations: Our primary contribution is the development of a dedicated Child Mode for engaging younger generations with cultural heritage, sophisticated search and filtering capabilities preserving cultural context, and a culturally-sensitive design approach developed through extensive community consultation with cultural authorities.

Methodology: We employed iterative, user-centered design principles with continuous stakeholder feedback integration, prioritizing authentic community partnership over extractive research approaches. The development process integrated ongoing cultural consultation rather than one-time approval mechanisms.

Results: The final prototype demonstrates successful achievement of three primary objectives: effective cultural preservation mechanisms maintaining traditional knowledge integrity, enhanced environmental awareness capabilities connecting cultural and ecological understanding, and inclusive community engagement features supporting intergenerational learning.

Impact and Contribution: This project contributes to digital heritage preservation by demonstrating practical approaches to indigenous knowledge representation, intergenerational cultural transmission, and the integration of environmental education with cultural preservation while maintaining community control and cultural authenticity.

Keywords: Digital heritage preservation, Māori cultural authenticity, Environmental education integration, Intergenerational engagement, Community-centered design, Indigenous knowledge systems, Accessibility and inclusion

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SECTION 1: PROJECT INTRODUCTION AND CONTEXT

1 PROJECT INTRODUCTION AND CONTEXT

Lake Waikare, situated in the lower Waikato catchment of New Zealand, represents far more than a geographical feature—it embodies centuries of Māori cultural heritage, traditional ecological knowledge, and environmental stewardship that has sustained local communities for generations. However, contemporary environmental challenges threaten not only the lake’s ecological integrity but also the cultural continuity of the knowledge systems intrinsically connected to this vital natural resource.

1.1 Cultural and Environmental Crisis

The environmental degradation of Lake Waikare due to agricultural runoff and inadequate wastewater management has created a cascading effect that extends beyond water quality metrics into the realm of cultural preservation. As the largest shallow lake in the lower Waikato catchment, Lake Waikare has historically served as a cornerstone for Māori communities, providing essential resources for sustenance and maintaining profound spiritual and cultural significance [?]. The deterioration of this ecosystem has resulted in the gradual erosion of traditional knowledge, oral histories, and customary practices that have been transmitted through generations.

This phenomenon represents a critical intersection of environmental and cultural loss, where ecological degradation directly threatens the preservation of indigenous knowledge systems. The disconnection between younger generations and their cultural heritage, exacerbated by modernization processes, compounds this challenge by creating knowledge gaps that traditional transmission methods struggle to bridge effectively.

1.2 Digital Preservation as Cultural Revitalization

In response to these interconnected challenges, this project investigates the potential of digital technologies to serve as culturally appropriate preservation and revitalization tools. Unlike conventional digital archiving approaches that often treat cultural content as static artifacts, our research explores how interactive digital platforms can maintain the dynamic, relational, and contextual nature of Māori knowledge systems while ensuring accessibility for diverse community stakeholders.

The Lake Waikare Digital Library project leverages the Greenstone Digital Library Software as its foundational platform, recognizing Greenstone’s established capabilities in cultural heritage preservation and its extensive deployment in indigenous communities

worldwide [?]. Developed by the New Zealand Digital Library Project at the University of Waikato, Greenstone provides a robust, open-source framework specifically designed for building and distributing digital library collections, making it particularly suitable for community-controlled cultural preservation initiatives.

The project emerges from extensive community consultation and represents a collaborative effort between academic researchers, local iwi, and community stakeholders to develop a preservation platform that respects traditional knowledge protocols while leveraging Greenstone’s proven digital capabilities. This approach recognizes that effective cultural preservation requires more than mere documentation—it demands the creation of engaging, accessible, and culturally authentic platforms that can facilitate intergenerational knowledge transmission while maintaining the technical reliability and scalability that Greenstone provides.

1.3 Research Significance and Innovation

This project contributes to the growing field of digital heritage preservation by addressing several critical gaps in existing approaches while demonstrating innovative applications of the Greenstone Digital Library framework. By building upon Greenstone’s established architecture, the project explores how existing digital library technologies can be enhanced and customized to serve indigenous knowledge preservation requirements more effectively.

