AN EXAMINATION OF CURRENT APPROACHES TO INTEGRATIVE INDIGENOUS AND WESTERN KNOWLEDGE SYSTEM IMPLEMENTATION IN WATER RESEARCH AND MANAGEMENT: A CASE STUDY ENCOMPASSING THE COLONIZED GEOGRAPHIES OF CANADA, AUSTRALIA, NEW ZEALAND, AND THE UNITED STATES

by

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Abstract

The commodification of natural resources and the pursuit of continuous growth has resulted in environmental degradation, depletion, and disparity in access to these life-sustaining resources, including water. Utility-based objectification and exploitation of water in some societies has brought us to the brink of crisis through an apathetic disregard for present and future generations. The ongoing depletion and degradation of the world’s water sources, coupled with a reliance on Western knowledge and the continued omission of Indigenous knowledge to manage our relationship with water has unduly burdened many, but particularly so for Indigenous communities. The goal of my thesis research is to call attention to and advance the value and validity of using both Indigenous and Western knowledge systems (also known as Two-Eyed Seeing) in water research and management to better care for water. To achieve this goal, I used a combined systematic and realist review method to identify and synthesize the peer-reviewed, integrative water literature, followed by semi-structured interviews with first authors of the exemplars from the included literature to identify the challenges and insights that researchers have experienced in conducting integrative water research. Findings suggest that these authors recognize that many previous attempts to integrate Indigenous knowledges have been tokenistic rather than meaningful, and that new methods for knowledge implementation are needed. Community-based participatory research methods, and the associated tenets of balancing power, fostering trust, and community ownership over the research process, emerged as a pathway towards the meaningful implementation of Indigenous and Western knowledge systems. Data also indicate that engagement and collaborative governance structures developed from a position of mutual respect are integral to the realization of a given project. The recommendations generated from these findings offer support for future Indigenous-led research and partnerships through the identification and examination of approaches that facilitate the meaningful implementation of Indigenous and Western knowledge systems in water research and management. Asking Western science questions and seeking Indigenous science solutions does not appear to be working; instead, the co-design of research projects and asking questions directed at the problem rather than the solution better lends itself to the strengths of Indigenous science.
Co-Authorship

The following are co-authors on each of the two manuscripts included in my thesis (Chapter 3 and 4):

Dr. Heather Castleden, Queen’s University
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List of Abbreviations

CBPR – Community-Based Participatory Research
CSRR – Combined Systematic Realist Review
CWN – Canadian Water Network
FNHA – First Nations Health Authority
NWI – National Water Initiative
UNDRIP – United Nations Declaration on the Rights of Indigenous Peoples
WHO – World Health Organization
Chapter 1

Introduction

1.1 Introduction

1.1.1 Challenge Statement

Who owns the water that we use? Often we can name the company or municipality that manages or distributes our water services, but ownership is much more difficult to define. Water may be considered to be owned by everybody, or nobody, but ultimately water is a necessity, and along with the earth, the wind, and the sun, support all life on this planet. However, for centuries, capitalistic tendencies and the commodification of natural resources from the dominant (Western) culture in society has resulted in environmental degradation, depletion, and disparity in access to the resources that sustain life.

Humankind has no use for a shared, poisoned resource, therefore those that have the means to clean, and prevent further depletion and degradation of our water have a level of ownership and power that allows for commodification, and the subsequent creation of water ‘haves’ and ‘have-nots’ globally. At a rights level, this unfair structure of ownership and power disproportionally disadvantages Indigenous people and runs contrary to the inherent rights of Indigenous peoples around the world to develop socially and economically without outside interference (UNDRIP, 2009). This problem, however, is greater than an issue of rights. The utility-based objectification and exploitation of water and other natural resources in some societies has brought us to the brink of crisis through continued growth and disregard for present

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1 Throughout this thesis, Indigenous or Indigenous people(s) is used to discuss those who self-identify as the original inhabitants of a territory that maintain a close connection to these traditional territories, and operate according to distinct political, economic, and social systems (United Nations, 2016). The geographic scope of my thesis includes Indigenous peoples across four jurisdictions: Canada, Australia, the United States, and New Zealand. In Canada, there are three recognized Indigenous groups: First Nations, Inuit, and Metis. In Australia, Aboriginal groups and Torres Strait Islander groups are politically recognized. In the United States, Native American and Alaskan Natives are recognized. In New Zealand, the Maori people are recognized.
and future generations (Barlow, 2014). We all now have a responsibility to protect the water as without it, none of us – human and non-human life alike, can survive.

While some societies have depleted and degraded water resources in mere centuries, others have displayed an ability to exist relationally with Nature for millennia. To take care of water, we can no longer rely solely on Western Ways of Knowing while omitting Indigenous Ways of Knowing. We must embrace the concept of Two-Eyed Seeing, as described by Mi’kmaq Elder Albert Marshall, and learn “to see from one eye with the strengths of Indigenous knowledges and Ways of Knowing, and from the other eye with the strengths of Western knowledges and Ways of Knowing ... and to use both these eyes together, for the benefit of all” (Institute for Integrative Science and Health, 2016).

The ongoing depletion and degradation of the world’s water sources, and the continued omission of Indigenous knowledge and Ways of Knowing has disproportionately burdened Indigenous communities, as evidenced by disparities in access to safe and sufficient water sources\(^2\) in Indigenous spaces (WHO, 2003). For example, in Canada approximately 1 in 5 First Nations communities\(^3\) are currently experiencing a drinking water advisory (Health Canada, 2016). While similar data for Inuit and Metis communities are not readily available, there are studies that indicate Inuit and Metis communities have similar problems (Hanrahan et al., 2014; Harper et al. 2011; Martin et al., 2007). In contrast to the issues of quality that are prevalent in Canada, over-allocations and issues of water quantity are the more prevalent issue in relation to water security\(^4\) for Indigenous people in Australia (Jackson et al., 2012; Bark

\(^2\) Safe and sufficient water sources is used to describe drinking water and sanitation, as well as healthy source waters and aquatic resources.

\(^3\) This does not include British Columbia as Health Canada no longer tracks this data for the province. As of October 2013, the First Nations Health Authority (FNHA) has been responsible for all health-related programming for First Nations in B.C. (Health Canada, 2016). As of April 2016, there are 25 active drinking water advisories in 22 of 198 First Nations communities in B.C., or approximately 1 in 10 (First Nations Health Authority, 2016; Indigenous and Northern Affairs Canada, 2010).

\(^4\) In the context of this thesis, the concept of water security is used according to the definition provided by United Nations – Water: “Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability” (UN-Water, 2013).
et al., 2012). These are but two of a multitude of disparities experienced by Indigenous peoples, often triggered by settler colonialism. Initiatives have been set in motion to address these and other disparities, including global initiatives such as the United Nations Declaration on the Rights of Indigenous Peoples which calls for recognition, reconciliation, and healing of the historical injustices that have been perpetuated against Indigenous peoples and have led to dispossession of lands and resources, and continue to negatively impact Indigenous self-determination. The success of such initiatives has yet to be determined, however, it represents an important aspect of the process of reconciliation between ourselves and the planet.

While recognition and interest in implementing Indigenous and Western knowledge has continued to grow, it is only the beginning of the process. The fact remains that both Settler and Indigenous peoples are not going anywhere, therefore the water crisis needs to be addressed through effective collaboration and cooperation. Indigenous place-based knowledge can contribute much to our wholistic understanding of water-related challenges, and Western knowledge systems have led to tremendous breakthroughs in end-point solutions to water-related challenges (i.e. drinking water treatment and sanitation) – though the exclusive use of this knowledge system has failed to address the causes of these water challenges, particularly in Indigenous communities (White et al., 2012; Jackson et al., 2014; Health Canada, 2016). An overreliance on Western knowledge systems and the omission of generations-worth of Indigenous place-based knowledge has contributed to the perpetual disparity between Indigenous and non-Indigenous communities in accessing safe and sufficient water. The goal of my thesis research then, is to call attention to, and advance the value and validity of using both Indigenous and Western knowledge systems in water research and management so that we can better care for water.

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5 The term Settler is used in the context of my thesis to refer to those people that are not the original inhabitants of Canada, Australia, New Zealand, and the United States. This is an admittedly complex topic of discussion, but for the sake of clarity, the term has been used in this broad sense. Settler colonialism refers to the (destructive) process of foreign populations migrating to new lands under the authority of an external governing body for the purposes of ‘destroying to create’ (Wolfe, 1999; 2006).
1.1.2 Research Objectives

Since 2009, there has been a steady increase in the peer reviewed literature regarding the implementation of Indigenous and Western knowledge systems as they relate to water, which influenced a call for proposals from the Canadian Water Network to better examine the relative merits of such work, and thus the undertaking of this thesis (See CWN, 2014 and Castleden et al., 2015). To facilitate this implementation, academics from across disciplines have attempted numerous methods and models (with varying degrees of success). What is absent from the literature, however, is a synthesized review of these methods and models as they relate to the implementation of Indigenous and Western knowledges in water research and management, and a thorough examination of the contributions that each of these research projects has made to this research field. My research offers a synthesized review of the peer-reviewed literature from research that was conducted in Canada, Australia, New Zealand and the United States – four countries with a shared, though not identical history of British colonialism. In addition to this review, I conducted interviews with many of the authors of these publications from Canada and Australia to seek out additional insights on this topic.

In consideration of the goal of my thesis research, this project sought to achieve the following five objectives:

1) Identify past and ongoing water-related academic research that has attempted to implement Indigenous knowledge systems;

2) Synthesize the methods and models used within these studies that support the implementation of Indigenous and Western knowledge systems;

3) Examine and highlight divergent perspectives and approaches (if any) between researchers;

4) Present evidence demonstrating the strengths and weaknesses of current research practices in their ability to create value for Indigenous communities;

5) Provide recommendations for future research projects that seek to implement – in a meaningful and appropriate manner – Indigenous and Western knowledge in water research and management.
Throughout my thesis, I refer to both water research and water management as areas of focus for my research goal, objectives, findings, and recommendations. While water research is the key target area for my study as I examined the work of academic researchers, and conducted interviews with the first authors of exemplary works, the management focus of my thesis refers to the policy implication for managing our relationship with water. The inclusion of these two audiences is intentional to broaden both the scope of my project, as well as the applicability of my findings and recommendations. What follows in the remainder of this chapter is a detailed account of the literature used to inform the direction of my thesis, as well as a statement about my positionality, which has impacted every facet of my thesis work. The chapter concludes with a description of the outline of my thesis in its entirety.

1.2 Literature Review

This section reviews three bodies of literature through which I have conceptually positioned my thesis. First, I discuss the notion of ‘Indigenous’ and ‘Western’ as distinct knowledge systems. This section draws on literature that discusses the creation and continuity of these two systems. Second, I review the literature on Indigenous and Settler perspectives as they relate to water. Specifically, this section contextualizes the discussions surrounding the differing ontological positions and values that Indigenous and Settler communities often have regarding their respective lived environments, and ultimately supports the call for the creation of collaborative partnerships. Third, and as a means to support these collaborative partnerships, I reviewed the integrative knowledge implementation literature pertaining to the Two-Eyed Seeing approach, which was used to guide the implementation process of this thesis. I conclude this section with a brief statement about the contributions that my research intended to make to these bodies of literature.

1.2.1 Indigenous and Western Knowledge Systems

At the outset, it is important to recognize the difficulties with defining what constitutes Western knowledge or science, and what constitutes Indigenous knowledge or science. Such attempts to define...
Western science often include references to knowledge generated using the scientific method, Positivism, objectivity, and replicability (see Oxford English Dictionary, 2016; Mazzocchi, 2006). While these definitions do encompass various aspects of some science, it does not account for all science. Subjectivity, relativism, and inductive reasoning are all prevalent within the realm of Western science, however all run counter to the definition of Western science that is often put forth and understood as the ‘gold standard’ in academe (Barnes, 2001; Jacobs & Spillman, 2005). There has also been a tendency to discuss Indigenous knowledge in terms of what it is not, rather than what it is – that is, knowledge is Indigenous because it is not Western, and vice-versa (Agrawal, 1995). This is problematic, however, as Western science is also not easily defined, therefore comparisons are quite difficult. Researchers must move beyond this tendency to contrast Indigenous knowledge with Western knowledge and instead treat both knowledge systems as legitimate and seek implementation opportunities rather than seeking differences.

Indigenous scholars Paul Nadasdy (1999) as well as Marie Battiste & James Youngblood Henderson (2000) have written that Indigenous and Western knowledge systems are categorically indefinable, contested, and incredibly dynamic spheres of knowledge. As separate terms, Indigenous and Western have been used to represent different Ways of Knowing during histories of co-existence; however, to categorically define either in a dichotomous relationship is to neglect the place-based nature of these knowledge systems and the resulting impacts of this centuries-old relationship of exchanges between Indigenous and Settler populations (Battiste & Youngblood Henderson, 2000; Nadasdy, 1999). Dr. Cheryl Bartlett, a Professor Emerita of Biology and former Tier 1 Canada Research Chair in Integrative Science with decades of experience working with Mi’kmaw Elders and the co-creator of the concept of Two-Eyed Seeing, describes Indigenous knowledge as being “inherently tied to the natural world (i.e., ecosystems and particular landscapes and landforms within them, plus skies overhead) in traditionally occupied territories” (Bartlett et al., 2015, p. 284).
Briggs (2005), a non-Indigenous scholar, raises an interesting line of reasoning regarding the use of Indigenous knowledge in development planning by stating that “whilst Indigenous knowledge seems to reject western science’s claims to universality and spatial transferability, at the same time its institutionalization casts it as an object that can be essentialized, archived and, indeed, itself transferred” (Briggs, 2005, p. 100). The implementation of Indigenous knowledge within a Western paradigm will inevitably fail when attempting to use Indigenous knowledge to focus solely on ‘solutions’ to problems. Seeking Indigenous knowledge ‘solutions’ marginalizes Indigenous knowledge by comparing it to the solutions offered by Western knowledge. Instead, the implementation of Indigenous knowledge and Western knowledge would be better served to address our understandings of the underlying problem, as related to the arguments of Reij and colleagues (2013) in their research regarding soil management in Africa. Briggs goes on to argue that a focus on solutions can lead to findings that may be considered too place-specific to effectively influence policy. What Briggs is suggesting is that Indigenous knowledge as a solutions-only form of knowledge hampers efforts of implementation, and at times can lead to scientific objectives and knowledge that are too different for any meaningful implementation to occur (Bohensky & Maru, 2011; Williams, 2006).

What is also apparent in the literature is the idea that knowledge held by Indigenous people about their traditional territories must somehow be verified by Western science before it can be supported as truth (Briggs, 2005; Castleden et al., 2009). For example, Malaspinas and colleagues (2016) recently confirmed through genomic testing that Aboriginal Australians were present on the continent over 50,000 years ago – making them the oldest known human civilization in history. This research was investigator driven and designed to identify the time period that Aboriginal Australians were present on the continent; however, the research only validated the knowledge already held by Aboriginal Australians, as Aboriginal Elder Aubrey Lynch stated, “This study confirms our beliefs that we have ancient connections to our lands and have been here far longer than anyone else” (Devlin, 2016). Both Indigenous and Western Ways of
Knowing were used in this example, yet the conclusions were the same – illustrating that Indigenous and Western knowledge can provide equal value to the solution of scientific questions.

Indigenous authors (for example, Kawagley & Barnhardt 1998, Wilson 2008, and Cajete 2015) argue that the over-reliance and higher value ascribed to Western knowledge is fostered in the education system within the Western world. Where Western science is compartmentalized, decontextualized, and transferred widely through designed curricula, Indigenous knowledge is understood to be much more experiential and relational, and therefore not conducive to being disseminated within a classroom setting, as presently designed (p. 2-3). Kaiser (2005) too supports the need for a pedagogical examination at the classroom level. Kaiser (2005) argues that pedagogy is often not considered within the Western science context, and that if implementation is going to occur, consideration must be placed on how we instruct our scientists. Recognition of Indigenous science as a valid science, and further removing it from the categories of pseudo-science or anti-science is necessary within our academic training system, as argued by Bala and Joseph (2007) and others (e.g. Cajete, 2015; McCarty & Lee, 2014; Wilson, 2014).

An explanation for emergence of Western knowledge legitimacy and preferential use over Indigenous knowledge is discussed in Stuart Hall’s (1992) seminal text and creation of the framework of *The West and the Rest*, partially developed through his examination of Edward Said’s (1985) *Orientalism*. The West and the Rest framework refers to the ‘othering’ of non-European populations by viewing them only through their existence as non-Western populations (MacNaughton & Davis, 2001), similar to the ways de Beauvoir (1949) discussed the ideological tradition of ‘creating’ women as other to man, or the ‘exotic’ other that is the colonized to the colonizer, as discussed by (Fanon, 1967). Hall (1992) argues that the West and the Rest was a powerful and formative discourse that ascribed Western epistemologies, ontologies, and methodologies a dominant status in an ‘us versus them’ relationship. Hall argued that this perceived Western superiority over Indigenous peoples and the subsequent colonial ‘othering’ discourse whereby the dominant (colonizers’) knowledge systems were used to provide the cultural lens through
which the New World was seen, and enabled the colonial domination that, to this day, continues to negatively impact Indigenous populations worldwide (Hall, 1992; Gregory, 2011; Ahmed, 2000; 2006).

Through this formative literature, I have attempted to situate the Euro-centric nature of Western scientific knowledge as one that has historically aligned itself with positivist notions of scientific objectivity and the scientific method, but from a critical lens, Indigenous scholars and Settler scholar-allies have made it possible for us to see that Western science is, in fact, one that is dynamic, subjective, and inductive (Liedloff et al., 2013; Medin & Bank, 2014). Nevertheless, these Euro-centric notions have perpetuated the oppression and suppression of Indigenous peoples and Ways of Knowing in the academy (Wilson, 2008). Recent trends, however, have indicated that Indigenous research paradigms are beginning to permeate the realm of the academia (Castleden et al., (forthcoming); Cunsolo et al., 2012; Bartlett et al., 2012; Kovach, 2005). The categorization of Indigenous and Western Sciences is made difficult by the ambiguity in definitions for either knowledge system, and this ambiguity makes the implementation of both knowledge systems problematic without meaningful engagement (Bartlett et al., 2015; Nadasdy, 2005; Battiste & Youngblood Henderson, 2000).

Ambiguity in definitions for Indigenous knowledge has led to my decision not to provide a definition of Indigenous knowledge, and attempting to do so would not do justice to the entirety of the Indigenous research paradigm. Instead, I have chosen to provide a description of Indigenous knowledge that was used to guide this research project. As explained by Indigenous scholar Marlene Brant Castellano, place-based Indigenous knowledge is “personal, oral, experiential, holistic, and conveyed in narrative or metaphorical language” (Castellano, 2000, p. 25). Western science or knowledge is not defined in my thesis either, and when referenced, is described as having been developed through existence in Western (European) contexts and representative of the societal values, norms, and customs that are associated with Western civilization.

1.2.2 Indigenous Perspectives in Water Management
Building upon the above formative literature regarding the concepts discussed in my thesis, the following is comprised of two sections that highlight two modes of implementing Indigenous perspectives and values in water research and management – through policy decisions, and through Indigenous methodologies.

1.2.2.1 Policy Decisions in Canada and Australia

Indigenous peoples and Indigenous communities have much to contribute in water management planning as a result of their long in situ relationship with water in particular environments ranging from the Arctic and sub-Arctic tundra of Canada’s North (Hanrahan et al., 2014) to the mountains of New Zealand (Tipa, 2009), and from the deserts of Australia (Jackson, 2004) to the plains of the United States (Bark et al., 2012). In addition to possessing the legal right to manage traditional lands and resources (Langton, 2002) as dictated by colonial governments, many communities also possess a cultural, spiritual, and/or social responsibility to take care of the Earth for future generations (McGregor, 2004). Given this, researchers, and in particular non-Indigenous or Settler researchers, are becoming aware of the need to engage with Indigenous Peoples and their knowledge systems to determine the best approaches to research and manage water-related challenges in Indigenous territories. Partnering in research is a mechanism for such engagement.

In recent years, this partnership responsibility has been formally stated in both legal and policy agreements. For example, in the midst of a decade-long drought, the governing bodies of each State and Territory of Australia developed and consented to the terms of a National Water Initiative in 2004. Realizing that over-allocations of water continued to strain the already limited water resources of the country, this Initiative was the first of its kind whereby state and territorial governments agreed to co-manage federal water resources. It was also the first time in which state and federal governments were

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6 Territories here refers to the lands that Indigenous communities have cared for as stewards for millennia and not only those lands that have been recognized through the creation of reserves/reservations or the signing of Treaties.
required to consider Indigenous interests in their water plans as well. Sections 52-54 of the Initiative are most notable in relation to Indigenous peoples’ involvement in water access and planning (see Table 1.1).
Table 1.1 - Australian National Water Initiative, 2004

<table>
<thead>
<tr>
<th>Indigenous Access</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>52.</strong> The Parties will provide for Indigenous access to water resources, in accordance with relevant Commonwealth, State and Territory legislation, through planning processes that ensure:</td>
</tr>
<tr>
<td>i) inclusion of Indigenous representation in water planning wherever possible; and ii) water plans will incorporate Indigenous social, spiritual and customary objectives and strategies for achieving these objectives wherever they can be developed.</td>
</tr>
<tr>
<td><strong>53.</strong> Water planning processes will take account of the possible existence of native title rights to water in the catchment or aquifer area. The Parties note that plans may need to allocate water to native title holders following the recognition of native title rights in water under the Commonwealth Native Title Act 1993.</td>
</tr>
<tr>
<td><strong>54.</strong> Water allocated to native title holders for traditional cultural purposes will be accounted for. (COAG, 2004, p. 9)</td>
</tr>
</tbody>
</table>

In Canada, no such initiative exists at the national level. However, this does not mean that Indigenous people in Canada are without federally-recognized rights to water. In fact, quite the opposite is true as Section 35 (1) of the Constitution Act of 1982 states that Indigenous people have the rights to traditional lands and adjacent waters (Phare, 2013). This section of the Constitution also argues that unless water rights have been limited by the existence of treaties, all rights to lands and water from pre-colonial times must be assumed to still exist. Phare (2013) notes the province of Manitoba as an example, where no known treaties were signed limiting the water rights of Indigenous people, suggesting that the right to water and land still exists, though this right has not been fully recognized, as evidenced by breaches in the Northern Flood Agreement (1977) for hydroelectric development purposes. Requirements to implement Indigenous Ways of Knowing are also apparent in the Canadian context. For example, the Northwest Territories Water Stewardship Strategy was developed by the territorial government in collaboration with community and federal-level actors to support Indigenous access to healthy lands and waters. Of particular importance to Indigenous peoples’ involvement in water access and planning are Sections
4.1.1-4, which detail the keys to successful partnerships between various actors in ensuring healthy lands and waters (see Table 1.2).

**Table 1.1 - Northwest Territories Water Stewardship Strategy; Keys to Success**

<table>
<thead>
<tr>
<th>Key to Success</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.1 – Develop a cooperative working environment for water partners</td>
<td></td>
</tr>
<tr>
<td>4.1.2 – Implement collaborative planning to address capacity issues</td>
<td></td>
</tr>
<tr>
<td>4.1.3 – Use best available knowledge to help inform all water partners.</td>
<td>Includes</td>
</tr>
<tr>
<td>i) Traditional and Local Knowledge; and/or</td>
<td></td>
</tr>
<tr>
<td>ii) Western Science Knowledge</td>
<td></td>
</tr>
<tr>
<td>4.1.4 – Continue ongoing communication, awareness and engagement among water</td>
<td>and with the general public (NWT Water Stewardship Strategy, 2010, p. 16-19)</td>
</tr>
<tr>
<td>partners and with the general public (NWT Water Stewardship Strategy, 2010,</td>
<td></td>
</tr>
<tr>
<td>p. 16-19)</td>
<td></td>
</tr>
</tbody>
</table>

The Winters Doctrine (*Winters v. United States*, 207 U.S. 564 (1908)) has similarly supported the claim Indigenous rights to adjacent waters are included within any Title or Land agreements, unless forfeiture of these water rights has been explicitly stated (Shurts, 2000). For over 100 years the United States has been operating under this example of jurisprudence, yet in Canada the inclusion of rights to adjacent waters remains unclear (Phare, 2013). In New Zealand, the Maori-led Waitangi Tribunal has been in existence since 1975 with the primary purpose of ensuring, among other things, that Maori rights to lands, waters, and all associated resources, as promised in the Treaty of Waitangi, are not being infringed upon in the creation of New Zealand federal policy (Waitangi Tribunal, 2016).

The strengths of legal doctrines in New Zealand and the United States, as well as federal and provincial policy in Australia and Canada represent variations in methods to achieve similar goals of Indigenous and Western knowledge implementation. These legal and legislative requirements have, in essence, been designed to ensure that while Indigenous and Western Ways of Knowing differ in some ways, both Indigenous and Western knowledge-holders must be engaged, as equals, to better take care of our water. Policies requiring collaboration do well to outline *that* collaboration must take place; however, what is
often lacking is a description of how this implementation is to take place (Jackson & Morrison, 2007; Nadasdy, 1999; Roy & Campbell, 2015; Castleden et al., forthcoming).

1.2.2.2 Indigenous Methodologies

Indigenous relationships with water and the spiritual, cultural, and social connections that accompany those relationships are often difficult to quantify within Western understandings (Bartlett et al., 2012; Liedloff et al., 2013). However, Indigenous knowledge does not need to ‘fit’ within Western understandings (Watts, 2016 (unpublished). Instead, to engage with both Indigenous and Western Ways of Knowing as they relate to water, researchers must continue to seek new methods and models that can allow for Indigenous Ways of Knowing about water to be implemented in a co-learning journey with Western Ways of Knowing. Such methods may include stories that are shared through paintings, film, dance, and myth, and exist within local ideas, customs and beliefs (as related to the work of Toussaint et al., 2005). Storytelling is an important component of culture for many Indigenous communities (Archibald, 2008; Corntassel et al., 2009; Bartlett et al., 2012) and, as Indigenous scholar Thomas King (2003) states (and is partly attributable to the work of Laguna storyteller Leslie Silko (1997)), “the truth about stories is that that’s all we are” (p. 1). These stories influence the relationship between human beings and the lands and water around us; therefore, this must be considered in water research and management initiatives, and influence the design of integrative research projects.

As Kovach (2015) explains, simply placing the term ‘Indigenous’ in front of research based on the inclusion of Indigenous partners is insufficient in determining whether or not a research method is indeed an Indigenous one. Instead, she argues that Indigenous methodologies comprise Indigenous Ways of Knowing, have decolonization objectives\(^7\) (as argued by Smith, 1999), a respect for the natural world and

\(^7\) Smith highlights the negative perspective that colonized Indigenous peoples have about “Western” methodologies towards research. This is exemplified in her statement that “it galls us that Western researchers and intellectuals can assume to know all this it is possible to know of us, on the basis of talking to some of us” (Smith, 1999, p. 1). Operation in such frameworks will never be consistent with Indigenous methodologies until perspectives and underlying assumptions in research are understood and rectified.
an understanding that humankind are actors in a relationship with the environment (as argued by Louis, 2007). To further identify whether research truly is consistent with Indigenous methodologies, Kovach suggests Indigenous research partners ask difficult questions such as, “is the research goal helpful for my community? Do the methods meet cultural protocols? And who is driving the research and what is the purpose?” (Kovach, 2015, p. 52).

