Project information

Project title	Northern Sustainability Research Lodges in Remote First Nation Communities
Administrative institution	University of Manitoba
Collaborating institutions	Red River College of Applied Arts, Science and Technology

Project leader

Name	Thompson, Shirley
Title/position	Associate Professor

Project funding

Total project cost	$2,046,551
Amount requested from the CFI	$354,446
Percentage of the total project cost requested from the CFI (maximum 40%):	17.3%

Disciplines

Primary discipline	Environment
Primary sub-discipline	Renewable and non-renewable resources management
Secondary discipline	Urban and regional studies, environmental studies
Secondary sub-discipline	Community development
Tertiary discipline	Urban and regional studies, environmental studies
Tertiary sub-discipline	Rural planning

Areas of application

Primary	Renewable resource production and technology
Secondary	Development of the North

Keywords

Research or technology development	land use, Indigenous development, resources, housing, renewable energy, water quality, fisheries,, sustainable planning, reserve homelessness, livelihoods, food
Specific infrastructure	research lab, solar pv, boat, all terrain vehicles, building tools, IAQ sensors

Plain language summary

This summary will not be used in the review process. Should the project be funded, the CFI may use it in its communication products.

The overall goal is to research the sustainability of the built, social and natural environment considered a two-eyed seeing approach - using one eye to see the strengths of Indigenous knowledges and the other for western ways of knowing. Through both a western scientific lens and research of Indigenous knowledge we resolve to research not only the problems but also the solutions using two-eyed seeing partnering with Garden Hill First Nation (FN) and Wasagamack FN as well as other remote, fly-in communities on the east-side. Working in partnership with the community we will identify culturally appropriate solutions.
We will assess the sustainable livelihood assets and identify the needs in the communities, e.g., renovating and building healthy and energy efficient houses on reserve, water quality, fisheries, access to natural resources, growing food and starting social enterprises. This research will seek solutions and trial housing designs and programs to meet these needs. Each intervention will have a research component involving students, researchers and local people. We will work in partnership with Garden Hill FN, Wasagamack FN, Sundial Building Performance Inc., AKI Energy, most public universities and colleges in Manitoba, Meechim Farm and other social enterprises to develop a self-determined sustainable model, that we can scale up from a community-level to a regional-level, considering the social as well as the technical aspects of community development.

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Principal users

Name	Institution	Department
Thompson, Shirley	University of Manitoba	Natural Resources Institute
Bibeau, Eric	University of Manitoba	Mechanical and Manufacturing Engineering
Coar, Lancelot	University of Manitoba	Architecture
Farenhorst, Annemieke	University of Manitoba	Soil Science
Lobb, David	University of Manitoba	Watershed Systems Research Program / Soil Science
Mallory-Hill, Shauna	University of Manitoba	Interior Design, Faculty of Architecture
O'Gorman, Melanie	The University of Winnipeg	Economics
Olsen Harper, Anita	University of Manitoba	Natural Resources Institute
Paterson, Michael	IISD-Experimental Lakes Area	
Rashwan, M. Shokry	Red River College of Applied Arts, Science and Technology	School of Construction and Engineering Technologies

Other users

Name and title/position	Institution and department
Cook, Becky Postdoctoral researcher	University of Manitoba Natural Resources Institute
Martin, Donna Associate professor	University of Manitoba College of Nursing
Bonniecastle, Marleny Assistant Professor	University of Manitoba Social Work
Schiff, Rebecca Assistant Professor	Lakehead University Department of Health Sciences
Quarter, Jack Professor	University of Toronto Adult Education
Settee, Priscilla Associate Professor	University of Saskatchewan Department of Indigenous Studies
Ballard, Myrle Post doctoral student	University of Manitoba Natural Resources Institute
Kavgic, Miroslava Assistant Professor	University of Manitoba Civil Engineering
Bjornson, Eric Mr.	Sundial Building Performance Inc. none
Ballard, Dennis Mr.	University College of the North Community-based services
Harm, Patricia Assistant Professor	Brandon University Sociology
Singh, Poonam Instructor	Assiniboine College Horticulture
Petrella, Serena Chair of Sociology and Associate Profess	Brandon University Sociology
Shukla, Shailesh Associate Professor	University of Winnipeg Indigenous Governance

