



Te Ao Māori & Water Sensitive Urban Design

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1. Karakia

Na te kukune, te pupuke
Na te pupuke, te hihiri
Na te hihiri, te mahara
Na te mahara, te hinengaro
Na te hinengaro, te tūmanako
Na te tūmanako, te wānanga
Na te wānanga, te matau
Hui e, taiki e!

2. Mihi

Tuia te rangi e tū iho nei
Tuia te whenua e takoto nei
Tuia ngā tūpuna maunga
Tuia ngā moananui
Tuia ngā waimanga
Ka rongō te pō, Ka rongō te ao
Tihewa mauri ora!!!

E ō tātou tini mate i takoto mai ai i roto i te kopū o te whenua,
E tika ana hei poroporoaki i a rātou,
Ngarue ana te whenua, ngaoko ana te moana,
Ka mū te ao, ka karanga te pō,
Nō reira, waiho rātou kia tīraha mai, ā, ko tātou ki konei takatū ai ki ngā mahi.
Āpiti hono, tātai hono
Rātou te hunga wairua ki a rātou
Āpiti hono, tātai hono
Tātou te hunga hīkoi ki a tātou.

E ngā mana, e ngā reo, e ngā karangatanga maha,
Ka huri ngā reo maioha e rere nei ki a koutou,
Tēnā koutou, tēnā koutou, tēnā koutou katoa.

3. Introduction

This report complements the ongoing research ‘Activating Water Sensitive Urban Design (WSUD) for healthy, resilient communities’ commissioned by the Building Better Homes Towns and Cities National Science Challenge (BBHTC). The overarching project aims to enhance capability and to address current barriers to the uptake of WSUD in Aotearoa (New Zealand).

Results of the Activating WSUD discovery phase identified a need to review management of the urban water cycle in Aotearoa (Moores et al., 2018). Specifically, the capacity of current approaches to meet reasonably foreseeable future requirements for urban liveability. Industry engagement identified (among other factors) an increasing sensitivity to Māori values and aspirations.

3.1. Purpose

This study explores how WSUD in Aotearoa (New Zealand) values, recognises, and provides for Te Ao Māori (Māori world view) and how it could do better. Based on literature review, and the experiences and learnings of the authors, we share an improved understanding of Te Ao Māori, to facilitate integrating Māori world views and mātauranga Māori to support uptake of WSUD and improve wider socio-cultural outcomes for healthy and resilient communities in Aotearoa (New Zealand).

The key areas where we aim to identify opportunity in the WSUD-space in Aotearoa (New Zealand) are:

- How well does WSUD in Aotearoa (New Zealand) provide for Māori values and uses of water?
- Are there opportunities to improve the implementation of WSUD through the integration of Te Ao Māori?

Roles within the water sensitive urban design space are varied, many professions and individuals have the capacity to empower positive change, including town planning, urban design, landscape design, ecologists, engineers, contractors, and residents – the list goes on. This study provides the first step to understanding WSUD through a Māori worldview lens, opening the door to change and discussing future opportunities.

This review is not an exhaustive survey of the available literature but presents outcomes from a sample. It is intended as a capacity building exercise for water sensitive design practitioners with future scope to expand the review to include a broader range of written literature and oral narratives. Translations of Māori words or phrases reference the source from which they were taken.

It must be acknowledged that the conclusions drawn are those of the authors. This study presents one interpretation; it reflects our understanding of Te Ao Māori, our experiences and learnings to date, and the learning and experiences of those who support us, while recognising there is regional variation – it is not intended to represent the view of all Māori.

Nā ngā tūpuna ngā taonga i tuku iho

Treasures passed down from our ancestors

4. Literature Review

4.1. Water Sensitive Urban Design in Aotearoa (New Zealand)

Before opening the door to Te Ao Māori – it is important we consider what WSUD means in the current Aotearoa (New Zealand) context. WSUD is summarised in *Activating WSUD for Healthy Resilient Communities - Discovery Phase: Results and Recommendations* by Moores, Batstone, Simcock, & Ira (2018) as an alternative to conventional forms of urban development which aims to integrate urban planning and water management. While different jurisdictions place emphasis on different aspects of WSUD, the following concepts are particularly evident in a New Zealand ‘understanding’ of WSUD:

- Limit stormwater runoff and contaminant generation at source by minimising the construction of impervious surfaces, such as roads and roofs
- Maintain the function of natural drainage systems, rather than replacing stream networks with piped systems

- Maintain characteristics of catchment hydrology, including infiltration, groundwater recharge and stream flow characteristics, similar to those that existed pre-development
- Use water sensitive or green technologies to better manage stormwater in a way that complements its approach to land use planning

In New Zealand, WSUD has a strong focus on management of stormwater and receiving water bodies. Consideration of its potential role in the water supply and wastewater sectors and in relation to wider (including non-water) contributions to urban liveability have received little attention (Moores, et al., 2018). It is important to recognise that a truly WSUD approach can include a broad suite of potential role(s), for example contributing to urban amenity and community health; providing multi-functional green spaces to recreate shade; or providing an alternative water supply to enhance drought resilience (Moores & Batstone, 2019).

Figure 1 summarises research conducted under the ‘Activating WSUD’ project that demonstrates the wide range of environmental and social benefits that can be associated with WSUD projects. This analysis has provided the basis for the development of a WSUD assessment method: the “More Than Water (MTW)” tool, for comparing potential outcomes under WSUD with those under conventional development approaches. The tool is described in Moores et al. (2019) and is available on the project web site.

It is important to recognise WSUD caters to the integrated management of the three (infrastructure) waters; stormwater, wastewater, drinking water, and wider socio-cultural wellbeing considerations – it is broader than stormwater management alone. While the current focus in Aotearoa (New Zealand) is narrow, it should be noted that growing consideration of indigenous cultural values and approaches to water appears to be a driver to uptake specifically local to Aotearoa (New Zealand) (Moores, et al., 2018).

Terminology varies within the literature, but the following are also considered representative of the principles of WSUD – Low Impact Development (LID), Low Impact Urban Design and Development (LIUDD), and Sustainable Drainage Systems (SuDS). Green Infrastructure (GI) or Water Sensitive Infrastructure are also devices or systems which support intended WSUD outcomes. Regardless of terminology, the concepts reflect a paradigm shift from conventional stormwater management techniques to a more sustainable design philosophy (Voyde & Morgan, 2012).

	Non-water Related	Water Related
Environmental	Preservation of natural soils Microclimate management Carbon sequestration and mitigation Better terrestrial habitat quality Terrestrial ecosystem connectivity Natural character (land)	More natural hydrological regime Better water quality Better aquatic and riparian habitat quality Drainage network and ecosystem connectivity Natural character
Social	Reduced building material consumption Infrastructure resilience Food & fibre production Public safety Connectedness with nature (land) Community health and wellbeing Property values	Provisioning (e.g.: fishing, shellfish collection) Contact recreation (e.g.: swimming) Water-related connectedness with nature Drainage and flood management Supplementary water supply Reduced wastewater / combined sewer system loading Climate change adaptation

Figure 1: Summary of WSUD Benefits (Moores, et al., 2019)

4.2. Te Ao Māori

In this section we aim to describe the strong connection between Māori and the environment – to share with the reader an understanding of Te Ao Māori, or the Māori world view, before we overlay the WSUD paradigm. While the following sections describe components of a Māori worldview, it is important to recognise that many of the concepts described are best understood in the context of the language and the culture they derive from. As Tipa & Nelson (2012) caution, a reinterpretation of these meanings in the English language loses context and meaning,

however; for non-speakers of Te Reo it provides a platform from which additional knowledge and understanding can grow.

4.2.1. History & Beliefs

Māori are acknowledged as *tangata whenua*, meaning “people of the land”. The expression illustrates the profound relationship Māori have with land and the environment (Awatere, et al., 2008). Māori view both themselves and all within the natural world as one in the same, connected through whakapapa (genealogical links) back to Io (supreme being) and regard land as being the basis of their very survival (Rolleston, 2006). More than a physical connection to the land, it is essential to understand the spiritual association with the land (Rolleston, 2005).

Whatungarongaro te tāngata, toitū te whenua

Man perishes, but land remains

Io is also known as Io-Atua (Supreme God), Io-Matua-Kore (the parentless), Io-Matua (the first parent), Io-Taketake (the originator), and Io-te-Waiora (the life giver, the source of life) (Whakaatere, et al., 2011; Raukawa Charitable Trust, 2015).

Ko te wai te ora o ngā mea katoa

Water is the life giver of all things

Traditional creation stories underpin Māori notions of identity, character, and connection with the environment (Awatere, et al., 2008; Williams, 2006; Ataria, et al., 2018). A breadth of views, and expressions, held by mana whenua are informed by specific relationships with environments that vary regionally. Although cultural variation developed as different iwi established intimate relationships with their tribal lands, similar underlying values and themes are referenced (Panelli & Tipa, 2007; Williams, 2006). Traditional Māori ways of knowing the world and the genealogy of creation begin with Io-Taketake and evolve through different spheres of development until the present day; I te timatanga, kō te kore (in the beginning there was a void) and moving to Te Pō (the night/darkness) to Te Ao (the light) (Harmsworth & Awatere, 2013; Harmsworth & Roskrige, 2014; Royal, 2005). Creation stories broadly reference the personification of, and separation of, Papatūānuku (the earth mother) and Ranginui (the sky father) as primal parents (Awatere, et al., 2008; Morgan, 2006) and reference to how they were responsible for creating the world in which we, the people, inhabit (Harmsworth & Awatere, 2013; Harmsworth & Roskrige, 2014; Royal, 2005; Awatere, et al., 2008; Morgan, 2006).

Descriptions reflect a widely-held belief that through the many phases of creation, a physical and spiritual element was created when Ranginui (the sky father) and Papatūānuku (the earth mother) were separated by their children (Morgan, 2006). Once the parents were separated their progeny—personified as natural phenomena—occupied and flourished in the various realms created (Awatere, et al., 2008; Morgan, 2006). The children of Ranginui and Papatūānuku are often termed departmental atua (deities), each with supernatural powers who preside over different domains (Harmsworth & Awatere, 2013; Harmsworth & Roskrige, 2014). Figure 2 presents one depiction of the creation story, demonstrating some of the embodied elements represented by the children of Papatūānuku and Ranginui.

The following is one version of part of the pūrākau (traditional Māori narrative) depicting the separation of Papatūānuku and Ranginui:

“In the creation, it was Tāne-Māhuta (atua of the forests and birds), one of the children of Ranginui and Papa-tū-ā-nuku, who pushed his parents apart to create the sky and the land as we know them today. Tāwhirimātea (atua of the winds, clouds, rain, hail, snow and storms) opposed his brothers in the venture and followed his father Ranginui to the realm above. He took revenge on his brothers and swept down in fury to lash the trees of Tane Māhuta until, uprooted, they fell in disarray. Tāwhiri then turned his rage on Tangaroa (atua of the sea and fish) who sought refuge in the depths of the ocean. But as Tangaroa fled his many grandchildren were confused, and while the fish made for the seas with him, the lizards and reptiles hid among rocks and the battered forests. It was then Tangaroa felt anger. His grandchildren had deserted him and were sheltering in the forests. So it is that to this day the sea is eating into the land, slowly eroding it and hoping that in time the forests will fall and Tangaroa will be reunited with his offspring.”

As direct descendants of Papatūānuku, Māori see themselves not only ‘of the land’, but ‘as the land’ (Mead, 2003).

Ko au te whenua, ko te whenua ko au.

I am the land, the land is me.

This is further cemented through the traditional Māori practice of placing the whenua (placenta, afterbirth) of a tamaiti (child) in the whenua (land) following childbirth (Harmsworth & Awatere, 2013; Stojanovic, 2012).

*Tuatahi ko te wai,
Tuarua whānau mai te tamaiti,
Ka puta ko te whenua.*

*When a child is born the water (amniotic fluid) comes first,
then the child is born,
followed by the afterbirth (whenua)*

The personification of earth as a mother is significant: similar to a maternal bond, land and environment provide sustenance for its inhabitants (Awatere, et al., 2008; Mead, 2003). The resources or children of Papatūānuku do not belong to tangata (people), but rather tangata are one of the many children who belong to Papatūānuku. People, animals, birds and fish all harvest the bounties of Papatūānuku but do not own them (Environmental Protection Authority–Te Mana Rauhi Taiao, n.d). Rather, the living generations act as guardians of the land, like their tūpuna (ancestors) before them (Mead, 2003). As part of this ancestry, emphasised by the personification of natural phenomena, responsibilities and obligations rest on Māori to sustain and maintain the physical and spiritual well-being of people, communities, and natural resources – of Papatūānuku, her children, and future generations (Harmsworth & Awatere, 2013; Harmsworth & Roskrug, 2014; Rolleston, 2005; Rolleston, 2006; Panelli & Tipa, 2007).

The creation model shows the interdependencies between land and sea, water and air, flora and fauna, and people and the ecosystem. It is not only all Māori who are connected in genealogical tables – all things are related by descent and so it becomes difficult to separate aspects of the environment for specific comment without considering them in a broader environmental and intergenerational context (Awatere, et al., 2008; Durie, et al., 2017; Rolleston, 2005; Rolleston, 2006; Paul-Burke, et al., 2018). For example, in taking fish for food or trees for timber, Māori are encroaching on the domain of particular atua. They must show respect, not exploiting mindlessly, but taking only that which is necessary and beneficial to others (Durie, et al., 2017); this is the true meaning of Kaitiakitanga (stewardship).

*Toitū te Marae o Tane,
Toitū te Marae o Tangaroa,
Toitū te Iwi.*

*If the domain of Tane survives to give sustenance,
And the domain of Tangaroa likewise remains,
So too will the people*

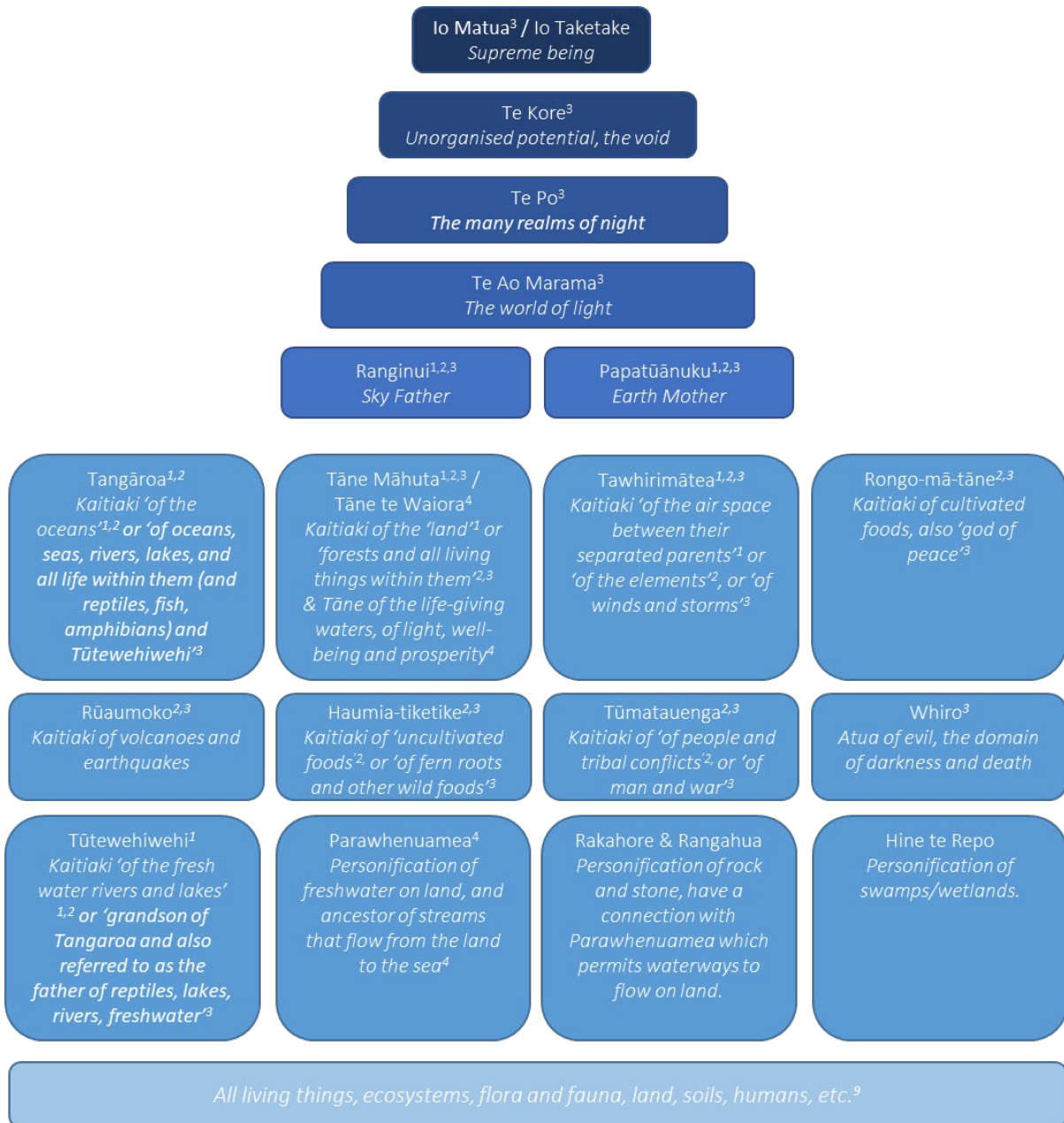


Figure 2: Schematic of the creation story, demonstrating variation (Sources: 1. (Morgan, 2006), 2. (Environmental Protection Authority–Te Mana Rauhi Taiao, n.d), 3. (Harmsworth & Awatere, 2013; Harmsworth & Roskrige, 2014), 4. (Ngata, 2018)

4.2.2. Whakapapa

Whakapapa literally means to place “layer upon layer” – it derives from *papa*, anything broad and flat, and from *whaka-*, a causative prefix that enables something to occur (Durie, et al., 2017). *Whakapapa* is unique to Māori without an exact English language equivalent. Because there is only one set of primal parents (Ranginui and Papatūānuku), from whom everything ultimately traces descent, all things are related (Hikuroa, 2017; Panelli & Tipa, 2007). *Whakapapa* (genealogy) is the central principle that orders the universe: describing the genealogical sequence within the creation story, it traverses both spiritual and physical realms. It demonstrates interconnectivity between everything placing all humans in an environmental context with all other flora, fauna, and natural resources, and expresses our fundamental kinship with the *atua* and the natural world (Harmsworth & Roskrige, 2014; Hikuroa, 2018; Hikuroa, 2017; Harmsworth & Awatere, 2013; Ngāti Whātua Ōrākei, 2018).