1.2.3 Integrative Knowledge Implementation

Further building on the literature regarding Indigenous Ways of Knowing, the following section is comprised of two discussions regarding the implementation of Indigenous Ways of Knowing with Western Ways of Knowing – Two-Eyed Seeing, and the processes of implementing.

1.2.3.1 Two-Eyed Seeing

This research project was designed according to the methodology of Two-Eyed Seeing, as described to me (and the larger research team) by Mi’kmaq Elder Albert Marshall of Eskasoni First Nation from Unama’ki – also known as Cape Breton, Nova Scotia – and Dr. Cheryl Bartlett. The concept of Two-Eyed Seeing was developed according to the work of the late spiritual leader, healer, and Chief Charles Labrador of Acadia First Nation – with specific emphasis given to this teaching: “Go into a forest, you see the birch, maple, pine. Look underground and all those trees are holding hands. We as people must do the same” (quoted in Iwama et al., 2009). Using this teaching, Elders Murdena and Albert Marshall and Dr. Bartlett developed the concept of Two-Eyed Seeing in 2004:

Two-Eyed Seeing refers to learning to see from one eye with the strengths of Indigenous knowledges and Ways of Knowing, and from the other eye with the strengths of Western knowledges and Ways of Knowing ... and learning to use both these eyes together, for the benefit of all. (Institute for Integrative Science and Health, 2016)

Throughout this thesis, Two-Eyed Seeing is the foundational principle that I used to guide my research and the path forward towards decolonized research and management processes that can benefit community partners as well as researchers, and Indigenous communities and Settler communities.
Bringing together Indigenous and Western experts and the use of both ‘eyes’ allows for the opportunity to have equal engagement of both Indigenous and Western perspectives, and through the interweaving of these perspectives, an understanding can be reached that will be more thorough than one that would emerge as a result of viewing the challenge through either ‘eye’ in isolation. Though the term ‘Two-Eyed Seeing’ is not stated within the context of their work, Liedloff and colleagues (2013) present an example of how Two-Eyed Seeing can be used in water research and management. To paraphrase their work, while Western Ways of Knowing identified indicators of high water quality, quantity, and aquatic resource levels in the Fitzroy River, Australia, Indigenous Ways of Knowing indicated that where fruit trees lined the river banks – which allowed for fruit to fall into the river, harvested fish would be of greater size and therefore higher nutritional value to the Indigenous communities in that area.

In general, alternative Ways of Knowing, and Indigenous perspectives in particular, have been notably absent in research (Smith, 1999; Martin, 2012; Bartlett et al., 2015). The emergence of Two-Eyed Seeing as a framework serves as a critique of the positivist notions that have undermined Indigenous Ways of Knowing, and though this term has only recently gained prominence in academe, these positivist critiques are well established in the literature (Adelson, 2005; Jones, 2006; Durey & Thompson, 2012). It is important to note that this thesis does not strive to devalue the contributions of Western science in favour of Indigenous knowledge systems, this thesis is intended to further the legitimacy of both knowledge systems in that both have equal value and merit in addressing our relationship to water.

1.2.3.2 Knowledge Implementation

There is a tension present within the study of integrative knowledge implementation, which is made even more apparent when it is an Indigenous knowledge system that is being used as part of the integration process. Knowledge integration has been described as the process of incorporating new information into an existing knowledge framework (Bohensky & Maru, 2011). However, as Bohensky and Maru (2011) discuss, this definition is flawed as it speaks to the existence of power and dominance that can be
apparent in knowledge integration, and raises questions such as: which Way of Knowing is *existing*, which one is *new*, and who has the power to decide?

In 1999, Nadasdy published a critique of the previous 15 years of ‘integrated’ knowledge research and the lack of an internal examination within these projects of the power dynamics that risk perpetuating the colonial domination that Indigenous peoples have encountered for hundreds of years. While the author notes that actually integrating one knowledge system with the other presents technical difficulties, the main argument that Nadasdy (1999) puts forth is that focusing only on technical problems ignores the political dimensions that accompany this type of research, and that it is actually these political issues that must be examined. When considering implementation, issues of power must be considered and reconciled, included questions such as: who decides that implementation should take place? Who decides how implementation takes place? And who stands to benefit? The need to understand and reconcile power dynamics are reflected in much of the critical social theory, decolonizing and Indigenous methodologies, and anti-colonial literature, including, for example, the works of Smith (1999), Braun and colleagues (2014), Kovach (2015), and Kawagley and Barnhardt (1998). In these articles, the authors argue that Indigenous knowledge will not be viewed as equal to Western knowledge in the academic realm so long as the academic institution continues to operate under a Western framework that compartmentalizes and decontextualizes knowledge.

Skepticism exists regarding whether integrative Indigenous and Western knowledge implementation can actually occur. Some Indigenous peoples have indicated that they do not believe that Western-trained Settler scientists intend to engage in the lifelong relationship of reciprocity and co-learning required in integrative water research, or that these Western-trained scientists are merely ‘checking a box’ to say that they had spoken to an Indigenous person in order to move on (Bohensky & Maru, 2011). At the same time, some Western-trained scientists have intimated that they believe ‘traditional knowledge’ to be antiquated and the concept is being used by Indigenous communities to wrestle power back from
scientists (Nadasdy, 1999; 2005). The Two-Eyed Seeing approach has been put forward as a conceptual model and methodological framework to effectively implement both Indigenous and Western Ways of Knowing in integrative ways and to rectify this apparent divide between them.

Thus, throughout my thesis, the term ‘integrated’ is not used to reference a collaboration between Indigenous and Western Ways of Knowing. Rather, ‘integrative’, which is a better reflection of what Two-Eyed Seeing strives for, is used throughout, and inter-changeably with implement/implementation. This is deliberate and done at the request of Albert Marshall, a Mi’kmaq Elder who is one of many Indigenous Knowledge-holders that have helped guide this research project. Elder Marshall explained that using the past tense of the term ‘integrated’ as in ‘integrated knowledge’ implies that this process of collaboration is linear and complete, which we know is not the case. The process is ongoing and cyclical (Bartlett et al., 2012) therefore, the terms ‘integrative’ and ‘implementation’ have been used throughout to reflect this dynamic process.

In reference to Indigenous knowledge implementation, Cruikshank (2012) argues that “what people say is common sense, cogent, logical, and should be taken seriously” (p. 240), and it is from this premise that I have developed my research project. Nadasdy (1999) first argued that integrative knowledge implementation research often concludes with statements urging others to implement both Indigenous and Western Ways of Knowing, but often lacks a discussion of the methods to proceed with this implementation. Seventeen years after that publication, I have sought to explore the methods and models that researchers have been using in their efforts to implement Indigenous and Western knowledge systems in water research and management.

1.3 Research Contributions to the Literature

There are two primary gaps in the literature that this research addresses. First, while water researchers and managers alike have attempted to implement Indigenous and Western knowledge to better research and manage our waters, after an exhaustive literature search, I have determined that there has not been a
comprehensive examination of the merits of the methods and models used to facilitate the implementation of both Indigenous and Western Ways of Knowing. Through the use of a combined systematic realist review, this research explores the strengths, challenges, and opportunities that have appeared within the body of peer-reviewed English language literature in four jurisdictions regarding the implementation of knowledge as it relates to water research and management. Through the use of semi-structured interviews with some of the authors of the literature captured in the review, participants were given an opportunity to share their stories and elaborate on their experiences in working in the realm of Indigenous and Western knowledge system implementation, and thus contribute a personal examination of their experiences in knowledge integration research to date.

Second, there are policies that explicitly require water researchers and managers to engage and collaborate with Indigenous knowledge holders, wherever appropriate, to continue to protect our waters. While such policies clearly outline that collaboration is necessary, how to implement both Ways of Knowing is not as clearly articulated. By synthesizing the results and conclusions of the published literature, as well as conducting semi-structured interviews with the authors of the literature, this research will contribute to filling the gap in how implementation research can occur in an effective, meaningful, and appropriate manner. Interviews include researcher perspectives regarding individual successes, challenges, and opportunities encountered during the research process that can facilitate the implementation of both Indigenous and Western Ways of Knowing.

The guiding principle of Two-Eyed Seeing was developed in 2004 by Mi’kmaw Elder Albert Marshall, using the wisdom gained from Elders in that area, and was shared with Institute for Integrative Sciences and Health at Cape Breton University as part of a co-learning journey. Though this principle was developed over a decade ago, it has only recently gained prominence in academia outside of the Institute for Integrative Science and Health (e.g., Martin, 2012; McKeon, 2012; Lavallee & Levesque, 2013; Marsh et al., 2015). Two-Eyed Seeing is also being fostered by the Canadian Institutes for Health
Research – Institute of Aboriginal Peoples Health, as it has recently been included as part of its strategic plan for funding opportunities (CIHR-IAPH, 2016).

1.4 Positionality Statement

Research involving human participants is a shared endeavor. An endeavor that is shaped by the researcher, the participants, and the experiences that have led both parties to the intellectual, social and physical position they are in now. My position as a researcher-in-training has been a difficult one for me to reflect on. Growing up, I did not feel a sense of privilege. While my family was not poor, and I felt that I was always able to participate in any sport or event that I wanted, I always knew there were other ‘rich kids’ that were certainly more privileged than me. I grew up as part of a working class, nuclear family, with loving parents and three siblings. My grandparents on my father’s side left Italy soon after the Second World War seeking a better life, and chose Canada as the setting for this new life. My family history on my mother’s side is much less clear, but I have been told that her side has been in Canada for as long as anyone living can remember, and maybe came from Scotland or England before that. What I am sure of is that after watching my parents and grandparents work hard for their entire working careers, I was part of the first generation of Stefanellis or Fosters (likely Scottish) that had the opportunity (or the desire) to attend university.

During my undergraduate degree, and specifically in my third year, I began to realize that maybe I was privileged. It was in this year that two things happened that have shaped who I have become. The first event was an opportunity to participate in an academic exchange to Stockholm, Sweden for the first semester of my third year. While on my exchange, I met new friends from around the world, and many told me about how great Canada was (though many had never been there and only heard ‘great things’ about it). Hearing how great Canada was from people around the world made me feel proud to be Canadian, and it made me excited to return to all the great things Canada had to offer – jobs, education, infrastructure and the like. The second event that shaped my positionality occurred when I returned to
classes in Canada for my second semester of third year. It was here that I took an elective course called “Indigenous Environments” with Dr. Chantelle Richmond. This was the first time that I was exposed to the reality that Canada is great – for some, and as a White Canadian, I was one of the privileged ones. Dr. Richmond taught me about environmental dispossession, disparities between Indigenous and non-Indigenous people in indicators of health and quality of life, and most important to this thesis, disparity in access to safe and secure water resources. Thus, my research career began by attempting to balance these two experiences – being proud to be a Canadian for all that is offered here and missing this land when I was gone, coupled with my learning that many Indigenous peoples do not share this same access to Canada’s resources and miss their land without leaving it (as it has been taken away, severed, and continually altered by factors beyond their control).

Upon completion of her course, Dr. Richmond invited me to work with her on an undergraduate thesis that further examined the water-related challenges in Indigenous communities in Canada. It was also through Dr. Richmond that I was connected to my current supervisor, Dr. Heather Castleden, who has made this entire thesis possible. As a researcher, I am tremendously privileged to have worked with both of these amazing researchers and educators that have provided invaluable guidance during my undergraduate and graduate research projects, and also played a tremendous role in shaping who I am as a researcher today.

1.5 Thesis Organization

My thesis is organized in a ‘manuscript-style’ format, separated into five chapters, each with their own standalone list of references cited, with a comprehensive bibliography at the end of this thesis. This first chapter presented an introduction to my research goal and objectives, as well as a review of the literature that was used to inform and situate my research project. The second chapter provides a detailed description of my methodology and the research methods I used to complete my data collection and analysis. The third chapter is the first of two manuscripts that are intended for academic publication. This
chapter details the results of a combined systematic realist review of literature from Australia, Canada, New Zealand, and the United States that focuses on the implementation of Indigenous and Western Ways of Knowing as they relate to water research and management. The fourth chapter is the second of the two manuscripts; it details the findings from 17 semi-structured interviews with water researchers from Canada and Australia about their integrative approaches to water research. The fifth chapter provides an overview of the study findings and implications, recommendations for future research, and a discussion of the limitations of this study.
1.6 References


Chapter 2

Research Design and Methods

2.1 Introduction

In the previous chapter, I situated my research project within current academic literature and articulated how my research attempts to fill a gap in our understanding regarding the implementation of Indigenous and Western knowledge in research and management. This chapter begins with a description of my research design, and includes a discussion of the necessary procedural components within this research project as well as a detailed account of the research methods used to collect and analyze the data.

My study was designed to explore contemporary perspectives of effective methods and models that can facilitate the implementation of Indigenous and Western knowledge in water research and management. My goal for my thesis research is to emphasize and further the legitimacy of both Indigenous and Western knowledge systems through an examination and evaluation of the most promising integrative water research and management practices that can allow us to better care for water. The research design and methods that I used to address these research objectives are detailed in the sections below.

2.2 Research Design

My thesis research was designed as a case study, and though the majority of my research was conducted according to a qualitative methodology, there were indeed quantitative elements to my case study. A case study, at its core, is “an intensive study of a single unit for the purpose of understanding a larger class of similar units” (Gerring, 2004, p. 342). As a methodology, a case study is best used to analyze phenomena within defined parameters (Asmussen & Creswell, 1995; Baxter, 2016) and should identify the research problem or challenge; provide extensive description and context for the case(s) studied; issues or themes that emerge are to be probed further; and conclusions and/or assertions are to be presented to the reader along with ‘lessons learned’ (Lincoln & Guba, 1985). My research uses a case study methodology to
explore the methods and models that can be used to support the implementation of Indigenous and
Western Ways of Knowing as they relate to water research and management across four jurisdictions:
Canada, Australia, the United States, and New Zealand.

While a case study represents the *methodology* or theory of how, why, and what can be researched
(Baxter, 2016), it does not address the mechanism or *methods* used to actually generate and collect data.

My thesis utilized three research methods to generate data from four regions. To meet Objective 1, I
began by conducting a systematic review (Moher et al., 2009; Shamseer et al., 2015) of the peer-
reviewed, published literature from research projects in Canadian, Australian, New Zealand, and
American research contexts that attempted to implement both Indigenous and Western systems of
knowledge in water research and management. From there, I analyzed this literature using a realist review
protocol (Pawson et al., 2005; MacDonald et al., 2013). Combining these two methods is an emerging
approach (for example, Mazzocato et al., 2010; O’Campo et al., 2011; Best et al., 2012; Macaulay et al.,
2011; Higgins et al., 2012; DeBono et al., 2012; Castleden et al., 2015; McConnell et al., 2013;
MacDonald et al., 2013), which I have referred to as a combined systematic realist review method or
CSRR.

Qualitative research provides an examination of the human experience related to specific phenomena
(Baxter & Eyles, 1997; Denzin & Lincoln, 2005). Where quantitative researchers rely on numerical data,
qualitative researchers use and analyze data in other forms, the most common of which is text-based
(Schwandt, 2001). Qualitative research often relies on open-ended questions to explore phenomena rather
than developing specific tests to assess the accuracy and validity of a defined hypothesis (Black, 1999;
Carter & Little, 2007). While there are elements of quantitative research apparent within my study, the
majority of this research was conducted according to the principles of rigorous qualitative research:
dependability, credibility, transferability, and confirmability (Baxter & Eyles, 1997; Denzin & Lincoln,
2005; Creswell, 2007). It is important to note that methodological variance among researchers does not
indicate an incompatibility between qualitative and quantitative traditions; instead, the use of multiple methodologies within a particular discipline, in this case geography, indicates a high level of intellectual vigour (Winchester & Rofe, 2016).

Data generated using the CSRR provided important findings; however, to respond to my overall research goal and meet Objective 2, a more comprehensive understanding of how Indigenous and Western knowledge was implemented in the projects described in the literature was necessary. To generate this data, interviews with authors of the aforementioned CSRR were conducted. In doing so, my study met the requirements of a case study to “…use extensive, multiple sources of information in data collection to provide the detailed in-depth picture of the [case being studied]” (Asmussen & Creswell 1995, p. 37). To support the data generated using the CSRR, as well as to provide the authors with an opportunity to expand on their ideas and experiences in relation to these projects, Canadian and Australian8 researchers were recruited to participate in semi-structured interviews that each lasted approximately one hour. What follows is a detailed account of the structure and progression of my research project from the design stages through to the data collection and analysis stages.

2.3 Research Preparation and Preliminary Considerations

My research was derived from a larger project funded by the Canadian Water Network (CWN), awarded to my thesis supervisor, Dr. Heather Castleden, to examine the “methods and models for integrative Indigenous and Western knowledge to inform water management and research in Canada” (CWN, 2014). In June of 2014 I was hired by Dr. Castleden as a research assistant on the CWN project, and to assist in the collection, analysis, and dissemination of the data generated in the Canadian context (see Section 2.3.2 – Research Project Design). I was able to use the Canadian literature and researcher interview data

8 While the CSRR included research from Canada, Australia, New Zealand, and the United States, only researchers from Canada and Australia were recruited to participate in interviews due to the substantially greater number of publications on this research topic that have come from researchers in those regions in comparison to New Zealand and the United States.
collected in the CWN project for my thesis research along with my own CSRR data from Australia, the United States, and New Zealand, as well as interview data from Australia, all collected according to the same research protocols used in the CWN project in an effort to generate a global perspective on researcher experiences.

Prior to the data collection phase, there were a number of preparatory steps that were taken in the CWN project and subsequently incorporated into my thesis project to ensure that data collection could be completed in an efficient and culturally-relevant manner. As part of the CWN project a National Advisory Committee was established, two National Water Gatherings were organized, the CSRR design was developed and interview guides were created for speaking with authors and/or their community partners. The guiding principles that emerged from the contributions of the National Advisory Committee members and the Water Gathering participants, as well as the research tools used to complete the CSRR and researcher interviews, were used to design my thesis research. These processes have been categorized and detailed below.

2.3.1 Project Timeline

This sub-section describes the development of the original CWN project, as well as the progression toward my own original research project. I joined the CWN project in June, 2014, and the table below illustrates, as closely as possible, the progression of my research that is common in qualitative studies.
**Table 2.1 - Research Timeline**

<table>
<thead>
<tr>
<th>Date</th>
<th>Project Task</th>
</tr>
</thead>
</table>
| April – May 2014 | - Notified of successful application to CWN*  
- Established a National Advisory Committee*  
- Conducted preliminary literature search  
- Contacted potential Water Gathering participants* |
| June 2014        | - First meeting of the National Advisory Committee to determine the purpose, questions, and directions of the research project*  
- First Water Gathering takes place in Ottawa, Ontario*  
- Developed CSRR data collection protocol*  
- Researcher and community partner interview guide drafted* |
| July – Dec 2014  | - Conducted systematic literature review  
- Research assistants selected articles for inclusion in CSRR  
- Completed the CSRR (Canada)  
- Potential interviewees are noted and proposed to research team  
- Sent recruitment emails to researchers |
| Jan 2015         | - First round of researchers respond to recruitment emails and establish dates and times to complete an interview  
- Interview guide goes through final revisions at project team meetings prior to completing first interviews |
| Feb - May 2015   | - Interviews were conducted with Canadian researchers that had worked with First Nations, Inuit* and Metis* community partners  
- Interviews are transcribed verbatim by professional transcriptionist and returned to participants for review  
- Interviews were coded and inter-coder reliability was established  
- Themes were identified within the codes  
- Invitations sent to Water Gathering Participants*  
- Project Report draft complete and given to Water Gathering participants to review prior to gathering* |
| June 2015        | - Second Water Gathering takes place in Ottawa, Ontario  
- Meeting of the National Advisory Committee takes place. Changes to the report are discussed and incorporated |
| July – Aug 2015  | - Writing and finalizing CWN project report* |
| Sept – Oct 2015  | - Conducted literature review for Australia, United States, and New Zealand  
- Completed CSRR for Australia, United States, and New Zealand  
- Literature results for United States and New Zealand are noticeably fewer than Australia; determination made to only continue the interview process in Australia  
- Established potential interviewee list, and recruitment emails sent |
| Nov 2015         | - Conducted one interview with author of project involving Indigenous peoples in the Northern Territory and Western Australia  
- Conducted one interview with author of project involving Indigenous peoples in the Northern Territory, Western Australia, and the Murray-Darling Basin  
- Conducted one interview with author of project involving Indigenous peoples in Western Australia and the Murray-Darling Basin |
| Dec 2015 – Feb 2016 | - Interviews were conducted with Australian researchers  
- Interviews are personally transcribed verbatim and returned to participants for review |
<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>March – Sept 2016</td>
<td>- Interviews were coded and themes were identified within the codes</td>
</tr>
<tr>
<td></td>
<td>- Thesis writing</td>
</tr>
<tr>
<td>October 2016</td>
<td>- Formal defense</td>
</tr>
<tr>
<td></td>
<td>- Final revisions and submission to Queen’s School of Graduate Studies</td>
</tr>
</tbody>
</table>

* Indicates a task that was outside the purview of my primary responsibilities. These tasks were completed by other team members for the purposes of the CWN project.

### 2.3.2 Establishing a National Advisory Committee

The CWN project team established a National Advisory Committee to provide guidance through all stages of the CWN research project. Committee members were selected through recommendations from team members, or from past relationships with team members. Members of the National Advisory Committee were chosen based on their experiences in this field, and represented different regions and perspectives from across Canada. The establishment of the National Advisory Committee was an integral part of this research project, as such expert perspectives were needed given the project’s national scope in terms of goals and implications. The guidance and lessons provided by the National Advisory Committee were used to support my thesis research as I expanded my regions of study beyond Canada to Australia, New Zealand, and the United States.

### 2.3.3 National Water Gatherings

There were two National Water Gatherings that functioned as workshops for the CWN project and allowed the research team to design and alter the research process in a manner that was consistent with the research team’s expertise in community-driven and participatory research and that met with the interests of the water gathering participants. Both Indigenous and non-Indigenous participants were recruited similarly to the NAC: through pre-established relationships with, or at the recommendation of members of the research team and the NAC. The first water gathering was used to design the data collection tools, and the preliminary data analysis was shared with the water gathering participants prior to the second water gathering to allow participants to provide feedback and to ensure that the results met
the intended goals. While the water gatherings were designed to support the goals of the CWN project, the research lessons and tools were also used to support the goals of my thesis research.

2.3.4 Combined Systematic Realist Review

A combined systematic realist review (CSRR) was used to identify the literature within Canada (Appendix A), Australia (Appendix B), the United States (Appendix C), and New Zealand (Appendix D), as well as to understand the circumstances in which this type of research can be successful or not successful. The data collection guide within the CSRR (Appendix E) was adapted from several research designs (i.e., Moher et al., 2009; Shamseer et al., 2015; Pawson et al., 2005, and MacDonald et al., 2013), in which systematic and realist review approaches were used. The search terms, as well as the academic journal databases used in the systematic review element were determined by the research team. The questions used in the realist component of the CSRR were determined by the research team with guidance from the NAC.

2.3.5 Adapting CSRR for Australia, the United States, and New Zealand

The CSRR was originally designed for the CWN project and focused on the Canadian context. To adapt these data collection tools, any use of the terms: “First Nations”, “Inuit”, or “Metis” were replaced with “Indigenous”, “Aborigine”, or “Torres Strait Islander” in Australia; “Native American”, “American Indian”, “Native Alaskan”, or “Native Hawaiian” in the United States; and “Maori” in the case of New Zealand. Additionally, any reference to “Canada” was replaced with the appropriate country of study.

2.3.6 Researcher Interview Guide

The interview guide was developed by the CWN research team with guidance from the National Advisory Committee, I then adapted it to the international contexts. After the CWN project received ethical clearance from the Queen’s University General Research Ethics Board to conduct research with humans (Appendix F) I filed an amendment for the purposes of my thesis that allowed me to contact researchers
in Australia, New Zealand, and the United States. Researchers were then recruited to participate via email through the use of a recruitment script (Appendix G) and were provided with a detailed information sheet about the project (Appendix H), as well as a consent form to review and sign (Appendix I) prior to completing an interview. The questions used in the Canadian-specific researcher interview guide (Appendix J) were developed in collaboration with the research team, the questions used in the Australian-specific interview guide (Appendix K) were developed on my own and differ slightly in terminology (First Nations, Inuit, and Metis replaced with Aborigine, Torres Strait Islander, and Indigenous. Though an interview guide was developed and used for community partner interviews in Canada (Appendix L), such interviews were not conducted in the Australian context and therefore no Australian community partner guide was developed. Prior to interviews with Canadian participants, the CWN research assistants conducted mock interviews with each other using this guide. This was done to ensure clarity with the research questions, identify lines of questioning that needed improvements, and to increase familiarity with the questions within the interview guide prior to completing researcher interviews.

2.4 Data Collection

This section outlines the techniques used to generate the data for my research project. The following subsections describe both the CSRR and interview data collection processes. The CSRR was conducted using published (in English) peer-reviewed literature from Canada, Australia, the United States, and New Zealand. Upon completion of the CSRR, based on the larger dataset that was found in the region, I determined that researcher interviews should be conducted in Australia and analyzed along with those interviews that I had already conducted in Canada.

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9 Interviews with community partners in Australia were not completed in my thesis due mainly to limited time and resources. Thus, the Canadian-based interviews with community partners were not included in my analysis but were used for the larger study. This limitation is explained further at the end of this chapter (Section 2.4.2.6 - Limitations)

10 The CWN project had three research assistants; each assistant was responsible for a particular set of interviews. I was responsible for conducting interviews with researchers that had completed research involving First Nations, the other two had similar responsibilities for research involving Inuit or Metis.
2.4.1 Combined Systematic Realist Review

I conducted a systematic review of the literature focusing on four English-speaking regions with a shared, but not identical British colonial history. I also conducted a realist review of the same literature through the use of a Reporting Tool (Appendix E) as it would be the most comprehensive way to search this literature. Combining a systematic review with a realist review – the CSRR – results in the rigour and replicability of a systematic review to determine the body of literature on an issue (Moher et al., 2009; Shamseer et al., 2015) with the detailed findings of why, how, for whom, and under what circumstances processes can be successful (Pawson et al., 2005; MacDonald et al., 2013) that are apparent in a realist review. The CSRR was used in order to determine what research had been done that attempted to implement both Indigenous and Western knowledge in water research and management, as well as why this research was successful (or not) in accomplishing this goal.

2.4.1.1 Databases and Inclusion Criteria

Literature for each of the four countries was searched across the same three databases, and selected for inclusion in the review according to an established set of inclusion criteria (see Figure 2.1 – Inclusion/Exclusion Criteria). Literature was limited to academic articles written in English and published from 1980 to 2015. SCOPUS, Web of Science, and Google Scholar were the databases used to search for appropriate literature according to defined search term keyword strings (See Tables 2.1-2.4 – Keyword Strings); these terms and databases were determined with the assistance of a research librarian at Queen’s University. Each database was searched using each keyword word string in each of the four countries, and the articles that appeared in the search results were sorted by relevance and viewed within the database in groups of ten articles. Titles were scanned and all titles that fit the inclusion criteria were selected for preliminary review. Once no relevant articles were found in the consecutive group of ten, I moved on to the next keyword string (as per Furgal, Garvin, & Jardin, 2010). After this preliminary body of literature
was created for each region, article abstracts were read to determine relevance to this project, again according to the inclusion criteria below (Table 2.2).