1. Institutional Capacity and Track Record

All the major public universities and colleges in Manitoba are committed to work together with Dr. Thompson on research to create First Nation (FN) community-led development and projects' based education on housing and other issues of sustainability. This research would be a first step to implement the Collaborative Indigenous Education Blueprint, which Manitoba Universities and Colleges signed at the University of Manitoba (UoM) in December 2015 to advance Indigenous education and reconciliation, by: "Engaging with Indigenous peoples in respectful and reciprocal relationships to realize the right to self-determination, and to advance reconciliation, language and culture through education, research and skill development" (UoM, 2015, p. 1). The research, on a pilot level, provides engagement with a two eyed way of seeing that has one eye on indigenous knowledge systems (IKS) and the other eye on western science to advance Indigenous scholarship and Indigenous perspectives in research. Advancing indigenous scholarship is a tenet of UoM's new strategic plan. That most public post-secondary colleges and universities in Manitoba are committed to FN research and education with Dr. Thompson, involving this CFI equipment and infrastructure is a first. This research by Red River College (RRC), Assiniboine College (AC), University College of the North (UCN), Brandon University (BU), University of Winnipeg (UoW) and UoM with FNs, social enterprises and Indigenous organizations will change education and housing. This research, which focuses on sustainability and community-led projects-based education, has the potential to transform education policy and practice at all levels - FN, province, nation and international. This participatory action research provides an approach to leapfrog Indigenous development and post-secondary education away from a colonial approach to a self-determined, community-led and sustainable approach. Wasagamack and Garden Hill FNs previously had requested college carpentry and other educational programs in their community without any take up by any institute, but facilitated by these partnerships and CFI funding, several colleges and universities have committed to provide this. The hardships caused by the lack of post-secondary education in remote communities, were filmed: https://www.youtube.com/watch?v=iAXgKPxCIT0&feature=youtu.be. This research led by FN communities is a step towards reconciliation. The National Truth & Reconciliation Calls to Action (92. ii) for "equitable access to jobs, training, and education opportunities in the corporate sector, and that Aboriginal communities gain long-term sustainable benefits from economic development projects" is worthy of research. UoM is committed to work towards reconciliation and houses the National Centre for Truth and Reconciliation. In the spirit of reconciliation, OCAP (Ownership, Control, Access, Possession) principals will be applied in FN communities.

For a successful research partnership, which is FN led, infrastructure and equipment is needed on FN reserves. This proposed research station will be the first university research station located on a FN reserve, which will help shift the research paradigm and enable world-class research and technology development in FNs. The two FN research centres, one in GHFN and the other in WFN will be sustainable as it will serve multiple key purposes and multiple groups to: 1) design, model, build and monitor a culturally-appropriate, net zero, sustainable northern house; 2) develop curriculum and teaching resources for the Northern Sustainable housing; 3) help accredit the first ever projects-based certificate program for sustainable northern housing and other certificate programs for community-led projects (waste management, water, etc.) through colleges and universities; 4) house research facilities and researchers, students and teachers looking at sustainable community issues that are in line with the community-led research priorities (e.g., housing design/build research, waste management, indigenous food systems, land use, etc.); and 5) provide think-tanks to leapfrog development from unsustainable to sustainable in communities at-risk from impacts of climate change. Research centres are typically located in urban centres and never on FN reserves. No research centre has had a research agendas that is FN community-led on sustainability. Similarly, pilot northern sustainable housing have been researched by CMHC but neither on reserve nor lived it cannot model the constraints that exist in remote, poor reserves and the overcrowding to provide

realistic results.

This research will study how to shift post-secondary education, housing, land use and food production from the status quo to sustainable self-determination by engaging all the university and colleges to work with these two FNs at the community level. Through applying and analyzing culturally-appropriate sustainable solutions to resolve development challenges and build communities these communities will become resilient to climate change. This proposal for community-led, project-based research and education could transform housing, food and post-secondary education to be more sustainable by being mainly locally-provisioned. For example, FN local sawmills can provide timber and wood-fibre insulation, which are the most bulky housing supplies. Remote communities need this shift with the ice road to ship up supplies being increasingly precarious in the face of climate change. Dr. Thompson has lots of successful experience being project director (PD) of a partnership development grant, SSHRC Insight Grants and the CIHR grant for work in Manitoba's FNs. Dr. Thompson was able to analyze 14 communities for food security (Thompson et al, 2012; Thompson et al, 2013; Thompson et al, 2015;). and builds on this work in this research to find solutions to the dire problem of high food insecurity in Northern Manitoba. Dr. Thompson's participatory research was instrumental to build a 15-acre permaculture farm, called Meechim Inc., that employs 10 to 15 youth as part of an employment training program and provided chickens, turkeys and vegetables to the community through markets and gift baskets (Thompson and Klatt, 2015). Dr. Thompson and students has worked successfully on farming and fisheries interventions by creating business plans that analyzed operations, including options for value added products and direct marketing. Dr. Thompson was successful in getting a special dealers license for local and provincial marketing of fish for two FN fisheries cooperatives at WFN and GHFN. Dr. Thompson built capacity by assisting with: fishers' co-operatives (Thompson, Rony, Temmer and Wood, 2014), farm social enterprise in GHFN (Thompson et al, 2015), community food markets; and country foods program and gardening youth education programs (Thompson et al, 2015). These projects continue to develop and need further research. These food programs were so successful they have spread to other communities.