The significance and intergenerational relationship between Māori and cultural landscapes within a catchment can be reflected in the place names assigned (Harmsworth & Roskrige, 2014). Ancestral stories were attached to every part of the landscape sharing the nature of the resource and an assessment of its status (Tipa & Nelson,

2012), linking people and culture to place, establishing spiritual and ancestral significance, and serving to locate points in tribal history (Harmsworth & Roskrug, 2014). The breadth of views, and expressions, held by mana whenua are informed by specific relationships with environments that vary regionally. Māori have a unique perspective on environmental issues and a profound relationship with the land that has developed over many generations, through connection, observation and experience. These expressions of place are linked to whakapapa through stories (Harmsworth & Roskrug, 2014). Specific to waterways, place names may describe the source of the waterway, its character, or discrete features within the catchment, for example:

- Te Awa-makarara – ‘the stream that makes a noise’ or ‘a stream with a noisy tributary’ (Tipa & Nelson, 2012)
- Tunamau – ‘to catch eels’, referencing the abundance of eels in this central Auckland stream (Lewis, 2008)

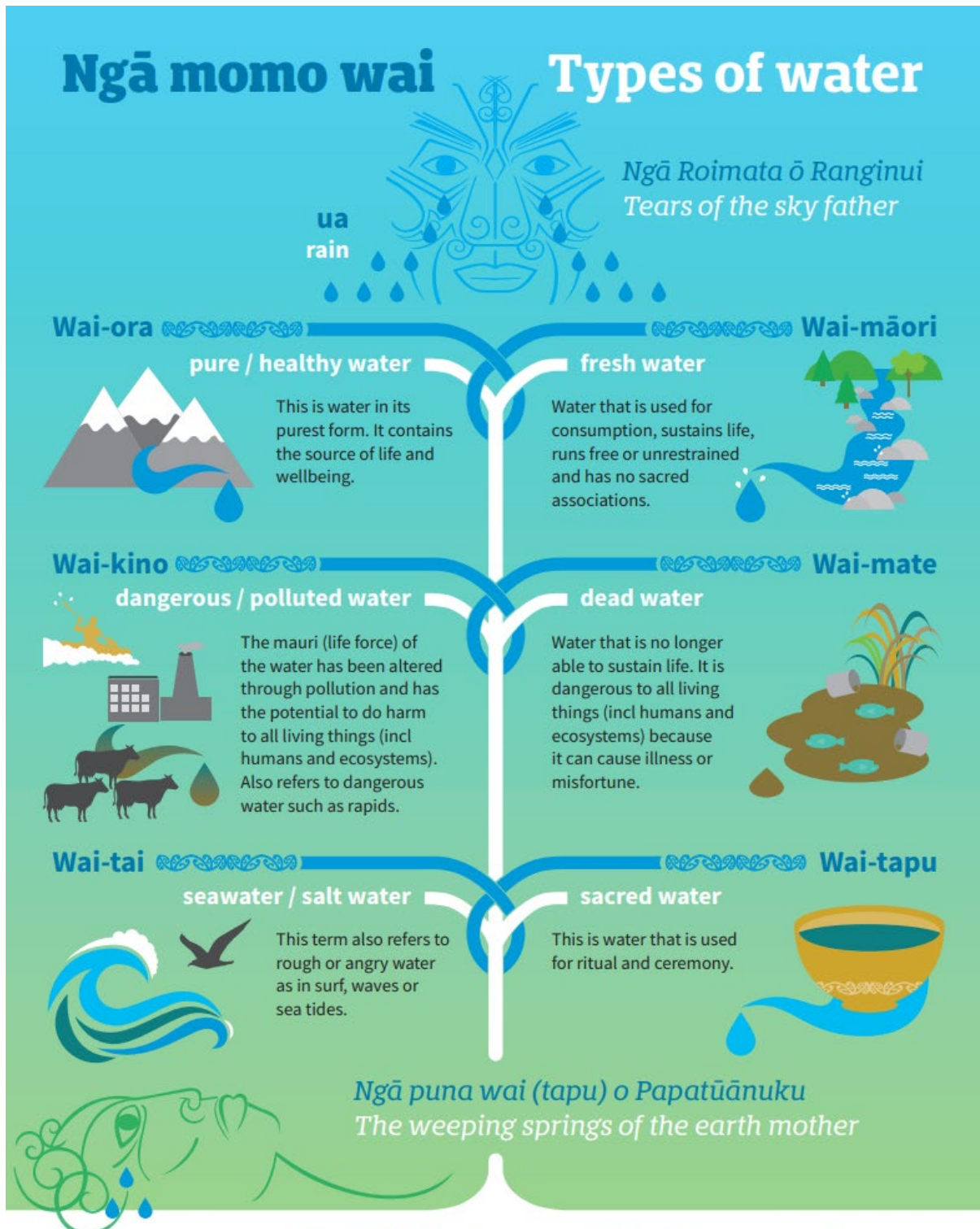
Panelli & Tipa (2007) explain how Māori relationships are sustained in contemporary cultural ways, including the practice of mihi (greeting and acknowledgment) and whakawhanaungatanga (forming connections and establishing relationships) whereby individuals identify themselves within their environment, integrating their maunga (mountain), their awa (river), their moana (ocean or large lake), their marae, and their tūpuna (ancestors). The foundation of individual identity includes intergenerational connection to tribal territory. Ecosystems do not simply connect biophysical components but involve a combination of physical, spiritual, and sociocultural phenomena that blur the modern Western scientific division between human and nonhuman elements (Panelli & Tipa, 2007).

4.2.2.1. *Wai*

Wai (water) is an integral part of Māori wellbeing and identity (Callaghan, et al., 2018; Grace, 2010). The widely-held belief is wai, in its various forms, originated from the separation of Ranginui and Papatūānuku through their grief and yearning for one another (Morgan, 2006; Williams, 2006; Ngata, 2018). The atua were so heartbroken by their separation that they shed an immense quantity of tears, creating the vast waterways and oceans of the Te Whai Ao (the world of light – the world as we know it today).

In one example, Morgan (2006) names rainfall as ‘Ngā roimata o Ranginui (the tears of Rangi)’ and the wellsprings as ‘Ngā puna tapu o ngā atua (the weeping of Papa)’. Waterways, the domain of Tangaroa, are of particular significance because their condition is seen as a reflection of the health of Papatūānuku (Panelli & Tipa, 2007; Andrew, 2016). Waterways are considered the bloodlines and the veins of Papatūānuku, which carry the vital forces to replenish life (Christchurch City Council, 2003; Brockbank, 2018; Bunny, 2014). Wetlands are often referred to by Māori as the ‘kidneys of Papatūānuku’, and act as filters to remove contaminants and cleanse receiving waters (Brockbank, 2018; Bunny, 2014).

Māori have a range of classifications for water depending on the particular qualities of the water. Douglas (1984) outlines terminology for five traditional Māori water states (Figure 3). Table 1 provides an extended list of water terminology from literature.



Te Wiki o te reo Māori

Māori Language Week

10 – 16 o Mahuru (September) 2018



Figure 3: Ngā Momo wai – Types of water, as prepared by WaterNZ for Te Wiki o te reo Māori (September 2018)

Table 1: Ngā momo wai (Types of Water)

Wai-	Description	Source
Manowai	Water that has deep, strong undercurrents	(Ngata, 2018)
Wai-ariki	Thermal water, hot springs or curative waters – the term ariki means "chief" in English and they are referred to as the chiefs or patriarchs of all waters	(Durie, et al., 2017; Grace, 2010; Ngata, 2018; Panoho, 2017)
Wai-atarau	Reflecting waters	(Lewis, 2008)
Wai-au	Strong current / River of swirling currents	(Panoho, 2017)
Wai-huka	Frothy water	(Ngata, 2018)
Wai-karakia	Water for ritual purposes	(Royal, 2006)
Wai-kato	Full flowing river	(Grace, 2010)
Wai-Kauau	Running water	(Taylor, 1848)
	Water in a running state, as a stream	(Kendall, 1820)
Wai-kawa	Rancid, slow-moving waters bitter, or brackish water	(Ngata, 2018)
		(Taylor, 1848)
Wai-kino	Polluted water – the mauri of the water has been altered through pollution (physical or spiritual) or corruption and has the potential to do harm to humans. Stagnant, dead, or death-inducing waters. Mauri has been changed and is susceptible to being changed back again.	(Grace, 2010; Williams, 2006; Douglas, 1984; Ngata, 2018)
	Dangerous water – sometimes inclement seas or swollen rivers. Mauri has been changed and is susceptible to being changed back again.	(Royal, 2006; Williams, 2006)
Wai-kōkota	Waters of cockles	(Lewis, 2008)
Wai-korohihī	Hissing water	(Panoho, 2017)
Wai-kuta	Waters of the reed	(Lewis, 2008)
Wai-maha	Many streams	(Panoho, 2017)
Wai-makariri	Cold waters	(Grace, 2010)
Wai-manawa-whenua	Water from under the land	(Royal, 2006)
Wai-mano	Deep flowing water	(Panoho, 2017)
Wai-māori	Normal or fresh water - this is referred to as ordinary water which runs free or unrestrained and it has no sacred associations.	(Durie, et al., 2017; Grace, 2010; Callaghan, et al., 2018; Williams, 2006; Douglas, 1984)
Wai-mā-reparepa	Water that splashes and ripples	(Panoho, 2017)
Wai-mātaitai	Estuarine water, or coastal lagoons 'hāpua'	(Williams, 2006)
Wai-mate	Water that is no longer able to sustain life. It is dangerous to all living things (including humans and ecosystems) because it can cause illness or misfortune.	(Grace, 2010; Williams, 2006; Douglas, 1984; Ngata, 2018; Panoho, 2017)
	Geographically it refers to sluggish water, stagnant or back water. Some tribes refer to it as wai-kawa.	
Wai-ngaehe	Murmuring waters	(Panoho, 2017)
Wai-nono	Water that oozes	(Panoho, 2017)
Wai-ora	Purest water - Used in rituals to purify and sanctify and has the power to give life, sustain wellbeing and counteract evil.	(Grace, 2010)

Wai-	Description	Source
	Water of life – especially rainwater or tears; also, springs, holy water and water from special places where the mauri of the water changes or where exceptional events have occurred in the past. Waiora can often rejuvenate damaged mauri, even that of humans (through the ceremony known as ‘pure’).	(Williams, 2006; Douglas, 1984)
	Can refer to soundness of body and mind	(Durie, et al., 2017; Grace, 2010)
	Sense of wellbeing across our physical, spiritual, emotional, communal and environmental dimensions.	(Ngata, 2018).
	Pure water is termed “Te Waiora ā Tane”.	(Williams, 2006; Douglas, 1984)
Wai-pao	Water that causes the rocks to clatter	(Panoho, 2017)
Wai-paru	Clouded waters	(Ngata, 2018)
Wai-piata	Glistening water	(Panoho, 2017)
Wai-piro	Odorous waters / stinking water	(Ngata, 2018; Lewis, 2008)
Wai-pōuri	Sad/dark water	(Panoho, 2017)
Wai-pukepuke	Water that has been whipped by the wind to form peaks	(Ngata, 2018)
Wai-rākei	The place where the pools were used as mirrors	(Merito, 2017; Grace, 2010)
Wai-rangi	Temporary, unbalanced state of mind or a state of emotional and mental upheaval.	(Durie, et al., 2017; Ngata, 2018)
Wai-rarapa	The glistening waters	(Grace, 2010)
Wai-rere	Water that rushes	(Panoho, 2017)
Wai-roa	Long water	(Panoho, 2017)
	Second River / Two rivers / Two waters	(Panoho, 2017)
	Can refer to one's soul or spirit	(Durie, et al., 2017; Merito, 2017)
Wai-rua	Can refer to one's attitude or mood	(Merito, 2017)
	May also refer to the two waters inside a pregnant woman; the amniotic fluid, and the tamaiti (child).	(Brockbank, 2018)
Wai-tai	Sea (or salt) water – this term also refers to rough or angry water as in surf, waves or sea tides.	(Durie, et al., 2017; Grace, 2010; Royal, 2006; Williams, 2006; Douglas, 1984)
Wai-taki	The tears of Aoraki	(Grace, 2010)
	Weeping waters / Waters that cry	(Panoho, 2017)
Wai-tangi	Grieving waters – refers to a river or part of a river which through some mishap has caused death, much pain and grieving to the tribe.	(Grace, 2010)
Wai-tapu	Sacred water–waters used for ceremonial purposes	(Royal, 2006; Douglas, 1984)
Wai-te-matā	“Waters glistening like obsidian”	(Ngāti Whātua Ōrākei, 2018).
Wai-te-matā-tūhua	Water smooth as the face of obsidian	(Panoho, 2017)
Wai-Whakaata	Shadow Water	(Panoho, 2017)
Wai-whakaika/	Water to assist in the cutting of hair	(Royal, 2006)
Wai-kotikoti	Specific ceremonial waters for the embedding of knowledge	(Ngata, 2018)
	Water where stars are reflected	(Panoho, 2017)
Wai-whetu	The star waters	(Grace, 2010)

4.2.2.2. *Mauri*

Mauri is the essence that has been passed from Ranginui and Papatūānuku to their progeny and down to all living things through whakapapa in the Māori creation story. It is considered to be the essence or life force that provides life to all living things and the potential to support life to water and land (Morgan, 2006; Voyde & Morgan, 2012; Ngata, 2018; Mead, 2003; Barlow, 1991; Marsden, 2003). It is inherently related with other metaphysical characteristics, including tapu, mana, and wairua. Mauri is the binding force that links the physical to the spiritual worlds and denotes a health and spirit which permeates through all living and non-living things. Damage or contamination of the environment is therefore damage to or degradation of mauri (Harmsworth & Awatere, 2013; Harmsworth & Roskrige, 2014). In very simplified resource management terms, mauri can be likened to the intrinsic value of ecosystems or the concept that ecosystems should be preserved for their own sake, rather than for their value to people (Morgan, 2008).

All water bodies have their own mauri which gives them distinct personality or mana (authority) (Durie, et al., 2017). Particular practices must be observed to maintain harmonic balance and prevent degradation of the mauri of the water. The basic premise is that water, once used, should be returned to Papatūānuku if the mauri of that water is not suitable for the subsequent use (Morgan, 2006). Brockbank (2018) explains that the water is meant for the whenua, meant for Papatūānuku – Ngā roimata o Ranginui (the tears of Ranginui) shed for his love, Papatūānuku. Te Ao Māori requires recognition of the importance of not altering mauri to the extent that it is no longer recognisable; the essential character of a site must not be changed as a result of human intervention (Williams, 2006). Waters of different mauri should not be deliberately or artificially mixed (Christchurch City Council, 2003; Lewis, et al., 2015) – mixing of incompatible mauri, in an unnatural way, or total pollution so water bodies are no longer capable of sustaining life may result in ‘waimate’ (Williams, 2006; Ministry for the Environment, 2003). The mauri of water can be enhanced by passing over the land, or by discharge into the whenua (via soakage) through land or rock before it is released into receiving environments (Lewis, et al., 2015; Brockbank, 2018; Brockbank, 2019). For stormwater treatment, this can be achieved via multiple water sensitive design practices including; outfalls set back from the main channel discharging to recovery reaches with riprap aggregate aprons at the outfall for erosion mitigation, or surface discharge into raingardens and swales. Figure 4 presents a depiction of the hurihanga wai (the water cycle) demonstrating the enhancement of mauri within the water cycle (Ministry for the Environment, 2003), and uses traditional Māori water state terminology from Douglas (1984). Figure 5 provides an alternate representation of the hurihanga wai reflecting modern water management terminologies and interactions between urban spaces and the natural water cycle.

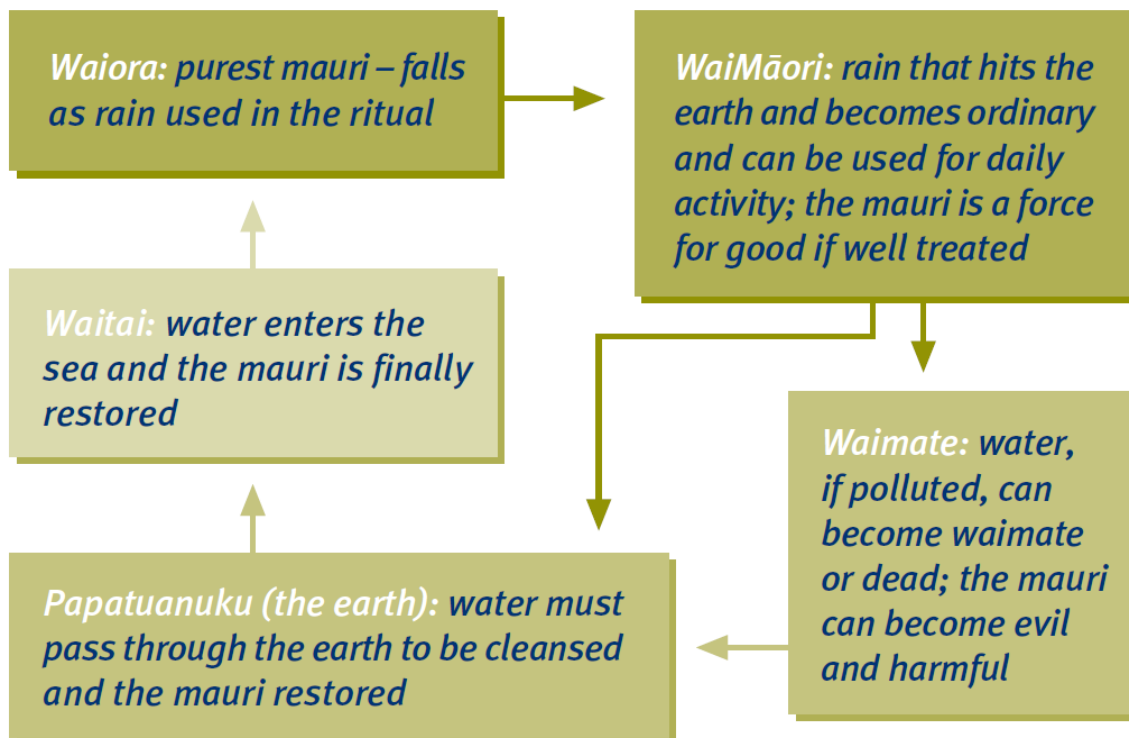


Figure 4: Te Hurihanga Wai – Māori Water Cycle (Ministry for the Environment, 2003)



Te Hurihanga Wai - Water Cycle



Te Wiki o te reo Māori
Māori Language Week



9 – 15 o Mahuru (September) 2019

Figure 5: Te Hurihanga Wai – Water Cycle, as prepared by WaterNZ for Te Wiki o te reo Māori (September 2019)

The Māori world view acknowledges a natural order to the universe, a balance or equilibrium, and that when part of this system shifts, the entire system is put out of balance (Harmsworth & Awatere, 2013). A key outcome for kaitiakitanga is to restore balance back to the whole system, to maintain or enhance mauri, and to ensure this balance is maintained between people and the natural and spiritual worlds (Harmsworth, 2018). The following philosophy underlies the desire by iwi to deliver on kaitiakitanga obligations (Tipa & Teirney, 2003):



'If you do not sustain the waterways, the mahinga kai sourced from them, and sites of significance in the wider environment, then you cannot sustain yourself, honour your ancestors, or provide for the children of your children into the future.'