**Table 2.2 - Inclusion/Exclusion Criteria Reflective Questions**

| 1. | Is the article reporting on empirical data about water? |
| 2. | Does the article describe integrative Indigenous and Western knowledge processes of research/management? |
| 3. | Is water the focus of the article, or is a wholistic\(^{11}\) perspective taken within which water is included? |
| 4. | Is it describing a [country of study] context? |

Articles that were found to have met at least three of the four outlined criteria were selected for inclusion in the CSRR (Appendix A-D), and those that did not meet these criteria were omitted at this stage.

Articles whose relevance to the project could not be determined through a review of the title and abstract were subjected to a full text review, after which the article was either included or excluded from the CSRR. The initial literature search generated 226 results in Canada, from which 45 academic articles were included in the realist review. From Australia, 181 articles were generated through the database search, from which 26 were included in the realist review. In the United States, 148 articles were found in the literature search, and only 12 were included in the realist review, as many of these articles were framed in terms of legal rights to water, rather than an attempted collaborative framework. From New Zealand, 114 articles surfaced in the literature search, with 14 articles included in the realist review.

**2.4.1.2 Systematic Review Component - Search Terms**

This section outlines the search keyword strings for each database and within each region. In Canada, the terms *First Nation, Inuit, Metis, Aboriginal*, and *Indigenous* were used as each are acceptable, though not interchangeable terms, used to describe the First People of Canada (Aboriginal Affairs and Northern Development Canada, 2016). In Australia, the term *Aborigine* was used in searches along with the term

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\(^{11}\) The term ‘wholistic’ was used in place of ‘holistic’ at the recommendation of Mi’kmaq Elder Albert Marshall as he felt it best represented the implementation of both Indigenous and Western knowledges.
Torres Strait Islander, although the former provided very little to the search results. Additionally, Indigenous People* was used in place of Indigenous as the latter brought about too many irrelevant results related to non-human species. In The United States searches, the terms Native Hawaiian, Native Alaskan, Native American, and American Indian were used as these terms appeared on the 2010 USA census (Norris, Vines, & Hoeffel, 2012). Finally, the term Maori was used in New Zealand searches to generate relevant results (Royal, 2015). The four tables below, with the keyword strings, are subdivided by country for clarity.

Table 2.3 - Keyword Strings Canada

<table>
<thead>
<tr>
<th>Google Scholar, Scopus and Web of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Collaboration</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Co-management</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Governance</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Indigenous Knowledge</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Source Water Protection</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Water Access</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Water Quality</td>
</tr>
<tr>
<td>- First Nation OR Metis OR Inuit OR Aboriginal OR Indigenous AND Canada AND Water AND Water Security</td>
</tr>
</tbody>
</table>
Table 2.4 - Keyword Strings Australia

<table>
<thead>
<tr>
<th>Google Scholar, Scopus and Web of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water</td>
</tr>
<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Collaboration</td>
</tr>
<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Co-management</td>
</tr>
<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Governance</td>
</tr>
<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Indigenous Knowledge</td>
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<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Source Water Protection</td>
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<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Water Access</td>
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<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Water Quality</td>
</tr>
<tr>
<td>• Indigenous People* OR Torres Strait Islander OR Aborigine OR Aboriginal AND Australia AND Water AND Water Security</td>
</tr>
</tbody>
</table>
### Table 2.5 - Keyword Strings United States

**Google Scholar, Scopus and Web of Science**

- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Collaboration
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Co-management
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Governance
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Indigenous Knowledge
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Source Water Protection
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Water Access
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Water Quality
- Native Hawaiian OR Native Alaskan OR Native American OR American Indian OR Indigenous People* AND United States* AND Water AND Water Security

### Table 2.6 - Keyword Strings New Zealand

**Google Scholar, Scopus and Web of Science**

- Maori OR Indigenous People* AND New Zealand AND Water
- Maori OR Indigenous People* AND New Zealand AND Water AND Collaboration
- Maori OR Indigenous People* AND New Zealand AND Water AND Co-management
- Maori OR Indigenous People* AND New Zealand AND Water AND Governance
- Maori OR Indigenous People* AND New Zealand AND Water AND Indigenous Knowledge
- Maori OR Indigenous People* AND New Zealand AND Water AND Source Water Protection
- Maori OR Indigenous People* AND New Zealand AND Water AND Water Access
- Maori OR Indigenous People* AND New Zealand AND Water AND Water Quality
- Maori OR Indigenous People* AND New Zealand AND Water AND Water Security
2.4.1.3 Realist Review Component – CSRR Reporting Tool

Upon completion of the systematic literature search, the collected articles were subjected to a realist review tool consisting of 33 questions (Appendix E). This Reporting Tool was initially created by the CWN project team and revised over multiple iterations between the CWN project team and NAC members, with the final version included and used here. These questions were used to generate responses from the selected literature that could then be coded and analyzed. The development of codes was data-driven and reinforced through an iterative process (Weston et al., 2001; DeCuir-Gunby et al., 2011). The intended purpose of my CSRR was to review a large body of literature as well as to provide an in-depth look at integrative water research and management in multiple regions.

2.4.1.4 Limitations of the CSRR

The CSRR is an effective tool in identifying and providing detailed information on a body of literature; however, there are limitations to using it. A notable limitation of this particular CSRR is that I only included literature published as academic articles. In order to comply with the requirements of academic journals, the entirety of the knowledge gathered from the completion of a research project may not be articulated within the written text and subsequently would not appear in my CSRR analysis. However, my study design counters this effect vis-à-vis the subsequent interviews with these authors. In doing so, I was able to move beyond an interpretation of the information provided in the academic article with a more detailed account of authors’ research process and experience.

2.4.2 Semi-structured Interviews

Semi-structured interviews were used to gather more detailed information regarding the experiences and reflections of those researchers who had attempted to conduct water research or management projects using Indigenous and Western knowledge systems. The semi-structured interview research method gave participants an opportunity to discuss in detail (as per Dunn, 2005; 2016), their experiences conducting
integrative water management research including strengths, limitations, and opportunities in the field that may not have been comprehensively explored in their published literature.

2.4.2.1 Procedural Ethics

The data collection protocol was reviewed and approved by the Queen’s University General Research Ethics Board (Appendix F) for the CWN project and allowed the team to contact researchers and community partners in Canada.12 For the purposes of my thesis research, an amendment was filed and subsequently approved to extend the ethical clearance of my research project to include interviews with researchers from Australia, the United States, and New Zealand.13 Efforts were made to ensure the confidentiality of participants (as described in detail in Section 2.4.2.4). Due to the personal nature of telephone and Skype interviews, anonymity was not sought in this research project. Participants were not subjected to undue risk or harm as a result of their participation in this research study.

In addition to the procedural ethics required by our academic institutions, both the CWN project and my thesis research were designed to align with the Tri-Council Policy Statement (2014), particularly Chapter 9: Research Involving The First Nations, Inuit, and Metis Peoples of Canada, which notes that research must be premised on respectful relationships and a collaborative research process (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2014, p. 109). The original CWN project was designed according to the principles of community-based participatory research (see Castleden et al., 2012), and mine followed suit, though it did not benefit from an international advisory committee.

12 Additional procedural ethics were required to speak with communities in Nunavut, Nunatsiavut, and Nunatuavut and Labrador. These interviews were conducted by a research assistant other than myself for the purposes of the CWN project. The data from those interviews were not included in this thesis and therefore do not appear in the Ethics subsection of this thesis.
13 Ethics approval was granted to speak with researchers in all four regions, though researchers from the United States and New Zealand were not contacted to participate in the interview process as the number of literature results from these regions were notably smaller than those from Canada and Australia (see Section 2.4.1.1 Inclusion Criteria).
2.4.2.1.1 Ethics in Practice

As Guillemin and Gillam (2004) note, qualitative research ethics can be divided into two dimensions: first are the procedural ethics as described above, and second are what the authors refer to as ‘ethics in practice’. The latter dimension refers to those ethical issues that may arise during the completion of qualitative research, whereas the former involves the ethical bodies that must approve the project at the outset. Fortunately, I did not experience any major ethical dilemmas throughout the completion of this project; however, there was an issue that needed to be reconciled and is important to document here. As per my GREB application, participants were asked whether or not they wanted to have their real name attached to the quotations that were used in this thesis. While some participants consented to the use of their name, others did not want to, or did not feel that doing so would be beneficial to the research project and, therefore, did not allow their name to be used. This presented an issue as the pool of Indigenous knowledge implementation and water researchers in both Canada and Australia are quite small. By attributing some names to quotations and not others, someone that is familiar with this research field might have been able to accurately attribute data to a researcher who did not want to be named. To remedy this ‘ethics in practice’ issue, all names were removed from quotations despite receiving consent from a selection of participants. Those researchers that had asked that their names be attributed to their quotations were contacted and alerted to the fact that their names would no longer be used in the dissemination of my research results.

2.4.2.2 Informed Consent

Prospective participants were provided with a detailed information sheet (Appendix H) informing them of the goal and objectives of this research project, and were required to give their informed written or oral consent (Appendix I) prior to their participation in the interview component of this research project. Participants were given the opportunity to withdraw from this project any time prior to the completion of the data analysis stage.
Interview Protocol

Interviews with Canadian and Australian researchers were conducted over a period of 12 months (February 2015-16, see Table 2.1) and each interview followed the researcher interview guide for the appropriate country (Appendix J, K). Interviews were conducted via telephone or Skype, and each took approximately 60 minutes to complete. Interviews were recorded using a digital audio recorder, and these data were supplemented with handwritten researcher notes.

The interview guides were composed of four sections, and included open-ended questions which led to discussions around four themes:

1. The participants’ general experiences in conducting research in this field;
2. A particular research project in this field (the decision for which specific project was left up to the participant, although it was usually the project associated with the article found in the CSRR);
3. The participants’ description of key terms such as Indigenous or Traditional knowledge and research methodologies; and
4. The prospects for future success of integrative knowledge projects in better researching and managing water resources.

The interview guide used for researchers working in Australia (Appendix K) included a fifth category of questions regarding actual and/or potential changes to research and management as a result of the 2004 implementation of a National Water Initiative. The importance of this initiative was discussed in a number of projects that appeared in the Australian CSRR (e.g., Jackson, 2006; Barber & Jackson, 2012; Hoverman & Ayre, 2012; Ayre & Mackenzie, 2013; Liedloff et al., 2013); therefore, I wanted to present an opportunity for Australian researchers to expand on this topic in interviews. The details of researcher recruitment and participation for each region are discussed in detail below.
2.4.2.3.1 Researcher Interviews - Canada

Recruitment emails were sent out to researchers that had identified themselves as having completed, or having attempted to complete integrative water research involving First Nations, Inuit, and Metis in Canada. Of the 42 unique first authors of the included literature, the two CWN research assistants and myself contacted approximately one-third to participate in interviews based on the how well the authors’ work fit within my research questions, as well as the substantial amount of information that was ascertained from their article during the CSRR process through the use of the 33-question Reporting Tool. Fifteen recruitment emails were sent to researchers and 13 potential participants were found through the CSRR, one was contacted through the process of snowball sampling (Bradshaw & Stratford, 2005) at the recommendation of another interview participant, and one requested to participate after listening to a conference presentation of the preliminary research. Of the 15 researchers contacted, 12 provided their consent and participated in interviews, one declined to participate, and two did not respond to the recruitment email. Eleven interviews were conducted by telephone, and one was conducted via Skype™. As Baker and Edwards (2012) note, interviews are to be conducted as long as participants continue to provide different answers, and upon completion of the 12th interview, the research team determined we had reached data saturation.

Researchers that consented to participate in this research study had a wide range of experience in researching Indigenous populations across Canada. Eleven of the 12 consenting research participants described working with First Nations communities; three indicated they had also worked with Inuit populations; one discussed also having worked with the Metis Nation. Seven researchers had described their work in the Canadian territories; four worked in Ontario; two had worked in British Columbia; two worked in Labrador; one worked in Saskatchewan. I conducted 6 of the 12 interviews with Canadian researchers, while the remaining interviews were conducted by the two CWN research assistants.
2.4.2.3.2 Researcher Interviews – Australia

Using the same recruitment technique as the one used in Canada, Australian researchers were identified through the CSRR, which highlighted their experiences in completing integrative water research in Australia. Recruitment emails were then sent out to 9 of 16 first authors. From the nine researchers contacted, six responded to recruitment emails, and interviews were conducted with five researchers. One researcher responded positively to the initial email, however subsequent emails did not receive a response; therefore, no interview was conducted. While the original project design intended for interviews to be conducted by telephone, in an effort to reduce expenses for the project, all interviews were conducted via Skype™ using the audio call function. Data saturation (as per Baker & Edwards, 2012) was achieved upon completion of these five interviews, therefore additional research participants were not recruited.

Of the five interview participants, four were asked to participate in an interview based on their previous work in Western Australia. Three researchers had also completed research in the Northern Territory of Australia. In addition to these regions, three of the researchers discussed previous research efforts along the Murray-Darling Basin, which extends across the states of South Australia, Victoria, and New South Wales. Two researchers discussed their work in Queensland. Four researchers worked with Aboriginal groups, while only one research project focused on Torres Strait Islanders.

2.4.2.4 Confidentiality

As noted above, all of the interview participants were given the option to have their name included in the context of my research, via the consent form. However, not all of the participants consented to this option, therefore all names were removed from transcripts and quotations in an effort to maintain confidentiality and consistency throughout the research. Recorded data was irreversibly removed from the audio recorder and transferred to my password-protected computer. Copies of both the audio and the transcription files were also stored on a password-protected external hard drive. All names on both copies of the audio and
transcription files have been replaced with pseudonyms, and these codes are stored in a separate, password-protected file. Participants have been informed that only I have immediate access to these files, and that my supervisor, Dr. Castleden has permission to access this information throughout the research project. In accordance with the terms of the Queen’s University General Research Ethics Board, information will be stored for a period of five (5) years, after which it will be destroyed.

2.4.2.5 Transcription and Validation

All interviews were audio recorded with the consent of the participants, and were transcribed verbatim. Nine of 12 interviews with Canadian researchers were transcribed by a professional transcriptionist (with participant names removed prior to transcribing), while I personally transcribed the remaining interviews. Upon completion of the transcription, all identifiers were removed and the transcript was emailed back to the participant. Each participant was given two weeks to make any required alterations to the transcript (all participants provided minor clarification without removing significant amounts of data), after which the transcript could then be coded and thematically analyzed.

2.4.2.6 Limitations of the Interview Process

Interviews, while a strong research method that can be used to generate important qualitative data, are limited by both the interviewer and the interview participant (Moser & Kalton, 1986; Carr & Worth, 2001). As an interviewer, the data that are generated are affected by my skills as an interviewer and my ability to encourage the interview participants to expand on pertinent information. Other factors that are largely beyond my control such as my status as a student researcher, my gender, my cultural identity, etc., may also play a role in recruitment, data collection, and analysis. Additionally, the number of interviewees who are recruited are limited to only those that I, as the primary recruiter, have chosen to contact based on the results of the CSRR. This has led to higher participation numbers among researchers in Canada in comparison to Australia (though proportionally, the number of participants contacted in relation to the number of first authors included in the review, were comparable) although this did not
severely impact the quality of my study (as generalizability and representative sampling were not goals that I strived to achieve). Despite reaching what I believed to be data saturation, with greater financial and temporal resources, more semi-structured interviews could have been conducted, potentially leading to new insights. The interview portion of my study is limited to only the data that participants offered during our semi-structured interview. While participants were given an opportunity to add any information that they felt appropriate to this research study, an obvious limitation exists whereby different interview questions may have generated different interview data. Unlike the CWN project, my thesis was limited in that I did not have an Australian National Advisory Committee to guide my interview research in Australia in the same way that a Canadian National Advisory Committee guided the Canadian portion of my study. This also partially influenced my decision not to contact Indigenous Australian community partners for participation in this study.

2.5 Data Analysis

Within qualitative research, the interpretation or data analysis stage is the necessary process in which large quantities of data are narrowed into a purposeful representation of the issue being studied (Creswell, 2007). The structure of analysis within qualitative research is quite flexible, and there exists many variations in data analysis across qualitative research projects (Hay, 2016; Creswell, 2007). Therefore, I have attempted to be comprehensive in the description of my analysis processes to increase transparency, which in turn affects the credibility, transferability, dependability, and confirmability of my study (Baxter & Eyles, 1997). The following represents a detailed account of the qualitative data analysis processes that I followed in the completion of my research project. Analysis of both the CSRR and interview data were conducted without the use of formal data analysis software, and instead were coded by hand, and through programs within the Microsoft Office Suite®.
2.5.1 CSRR Coding

The nature of the CSRR was such that it required coding to be done using two distinct methods. The majority of data from the CSRR Reporting Tool were coded and represented using quantitative techniques, and the remaining data were coded for categories and then overarching themes. Of the 33 data points for each article within the CSRR Reporting Tool, 23 generated descriptive data such as date of publication and type of water studied, and were coded numerically and represented in graph format (see Chapter 3). The other 10 responses from the Reporting Tool were open-ended and qualitative in nature, and included questions such as “How was Indigenous knowledge implemented?” or “How were integrative processes defined?”, therefore they were coded and thematically analyzed.

2.5.2 Interview Coding

The interviews for Canada and Australia were thematically analyzed using the same content-analysis technique (Cope, 2016); however, interview data in Canada were coded with the assistance of two additional research assistants and a project manager, (then reviewed again upon completion of Australian interviews) whereas interview data from Australia were coded without assistance but using the same and emergent codes. There were three stages to the interview coding process, as detailed below.

2.5.2.1 Open Coding

Transcripts were read in full to identify concepts that were apparent across all, or most of the transcripts, from Canadian researchers (Miles & Huberman, 1994). This process was replicated for the transcripts from interviews with Australian researchers. In the case of Canada, each research assistant and the project manager met to discuss findings through a process described as inter-coder reliability (Weston et al., 2001) whereby each research assistant coded the same three transcripts and compared their codes with the

14 Content analysis is described as “a system of identifying terms, phrases, or actions that appear in a text document, audio recording, or video” and that the coded findings are typically subjected to “statistical analysis to determine frequencies, correlations, variations, and so on” (Cope, 2016, p. 378)
other research assistants to ensure coding reliability. Because the Australian data were collected later, the process of inter-coder reliability was not required. To ensure that my codes were reflective of participants’ experiences and interpretations, coded data were returned to the participant for verification (see Section 2.5.3 – Validation of Codes). The themes that were identified were then noted in a codebook.

2.5.2.2 Using a Codebook

With the list of identified codes, the transcripts were reviewed a second time. Data from the transcripts were highlighted by hand and categorized according to the appropriate code within the codebook. Data were coded for meaning, and codes were not mutually exclusive, therefore multi-coding was not restricted (DeCuir-Gunby et al., 2011). In the case of Canada, inter-coder reliability was again sought through the reviewing of coded transcripts to ensure codes were consistent across researchers.

2.5.2.3 Thematic Separation

After all transcripts had been coded, and, in the case of Canada, inter-coder reliability had been established, participant quotations that supported a coded theme were placed in a separate document with all quotations within that coded theme. If a quotation was multi-coded, it appeared in each document for each respective code. Overarching themes, as well as sub-themes were then identified using these separate documents for each code.

2.5.3 Validation of Codes

Where direct quotations from a researcher have been used in this project, the participant has been given an opportunity to review their quotation in the context of the research findings, and to decide whether or not they agree that their statement is being used in an appropriate manner (Baxter & Eyles, 1997; Dunn, 2016). Participants were given a copy of the results of this thematic analysis wherever their direct quotations were used, and were given a two-week period to comment on the use of their data. If no objections were made, or if participants provided clearance, the direct quotations were then used in the
context of the research findings. Though each researcher had the opportunity to make changes to their quotations, no significant alterations or omissions were requested.

2.6 Chapter Summary

This chapter has provided a description of the methods used throughout this research, including the research design, data collection, and data analysis stages. The findings of my research project are presented in Chapters 3 and 4 in manuscript format. Chapter 3 will discuss the findings of the CSRR component, and Chapter 4 will describe the results of the semi-structured interviews.
2.7 References


Chapter 3

A Combined Systematic Realist Review of Literature from Canada, Australia, New Zealand and the United States

3.1 Introduction

We have now entered into a period of global water crisis (Barlow, 2009; 2014). Pollution of source waters (McDonald et al., 2016), over-allocation and diversion for agriculture (Duncan, 2014), and the resulting effects of climate change (Hansen et al., 2016; Gersonius et al., 2013; Cook et al., 2015) are just some of the stressors that have brought about and exacerbate the current water crisis. Nowhere is this crisis more apparent than in Indigenous communities around the world (White et al., 2012; WHO, 2003). This is not an issue of inferior or unavailable technology or infrastructure (White et al., 2012); it can be attributed to the commodification of water and the subsequent creation of water ‘haves’ and ‘have nots’ (Barlow, 2010).

This commodification of resources has both enabled, and has been supported by colonization efforts and environmental dispossession (Berkes, 2010; Richmond & Ross, 2009). While pre-colonized Indigenous societies had some degree of impact in terms of their relationship with water, these Indigenous societies survived and thrived for millennia on their traditional territories without posing the same threat to our fresh water supply that is apparent in so many communities today (Warren, 1996; Petty et al., 2015). Their knowledge systems, developed in place over millennia evidently dictated how to live and relate to the resources around them without depleting said resources to unsustainable levels. Settler colonial policies of environmental dispossession and relocation (Richmond & Ross, 2009) have contributed to the disparity that exists between Indigenous and non-Indigenous communities in access to water (White et al., 2012), as well as the continued devaluation of Indigenous Ways of Knowing in resource management despite a history of sustainable resource use.
Since the scientific revolution, which closely followed on the heels of the enlightenment period, Indigenous knowledge has been devalued (Cruikshank, 2012). In colonized countries like Canada, Australia, New Zealand and the United States, Western knowledge has been privileged since the time of British expansion, beginning as far back as 500 years ago. Indigenous knowledge systems have only recently been invited into institutional environments (e.g. government and academia). Yet still, there is an air of dismissiveness from researchers, policy-makers, and the general public: Western knowledge is still needed to validate the knowledge that Indigenous people hold (Cruikshank, 2014; Truth and Reconciliation Commission, 2015). This is evidenced by recent research published in the ‘world’s best science journal’, *Nature*, from Malaspinas and colleagues (2016) that used genomic history to ‘reveal’ that Aboriginal Australians’ were present on the continent over 50,000 years ago, making them the oldest civilization on record. This research is being touted as ground-breaking despite Aboriginal Australians themselves knowing and stating that this ‘new’ knowledge only confirms what they already know: that they have ancient connections to the lands and have lived there far longer than anyone else (Devlin, 2016). There is much that Indigenous knowledge can tell us that Western science has not yet been able to ‘confirm’, but this need for confirmation continues to relegate Indigenous knowledge to a secondary role. Instead, the implementation of Indigenous and Western Ways of Knowing presents a promising path forward for humanity to better take care of our water.

In this paper we examine integrative water research and management literature from four countries with similar, though not identical histories of British colonialism and are each comprised of the traditional territories of many diverse Indigenous groups: Canada, Australia, New Zealand and the United States. Trends in the literature are illustrating a shift towards academic understanding that the implementation of Indigenous knowledge together with Western science can be an effective approach for better research and management of water resources (Castleden et al., 2015; Jackson & Morrison, 2007, Berkes et al., 2007; Ayre & Mackenize, 2013). The persistence of water-related challenges in Indigenous communities, including, for example, drinking water advisories, poor wastewater and sanitation infrastructure, climate
change and ice melt, and unequal access to source waters (Health Canada, 2016; UNESCO, 2006; WHO, 2003; UNDRIP, 2009) indicates that despite the strengths and innovation that have been brought about through advancements in Western science, the exclusive use of Western systems of knowledge and research methods have not been able to address water crises facing global Indigenous populations. Investment in infrastructure and drinking water quality, while important, ignores many of the wholistic components of water such as the systemic, cultural, spiritual, and economic stressors facing many Indigenous communities (Rigby et al., 2011; Salmond, 2014).

Peer-reviewed, academic literature that refers to the implementation of both Indigenous and Western knowledge and/or methods in efforts to better research and manage water resources was obtained and synthesized through the use of a combined systematic and realist review method. Our research was guided by the concept of ‘Two-Eyed Seeing’ – a continuous and joint learning process of Indigenous and Western knowledge-holders seeking to implement the two knowledge systems (see Bartlett et al., 2012; 2015 for rich discussion of Two-Eyed Seeing) – and followed the protocols and recommendations of a Canadian-based National Advisory Committee (NAC) that was comprised of Indigenous and non-Indigenous water experts for a Canadian-specific arm of this study (see Castleden et al., 2016). We begin with an overview of the research project design, and include a description of the data collection and analysis processes. From there we report the results of the review and provide a discussion of these findings. We conclude with recommendations for water researchers and managers seeking to undertake a journey of Two-Eyed Seeing.

3.2 Methodology

Using both a systematic and realist review, which we have coined ‘combined systematic realist review’ or CSRR, combines the replicability, rigour, and breadth of a systematic review (Shamseer et al., 2015),

15 A Two-Eyed Seeing Journey, and co-learning journey, are referred to here to describe the process of viewing our knowledge systems as objects, and then learning from each other through examinations of similarities and differences (Bartlett et al., 2012)
with the depth of a realist review that allows for an interpretation of why, for whom, and under what conditions a process or processes were successful or unsuccessful (Pawson et al., 2005). Through the use of these two review strategies, inferences about water research and management techniques can be drawn from an examination of four countries. In addition to the substantive findings for integrative water research, this paper contributes to an emergent body of methodological literature that is beginning to employ the combined systematic and realist review approach (see, for example, Mazzocato et al., 2010; O’Campo et al., 2011; Best et al., 2012; Macaulay et al., 2011; Higgins et al., 2012; DeBono et al., 2012; Castleden et al., 2015; McConnell et al., 2013; MacDonald et al., 2013).

3.2.1 Data Collection

Literature for the CSRR was collected through a search of three electronic databases (Web of Science, GEOBASE, and Scopus) using a series of keywords defined by the research team with the assistance of an academic reference librarian (see Tables 2.3 through 2.6, Chapter 2). Our search was refined to include only those articles that were peer-reviewed, completed in one of the four study regions, and published within the time frame of January 1980 through December 2015. Drawing on the methodology by Furgal and colleagues (2010), titles and abstracts of search results were reviewed for relevance to the project, and database results were scanned in groups of 10 until a group of 10 did not contain any relevant results, at which point our research team moved to the next keyword string. Upon completion of the title and abstract search, articles were selected for inclusion in the realist component of the review based on a ratings scale of 0-3, with 0 meaning do not include, and a score of 3 meaning definitely include. Scores of 1 and 2 meant the relevance of the article could not be determined by an abstract scan, and required a full text review. A score of 1 meant that it was unlikely for the article to be included, while a score of 2 meant the article was likely to be included. Articles that met at least three of the four inclusion criteria were included in our dataset (See Table 3.1 – Inclusion Criteria). The first level of systematic analysis, as per the Reporting Tool, was used to identify descriptive data such as dates of publication, geographic region of study, and author background, among others. Geographic region was determined by the country of
study stated in the article, and the researcher background was determined by the stated faculty affiliation of the first author.