Strong collaborations and effective partnerships exist between WFN and GHFN with Dr. Thompson. Dr. Thompson was asked by these and other FN communities to help with their east-side planning, when it was at a stalemate. Drs. Thompson and Olsen Harper and many students have assisted these communities with developing land use plans for their traditional territory, which will be finalized and released in winter 2016 (Thompson and Olsen Harper, nd; Thompson, Klatt and Oyegunle, 2015; Thompson and Klatt, 2015) and this work continues. Dr. Thompson currently has band council resolutions for these communities to do research on sustainable community development and land use. Island Lake FNs desire to lead in sustainably managing the resources in their traditional territories with the food and timber for local uses, such as housing. This will require research to apply for community woodlot licenses, wild rice licenses and Island Lake FN forest management unit, which would require determining the sustainable harvest rate. This research is a long-term endeavor that requires research centres and partnerships for lots of leading-edge research opportunities.

The partnership development grant work on building farms, markets, country foods and fisheries resulted in many partners (AKI Energy, RRC, Anikowiin, AC, Manitoba Conservation, WNO, etc.), undertaking food participatory research, who saw the need for participatory research in other area including housing, waste management and land use. Drs. Rashwan and Thompson organized monthly meetings at RRC from fall 2015 to the present, which involved WFN and GHFN representatives (employment and training directors, education directors, chiefs and councilors), researchers, including deans and professors from UoM, RRC, BU, UCN, ACC, UoW, as well as key people from social enterprises (BUILD, AKI Energy, Aniikowin, Sundial Building Performance) and Aboriginal organizations (MKO) to further grow this partnership to include all the necessary partners. A successful SSHRC partnership letter of intent led by Dr. Thompson and a partnership grant application for 2017 to 2024 resulted that has strong synergy with this CFI. This partnership grant

expands from the focus of the partnership development grant on FN food-based community development, to sustainable housing, land use and education, as well as food, according to requests of FN chiefs, councilors, health directors, all of which had housing as their priority issue.

Photos 1 and 2 show massive support in both communities for research in their community and include partners from RRC, BU & AU and Sundial Building Performance, as well as chief and council, health staff, directors and staff of the Employment and Training Division, Elders as well as local and graduate students.

Photo 1: After the research meeting with Garden Hill FN members and University team in 2016

Photo 2: Second day of two-day workshop with Wasagamack FN, including chief and council with partners from RRC, UB, AC, UoM for CFI and SSHRC in 2016.

Dr. Thompson has built an effective world-class team for succeeding in this partnership and CFI research. At the community level, engaging students will be possible. The employment and training directors, Elsie Monias at GHFN and Ernie Harper at WFN, have employed youth to build three timber houses at GHFN and do water/sewer retrofits at WFN with apprenticeship trainers supervising them and so are capable of doing this again supported by university or college instructors this time. These two directors have committed to pay local students to design/build the two pilot sustainable houses if they take projects-based education programs with RRC or UCN. A sustainable northern house is possible to be built there due to Mr. Bjornson who built the only Passivhaus and net zero energy standards in Manitoba, volunteering to supervise local FN students, instructors and trainers to build the first sustainable house built in Wasagamack, based on his preliminary open-source design. With the key housing experts in air quality, structure and energy efficiency, Drs. Rashwan, Hill-Mallory and Kavgic, will be able to assess this house to improve the design of the second sustainable house to be built in Garden Hill. Architect, Prof. Coar, then will work with 10 to 15 graduate students and FN local students to improve the design from WFN at GHFN and teach sustainable design and building. The program will help build sustainable houses in the community by accessing CMHC funding for further houses in Wasagamack. Many world-class scholars including FN scholars, in land, food, water, housing and education research, will address sustainability in their areas of expertise to ensure sustainability occurs for housing but also water, land, food and community-led education.