Thus, sustainability, the long-term well-being, and healthiness of Māori are seen by some Māori as one and the same thing.

When mauri is viewed in the context of life, energy, and vitality, it is easier to understand how resource use and development can alter the mauri of rivers by altering the food or energy sources, the water quality, the habitat, the energy of the flow regime, and the biotic interactions of the river ecosystem (Tipa & Nelson, 2012). Hopkins (2018) aimed to classify the mauri of wai in Matahuru Awa (river) in North Waikato. Hopkins (2018) concluded that not only was the mauri of the awa degraded through land development practices impacting water quality, a lack of viable ngahere (forest) required for manu (bird) habitat throughout the catchment resulted in the loss of mana of the hapū. This was because whānau were prevented from undertaking their kaitiakitanga and manaakitanga responsibilities due to land alienation preventing access to their ancient taonga. Similarly, while continued water degradation has a negative impact on the health and wellbeing of downstream mahinga kai (food gathering place), the inability of Māori to continue the longstanding food gathering tradition also has lasting impacts on overall cultural and social wellbeing (Brockbank, 2018).

4.2.3. Mātauranga Māori

Māori have an intricate, holistic and interconnected relationship with the natural world and its resources, with a rich knowledge base – mātauranga Māori – developed over thousands of years and dating back to life in Polynesia and trans-Pacific migrations (Clapcott, et al., 2018; Hikuroa, 2017; Harmsworth & Awatere, 2013; Ataria, et al., 2018). Traditional knowledge has been reinforced through whakapapa and kōrero tuku iho (creation narratives passed down) which have informed cultural values and ethics (Ataria, et al., 2018).

There are numerous definitions of mātauranga Māori. Harmsworth & Awatere (2013) cite Marsden's (1988) definition as one of the more generally accepted:

"the knowledge, comprehension or understanding of everything visible or invisible that exists across the universe"

Mātauranga Māori includes all Māori knowledge systems or ways of knowing and doing and can also be simply defined as wisdom (Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014). It is a holistic perspective encompassing all aspects of knowledge and seeks to understand the relationships between all component parts to gain an understanding of the whole system – human and non-human, and the natural and spiritual worlds (Kitson, et al., 2018; Clapcott, et al., 2018). Mātauranga Māori has been described as the ūkaipō (source / origin) of knowledge in Aotearoa (New Zealand) (Hikuroa, 2017).

Mātauranga is specific to geographic place and local context (Kitson, et al., 2018; Paul-Burke, et al., 2018). Kitson, et al. (2018) caution *'the whakapapa of knowledge is important'* and argue that there is a need to protect mātauranga Māori by seeking appropriate permissions to use information, acknowledging historical sources and biases, and exploring how to support kaitiakitanga and tino rangatiratanga (self-determination) of mātauranga.

Māori culture is based on strong oral narratives, including maramataka (Māori lunar calendar used to guide planting, harvesting, fishing, and hunting; dynamic and tested through experiential learning), whakataukī (proverbs), whakapapa (genealogies), pūrākau (stories, traditional Māori narratives), waiata (songs), mōteatea (chants, poems), and whaikōrero (oratory, speechmaking) (Rolleston, 2005; Rolleston, 2006; Andrew, 2016; Hikuroa, 2017). Huge quantities of ancestral and traditional knowledge were memorised and retained by people such as tohunga (priests, specialists), rangatira (chiefs), kaumātua (elders), kuia (elderly female), and pakeke (adults) (Harmsworth & Roskruge, 2014).

The ancestral landscape and environment are of critical importance for Māori communities – each of the elements of landscape have kōrero tawhito (ancient histories) and whakapapa woven into their landscapes with generations of uri (descendants) engaging in these places and practices (Jackson, et al., 2018). These histories provide a link between the past, present, and future ancestors of the place, and give voice to the significance of the areas so as to promote the safeguarding of the places for sustained the well-being. Ataria et al. (2018) open with the whakataukī:

He hanga nā te waha o te ngutu nō mua iho anō.
(Williams HW 1908)

*Although seeming to be only from the lips, it is
actually of ancient origin*

Ataria et al. (2018) further explain – ancient sayings and customs gain force from their antiquity, providing guidance for modern times.

Oral narratives are frameworks by which Māori understand and comprehend Te Taiao—the universe, the natural world (including us)—add to and test that knowledge, share it within generations, and pass it down through the generations (Hikuroa, 2017; Hikuroa, 2018). Ataria, et al. (2018) explain that mātauranga Māori spans knowledge, culture, values and worldview, and incorporates knowledge generated using techniques consistent with the scientific method but explained according to a Māori world view. It is this understanding of mātauranga that supports application alongside western science.

Whakataukī shed light on the connections between humans and their environment, beyond physical use to incorporate deeper social and behavioural engagement with the surrounding environment (Whaanga, et al., 2018; Andrew, 2016). Whakataukī in the literature recognise the special value of specific places as well as associations and identifications. For example:

*Ma te mauri kei Ōmāpere ka ora te
whenua*

When the mauri of Ōmāpere is strong, the land is healthy
(NRC, MPI, & MfE, 2015)

*Te toto o te tangata he kai; te oranga o
te tangata he whenua*

Food supplies the blood of man; his welfare depends on the land
(Rolleston, 2005)

*He kura whenua e hokia; he kura
tangata e kore e hokia*

The treasure of land will persist; human possessions will not
(Brougham et al., 1987) in (Rolleston, 2005)

However, oral narratives are not well represented in western-science based considerations. Dismissing oral narratives as just myths, ancient legends, incredible stories and folklore does not value Te Ao Māori or the importance of pūrākau, maramataka, and whakataukī (among other oral narratives) in teaching, learning and the intergenerational transfer of knowledge (Hikuroa, 2017). Meanings may not be immediately apparent without knowing the historical, cultural and linguistic context from which the narrative originated. What those who disregard oral narratives fail to comprehend, is that the knowledge was generated using scientific methods, explained according to a Māori world view (Hikuroa, 2017). Oral narratives comprise knowledge generated using methods and techniques developed independently from other knowledge systems, comprise codified knowledge, and include a suite of techniques empirical in nature for investigating phenomena, acquiring new knowledge, and updating and integrating previous knowledge. (Hikuroa, 2017; Hikuroa, 2018). Empowering understanding of Māori oral traditions is essential to gain insight to traditional knowledge and practices in the context of contemporary applications of that knowledge. Capturing these oral narratives requires establishing relationships through correct protocol, acknowledging mana, and taking the time to talk and listen (Andrew, 2016).

Mātauranga Māori is the pursuit and application of knowledge and understanding of Te Taiao (the natural world), following a systematic methodology based on evidence, incorporating culture, values, ethics, and world view (Hikuroa, 2018; Ataria, et al., 2018; Paul-Burke, et al., 2018). Mātauranga Māori is a dynamic and evolving knowledge form that represents more than the past, it adapts and changes but does not lose its integrity nor sense of origin (Harmsworth & Awatere, 2013; Kitson, et al., 2018; Paul-Burke, et al., 2018; Awatere, et al., 2013; Ogilvie, et al., 2018; Bargh, 2014). Mātauranga Māori incorporates both qualitative and quantitative aspects (Kitson, et al., 2018), and is continually being used, adapted and incorporated into people's lives which allows for innovative ideas and practices including those evolving from fresh discoveries and research (Ataria, et al., 2018; Awatere, et al., 2008; Hikuroa, 2017). Mātauranga Māori has an important part to play in modern urban planning and design (Rolleston & Awatere, 2009).

4.2.4. Values

Māori values are derived from the traditional belief system based on mātauranga Māori and can be defined as instruments through which Māori make sense of, experience, and interpret their environment (Harmsworth &

Awatere, 2013; Harmsworth & Roskrige, 2014; Durie, et al., 2017). Important Māori values presented frequently within the literature are provided in Table 2. Table 3 provides a range of environmental concepts that are guided by the foundation values. Beyond these overarching values and concepts, iwi-specific approaches to management are defined and implemented based on local environment and customs.

There are many areas of overlap in these values and concepts stemming from the inherently interdependent and interconnected nature of indigenous knowledge and lived experience. Paul-Burke, et al., (2018) define whanaungatanga as including the principles of kotahitanga, manaakitanga, kaitiakitanga and rangatiratanga. Northland Tangata Whenua Freshwater Values (2015) also note that many of the values are interdependent – for example, mana can be compromised by failure in manaakitanga, and mana has a tapu dimension. Koroi (2017) considers the overlap expresses the various layers of mātauranga Māori and their hierarchical dependence on one another – firstly, when there is an understanding of Māori histories and beliefs, one can understand whakapapa and its importance for Māori; then when whakapapa and our (human) position spiritually and physically interconnected to the wider environment is understood, then one can understand tikanga and its location specific context.

Table 2: Overarching Values

Value	Description	Source
Arohatanga	The notion of care, respect, love, compassion	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Maxwell, et al., 2018; NRC, MPI, & MfE, 2015)
Kaitiakitanga	Environmental guardianship, stewardship (also mana-tiakitanga), An active rather than passive relationship with intergenerational responsibilities Link to <i>tau utu utu</i>	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Rolleston, 2005; Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Harmsworth, 2018; Maxwell, et al., 2018; Brockbank, 2018) (Blair, 2009; Tipa & Teirney, 2003; Tipa & Teirney, 2006)
	Managing and conserving the environment as part of a reciprocal relationship, based on the Māori world view that we as humans are part of the natural world	(Ngā Aho, 2019; Tipa & Nelson, 2012)
	The responsibility of all and strives to regulate and sustain the well-being of people and natural resources	(Clapcott, et al., 2018)
	Underpinned by values such as whakapapa, mana, and mauri, and using tools and methods (ritenga) such as rāhui (temporary prohibition, reserve)	
	Exercise of customary custodianship, incorporating spiritual matters	(Panelli & Tipa, 2007)
	Use of natural resources governed and regulated through cultural lore and traditions of tapu, rāhui, and noa (sanction). Conservation and protection of the natural environment promotes community awareness of inherent values contained within the environment.	(Rolleston, 2005; Rolleston, 2006)
Kotahitanga	Unity, solidarity, consensus, participation, cohesion, collective action, and collaboration, respect for individual differences and participatory inclusion for decision making	(Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Rolleston, 2005; Ngā Aho, 2019; Harmsworth, 2018; Maxwell, et al., 2018; Brockbank, 2018)
Tikanga	Customary practice, tradition, values, protocols	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Rolleston, 2005; Harmsworth, 2018; Koroi, 2017; Maxwell, et al., 2018; Rolleston, 2006; Rolleston, 2005; Tipa & Teirney, 2006) (Tipa & Nelson, 2012)
(Tino) Rangatiratanga	Sovereignty, empowerment, self-determination, autonomy, control, leadership, management, identity, decision making, and independence Allows Māori to control their own culture, aspirations and destiny Māori values and iwi rights and interests are central to decision making	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Rolleston, 2005; Clapcott, et al., 2018; Awatere, et al., 2009; Awatere, et al., 2008; Rolleston & Awatere, 2009; Harmsworth, 2018; Brockbank, 2018) (Blair, 2009) (Tipa & Teirney, 2006) (Tipa & Nelson, 2012)
	The right to exercise authority and self-determination within one's own iwi / hapū realm	(Ngā Aho, 2019; Maxwell, et al., 2018; NRC, MPI, & MfE, 2015)
	Recognition and acknowledgement	(Rolleston, 2005; Rolleston, 2006)

Value	Description	Source
Mana Mana whenua	Authority over land and resources	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Rolleston, 2005; NRC, MPI, & MfE, 2015)
	Represents authority, power, control, status, leadership (based on whakapapa) Also: mana moana, mana atua, mana whakahaere, mana tangata, and whakamana	(Harmsworth, 2018; Maxwell, et al., 2018)
Manaakitanga	Acts of giving and caring for, looking after, hosting	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Harmsworth, 2018; Maxwell, et al., 2018; NRC, MPI, & MfE, 2015)
	Hospitality and security.	(Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009)
	The ethic of holistic hospitality whereby mana whenua has inherited obligations to be the best hosts they can be. Fostering and nurturing of relationships between a host and a visitor (manuhiri), the well-being of the visitor is paramount.	(Ngā Aho, 2019; Tipa & Nelson, 2012)
Mātauranga	Knowledge, expertise, understanding, comprehension, of aspects both visible and invisible, wisdom	(Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Rolleston, 2005; Ngā Aho, 2019; Brockbank, 2018; NRC, MPI, & MfE, 2015; Rolleston, 2005)
Mauri Mauritanga	Life principles, essence, life-force, derived from whakapapa	(Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Rolleston, 2005; Harmsworth, 2018; Brockbank, 2018; NRC, MPI, & MfE, 2015; Panelli & Tipa, 2007) (Tipa & Teirney, 2003) (Tipa & Teirney, 2006) (Tipa & Nelson, 2012)
Orangatanga	Health and wellbeing Links human and environmental health as interdependent	(Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Harmsworth, 2018; Brockbank, 2018; NRC, MPI, & MfE, 2015)
Wairuatanga	A spiritual dimension, embedded emotion/spirit, spiritual wellbeing	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Harmsworth, 2018; Maxwell, et al., 2018; Panelli & Tipa, 2007; Tipa & Nelson, 2012)
	The spiritual connection of everything, the immutable spiritual connection between people and their environments	(Durie, et al., 2017; Ngā Aho, 2019; Brockbank, 2018; NRC, MPI, & MfE, 2015)
Whakakotahitanga	Consensus, respect for individual differences and participatory inclusion for decision-making	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014)

Value	Description	Source
Whakapapa	Ancestral lineage, genealogical connections, relationships, links to ecosystems Māori seek to understand the total environment or whole system and its connections through whakapapa, not just a part of these systems Holistic and integrated perspective Link to <i>ki uta ki tai</i>	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Rolleston, 2005; Harmsworth, 2018; Koroi, 2017; Durie, et al., 2017; Maxwell, et al., 2018; Brockbank, 2018; Panelli & Tipa, 2007) (Rolleston, 2006) (Tipa & Teirney, 2006) (Tipa & Nelson, 2012)
Whanaungatanga	Family connections, relationships, kinship. Regards the extended family structure and acknowledges the relationships that Māori have to one another and to the world around them	(Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Rolleston, 2005; Clapcott, et al., 2018; Harmsworth, 2018; Brockbank, 2018; Panelli & Tipa, 2007; Blair, 2009; Tipa & Nelson, 2012)
	Participation and membership	(Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Rolleston, 2005; Rolleston, 2006)
	A relationship through shared experiences and working together which provides people with a sense of belonging	(Ngā Aho, 2019; Maxwell, et al., 2018)

Table 3: Additional Concepts

Value	Description	Source
Ki uta ki tai	A whole-of-landscape holistic approach, understanding and managing interconnected resources and ecosystems from the mountains to the sea. Acknowledges the reciprocal relationship between people and the environment. Relies on the idea that the mauri of a river cannot be assessed in isolation of its surroundings and must be based on the mauri of interrelated components in the wider catchment (the Māori concept of integrated catchment management) Also: “Ngā maunga ki te ngutu awa, Ngā maunga ki te moana”, “ko au te awa, ko te awa ko au”	(Harmsworth, 2018; Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; Brockbank, 2018; Grace, 2010; Koroi, 2017; Clapcott, et al., 2018; Kainamu-Murchie, et al., 2018; Tipa & Teirney, 2003)
Mahinga kai	All-inclusive term encompassing places for food gathering, food production and sources of rongoā, and the activity of gathering –requires healthy and diverse ecosystems to ensure the resource is fit for cultural usage Mahinga kai species as tohu (indicators) for environmental monitoring; if mahinga kai is not present, or is unsafe to harvest, then that natural system is under stress and requires remedial action	(NRC, MPI, & MfE, 2015; Tipa & Teirney, 2003; Tipa & Teirney, 2006) (Grace, 2010; Tipa & Nelson, 2012)
Mana motuhake	The importance Māori place on identity for the wellbeing of an individual and their community	(Koroi, 2017)
Mana whakahaere	Access and admission, traditionally restricted and regulated access to certain areas through the use of tapu, rāhui and noa	(Rolleston, 2005; Rolleston, 2006)
Pūrākau	A narrative that aids in learning knowledge, rituals, karakia, history and creation	(Maxwell, et al., 2018)

Value	Description	Source
Ritenga	Sanctions and restrictions, regulation and use Customs, protocols and laws that regulate actions and behaviour related to the physical environment and people. Includes concepts such as tapu (sacred), rāhui (restricted), and noa (unrestricted), practical rules to sustain the well-being of people, communities and natural resources. Requires balance between regulated and de-regulated states.	(Rolleston, 2005; Harmsworth, 2018; Harmsworth & Awatere, 2013; Harmsworth & Roskruge, 2014; NRC, MPI, & MfE, 2015)
Taonga tuku iho	Asserts the centrality and legitimacy of Te Reo Māori, tikanga and mātauranga Māori and allows the Māori ways of knowing, doing and understanding the world to be considered valid in their own right Intergenerational protection of highly valued taonga, passed on from one generation to the next, in a caring and respectful manner	(Clapcott, et al., 2018) (Harmsworth, 2018; Harmsworth & Awatere, 2013; NRC, MPI, & MfE, 2015; Panelli & Tipa, 2007; Tipa & Teirney, 2006)
Tau utu utu	Reciprocity, giving back what you take – e.g. <i>humans provide benefit to the ecosystem, through guardianship and sustainability, which means the ecosystem is sustained and can then provide benefit back to humans</i> Link to <i>Kaitiakitanga</i>	(Harmsworth, 2018; Harmsworth & Awatere, 2013; Grace, 2010)
Te Ao Tūroa	The natural world, the long-standing world, or the enduring world Intergenerational concept of resource sustainability	(Harmsworth, 2018; Harmsworth & Awatere, 2013)
Tohatoha	To disperse, spread, distribute, share, allocate	(Maxwell, et al., 2018)
Tohungatanga	The retention and use of knowledge to benefit the tribe or business	(Harmsworth, 2018)
Uru te ngangana	Balance between complementary or conflicting forces and needs	(Panelli & Tipa, 2007)
Wāhi tapu & wāhi taonga	The need to provide for and protect sacred sites – sites significant due to their tapu or taonga status, as mandated by kaitiaki	(Grace, 2010; Tipa & Teirney, 2006)

4.3. Contemporary Setting

In this section we aim to summarise current policies and guidelines that provide connection between Te Ao Māori and urban water management. These initiatives provide examples for empowering the naturalisation of Te Ao Māori in water management for healthy and resilient communities in Aotearoa.