First, the project demonstrates how Greenstone’s flexible collection management system can be adapted to respect and reflect indigenous epistemologies rather than imposing Western knowledge organization systems. The platform’s customizable interface capabilities enable the creation of culturally appropriate navigation structures and content presentation methods that align with Māori knowledge organization principles.

Second, it explores innovative approaches to intergenerational engagement through the development of specialized Child Mode interfaces within the Greenstone framework, demonstrating how established digital library platforms can be extended to make cultural content accessible to younger audiences without compromising authenticity or cultural protocols. This represents a novel application of Greenstone’s interface customization capabilities for age-specific cultural engagement.

The integration of environmental and cultural preservation within a single Greenstone-based platform represents an innovative approach that recognizes the inseparable connection between ecological health and cultural vitality in Māori worldviews. By leveraging Greenstone’s multimedia handling capabilities and metadata management systems, the platform presents environmental data alongside cultural narratives, demonstrating how digital library technologies can support holistic preservation approaches that inform contemporary environmental stewardship while maintaining cultural relevance for modern communities.

1.4 Community-Centered Methodology

Central to this project’s approach is the recognition that authentic cultural preservation cannot occur without genuine community partnership and ongoing stakeholder engagement. The project operates under the guidance of Glen Tupuhi, our principal stakeholder and cultural authority, whose extensive governance experience and deep cultural connections provide essential direction for the platform’s development.

Glen Tupuhi brings unparalleled expertise to this initiative through his role as Trustee of Whakatupu Aotearoa Foundation and his extensive background in Māori governance structures. His whakapapa connections—Tainui te waka, Ngāati Pāoa ki Waiheke, Tāmaki Makaurau, Hauraki, Waikato, Ngati Hine, Ngati Naho o Waikato, Ngati Rangimahora, Ngāati Apakura—establish direct cultural authority over the Lake Waikare region and ensure that the digital library development respects appropriate cultural protocols and community priorities.

Glen’s governance portfolio, including his roles as Hauraki representative for Waikato District Health Board Iwi Māori Council, Chair of Ngāa Muka Development Trust, and his previous positions with The Ngati Pāoa Trust and Hauraki Māori Trust Board, demonstrates the collaborative networks essential for sustainable cultural preservation initiatives. His academic credentials, including a Graduate Diploma in Business Studies from Massey University and NZ Institute of Directors Certificate, provide the strategic oversight necessary for developing community-controlled digital resources.

Rather than adopting extractive research methodologies that treat communities as data sources, this project employs a collaborative framework where Glen Tupuhi and associated community members serve as co-researchers, cultural authorities, and primary beneficiaries of the developed platform. This methodology ensures that the digital library reflects community priorities, respects cultural protocols, and addresses genuine community needs rather than academic assumptions about cultural preservation requirements.

The involvement of Glen’s extensive network, including connections to the Waikato Regional Council through his various trustee roles, demonstrates the project’s commitment to creating sustainable, community-controlled resources that can continue to evolve and expand beyond the initial development phase.

1.5 Project Scope and Objectives

The Lake Waikare Digital Library project encompasses the design, development, and evaluation of a comprehensive digital platform built upon the Greenstone Digital Library Software framework. This foundation provides the technical infrastructure necessary to serve multiple community stakeholder groups while maintaining cultural authenticity, accessibility, and long-term sustainability.

The platform leverages Greenstone’s core capabilities—including multimedia collec-

tion management, flexible metadata schemas, and customizable user interfaces—while extending these features through innovative adaptations for cultural preservation and community engagement. The project integrates interactive mapping technologies with Greenstone’s search and browsing capabilities, implements multilingual content presentation using Greenstone’s internationalization features, and develops sophisticated filtering systems that respect cultural organization principles.

The development of the specialized Child Mode represents a significant extension of Greenstone’s interface capabilities, demonstrating how established digital library platforms can be enhanced to create age-appropriate cultural engagement tools while maintaining the robust collection management and preservation standards for which Greenstone is recognized.