2. Research or technology development

The overall vision is to explore if community-led projects-based post-secondary education can achieve sustainable housing and other community priorities, to live sustainably and foster self-determination within the constraints of being a remote northern First Nation (FN) community without access roads. Community-led applied post-secondary education in remote First Nation (FN) communities has the potential to fulfill both basic (e.g., food security, healthy housing, safe water, land planning) and cultural needs (e.g., language, traditional knowledge, Indigenous governance). Applied projects-based adult education can address the lack of infrastructure and other critical FN needs to address the root causes of poverty, violence, addiction & poor health outcomes in FNs.

This research is different than what is currently done as rather than only research the problems through a western scientific lens it resolves to research not only the problems but also the solutions using two-eyed seeing in a wholistic way. Research will be done in keeping with OCAP (Ownership, Control, Access, Possession) principals for research in FN communities. Rather than only research through a western scientific lens, in partnership with the communities, we will apply an integrative and interdisciplinary "two-eyed seeing" approach. "Two-eyed seeing" is best understood as using one eye to apply the strengths of Indigenous knowledges, while with the other eye, strengthen Western knowledges. Alternatively, both forms of knowledge are seen as equal in value and when used together will research practical and sustainable solutions to sustainability challenges.

Self-determination offers a framework to reconcile past and ongoing oppression in a dynamic way (Kelly 2014, Stanton 2013) to respond to the TRC's calls for action on jobs, training and education. Research to support and assist Indigenous self-determination embraces a different paradigm of research that attempts to assist decolonization and develop sustainable futures for FNs and all communities. This research will assist planning for self-determination and Indigenous sustainable development in WFN and GHFN through applied research. This community-driven approach will have researchers tackling the most pressing issues – housing, water quality, FN resource access and management in traditional territories, food security/sovereignty, domestic violence, unemployment, cultural integrity, etc. Three factors will be considered in the impact of our research related to self-determination, namely: cultural identity; culturally-appropriate sustainable livelihoods; and sovereignty (Hibbard and Adkins, 2013). A sustainable livelihood is defined as "the assets (natural, physical, human, financial and social capitals), the activities, and the access to these (mediated by institutions and social relations) that together determine the living" (Ellis, 2000, p. 10) and can be conducted at the household or community level. In looking at livelihoods the structures, processes and vulnerability context that play a large role in creating the assets are examined for interventions. For example, the human assets in FNs in Northern Manitoba are curtailed (Thompson et al., 2011, 2012) due to the lack of any post-secondary training in the community. The research is broken down into two areas: 1) Designing, modeling, building, monitoring and educating for Northern FN sustainable housing; and 2) Indigenous planning and education research for First Nation self-determination

2.1 Designing, building, monitoring and educating for Northern FN Sustainable Housing

Objectives:

- Design, model, build and monitor a culturally-appropriate, net zero, sustainable northern house using local materials where possible;
- Distribute modifiable open-source sustainable northern house design; and,
- Develop a projects-based certificate program for sustainable northern housing with curriculum, films and teaching resources to support this new programming.

2.1.1 State of Northern Sustainable Housing Research Applicable to FNs

Four houses were designed and built under Canada Mortgage and Housing Corporation's (CMHC) Northern Sustainable House initiative from 2009 to 2013 to research culturally appropriate, highly energy efficient housing in the North. However, none of these houses were built on a reserve, let alone an isolated reserve. CMHC stressed the importance of integrated design charrettes to engage the local community in the design of homes that address occupant concerns and preferences from a comfort and cultural perspective. These projects demonstrated that highly energy-efficient and culturally appropriate houses can be built in the North for a moderate cost. However, CMHC admits these houses were difficult to commission and operate (CMHC, 2014). These studies demonstrate that actual solar energy capture is very sensitive to house orientation regarding angles to the sun and the site. Although this research shows that highly insulated walls, airtight construction, triple-glazed windows and passive solar orientation can reduce energy consumption and costs, this research made little or no impact on housing policy or housing on FN reserves. More research is needed to design and build sustainable housing in in a way that will make a difference to FN communities housing crisis.

2.1.1. The housing crisis

Housing is a large crisis in FNs across Canada but particularly in Manitoba and needs housing research to prioritize the need and offer sustainable solutions. James Anaya, Special Rapporteur on the Rights of Indigenous Peoples, reported in July 2014 that housing in Canada's Indigenous communities "has reached a crisis level" (Anaya cited in The Interim Report of the Standing Senate Committee on Aboriginal Peoples, 2015, p. 5). Many homes on reserve are in substandard condition, needing major renovations or replacement to meet standards of adequacy: 44 percent of people living on reserves in 2006 lived in homes requiring major repairs, compared to 7 percent of the non-Aboriginal population (Senate Committee on Aboriginal Peoples, 2015). Harold Calla, Executive Chair, First Nations Financial Management Board reports a housing deficit of $3-$5 billion in Canada (Senate Committee on Aboriginal Peoples, 2015). Government documents state that Manitoba FNs have the worst housing conditions in Canada and it will cost $2 billion to eliminate mold and chronic overcrowding in that province alone, which is 13 times higher than the national budget for FN housing for this year (Puxley, 2016).