4.3.1. Te Tiriti o Waitangi

The Treaty of Waitangi (Te Tiriti o Waitangi) 1840 provides the basis for partnership and engagement between Māori and the Crown (the Government). The Treaty, written in Māori and English, has been the origin of much debate between Māori and Europeans since 1840, with various interpretations of the text and what it means (Harmsworth & Awatere, 2013; Harmsworth & Roskrige, 2014; Koroi, 2017; Panelli & Tipa, 2007). It is beyond the scope to enter that debate herein. However, the principles of partnership, participation and protection which underpin the relationship between the Government and Māori under the Treaty of Waitangi provide a basis for participation and decision-making by Māori with the Crown and with other stakeholders (e.g. community groups, industry, landowners) (Harmsworth & Awatere, 2013).

4.3.2. Te Mana o te Wai

The National Policy Statement for Freshwater Management (NPS-FM) recognises that fresh water has deep cultural meaning to all New Zealanders. Te Mana o Te Wai is a concept described within the NPS-FM referring to *the integrated and holistic well-being of a freshwater body* (Ministry for the Environment, 2017).

Te Mana o te Wai acknowledges each water body has its own mauri and its own mana which must come first to protect the integrity of the water body (Ministry for the Environment, 2017; Porou, 2017). Upholding Te Mana o te Wai requires provision for Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody), and Te Hauora o te Tangata (the health of the people). Porou (2017) explains Te Mana o te Wai is all encompassing ensuring the first right to the water goes to the water, it recognises that wai is nurturing and teaches us the lesson:

Ko au te wai, ko te wai ko au

I am the water and the water is me

While the concept is expressed in te reo, te mana o te wai applies to freshwater management on behalf of the whole community aiming to incorporate the values of tangata whenua and the wider community in relation to each water body based on their unique relationship with that water body (Ministry for the Environment and Ministry for Primary Industries, 2018; Ministry for the Environment, 2017).

The NPS-FM and te mana o te wai align with wider WSUD objectives, recognising an objective to improve integrated management of fresh water and the use and development of land in whole catchments, including recognising interactions ‘*ki uta ki tai*’ (Table 2) between freshwater, land, ecosystems and the coastal environment (Ministry for the Environment, 2017).

4.3.2.1. Urban Water Principles – Ngā Wai Manga

The development of ten urban water principles began with the concept of Te Mana me Te Mauri o Te Wai – this means that we owe the greatest obligation to that which ‘gives us life’ (Ministry for the Environment, 2018).

The principles are intended:

to guide decision-making promotes sustainable behaviours and the creation of water sensitive urban spaces by drawing on mātauranga, the lessons of the past, international best practice, the needs of our present communities, and a vision of a sustainable, resilient future. (Ministry for the Environment, 2018)

The principles are summarised as follows:

PAPATŪĀNUKU – Our relationship with the land–Papatūānuku–will pre-determine our relationship with water

1. Protect and enhance ecosystem health of all receiving environments.
2. Co-design with nature an integrated and regenerative approach to urban development.
3. Address pressures on waterbodies close to source.

NGĀ WAI TUKU KIRI – “Our waters are a gift of life provided to us by our tūpuna”

4. Recognise and respect mana motuhake – the whakapapa and relationship that mana whenua have with water ecosystems in their rohe.

TĀNGATA – “Our environments are places of human occupation”

5. Identify and consider the community values for urban water and reflect them in decision-making.
6. Optimise environmental, social and cultural benefits when investing in buildings and infrastructure.

TE HĀPORI ME TE WAI – “The community’s love and care for water is enduring”

7. Uphold and foster kaitiakitanga and custodianship of urban water ecosystems.
8. Collect and share information to promote common understanding of urban water issues, solutions and values.

TIAKINA MŌ APŌPŌ – “In building future resilience, our connectedness with the environment is our strength”

9. Increase resilience to natural hazards and climate change.
 10. Conserve and reuse water resources.
-

These principles condense many of the overarching values and concepts presented in Table 2 and Table 3 which reflect Te Ao Māori and demonstrate how to apply them in the context of urban water management. While driven from the urban water space, they specifically intend to support and guide the implementation of water sensitive design – and Te Ao Māori– which recognises an inability to disconnect water from land, and people from the ecosystem.

4.3.3. Essential Freshwater work programme

The Essential Freshwater work programme aims to reverse water quality trends and achieve long-term improvements in freshwater health (Ministry for the Environment and Ministry for Primary Industries, 2018). The programme has three main objectives: to stop further degradation and loss, to reverse past damage, and to address water allocation issues.

While not referenced within the body of the issued document, the Cabinet Paper appended specifically identifies a vision (Ministry for the Environment and Ministry for Primary Industries, 2018):

“Mauri must be restored to waterways subjected to pollution and practices that have compromised the relationship that Māori have traditionally had with these taonga;”

As a companion to the Essential Freshwater work programme, the MfE published *Shared Interests in Freshwater: A New Approach to the Crown/Māori Relationship for Freshwater* (Ministry for the Environment and Māori Crown Relations Unit, 2018). The document clarifies that the Essential Freshwater work programme cannot be progressed without a “concurrent and substantive” discussion with Māori about their rights and interests in freshwater under the Treaty of Waitangi.

The document recognises there is a wide range of views within Māoridom about how to address freshwater issues, but broadly summarises aspirations for improvements to the health of ecosystems and waterways, governance and decision making, and recognition of iwi/hapū relationships with particular freshwater bodies. A foundation to these aspirations is the need to ensure protection of customary activities (such as food gathering, access to wāhi tapu, and use of water for spiritual practices) and recognising, protecting, and enhancing the mauri of the water bodies (Ministry for the Environment and Māori Crown Relations Unit, 2018).

While not specifically referenced, the Essential Freshwater programme and the intended empowerment of Te Ao Māori within the framework strongly parallel the outcomes intended by WSUD – for healthy resilient communities we must achieve a healthy and resilient ecosystem *ki uta ki tai*. As is consistently represented through whakapapa and mātauranga Māori we cannot separate people from the land, and therefore we must consider a holistic approach.

4.3.4. Te Aranga Principles

Te Aranga principles (2008) are a set of outcome-based principles founded on Māori cultural values and formulated to provide practical guidance for enhancing outcomes for the design environment (Figure 6)

The key objective of Te Aranga Principles is to enhance the protection, reinstatement, development and articulation of Mana Whenua cultural heritage and cultural landscapes enabling all (including Mana Whenua, mātāwaka, tauwi, and manuhiri) to connect to and deepen our ‘sense of place’ (Cunningham, et al., 2017).

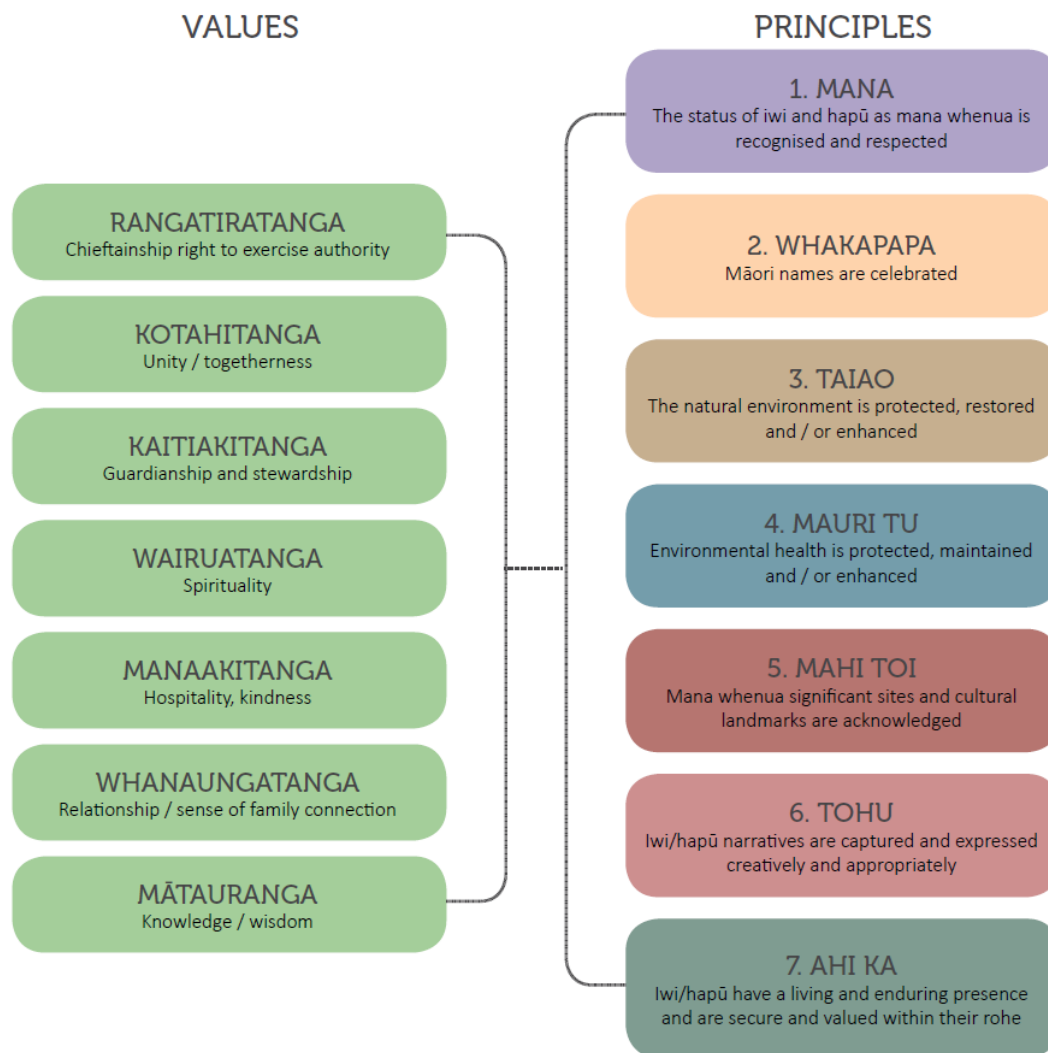


Figure 6: Te Aranga Principles (Tāmaki Regeneration Company, 2016), based upon (Ngā Aho, 2019)

Te Aranga Principles present a Cultural Landscape Strategy which aims to enable iwi to positively influence and shape the design of cultural landscapes within their tribal boundaries. The term “cultural landscape” was adopted by mana whenua as a more appropriate term than “urban design” as it acknowledges a Māori world view that not differentiate between urban and rural areas and where physical landscapes are inseparable from tūpuna, events, occupations, and cultural practices (Te Aranga, 2008). The following outlines the concluding message:

To kaitiaki – whānau, hapū, iwi: <i>Mā to rourou, mā tōku rourou e ora ai te Iwi</i>	<i>With your food basket and my food basket (by working together) the people will be well</i>
To territorial authorities: <i>Whatungarongaro te tangata – toitū te whenua</i>	<i>People come and go, the land remains</i>
To crown agencies: <i>Ma te huruhuru ka rere te manu</i>	<i>With feathers the bird can fly (with the right support the strategy will succeed)</i>
To Māori professionals: <i>Hokia ki o maunga kia purea e koe I ngā hau o Tawhirimātea</i>	<i>Return to your ancestral mountains to be cleansed by the winds of Tawhirimātea</i>
To professionals and their professional bodies: <i>Ehara taku toa I te toa takitahi, engari taku toa he toa takitini</i>	<i>My achievement is not that of an individual, but is that of many (we can achieve much together)</i>

4.3.5. Iwi/hapū Management Plans

Iwi/hapū management plans are planning documents used to express kaitiakitanga for a specific region/rohe. They act as a guideline for resource management practitioners – particularly developers and decision makers operating under the Resource Management Act 1991. Their format depends on the priorities of the iwi/hapū preparing the plan, addressing a single issue or resource such as freshwater or Māori heritage, or providing a regional assessment of issues of significance in a given area. They may address economic, social, political and cultural issues in addition to environmental and resource management issues. The following draws on examples of Iwi Management Plans (IMPs), familiar to the authors, to illustrate the articulation of aspirations for Te Ao Māori principles to play a central role in decision making. We acknowledge there are many other Iwi Management Plans currently operative.

Te Pou O Kāhu Pōkere: Iwi Management Plan for Ngāti Whātua Ōrākei 2018 (Ngāti Whātua Ōrākei, 2018) is introduced as a wero, a challenge, ‘to work together to better understand the views, perspectives and priorities of Ngāti Whātua Ōrākei in relation to resource management matters’. New Zealand Herald (2018) quotes Ngāti Whātua Ōrākei Trust deputy chair Ngarimu Blair, noting iwi and the council had been trying to "weave the two world views together" – kaitiakitanga and resource management:

"At the heart is kaitiakitanga, sustainability, and thankfully [this council] and the world is moving towards that, which Māori and indigenous peoples around the world have been pushing for generations." Key themes in the Kaitiakitanga Framework reflect intergenerational responsibility, a reciprocal and balanced relationship with the natural world, and emphasise whakapapa and connection to the physical and spiritual worlds (Ngāti Whātua Ōrākei, 2018):

"If the land and sea is polluted then the health of the people will be affected as will the mana of the iwi"

"Our role as kaitiaki requires us to protect and nurture our environment and it will in turn protect and nurture us."

The Ngāti Whātua Ōrākei Kaitiakitanga Framework specifically references objectives for water sensitive urban design within the "Water" section. However, additional sections reference wider principles of water sensitive urban design than those typically applied in Aotearoa (New Zealand) – including climate change considerations, energy and water efficiency objectives, urban planting, spatial planning, and waste minimisation, highlighting parallels between Te Ao Māori and WSUD when considered in its broadest context (Figure 1).

The *Northland Tangata Whenua Freshwater Values: A Literature Review* (NRC, MPI, & MfE, 2015) and companion report *A Framework to Guide Decision Making 2015* (NRC, MPI, & MfE, 2015) describe Tai Tokerau tangata whenua freshwater values and frameworks for implementation under the NPS-FM. While local issues and values differ from river to river and from whānau to whānau, there is a high degree of agreement on the overarching values. Freshwater is essential to the fabric of communities – it is essential for human health and prosperity, but also for identity and other means of connection to the environment. One aim encapsulated the study findings more than any other:

*kia pai te kaukau i ngā awa nui,
kia inu pai i ngā awa iti*

*swim safely in the big rivers,
drink safely from the small rivers*

Similar to the Ngāti Whātua Ōrākei Kaitiakitanga Framework, the Northland Tangata Whenua framework identifies the need for an integrated management approach – *ki uta ki tai* (from inland to the sea) – to achieve desired liveability outcomes (NRC, MPI, & MfE, 2015).

4.3.6. Regional Initiatives

The following are a range of regional initiatives naturalising Te Ao Māori in water policy and design guidance.

4.3.6.1. Auckland Council Water Strategy

Our Water Future: Tō tātou wai ahu ake nei (Auckland Council, 2019) poses a significant mind shift for the way water is viewed and managed in the Auckland region. The strategy considers an overarching vision of one water. Water in all its different forms is considered in a holistic system-wide view: in rivers and streams; in underground aquifers; in estuaries, harbours and marine areas; and in the three (infrastructure) waters: drinking water, wastewater, and stormwater. The priority of the strategy is “Te mauri o te wai – the life supporting capacity of water”. This vision puts water at the centre with people, more in line with Te Ao Māori views.

Auckland Council recognise that across the organisation, particularly in the water space, one area of improvement as they implement the strategy is “Applying a Māori world view”. This is signalled in the Strategy’s Framework and can be achieved following the principles identified in Figure 7.

Wider adoption of WSUD in the Auckland Region is one possible avenue Auckland Council can follow to contribute to meeting their commitments under *Our Water Future: Tō tātou wai ahu ake nei* (Auckland Council, 2019).