**Table 3.1 - Inclusion Criteria**

<table>
<thead>
<tr>
<th>1.</th>
<th>Is the article reporting on empirical data about water?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Does the article describe integrative Indigenous and Western knowledge processes of research/management?</td>
</tr>
<tr>
<td>3.</td>
<td>Is water the focus of the article, or is a wholistic perspective taken within which water is included?</td>
</tr>
<tr>
<td>4.</td>
<td>Is it describing a [country of study] context?</td>
</tr>
</tbody>
</table>

3.2.1.1 Process of Literature Exclusion

The initial title search resulted in 669 combined records from the four countries of study. The final dataset was 97 combined records from these four countries, and the process of exclusion is described in the steps below.

1. Of the 669 records gathered from the initial title scan, 226 articles were from Canada, 181 from Australia, 114 from New Zealand, and 148 from the United States.

2. After applying the inclusion criteria (Table 3.1) to the abstracts of these returns, we reduced our dataset to 202: 76 Canada records, 61 Australia records, 27 New Zealand records, and 38 United States records.

3. These 202 records were read to determine relevance to this research project, and 31, 35, 13, and 26 ineligible records were removed from Canada, Australia, New Zealand, and the United States, respectively (see Table 3.2 – Full Text Exclusion).

4. The final dataset was 97 records with 45, 26, 14, and 12 records from Canada, Australia, New Zealand, and the United States, respectively.

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16 Of the Canadian records, I read only those records that were discussing a First Nations context, which comprised approximately half of the 76 records. As well, records were not all read in their entirety if it could be determined early on in the review that the project was not eligible for inclusion.
Table 3.2 - Full Text Exclusion

<table>
<thead>
<tr>
<th>Reason for Exclusion</th>
<th>Number of Excluded Records</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAN</td>
</tr>
<tr>
<td>Not peer-reviewed</td>
<td>1</td>
</tr>
<tr>
<td>Not focused on Indigenous people</td>
<td>6</td>
</tr>
<tr>
<td>Not focused on geographic area of study</td>
<td>0</td>
</tr>
<tr>
<td>Not focused on water research or management</td>
<td>14</td>
</tr>
<tr>
<td>Only one knowledge system used</td>
<td>10</td>
</tr>
</tbody>
</table>

3.2.2 Data Analysis

To begin our analysis of the data, a Reporting Tool was used to ‘ask questions’ of the included literature. This Reporting Tool consisted of 33 questions derived from the work of Castleden and colleagues (2016), as well as systematic review elements from Shamseer and colleagues (2015), and realist review elements from Pawson and colleagues (2005). Data were descriptively (systematic review) and qualitatively (realist review) analyzed through the use of this Reporting Tool. These queries were used to provide insight regarding the methods and models used by researchers, as well as the reasons why, for whom, and under what circumstances these methods and models were (un)successful. The questions within this Reporting Tool were categorized according to two broad question topics:

1. What are the implications, findings, and conclusions drawn by the authors about their research in terms of the implementation of Indigenous and Western sciences and research methodologies?
2. How, and under what circumstances are Indigenous perspectives and methodologies that are related to water research and management successfully implemented in the integrative process, and why did this implementation promote (or not), more effective water policy, governance, research, and/or resource management?

For each article, a response was generated for each of the 33 questions within the Reporting Tool as accurately and completely as possible according to the published information. Responses were then coded
and represented graphically where appropriate, or thematically analyzed where the elicited responses were more detailed.

3.3 Research Findings

The findings of the CSRR as generated by the Reporting Tool have been separated into four thematic categories that provide insights into one or more of the above research questions: (1) general descriptive data; (2) research purposes and objectives; (3) the strengths of combining systematic and realist findings to further our understanding; and (4) barriers to implementation. The findings indicate similarities across all four countries, perhaps not surprising given their colonial histories. To increase transparency, the articles that have been included in the CSRR are included as appendices (Appendix E to H).

3.3.1 Descriptive Data

3.3.1.1 Date of Publication

While the parameters for this study offered a publication range from 1980-2015, the majority of articles were published after 2005. In fact, the United States was the only country with included records that were published before 2000 (Shupe, 1985; Sukhwal, 1991). The largest influx of publications occurred between the years of 2009 and 2014 (See Figure 3.1).
3.3.1.2 First Author Identification

In New Zealand, 50% of the first authors identified themselves as being an Indigenous scholar, while in Canada only 11%, did, with still fewer in the United States (8%) and Australia (4%) (Figure 3.2). In each region, the majority of first authors were academically-trained researchers (Canada 84%, Australia 69%, New Zealand 80%, USA 69%), (Figure 3.3), although there were differences between nations in terms of the most common discipline of first authors. In Canada and Australia, the majority of authors were within the social science realm (57% and 62% respectively), whereas in New Zealand and the United States, first authors with a legal background had the largest representation (21% and 25%, respectively) (Figure 3.4). While the smaller sample size of the latter two regions could be cause for these differences, it should be noted that both Canada and Australia had scores of 0% in the category for authors with a legal background.
Figure 3.2 - First Author Identification as Indigenous
Figure 3.3 - Organizational Affiliation of First Authors
3.3.2 Research Purposes and Objectives

Through the use of the Reporting Tool, each article’s stated research purpose and objectives were coded and categorized into three broad themes: (1) The role of institutions and governance in knowledge implementation; (2) the use, evaluation and/or comparison of two distinct perspectives; and (3) the disparity that exists in access to safe water that current methods and practices are unable to address. Each of these themes are elaborated below.

3.3.2.1 The Role of Institutions and Governance in Indigenous and Western Knowledge Implementation

The role of institutions and the need for changes in policy and governance in order to effectively implement Western and Indigenous knowledge systems in water research and management was the theme that was most commonly referred to by authors within their stated research purpose. Discussions within this theme included examinations of the barriers and strengths within institutional arrangements that
allow, or do not allow, effective implementation to occur (e.g., King, 2004; Harper et al., 2011; Rizvi et al., 2013; Ayre & Mackenzie, 2012; Jackson & Altman, 2009; Cronin & Ostergren, 2007; Memon & Kirk, 2011; Ruru, 2013), as well as statements regarding the need to establish effective co-management regimes within these institutions to overcome these challenges (e.g., Armitage et al., 2011; Bark et al., 2012; Hand, 2007; Aho, 2009; Huntington et al., 2011; Maclean, 2015; Poirier & Schartmueller, 2009).

3.3.2.2 The Use, Evaluation, and/or Comparison of Two Distinct Perspectives

Not surprisingly, another common purpose that was often stated was to implement both an Indigenous and a Western perspective in some capacity within the authors’ research projects. When discussing why they sought to implement Indigenous and Western Ways of Knowing, authors discussed a realization that occurred in the scientific community that Indigenous peoples possess a wealth of knowledge related to, for example, concepts such as sea ice management and melting patterns (e.g., Gearheard et al., 2006), sustainable aquatic resource consumption (e.g., Jones et al., 2010), and water governance plans that can support equal access for all communities (e.g., von der Porten & de Loe, 2013). Additionally, researchers explained that Indigenous and Settler communities can have different conservation goals and values related to water, and implementation of both Indigenous and Western Ways of Knowing can be a way to examine and incorporate these differing systems of values (e.g., Bark et al., 2014; Jackson & Barber, 2013; Maclean, 2015; Jackson, 2008; Steenstra, 2010; Salmond, 2014; Morgan, 2006).

3.3.2.3 Current Methods and Practices are Inadequate in Addressing Water Disparities

Finally, with the ongoing disparities that exist in access to safe water in Indigenous communities in comparison to non-Indigenous communities, researchers across the four regions of study have designed research studies that attempt to test new methods, or evaluate current methods to measure their effectiveness in creating value for Indigenous communities. Such new approaches included, among others, participatory photography (e.g., Fresque-Baxter, 2013; Maclean & Woodward, 2013), seasonal calendar creation (e.g., Woodward et al., 2012), as well as various cultural and value incorporation
approaches such as Haida cultural marine planning (e.g., Jones et al., 2010), cultural ecosystem services in water management (e.g., Bark et al., 2014), or the Kaupapa Maori Methodology in New Zealand¹⁷, which has been designed by Maori people to insure that Maori Indigenous knowledge is incorporated in natural resource management (e.g., Hikuroa et al., 2011; Steenstra, 2010; Williams, 2006). In addition to implementing new research and management approaches, researchers have also modified Western-based research approaches to be more consistent with Indigenous cultures and values through the creation of partnerships and designing research projects collaboratively. These modified methods include evaluations of multi-barrier approaches to drinking water safety (e.g., Finn, 2010), quantitative surveys (e.g., Baird et al., 2013), surface water flow assessments (e.g., Finn & Jackson, 2011), and collaborative governance structures (e.g., Bark et al., 2012), among others.

3.3.3 Combined Systematic and Realist Contributions

Our research uses a combined systematic realist review to identify what has worked, as well as to understand why, and under what circumstances researchers and managers have been able to implement Indigenous and Western knowledge systems as they relate to water. To illustrate the strengths of combining systematic and realist review techniques, the following section outlines the findings from the systematic portion of the review, followed by the realist findings that serve as an extension of these systematic findings.

3.3.3.1 Community Partnership

**Systematic Component:** Across four countries, what percentage of research projects include Indigenous peoples as ‘partners’ or ‘co-researchers’?

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¹⁷ The Kaupapa Maori methodology consists of eight key principles, as originally described by Graham Hingangaroa Smith (1990). These principles for research are: (1) Self-Determination; (2) Cultural Aspiration; (3) Culturally Preferred Pedagogy; (4) Socio-Economic Mediation; (5) Extended Family Structure; (6) Collective Philosophy; (7) Treaty of Waitangi; and (8) Growing Respectful Relationships (Rangahau, 2016)
In Canada, Australia, New Zealand and the United States, the majority of research projects identified some form of Indigenous community involvement (82%, 77%, 50%, and 50%, respectively) while government institutions, as well as NGOs, academic institutions, and non-community based research projects (categorized as ‘other’) also appeared in the data. (See Figure 3.5). Additionally, in Canada, Australia, and the United States, the majority of authors described having Indigenous community members work with them on the project as research partners (60%, 60%, and 50%, respectively). New Zealand had only 7% of records indicate Indigenous community partnership (see Figure 3.6). However, this might be attributable to the fact that research was led by Indigenous authors more often than in any of the other regions, suggesting there was more Indigenous water research being done by Indigenous peoples not with them, for them, or on them (as described in Koster et al., 2012; Smith, 1999).

![Figure 3.5 - Organizational Involvement in Research](image)

Figure 3.5 - Organizational Involvement in Research
Realist Component: Where, and under which circumstances have researchers and community members effectively collaborated as research partners to better understand and take care of water?

Researchers from Canada, who were for the most part non-Indigenous, and New Zealand stressed that collaboration between Indigenous peoples and academic researchers must begin from a position of respect and appreciation for both Indigenous and Western knowledge systems (e.g., Cave, 2012; Grimwood & Doubleday, 2013; Giles et al., 2013; Hikuroa et al., 2011; Ruru, 2013). From this position, Indigenous and Western knowledge implementation research can be co-designed prior to any data collection, as recommended in the written records from each of the four countries of study (e.g., Wolfe et al., 2007; Laidler et al., 2007; Giles et al., 2010; Goldhar et al., 2013; 2014; Longboat, 2014; Bark et al., 2014; Jackson, 2006; Liedloff et al., 2014; Burger et al., 2014, Ruru, 2013; Ross & Pickering, 2002).

Community-based participatory research (CBPR) was recommended in Canadian and Australian records.
as a way to effectively conduct water research that supports the implementation of both Indigenous and Western knowledge (e.g., Grimwood & Doubleday, 2013; Giles et al., 2013). Circumstances in which the central tenets of CBPR are used in research, including balancing power, fostering trust, and community ownership over the research process (Castleden et al., 2008), have been discussed by the authors of reviewed records as being effective in facilitating effective and meaningful researcher–community collaboration.

3.3.3.2 Indigenous and Western Knowledge Implementation

**Systematic Component**: Across the four countries of study, how often were the processes of Indigenous knowledge implementation defined in the literature?

Results illustrate that in Canada (33%), Australia (24%), New Zealand (29%), and the United States (42%), the actual integration of Indigenous and Western knowledge systems was not often stated explicitly (See Figure 3.7). For example, researchers identified or acknowledged the existence and necessity of these integrative research processes in the majority of the included articles in Canada (64%), Australia (52%), and the United States (58%), with New Zealand (29%) being the exception (see Figure 3.8). However, results indicate that many components of the integrative research process, including the details of initial engagement, the reasons for partnering, and the collaborative process were not defined or described frequently in Canada (22%), Australia (20%), New Zealand (21%), or the United States (8%) (See Figure 3.9)
Figure 3.7 - Author Description of the Integrative Process
Figure 3.8 - Author Identification of the Integrative Process
Figure 3.9 - Author Definition of the Integrative Process

**Realist Component:** What are the reasons or recommendations offered by researchers that have facilitated, or can facilitate the completion of Indigenous and Western knowledge implementation research, as it relates to water?

Despite a lack of clarity about identifying and defining integrative processes, according to the literature reviewed, the development of research teams consisting of both Indigenous and Western scientists was identified by authors as proving to be effective in generating opportunities for both Indigenous and Western expertise to be included in the research process across all four jurisdictions (e.g., Bark et al., 2012; Jackson, 2005; Woodward et al., 2012; Strang, 2014; Steenstra, 2010; Morgan, 2006; Aho, 2009; Cummins et al., 2012; Davidson-Hunt & O’Flaherty, 2007; Ferreyra & Beard, 2007; Finn, 2010; Harper et al., 2011; Giles et al., 2010). Knowledge sharing opportunities were also identified in the included literature and occurred through cultural exchanges between researchers and community partners (e.g., Gearheard et al., 2006; Woo et al., 2007; Jackson, 2006), and was facilitated by an acknowledgement
from both sides that neither had expert-level familiarity with the other’s knowledge system and therefore would benefit from such exchanges (e.g., Hikuroa et al., 2011; Hoverman & Ayre, 2012). Additional recommendations from the authors for Canada and Australia included the use of local interpreters and recruiters (e.g., Martin et al., 2007, Hoverman & Ayre, 2012), the presence of formal policies that require the implementation of Indigenous knowledge in water policy, such as the Water Stewardship Strategy in the Northwest Territories (NWT, 2010), or the National Water Initiative in Australia (Finn & Jackson, 2011), and a recognition of the importance of clarity of language and terminology in exchanges between Indigenous and Western knowledge holders (e.g., Laidler et al., 2008; Ruru, 2013). The importance of in situ knowledge and seeking input from those that have experience living in, as well as a vested interest in the location being studied, was a sentiment expressed in the papers reviewed in Australia (e.g., Ayre & Mackenzie, 2012; Hawke, 2012). In New Zealand, the creation of Maori-led tribunals such as the Waitangi Tribunal (Salmond, 2014) was identified as effective in ensuring that Indigenous knowledge was implemented by ensuring that Treaty obligations were met, including, among other things, obligations relating to water and aquatic resources. Of importance to this thesis is the second clause in the Treaty of Waitangi which states in part, “Her Majesty the Queen of England confirms and guarantees to the Chiefs and Tribes of New Zealand and to the respective families and individuals thereof the full exclusive and undisturbed possession of their Lands and Estates, Forests, Fisheries and other properties which they may collectively or individually possess so long as it is their wish and desire to retain the same in their possession” (Waitangi Tribunal, 2016).

3.3.4 Barriers to Implementation

Researchers acknowledged that there are barriers that can hamper implementation efforts. In Canada, Australia, and the United States, language and translation barriers were discussed (e.g., Laidler et al., 2008; Berkes et al., 2007; Nichols et al., 2004; Perron, 2011). In New Zealand, barriers related to recruitment and participation of Indigenous people in research activities were discussed and influenced by differences in estimated time and resource commitments. For example, as Morgan (2006) states,
“approaches that use timeframes less than or equal to the 50 year scope of many of the New Zealand sub-regional strategies are not considered appropriate. The timeframes applicable should be at least ‘the mokopuna of the mokopuna’ [grandchild of the grandchild]” (Morgan, 2006, p. 135). Additional barriers include ensuring that the implementation of the contributed knowledge in water management and policy decisions actually occurs (e.g., Geertsema, 2009; White et al., 2012).

von der Porten & de Loe (2013) discuss the difficulties that inevitably arise from treating Indigenous community participants as one of many stakeholders, rather than equals in the research and management process. As holders of sui generis rights, or rights that are the result of Indigenous Nationhood and not granted by the State, the authors argue that “…it is inaccurate to define Indigenous peoples as one of many minorities, interest groups, or stakeholders. Indigenous people should instead be referred to as Nations” (von der Porten & de Loe, 2013, p. 151). This sentiment is echoed by other authors in our dataset including, for example, Berkes et al. (2007), who detail the difficulties in trying to cut and paste knowledge from various stakeholders and implement them within a dominant (Western) knowledge system. The wholistic and place-specific nature of Indigenous knowledge prevents such an approach from being effective, and therefore a collaborative generation of context-specific knowledge is recommended.

Barriers related to scope and scale were particularly apparent in Australia and the United States, as authors discussed the limitations in the translatability of their results, as well as the idea that water governance structures often do not account for other factors that are not water-related such as trees along the river bank that can support aquatic life (e.g., Liedloff et al., 2013), or cultural significance, which is often just as important to communities as the practical uses for water (e.g., Jackson & Barber, 2013; Maclean, 2015; Wohling, 2009; Cronin & Oстergren, 2007). In New Zealand, authors identified barriers related to time. They referred to tools in place to implement more effective structures of collaborative governance, but that the actual implementation of such policies require a great deal of time and work to
complete, which may serve as a barrier preventing such tools from being used (e.g., Hikuroa et al., 2011; Morgan, 2006; Steenstra, 2010).

3.4 Interpretation of Findings

Publications regarding integrative Indigenous and Western knowledge implementation in water research were available in each of the four regions of study, though the included records were largely concentrated in Canada and Australia. Since 2000, the amount of research that has been conducted involving integrative Indigenous Ways of Knowing and Western Ways of Knowing in water research and management appears to have steadily increased, with the largest concentration of publications occurring during the five-year period between 2009 and 2014. This may represent emerging recognition of the value that implementing both Indigenous and Western knowledge can provide in the realm of water research and management. While the implementation of Indigenous ontologies, methodologies and epistemologies alongside traditionally Western-dominated frameworks for research as they relate to water is a developing field, the continual development of policy initiatives (such as the NWI in Australia) and the subsequent increase in funding presents an opportunity for researchers to attempt and build upon their research practices to further the legitimacy of both Indigenous and Western knowledge systems.

The results of the CSRR illustrate a trend that continues within the realm of academia whereby the majority of first authors\(^\text{18}\) (Canada 89%, Australia 96%, United States 92%, though New Zealand is an outlier at 50%) do not identify as being an Indigenous person within the context of their research projects (see Figure 3.2). While these figures do not account for those Indigenous researchers that choose not to self-identify within the context of their research, the abundance of non-Indigenous researchers reflects the idea that the dominant voice within this domain is not an Indigenous one. This idea is not lost on the non-Indigenous researchers within this field, as many of these researchers have made recommendations for the

\(^{18}\) The research team recognizes that order of authorship is not consistent across countries of study or academic disciplines, and we acknowledge that contacting only the first author represents a limitation of this research study.
development of interdisciplinary research teams and management councils that have both Indigenous and non-Indigenous representation (e.g., Davidson-Hunt & O’Flaherty, 2007; Ferreyra & Beard, 2007; Finn, 2010; Harper et al., 2011; Steenstra, 2010; Strang, 2014; Morgan, 2006; Aho, 2009; Cummins et al., 2010; Bark et al., 2012; Jackson, 2005; Woodward et al., 2012). The recognition of the importance of partnerships between Indigenous and non-Indigenous people is an important in ensuring a sustainable water future.

In addition to the higher numbers of non-Indigenous researchers in this review, an examination of the disciplinary training for all first authors19 illustrates an abundance of social scientists and a relative absence of engineers and other researchers within the natural sciences who are working in the area of knowledge implementation and community-based participatory research as it relates to water. It is possible that researchers within the natural sciences are not conducting their research projects in a participatory or collaborative manner as these methods are subjective in nature and may not align well with the positivist research frameworks that are typical within the natural sciences. This is not to say that the natural sciences have entirely ignored participatory research methods and the implementation of Indigenous knowledge. Researchers such as Morgan, 2006 (engineering), Harper et al., 2011 (epidemiology), and Leidloff et al., 2013 (biology and ecosystems modelling), are a small sample of researchers that illustrate the feasibility of implementing Indigenous knowledge systems in water research conducted within academic faculties that are traditionally oriented towards the Western sciences.

The United Nations Declaration on the Rights of Indigenous People, which has been supported by each of the four nations in this study (though they were the only four nations to originally object to the Declaration), represents a recognition of Indigenous sovereignty by each of the federal governments and an important aspect of meaningful partnerships in the research and management of water resources. This

19 This finding is indicative of only the first author listed in the citation, and we as a research team recognize this as a limitation due to inconsistencies across academic disciplines regarding order of authorship.
movement is just emerging, and there are still higher rates of integrative water research in the social sciences when compared to engineering or the natural and health sciences. With the wide-spread acknowledgement of the disproportionate burden of water-related issues experienced by Indigenous populations, and with our current understanding of the significant benefits that accompany the implementation of Indigenous research and management techniques, we cannot justify the continued omission of Indigenous peoples and their Ways of Knowing from decision-making processes. The exclusion of Indigenous epistemologies, ontologies, and methodologies in the present-day water crisis simply does not make sense.

3.4.1 Recommendations

Based on our findings, we identified four ‘universal’ recommendations that can help guide future research regarding the implementation of Indigenous and Western knowledge systems:

(1) Research teams should consist of both Indigenous and non-Indigenous team members, and Indigenous team members should have the ability to make binding decisions that guide the research project. Doing so will allow for equitable knowledge creation and mobilization to occur between knowledge-holders and for both ‘eyes’ to be used, as described in the Two-Eyed Seeing methodology.

(2) Research teams should spend time with members of the community to discuss challenges that both the research team, and the community partners would like to address. This time spent should result in the creation of local, regional, national, and/or international advisories committees that serve as opportunities to provide guidance and direction to the proposed research project. These types of advisory opportunities and discussions are not exclusive to qualitative-style research within the social sciences and are essential to ensuring that proposed research project from any academic discipline has meaning.

20 By universal we mean that these recommendations are not country or region specific, though we acknowledge that each recommendation may not be applicable across all research projects.
(3) Research teams and managers, particularly those that are inexperienced in qualitative or community-based research, need to understand that the results of their case-based research project are not necessarily generalizable or transferable to other cases, and that due to the dynamic nature of knowledge systems, conclusions are often fixed to a specific time and place.

(4) Research teams need to be respectful of both Indigenous and Western Ways of Knowing. Participatory research requires the creation of space where new research paradigms can be formed, rather than selectively adding elements from Indigenous or Western paradigms. Both researchers and community partners have levels of expertise that can be used toward overcoming water-related challenges, and a recognition by both parties of the strengths and weaknesses of both Indigenous and Western sciences will allow for effective collaboration to occur.

3.4.2 Limitations

While time and resources are an obvious limitation to any study, this research was further limited to only the peer-reviewed academic literature that was successfully published in English in reputable journals and available online using specific database searches. These parameters may have resulted in the exclusion of important literature produced by community members or organizations with similar goals of integrative knowledge implementation for water research and management. Additionally, literature appearing in the systematic database searches was the result of keyword searches and analyses of abstracts. Literature may exist that was not found using the particular search terms, or was inappropriately excluded based on content within the abstract. The timeframe imposed on this project did not account for literature published after 2015, or before 1980. In the context of this research project, we may have erred in assuming that the first author listed in the CSRR was the Principal Investigator and contributed the most to the design and writing in terms of what they chose to include or leave out, though we acknowledge that not all publications follow these authorship guidelines.
3.5 Conclusion

In the four countries of study, Canada, Australia, New Zealand and the United States, Western knowledge has continually been privileged over Indigenous knowledge since the time of British colonial expansion. Indigenous knowledge systems have only recently been invited into institutional environments, though a review of the methods and models used to implement Indigenous knowledge in these four regions has been notably absent from the literature. The goal of this research has been to examine and synthesize the body of literature published from 1980 to 2015 regarding the implementation of both Indigenous and Western knowledge and methods to better research and manage water resources in Canada, Australia, New Zealand, and the United States and to address this gap. This paper also contributes to the growing body of literature of the methodological approach of combining systematic and realist reviews. Findings from our research illustrated that the majority of Indigenous and Western knowledge implementation projects related to water have been conducted by Canadian and Australian researchers with an influx of publications from 2009 to 2014. As well, the ongoing disparity between Indigenous and non-Indigenous communities regarding access to safe and secure water sources has reinforced our belief that new research methods are needed to address these disparities, and that community-based participatory research methods can effectively support the completion of research ‘in a good way’ and benefit both the research team and the community research partners. Ultimately, our research was conducted to further the legitimacy of Indigenous Ways of Knowing and to encourage readers to continue working towards a common goal of reconciliation and equality in all partnerships.
3.6 References


Chapter 4

Canadian and Australian Researchers’ Reflections on Implementing Indigenous and Western Knowledge Systems in Water Research and Management

4.1 Introduction

Water is one of the most abundant natural resources, yet access to safe and sufficient water sources for all, and ensuring this same level of security for future generations, is one of the most pressing challenges humanity is facing today. Source water pollution (McDonald et al., 2016), inadequate wastewater and sanitation infrastructure (Karaita et al., 2015), ice melt (Hansen et al., 2016), flooding (Gersonius et al., 2013), drought (Cook et al., 2015), aquatic resource depletion (Eero et al., 2012), over allocation (Duncan, 2014), and mismanagement of our water resources (Barlow, 2015) represent a few of these challenges contributing to the global water crisis. Nowhere is this water crisis more apparent than in Indigenous communities (White et al., 2012; Barlow 2009; WHO, 2003). While Western science has led to many innovations in the treatment and management of our water resources, the exclusive use of Western science and methods has not kept pace with our relationship to water, nor has it adequately addressed the higher frequency and persistence of water-related challenges in Indigenous communities in comparison to non-Indigenous communities.

In Canada and Australia, this higher frequency and persistence of water-related challenges in Indigenous communities is quite apparent (Health Canada, 2016; FNHA, 2016; Jackson et al., 2014). Boil water advisories and flooding burden Indigenous communities in Canada at a significantly higher rate than Settler\textsuperscript{21} communities (White et al., 2012; Newton et al., 2005), while resource depletion and diversion

\textsuperscript{21} The term Settler is used in the context of my thesis to refer to those people that are not the original inhabitants of Canada, Australia, New Zealand, and the United States. This is an admittedly complex topic of discussion, but for...
away from Indigenous territories for agriculture represent two of the most pressing water-related challenges that Indigenous communities in Australia experience (Jackson et al., 2012; Bark et al., 2012). Recognizing the value of place-based Indigenous knowledge, and the inadequacies of Western science to assist in reducing this disparity between Indigenous and non-Indigenous communities in both countries, researchers and managers (who remain largely members of Settler society) have begun to seek out ways to implement Indigenous and Western Ways of Knowing. The implementation of these Ways of Knowing represents a promising shift towards viable solutions for addressing the water crisis, and this is reflected in the growing number of publications as a result of integrative water research projects in Canada and Australia (Stefanelli & Castleden, in preparation).