Safe, healthy and affordable housing is necessary for well-being and full participation in the social, political and economic fabric of society (UNHCHR, 2009; Schiff, 2015: Schiff & Brunger, 2015). The United Nation's High Commission for Human Rights (UNCHR) and UN Habitat notes that despite a central place for the "right to an adequate standard of living, including adequate housing" in international law (as declared in the UN Declaration of Human Rights of 1948), "well over a billion people are not adequately housed" (UNHCHR, 2009, p.1). Homelessness and housing insecurity negatively impact the lives of affected individuals and families. Housing insecurity includes individuals living in housing that does not meet needs in respect to condition (poor quality) or size (overcrowding).

The Senate Committee on Aboriginal Peoples (2015, p. 2) found across the nation "that there are homes where 16 or 17 people live in a small, three-bedroom house, often in great disrepair. There are communities where people move back into condemned buildings because there is nowhere else for them to go". Chief David McDougall from Island Lake calls the housing situation a "ticking time bomb" with 1500 houses on the waiting list for the cluster of four reserves, including Wasagamack and Garden Hill FNs, and he documented 23 people living in a two-bedroom home where "they had to take turns sleeping" (Puxley, 2016). This overcrowding, combined with the use of poor-quality building materials, lack of information among residents on how to maintain the housing, and insufficient funds to address maintenance problems places housing on reserves under much more

severe strain than off-reserve housing (Senate Committee on Aboriginal Peoples, 2015). These substandard conditions are worsened by: poor or no sewage systems, unsanitary water access, faulty, aging and overloaded electrical wiring, and deficient foundations that do not account for permafrost and other elements common in northern climates. The federal government in the last few years added badly designed cisterns for water and sewer to many Island Lake reserve's homes without addressing the unhealthy, overcrowded houses need for major repairs which provides a short-term Band-Aid rather than wholistic solution. Clearly, water and sewage should be integrated with renovating housing.

Communities, such as WFN and GHFNs, which are only accessible by air, water and winter road face particular challenges relating to their housing and infrastructure needs (Senate Committee on Aboriginal Peoples, 2015). The challenges to build, renovate and maintain housing is increased as it is challenging to bring over winter ice roads non-local building supplies to these communities in an efficient manner. As well, some of these communities have many barriers to accessing qualified building inspectors, or individuals in the trades and professions needed. Community members in remote locations are almost completely reliant on the housing in the FN, with no nearby towns or cities having alternative housing to mitigate a housing shortage on the reserve. In these remote communities, with such high unemployment rates, facilitating private home ownership or putting in place a rental regime apart from using the shelter allowance portion of social assistance payments is very difficult (Senate Committee on Aboriginal Peoples, 2015). Communities, like Wasagamack and Garden Hill FNs, which do not have their own sources of revenue from business ventures and economic interests are much more reliant on federal government funding to meet the housing needs of their members but due to third party management these funds have not been forthcoming.

Inadequate housing on reserve is linked to both negative health impacts of its inhabitants and destructive social impacts. A high incidence of mold growth exists in "the dilapidated housing that characterizes much of the shelter available to the Indigenous ("First Nations") people of Canada" (Optis, Shaw, Stephenson & Wild, 2012, p. 14). Inadequacies and overcrowding of on-reserve housing are linked to higher incidence rates of: hepatitis (Jin & Martin, 2003), acute rheumatic fever (Gordon et al., 2015), asthma (IHC, 2003) and tuberculosis (Clark & Ribben, 2000; Clark et al., 2002; Lancombe et al., 2011 Smeja & Brassard, 2000). Tuberculosis, a major public health problem for Canadian First Nations communities, is nine times more prevalent in these communities than in Canada as a whole (IHC, 2003).

The shortage of on-reserve housing causes migration to larger urban centres and exacerbates young women's and girls' vulnerability to sex trade work and trafficking, particularly since affordable housing in urban centres to people without a rental history is difficult to access (Beavis, Klos, Carter & Douchant, 1997; Collins, 2010; Geisler & George, 2006; Peters & Robillard, 2009; Westerfelt & Yellow Bird, 1999; Zerger, 2014). Some people with inadequate on-reserve shelter have ended up homeless in Winnipeg: "There is a constant pull and push that propels migrants between deteriorating, overcrowded housing conditions and low economic opportunities in their home reserve communities, and an often-hostile urban environment (Brandon & Peters, 2015, p. 7). By linking the social, health and physical impacts of the housing crisis on reserves together and looking for solutions, this research will assist FNs to create awareness of the large impact of the housing crisis on FN reserves and to gain recognition of the community-driven solutions that could address these issues with proper funding, supports and government policies.