Te mauri o te wai: putting water at the centre					
Vision	Te mauri o te wai o Tāmaki Makaurau – the life supporting capacity of Auckland’s water – is protected and enhanced.				
Values	Ecosystems <i>Healthy water systems nourish the natural environment.</i>	Water Use <i>We can meet our everyday water needs, safely, reliably and efficiently.</i>	Culture <i>Water contributes to our identity and beliefs, as individuals and as part of communities.</i>	Recreation and Amenity <i>We enjoy being in, on and near the water.</i>	Resilience <i>Our communities, catchments and coastlines are resilient to natural hazards and the impacts of climate change.</i>
Issues we need to work on	Cleaning up our waters	Meeting future water needs	Growth in the right places	Adapting to a changing water future	
Processes we need to work on	Creating our water future together		Setting priorities for investment	Achieving net benefits for catchments	
	Applying a Māori world view				
Principles to guide our work	<ul style="list-style-type: none"> Recognise that water is a treasured taonga Work with natural ecosystems Deliver catchment scale thinking and action 		<ul style="list-style-type: none"> Focus on achieving right-sized solutions with multiple benefits Work together to plan and deliver better water outcomes Look to the future 		

Figure 7: The proposed Te Mauri o Te Wai framework for an Auckland Water Strategy (Auckland Council, 2019)

4.3.6.2. *GD01: Stormwater Management Devices in the Auckland Region (2017)*

Auckland Council’s Stormwater Management Devices in the Auckland Region guideline document (GD01) provides detailed design considerations aligned with the Council’s philosophy of stormwater management – where cultural values, social needs and natural features are considered as part of the functional design of the stormwater network – to achieve a resilient and sustainable outcome under the principles of water sensitive design (Cunningham, et al., 2017).

GD01 recognises that mana whenua values are intrinsic to the design, construction and management of stormwater devices in the Auckland region, and incorporates Te Aranga principles (Figure 6) to provide guidance around culturally appropriate design processes and design responses that enhance our appreciation of the natural landscape and built environment, and help to inform culturally appropriate stormwater management design. Mana whenua values have been interwoven throughout the document to naturalise tikanga, mātauranga, and Te Ao Māori in the design of Stormwater management practices.

4.3.6.3. *GD04: Water Sensitive Design for Stormwater (2015)*

Auckland Council’s Water Sensitive Design for Stormwater guideline document, GD04 (Lewis, et al., 2015), provides guidance for the application of water sensitive design (WSD) in land use planning and land development within Tāmaki Makaurau, with a specific focus on stormwater and freshwater management. GD04 recognises that WSD promotes multiple objectives for stormwater management, including incorporating iwi perspectives, enhancing landscape and natural character values, providing for positive urban design outcomes, and ensuring public safety (Lewis, et al., 2015).

To deliver best practice, the guideline elaborates on the use of Mātauranga Māori, and the considerable potential within the design of stormwater management systems to acknowledge and include mātauranga Maori. Opportunities identified include selection of plant varieties for cultural harvest, kaitiakitanga (stewardship), and promotion of mauri (life force/spiritual health) (Lewis, et al., 2015).

The guideline outlines the following potential WSD management practices that account for mana whenua & tangata whenua perspectives (Lewis, et al., 2015):

- *“Recognition and involvement of tangata whenua in decision-making and planning processes as kaitiaki (guardian)*
- *An increased level of meaningful engagement around stormwater management practices and landscape responses*
- *Engagement of mātauranga Maori in research and design of water systems*
- *Avoiding the mixing of waters from different catchment sources*
- *Treating stormwater by passing it through land or rock before it is released into receiving environments*
- *Water conservation, including water harvesting, to preserve the resource and its mauri*
- *Identification, recognition and appropriate protection/enhancement of culturally significant sites/features*
- *Re-vegetation for stormwater management utilising indigenous plants, and incorporating species that will allow Maori to safely harvest traditional flora and fauna resources*
- *Tertiary treatment wetlands with the potential for use by communities*
- *Protecting and restoring streams as taonga (socially or culturally valuable resources), including restoring eroded and channelised streams and daylighting streams from pipes.”*

4.3.6.4. Waterways, Wetlands and Drainage Guidelines (WWDG) (2003)

Christchurch City Council (CCC)'s Waterways, Wetlands and Drainage Guidelines(WWDG) is:

“...intended for all people involved with waterways, wetlands, and drainage protection, restoration, management, and design within the Christchurch city council. It contains useful information for sustainable management of waterways and wetlands not only in Christchurch but throughout New Zealand and beyond.” (Christchurch City Council, 2003)

The guidelines introduce the CCC's philosophy to encourage people to work with natural features and processes in the landscape. Management of a waterway or wetland frequently includes its restoration and protection. Six core values, including Drainage & Culture (Figure 8), form the foundation of a philosophy that is multi-disciplinary and sustainable.

The guideline expands on the cultural value, introducing both a local Māori perspective of water, and contrasting values from Tauīwi (non-Māori) as depicted in the following quote;

"a better life, in terms of simple materialism, more comfort and money....To the settler, land was money; but to the Māori it was life itself and more" (Sinclair, 1969).

The following values are specifically identified (Christchurch City Council, 2003):

- Natural Systems: introducing the concept of the whakapapa of water
- Knowledge Transmission: understanding the kaitiaki obligations and enduring relationships of mana whenua with the land
- Mixing of Waters: types of water and consideration for how they are individually managed
- Interpreting Water: recognition of both spiritual and physical elements to water bodies

Consultation is indirectly referenced through recognition that the Resource Management Act (1991) and the Treaty of Waitangi require that due consideration be given to issues of importance to tāngata whenua – and waterways are taonga (treasures) to be accorded high value (Christchurch City Council, 2003).

Values	
Ecology	The self-sustaining processes and inter-relationships among plants, animals and insects
Landscape	Includes the special character of sites and places, their aesthetic qualities, and their meaning to the community
Recreation	Includes active and passive recreation, play, and the structures that support these activities
Heritage	Includes sites and activities of historical significance (structures, remains, etc) and natural significance (remnants, landforms, etc)
Culture	The community's perception of a resource and its values, indicated by community involvement in management, celebration of past events, and planning for the future
Drainage	Includes inter-relationships between groundwater and surface water, natural flow regimes, and management of storm events

Figure 8: Six Values of WWDG (Christchurch City Council, 2003)

4.3.6.5. Water Sensitive Urban Design: A Guide for WSUD Management in Wellington (2015)

The Wellington City Council WSUD guide aims to help large and small-scale developers – public and private – to understand the importance of incorporating water-sensitive urban design (WSUD) into future stormwater management projects (Wellington City Council, 2015). The background of WSUD, land-use considerations and the local Wellington context is provided in support of an overview of a range of WSUD systems that aim to:

- Stabilise water flows in streams
- Improve the quality of the water in our streams and harbours
- Reduce the frequency and severity of flooding in urban areas
- Reduce the quantity of stormwater entering the sewerage system
- Protect or enhance environmental, social and economic values
- Reduce demand on potable water supply
- Improve amenity in the urban environment enhancing the 'liveability' of Wellington.

The guideline does not go into any detail on implementing Māori values, but does touch on the relationship of Māori to streams, water, and associated resources, and their important significant to tangata whenua (Wellington City Council, 2015).

4.3.6.6. Water Sensitive Design for Stormwater: Treatment Device Design Guideline - DRAFT (2019)

Wellington Water are currently consulting on a new draft guideline Water Sensitive Design for Stormwater: Treatment Device Design Guideline (as at 1st August 2019). This guideline is intended to provide localised best practice for the design of four types of green infrastructure - constructed wetlands, rain gardens, swales, and pervious paving (Farrant, 2019).

The Draft guideline does not go into any detail regarding implementing mātauranga Māori, tikanga, customs, or values.

4.3.6.7. Whaitua Committees - Wellington

Whaitua committees are groups of local people, made up of community members, iwi representatives, local authority representatives, and Greater Wellington Regional Council (GWRC) representatives, tasked with

recommending ways to maintain and improve the quality of fresh water within the local catchment (Greater Wellington Regional Council, 2019).

The committees are responsible for developing a Whaitua (catchment) Implementation Programme (WIP) to suit local needs. A WIP is intended to describe the ways in which the people from that catchment want to manage their water now and for future generations through a range of integrated tools, policies, and strategies. Regulatory recommendations in the WIP go to GWRC for approval to be included in a plan change process and ultimately become a chapter in the Natural Resources Plan. Non-regulatory recommendations are intended to be developed by GWRC with relevant external organisations.

Whaitua Committees incorporate concepts from Te Ao Māori in a community-based approach to improving catchment management. The committees work in partnership with mana whenua and develop recommendations for the catchment guided by five key principles (Figure 9):

- Ki uta ki tai: connectedness
- Wairua: identity
- Kaitiaki: guardianship
- Tō mātou whakapono: judgement based on knowledge
- Mahitahi: partnership

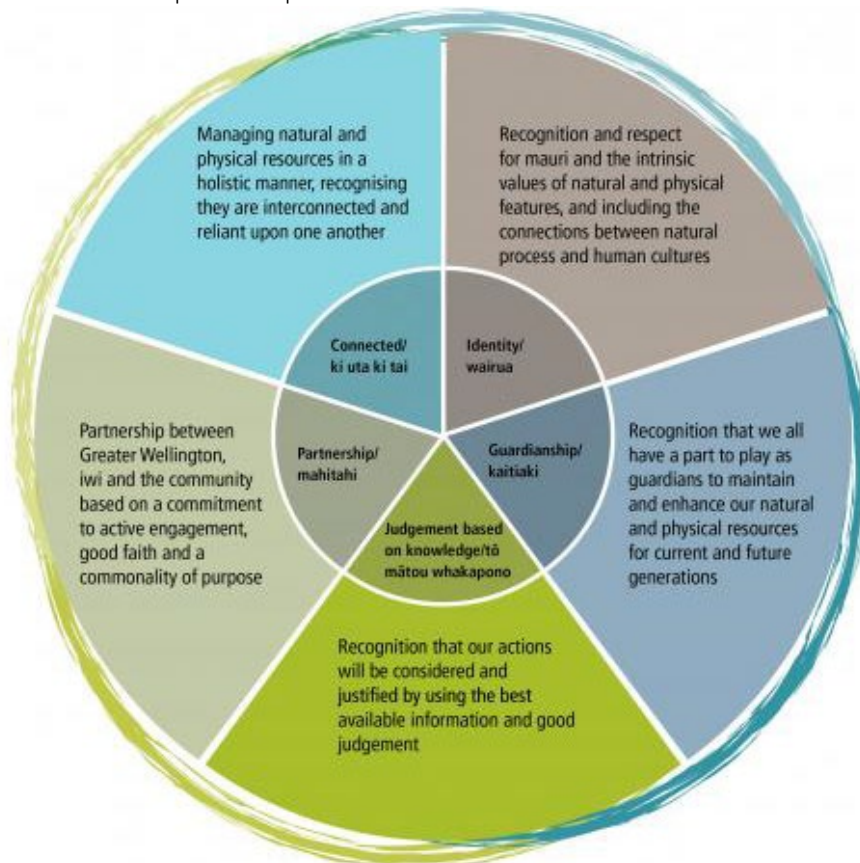


Figure 9: Whaitua Guiding Principles (Greater Wellington Regional Council, 2019)

4.4. Health & Wellbeing

The link between health and well-being is stated clearly in the World Health Organization's (WHO) description of human health: "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2019). There is growing scientific recognition that people in suburban and urban areas with fewer experiences of nature (including home gardens and public green spaces) tend to have worse health across multiple domains, but have the potential for the greatest gains from spending longer in nature, or living in green areas (Cox, et al., 2018; Dennis & Philip, 2017; Ekkel & De Vries, 2017; Joye & Dewitte, 2018). Viewing nature through a window, living in environments with a high percentage of green space, and having access to nearby green areas and parks have all been positively associated with health aspects (Ekkel & De Vries, 2017).

With increasing numbers of people living in urban areas, daily contact with nature is reducing. Space is costly in an urban context, and the maintenance costs of the greenery (real or perceived) add to this. Studies suggest that cumulative exposure to nature – including blue spaces (access to surface water), areas smaller than 1 ha, small scale horticulture, and isolated natural elements (i.e. street trees & green verges) – show more consistent and positive associations with health indicators than proximity to a formal “greenspace” alone (Ekkel & De Vries, 2017; Dennis & Philip, 2017).

The very identity of Māori is inextricably intertwined with the environment. There is growing understanding of the reciprocal relationship linking healthy ecosystems and people’s cultural, spiritual, and physical wellbeing (Harmsworth & Awatere, 2013; Brockbank, 2018; Ataria, et al., 2018; Panelli & Tipa, 2007). While the resources sustained by tribal lands and waters contribute to physical well-being, tribal lands also nourish a sense of continuity between generations, reinforcing spiritual well-being in the form of whakapapa (Panelli & Tipa, 2007). Humans and ecosystems are inter-connected through whakapapa and the interaction between them is what determines the welfare of both (Harmsworth & Awatere, 2013; Andrew, 2016).

The following whakataukī reflects the holistic relationship Māori have with the environment:

*Ka ora te wai,
Ka ora te whenua.
Ka ora te whenua,
Ka ora te tangata.*

*If the water is healthy,
The land will be nourished.
If the land is nourished,
The people will be provided for.*

Modern urban expansion has a propensity to overlay natural features and historic land-use and activity with little acknowledgement of what was there before (Rolleston, 2005; Rolleston, 2006). To fully appreciate the past lives and activities of Māori, it is necessary to view traditional sites within their wider context, and to focus on the relationships between the sites and the wider cultural landscape (Tipa & Teirney, 2003).

Intensification of urban settlements has not only affected the natural and built environment but also the relationship Māori have to traditional landscapes. With increased urbanisation and social mobility, high numbers of Māori are living away from their homelands. There is risk that Māori are becoming increasingly disconnected with their environment and weakening the intergenerational knowledge transfer process (Ataria, et al., 2018; Panelli & Tipa, 2007). Urbanisation has changed the Māori cultural experience of their natural world (Callaghan, et al., 2018; Ataria, et al., 2018). Students are taught a mainstream science curriculum that is devoid of cultural anchor points, reinforcing the environmental disconnect that Māori students encounter particularly in our urban environments (Callaghan, et al., 2018). Callaghan, et al. (2018) present a collaborative school project established to look after the waterways and re-connect rangatahi (youth) with these environments. Fundamental to this project was the opportunity to integrate science with mātauranga Māori as equally valid knowledge systems, aiming to bring to life a cultural narrative of science.

The disconnect with nature can be viewed as a wider symptom of urbanisation, not restricted to Māori communities. There is evidence that people with a greater orientation to nature have better mental health, social cohesion, and physical behaviour, highlighting the importance of supporting the development of a connection to nature across a person’s life-course (Cox, et al., 2018). Van Dijk-Wesselius, Maas, Hovinga, & Van Vugt (2018) conclude that greening of school yards – to reconnect children with nature – has a positive impact on children’s appreciation of the schoolyard, their attentional restoration after recess, and social well-being. Implementation of WSUD provides a clear opportunity to enhance urban greenspaces and reconnect people with the natural environment. Te Ao Māori encompasses the holistic intent of WSUD and is enhanced through the growth of a Māori renaissance in social, cultural, and political spheres, increasing articulation of mana whenua as kaitiaki; guardians of both their cultural identity and environment (Panelli & Tipa, 2007).

4.4.1. Models of Health & Wellbeing

A number of holistic models of health and well-being have been proposed, based on Māori traditional knowledge and understanding (Harmsworth & Awatere, 2013). Te Whare Tapa Whā compares health to the four walls of a house (Figure 10). All four are necessary for balance, and each represents a different dimension:

- taha whānau (extended family wellbeing)
- taha wairua (spiritual wellbeing)

- taha hinengaro (emotional/mental wellbeing)
- taha tinana (physical wellbeing)

To achieve wellbeing all four dimensions must be in balance (Harmsworth & Awatere, 2013; Mark & Lyons, 2010). Taha wairua extends to include relationships with the environment, whereby environmental features including te whenua (land), ngā roto (lakes), and ngā maunga (mountains), have a spiritual significance beyond functional considerations. The Whenua or Te Ao Tūroa dimension, presenting the environment as a strong foundation, is not shown in all depictions of the model. Heaton (2015) explains Māori, in their role as tangata whenua, recommended that a taha whenua dimension be added to the model, acknowledging the implicit interrelationship of whenua as the foundation for a whare. However, a taha whenua dimension was ultimately excluded in the final Health and Physical Education in the New Zealand Curriculum (HPENZC) (Ministry of Education, 1999) document, with Heaton (2015) commenting the inclusion may have been too contentious at the time, considering Treaty of Waitangi land grievances before the state.

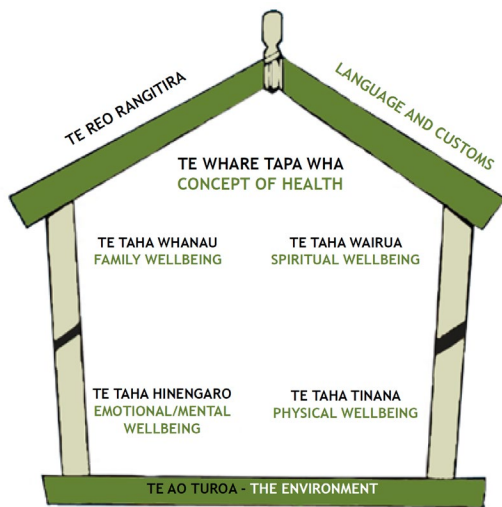


Figure 10: Te Whare Tapa Whā model developed by Mason Durie (BPAC, 2006)

The Ngā Pou mana (four supports) model places greater emphasis on the external environment and the significance of oral tradition (Harmsworth & Awatere, 2013). It describes a full set of values and beliefs as pre-requisites for health and well-being (Harmsworth, 2018). With four key supports (Figure 11), the interacting variables for both individual and group well-being include:

- Whānaungatanga (the importance of the family)
- Taonga tuku iho (cultural heritage)
- Te ao tūroa (the natural environment)
- Turangawaewae (the land base, a place of belonging, standing and identity)

The Ngā Pou model emphasises that well-being is affected not just by access to or quantity of natural resources but also by their state or condition (Harmsworth & Awatere, 2013).