While published literature provided a strong indication of theoretical and applied knowledge on this issue (Stefanelli & Castleden, in preparation), the purpose of this analysis is to provide a more nuanced understanding of the experiences of researchers seeking to implement Indigenous and Western knowledge systems in their water-work. Given that our findings revealed more published literature from Australian (26 records) and Canadian-based (45 records) research projects as compared to the United States (12 records) and New Zealand (14 records), only Australian and Canadian researchers were contacted and invited to participate in interviews (see Figure 4.1 – Included Articles by Region).

4.2 Background

Much has been written about the differences that exist between Indigenous and Western systems of knowledge. For instance, Western knowledge in the academy has traditionally been compartmentalized into various disciplines and grounded in Western epistemologies (Smith, 1999), while Indigenous

the sake of clarity, the term has been used in this broad sense. Settler colonialism refers to the (destructive) process of foreign populations migrating to new lands under the authority of an external governing body for the purposes of ‘destroying to create’ (Wolfe, 2006)

22 Ways of Knowing reflect the values and beliefs of those that have generated the knowledge, and influence the manner in which data are gathered and the lens through which these data are analyzed. Therefore, Indigenous Ways of Knowing are developed through existence within Indigenous contexts, while Western Ways of Knowing are developed through existence in Western contexts (Cochran et al., 2008).
knowledge is predicated on holistic perspectives, respect, and reciprocity (Kovach, 2015). Although there are differences between these systems of knowledge, they do not exist in isolation from one another, nor do they exist dichotomously; rather, there is a good deal of complementarity between Indigenous and Western knowledge systems (Berkes et al., 2007; Mazzocchi, 2006). For example, Western science and Indigenous science ‘facts’ can be produced through observation, trial and error, and adaptation to changing conditions. Indeed, Indigenous peoples have been using these methods to prosper in various climates for millennia. Additionally, the interconnectedness associated with inter- and intra-species relationship that is present in Indigenous systems of knowledge is quite similar to the cause and effect principles used in the Western sciences (Cruikshank, 2014).

Attempts at, and challenges to the implementation of these complementary systems of knowledge in water research and management is an emerging area of study for researchers in Canada (e.g., Castleden et al., 2015a) and Australia (e.g., Jackson et al., 2014). Through a systematic review of literature on this topic, we found that attempts to implement Indigenous and Western systems of knowledge are largely unsuccessful when: (1) the research process includes assimilationist tendencies (Mascarenhas, 2007), (2) flawed governance structures lead to unfair allocation of water (Jackson & Langton, 2011), (3) a top-down approach is taken to managing or researching water (Memon & Weber, 2010); and/or (4) an unequal exchange of expertise between parties is present (Wolfe et al., 2007; Armitage et al., 2011; Maclean & Woodward, 2013; Aho, 2009). To be successful, the creation of collaborative research teams consisting of Indigenous and Western knowledge-holders will be more apt towards developing meaningful and shared goals for the research project, and having both community and academic researchers in positions to make binding research decisions (See Stefanelli & Castleden, in preparation). Though both Australia and Canada have had some success in integrative Indigenous and Western knowledge mobilization, uncertainty still remains about how best to implement the expertise of Indigenous peoples with the expertise of Western-based water researchers and managers.
The literature, however, can only tell us so much. Given this, we wanted to explore this approach in more detail by conducting interviews with the authors of these studies. One of the major strengths of the interview process is that it allows the researcher to identify what the participant finds most relevant about a topic (Dunn, 2016) and to receive a first-hand account of the participant’s experience that may not be conveyed in the context of a written article. What follows is a description of the methods we used to recruit water researchers from Australia and Canada to qualitatively explore the successes and challenges that they experienced in attempting to implement Indigenous and Western systems of knowledge in their water research and management. This study is a corollary of a larger program of research, funded by the Canadian Water Network, which sought to determine the most promising methods and models for engaging in integrative water research and water management with First Nations, Inuit, and Métis/Metis peoples in Canada (Castleden et al., 2015a). A national advisory committee of Indigenous and non-Indigenous knowledge-holders guided that program design and its implementation. Drawing on the original protocol and Canadian data involving First Nations, Inuit, and Metis23, this study of Australian researcher experiences represents a progression of that Canadian-based work.

4.3 Methods

4.3.1 Interview Protocol

In order to move beyond the data provided through the CSRR (Stefanelli & Castleden, forthcoming), the research team conducted interviews with these Canadian and Australian ‘exemplars’ to unveil any additional insights that were not apparent within the published literature. Exemplars were determined based on a number of factors that included author frequency within the included records, as well as interesting, substantive, and/or significant findings. Moreover, we were interested in comparing and contrasting the interview data from Australian and Canadian researchers to identify any new insights.

23 First Nations, Inuit, and Metis are the three distinct Indigenous populations recognized in the Canadian Constitution as ‘Aboriginal’. We have chosen to use ‘Indigenous’ to represent these populations in accordance with the United Nations Declaration on the Rights of Indigenous People (UNDRIP, 2007).
Interviews were semi-structured, following a series of questions from an interview guide that was originally developed with the aforementioned national advisory committee and then adapted for Australian researchers where language was Canada-specific (i.e. ‘Canada’ changed to ‘Australia’; ‘First Nation’/ ‘Inuit’/ ‘Metis’ changed to ‘Indigenous’). Additionally, a section of questions regarding the National Water Initiative was added due to recurring references made to the NWI in Australian literature. The questions flowed from four broad areas: 1) general experiences in conducting integrative research; 2) detailed accounts of specific integrative research projects; 3) researcher definitions and/or descriptions of the terminology used within this field (such as Indigenous/ Western knowledge and methodologies); and 4) future prospects for success in implementing both Indigenous and Western knowledge systems in the realm of water research and management. Interviews ranged from 50-75 minutes and were recorded using a digital audio recorder. Using the audio files, the interviews were transcribed verbatim, then thematically coded and analyzed.

4.3.2 Participant Recruitment

There were 24 exemplars from Canada and Australia and each of the first authors were contacted to participate in semi-structured interviews. Of those 24, 17 consented to participate in a 60 minute, semi-structured interview (See Table 4.1 – Interview Participant Description), completed over a period of 12 months (February 2015-2016).

24 We acknowledge that the convention of authorship varies between disciplines. We opted for contacting the first author because, despite their rank on the research team, they are often the ones that contributed most in the research project.
Table 4.1 - Interview Participant Description

<table>
<thead>
<tr>
<th>Participant Code</th>
<th>Region</th>
<th>Academic or Community (as Primary Affiliation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researcher A1</td>
<td>Australia</td>
<td>Community</td>
</tr>
<tr>
<td>Researcher A2</td>
<td>Australia</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher A3</td>
<td>Australia</td>
<td>Both</td>
</tr>
<tr>
<td>Researcher A4</td>
<td>Australia</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher A5</td>
<td>Australia</td>
<td>Community</td>
</tr>
<tr>
<td>Researcher C1</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C2</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C3</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C4</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C5</td>
<td>Canada</td>
<td>Community</td>
</tr>
<tr>
<td>Researcher C6</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C7</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C8</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C9</td>
<td>Canada</td>
<td>Community</td>
</tr>
<tr>
<td>Researcher C10</td>
<td>Canada</td>
<td>Community</td>
</tr>
<tr>
<td>Researcher C11</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>Researcher C12</td>
<td>Canada</td>
<td>Academic</td>
</tr>
<tr>
<td>N=17</td>
<td></td>
<td>Australia=5 Community=11 Both=1</td>
</tr>
</tbody>
</table>

4.3.2.1 Canadian Recruitment

Recruitment in Canada was completed as a component of the CWN project (Castleden et al., 2015a). Recruitment emails were sent to 15 researchers. Of the 15 researchers contacted, 12 researchers consented and participated in our study, while two did not respond, and one declined to participate. Of the 12 interviewees, 11 stated a history of working with First Nations populations, 3 of 12 researchers described their work with Inuit communities, and 1 of the 12 interviewees identified a previous research partnership with a Metis community. As a research assistant, I conducted 6 of 12 Canadian interviews. Participants reported that their integrative projects had been conducted in the Canadian North (i.e., Yukon, Northwest Territories, and/or Nunavut), British Columbia, Saskatchewan, Ontario, and Newfoundland/Labrador.
4.3.2.2 Australian Recruitment

Similar to Canada, Australian researchers were identified through the completion of the CSRR based on their experiences in conducting integrative research, and recruited via email. To increase the likelihood of responses, recruitment emails were sent to researchers during business hours within the Australian time zones. Nine researchers were identified for their integrative work and were contacted via email. Of these nine, six researchers agreed to participate, although only five researchers were interviewed (the sixth did not respond to my attempts to set an interview date). Of the five researchers interviewed, all had worked with Aboriginal communities, while only one discussed working with Torres Strait Islander communities. Geographically, participants discussed their experiences of working with communities in Western Australia, Northern Territory, South Australia, Victoria, New South Wales, and Queensland.

**Table 4.2 - Exemplar Identification and Recruitment**

<table>
<thead>
<tr>
<th></th>
<th>Canada</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Included Records</strong></td>
<td>45 (42 Unique First Authors*)</td>
<td>26 (16 Unique First Authors*)</td>
</tr>
<tr>
<td><strong>Exemplars Identified</strong></td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td><strong>Interviews Conducted</strong></td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

* Though there were 45 and 26 records included from Canada and Australia, respectively, a number of authors had numerous articles included in the review.

4.3.3 Data Analysis

4.3.3.1 Coding and Analysis

Interviews were transcribed verbatim, coded, and thematically analyzed using the content analysis method to identify latent and manifest themes (Dunn, 2016). Analysis began using the process of open coding (Miles & Huberman, 1994) whereby transcripts were read in full and codes were derived from the data. Identified codes were noted in a codebook, which was then used in the second stage of the analysis process. In this stage, each transcript was again read in full, and sections of text were highlighted.
according to the appropriate code noted within the codebook. It should be noted that codes were developed based on meaning, and that codes were not mutually exclusive (DeCuir-Gunby et al., 2011). The final stage of the analysis process was thematic separation in which all participant quotations from each selected code were placed in a separate document. These documents allowed for overarching themes and sub-themes to be identified across, between, and within each country. Interview participants were given an opportunity to review the transcription of their interview to ensure clarity and appropriate use of data and they were given an opportunity to review the use of their quotations in the context of my findings as a way to validate the conclusions I arrived at. While all research participants provided minor clarifying statements, no substantial edits or subtractions were made.

### 4.4 Findings

Three broad themes emerged from our analysis, and within these, eight sub-themes were identified; not surprisingly, there is substantial overlap between them. For the purposes of presenting coherent findings, they have been disarticulated from each other in Table 4.3 below.

**Table 4.3 - Interview Findings by Theme**

<table>
<thead>
<tr>
<th>Overarching Themes</th>
<th>Sub-Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Relating to Water</em></td>
<td></td>
</tr>
<tr>
<td>1) Coming to know our relationship to water</td>
<td>2) Viewing water as a right or a relationship</td>
</tr>
<tr>
<td>3) The ‘value’ of water</td>
<td></td>
</tr>
<tr>
<td><em>Power</em></td>
<td></td>
</tr>
<tr>
<td>4) Socio-political contexts</td>
<td>5) Researcher-community relationship</td>
</tr>
<tr>
<td><em>Knowledge</em></td>
<td></td>
</tr>
<tr>
<td>6) Support (or lack thereof)</td>
<td>7) Implementation without equal benefit</td>
</tr>
<tr>
<td><em>Implementation</em></td>
<td></td>
</tr>
<tr>
<td>8) Participants’ ‘lessons learned’</td>
<td></td>
</tr>
</tbody>
</table>
These themes are described in detail below with anonymized quotes from interviewees interspersed throughout to contextualize our findings (interviewees are identified only by home country with ‘A’ for Australian researchers and ‘C’ for Canadian researchers).

4.4.1 Relating to Water

The theme of ‘relating to water’ encompasses the many ways in which interview participants discussed how they themselves understand, and/or how they perceived their community partners to understand their personal and/or professional relationship to water.

4.4.1.1 Coming to ‘Know’ Our Relationship to Water

Participants were asked to describe Indigenous and Western knowledge systems as a way of beginning the conversation about their research. In doing so, we developed a baseline understanding of the ways in which Indigenous and Western epistemologies shape participants’ relationship(s) with water. Interviewees generally shared their understandings of Indigenous and Western knowledge systems as being experiential and objectivity-focused, respectively. For example, one participant stated their interpretation of Indigenous knowledge as:

*Knowledge that encompasses ways of thinking but also ways of being and doing. It is knowledge that is enacted in practice and passed on in informal contexts as well as formal ones. I think it is knowledge that... is less commonly systematically described, at least to outsiders.* (Researcher A3)

Whereas another participant described Western knowledge as:

*Very structured in... that there's very set steps of how that knowledge is produced, who produces knowledge that's considered valued, and ... it's very rooted in kind of a colonial history of how we consider what is valued knowledge. Western science is often produced through sort of measurement means, replication of specific results.* (Researcher C9)

Participants often chose to discuss the incongruences between Indigenous and Western knowledge as a way to differentiate between the two systems:

*Non-Indigenous researchers typically use the scientific methodology and remove the emotion, perspective and opinion from the data; and that is how you understand how a natural system*
Indigenous people in my experience would think that is only a partial understanding of how a natural system operates, and that you have to understand the cultural contexts. (Researcher A1)

While participants largely conceded that it may be useful to define or describe systems of knowledge through a comparison to other systems, they also thought it was important for researchers to spend more time understanding their own system of knowledge to know exactly what their knowledge system was being compared to:

There is also a degree to which [Indigenous knowledge] is often contrasted with scientific or Western knowledge... Indigenous knowledge is ‘this’ because it’s not ‘that’, or it’s different from ‘that’. But sometimes what it is that it’s being compared to isn’t particularly well described or understood in its own sense. (Researcher A3)

Another common theme in participants’ descriptions of Indigenous Ways of Knowing about water was the importance of a wholistic25 view of not just water, but the total environment. Specifically, participants discussed the importance of place, people, and language as essential to Indigenous Ways of Knowing. They also stressed that Indigenous knowledge is place-specific, and therefore not easy to transfer or replicate elsewhere, and attempting to do so may actually be inappropriate, as cultural protocols may dictate that only certain people are permitted to speak about traditional places, as an Australian participant commented:

Aborigines are defined by place, by their country. So it follows that their Indigenous knowledge is place specific, not comfortably generalizable – Actually, rather than place, Aborigines call it their country. Knowledge about their country is held by the group and particular members are empowered to speak about particular aspects of their country. (Researcher A2)

In contrast to the wholistic perspectives often used within Indigenous knowledge systems, participants noted that Western knowledge has largely emerged from the use of the scientific method to support or refute specific facts about the natural world. This specificity represents a strength of Western knowledge, and its use allows for the generation of a substantial amount of information and expertise within a

25 Wholism is used here instead of holism as wholism posits that the whole is greater than, and different than the sum of all of its parts and understanding the relationship between those parts is central to a wholistic understanding. Holism, on the other hand, is a form of understanding whereby there are no parts, and therefore no relationship between parts (Pribram, 2006).
compartmentalized discipline that can then be shared with experts in other disciplines to attain a detailed perspective of particular parts of the whole.

What tends to have been characterized as a Western, let's say, scientific approach in the past... century, has been an attempt to, in a sense, fragment knowledge as a whole into small compartments we call areas of expertise. And that's definitely quite different from Indigenous knowledge. (Researcher C4)

Participants cautioned against viewing Indigenous and Western knowledge as two distinct entities that could be picked apart and selectively added to one another as doing so would support the false dichotomy that exists between the two knowledges. As one participant stated:

When we set up binaries, one is given the status and the authority and the power, and the other gets marginalized. (Researcher C8)

Participants reiterated numerous times that both systems of knowledge are different, but not opposite or conflicting, and that these systems have developed, and should continue to develop together.

4.4.1.2 Our Relationship to Water: Rights and Responsibilities

Participants noted that Indigenous Ways of Knowing and Western Ways of Knowing differ in how human relationships to water are viewed – as a right to water, or a responsibility to care for water. One participant explicitly made reference to this being an obstacle that researchers must consider when attempting integrative water research:

[It is important] to note that many [Indigenous nations] don't just see their rights to their land and water as a right, but also as a responsibility. That is an important distinction ... many Indigenous people speak of rights and responsibilities. So it's not just, "This is our land, and we have the right to it," but, "We have the responsibility that's been passed down from Elders, or that we have been taught that it's our job to take care of these lands and waters." And I think that's an important cultural difference. (Researcher C1)

Some participants took this idea further, and identified that cultural protocols in many Indigenous communities, women have traditionally been responsible for protecting water resources. When asked about their motivations for researching water issues, one Canadian participant stated:
It’s personal in that it was driven by my personal responsibility and I had the Elders tell me that maybe it was my responsibility as [an Indigenous] woman [that] was driving that. That I feel the need that something needs to be done about this… the crisis, the water crisis. (Researcher C3)

While recognizing the importance of the distinction between rights and responsibilities to water, a number of participants discussed their community partners’ beliefs that it was difficult to realize their responsibilities to water within their country’s legal structures. In Canada, participants noted that there are often attempts, vis-à-vis dominant institutions and actors, to force Indigenous communities to view water from a Western-based rights perspective:

We have connections that are both physical and spiritual that I think supersede our notions of rights and responsibilities that we have tended to kind of create in our societies. Really, if you go to an Aboriginal community, people really don’t talk about rights. You know, now they do because they have had to; their rights have been taken away in so many ways by removing their access to land and so on. But their relationship to water is far greater. (Researcher C4)

In Australia, circumstances are similar to Canada in that rights to water are an important, though partial, aspect of water for communities that researchers may consider in their work. However, as one participant noted, the existence of Title rights does not necessarily clarify the ambiguity in how those rights are to be asserted, particularly in the case of water rights:

There is an undercurrent of Indigenous rights in everything that we do. Australia has a Native Title Act essentially that protects Native Title rights on country or areas where people have a right to access. The Act also protects the right to harvest resources for traditional purposes in those areas. There is a Native Title right to harvest resources for traditional purposes on Native Title land, and to be able to quantify how important that was, that was part of our work. Because water extraction upstream for agricultural purposes can erode that right, Indigenous rights to water is actually less clear in the Australia context than the Native Title right to hunt and fish. (Researcher A1)

Viewing water as a right or as a responsibility represents one of the differences between Indigenous and Western knowledge systems. In addition to this rights–responsibility difference, Indigenous communities often have different goals in relation to water in comparison to the outside, Western-trained researchers who do not typically have the same vested interest in that particular area. In recognition of these differing interests, one participant stated the importance of taking a research position that allows them to continue to work on objectives that are important to the community in which they partnered with:
And for me, [this] was an opportunity to not be kind of what I like to call a "helicopter researcher". You go in, you do your work, and you leave never to be heard from again. I'm still here. I'm still working on these issues. I'm not living in that community, but I'm still working very closely with that community and others to continue to drive the importance of collaborative, community-based research. (Researcher C9)

Ultimately, researchers concluded that both rights and responsibilities to water must be considered when conducting knowledge implementation research, as both play an important role in the health of Indigenous communities. According to one Canadian participant:

In the context of First Nations and Northwest Territories and some of the places where I've worked and other students of mine have worked, [water] is so connected to people's well-being. And so there's that relationship between rights and well-being and an opportunity to live a full and healthy life being connected to water. (Researcher C11)

How one views their relationship to water – be that a rights or responsibility relationship, may often be influenced by the personal or community values that have been ascribed to water, in their various forms.

4.4.1.3 The Value of Water

Participants identified spiritual or cultural values that Indigenous peoples in Canada and Australia held regarding water and other natural resources. A Canadian researcher described their understanding of these values when asked about the importance of water to the community they partnered with in research:

My participants described [water] as... something that was very much related to spirituality, to the notion that the responsibility for governance is something that was given to them by The Creator. It is based on, in this case, women's connection with water through childbearing and childbirth. It's something that is preserved over time. It has to do with an understanding that all things are sentient and so there is a respect for the water in the way that the water is equal to us and that she has her own purpose for existing that's quite independent of ours, and that we need to take heed to that and respect that. (Researcher C5)

A natural scientist who had conducted research in Australia reiterated this spiritual understanding in the context of implementing Indigenous Ways of Knowing along with the principles of Western science. The participant implied that before the research began, they thought that these spiritual understandings would be difficult to work with; however, upon completion, realized that this Way of Knowing was an opportunity to better understand water:
I guess when you talk about cultural beliefs about how rivers function when you are coming in as a quantitative scientist, you don’t have the theological background to the way you think things work in the way that Aboriginal people in northern Australia do. Once I’d conducted the work, I didn’t see the belief systems as a problem. It is more of an opportunity to understand how people think about water, how they value water, and how they relate to water. (Researcher A1)

While participants discussed a spiritual element as part of an Indigenous value system, it was not the only aspect mentioned. They identified Indigenous values related to water that go beyond the Western-based measures of drinking water quality or quantity, such as turbidity, flowrates, and chemical composition, among others. These Indigenous values included the inherent value of water as a gift from The Creator, stories associated with water that have been shared for generations, and that water is integral to supporting all life. One researcher summarized these additional values in their discussion of the importance of place-based knowing:

\[\text{The findings of the work as it sort of evolved made me realize how important water is, especially here, to a population of individuals that live so intimately with their surrounding environment and how important that is beyond just sort of the physical dimensions of needing water for life.} \quad (\text{Researcher C6})\]

On the whole, participants identified that recognition of differing values is an important component in the undertaking of integrative water research and management projects. They urged other researchers to invest their time and energy into meeting with community members to fully understand the water-related values that are held by the community, and to collaboratively develop research goals that encompass these values.

**4.4.2 Power Dynamics**

The second major theme that emerged from the analysis was the importance of understanding and reconciling the unequal power dynamics that continue to disadvantage Indigenous Canadians and Australians in the context of water research and management. While inter-related, the two sub-themes: socio-political power dynamics writ large and researcher-community power dynamics in the context of their projects, are presented in turn.
4.4.2.1 Power Dynamics in the Socio-Political Context

In talking about their general experiences and respective projects, participants often referred to the power held by institutions and/or state governing bodies in relation to the management and governance of water resources. In Australia, much of this discussion focused on the implementation of the 2004 National Water Initiative (NWI), which attempted to reform past practices that had led to over-allocations of water resources (Bark et al. 2012), “typically for agricultural purposes” (Researcher A3). Participants highlighted fragmentation in governance as a primary cause of the mismanagement of water:

*Part of this is the enduring problem in Australia of federalism, where each of the states have jurisdiction to some extent over water. Partly what the National Water Initiative did was to try to wrestle some of that policy control back from the states, but those water plans continue to be instituted under state and territory legislation. So that disjunction in terms of jurisdictional control meant that [implementation] was going to be at the discretion of the states and the territories.* (Researcher A4)

In addition to bringing together state-level policy makers to agree on a federal water initiative, the NWI also required state jurisdictions to provide access and opportunities for Indigenous Australians to participate in the decision-making process, as well as to incorporate Indigenous values wherever possible, and to recognize the potential for Native Title Rights to influence such policy decisions (COAG, 2004). Participants discussed the importance of this aspect. For example:

*The NWI was the time where it became much more explicit that Indigenous people had a role and a say in water planning as such. So that’s my general sense of it. I haven’t engaged in detail with it for a little while now, but it was sitting behind a lot of the work that we were doing in the sense that it was directed through [identifier removed] or whoever else that was looking at Indigenous issues in water planning, questions of cultural flows or however else it was framed. The NWI was the institutional driver for asking those questions.* (Researcher A3)

In Canada, with a similar federal and provincial/territorial political structure as Australia, no such federal level initiative exists whereby provinces and territories have signed binding agreements that state that Indigenous knowledge about water responsibilities must be implemented. One participant noted that problems in knowledge implementation are often caused by differing levels of power and values that are
ascribed to each way of knowing, and they thought that a centralized water governance plan could remedy this:

I do think it's not only a difference of knowledge systems, but I also think that it's a real issue of power differences, where [Indigenous] people and their knowledge simply don't have the respect from non-Indigenous decision-makers. And they don't have the same power and capacity and money and resources to implement their knowledge systems. There's a very, very dominant culture and a dominant way of thinking and a dominant knowledge, and that knowledge is science. (Researcher C1)

To meaningfully engage with Indigenous people and Indigenous knowledge systems about water, participants stressed the need to recognize that current colonial government decision-making structures value Western scientific knowledge over all other knowledge systems. As one participant described:

Federally and provincially they're pretty biased in terms of a preference towards quantitative data... in their decision-making. And those decisions they’re making based on that one kind of evidence and that one kind of truth impacts people that don’t necessarily identify the same way with that truth. They’ve got policies in this country founded and based and supported and justified from one knowledge system that are influencing and very directly impacting the lives of the First Peoples of this country. (Researcher C10)

In addition to recognizing the current dominance of Western knowledge systems in policy making, participants indicated that governing bodies and researchers alike must also better understand the power dynamic that exists and how that prevents the facilitation of meaningful engagement and collaboration. A Canadian researcher noted:

When you have something like a collaborative process that is premised on genuine speech and dialogue and consensus decision-making and you're assuming that everybody's equal, you're immediately out to lunch. Because if you've got some little collaborative watershed process and it is, “Hi, I'm Joe, I'm a retired school teacher,” and “I'm Mary. I'm a housewife who's interested in the environment,” and “Yeah, I'm Steve and I represent a $400 billion mining corporation, but we're all equal here!” No, we're not. And so power is a critical factor that I think we need to get much better at understanding when it comes to what facilitates effective governance. You know, power, the different issues, institution issues, these sorts of things are important. (Researcher C6)

As this example illustrates, effective implementation of knowledge systems is much more than an inclusion of Indigenous peoples or providing a seat at the table to discuss, from a Western epistemology,
the best practices in managing natural resources. A broader scope of methods must be considered, and to effectively do so, researchers must be aware of both socio-political power relations.

4.4.2.2 Power Dynamics in the Researcher–Community Relationship

Within the broader milieu of socio-political power relations, researcher-community partner power dynamics also surfaced from the data, such as questions regarding who decides when and where collaboration is to take place, or who decides the details of the research process? Participants emphatically stressed the importance of relationship building as an effective strategy to mitigate these power imbalances. They suggested that relationships with a community should be established long before any data collection occurs, and once that relationship has been established, research could be co-designed – as detailed by one participant:

*It is important to form relationships first and maintain them. Because without those strong relationships I don’t think what we did could have worked. We spent up to four months a year living in Indigenous communities, probably more than a month in each community each time. But without that, this sort of research sort of skims off the top of the proper understanding. (Researcher A1)*

While relationship building is a key process, another participant discussed the difficulties related to grant procurement when attempting to build a relationship and design a research project together with a community partner:

*I came in all ready with all my natural science funding to do my natural science research, and then the Traditional Knowledge component came after, which is probably more typical, because how often, especially in northern communities, how often are you in a situation where you just pull some money out of the way from somewhere and head up and try to engage with a community from the beginning and have it all in sync from the get-go? That's what we wanted to occur, but there often isn't the mechanism in place to allow that to happen. (Researcher C7)*

Even when funding constraints are not an issue, a Canadian participant acknowledged the difficulties that may occur in designing a research project together with a community, as Western-style research methods may not be consistent with the cultural practices of the community partners:

*One way of looking at it is just even the assumption that we would look or sit down to talk about something. Venue is one thing that could change. In some cultures, for example, decisions are
made out on the land, and people talk as they are doing whatever they’re doing, be it gathering or moving around from one location to another, hunting – whatever it is. Just that process of who makes decisions and when and how it’s discussed differs. So sitting down in a boardroom immediately biases the conversations to a Western way. (Researcher C1)

While it is important to establish meaningful relationships with community partners and to design research projects that have a shared benefit for both parties, there are structural obstacles that hamper these relationship-building efforts. Interview participants indicated that in order for the effective implementation of Indigenous knowledges within a Western, academic framework to occur, timing and funding structures must be altered to allow researchers the freedom to design projects with community partners. Researchers must better understand the ongoing power dynamics that have historically disadvantaged Indigenous communities – both in their own research, and the broader socio-political context.