2.1.1 Research plan for housing design and development

The research on housing will undertake the following six steps:

1) Design housing: Housing designs will have local input through design charrettes to create culturally appropriate housing people considering IKS as a way to make it more sustainable and use as much local materials as possible. Draft housing designs of Sundial Performance Buildings' Mr.

Bjornson based on meetings shown at https://youtu.be/8dLtNsjeQVQ, will be modified in 2017 for WFN with Dr. Rashwan, Professor Coar, as well as Mr. Bjornson. Graduate and local FN students will learn how to design highly efficient structures for northern climates and to capitalize on local resources, knowledge & skills, particularly IKS, in 2017 and with Dr. Coar in the design/build in 2018. Dr. Coar's research is aimed at providing an important perspective from the community to explore and examine what a more meaningful home would look like, be built like, and function like for FN communities. The concern specifically is centered on: 1) the quality and type of building system proposed for northern cold-climate communities; 2) the appropriateness of the layout of the home to support traditional activities and contemporary lifestyles of community members; and 3) the exploration of an increased focus on higher efficiency and localizing resources so that these homes can be maintained and built from local material and labour sources.

2) Model energy for optimization: Research will be undertaken to see how the housing design performs under different weather conditions and how close it comes to meeting the standards for Passivhaus Building Standard and net zero energy as well as the National Building Code (2015). Drs. Kavgic, Mallory-Hill, Coar, Bibeau and Rashwan will simulate for proposed occupancies (e.g., people per square meter) and simulate people's daily schedules to determine the indoor air quality, percent of people satisfied, etc. Dr. Kavgic will use freely available, open-source programs software for whole building energy modeling such as Energy Plus, OpenStudio, and CAN-QUEST to estimate energy performance of the house prototype and determine the perfect amount of insulation and types of windows, ventilation, etc. to achieve net zero and good indoor air quality with the number of occupants.

3) Build local capacity in construction: Mr. Bjornson has volunteered to assist to build a culturally appropriate sustainable house in WFN in 2017 or 2018 with local community trainers (apprenticeship trainers), RRC & UCN instructors & other local FN people. The next year, after monitoring of air quality, structure and energy efficiency information is obtained, Prof. Coar's design/build course will involve 10-15 graduate students in architecture & 15 -20 local students from Garden Hill working together to build capacity and improve the design building a sustainable house in Garden Hill Students and local people will also gain new skills for working with construction tools and discover how their designs must be well organized to be realized through construction. These two design/builds will result in Passivhaus open source designs, blueprints, culturally appropriate curriculum, educational videos & other teaching resources in English & Oji-Cree to develop a certificate program in building northern sustainable housing that will be freely available.

4) Monitor and evaluate the housing: Drs. Mallory-Hill, Rashwan and Kavgic will undertake the housing performance evaluation research with the research centre being used for housing and research. They will teach local FN students, teachers and trainers how to analyze the results from the different housing sensors as well as how to employ field-measuring devices including thermographic cameras for rapidly detecting mold inside and energy. Critical planning on different aspects such as operation and maintenance and management will be provided and design aspects will be reviewed and changed to be more sustainable.

5) Test local materials to maximize their use: Testing of local materials is required to maximize the use of local wood products, for example local timber and insulation. For example, ash wood-fibre insulation is abundantly available and is used extensively in Europe but not in Canada. Ash insulation is known to have many excellent properties for insulation including that it: diffuses moisture to prevent mold, low thermal conductivity from 0.037W/mK to 0.05W/mK and good fire resistance. Dr. Rashwan with the Centre for Applied Research in Sustainable Infrastructure and the New Building Envelope & Fenestration Test Chamber at RRC can assist with the testing of insulation and other materials**.** If feasible a business plan to create a new business for selling this product both locally and abroad using empty trucks that come up to deliver other construction materials.

6) Analyze Impact of Homelessness and Housing Education Program: Drs. O'Gorman,

Bonnycastle, Schiff and Thompson will conduct household and trainee surveys with local FN students regarding housing issues including prevalence counts of homelessness and hidden homelessness as well as social, financial, health and impacts on sustainable livelihoods of under-housing. The impact of the new housing education program on sustainable livelihoods will be studied. Policy briefs, reports, films and photovoice with high policy impact will be undertaken to show the need for housing but also the difference projects-based education can make.