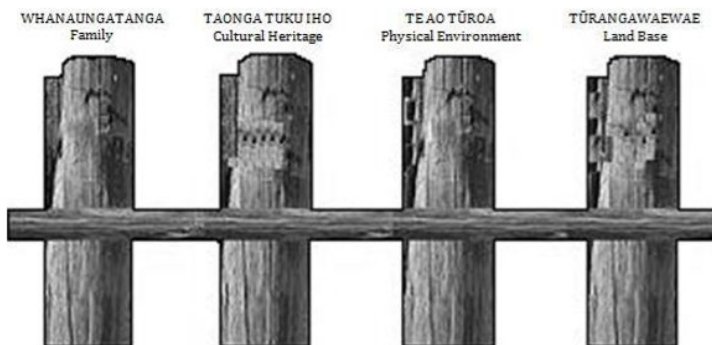


Figure 11: Ngā Pou Mana model developed by Mason Durie (BPAC, 2006)

Te Wheke model extends the four dimensions of Te Whare Tapawhā to eight, adding:

- mana ake (the unique qualities of each individual and family, to create positive identity)
- mauri (vitality, the life-sustaining principle in all people and objects)
- hā a koro mā a kui mā (breath of life from ancestors, inherited strengths)
- whatumanawa (the open and healthy expression of emotion).

Te Wheke employs an octopus metaphor to illustrate the interdependence of all things: the head or eyes represents the collective waiora – the total well-being for the individual and family – and each tentacle represents an intertwined dimension that helps give sustenance to the whole (Harmsworth & Awatere, 2013; Harmsworth, 2018; Mark & Lyons, 2010).

Mark & Lyons (2010) explored Māori spiritual healers' views on healing practices in Aotearoa (New Zealand) ultimately proposing an alternate model called Te Whetu (The Star), with five interconnected aspects: mind, body, spirit, family, and land. They found that Māori cultural perspectives influenced views of the mind, body, spirit but healers also identified whānau/whakapapa (family and genealogy) and whenua (land) as significant and fundamental to a person's health (Mark & Lyons, 2010). The connectedness of mind, body, and spirit was highlighted, but the external relationships people have with their family/genealogy and with the land are viewed as just as important for maintaining good health.

These models, among others, are particularly useful when linking Māori well-being to the natural environment as they demonstrate Māori relationships with and dependency on environmental conditions. There are many variations of these models and concepts, but Harmsworth (2018) notes – most stress a set of principles and practices to achieve a goal of mauri maintenance and human well-being. The models reflect how Māori observe the world in both spiritual and physical terms (Koroi, 2017) and recognise that well-being is affected not just by access to or quantity of natural resources but also by their state or condition. Therefore, the loss of land, pollution (through sewage effluent and other contaminants) affecting traditional areas of food gathering, and the depletion of natural resources are all destabilising factors on health and well-being to the detriment of spiritual and cultural values (Harmsworth & Awatere, 2013).

4.5. Urban Design & Cultural Landscape

A conventional New Zealand approach for land development has relied heavily on manipulation of the land – with cut to fill earthworks and modification to watercourses (for example lining, reclamation, and piping) frequently employed to create a landform desired for development. We have disrupted the flow of water, in particular ngā roimata o ngā Atua (rainfall), the tears of Ranginui (sky father) for Papatūānuku (earth mother). Altering our urban environments by laying concrete pavement, asphalted roads, and constructing roofs means we have made the land impervious to water and prone to the accumulation of pollutants from contaminant generating activities. We have purposefully piped and culverted our waterways – the arteries of Papatūānuku, and disrupted the journey not only mai te rangi ki te whenua (from the sky to the land), but mai uta, ki tai (from the ridgeline, to the sea) (Brockbank, 2019).

This style of development fundamentally conflicts with Māori views of development where Te Ao Māori emphasises reciprocity with the environment and a respect for the carrying capacity of ecosystems (Koroi, 2017). Urbanised modifications to the land and streams, their associated vegetated margins (riparian areas) and the wider catchment have altered the connection and relationship of Māori with their taonga and resources (Lewis, et al., 2015; Wellington City Council, 2015).

There is growing recognition that no single skill or profession can deal with the complexity of change associated with urban development (Awatere, et al., 2008). To solve complex societal and environmental problems, the western view of the world is becoming increasingly holistic. Harmsworth & Awatere (2013) note that in many areas we are seeing a re-alignment between indigenous and non-indigenous thinking. We are moving from a narrow single-perspective focus to recognise the need for integrated studies and collaborative learning; understanding the sensitive balance between human beings and nature; and working towards greater equity, inclusivity, and participatory decision-making (Harmsworth & Awatere, 2013). A water sensitive approach is one such mechanism aligning indigenous and non-indigenous thinking – development through a water sensitive lens aligns far more strongly with Te Ao Māori and Māori aspirations for development than the traditional western approach. Te Aranga Principles (Ngā Aho, 2019), arising from the Te Aranga (2008) Cultural Landscape Strategy,

aims to enable iwi to positively influence and shape the design of cultural landscapes, including water sensitive design, within their tribal boundaries.

Urban design is more than just the construction and placement of physical structures, and the papakāinga means far more than housing alone – they are about making connections with people and places and achieving goals of unity, cohesion, autonomy, community, and culture (Rolleston, 2005; Rolleston, 2006; Blair, 2009; Awatere, et al., 2009). The term papakāinga originates from two Māori words that refer to “land and home” – settlements are not just physical spaces where people live but are an expression and extension of identity (Awatere, et al., 2008). Building the mana and pride of the community is foremost, while housing complements and supports those goals (Blair, 2009). The notion of connections between people, places and spaces is inherent in Te Ao Māori and is encapsulated within the broader concept of whakapapa, encompassing kaitiakitanga, rangatiratanga, and whanaungatanga (Table 2). Development through the lens of Te Ao Māori is inherently holistic. To implement mātauranga Māori into design processes, development must occur in a manner that acknowledges kaupapa Māori processes and considers the indelible link between whenua, whānau/hapū/iwi, and identity (Awatere, et al., 2008; Rolleston, et al., 2009).

Awatere, Rolleston, & Pauling (2009) provide example projects merging Māori values with western development disciplines to produce frameworks to guide development. The frameworks promote integration between cultural, social, environmental, and economic aspects of urban design and favour more water sensitive, energy-, resource- and cost-efficient design, to achieve socially and culturally sensitive sustainable development. Nine guiding mātauranga Māori cultural design qualities (Table 2 & Table 3) aim to preserve culturally significant resources and landscapes and build community identity and social cohesion (Awatere, et al., 2008; Awatere, et al., 2009; Rolleston & Awatere, 2009; Rolleston, 2005).

4.6. Water Sensitive Urban Design

WSUD as a principle is strongly linked to the broader concept of urban design and cultural landscape, although it is typically assessed in a narrow stormwater centric perspective in Aotearoa (Section 4.1). A single paradigm has traditionally dominated conventional stormwater management practices in New Zealand. Stormwater runoff is viewed as undesirable and must be removed from the site as quickly as possible – contaminated stormwater runoff discharges directly into the receiving water body at accelerated flow rates and increased volumes, negatively affecting the mauri of the water.

Fenelon & Hellberg (2015) trace the evolution of stormwater management in Auckland; and show how water sensitive design is the natural progression for stormwater management in Auckland. The development strategy acknowledges that people and nature are inseparable and provides WSUD as the pathway to achieve integrated built and natural form and character in Auckland (Fenelon & Hellberg, 2015). While not directly referenced, these conclusions reflect Māori values.

Voyde & Morgan (2012) describe commonalities between indigenous concepts and sustainable design principles, suggesting that WSUD principles may have been implemented sooner in Aotearoa (New Zealand) if mātauranga Māori had informed design decisions. One example provided, the Haumingi 10a2b Papakāinga constructed in the 1980s (Morgan, 2006), was designed based on the collective aspirations of the Māori owners, and demonstrates clear parallels to current WSUD design principles. Morgan (2006) concludes the result was and is an economically and environmentally superior solution to the conventional development approaches typically implemented at the time. Māori efforts to explore alternative development paths have been largely overlooked, yet what is becoming more apparent is that WSUD principles run parallel to the traditional Māori relationship with the environment (Voyde & Morgan, 2012). By incorporating mātauranga Māori into design and development, another channel is opened to promote WSUD whereby the intrinsic value and integrity of the ecosystem is considered in the design process to enhance urban development and socio-cultural outcomes (Voyde & Morgan, 2012; Morgan, 2006).

Māori prefer stormwater runoff to be treated (preferably land based) before discharge into waterways, the mixing of water and waste pollutes the mauri of the waterbody (Ministry for the Environment, 2003; Christchurch City Council, 2003; Lewis, et al., 2015). Tikanga Māori did not permit the discharge of waste of any kind into water – bodily waste, food scraps, fish scales and gut, and pipi shells were discharged only to land (Durie, et al., 2017; Harmsworth & Roskrige, 2014). Discharging impure water into waterways is offensive to Māori, no matter how well treated (Durie, et al., 2017; Harmsworth & Roskrige, 2014; NRC, MPI, & MfE, 2015; Morgan, 2008) affirming Papatūānuku as the appropriate filter for impure water (such as through terrestrial and artificial wetlands), and

emphasising the importance of maintaining the integrity of the mauri of each waterbody (Harmsworth & Roskrige, 2014; Morgan, 2006). Essentially, Māori want water to be treated as water, ensuring it goes through the processes of transformation from tapu to noa, to ensure it is safe for humans (Brockbank, 2018).

Brockbank & Jonathan (2017) note some contradiction with the use of water sensitive infrastructure for stormwater treatment – the use of vegetated systems such as engineered wetlands, for stormwater quality treatment means that these systems are specifically designed to absorb or retain contaminants at levels beyond those encountered in a comparable natural wetland. In an effort to protect the receiving environment, designers create new sacrificial “green” environments. Brockbank & Jonathan (2017) propose that a hybrid solution, for example an upstream gross pollutant trap or filtration device prior to a treatment wetland, can avoid or reduce this unintended outcome by utilising grey infrastructure to reduce the concentration of contaminants entering the vegetated system through a treatment train type approach. The outcome is a more natural stormwater treatment system; an environmental outcome better aligned with Māori values to protect the mauri of the system.

The collection and use of rainwater for drinking purposes is another contradiction to traditional tikanga. In the Māori worldview, rainwater is considered waiora (pure water). It is the contact of waiora with Papatūānuku which purifies it and enables a transformation (whakanoa) to a state of noa (unrestricted) (Figure 4) (Douglas, 1984). In a state of noa, water is suitable for human consumption (Douglas, 1984). Water for use in pure (traditional cleansing ceremonies) was collected by tohunga (holder of knowledge) in ipu (containers) reserved for the purpose of collecting rainwater directly as it fell from the sky. Use of rainwater, before contact with Papatūānuku, for ceremonial purposes reflects the purity of mauri of that water.

*Titiro whakamuri
Haere whakamua*

*We look to the past,
as we move forward into the future*

As demonstrated through the development and growing implementation of water sensitive design principles, we are living in an evolving world – Te Ao Hurihuri. This emerging world is reflected in modern tikanga. We cannot know how urban development would have evolved in Aotearoa if Te Ao Māori and Māori values had been embraced alongside technological progression and urbanisation (Voyde & Morgan, 2012). While traditionally, waimāori for drinking was sourced from streams and surface waterbodies, this is no longer always feasible for our urbanised communities. Necessity means alternate sources, such as roof runoff, without transitioning to a state of noa through contact with Papatūānuku, are recognised as suitable sources of drinking water. In modern terms, roof runoff is comparable to a traditionally sourced surface water supply due to both quality and quantity limitations in current urban environments.

Water quality degradation through agriculture, urbanisation, piping of streams, and population growth, means we no longer have access to sufficient safe drinking water than can be recognised in the traditional sense as waimāori. This detracts from the core Māori value of manaakitanga (Table 2); mana whenua & haukāinga (home people - hosts) are no longer able to provide water for manuhiri (visitors). For example, Auckland relies on the Waikato river for nearly one-fifth of its annual water needs (Watercare, 2019). The mana (authority) of the iwi of Auckland can be considered diminished through reliance on water resources from outside their rohe (region). In addition, the mixing of waters from disconnected catchments, does not maintain the integrity of the mauri of each waterbody (Harmsworth & Roskrige, 2014; Morgan, 2006). For example, discharge of water from the Waikato river into the Manukau Harbour – waters from the Waikato river now discharge at Putataka (Port Waikato). A growing solution to water scarcity challenges, reflected in WSD principles and devices, is to collect roof water for use, where appropriate, to support self-sufficiency and the ability to manaaki manuhiri.

*He tangata takahi manuhiri,
He marae puehu*

*A person who mistreats his guest
has a dusty marae*

Living roofs provide another example whereby modern tikanga reflects Te Ao Hurihuri (our evolving world). Living roofs align with traditional Māori values (Table 2), but are a device borne of urbanisation and technological advancement. Living roofs not only protect downstream waterbodies by reducing peak flows and runoff volumes from impervious roofing materials, they also manage water onsite using a lightweight soil-like media (similar to raingardens) and vegetation. This aligns with the ethic that Ngā roimata o Ranginui (the tears of Ranginui, or

rainfall) are meant for Papatūānuku. Furthermore, living roofs provide aesthetic, amenity, and biodiversity value; improve urban air quality; and reduce the heat island effect, all of which kaitiaki the environment and enhance the mauri of what can conventionally be stark urban spaces (Voyde & Morgan, 2012).

<i>E tipu e rea mō ngā rā o tō ao.</i>	<i>Grow up and thrive for the days destined to you.</i>
<i>Ko tō ringa ki ngā rākau ā te Pākehā hei ara mō tō tinana,</i>	<i>Your hands to the tools of the Pākehā to provide physical sustenance,</i>
<i>Ko tō ngākau ki ngā taonga a ō tīpuna Māori,</i>	<i>Your heart to the treasures of your Māori ancestors</i>
<i>Hei tikitiki mō tō māhuna,</i>	<i>as a diadem for your brow,</i>
<i>Ko tō wairua ki tō Atua, nāna nei ngā mea katoa.</i>	<i>Your soul to your God, to whom all things belong.</i>

Blair (2009) demonstrates how the Ngāti Whātua o Ōrākei (NWŌ) papakāinga plan, based on traditional cultural values, reflects the principles of water sensitive design approach. NWŌ is 10 years into a major ecological restoration programme on its reserve land. Water sensitive outcomes and aspirations driven by Māori values include: community gardens, recycling and composting with a future zero-waste goal, future grey-water treatment, applications to utilise roof water for potable use and install composting toilets, and exploration of alternative energy options, from wind to solar and passive solar heating (Blair, 2009). Blair (2009) directly links te ao Māori and WSUD, specifically noting “*better knowledge of LIUDD and its relationship to kaitiakitanga should improve the quality of future tribal housing at Ōrākei*” (Blair, 2009). NWŌ have identified how its cultural values can be applied to the design and development of its housing land and raised awareness and group knowledge of kaitiakitanga and its practical application in development.

Water sensitive design and water sensitive systems not only reduce the volume of water but have the potential to treat it onsite using planting media, in line with the ethic that Papatūānuku is responsible for the ultimate treatment of a pollutant. The integrity of the receiving waters and surrounding environment is retained, thus maintaining the mauri (life giving force) of the water and ecosystem as a whole. Morgan (2006) defines an integrated holistic approach to water management following te ao Māori as requiring:

- Maintain sufficient water flow to support ecosystems
- Increase water use efficiency and recycling
- Decrease wastage of the water resource
- Reduce, recycle or eliminate wastewater flow
- Reduce, recycle or eliminate stormwater flow
- Encompass the views of Tangata Whenua

Considering core Māori values (Section 4.2) in parallel with a water sensitive approach to development provides a holistic approach to development, benefiting the wider environment (people and natural) by prioritising the mauri of the community, and their surroundings. This ensures that cultural and social outcomes are not diminished as a result of more typical monetary focused cost-benefit analysis for decision making (Brockbank, 2018).

Whakapapa recognises that we cannot consider matters in isolation; consideration of the ecosystem as a whole is necessary to truly assess the impacts of engagement within an environment (Koroi, 2017; Ngata, 2018). Embracing the complexities of whakapapa fosters a holistic view of ecosystems and enables practitioners in the WSUD-space to capitalise on a long-established and intimate environmental relationship based upon guardianship, connectedness and reciprocity (Ataria, et al., 2018; Ngata, 2018). WSUD needs to be recognised in the context of catchment management – ki uta ki tai – rather than perceived purely as a stormwater management tool. ‘Ki uta ki tai’ draws upon whakapapa recognising that to assess the mauri of a river, the entire catchment through which the river flows must be examined. An intact mauri depends on the status of all components of the catchment (Tipa & Nelson, 2012). This principle informs wider catchment land use decisions, reflecting a holistic WSUD approach. Māori explicitly acknowledge that instream river conditions are determined by processes occurring within the catchment and cannot be isolated out of this context. Tackling these issues requires a collaborative and integrated management model.

For example, mahinga kai reflects the ability to access customary resources, the site of gathering, and the health of the resource itself. The state of mahinga kai can be used to measure the health of an ecosystem. Mātauranga Māori traditionally ensured mahinga kai are maintained through practices such as rāhui, a periodic restriction of resource harvesting to allow stocks to replenish. The degradation of freshwater and physical loss mahinga kai

sites has led to the loss of traditional resources. The problems arising under current paradigms extend beyond the challenge which Mātauranga Māori evolved to deal with – for example chemical contamination through urban industrial and intensive agricultural land uses. Scientific and indigenous knowledge can be used in tandem to achieve the best outcome for the revitalisation of these environments (Koroi, 2017). A solution to reverse water degradation to allow for downstream uses and incorporate mātauranga Māori would have positive effects beyond water quality management – enhancing social, cultural, and environmental outcomes.