4.4.3 Indigenous and Western Knowledge Implementation

A third key theme that emerged from the data related to researchers’ attempts to implement both knowledge systems in water research and management. Three sub-themes were identified from participant responses: support (or lack thereof) for Indigenous knowledge implementation, attempts to implement that do not result in equal distribution of benefits, and participants’ ‘lessons learned’ conducting knowledge implementation research.

4.4.3.1 Support (or Lack Thereof) for Indigenous and Western Knowledge Implementation

While promising research practices and policy in support of Indigenous and Western knowledge implementation for water research and management have been enacted in both Canada and Australia, many researchers spoke about various forms of resistance (including resistance from government officials, industry professionals, and other researchers) that they had experienced in some capacity during their research careers. In some cases, it was stressed that potential partnerships between conservation managers and Indigenous communities have collapsed when both parties have felt that the differences that
Some conservationists won’t have anything to do with [Indigenous] resource management because the two groups have very different goals in their management of resources. (Researcher A2)

The participant went on to state that this problem is not exclusive to NGOs and often resistance appears in government as well:

Within the agency itself, there were very stalwart bureaucrats that didn’t believe that the community should be involved in water management at all, let alone Indigenous communities, which is not at all unusual. In government I have worked with a number of officers who believe that people and communities should have nothing to do with government business, that it is the government’s role to tell the people what they should have. (Researcher A2)

Systematic discrimination and institutional racism were certainly raised issues that can hinder implementation of Indigenous Ways of Knowing; however, participants also stressed that knowledge implementation may be inappropriate in all areas of the research study – at least in its current form. The majority of researchers were hesitant to promote the implementation of Indigenous and Western knowledge without first stating that there are various issues associated with the selective extraction of Indigenous knowledge into Western knowledge. As one participant noted:

I think that’s part of the risk, right, is that one gets subsumed into the other, and I think that is what happens, and there’s tons of literature on this stuff, is that when we set up binaries, like this one is given the status and the authority and the power, and the other gets marginalized. (Researcher C8)

When this type of selective extraction occurs, participants cautioned that it threatens to devalue the entire Indigenous knowledge system in favour of a Western knowledge system:

I find a lot of the so-called efforts to integrate Western science and traditional knowledge are very much of that flavour. When you look at what integration means, it’s like the really important questions get answered by the biologists, and then there’s this thin, sort of politically correct layer of Indigenous knowledge that gets put on top of it. And I think that’s a bullshit kind of approach. (Researcher C6)

As this participant alluded to, tokenistic engagement is an obstacle in the design and implementation of water research and management.
4.4.3.2 Implementation without Equal Benefits

Integrative research requires the development of honest and respectful relationships built on the premise of equal partnerships that are mutually beneficial. However, participants cited examples, either from their own research or from the work of others, where these relationships did not develop and attempts to implement Indigenous knowledge in water research and management were not conducted in an appropriate manner. They referred to such attempts as lacking meaningful engagement with Indigenous communities, and they noted that an asymmetrical distribution of benefits has led to a lack of trust in the partnership. As one participant discussed in a general sense:

_The context in which Indigenous research takes place is often one in which there's very little trust going in. And there's been very little gain in the past as far as research not serving Indigenous peoples but rather objectifying, pathologizing, downright ripping off and using what's been there, as opposed to serving the communities in a decolonizing capacity._ (Researcher C2)

In discussions surrounding their own work, one researcher cited the restrictions that occur in academia that prevent researchers and community members from working towards the same goal:

_I find that the ways in which we’re encouraged to write about these things are often not really serving the communities that we are working with and that we’re hopefully intending to serve. So we’re ending up serving our own disciplinary requirements and career paths rather than producing work that is truly beneficial for communities, and that's a larger structural problem in terms of the academy and academics working within Indigenous communities, is that our work is often measured, at least in terms of our profession, in terms of scientific and academic processes that do little to assist community. So that's ultimately a challenge, for me._ (Researcher C12)

Another cause for the unequal distribution of research benefits between researchers or managers and participants that was purported by a number of Canadian participants is a form of tokenistic engagement that occurs when Indigenous communities are treated as one of many stakeholder groups with a vested interest in the topic at hand to be included in the decision making process. Indigenous communities are not merely stakeholders, as one Canadian participant stated:

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26 Mutually beneficial research is used to describe research projects that provides both benefits for the academic researchers (which may or may not include publications), as well as the benefits for the community that were discussed at the outset of the research project (which may include financial compensation, increased understanding of an issue, remediation of an environmental (water) issue, and/or employment, opportunities, among others).
First Nations are absolutely not a ‘minority’ of Canada, and I think it’s common just to lump them in with other peoples, but I think very obviously there’s this assumption that First Nations are stakeholders. Some people really think that that’s a really progressive step forward – to include First Nations in this conversation. But that’s nowhere near the level of understanding or respect that’s needed to create a relationship where something could be done in terms of real action. (Researcher C1)

While Australian researchers did not discuss the implications of viewing Indigenous people as one of many stakeholders, participants did note that a common misunderstanding exists in the water research and management communities: That Indigenous peoples shared the same values as conservation organizations. As a result, there has been an assumption that consultation with Indigenous peoples was unnecessary:

We assumed for a long time that if we get conservation objectives right, then Indigenous people would just live off the natural system that is protected anyway. More and more we are starting to understand that the objectives of conservation and other groups can be quite different than those of Indigenous people, so we need to consider those differences explicitly. (Researcher A1)

Even still, once these differences have been considered and understood, there exists the possibility that engagement may not be meaningful, and Indigenous knowledge implementation may not occur:

We had identified those Indigenous priorities, but whether they were going to be given equal weight, finally, whether we brought the [government] department at all to the point of thinking that it was actually important that the plan reflected the communities’ wishes, is somewhat doubtful. (Researcher A2)

Designing research projects that are mutually beneficial for the research team and the community partners is integral for the creation of meaningful partnerships that support the implementation of both Indigenous and Western knowledge systems.

4.4.3.3 Participants’ ‘Lessons Learned’

Participants were asked to discuss some ‘successes’ in integrative water research and management, be that at a national level, or at an individual level through their work with Indigenous community partners. Australian participants pointed to the enactment of the NWI as an important starting point in the effective implementation of Indigenous knowledge. Such policy initiatives were highlighted as potential pathways
to providing support for researchers that are attempting to implement Indigenous and Western Ways of Knowing, as they relate to water:

_I think the strength [of the NWI] is, like I’ve said, that it specifically mentions the need to include Indigenous perspectives when you manage water. So it is explicitly stated at the national level that Indigenous people are important users, and there is a better understanding that the Native Title right can be eroded if water isn’t carefully managed. So I think that strength for Indigenous communities is that it directs the states and territories to consider their rights when looking at the water management process._ (Researcher A1)

In a Canadian context, researchers did not discuss any one ‘watershed’ moment at a national level that represented the starting point in the shift towards effective implementation of Indigenous and Western knowledge in water research and management. Instead, Canadian participants noted that a transition is occurring more at an individual level whereby water researchers and managers are recognizing that using only a Western perspective to view water ignores the potential contributions from people that have lived in relationship with, and developed an understanding of, the lands and waters around them:

_If we’re talking in Western science that nature is something that can be managed and controlled and predicted, then we're really not listening very well to what it is that people who have spent a great deal of time on the land and who relate to it in different ways and ways that are informed by Indigenous knowledge and action, we're not really listening._ (Researcher C12)

Consistent with the shift in understanding the benefits of implementing Indigenous knowledge together with Western knowledge has been an increase in community-driven and participatory approaches to research that implement Indigenous Ways of Knowing. Interviewees cited flexibility in the research process as integral to meaningful engagement:

_If I look back over the last 10 years... usually the most productive projects are the ones where you have had the most flexibility to engage locally with what research questions are important. And work out how they fit with whatever funding body or agenda you have, that is, institutionally important for whomever you are working for and then finding the best fit there. So I think that would probably be the most important is retaining that flexibility and the sensitivity, having a sensitivity to local conditions that enables you to then pick a pathway that is going to be the most meaningful for everyone involved._ (Researcher A3)
Overall, participants stressed that implementation of Indigenous knowledge is a complex task not to be taken lightly. It requires a significant time and resource investment from both the community and the researcher. An Australian participant stated:

\[\text{I found it difficult because I wasn’t living in community. I was . . . travelling probably on average once every two or three weeks to the islands. So that is not an ideal situation when you’ve got, well the time parameter on that project was about 18 months, and so it is difficult to develop those trusting relationships and also understand the nuances of the context if you’re visiting more or less. That’s, I don’t think that diminished the value of the work in the sense that [they] are used to working like that. They are on an island. It is expensive to stay there. It is difficult to get around. (Researcher A4)}\]

Participants often made comments to the effect that even when all attempts have been made to establish a meaningful relationship with community partners, circumstances can and will change, and there is no guarantee that the partners that a researcher connects with will remain in their role throughout a research project and beyond. One participant noted:

\[\text{The frustration was, I think, that we then had the mining downturns, some major restructuring in the company and the champions kind of moved on to other roles. So you have that situation where you were really looking for an ongoing engagement and for circumstantial reasons it didn’t actually occur. And I think that it was unfortunate in the circumstances but you know, it happens on a regular basis. (Researcher A3)}\]

Despite some of the challenges of integrative Indigenous and Western knowledge implementation and the resource constraints associated with community-based participatory research (CBPR) methods, many of the participants’ ‘lessons learned’ aligned with the tenets CBPR, including balancing power dynamics, fostering trust between researcher and participant, and community ownership over the research process (Castleden & Garvin, 2008). Some participants offered practical guidance for integrative researchers that CBPR can be used to implement Indigenous and Western Ways of Knowing and water values. For instance, when discussing their community-based participatory research project, an Australian participant stated that a specific Indigenous Way of Knowing was used to better understand river flows, while also incorporating community values:

\[\text{Even the concept of calendar months are fine for a scientific understanding, but when you try to tie a calendar month into a river flow understanding, it is quite meaningless because of the}\]
variability each year. It doesn’t matter what month you are in, it is when a river hits a particular flow rate that the fish start biting and you start catching them. We’ve been quite open to including other aspects in models that western science wouldn’t usually use such as the smells you get from a wetland that is dry at the end of the dry season, which often invokes memories and the understanding that the system is actually healthy. While you can’t actually quantify why something is related to a feeling, that feeling has a definite relationship to part of the environment, and so we introduced smells, beliefs and feelings. (Researcher A5)

Such examples speak to the careful considerations that these participants urge other researchers to take into account when attempting integrative water research and management, and many of the considerations emerge out of meaningful discussions with community partners about aspects of the water system that are highly prioritized. Participants emphatically encouraged researchers to involve Indigenous peoples throughout the entirety of the research process from design to dissemination as they are often better suited to identify the considerations that must be accounted for to conduct meaningful and effective research in their community.

4.5 Discussion

The findings from this research suggest that Indigenous and Western knowledge implementation in the field of water research and management is influenced by our personal and professional relationship with water, the structures of power in State–Indigenous and academic–community relationships; and the need to overcome the challenges preventing implementation from occurring in order to have meaningful engagement and discussion with Indigenous peoples. The following discussion of the findings is organized around these themes.

4.5.1 Relating to Water

The concept of place, and both its physical and social components, is integral in understanding the development of local knowledge systems. This physical knowledge of place is hundreds of generations in the making, while the social components are continually strengthened through existence and relationality in space. Our analysis of the data revealed the importance of place as a concept that has connected
Indigenous and Western knowledge systems, rather than serving as a point of divergence. From colonization onward, both Indigenous and Western knowledge systems have developed alongside each other through a co-existence in place – albeit co-existence predicated on Indigenous exploitation and Settler domination. This co-existence in place has led to the expansion of two distinct systems of values as they relate to the same water sources (Woodward, 2008).

In both Canada and Australia, participants asserted that the distinct Indigenous knowledge systems used in communities were not easily translatable outside of the context from which they were created. In order to implement systems of knowledge that include both Indigenous and Western strengths in water research and management, researchers must spend time with Indigenous peoples on their traditional territories, and develop relationships and understandings of the importance of the territories to the communities whose cultural, spiritual, mental and physical health and identity depend on access to the lands and resources (Wilson, 2003; Richmond & Ross, 2009).

Rights to water, as opposed to responsibilities to water, is a point of divergence between Indigenous and Western Ways of Knowing, and between the experiences of Canadian and Australian researchers. To view water from a rights perspective is to view water through a Western, legal framework – which is not always consistent with the manner in which Indigenous communities relate to their water resources. Several of the Canadian participants in this study noted that many First Nations’ worldviews include the notion that they have been given a responsibility from The Creator to take care of water and the land, and that responsibility aspect is lost when access to water is viewed only through a rights lens. Australian participants did not explicitly use ‘responsibility’ as a concept although it was implied through their stories of how community research partners relate to their water resources. Rather than discussing a responsibility relationship to water in detail, respondents from Australia chose to focus more intently on the importance of government and policy-makers in fulfilling their legal requirements under the Native Title Act.
As policy and land ownership decisions are often made within the legal realm in both Canada and Australia, the importance of binding legal agreements and entitlements as components of reconciliation\textsuperscript{27} and decolonization\textsuperscript{28} cannot be overstated. Determining rights to land ownership is important in both the Canadian and Australian contexts, however these concepts of land ownership are not shared across all Indigenous contexts and sentiments of responsibility and generational planning of water sources must also be considered in addition to ownership and rights considerations. Doing so will allow for a more comprehensive framework for integrative water research projects that use both Indigenous and Western knowledge systems, and are consistent with both Indigenous and Western values.

Another area of difficulty discussed by participants included the challenges of working within a natural sciences research framework – a framework that places emphasis on precise measurements that can then be analyzed and used to determine indicators such as water quality and quantity. This is not always possible in Indigenous communities, as many aspects of a water system are not easily measurable or comparable. For example, spiritual and cultural connections to water cannot be measured using the same tools or in the same way that flow rates and turbidity levels of water can be measured. These difficulties in measurement were referred to as deterrent for some natural scientists wanting to undertake integrative water research. And herein lies the problem – these variables, although difficult to measure, are important to people living in these communities, and if these variables do not fit within pre-established methodological frameworks, the solution to these water challenges cannot be to simply omit these variables from analyses, or to avoid this type of research altogether. The solution must be to ask alternative research questions. Western knowledge systems are compartmentalized, and therefore the research questions that emerge within this knowledge system are also compartmentalized. Though this represents one of the strengths of Western knowledge, this does not necessarily fit within Indigenous

\textsuperscript{27} Reconciliation, as stated by the National Centre for Truth and Reconciliation, is defined as “an ongoing process of establishing and maintaining respectful relationships” (TRC, 2015, p. 16).

\textsuperscript{28} Decolonization is used here to describe actions that reverse the oppression of colonialism on Indigenous peoples.
knowledge systems that use a more wholistic perspective. Identifying research questions that address the wholistic nature of water, and the subsequent creation of spaces to develop new methods in conjunction with the community research partners to address these questions, can provide opportunities to implement the expertise of both parties. In doing so, researchers can bridge this gap between differing systems of knowledge and values in relation to water resources.

4.5.2 Structures of Power

Central to the tenets of meaningful engagement of local Indigenous communities and the implementation of Indigenous Ways of Knowing is an understanding of power structures, and a subsequent redistribution of power within the research process. These structures of power are evident within both the socio-political realm, and the researcher-community partner realm. Indigenous communities in both Canada and Australia face similar challenges in relation to power dynamics where only recently have governance structures and academic researchers begun the process of the redistribution of power in water research and management.

In Canada and Australia, respondents referred to socio-political dynamics related to the history of colonialism. This history, and its ongoing manifestations, has created an environment in which Western science is heavily favoured, and Indigenous knowledge and knowledge holders are often included in a tokenistic manner in resource governance discussions. Within this argument are the complexities associated with stakeholders and stakeholder engagement. In Canada, for example, First Nations peoples are not just stakeholders with an interest in the results of a project – they are rights-holders vis-à-vis our Constitution and through Treaties. Within this Canadian context, the recently elected federal government has acknowledged the need to enter into a Nation-to-Nation relationship with First Nations in order to rectify the imbalance of power that currently defines Indigenous–state relations, though time will tell if these campaign promises materialize.
According to our data, one way to address issues in socio-political power structures could be through uniform federal policies for governance of water and other resources, such as the NWI in Australia. The NWI serves as a starting point, as it requires that water managers account for Indigenous groups, although it does not address how such implementation is to take place. This ambiguity has led researchers to seek new methods and models that can allow for meaningful engagement and successful implementation of both Western and Indigenous Ways of Knowing. The challenge, as with any attempted uniform policy, is the unintended consequence of such a broad application of guidelines. The strength of a federal water policy would lie in the requirement to engage with Indigenous peoples and to implement both Indigenous and Western knowledge systems.

To help rectify power imbalances in research relationships, respondents from both Canada and Australia unsurprisingly referenced the tenets of community-based participatory research as an appropriate avenue to explore when undertaking research on water resource management. Establishing relationships with communities and working together as equals in the development of research from the proposal stage through to publication and dissemination of results. While community-based participatory research is easy to recommend, it takes a serious commitment of time, energy and resources, and this is made difficult by the possibility of change in a person’s circumstance. There is no way to ensure a person remains in their role – as a researcher or a community partner – and this presents one of the difficulties (along with financial, publication, and time constraints) that participants mentioned in reference to their community-based work. Despite these (and other) challenges, participants in both Canada and Australia have suggested that taking a community-based participatory approach to their research has proven to be a successful way to support the implementation of Indigenous and Western Ways of Knowing in water research and management.

4.5.3 Implementation of Knowledge
In order for the strengths of Indigenous knowledge to be operationalized alongside the strengths of Western knowledge to benefit all communities, government officials, researchers, and community members must account for and overcome barriers to implementation. Participants from both Canada and Australia described these barriers to implementation in two ways: a lack of support for implementation in its current form and implementation efforts that result in unequal distribution of benefits. Participants concluded their discussions of knowledge implementation research with the ‘lessons learned’ from their own processes.

In instances where participants did not support the implementation of Indigenous knowledge, they cited criticisms with members of the ‘old guard’ within government organizations that simply do not believe that community members, or their Ways of Knowing, have a place in resource governance discussions. As one participant noted, “We had managed to get the [Indigenous leadership] council on board, and the communities on board, but within the [government] agency itself, there were very stalwart bureaucrats that don’t believe that the community should be involved in water management at all, let alone Indigenous communities” (Researcher A2). This participant went on to explain that if one side was not sincere in their desire to implement, projects designed to implement both Indigenous and Western knowledge will inevitably fail. Additionally, both Australian and Canadian interview participants discussed their hesitancy to implement Indigenous Ways of Knowing with Western Ways of Knowing when it was not clear that decision-makers were sincere in their intentions. This fear that organizations were merely ‘checking a box’ under the guise of meaningful implementation efforts and wanted to continue with a ‘business as usual’ approach was the strongest factor in limiting research participants’ support for the implementation of Indigenous and Western knowledge systems.

Avoiding tokenistic engagement that resulted in unequal distribution of benefits between researchers and community members was also discussed as a primary concern for researchers in relation to the implementation Indigenous and Western knowledge systems in water research and management. This
concern was primarily raised by Canadian researchers, and only given peripheral acknowledgement from Australian researchers. In Canada, there is a strong belief from participants that those in power, and more specifically, those that stand to gain or lose the most money, are the ones that still make all of the water resource decisions according to Western Ways of Knowing. As one participant noted, “Things don't matter until it matters to the money people it seems, and that's the way the world works” (Researcher C6).

Participants also stated that organizations sought to consult with Indigenous community members only after the project was nearing completion, or consulted with Indigenous community members in an ‘appropriate’ manner prior to the start of a project but did not actually intend to implement any of the concerns raised in those consultations. In Australia, concerns were raised regarding a reduction in community willingness to participate in studies based on a history of improper research practices. This reluctance to participate is partly attributable to the lack of tangible benefits resulting from community participation in water-related research projects.

In discussions of their lessons learned, participants from both Canada and Australia identified the use of integrative Indigenous and Western research methods and models as a potential pathway to better manage water resources. While integrative research is taking place in both Australia and Canada, specific research methods for undertaking this type of research were rarely mentioned by interview participants. Instead, researchers discussed community-based participatory research, which is more of a philosophical orientation towards conducting research in an ethical manner than it is a research method (Castleden et al., 2015b). The philosophical guidance offered by Australian and Canadian participants stressed the importance of relationship building, equitable partnerships, and equal distribution of benefits, among others, in order to meaningfully engage with Indigenous community partners, and to implement both Indigenous and Western Ways of Knowing to take care of water.
4.6 Implications

While the focus of these interviews was on the topic of water, it should be noted that many of the conclusions that emerged from this research have implications beyond the realm of water and often provide a commentary on the relationship that exists between Indigenous and Settler populations and our lived experiences in place. Academics seeking to conduct research that implements both Indigenous and Western systems of knowledge should consider what this means in the context of a particular research project. While researchers within this field often do not lack the understanding of just how much time, energy, and resources are required to successfully implement Indigenous and Western knowledge systems through meaningful engagement with research participants, participants have stated that there is a need for this same level of recognition from a broader audience – particularly those within government and academic environments such as policy-makers, granting agencies and publishers. At present, these institutions have recognized the value of using multiple knowledge systems to overcome water-related challenges; however, recognition that knowledge implementation should occur and enacting policies that require this implementation have not led to a clear articulation of how multiple knowledge systems can be implemented (for further discussion on articulation challenges, see Zwicky, 2012). Improving institutional understanding as well as providing funding and resources to researchers working to address these questions of how to implement Indigenous and Western knowledge would allow for researchers to better overcome the many obstacles that impede the meaningful engagement between community and researcher as it relates to water research and management.

4.7 Limitations

This study was limited to only those participants who had authored academic publications and self-identified as having conducted research on the topic of knowledge integration in water research and management. The research was conducted only in English, which is a limitation as it excludes French, the other official language in Canada. Like most qualitative studies that use interviewing as a data collection
method, this research was subject to the level of interest and willingness to share information on the part of the research participants. Another limitation to this project was that most (16 of 17) of the participants that were recruited and agreed to participate were of a Settler heritage, and all were academically-trained researchers (despite not all remaining in academia). Therefore, the results of my study represent mostly the perspectives of the Western/ academic-trained researchers and does not include Indigenous community member perspectives. The next logical step for this research would be to contact and conduct similar interviews with the community partners that worked with those interviewed for this study. Doing so would provide community-based Indigenous perspectives on the same research project, leading to additional research insights.

4.8 Conclusion

The implementation of Indigenous and Western knowledge systems occurs within large structures of power and disparate understandings of our relationship with water. The purpose of this paper has been to explore researchers’ experiences in conducting integrative water research and management in Canada and Australia by providing researchers with an opportunity to expand on the details of their approach beyond what has been written in published literature. On the whole, participants supported the tenets of community-based participatory research methods, including relationship building, fostering trust, and community ownership over the research process, as an effective way forward in the relationship between community partners and researchers.

Water is a transboundary resource and its protection requires cooperation between many levels of government. But water is more than just a resource that needs to be managed – water is life. Without water, neither Indigenous nor Settler populations can survive. We all have a stake in ensuring water is protected, and to date, the exclusive use of Western sciences has failed to provide access to safe water for Indigenous people in Canada, Australia, and beyond. Continuing to design research and management practices according to Western-based questions and then seeking Indigenous-based solutions will
continue to hamper implementation efforts. The wholistic nature of Indigenous knowledge lends itself to addressing the root of the problem, rather than identifying solutions. To account for this, researchers and managers should consider altering the questions, and then collaboratively determining an appropriate strategy to address these questions (Fowler & Hobbs, 2009). We need to establish equitable, meaningful partnerships designed in a manner that will support the strengths of both Indigenous and Western Ways of Knowing in an effort to take care of water, both for the present and future generations.
4.9 References


Chapter 5

Conclusion

5.1 Introduction

Indigenous peoples have existed in their homelands for thousands of years and despite colonization, assimilation, and genocidal efforts, still exist today on each of the six inhabited continents. The four colonized countries that I have studied within the context of my research – Canada, Australia, New Zealand, and the United States of America are each comprised of the traditional territories of many diverse Indigenous groups that have the right to be treated as equals while also having the right to “maintain and strengthen their distinct political, legal, economic, social, and cultural institutions” (UNDRIP, 2009, Article 5). However, despite recognition of these rights and millennia of successful stewardship (Ross, 2011), these rights and stewardship responsibilities have been undermined through the processes of colonial domination, and the exploitation of our natural resources has, in a matter of only a few hundred years, brought us into an era of global water crisis. (Barlow, 2009; 2010; Watkins, 2006).

Disparities in access to safe and sufficient water sources is a persistent issue in both regions from which interview participants were recruited – Canada and Australia, while issues related to legal rights to water were found to be the most discussed in New Zealand and the United States. In Canada, approximately 1 in 6 First Nations communities are currently experiencing a drinking water advisory (Health Canada, 2016; First Nations Health Authority, 2016). While data for Inuit and Metis communities are not readily available, there are no indications that either Inuit or Metis communities have access to substantially higher quality water resources (Harper et al. 2011; Martin et al., 2007). While it is issues relating to water quality that are most prevalent in Canada, over-allocations of water for agriculture and the resulting issues of water quantity are the more prevalent issues for Indigenous people in Australia (Bark et al., 2012). In the United States, the Winters Doctrine and the impact of that legal decision on current policy was discussed most often (e.g., Shupe, 1985; Cosens, 2012; Osborn, 2009), whereas the importance of the
Waitangi Tribunal in ensuring Treaty obligations (including those related to water) were met in New Zealand was stated (e.g., Memon & Kirk, 2011; Salmond, 2014). As discussed in Chapters 1, 3 and 4, researchers and policy-makers alike have attempted to remedy these water-related challenges (with varying degrees of success); however, it remains apparent that researchers and policy-makers in Canada, Australia, New Zealand, and the United States continue to struggle with the implementation component when meaningfully engaging with Indigenous communities. An interview participant framed this difficulty best when stating: *We now know what we need to do. But how do we do it?* (Researcher C3). Throughout this thesis, I have examined this question in relation to my research goal to call attention to, and advance the value and validity of using both Indigenous and Western knowledge systems in water research and management so that we can better care for water.

The study emerged from a larger national project that sought to identify the most promising methods and models for doing integrative water research that was undertaken by four principal investigators from Queen’s University, Cape Breton University, Dalhousie University, and the University of Guelph and was funded by the Canadian Water Network. Within the context of the goals of this larger project, and applied across three new contexts of Australia, New Zealand, and the United States, my research sought to achieve the following five objectives:

*Research Objective 1* – Identify past and ongoing water-related academic research that has attempted to implement Indigenous knowledge systems;

*Research Objective 2* – Synthesize the methods and models used within these studies that support the implementation of Indigenous and Western knowledge systems.

*Research Objective 3* – Examine and highlight divergent perspectives and approaches (if any) between researchers.