This report presents the complete development process, from initial community consultation through final prototype evaluation, demonstrating how the Greenstone platform can be adapted and extended to address community-identified challenges while maintaining rigorous technical standards. The project’s outcomes extend beyond the specific Lake Waikare context to provide insights and methodologies applicable to similar Greenstone-based digital heritage preservation initiatives in indigenous communities worldwide, contributing to the broader ecosystem of culturally responsive digital library implementations.

SECTION 2: ORGANIZATIONAL CONTEXT AND WORK ENVIRONMENT

2 ORGANIZATIONAL CONTEXT AND WORK ENVIRONMENT

The Lake Waikare Digital Library project operates within a complex multi-organizational ecosystem that reflects the collaborative nature of contemporary indigenous digital heritage initiatives. This section delineates the organizational structures, stakeholder relationships, and institutional frameworks that have shaped the project's development trajectory and ensured its alignment with both academic rigor and community authenticity.

2.1 Primary Institutional Framework

2.1.1 The University of Waikato - Academic Foundation

The University of Waikato serves as the primary institutional host for this initiative through the CSMAX570-25A Computer Science Masters Extended Programme. The university's established commitment to Māori scholarship and digital innovation provides both the academic infrastructure and cultural sensitivity necessary for this type of community-partnered research.

The university's significance extends beyond mere institutional affiliation—it represents the birthplace of the Greenstone Digital Library Software, making it uniquely positioned to support advanced applications of this platform for indigenous cultural preservation. The university's Digital Library Research Group, established in 1995, has maintained continuous development of Greenstone and accumulated extensive expertise in digital heritage applications, particularly within New Zealand's bicultural context [?].

The academic supervision structure includes Dr. Colin Pilbrow as Project Supervisor, providing specialized expertise in digital systems development and community-engaged research methodologies. David Bainbridge, serving as Program Coordinator, brings extensive technical knowledge of digital library architectures and has been instrumental in Greenstone's ongoing development. Alvin Yeo, as Course Instructor, ensures that the project meets rigorous academic standards while maintaining practical applicability.

2.1.2 Supervision and Academic Governance

The project operates under a robust academic governance structure designed to balance scholarly rigor with community responsiveness. The supervision team represents complementary expertise areas essential for successful digital heritage initiatives:

Dr. Colin Pilbrow provides project oversight with particular emphasis on research methodology, stakeholder engagement protocols, and ensuring that academic outputs serve genuine community needs rather than extractive research purposes. His supervision ensures that the project contributes meaningfully to both academic knowledge and community capacity building.

David Bainbridge contributes technical leadership, particularly regarding Greenstone platform optimization, digital collection management best practices, and long-term sustainability considerations for community-controlled digital resources. His involvement ensures that technical implementations align with established digital library standards while accommodating specific indigenous knowledge organization requirements.

Alvin Yeo maintains academic quality assurance, ensuring that project deliverables meet masters-level research standards while remaining accessible and actionable for community stakeholders. His role includes facilitating connections between theoretical frameworks and practical implementation outcomes.

2.2 Community Stakeholder Organizations

2.2.1 Primary Cultural Authority - Glen Tupuhi and Associated Networks

Glen Tupuhi represents the project's primary cultural stakeholder, bringing extensive governance experience and deep whakapapa connections that establish authentic community authority over the initiative's direction and implementation. His organizational affiliations create a comprehensive network of cultural and administrative support essential for sustainable digital preservation initiatives.

As Trustee of **Whakatupu Aotearoa Foundation**, Glen provides direct access to organizational structures specifically designed for Māori community development and cultural preservation. This foundation's mission aligns closely with the digital library's objectives, creating natural synergies for long-term platform sustainability and community adoption.

Glen's role as **Hauraki representative for Waikato District Health Board Iwi Māori Council** establishes crucial connections between the digital library initiative and broader regional development strategies, ensuring that cultural preservation efforts integrate with existing community health and wellness frameworks.

His position as **Chair of Ngāa Muka Development Trust**, representing a cluster of northern Waikato marae under Waikato Tainui, provides direct access to the marae network essential for authentic cultural content validation and community engagement. This connection ensures that the digital library reflects genuine community priorities rather than external assumptions about cultural preservation needs.