The conservation paradigm assumes improved environmental outcomes are achieved though excluding humans from the landscapes. However, there is increasing evidence that the opposite is true – conservation is enhanced when people are living in an environment (Ataria, et al., 2018). This perhaps reflects that as people feel connected to an environment, they are more inclined to protect it for the future and may explain why indigenous people are often considered good custodians – through a stronger connection to the environment they see the triggers early (Ataria, et al., 2018). Māori recognition of the health of an ecosystem typically incorporates relationships to the people – is it abundant enough to harvest from? can we swim in the waterways? etc. (Ngata, 2018). This demonstrates a distinction between kaitiakitanga and conventional notions of conservation – which lean towards pristine, untouched ecosystems. Māori notions of care always consider a human dimension and it is our interaction with these systems that underpins our duty of care. Well-being of our waterways is inherently connected with the wellbeing of our people and culture – through whakapapa they are all one and the same thing (Ngata, 2018). Relationships, connections, and intergenerational equity – whakapapa – reflect the importance of the social interactions between people and people, and people and the environment. Collective participation and membership – whanaungatanga – recognise common interests to encourage and build community pride, identification and ownership. One intent of WSUD is to reconnect people to the natural physical environment. Te Ao Māori enhances this by also reconnecting people to the spiritual world in tandem with the physical world, recognising the physical world has intrinsic value in and of itself separate to human use. A strong connection to nature has been demonstrated to support improved mental health, social cohesion, and physical behaviour within communities – linking healthy ecosystems to people’s cultural, spiritual, and physical wellbeing (Harmsworth & Awatere, 2013; Brockbank, 2018; Ataria, et al., 2018; Panelli & Tipa, 2007; Cox, et al., 2018).

4.7. Cultural Assessment Tools

A number of Māori-led cultural assessment and monitoring approaches based on a blend of mātauranga Māori, traditional concepts, and Western scientific knowledge have been developed to provide Māori with tools to articulate their values and perspectives by recording or assessing changes to ecosystems (Harmsworth & Awatere, 2013; Harmsworth, et al., 2016). The models and tools help connect humans, activities, and use, to ecosystems and are increasingly being used to provide cultural perspectives (Harmsworth & Awatere, 2013). Harmsworth, et al. (2016) note that New Zealand provides an exemplar internationally in the integration of indigenous knowledge into freshwater management science, policy, and practice through the adoption of indigenous concepts within a national policy framework.

4.7.1. Freshwater Cultural Health Index

The Freshwater Cultural Health Index (CHI) is an environmental monitoring and reporting tool developed to enable Māori groups to express their cultural values (Table 2 & Table 3) relating to river and stream health and customary resources (Harmsworth & Awatere, 2013; Tipa & Teirney, 2006). Details of the tool are well documented (Tipa & Teirney, 2003; Tipa & Teirney, 2006; Tipa & Teirney, 2006; Tipa & Nelson, 2012). The information merge between established scientific approaches and traditional Māori values informs a *ki uta ki tai* (Table 3) environmental strategy in both rural and urban waterways (Harmsworth & Awatere, 2013; Tipa & Nelson, 2012; Ataria, et al., 2018). Tipa & Teirney (2003) conclude one of the major advantages of developing the CHI was how the two knowledge systems complemented each other. Linking Western scientific design and analytical skills and cultural knowledge was shown to be an innovative way of developing an effective tool for iwi and resource managers. Respecting the values and beliefs of each party was fundamental – when respect of sensitive tribal knowledge was demonstrated, mutual trust and respect grew, which enhanced relationships (Tipa & Teirney, 2003). The tool commentary and application support the conclusion that the activation of WSUD will be enhanced through revitalisation of Te Ao Māori.

4.7.2. Mauri Model

The Mauri Model was developed as a framework, assessment method, and decision-making tool that integrates qualitative indigenous values (Awatere, et al., 2008). It is based on the concept of mauri and measures the impacts of anthropogenic activities and practices on the mauri within four key concentric aspects: ecosystems (which encompass all), hapū (cultural), communities (social), and whānau (economic) (Morgan, 2008; Morgan, 2006). The Mauri Model uses the combined analyses of stakeholder worldviews and the impact upon indicators to determine the absolute sustainability of options. The analysis first identifies differences in worldviews and values, quantifies these, and then leverages these to identify relevant performance indicators (Fa’au & Morgan, 2014). Participants are assisted to better understand the limitations of their own worldviews, which is essential to fairly represent the values of others (Fa’au & Morgan, 2014; Cunningham & Morgan, 2016). Koroī (2017) describes the mauri model as enabling the use of multiple ways of knowing in decision-making, concluding the framework provides space for multiple knowledge systems to work together while at the same time ensuring that indigenous knowledge is recognised and valued. Motu Economic and Public Policy Research (2017) concur, stating the mauri model

“...facilitates recognition and respect of Mātauranga Māori alongside mainstream science, seamlessly integrating quantitative and qualitative data to provide a more complete understanding of the problem”.

4.7.3. Wai Ora Wai Māori

Wai Ora Wai Māori is a kaupapa Māori assessment tool – it was developed with specific reference to the Waikato Region enabling Māori groups to assess the condition of freshwater (Awatere, et al., 2017). The tool comprises qualitative and quantitative measures for stated attributes, comparable to the mauri model approach in that they provide a scale from low to excellent, consistent with National Objectives Framework (NOF) bands for assessing and reporting standards and condition of selected attributes. This kaupapa Māori approach can be used to assess and articulate resource condition and impact (e.g. resource degradation, water quality, mauri) related to human activities and land management practices (Awatere, et al., 2017). When used alongside scientifically based quantitative attributes and measures, the tool helps provide a robust, holistic, and complementary data set to inform freshwater management within a kaupapa-based assessment framework to measure progress on stated iwi/hapū aspirations and outcomes (Awatere, et al., 2017).

4.7.4. Decision Support System

Moore, et al. (2017) developed a decision support system (DSS) to help assess the impacts of urban development on attributes such as water and sediment quality; ecosystem health; and cultural, amenity and recreation values. The DSS allows comparisons of alternative urban development scenarios to be made by varying inputs representing land use change, stormwater management and related attributes. The paper describes the development and incorporation of indicators of Māori cultural well-being in the DSS. The indicators aim to provide a relative assessment of the extent to which urban development recognizes and provides for mana whenua interests and values, including opportunities for resource use; access to culturally significant waterbodies; restoration of lost waterbodies; wai and wāhi tapu protection; and the availability and quality of cultural resources. The tool is not intended as a replacement for direct engagement, but to provide a basis for a screening-level cultural assessment that is integrated and simultaneous with environmental, economic and social considerations (Moore, et al., 2017).

4.7.5. Summary

While there are a number of tools available, all aim to value the Māori worldview and relationship with the ecosystem in tandem with mainstream western scientific methods. It is essential to ensure Māori values are appropriately represented rather than diluting them to simplified assessment metrics (Harmsworth & Awatere, 2013). It is not uncommon for assessors to seek to convert, quantify, and express human and cultural values as a number, such as a monetary valuation. Placing a financial figure on Māori values and knowledge is seen as insensitive and lacks understanding or acknowledgement of the validity of alternative world views (Awatere, et al., 2013). Concepts such as wairua and mauri (Table 2) do not fit easily into the scientific paradigm typically associated with WSUD. The Northland Tangata Whenua Freshwater Values Framework (NRC, MPI, & MfE, 2015) notes that *“a value or concept such as wairua is not, and should not be, subject to measurement”*. While

measurement is appropriate at times, for example scientific water quality parameters, it is inappropriate to try and quantify fundamental concepts such as wairua. Likewise, mauri is “*more likely to be perceived, understood and appreciated rather than specified and measured*”. Māori are more supportive of qualitative approaches that better express Māori values and knowledge (Awatere, et al., 2013).

Similarly, discussions have arisen within Māori networks with concerns around the quantitative outcome of the mauri model and challenging its suitability. Mauri is a metaphysical concept that cannot be quantified (Cunningham & Morgan, 2016) – when viewing any physical element, you are viewing the tohu (signs) and processes that demonstrate good health of a system, but you cannot see the mauri of the system. Likewise, you cannot physically enhance mauri, but you can restore the tohu and processes that provide the visible display of mauri. For example, a pristine wetland in its natural state may be considered as having strong mauri, but if that wetland is overgrown with weed species some might say its mauri is diminished. This depends on your perspective – in this overgrown state, the mauri of the weeds is strong, even if the wetland is impaired in terms of natural character. Likewise, if you remember the pristine wetland, while its mauri is not visibly present, it still exists through your memory.

Northland Tangata Whenua Freshwater Values Framework (NRC, MPI, & MfE, 2015) queries if integration is a useful goal, citing F. Berkes (pers. comm. 2015):

I am not a fan of ‘integrating’ two different knowledge systems. I think one can deal with different kinds of knowledge in parallel

Likewise, Harmsworth & Awatere (2013) support the respect and application of Māori values in ecosystems management, where Māori knowledge systems sit equally alongside Western science to manage and enhance ecosystems and taonga. The two paradigms do not always replicate one another but can support one another in parallel. Hepi, et al. (2018) take the position that Mātauranga Māori and science should not be blended but rather should strengthen and complement each other. Harmsworth & Awatere (2013) suggest introducing more qualitative measures and assessments alongside quantitative measures and assessments, so they are regarded equally. Assessment criteria need to respect and recognise broader holistic values that have validity in all decision-making.

The Māori worldview does not separate spiritual and intangible aspects from the non-spiritual and tangible. Arguably, it is the intangible values ascribed by Māori that are difficult for resource managers and scientists to accommodate within existing frameworks (Tipa & Nelson, 2012). While there are clear parallels linking te ao Māori to WSUD and desire for the two paradigms to work in tandem, there remain challenges to overcome. Iwi and hapū can exercise their right as kaitaki based on mana whenua status and yet within a multi-cultural context other players – businesses, local and central authorities, environmental and community interest groups etc. – each have their own agenda that may or may not conflict with those of mana whenua (Awatere, et al., 2013). It is important to recognise that Māori are more than just stakeholders; Māori have valuable contributions to make within collaborative planning and design processes which require their own assessment approaches and reporting of values alongside and in support of mainstream science (Awatere, et al., 2017). Therefore, respecting and valuing Te Ao Māori and Māori values is essential to understand the Māori perspective, to protect and manage our environments sustainably, and to ultimately maintain and enhance human well-being and intergenerational sustainability (Harmsworth & Awatere, 2013; Harmsworth & Roskrug, 2014).

5. Discussion

Māori culture recognises that environmental care has integral links with the mauri (life force) of the environment and concepts of kaitiakitanga (stewardship). Te Ao Māori does not separate spiritual and intangible aspects from the non-spiritual and tangible. Te Ao Māori links the roles and health of people to the protection of the wellbeing of the environment, through the intrinsic relationship between people, water, and Te Ao Tūroa (the enduring world). Integrating core water sensitive design values with mātauranga Māori (indigenous knowledge) and principles of tikanga Māori (traditional indigenous practices) may provide a holistic, culturally enhanced approach to protecting our water for future generations, more in line with natural hydrological processes, and inherently providing for enhanced socio-cultural outcomes, in addition to environmental stewardship.

Traditional knowledge, values, and concepts – aligning with the implementation of WSUD – are of continuing relevance and may support resolving the contemporary sustainable development dilemmas faced in New Zealand (Awatere, et al., 2008). However, a lack of implementation by the mainstream requires a more integrative and progressive framework in order to achieve an inclusive Aotearoa-specific sustainable urban development paradigm (Awatere, et al., 2008; Awatere, et al., 2009). The many stakeholders associated with environmental problems must develop solutions cooperatively rather than acting single-mindedly in their own interest (Greenaway, et al., 2005). Greater effort is required to collate, articulate, and illustrate a range of examples across New Zealand that show how Māori values can be effectively incorporated into mainstream planning and design and therefore contribute to greater goals of WSUD (Awatere, et al., 2008; Brockbank, 2019; Ngā Aho, 2019). Ongoing commitment to Māori involvement and activity in the design of sustainable developments is needed to achieve integrated urban outcomes and meet Māori aspirations (Awatere, et al., 2009). Establishing meaningful relationships is the first step in considering the role of tangata whenua and is key to achieving beneficial development outcomes for all involved (Awatere, et al., 2013).

Traditional beliefs, values, and cultural perspectives resonate strongly in contemporary society (Harmsworth & Roskrug, 2014). Mātauranga Māori is a dynamic and evolving knowledge form that continues to adapt and change, without losing sense of its origin (Harmsworth & Awatere, 2013; Kitson, et al., 2018; Paul-Burke, et al., 2018; Awatere, et al., 2013; Ogilvie, et al., 2018; Bargh, 2014). Mātauranga Māori possesses qualities that can support the preservation of culturally significant resources and landscapes as well as build community identity and participation, with more contemporary forms of mātauranga Māori including adoption of WSUD features (Rolleston & Awatere, 2009; Awatere, et al., 2008). However, in the context of WSUD in Aotearoa, mātauranga Māori is often poorly understood (Harmsworth & Awatere, 2013). Current approaches struggle to respectfully recognise and provide for tangata whenua values in a climate of multiple and often conflicting demands (Kitson, et al., 2018). Poor understanding of Māori values, perspectives and knowledge; lack of recognition of the validity of different knowledge forms; and limited mana whenua capacity are contributing factors limiting the incorporation of Mātauranga Māori in urban planning and WSUD (Harmsworth & Awatere, 2013). To facilitate the recognition of, and uptake of, te ao Māori in WSUD we recommend upskilling practitioners to better understand mātauranga Māori and empowering more Māori practitioners to enter the disciplines supporting the WSUD industry – for example: town planning, urban design, landscape design, ecology, engineering, and construction.

Science and mātauranga Māori should be working together to address complex issues like freshwater management in Aotearoa (New Zealand). Callaghan, et al. (2018) conclude, it takes courage and a willingness for both parties to engage respectfully in a bi-cultural process to work together, but this collaboration of worldviews can enhance outcomes. Resurgence and revitalisation of Te Ao Māori can reconnect urban Māori, or those otherwise disconnected, with mātauranga Māori while also sharing the Māori worldview with non-Māori practitioners. Trust and relationships – whanaungatanga – are critical to scaffolding collaborative worldviews. Mātauranga Māori must be protected so it is not shared or used outside the cultural context in which the information was generated and is intended to inform (Kitson, et al., 2018).

The economic, social, amenity, and environmental values of stormwater management are widely understood and seen in practice. However, cultural involvement and knowledge incorporated within these core values, either as a standalone value or weaved throughout, is often considered as a ‘last minute addition’ or at times completely absent (Brockbank, 2018). It is important to recognise that Māori are more than simply stakeholders; Māori have valuable contributions to make within collaborative planning and design processes which require their own assessment approaches and reporting of values alongside and in support of mainstream science (Awatere, et al., 2017). Māori knowledge systems sit equally alongside Western science to manage and enhance ecosystems and taonga. The two paradigms do not always replicate one another but can support one another in parallel. Hepi, et al. (2018) take the position that Mātauranga Māori and science should not be blended but rather should strengthen and complement each other. Harmsworth & Awatere (2013) suggest introducing more qualitative measures and assessments alongside quantitative measures and assessments, so they are regarded equally. Assessment criteria need to respect and recognise broader holistic values that have validity in all decision-making. The activation of WSUD needs to avoid marginalisation of mātauranga Māori to a ‘cultural objective’ and instead consolidate engagement and integration across the entire approach. WSUD needs to provide opportunity for mātauranga Māori to enrich contemporary scientific thinking, to support Māori culture and identity but also benefit all New Zealanders (Ataria, et al., 2018). The challenge in building capacity in the industry is how to effectively incorporate Māori perspectives and Mātauranga Māori into WSUD without altering the original

meaning and conceptual understanding, and while remaining true to a Māori worldview and philosophy. A further layer of complexity is recognising and providing for regional differences.

There is not a large number of studies specifically linking WSUD with Te Ao Māori. It is concluded that in part, this is because the guiding principles of WSUD parallel fundamental principles within mātauranga Māori (Voyde & Morgan, 2012). WSUD is an approach consistent with Māori resource management; it is design based on ecological and energy-efficient principles aiming to manage the environment in a sustainable way (Awatere, 2017). The strong cultural link with water and the importance of high-quality waterways within Te Ao Māori offers an opportunity to support the activation of WSUD (Moores, et al., 2018; Brockbank, 2017). WSUD is not a “new approach”, but rather embraces traditional environmental management paradigms and socio-cultural interactions with the environment reflected in Te Ao Māori.

As has been presented across a range of disciplines the overarching values representing Te Ao Māori cannot be viewed in isolation and permeate all facets of life. It is these principles that reflect the aspirations of WSUD to support healthy and resilient communities. A number of supporting frameworks can guide the application of Te Ao Māori alongside WSUD – for example, Te Mana o Te Wai, the Urban Water Principles, the Te Aranga principles, the Essential Freshwater work programme, and iwi management plans. This review provides the first step to understanding WSUD through a Māori worldview lens. Recognising the validity of this alternate worldview and embracing qualitative measures alongside quantitative scientific assessment will open the door to change and future opportunities for enhanced environmental and socio-cultural outcomes in Aotearoa (New Zealand).

Through literature review and the experiences and learnings of the authors, this review aimed to address two overarching questions in support of the activation of WSUD for healthy and resilient communities in Aotearoa (New Zealand):

- How well does WSUD in Aotearoa (New Zealand) provide for Māori values and uses of water?
- Are there opportunities to improve the implementation of WSUD through the integration of Te Ao Māori?

In summary, in response to the first question – the principles of WSUD and intended outcomes are already interwoven within the fabric of Te Ao Māori, drawing upon fundamental Māori values. For example: whakapapa, whanaungatanga, kaitiakitanga, manaakitanga, and mātauranga Māori. Aotearoa is moving towards a more explicit recognition of Māori values, for example through Urban Water and Te Aranga principles, but Te Ao Māori is not yet prevalent within mainstream planning and design. In response to the second question – we argue that integration of mātauranga Māori into WSUD is not the goal – rather than trying to integrate Te Ao Māori, we need to recognise that WSUD and its intended outcomes already draw upon fundamental Māori values and consider the different perspectives in parallel.