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29 Dr. Heather Castleden, Dr. Ashlee Cunsolo, Dr. Debbie Martin, and Dr. Sherilee Harper, respectively.
Research Objective 4 – Present evidence demonstrating the strengths and weaknesses of current research practices in their ability to create value for Indigenous communities.

Research Objective 5 – Provide recommendations for future research projects that seek to implement – in a meaningful and appropriate manner – Indigenous and Western knowledge systems in water research and management.

As a research assistant serving on the aforementioned CWN project, I conducted various aspects of both the Combined Systematic Realist Review (CSRR), as well as the semi-structured interviews (including analysis). Drawing on my experiences working on the Canada-wide project, I designed my thesis study to replicate the research process in three new contexts: Australia, New Zealand, and the United States. Upon completion of a second CSRR involving these countries (and the Canadian data), I became aware that the largest amount of literature that was relevant to my project emerged out of the Australian context, therefore I decided to pursue semi-structured interviews with researchers that were based in Australia. Data from both the CSRR and the semi-structured interviews were analyzed thematically using the process of induction whereby the codes that I used emerged from the data. From these processes, seven key findings emerged, each of which are described below.

5.2 Substantive, Methodological, and Theoretical Contributions

The contributions of this thesis are divided into three sub-sections that detail the key findings from my thesis research. First, the substantive contributions are discussed and presented in two sub-sections (Section 5.2.1). Sub-section 5.2.1.1 outlines the key findings from the CSRR component that was conducted on literature from Canada, Australia, New Zealand, and the United States. Sub-section 5.2.1.2 describes the key findings that emerged through semi-structured interviews with researchers from Canada and Australia, as well as how these interview findings build upon the CSRR findings. Section 5.2.2 identifies the methodological contributions that I have made, and Section 5.2.3 details the theoretical contributions that I have made in my thesis.
5.2.1 Substantive Contribution

5.2.1.1 CSRR Findings

**Finding 1:** Academic researchers recognize the importance of implementing both Indigenous and Western Ways of Knowing; however, their discussion of the processes that support implementation is often absent from the literature.

Upon completion of the CSRR, it was apparent that interest in integrative research that combines the strengths of Indigenous and Western Ways of Knowing is on the rise in each of the four regions of study. The majority of articles that were included in the review discussing the importance of implementation were published after 2009 (Canada: 69%; Australia: 84%; New Zealand: 86%; United States: 50%; See Figure 3.1 – Dates of Publication). While it is promising that there is an increase in both publications and researcher interest in the topic of implementing Indigenous and Western Ways of Knowing in water research and management, the discussion of the integrative research process that was used (successfully or unsuccessfully) is often not a rich one, if it exists at all. In fact, less than half of projects in Canada (33%), Australia (24%), New Zealand (28%), and the United States (42%) discussed actually implementing both Ways of Knowing within the included article (Figure 3.24 – Integration of Indigenous and Western Sciences). This finding may be attributed to the complex nature of integrative research and the difficulties associated with attempting to articulate this process in the context of a published peer-reviewed article.

**Finding 2:** The dominant voice in this area of study is not an Indigenous one, as the majority of first authors do not self-identify as Indigenous.

Of the included literature in the CSRR, very few of the first authors self-identified as being an Indigenous researcher/manager (with the exception being the New Zealand context which included 50% Indigenous first authors). In Canada (11%), Australia (4%), and the United States (8%) (See Figure 3.4 – First Author Self-Identification as Indigenous) the percentage of literature authored by Indigenous researchers was
quite low. This indicates that the dominant voice in the peer-reviewed literature within this research field is not that of Indigenous peoples. The high number of non-Indigenous first authors suggests that while collaborative research may have taken place, non-Indigenous experts are more prevalent in the leading roles in integrative water research.

**Finding 3:** When examining the lead authors of included literature in the CSRR, there is an abundance of social scientists and a relative absence of engineers, health scientists, and natural scientists.

Order of authorship is a complicated issue, and while guidelines are in place to assist in the determination of order of authorship (such as the APA Ethics Code, 2002; 2010), we know these standards are not universally applied across academic research (Geelhoed et al., 2007). Operating on the assumption that the researcher that designed and led the research project was given first authorship (see Spiegel & Kieth-Spiegel, 1970; Bartle et al. 1992), I analyzed the background of each first author to determine which discipline had the highest representation in the CSRR literature. I found that social sciences had a much stronger representation in the data. This was illustrated by the abundance of qualitative, social scientists leading manuscripts in this field, and a relative absence of natural scientists, health scientists, and engineers leading manuscripts (see Figure 3.5 – First Author Background). Academic institutions are inherently compartmentalized (e.g. schools, faculties, departments, specializations) and this is not a weakness of Western knowledge as it has allowed for the generation of intricate understandings of specific aspects of our world. This finding about the underrepresentation of engineers, natural scientists, and health scientists in integrative water research is an important one as the sharing of knowledge within integrative partnerships as they relate to water is not presently realized across all of the Western sciences. The absence of certain Western science experts from the field of Indigenous knowledge implementation (including engineers, natural scientists, and health scientists) limits the ability of the entirety of Western science to both contribute Western specific expertise to integrative water discussions, as well as the ability to learn from the expertise of other knowledge systems (Martin et al., 2010), which detracts from
the prospects of Indigenous knowledge systems permeating the realm of water research and management at a grand scale.

**Finding 4**: *Researchers conducting research in this field favoured the use of Western research methods in comparison to Indigenous research methods.*

It goes without saying that the implementation of Indigenous and Western Ways of Knowing cannot be done if Western-derived research methods are used alone within a dominant (Western) research paradigm. Cree scholar Shawn Wilson (2008) posits that relational accountability (researchers as actors and interpreters in and of our relationships with each other and the cosmos) is the key to determining whether or not research methods fall within an Indigenous research paradigm. Wilson (2008) goes on to state that “traditional Indigenous research emphasizes learning by watching and doing” (p. 40), though participatory research methods are not necessarily required as long as the borrowed methods are consistent with an Indigenous research paradigm. Kovach (2005) also argues that ensuring value for the community is integral to Indigenous methods and Indigenous research paradigms as a whole.

From these understandings of Indigenous research methods and Indigenous research paradigms, I have found during my analysis that research methods that support the relational accountability that Wilson (2008) discussed, and provide the community value that Kovach (2005) referred to (such as collaboratively designed seasonal calendars, for example), continue to be under-utilized, or not well-explained by the academic research community in the context of the peer-reviewed literature. The use of Indigenous research methods was articulated in only 13% of the included records from Canada; 17% of Australian records; 12% of records from New Zealand; and 0% of records from the United States. Effective implementation of both knowledge systems requires Western and Indigenous epistemologies,

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30 As argued by Wilson (2008), as long as the research methods used fit the epistemology, ontology, and axiology of an Indigenous research paradigm (including relationality), these methods can be borrowed from other research paradigms.
ontologies, axiologies, and methodologies to be included in research. Such low usage of Indigenous methodologies suggest that Indigenous Ways of Knowing are not being implemented in research as often as Western Ways of Knowing, which may be attributed to factors that were discussed in further detail in the interview portion of my research, including the requirement from funding agencies to fully articulate a research plan *prior* to meeting with communities.

5.2.1.2 Interview Findings

**Finding 5**: *Indigenous and Western Ways of Knowing influence the ways in which we know and relate to our water, and these differences present an opportunity to share our understandings and continue a co-learning journey to take care of water.*

Throughout the interview process, participants repeatedly discussed the local and place-based nature of Indigenous Ways of Knowing, noting that Indigenous knowledge is bound to specific places, and has a level of relationality whereby we as humans are acting in a relationship with each other and our world (including our water), and have a responsibility to take care of these relationships. This differs from conventional Western Ways of Knowing which have positivist roots in the search for universal and objective truths and seek to understand our world through fragmentation and specialization in various disciplines. While the move away from the search for up-scaled objective truths is more readily apparent in the social sciences, this shift is apparent less so in the natural sciences, health sciences, and engineering disciplines. Despite these differences, both Indigenous and Western Ways of Knowing are dynamic, and it is this continually evolving nature that indicates that Indigenous and Western Ways of Knowing have not developed entirely separate from one another – as Indigenous and Western experts have existed together in close proximity since the time of colonization. Both Indigenous and Western Ways of Knowing have changed and adapted through years of co-existence, and it is for this reason that both Ways of Knowing can continue to co-exist, and experts can continue on a co-learning journey that uses the strengths of both Ways of Knowing for the benefit of all (Bartlett et al., 2012).
Finding 6: Power plays an important role in the relationship between Indigenous communities and researchers, as well as Indigenous government and national government institutions.

Participants repeatedly stated that broad socio-political dynamics as well as researcher power should be considered in the design and operationalization of research that seeks to implement Indigenous and Western knowledge systems. In regards to socio-political power, I found that most research participants recognized the fact that Indigenous communities are more than just one of many stakeholders with an interest in addressing environmental challenges, they are rights-holders. Therefore, participants stressed that any agreements about the state of natural resources are to be done at a Nation-to-Nation level. This is important as too often Indigenous rights, interests, values, and perspectives have not been respected, and this furthers the disparity that exists in access to safe water (von der Porten & de Loe, 2013).

The role of interpersonal power dynamics is also evident throughout the research process and must be addressed by researchers attempting to implement Indigenous and Western Ways of Knowing. Participants discussed their awareness of others’ inappropriate research engagement with Indigenous community partners as being either tokenistic, whereby consultation occurred after project completion, or ineffectual, whereby consultation occurred but the results were not implemented in the final research design. To remedy some of these issues of power, research participants often referred to the tenets of community-based participatory research. I have found that being humble, honest, and sincere in commitments to equitable partnerships predicated on respect between a research team and a participating community partnership are integral to conducting meaningful and effective community-based participatory research and knowledge implementation research.

Finding 7: Implementing Indigenous Ways of Knowing requires overcoming challenges that include: A reluctance to include local populations, tokenistic engagement, and financial and temporal resource constraints associated with research conducted in rural and remote communities.
First, implementation is often impeded by a hesitation or reluctance on behalf of decision-makers (e.g., NGOs, city planners, government officials, civil servants, funding bodies) to include Indigenous and Western perspectives within the decision-making process. Participants cited a belief that some members of ‘the old guard’ did not feel that Indigenous community members should influence how decisions are made, and instead this process should be left to those who have been trained (in Western approaches to policy and resource management) to make such decisions. This finding is important as decision-makers play a vital role in water policy development and must support the validity of in situ, Indigenous knowledge if meaningful engagement and Indigenous knowledge implementation are to occur.

The second obstacle that was identified by researchers was the insincere and/or effectual implementation of knowledge, despite a willingness to engage with Indigenous communities. Participants noted that ineffectual implementation occurs for one of two reasons: First, that researchers and industry representatives can be insincere and do not really intend to implement additional Ways of Knowing – that researchers want to ‘check the box’ stating that Indigenous peoples participated in the research, or that government and industry must meet the duty to consult and engage with Indigenous leaders prior to conducting ‘business as usual’. This tokenistic engagement is problematic and quite destructive to the prospects of future partnerships between researchers or managers and Indigenous communities. As participants noted, if consultation is sought but the information and values that are shared are not implemented in final policy, communities will be less likely to participate in future projects.

The third factor that may cause ineffectual implementation to occur is associated with an inability to commit the necessary resources – be they temporal or financial – to ensure that results are brought back to the community partners. I found that participants often cited distance to and from the study site as the primary cause of the financial and temporal constraints preventing implementation within their own projects – particularly those participants that worked in the remote northern territories of Canada and Australia. As well, funding opportunities that require the articulation of a detailed research proposal prior
to speaking with communities was cited as an obstacle preventing collaborative research design that may led to mutually beneficial integrative water research and management.

5.2.2 Methodological Contribution

One of the most notable findings from the CSRR was that while implementation of Indigenous and Western knowledge systems was often stated in the context of academic literature, a rich discussion of the processes that supported or hindered this implementation was often lacking. I sought to remedy this by providing researchers with an opportunity to expand on their experiences through interviews. I asked interview participants to detail the project design, as well as the strengths, barriers, and opportunities they had experienced while conducting integrative water research in Canada and Australia. This additional insight gleaned from interviews about the implementation process also represents an area where my research project can contribute to the literature. While there is much that can be derived from an analysis of the literature, my project illustrated that researchers hold additional knowledge about the implementation process that often does not appear in their peer-reviewed published literature.

5.2.3 Theoretical Contribution

The guiding principle of Two-Eyed Seeing was developed in 2004 by Mi’kmaw Elder Albert Marshall, using the wisdom gained from Elders in that area, and was shared with Institute for Integrative Sciences and Health at Cape Breton University as part of a co-learning journey. Though this principle was developed over a decade ago, it has only recently gained prominence in academia outside of the Institute for Integrative Science and Health (e.g., Martin, 2012; McKeon, 2012; Lavallee & Levesque, 2013; Marsh et al., 2015). Two-Eyed Seeing is also being fostered by the Canadian Institutes for Health Research – Institute of Aboriginal Peoples Health, as it has recently been included as part of its strategic plan for funding opportunities (CIHR-IAPH, 2016).

As Two-Eyed Seeing is so new as a theoretical framework, my research contributes to the emerging peer-reviewed literature that employs this framework. The implementation of Indigenous and Western
knowledge systems requires community partners, and researchers and managers to undertake a co-
learning journey where the strengths of both knowledge systems can emerge. Applying this framework to
the context of water research and management in Canada, Australia, New Zealand, and the United States,
my research allows for further examination of the applicability and merits of this framework as a way to
implement both Indigenous and Western Ways of Knowing.

5.3 Recommendations

After an analysis of the results of my study, I identified six research- and policy-oriented
recommendations. The four research-oriented recommendations are tailored towards academic
researchers that intend to implement Indigenous and Western Ways of Knowing to better take care of our
water resources. The two policy-oriented recommendations are actionable items intended for an audience
of water managers and policy decision-makers.

5.3.1 Research-Oriented Recommendations

**Recommendation 1** – *Research teams should consist of both Indigenous and non-Indigenous team
members.*

As discussed throughout my thesis, knowledge systems are not something that can be extracted from a
group of people beyond the time and place through which this knowledge was created. This means that
Indigenous knowledge systems cannot be selectively ‘cut and pasted’ from one community context and
added to any Western-designed research projects (Berkes et al., 2007). Understanding that a non-
Indigenous voice is still the most prevalent in this realm, my analysis revealed that in order to strengthen
the Indigenous voice within this area of study, Indigenous academics and experts should take on a leading
role in guiding the goals and direction of integrative research projects and research teams should be
comprised of Indigenous and non-Indigenous experts. (Jackson et al., 2012). Not only should teams be
comprised of both experts, but both sets of experts should have an equal opportunity to share their
knowledge, make binding decisions, and guide the direction of the water project. Doing so will allow for knowledge translation and mobilization to occur between knowledge-holders.

**Recommendation 2 – Community-based participatory research should be used when implementing Indigenous and Western knowledge systems.**

Community-based participatory research is an effective approach to research that can lead to meaningful engagement with Indigenous communities and the implementation of Indigenous and Western Ways of Knowing. Spending time living and working in the community is important as it allows for a trusting relationship between parties to develop, and for both parties to discuss the challenges that are most important to the community and the research team (Jackson et al., 2012, Castleden et al., 2012). These discussions are essential to ensuring that any proposed research project has meaning and utility to all those who are involved. Community-based participatory research requires a great deal of both temporal and financial resources, and can fail if these resource commitments are underappreciated. As one interview participate stated, “…knowledge integration work is expensive … it takes time to do it properly. It takes investment from people on both sides, and that is something that really needs to be recognized. It is not something that should be entered into lightly” (Researcher A3). The results of the research project must be communicated back to the community in order for meaningful changes to take place and justify the research, and this too must be factored into resource commitments.

**Recommendation 3 – The findings from case-based, integrative water research in Indigenous communities should not be assumed to be translatable or representative of all other cases.**

Researchers entering into partnership with Indigenous communities should do so with an understanding that the results of the research may or may not be representative of the specific community as a whole, and may or may not be representative or translatable in other communities. The generalizability and translatability of case study research, and the merits of doing so, is a contentious issue (Flyvberg, 2006),
and therefore my finding is not directed at case studies as a whole. Instead, this finding is concerned with the fact that while Indigenous knowledge can be used to refer to the vast amount of knowledge held within many Indigenous communities, there are differences in knowledge, values, and perspectives between these communities. Therefore, it is unreasonable to assume that the results of the research represent an official position on the matter being studied. The issue lies in the assumption, and it becomes problematic when research results are communicated as an official position. I recommend that during preliminary discussions, it should be communicated that as a researcher, you are not attempting to establish an official position on any of the matters that are discussed throughout the research process. Due to the dynamic nature of knowledge systems, most conclusions are fixed to a specific time and place and may change throughout the course of a research project and beyond.

**Recommendation 4 – Effective implementation of Indigenous and Western knowledge systems requires co-designing research within new research paradigms.**

Implementation of Indigenous and Western knowledge systems cannot occur when the strengths of one system of knowledge are favoured over the strengths of the other. In order to ensure that both knowledge systems are given equal value throughout the project, researchers should first remain humble about the strengths of their own skills within a Western knowledge system and recognize that community partners that have lived within the area of study have much to contribute to our growing understanding of how to take care of our water. Second, modesty is important for researchers when discussing the anticipated benefits of the research as well as how each party stands to benefit from the results of the research. As one research participant noted, “one of the things that can be frustrating for Indigenous people is to talk to a researcher and … have that engagement occur really productively, but at the end of the day, relative to a large array of other forces in wider society, researchers aren’t very powerful … in terms of influencing broader debates, there can be times where research is frustratingly limited in its ability to influence the circumstances (Researcher A3). Both researchers and community partners have areas of expertise that can
be used toward overcoming water-related challenges, and recognition by both parties of the strengths and limits of both Indigenous and Western sciences will allow for effective collaboration to occur.

5.3.2 Policy-Oriented Recommendations

**Recommendation 5** – *Develop and implement a federal water governance policy.*

At present, water-related governance and management is the jurisdictional responsibility of the provinces, territories, and municipalities in Canada, whereas the relationship between First Nations, Inuit, and Metis Peoples and the Canadian State as framed within the context of the Canadian Constitution must necessarily occur at the federal level. This creates a tiered system of governance that often impedes the implementation of Indigenous knowledge and the progress towards sufficient access to safe water. Australia has a similar governance structure whereby water is managed at the state level, though they have had moderate success in remedying this issue by developing and enacting a national water initiative that binds all states and territories to one water governance structure, and explicitly states a requirement to engage with, and implement the ideas and concerns of Indigenous community members wherever possible (COAG, 2004). While Canada has had some success at developing such policy initiatives at the provincial level (e.g., the Northwest Territories Water Stewardship Strategy), there is no such initiative at the federal level. Provinces and territories of Canada should collaborate with federal and Indigenous governments to develop a similar national water governance plan that accounts for the unique challenges and additional knowledge systems that are present within First Nations, Inuit, and Metis Nations, without being overly prescriptive in a manner that does not account for community differences. Such a plan can make the implementation of Indigenous and Western Ways of Knowing mandatory, while differing to Indigenous governments for how this implementation can best occur.

**Recommendation 6** – *Conduct water management discussions with Indigenous communities at a Nation-to-Nation level.*
Indigenous populations are the traditional stewards of the lands within each of the countries studied within my thesis project. While each of these countries have a different set of constitutional requirements for engaging with Indigenous populations at the federal and state level, policy makers should engage with Indigenous people in discussions about water at a Nation-to-Nation level. As the original inhabitants of these lands, it can be argued that Indigenous communities have a greater claim to the waters than any federal government does and so agreements should be negotiated with that in mind. Because Indigenous Nations are more than just one of many groups of stakeholders with an interest in having access to safe drinking water, their water-related perspectives, values, and concerns must be negotiated with federal governing institutions as Nations in order to implement Indigenous and Western Ways of Knowing and support equal access to safe water.

5.4 Limitations

While time and resources are an obvious limitation to any study, this research was further limited to only the peer-reviewed academic literature that was successfully published in English in reputable journals and available online using specific database searches. These parameters may have resulted in the exclusion of important literature produced by community members or organizations with similar goals of integrative knowledge implementation for water research and management. In the context of this research project, we may have erred in assuming that the first author listed in the CSRR was the Principal Investigator and contributed the most to the design and writing in terms of what they chose to include or leave out, though we acknowledge that not all publications follow these authorship guidelines.

This study was also limited to only those participants who had authored academic publications and self-identified as having conducted research on the topic of knowledge integration in water research and management. Like most qualitative studies that use interviewing as a data collection method, this research was subject to the level of interest and willingness to share information on the part of the research participants. Another limitation to this project was that most (16 of 17) of the participants that were
recruited and agreed to participate were of a Settler heritage, and all were academically-trained researchers (despite not all remaining in academia). The next logical step for this research would be to contact and conduct similar interviews with the Indigenous community partners that worked with those interviewed for this study. Doing so would provide community-based Indigenous perspectives on the same research project, leading to additional research insights.

5.5 Concluding Comments

With the available 21st century technological resources, as well as our level of expertise on the matter, it is reasonable to suggest that access to safe water should not be an issue for any community globally. Yet it is disheartening that within the so called ‘first-world countries’, water remains an issue for a significant portion of Indigenous communities (WHO, 2003). As researchers and water managers continue to strive for new methods and models to help remedy these water-related challenges, it is important to step back and evaluate the work that has been done so far to see the gaps and lessons learned by those working at the leading edge of integrative Indigenous and Western water research and management – and that is what I have attempted to do in this body of work. By conducting interviews with researchers that are attempting to implement Indigenous and Western knowledge systems in their work, I was able to further understand the strengths, opportunities, and challenges that are associated with this type of research, and synthesize these results in the context of my research findings. Despite water being the central focus of my thesis, many of these results are not exclusive to water-related challenges, and in fact speak to the broader relationships between governments, researchers and communities, and Western knowledge systems and Indigenous knowledge systems. Approaching these relationships from a position of respect, reciprocity, humility, and understanding can go a long way towards reconciling relationships between Indigenous and Settler peoples, and with the waters that we all rely on.
5.6 References


Appendix A
CSRR Included Literature – Canada


10. Gearheard, S. et al. (2006). "It's not that simple": A collaborative comparison of sea ice environments, their uses, observed changes, and adaptations in Barrow, Alaska, USA, and Clyde River, Nunavut, Canada.


23. Nichols, T., Berkes, F., Jolly, D., Snow, N., & The Community of Sachs Harbour. (2004). Climate change and sea ice: Local observations from the Canadian Western


34. von der Porten, S., de Loë, R.C (2013). Collaborative approaches to governance for water and Indigenous peoples: A case study for British Columbia, Canada.


**Second Search (Oct 2014-2015)**


Appendix B

CSRR Included Literature – Australia


Appendix C
CSRR Included Literature – United States


Appendix D  
CSRR Included Literature – New Zealand


Appendix E
CSRR Reporting Tool Questions

DESCRIPTIVE

1. Year Published:
2. Journal title:
3. Title of article/research project:
4. Type of article:
5. Classification of article:
6. First author affiliation:
7. Does the first author self-identify (in the text of the article) as Indigenous?
8. First author background:
9. Contact information:
10. Corresponding author affiliation (if FA different from CA):
11. Corresponding author background (if FA different from CA):
12. Funding agency:

CONTEXT

13. Geographic Focus:
14. Project Lead (if stated):
15. Who does the project involve?
16. Was an Indigenous community/organization partner identified?
17. Is water the main focus?
18. How is water incorporated in this study?
19. What was the research purpose?
20. Does the article acknowledge Treaty and Aboriginal rights that recognize the right to clean water? If so, in what way?
MECHANISMS

21. What methodology/methodologies were used?

22. What research methods were used?

23. Did the authors distinguish between Indigenous and Western methodologies and/or methods?

24. How were Indigenous methodology/methods defined?

25. How was Indigenous knowledge defined?

26. Was the integration of Indigenous and Western science/methods stated explicitly?

27. Were integrated/integrative processes identified, and if so, how?

28. How were integration/integrative processes defined?

29. What description of the research relationship or community-based research approach was provided?

30. Limitations acknowledged?

OUTCOMES

31. Are any of the findings specifically directed at integrated water management? If yes, what were they?

32. How was Indigenous knowledge implemented?

33. What benefits to the community and beyond were discussed?

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<th>Combined systematic realist review Reporting Tool</th>
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<td>Year in which the article was published.</td>
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<td>- Full length</td>
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<td>- Conference Paper</td>
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<td>- Workshop Summary</td>
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<td>- Water Stewardship Strategy</td>
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### 5. Classification of Article

**Classification of article:**
- Theoretical
- Empirical with data
- Mixed
- Water Stewardship Strategy
- Workshop Summary
- Report
- Reflection Paper
- Other (please specify)

### 6. First Author Affiliation

Information about the first author (the institution/organization) that the author was associated with when they produced the article. First author affiliation can usually be located within the article (below abstract or at the end of the article). In cases where an association is not provided, Google search engine will be used to identify the primary affiliation at the time of the publication.

- Researcher
- Government
- NGO
- Civil Society
- Other (please specify)

<table>
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<tr>
<th>Researcher</th>
<th>Individual is associated with an educational institution (University of College). Also includes individuals working for private and/or for profit company conducting research for the purpose of fulfilling company goals and objectives.</th>
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<td>Government</td>
<td>Individual working for or in association with a municipal, provincial, federal or international government body.</td>
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<td>Non-governmental Organization</td>
<td>Individual working for or in association with a non-profit organization on the work in question.</td>
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<tr>
<td>Civil Society</td>
<td>Public servants (e.g. health care professionals, legal practitioners, public safety personally) or any others whose primary profession is to serve the public, but who is not a government employee.</td>
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### 7. Does the first author self-identify (in the text of the)

Does the first author self-identify (in the text of the article) as Indigenous, Inuit, First Nations or Métis/Métis?
| **article** as Indigenous, Inuit, First Nations or Métis/Métis? | • Yes (Give details)  
• No |
|---|---|
| **8. First Author Background** | Department in which the first author is affiliated with at the time of publication. This will usually be identified within the article, if not provided, Google will be used to identify the primary affiliation at the time of publication.  
• Health  
• Science  
• Social Science  
• Engineering  
• Geography  
• Interdisciplinary  
• Other (please specify) |
| **9. Contact information** | Corresponding author listed and email address. |
| **10. Corresponding Author Affiliation (if FA different from CA)** | Information about the first author (the institution/organization) that the author was associated with when they produced the article. First author affiliation can usually be located within the article (below abstract or at the end of the article). In cases where an association is not provided, Google search engine will be used to identify the primary affiliation at the time of the publication.  
• Researcher  
• Government  
• NGO  
• Civil Society  
• Other (please specify) |
| **11. Corresponding Author Background (if FA different from CA)** | Department in which the first author is affiliated with at the time of publication. This will usually be identified within the article, if not provided, Google will be used to identify the primary affiliation at the time of publication.  
• Health  
• Science  
• Social Science  
• Engineering  
• Geography  
• Interdisciplinary  
• Other (please specify) |
<p>| <strong>12. Funding agency</strong> | Funding agency (or agencies) acknowledged. |</p>
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<th>13. Geographic Focus</th>
<th>Geographic location in which the research was based.</th>
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<td>• Detailed State, Province, Territory, Region</td>
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<th>14. Project Lead (if stated)</th>
<th>Person identified as the project lead.</th>
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<th>15. Who does the project involve?</th>
<th>List the names of identified partners involved in the development, implementation and/or evaluation of the project.</th>
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<td></td>
<td>• Community</td>
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<td>• Government (municipal, provincial/territorial, federal)</td>
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<td>• Other organizations or institutions</td>
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<td>• Other stakeholders</td>
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<th>16. Was an Indigenous community/organization partner identified? (Was the Indigenous community identified as a “Partner” or was the language used suggestive of other relationships (e.g. participants in a study)? i.e. was a CBPR or conventional approach used?)</th>
<th>Was an Indigenous community/organization partner identified</th>
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<td>• Yes</td>
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<td>If YES – Who is identified as the community/organization partner?</td>
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<th>17. Is water the main focus?</th>
<th>Is water the main focus?</th>
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<td>• Yes</td>
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<td>• No</td>
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What form of water is being referred to?