2.2.2 Regional Government Partnership

The **Waikato Regional Council** serves as a crucial institutional partner, providing both environmental data access and regulatory context essential for the platform's integrated approach to cultural and environmental preservation. The Council's involvement ensures that environmental information presented through the digital library maintains scientific accuracy while supporting traditional ecological knowledge perspectives.

This partnership reflects the Council's recognition that effective environmental management requires integration of indigenous knowledge systems alongside Western scientific approaches. The Council's commitment to Treaty of Waitangi obligations creates a supportive policy environment for initiatives that strengthen Māori cultural capacity while addressing environmental challenges.

2.2.3 Local Iwi Partnership Structure

The project operates within a broader **Local Iwi Partnership** framework that ensures authentic community control over cultural content and knowledge sharing protocols. This partnership structure reflects established best practices for indigenous digital heritage initiatives, where community ownership and control remain paramount throughout development and implementation phases.

The iwi partnership provides essential cultural oversight, including validation of content authenticity, approval of knowledge sharing protocols, and ongoing guidance regarding appropriate cultural representation within digital contexts. This relationship ensures that the platform serves community-defined objectives rather than external research agendas.

2.3 Collaborative Work Environment and Methodology

2.3.1 Agile Development Framework

The project team adopted an agile development methodology specifically adapted for community-engaged digital heritage work. This approach emphasizes iterative development cycles with continuous stakeholder feedback integration, ensuring that technical development remains responsive to evolving community needs and cultural requirements.

Biweekly team meetings provided regular opportunities for progress assessment, challenge identification, and collaborative problem-solving. These meetings included both technical development discussions and cultural consultation processes, ensuring that technological decisions remained grounded in community priorities and cultural appropriateness.

The agile framework proved particularly valuable for managing the complex intersection of technical requirements, academic standards, and cultural protocols. By maintain-

ing flexibility in development approaches while adhering to clear project objectives, the team successfully navigated challenges that traditional project management methodologies might have struggled to accommodate.

2.3.2 Community Consultation Integration

Rather than treating community consultation as a discrete project phase, the work environment integrated ongoing stakeholder engagement throughout the development process. This approach reflects recognition that authentic cultural preservation requires continuous community input rather than one-time approval mechanisms.

Regular consultation sessions with Glen Tupuhi and associated community networks provided essential guidance on cultural representation, knowledge organization principles, and appropriate technology applications. These sessions ensured that technical capabilities served community-defined objectives while maintaining cultural integrity and authenticity.

2.4 Institutional Resources and Infrastructure

2.4.1 Technical Infrastructure

The University of Waikato provided comprehensive technical infrastructure supporting both development activities and long-term platform sustainability. Access to Greenstone development environments, digital collection management systems, and specialized software tools enabled sophisticated prototype development while maintaining alignment with established digital library standards.

The university's commitment to open-source digital library development created an ideal environment for community-controlled resource creation, ensuring that resulting platforms could be maintained and modified by community stakeholders rather than requiring ongoing dependency on external technical expertise.

2.4.2 Academic and Cultural Resources

The project benefited from the university's extensive collection of Māori scholarship, digital heritage research, and community-engaged research methodologies. Access to specialized libraries, research databases, and expert consultation provided essential background knowledge for culturally appropriate digital platform development.

The university's established relationships with Māori communities and commitment to Treaty of Waitangi obligations created a supportive institutional environment for authentic partnership development and culturally responsive research practices.

2.5 Quality Assurance and Ethical Framework

The organizational context includes robust quality assurance mechanisms ensuring that academic rigor and cultural authenticity remain complementary rather than competing priorities. Ethics approval processes, cultural consultation protocols, and academic supervision structures work collaboratively to maintain both scholarly standards and community trust.

Regular evaluation processes, including formal presentation opportunities and peer review mechanisms, provide external validation of both technical achievements and cultural appropriateness. These processes ensure that project outcomes contribute meaningfully to both academic knowledge and community capacity while maintaining the highest standards of cultural respect and authenticity.

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