We conclude that design through the lens of te ao Māori, applied as a mainstream principle through the WSUD framework, will create the desired social and environmental connections; create spaces which encourage community participation and membership, to prevent isolation or segregation of members of the community. The effective implementation of mātauranga Māori to achieve goals for sustainable urban development will be essential if cultural identity, history and traditions of both Māori and Pākehā are to be truly reflected in the built and natural environment. The desired outcome is to remove the compartmentalisation of mātauranga Māori as a separate “cultural bottom line” indicator, and to instead recognise that the holistic values reflected in Te Ao Māori benefit the wider community as a whole and should be embraced in parallel. To this effect, we cannot properly approach mātauranga māori without Te Reo, so it will also be important to provide opportunities to educate and encourage update and normalisation of Te Reo within both colloquial and professional language.

These conclusions reflect the nature of this piece of work – predominantly a literature review. It would be valuable to extend the work to encompass an evaluation of practical applications of Te Ao Māori in WSUD. Section 6 provides our recommendations for capacity building to support the uptake of Te Ao Māori and mainstream concepts of WSUD in parallel.

6. Recommendations

The process of identifying literature specifically linking WSUD to te ao Māori has identified many areas where more detailed research, and particularly collaborative research (for example hui) would greatly enhance an

understanding of the opportunities to activate WSUD through better provision for Te Ao Māori principles. What has become clear in the context of WSUD is that while te ao Māori is infrequently represented explicitly, freshwater resource management is making progress driven by the NPS-FM and Te Mana o Te Wai. We make a number of recommendations for further research and engagement to enhance industry wide understanding of te ao Māori, to facilitate the empowerment of mātauranga Māori in a space where it inherently exists – WSUD seeks outcomes of a holistic approach to land and water management, connection with ecosystems, community wellbeing, resilience, and intergenerational equity, all of which are embraced within Te Ao Māori.

6.1. Case Studies

It will be valuable to evaluate a range of WSUD case studies for the degree to which each project incorporates Te Ao Māori. These case studies can serve as reference projects illustrating good and bad practice, informing the design of future projects and the wider building of industry capacity. The focus should be on contemporary alternatives to NZ conventional approaches that focus on either ‘treading lightly on the earth’ and increasingly ‘regenerative’ design for areas that are ex-farmland or brownfield. The collation and articulation of a range of examples across Aotearoa that show how Māori values can be effectively incorporated into mainstream planning and design would contribute to greater goals of WSUD.

The following case studies were identified during this literature review:

1. Ōrākei development (Rolleston & Awatere, 2009; Rolleston, et al., 2009; Awatere, et al., 2008; Blair, 2009)
2. Oikimoke development (Rolleston, et al., 2009; Awatere, et al., 2008)
3. Wigram Skies – Te Heru o Kahukura (Awatere, et al., 2013)
4. Flat Bush & Long Bay (Fenelon & Hellberg, 2015)
5. Haumingi 10a2b Papakāinga (Morgan, 2006; Voyde & Morgan, 2012)

In addition, the following projects have been assessed as case studies by the Activating WSUD research team for the More Than Water Tool (Moores, et al., 2019). Refer to the Activating WSUD Research Outputs website (Manaaki Whenua | Landcare Research, 2019):

6. Kirimoko Park residential subdivision in Wanaka
7. Auckland Manukau Eastern Transport Initiative (AMETI)
8. Talbot Park community regeneration project in Auckland
9. Living roofs in the Queenstown area

It would be valuable to reassess these case studies in the context of recognition of Te Ao Māori within the design, particularly should funding opportunities enable the further development of the MTW assessment tool to explicitly provide for Māori values (refer Section 6.3).

Brockbank (2019) identified and presented examples of WSUD which reflect Māori values (whether intended or not). These examples have not been fully assessed. It is recommended these demonstration sites are more thoroughly assessed, to write up as case-studies and further disseminate the parallels between Te Ao Māori and WSUD, potentially using the MTW assessment tool to guide assessment (refer Section 6.3):

10. Ōtāhuhu Bus Station
11. Manukau Bus station & green street
12. SH20 Kirkbride interchange
13. SH2 Watchmans Rd Interchange

With all case studies, we recommend exploring a comparison between a conventional overlay of “business as usual” against an assessment of the actual design (as constructed) applied in the context of Te Ao Māori.

6.2. Collaboration

The current research is limited to the experiences and knowledge of the authors of this report. We recommend conversations and connections to support the research and better understand the current context from varied perspectives, from communities both within and outside the urban water management sector. Suggested mechanisms include:

6.2.1. Hui

Subject to funding opportunities, we propose conversations with Māori in the WSUD community of practice to find out more about barriers, aspirations, and opportunities.

- Initial brief consultation and engagement through workshops to develop a “WSUD narrative” for Māori – explore what restoration and protection might look like in the urban context.
 - Provide initial thought piece upfront to prompt discussion
- Plan for future comprehensive hui:
 - Multiple iwi groups – North & South Islands to capture regional variation
 - Not limited to WSUD practitioners – narrower view, often constrained or biased by technical knowledge
- Appropriate to hold on marae
 - Start with vision setting and what is WSUD for Māori – invite Māori community leaders, iwi environmental officers and Māori practitioners.
 - Recognise timeframes for seeing the ultimate result in the receiving environment may be multi-generational.
 - Delve into the details of the barriers to applying WSUD and revitalising Te Ao Māori in mainstream NZ
 - Brainstorm how to overcome the barriers with the Māori practitioners and iwi and community representatives
 - Discuss methods to ensure the mātauranga shared is appropriately recorded, and how to prevent misuse of the knowledge

Ogilvie, et al. (2018) conclude successful integration of different disciplinary perspectives, knowledge systems and cultures is not just a matter of bringing people together – for collaborations to work (in this example, between Māori whānau-owned fishing company and scientists), an investment of time and intent is required to build a culture of trust and respect between the different parties involved. Time is necessary so those involved can understand and appreciate novel concepts, and to develop the friendship and collegiality required for such transdisciplinary endeavours (Ogilvie, et al., 2018). It is important that teams working in this way actively look to bridge communication gaps that can be problematic such as between indigenous and western science knowledge and cultural systems (Ogilvie, et al., 2018).

6.2.2. Academia

Learning experiences with academic institutes, for example the Australian Co-operative Research Centre for Water Sensitive Cities or Canadian researchers (cited above in Section 6.5) may enable the sharing of local experience while learning from the experiences of others. For example, the 2020 International Conference on Urban Drainage (Monash, CRC) provides further opportunity to disseminate learnings, while learning from others.

6.2.3. Citizen Science

There are a number of opportunities to consider how citizen science and community education can enhance understanding of Te Ao Māori and support its uptake when activating water sensitive urban design, examples to explore include:

- RIMU – A review of indicators used for ‘cultural health’ monitoring of freshwater and wetland ecosystems in New Zealand. Auckland Council discussion paper, DP2019/001 (Bishop, 2019)
- WaiCare, EnviroSchools, Friends of Oakley Creek, Tararata Stream Team etc.
- Auckland Council / Panuku use of *Take Mauri, Take Hono* tool
- Incorporate consideration of tools such as the Kiwa Digital Cultural Health Indicator application to inform cultural assessments.

6.2.4. Terminology

Future hui should include discussion to understand different ideas and perspectives for terminology. Can we work with mana whenua across New Zealand to identify a Māori phrase that represents water sensitive urban design, in its broadest sense – expanded to reflect Te Ao Māori – to create an identity specific to Aotearoa (New Zealand). It is anticipated discussion would lead to a phrase that reflects the integration of land and water, not purely water alone, and overarching relationships between Māori and the environment.

6.3. MTW Assessment Tool

The Activating WSUD research team have emphasised that the current version of the MTW assessment tool (see Section 4.1) is not considered to be an end-product (Moores, et al., 2019). While a collective exploration (involving the authors of this report) has begun of how the tool can be developed further to provide for WSUD assessments to consider Te Ao Māori values, this remains a work in progress. Reflecting the discussion in Sections 4.7.5 and 5 of this report, the aim of the further development of MTW is not to integrate western and Te Ao Māori world views, but rather to allow an inclusive assessment that considers both perspectives in parallel.

Initial exploration has identified likely opportunity to interweave mātauranga Māori through the MTW assessment tool to avoid marginalisation of mātauranga Māori as a ‘cultural objective’. The MTW assessment tool inherently provides for qualitative measures and assessments alongside quantitative measures and assessments, recognising broader holistic values have validity in all decision-making. Further development of the tool to recognise for Te Ao Māori may also enable normalisation of the use of Te Reo within a mainstream assessment tool.

6.4. Practical application of WSUD

The ultimate aim of this research is to identify practical measures to improve the uptake of WSUD. To be considered a success, this will involve embracing Te Ao Māori and developing appropriate methods for WSUD implementation in which the two worldviews are equally represented and support one another.

Attendance at the Shift Aotearoa Conference 2019 ‘*Kāinga Tahi Kāinga Rua – Māori Housing Think Tank*’, and particularly presentations addressing papakāinga development inspired one clear opportunity to practically implement WSUD in parallel with Te Ao Māori. Reddy, et al. (2019) presented their findings entitled ‘*He Kāinga Pai Rawa Atu Mō Ngā Kaumātua: He Keteparaha Tēnei Mō Te Whare Kaumātua / A Really Good Home For Our Kaumātua: A Toolkit For Kaumātua Housing*’. Reddy, et al. (2019) state the toolkit is for anyone working with urban, rural, marae and other communities, who aspires to co-design and build culture-centred kaumātua housing and communities.

The toolkit guides development for housing and community but does not specifically address environmental outcomes for kaumātua housing – we propose creating a parallel toolkit for implementing WSUD to identify and achieve environmental outcomes. The toolkit would guide papakāinga design to empower Māori in their role of kaitiaki for the environment. By linking WSUD to integral values within the papakāinga design, coordinated design representing housing, community, and environment may provide means to ensure water sensitive features are not value engineered out as the development progresses.

The following are considered benefits and opportunities arising from this recommended extension to the current work:

- Opportunities for demonstration projects and case studies which purposefully address WSUD and Te Ao Māori in parallel, to further enable dissemination of learnings through real life projects.
- Further develop the MTW assessment tool for Te Ao Māori, with direct input from Māori practitioners for housing and community.
- Extend papakāinga development to explicitly connect with the environment.
 - As people feel connected to the environment, they are more inclined to protect it for the future.
 - A strong connection to nature has been demonstrated to support improved mental health, social cohesion, and physical behaviour within communities.
 - Integrating the human dimension into the natural environment aims to encourage kaitiakitanga, rather than isolation of the environment in the conventional notion of conservation.
- Collaborate with and learn from an existing workstream and researchers within the Building Better Homes Towns and Cities National Science Challenge (BBHTC).
- Share knowledge
 - Mutually upskill WSUD practitioners in Māori values, and Māori housing practitioners in current approaches to WSUD
 - Application of the toolkit may empower more Māori practitioners to enter the disciplines supporting the WSUD industry – for example: town planning, urban design, landscape design, ecology, engineering, and construction
- Link with existing research and case studies (Section 6.1), for example ‘*Tū Whare Ora – Building Capacity for Māori Driven Design in Sustainable Settlement Development*’ (Awatere, et al., 2008).

We envisage following the checklist-style structure of the Toolkit for Kaumātua Housing (Reddy, et al., 2019) will provide a simple to follow method that can be completed in tandem with the Toolkit for Kaumātua Housing. The supporting WSUD toolkit will be based upon the Toolkit for Kaumātua Housing, but it is anticipated to be suitable for general papakāinga housing, with potential to extend to wider application for general development while embedding Te Ao Māori in tandem with WSUD.

6.5. International Literature

Review international literature to identify examples where indigenous knowledge and alternate worldviews have been successfully integrated into mainstream WSUD:

- Canada and integration of First Nations world view
 - Dyanna Jolly - Whitebear First Nations, Saskatchewan, Canada (PhD candidate, University of Otago)
 - Awatere, et al. (2013) note the consideration of indigenous knowledge within environmental decision making has been increasingly promoted and, in some cases, formalised in Canada
 - Battiste M. 2000. Reclaiming indigenous voice. Vancouver: UBC Press
 - Harmsworth, et al. (2016) cite the follow texts in reference to an increasing international trend to engage with indigenous communities for research and collaboration in resource management decision making:
 - Dove, M. R. 2006. Indigenous peoples and environmental politics. Annual Review of Anthropology 35:191-208. <http://dx.doi.org/10.1146/annurev.anthro.35.081705.123235>
 - McGregor, D. 2014. Traditional knowledge and water governance: the ethic of responsibility. AlterNative: An International Journal of Indigenous Peoples 10(5):493-507.

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APPENDIX A: Whakataukī

This appendix lists the whakataukī used in this report.

#	Whakataukī	English Interpretation	Source
1	Nā ngā tūpuna ngā taonga i tuku iho	Treasures passed down from our ancestors.	-
2	Whatungarongaro te tāngata, toitū te whenua	Man perishes, but land remains	-
3	Ko te wai te ora o ngā mea katoa	Water is the life giver of all things	-
4	Ko au te whenua, ko te whenua ko au.	I am the land, the land is me.	-
5	Tuatahi ko te wai, Tuarua whānau mai te tamaiti, Ka puta ko te whenua.	When a child is born the water (amniotic fluid) comes first, then the child is born, followed by the afterbirth (whenua).	-
6	Toitū te Marae o Tane, Toitū te Marae o Tangaroa, Toitū te Iwi.	If the domain of Tane survives to give sustenance, And the domain of Tangaroa likewise remains, So too will the people	-
7	He hanga nā te waha o te ngutu nō mua iho anō.	Although seeming to be only from the lips, it is actually of ancient origin	(Williams HW 1908) in (Ataria, et al., 2018)
8	Ma te mauri kei Ōmāpere ka ora te whenua	When the mauri of Ōmāpere is strong, the land is healthy	(NRC, MPI, & MfE, 2015)
9	Te toto o te tangata he kai; te oranga o te tangata he whenua	Food supplies the blood of man; his welfare depends on the land	(Rolleston, 2005)
10	He kura whenua e hokia; he kura tangata e kore e hokia	The treasure of land will persist; human possessions will not	(Brougham et al., 1987) in (Rolleston, 2005)
11	Ko au te wai, ko te wai ko au	I am the water and the water is me	-
12	Mā to rourou, mā tōku rourou e ora ai te Iwi	With your food basket and my food basket (by working together) the people will be well	(Te Aranga, 2008)
13	Whatungarongaro te tangata – toitū te whenua	People come and go, the land remains	(Te Aranga, 2008)
14	Ma te huruhuru ka rere te manu	With feathers the bird can fly (with the right support the strategy will succeed)	(Te Aranga, 2008)
15	Hokia ki o maunga kia purea e koe I ngā hau o Tawhirimātea	Return to your ancestral mountains to be cleansed by the winds of Tawhirimātea	(Te Aranga, 2008)
16	Ehara taku toa I te toa takitahi, engari taku toa he toa takitini	My achievement is not that of an individual, but is that of many (we can achieve much together)	(Te Aranga, 2008)
17	Kia pai te kaukau i ngā awa nui, kia inu pai i ngā awa iti	Swim safely in the big rivers, drink safely from the small rivers	(NRC, MPI, & MfE, 2015)

#	Whakataukī	English Interpretation	Source
18	Ka ora te wai, Ka ora te whenua. Ka ora te whenua, Ka ora te tangata.	If the water is healthy, the land will be nourished. If the land is nourished, the people will be provided for.	-
19	Titiro whakamuri Haere whakamua	We look to the past, as we move forward into the future	-
20	He tangata takahi manuhiri He marae puehu	A person who mistreats his guest has a dusty marae	-
21	E tipu e rea mō ngā rā o tō ao. Ko tō ringa ki ngā rākau ā te Pākehā hei ara mō tō tinana, Ko tō ngākau ki ngā taonga a ō tīpuna Māori, Hei tikitiki mō tō māhuna, Ko tō wairua ki tō Atua, nāna nei ngā mea katoa.	Grow up and thrive for the days destined to you. Your hands to the tools of the Pākehā to provide physical sustenance, Your heart to the treasures of your Māori ancestors as a diadem for your brow, Your soul to your God, to whom all things belong.	Sir Apirana Ngata, 1949

APPENDIX B: Glossary

Aotearoa	New Zealand
Arohatanga	The notion of care, respect, love, compassion
Atua	Ancestor with continuing influence over particular domains
haukāinga	local people, home people, home winds
kaitiakitanga	guardianship, stewardship
karakia	incantation
kaumātua	Elders
ki uta, ki tai	A whole-of-landscape holistic approach. Understanding and managing interconnected resources and ecosystems from the mountains to the sea.
kōrero tawhito	ancient histories
kōrero tuku iho	creation narratives passed down
kotahitanga	unity, solidarity, consensus, participation, cohesion
kuia	elderly female
mahi	work
mahinga kai	garden, cultivation, food-gathering place
mana	authority
mana whenua	The indigenous people (Māori) who have historic and territorial rights over the land. Represents authority, power, control, status, leadership (based on whakapapa)
manaaki	to support, take care of, give hospitality to, protect, look out for - show respect, generosity and care for others
manaakitanga	hospitality, acts of giving and caring for, looking after
manuhiri	Visitor, guest
maramataka	Māori lunar calendar
mātauranga Māori	Māori knowledge
mauri	life force, vital essence
mihi	greeting and acknowledgment
mōteatea	chants, poems
noa	unrestricted
ora	life
oratanga	health and wellbeing
pakeke	adults
Papatūānuku	the earth mother
pūrākau	stories, traditional Māori narratives
pure	traditional cleansing ceremony
rangatahi	youth
rangatira	chiefs
rangatiratanga	sovereignty, empowerment, self-determination
Ranginui	the sky father
rohe	boundary, district, region, territory, area, border (of land)
tangata whenua	people of the land
tapu	sacred, restricted
Te Ao Māori	Māori worldview
Te Ao Tūroa	the natural, long standing, or enduring world (including us)
Te Hurihanga Wai	the water cycle

Te Taiao	the natural world, the contemporary environment (including us)
tikanga	customary practice, tradition, values, protocols
tohu	signs
tohunga	priests, specialists
tūpuna	ancestors
uri	descendants
wai	water
waiata	songs
wairua	spirit, soul
whaikōrero	oratory, speechmaking
whakapapa	genealogy, lineage, descent
whakataukī	Proverb, significant saying
whanaungatanga	family connections, relationships, kinship