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<td>• Drinking water</td>
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<td>• Storm water</td>
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<td>• Wastewater</td>
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<td>• Sea Ice</td>
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<td>• Lakes, Rivers, Streams</td>
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<td>• Sea or Ocean</td>
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<td>• Watershed/ water basin</td>
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<td>• Water Governance</td>
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<td>• Other (please specify)</td>
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<tr>
<th>18. How is water incorporated into the study?</th>
<th>Describe how water has been incorporated into the study.</th>
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What aspect(s) of water research or management are addressed in the study?

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<td>• Public health</td>
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<td>• Resource management</td>
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<td>• Environmental/ecosystem health</td>
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<td>19. What was the research purpose?</td>
<td>List the research question(s) and/or research objectives listed by the authors.</td>
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| 20. Does the article acknowledge Treaty and Aboriginal rights that recognize the right to clean water? If so, in what way? | Does the article acknowledge Treaty and Aboriginal rights that recognize the right to clean water?  
- Yes  
- No  
If yes, describe what role Treaty and Aboriginal rights played. |

### MECHANISMS

| 21. What methodology/methodologies were used? | List the research methodology/methodologies used by the researchers:  
- Ethnography  
- Phenomenology  
- Grounded Theory  
- CBPR  
- Case Study  
- Experimental  
- Empirical  
- Mixed Methods (identify all methodologies used)  
- Other(s) (please specify) |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 22. What research methods were used? | Methods used for data collection (list all that apply).  
- Interviews (structured, semi-structured, unstructured)  
- Focus Group  
- Survey  
- Participant Observation  
- Document Review  
- Monitoring  
- Photovoice  
- Digital media, including participatory video or digital storytelling  
- Sharing Circle  
- Oral History  
- Ceremony  
- Other(s) (please specify) |
| 23. Did the authors distinguish between Indigenous and Western methodologies and/or methods? | Did the authors distinguish between Indigenous and Western methodologies and/or methods? |
| **Western methodologies and/or methods?** | • Yes  
• No |
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<td><strong>24. How were Indigenous methodology/methods defined?</strong></td>
<td>Definition of indigenous methodology/methods by authors (if provided). Please note if no definition was provided.</td>
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<td><strong>25. How was Indigenous knowledge defined?</strong></td>
<td>Definition of Indigenous knowledge by authors (if provided). Please note if no definition was provided.</td>
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| **26. Was the integration of Indigenous and Western science/methods stated explicitly?** | Was the integration of Indigenous and Western science/methods stated explicitly?  
• Yes  
• No |
| **27. Were integrated/integrative processes identified and if so, how?** | Describe how the authors talked about integrative processes. |
| **28. How were integration/integrative processes defined?** | Definition of integration/integrative processes by authors (if provided). Please note if no definition was provided. |
| **29. What description of the research relationship or community-based research approach was provided?** | How is the research relationship described? What, if any, steps were taken to engage Indigenous community/organization partner involvement through all or some of the research process?  
• Design  
• Oversight  
• Data Collection  
• Data Analysis  
• Knowledge Sharing (academic, policy, community/organization, other)  
• Not sure/not specified  
• Other (please specify) |
| **30. Limitations acknowledged?** | What, if any, limitations were acknowledged? |

**OUTCOMES**

<p>| <strong>31. Are any of the findings specifically directed at integrated water management? If yes, what are they?</strong> | List the key findings and conclusions from the study that are specifically related to integrated water management. |
| <strong>32. How was Indigenous knowledge implemented?</strong> | Look to the outcomes of the project or conclusions of the paper to help determine whether they reflect partial, full, or no implementation of Indigenous knowledge. Report what the authors describe as evidence for having implemented Indigenous knowledge. |
| <strong>33. What benefits to the community and beyond were discussed?</strong> | What were the benefits described (perceived or actualized)? |</p>
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<tr>
<th>Policy</th>
<th>Governance</th>
<th>Health</th>
<th>Theoretical</th>
<th>Environmental</th>
<th>Band Council</th>
<th>Cultural</th>
<th>Economic</th>
<th>Social</th>
<th>Not sure/not specified</th>
<th>Other (please specify)</th>
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Appendix F
Ethics Application and Amendment

Original General Research Ethics Board Application

August 25, 2014

Dr. Heather Castleden
Associate Adjunct Professor
Department of Geography
Queen's University
Kingston, ON, K7L 3N6

GREB Ref #: G GEO-173-14; Romeo # 6013463
Title: "G GEO-173-14 Examining Methods and Models for Integrative Indigenous and Western Knowledge to Inform Water Management and Research in Canada"

Dear Dr. Castleden:

The General Research Ethics Board (GREB), by means of a delegated board review, has cleared your proposal entitled "G GEO-173-14 Examining Methods and Models for Integrative Indigenous and Western Knowledge to Inform Water Management and Research in Canada" for ethical compliance with the Tri-Council Guidelines (TCPS) and Queen's ethics policies. In accordance with the Tri-Council Guidelines (article D.1.6) and Senate Terms of Reference (article G), your project has been cleared for one year. At the end of each year, the GREB will ask if your project has been completed and if not, what changes have occurred or will occur in the next year.

You are reminded of your obligation to advise the GREB, with a copy to your unit REB, of any adverse event(s) that occur during this one year period (access this form at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Adverse Event Report). An adverse event includes, but is not limited to, a complaint, a change or unexpected event that alters the level of risk for the researcher or participants or situation that requires a substantial change in approach to a participant(s). You are also advised that all adverse events must be reported to the GREB within 48 hours.
You are also reminded that all changes that might affect human participants must be cleared by the GREB. For example you must report changes to the level of risk, applicant characteristics, and implementation of new procedures. To make an amendment, access the application at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Amendment to Approved Study Form. These changes will automatically be sent to the Ethics Coordinator, Gail Irving, at the Office of Research Services or irvingg@queensu.ca for further review and clearance by the GREB or GREB Chair.

On behalf of the General Research Ethics Board, I wish you continued success in your research.

Yours sincerely,

Joan Stevenson, Ph.D.
Chair
General Research Ethics Board

c.: Dr. Debbie Martin, Dr. Ashlee Willox, Dr. Sherilee Harper, Co-Principal Investigators
    Ms. Catherine Hart, Research
    Dr. Mark Rosenberg, Chair, Unit REB
    Ms. Joan Knox, Dept. Admin.
Amended GREB Application for Australia, USA, and New Zealand

August 07, 2015

Dr. Heather Castleden
Associate Professor
Department of Geography and Planning
Queen's University
Kingston, ON, K7L 3N6

Dear Dr. Castleden:

RE: Amendment for your study entitled: GGEO-173-14 Examining Methods and Models for Integrative Indigenous and Western Knowledge to Inform Water Management and Research in Canada; ROMEO#6013463

Thank you for submitting your amendment requesting to contact and interview researchers from the United States, Australia, and New Zealand.

By this letter you have ethics clearance for this change.

Good luck with your research.

Sincerely,

Joan Stevenson, Ph.D.
Chair
General Research Ethics Board
c.: Dr. Debbie Martin, Dr. Ashlee Willox, and Dr. Sherilee Harper, Co-Principal Investigators
Ms. Lindsay Day, Co-investigator
Ms. Catherine Hart, Research Coordinator
Mr. Robert Stefanelli, Research Associate
Dear __________,

My name is Rob Stefanelli, and I am a Masters student working on an Indigenous knowledge project led by Dr. Heather Castleden at Queen’s University, Canada. Our project focuses on the implementation of Indigenous and Western knowledge in water management in both Canada and Australia. This project has received funding from both the Canadian Water Network, as well as the Social Sciences and Humanities Research Council of Canada. The goal of this research is to collect information about the ways in which Indigenous and Western knowledges can be implemented in water management, as well as to identify the similarities and differences between Australian and Canadian research in this field.

I am contacting you today as you have published academic work in this field, and I would like to invite you to participate in a telephone interview regarding your work in this area. Through my research thus far, I have read [specific publication(s) that appeared in CSRR], and I believe that your perspective would provide tremendous depth to this research project.

Your voluntary participation would involve a 45-60 minute phone interview with me - set at a date and time that is most convenient for you.

If you are interested in participating in this research project, please reply to this email and I will provide you with a detailed information sheet about the project as well as a consent form for you to sign.

I want to thank you for considering this request, and I look forward to hearing from you at your earliest convenience.

Best Regards,

Rob Stefanelli
Appendix H
Detailed Information Sheet

Research Project: Implementation of Indigenous and Western Knowledge for Effective Water Research and Management: An Examination of Canada and Australia.

Principal Investigator: Dr. Heather Castleden, Queen’s University
Co-Principal Investigators: Dr. Ashlee Cunsolo Willox, Cape Breton University; Dr. Sherilee Harper, University of Guelph, and; Dr. Debbie Martin, Dalhousie University

Funded by: Canadian Water Network (CWN), and Social Sciences and Humanities Research Council of Canada (SSHRC).

Introduction: We would like to invite you to take part in our research project titled, “Implementation of Indigenous and Western Knowledge for Effective Water Research and Management: An Examination of Canada and Australia.” The information below tells you about what is involved in the research, what you will be asked to do and about any benefit, risk, and inconvenience that you might experience. Please feel free to ask as many questions as you like.

Research Purpose: In contrast to non-Indigenous communities, water-related issues are a significant problem in Indigenous communities around the world (e.g. contaminated drinking water; malfunctioning wastewater treatment facilities; flooding; changes in hydrological cycle affecting access to land and wild foods). While government agencies and researchers have relied on Western science to deliver water-related resources and improve water management challenges in these communities, there has been increasing recognition of the importance of applying Indigenous Knowledge and Indigenous methodologies to water research and management. This project seeks to respond to the question of how can Indigenous Knowledge and Indigenous methodologies be used in an integrative way alongside innovations in Western science and engineering to support effective water policy, governance, and decision-making. To respond to this question, this project will draw of previous research in Australia and Canada. We invite you to participate in this project based on your involvement with previous water-related research and projects.
Your Participation: Your voluntary participation involves a one-on-one phone or Skype interview. The interview will take approximately 45-60 minutes of your time, and will occur at a time of mutual convenience. During this interview there are no right or wrong answers; the research team is interested in your perspective and experiences. With your permission, the interview will be recorded. Your comments may be used as part of the research team’s project and in public dissemination, but careful measures will be taken to keep your information confidential. This means that your name will not be revealed, unless you wish to be identified (and provide your written consent to do so). We will be interviewing between 18-30 people for this project.

Who can Take Part in this Study: You can take part in this study if you have been involved (as a researcher, project manager, or community partner) previously with a project that integrated or attempted to integrate Indigenous and Western knowledge and/or methodologies in water research.

How this Research will be used: Direct quotes of what you say may be used in our reports, presentations, and other forms of knowledge-sharing. Any oral or written presentations of the research findings will not have your name on them, unless you wish to be identified (and provide your consent to do so).

Benefits of this study: The information obtained from this research will improve our understanding of integrative approaches to water research, management, policy and decision-making in (and with) Indigenous communities. It will also provide insight as to how integrative approaches to water management can be done in a meaningful and culturally appropriate way in partnership with Indigenous communities in Canada and Australia.

Risks: There is minimal risk to participating in this study. However, participants are sometimes uncomfortable about being interviewed in general, or more specifically, you may find the subject matter sensitive or cause you to have an emotional response. Your comfort is our research team’s priority. If you are uncomfortable talking about something or answering a question, we can skip it and move on. You will have an opportunity to review and make changes to the transcript of your interview, and the interviewer will strike comments that you have made during your interview from the transcripts if you are uncomfortable with them, and can omit/delete anything you have shared at your discretion.

Withdrawal from the Study: You may refuse to participate or to later withdraw from the study, including before, during, and after the interview, without penalty, by simply telling the person...
interviewing you, Dr. Castleden or the Research Project Coordinator (see contact details below). You also have the right to skip questions you prefer not to answer. Should you wish to withdraw after you have completed your interview, you will have the option to withdraw your interview transcript up until the preliminary analysis is complete. You have the option of seeing how any quotes we may use from your interview are used in the context of our preliminary analysis.

Confidentiality: Because this research is being conducted with a targeted group of water researchers and managers, it may not be possible to keep your participation and responses completely anonymous. However, your name will not be used and a pseudonym (fake name) will be employed to ensure confidentiality in the dissemination of this research. All information shared during the one-on-one interview will be kept confidential and your identity will not be revealed unless you give written consent to do so. All raw data (interview recordings and interview transcripts) will be stored with Dr. Castleden in a secure location on campus (password-protected computer and locked steel filing cabinet in her office) and will be destroyed five years after the study is completed. These data will only be available to the research team, all of whom have signed oaths of confidentiality.

Duty to Disclose:
Should reports of child abuse or neglect or the abuse or neglect of an adult in need be revealed or suspected through the course of the interview, I have a duty to disclose this information to the research investigators and to the appropriate authorities.

Results from the Study: The results of the Canadian study will be written in a final report for the Canadian Water Network. The final report will be made available on their website (http://www.cwn-ree.ca). The results from the multi-case study in Australia and Canada will serve as the data for a Master’s Thesis, and it is anticipated that two or more publications will result from this research.

Consent: Attached to this letter of information is a consent form. A member of the Research Team will go through this letter of information and the consent form with you and answer any questions you might have about the project and your involvement in it. After that, you will be given an opportunity to read the consent form, and then you can decide if you want to sign it, thus agreeing to participate in the study.

If you have any comments or concerns about this research, please contact the Principal Investigators, Rob Stefanelli (9rds3@queensu.ca), Dr. Heather Castleden (heather.castleden@queensu.ca), or her Research Coordinator, Catherine Hart catherine.hart@queensu.ca)
This study has been reviewed by the Queen’s University General Review Ethics Board as well as the Guelph, Dalhousie, and Cape Breton Universities’ Research Ethics Boards. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at char.GREB@queensu.ca or 613-533-6081. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and the policies of the participating Universities.
Appendix I

Consent Form

Research Project: Implementation of Indigenous and Western Knowledge for Effective Water Research and Management: An Examination of Canada and Australia.

Principal Investigator: Dr. Heather Castleden, Queen’s University
Co-Principal Investigators: Dr. Ashlee Cunsolo Willox, Cape Breton University; Dr. Sherilee Harper, University of Guelph; Dr. Debbie Martin, Dalhousie University

Funded by: The Canadian Water Network (Network Centre of Excellence), Social Sciences and Humanities Research Council of Canada

For each of the 11 questions below, please circle your answer as either Yes or No.

1. Do you understand that you have been asked to take part in a research study?
   a. Yes   No
2. Have you received and read a copy of the Information Letter?
   a. Yes   No
3. Do you understand the benefits and risks involved in taking part in this research?
   a. Yes   No
4. Have you had an opportunity to ask questions about this research project with a research team member?
   a. Yes   No
5. Do you understand that you can stop taking part in this study at any time up until the beginning analysis has been completed? *You do not have to say why you decided to withdraw.
   a. Yes   No
6. Do you understand that we will make every effort to keep your identity confidential but we may not be able to keep your responses anonymous due to the specific focus of this study?
   a. Yes   No
7. Do you understand that all members of the research team will have access to your interview data?
   a. Yes   No
8. Do you consent to being audio-taped?
   a. Yes   No
9. Do you want to be assigned a pseudonym (fake name) for all quotations used in our data analysis?
   a. Yes  No

10. Would you like to see how quotes from your interview are used before our data analysis is finalized?
   a. Yes  No

You will be provided with a copy of your transcript to check for accuracy and you may opt out of doing so upon receiving it.

If you circled “No” to Question 9 about being assigned a pseudonym (fake name), please confirm, by signing below, that you want your real named used for any quotations used in our data analysis.

I want to use my real name: ____________________________________________

Signature  Printed Name

(Or oral consent will be recorded)

I agree to participate in this research project. (Or oral consent will be recorded).

________________________________________________
Signature

________________________________________________
Printed Name

_________________________________________________
Date

If you have any comments or concerns about this research, please contact the Principal Investigators, Rob Stefanelli (9rds3@queensu.ca), Dr. Castleden (heather.castleden@queensu.ca) or her Research Coordinator, Catherine Hart (catherine.hart@queensu.ca). If you have any complaints about this research,
you can contact the Queen’s University Research Ethics Board at: char.GREB@queensu.ca or 613-533-6081.

This study has been reviewed by the Queen’s University General Review Ethics Board as well as the Guelph, Dalhousie, and Cape Breton Universities’ Research Ethics Boards.

Thank you for your participation.
Preamble

Where participants have received the Letter of Information but prefer to do oral consent over the phone, the recorder will be turned on immediately and each question on the consent form will be asked in turn. Thank you for taking the time to speak with me today. Some background on our conversation today. As the Letter of Information described, our conversation will take approximately 45-60 minutes. If at any point you don’t want to answer a question, we can skip it. If you say something that you don’t want recorded, just say so, and it can be removed - even after you have completed the interview. You also have the right to withdraw from the research project at any time, and you can withdraw your interview, up until the preliminary data analysis is complete and you have been offered an opportunity to review any quotes we use from your interview in the context of our research findings. Do you have any questions before we get started? I want to let you know that I will be taking some notes as we go along, so there may be pauses in between questions. If you don’t have any questions, we can begin with the consent form. [turn on audio recorder].

Interview Questions

1. As you may recall, this project is about water, and how Indigenous and Western knowledge and methods can be used together to take care of water. So, can we begin with you telling me about your (personal/professional) interest in water?
   a) Can you tell me about your relationship with water? What does water mean to you?
   b) When you think about water, do inherent rights come to mind? Can you explain?
2. Could you tell me a little bit about [name of project] (eg. tell me about the Design/Purpose). What is your history of working on projects in this area?
3. Can you tell me more about your project’s relationship with Indigenous communities that were involved? (eg. who initiated the research relationship?)

Why did you feel it was important to involve these particular participants for this project?

At what point did you connect with the participants to begin a partnership relationship?

What sorts of things did you do to engage/connect with? (eg. Why did they want to participate?)

What sort of opportunities, strengths or challenges did you encounter?

Did Indigenous rights have role with respect to water and/or the project?

4. How would you define or describe Indigenous or Traditional knowledge?

5. Thank you. And how would you define or describe Indigenous research methodologies?

6. Thank you. And just two more questions about this, how do you distinguish between Indigenous and Western knowledge?

7. How do you distinguish between Indigenous and Western methodologies?

8. Could you describe the ways in which Indigenous and Western knowledge or methodologies were integrated within your research project(s)?

   a) How do you define knowledge “integration” and “integrative processes”?

   b) What made this project successful or not successful from your perspective?

9. Maybe in more general terms, what works well in terms of applying Western science and Indigenous knowledge in research or resource management?

10. What are some barriers to implementing traditional knowledge with Western Science?

11. What would you say were the key findings and implications of the project?

12. With respect to knowledge integration, were there any insights gained from this project that would lead you to do things differently in future research? (Please describe).

13. What do you think your Indigenous community participants gained from their involvement in your research?
14. Were there any insights from your research that did not make it into publication that you would like to share? If so, what were they, and why were they excluded?

15. Beyond your research project, do you think an integrative approach can be used for more effective water policy, governance and decision-making in Canada? Why or why not?

This concludes my questions, but are there any documents or resources that you recommend we look at. Other people you think we should talk to?

Is there anything you would like to add to our conversation today?

Thank you for your time. I want to re-emphasize that everything you’ve shared today will remain confidential and a fake name will be used in any publications or presentations. If you have any questions or concerns regarding today’s interview please do not hesitate to contact me, any member of the research team, or the Queen’s research ethics office. I’ll be in touch with a copy of your transcript to review (if the participant requested a copy to review on their consent form) and/or I’ll be in touch once the data are analyzed to show you how quotes from your interview are being used in our data analysis (if the participant requested an opportunity to do so. Thanks again for your time.
Appendix K

Researcher Interview Guide – Australia

Preamble

Where participants have received the Letter of Information but prefer to do oral consent over the phone, the recorder will be turned on immediately and each question on the consent form will be asked in turn.

Thank you for taking the time to speak with me today. Some background on our conversation today. As the Letter of Information described, our conversation will take approximately 45-60 minutes. If at any point you don’t want to answer a question, we can skip it. If you say something that you don’t want recorded, just say so, and it can be removed - even after you have completed the interview. You also have the right to withdraw from the research project at any time, and you can withdraw your interview, up until the preliminary data analysis is complete and you have been offered an opportunity to review any quotes we use from your interview in the context of our research findings. Do you have any questions before we get started? I want to let you know that I will be taking some notes as we go along, so there may be pauses in between questions. If you don’t have any questions, we can begin with the consent form. [turn on audio recorder].

Interview Questions

1. As you may recall, this project is about water, and how Indigenous and Western knowledge and methods can be used together to take care of water. So, can we begin with you telling me about your (personal/professional) interest in water?
   a) Can you tell me about your relationship with water? What does water mean to you?
   b) When you think about water, do inherent rights come to mind? Can you explain?

2. Could you tell me a little bit about [name of project] (e.g. tell me about the Design/Purpose). What is your history of working on projects in this area?
3. Can you tell me more about your project’s relationship with Indigenous communities that were involved? (e.g. who initiated the research relationship)

Why did you feel it was important to involve these particular participants for this project?

At what point did you connect with the participants to begin a partnership relationship?

What sorts of things did you do to engage/connect with? (e.g. Why did they want to participate)

What sort of opportunities, strengths or challenges did you encounter?

Did Indigenous rights have role with respect to water and/or the project?

4. How would you define or describe Indigenous or Traditional knowledge?

5. Thank you. And how would you define or describe Indigenous research methodologies?

6. Thank you. And just two more questions about this, how do you distinguish between Indigenous and Western knowledge?

7. How do you distinguish between Indigenous and Western methodologies?

8. Great, thanks. I’ll move on. I understand that in 2004 Australia introduced a National Water Initiative to govern national water policy and reform.

a) How would you describe the strengths of the NWI? How would you describe its challenges or limitations?

b) In the context of water research and water management involving Indigenous communities in Australia, how would you describe the strengths of the NWI? How would you describe its challenges or limitations?

9. Could you describe the ways in which Indigenous and Western knowledge or methodologies were integrated within your research project(s)?

a) How do you define knowledge “integration” and “integrative processes”?

b) What made this project successful or not successful from your perspective?

10. Maybe in more general terms, what works well in terms of applying Western science and Indigenous knowledge in research or resource management?
11. What are some barriers to implementing traditional knowledge with Western Science?

12. What would you say were the key findings and implications of the project?

13. With respect to knowledge integration, were there any insights gained from this project that would lead you to do things differently in future research? (Please describe).

14. What do you think your Indigenous community participants gained from their involvement in your research?

15. Were there any insights from your research that did not make it into publication that you would like to share? If so, what were they, and why were they excluded?

16. Beyond your research project, do you think an integrative approach can be used for more effective water policy, governance and decision-making in Australia? Why or why not?

This concludes my questions, but are there any documents or resources that you recommend we look at. Other people you think we should talk to?

Is there anything you would like to add to our conversation today?

Thank you for your time. I want to re-emphasize that everything you’ve shared today will remain confidential and a fake name will be used in any publications or presentations. If you have any questions or concerns regarding today’s interview please do not hesitate to contact me, any member of the research team, or the Queen’s research ethics office. I’ll be in touch with a copy of your transcript to review (if the participant requested a copy to review on their consent form) and/or I’ll be in touch once the data are analyzed to show you how quotes from your interview are being used in our data analysis (if the participant requested an opportunity to do so. Thanks again for your time.
Appendix L
Community Partner Interview Guide

Thank you for taking the time to speak with me today. Before we begin, I just want to explain a bit about what our conversation will look like today. Our original research plan was to interview academic researchers that had worked in Indigenous communities, and then to interview a community member that had participated in the research. Since I received your name through a member of our advisory committee, the recruitment was a little different and so some of the wording of the questions might not apply exactly to you and what you do. So I will ask questions about “your community” but that can mean the communities you work in, the community you live in, or your organization as a whole – whichever you prefer to use to answer the question.

And some other basic information about our project - as the Letter of Information described, our conversation will take approximately 45-60 minutes. If at any point you don’t want to answer a question, we can skip it. If you say something that you don’t want recorded, just say so, and it can be removed - even after you have completed the interview. You also have the right to withdraw from the research project at any time, and you can withdraw your interview, up until the preliminary data analysis is complete and you have been offered an opportunity to review any quotes we use from your interview in the context of our research findings. Do you have any questions before we get started? I want to let you know that I will be taking some notes as we go along, so there may be pauses in between questions. If you don’t have any questions, we can begin (with the consent form).

1. As you may recall, this project is about water, and how Indigenous and Western knowledge and methods can be used together to take care of water. So, can we begin with you telling me a bit about your (personal/professional) interest in water?

2. How does your community connect to water? Can you tell me a bit about your community’s connection/relationship to water?
3. What sorts of water-related issues (in the past, present, and/or future) are on your mind for your community?

4. Can you tell me about an experience when an academic researcher has worked with you or your organization or your community on a research project? OR can you tell me about your organization’s Traditional Knowledge Program?
   a. What was the purpose of the project?
   b. How/Why did the relationship between the community/Elders and the researcher begin?
   c. What was the outcome of the research?
   d. What role did the community play in the research process?

5. Can you tell me how you use traditional knowledge in your community or organization?
   a. How did your ancestors/grandparents do work in your community?
   b. How are you doing things today that are part of your culture?
   c. How is Elder knowledge used in your community?

6. Can you tell me about ways that you use traditional knowledge in research projects?

7. In your opinion, what is the difference between science and traditional knowledge?

8. In general, what do you think are the best ways to combine science and community knowledge together?

9. In your opinion, and in your community or organization specifically, how do you use science alongside community/traditional knowledge?

10. In your community, how can research be done that would be consistent with your culture? (some principles of good research)

11. What have been some strengths, challenges, and/or opportunities in research that has been done in your community?
12. With respect to using science and traditional knowledge together, what are some things you’ve learned that you can or will use in the future?

13. Do you feel that your organization has been meaningfully involved in university-led research? Why or why not?

14. Do you feel that the values of your community have been respected by researchers? Why or why not?

15. How have Elders been involved in research in your community?
   a. Was their knowledge used in a respectful and appropriate way? How so?
   b. Was their knowledge used throughout the project? (as opposed to just before or after the research was complete)

16. What things make it difficult to use traditional knowledge with science in water management?

17. Finally, coming back to the research here, we are trying to look at ways that traditional knowledge can be used to make rules and regulations about water quality and management, therefore how do you think traditional knowledge can be used/shared to make better rules around water management in Canada?

That concludes my list of interview questions, but is there anything that you would like to add to our conversation today?

After participating in this interview, is there anyone else that comes to mind that you believe I should contact to participate in an interview?

Thank you very much for taking the time to speak with me today and I will be in touch again to provide you a copy of the transcription from this interview for you to review.