2.2 Indigenous planning and education research for First Nation self-determination

Objective: Assess community needs and research options for developing Indigenous community plans and community-led post-secondary education to improve sustainable livelihoods and FN self-determination.

2.2.1. Research on Post-secondary education in FN communities

Presently no adult education university or college courses are offered in GHFN or WFN and no project-based degrees occur in Manitoba geared to FN people. Although 2 workshops with youth this summer in Island Lake showed that more than 90% of the 30 participating youth wanted to stay in their community to attend college or university. Limited funding is another issue, for example, WFN is only able to fund 3 students/year for tuition, travel & on average $1500/month for accommodation & living costs. These FN students often return home without a degree or diploma & feel disempowered due to numerous barriers to education in Manitoba. The lack of post-secondary training severely curtails education as shown in the film, https://www.youtube.com/watch?v=iAXgKPxCIT0&feature=youtu.be. In 2001, only 23% of registered Indigenous people attained a post-secondary certificate, diploma or degree compared to 40% of other Canadians (Frideres & Gadacz, 2004). According to Stonechild (2006), Canada's two-level educational system relegates Indigenous peoples to be an unskilled, seasonal work force supporting the elite. The TRC (2016) called for actions on jobs, training & education to reconcile, educate and skill FN people.

2.2.2 The need for Indigenous Planning

In *Doing It For Themselves: Transformative Planning by Indigenous Peoples,* Lane and Hibbard (2005, p. 172) discuss how Indigenous people have recognized that planning is a critical tool to enable "economic self-sufficiency and self-determination". Jojola (2008) describes Indigenous planning as an emerging concept involving promotion of community development to address social, economic, environmental, political and cultural challenges in Indigenous communities. He explains how Indigenous worldviews, identities and land tenures are the basis of the kind of planning that increases governance capacity, and builds and strengthens community self-determination while counteracting the negative intrusions of mainstream society. Claiming and developing ancestral territories and resources can be assisted by research on using local lumber for housing through forest management and woodlot licenses, as well as traditional land use plans, wild rice licenses and fishers' special dealer licenses. Dr. Thompson has developed preliminary plans with WFN and GHFN but further, long-term work is needed to implement them.

Indigenous nations are struggling to reassert their nationhoods and overcome the heavy impacts of colonialism in Canada (Anderson, Dana, & Dana, 2006). Over 3,000 programs in Aboriginal communities initiated community economic development (CED) (Chaland & Downing, 2003) but due to a lack of proper involvement of community members i.e. a top-down approach, the failure rate of these programs have been high (Reiter, 1990; Napoleon, 1992). Community development in these communities should be based on internal concepts of *mino bimaatisiiwin* or the "good life" of "continuous rebirth" (LaDuke, 2002, p. 79). FNs' research, governance, community

development and social enterprises must consider how to operate within this living system of continuous rebirth to provide running water, electricity, healthy foods, and good health care without imposing a capitalistic approach of competition, profit motives and environmental exploitation (Lee, 2009; LaDuke, 2002; Thompson, 2016). Indigenous communities in Canada are looking for a middle path for economic independence that incorporates Indigenous values to market capitalism (Loizides & Wuttunee, 2005) but also considering that there is a need to meet basic needs through community economic development (Thompson et al, 2014).

The traditional territory of FNs in Northern Manitoba are rich in resources but lack critical infrastructure, such as healthy housing, safe water, sanitation and roads, and the FN people there typically live in economic poverty despite Northern Manitoba's abundant natural resources (Thompson, Wiebe, Gulrukh & Ashram, 2012). FNs are cognizant that non-FNs large-scale mining, hydro, logging and tourism have resulted in mostly negative environmental and economic impacts (Merrick, 2014; Thompson, 2016) as well as a high level of state dependency. For example, on the traditional territory of Island Lake (which includes GHFN and WFN, as well as two other communities), mining exploration has found billions of dollars' worth of gold but still the FNs there live in economic poverty with no impact benefit agreements to share in the wealth with 50% of houses lack running water and/or any sewage services until recently (Falding, 2011) and a housing crisis. That there is no impact benefit agreement in place in Manitoba signals a need for change and research (Thompson, 2016). Research, capacity-building and amplifying calls for government support through this research can assist and technically support Indigenous development.

Applying the dependency perspective to FN development issues shows that the "assault on the land base of Native northerners threatened their basic economic resources and the way of life that these resources sustained....when all the riches were taken out from under" (Usher, 1993, pp. 106-107). According to the Royal Commission on Aboriginal People (RCAP), state dependency has large socio-economic costs, estimated to be $7.5 billion in 1996 or 1% of the GDP, increasing to $11 billion by this year, 2016 (Anderson, Dana, & Dana, 2006). Many negative impacts result from state dependency including poverty, lack of services and infrastructure on reserve, youth suicide (Office of the Ontario Coroner, 2011), poor rates of secondary school completion, ill health, domestic violence and homelessness. (Statistics Canada, 2011; McKinnon, 2014). Palmater's (2012) article summarizes the worsening conditions on reserves and the human toll it is taking: "Stretched beyond human limits: Death by poverty in First Nations". High food insecurity on Manitoba's northern reserves indicates the high economic poverty.

2. 2. 1.1 Food Insecurity in First Nations

With high food insecurity rates of 75% in Northern Manitoba communities, something has to be done. Problems of food access in remote fly-in communities in Manitoba include limited selection of perishable foods, high food prices, escalating transportation costs, uncertainty of travel on winter ice roads, high poverty rates, and a declining use of local country foods (Thompson et al., 2011a, 2011b). The rates for food security are highest in remote communities at 88% in Garden Hill FN and 86% in Wasagamack FN (Thompson, 2011a). The re-invigoration of local food production is considered key to food access (NFPSC, 2003).

Community-based food action is one possible response to tackle food insecurity, alongside business activities, government programs, and social policy (Thompson et al, 2014). Indigenous food systems in Island Lake could be used to improve food security to assist the fishing, hunting, gardening and a community food stores. Meechim Farm Inc., a community run enterprise, is a 15 acres farm started in 2015 with the help of Dr. Thompson and her graduate students at the request of chief and council. Meechim, which means food in Oji-Cree, is the only farm in Northern Manitoba employing 10 to 15 youth through employment training in 2015 and 2016. However, although elders used to garden, hence the community name, Garden Hill, this has not occurred in decades and so little

expertise was available locally to draw on. The community has requested horticulture programming that considers IKS and country foods (Thompson et al, 2014).

There are 4 steps for research in Indigenous planning:

1) Assess community needs for priorities: A community planning team, including the employment & training director, will determine the communities' research priorities and thus the projects undertaken by the researchers. Community consultation will occur with at least 3 meetings in both FNs during the first few years of research.

To help assess community needs and inform consultation ensure basic needs are being met there will be an investigation of housing, water and food insecurity of households through a household survey and other community-based participatory research. A homelessness/housing insecurity prevalence count will be conducted and the experience of homelessness and housing security through surveys, photovoice and film by Drs. Schiff and Bonnycastle. This research will include analyzing data about people's mobility from the north to the south because of housing, domestic violence, health issues, etc. and its role in murdered and missing women and other social problems with Dr. Bonnycastle taking the lead. How housing insecurity intersects with food and water security will be explored. Drs. Farenhorst, Patterson and Lobb will study drinking water quality in cisterns, pipes and treatment plan in households to study the need for addressing water quality to safeguard health. They will map out the findings and compare to health impacts. Food insecurity rates will also be determined. Through surveys, community cafes and photovoice activities/exhibits, community meetings, workshops, community members will increase their capacity and skills by participating in and evaluating the current state of housing, water and food and create greater awareness: Drs. Schiff, O'Gorman, Martin, Bonnycastle; Olsen Harper and Thompson.

2) **Plan community projects, research and education:** To develop a community plan the community will consider their priorities for development projects, research and education over a 1 year, 5 year and 10 year period and revise it periodically. For planning purposes the community will consider their resources and capabilities as well as their needs for housing, water, food security, sustainable livelihoods and IKS to develop a strategic plan for meeting these needs. Drs. Thompson, Olsen Harper, Settee and Ballard will work with the community planning teams and determine what research, education and programs are needed to realize the plan and the steps required to realize the priority projects, such as curriculum development with a college or university.

A plan to manage resources sustainability may need research on the resource base in their traditional territory and how to better access and protect these resources. The communities recognize they need research assistance to develop woodlots and obtain forest management licenses to use local timber for housing. However, as this area has no forest management units some research would be required to determine the sustainable harvest. As well, research on other designations to protect traditional territory from unwanted outside development is needed. For food security, there is an interest in obtaining wild rice licenses for the traditional territory of Island Lake. Options to increase food security will also be considered (e.g., country foods programs, fishing, local markets, agriculture, etc.). Programming for country foods and fisheries requires research on quantity, quality and cultural importance of country foods and fishing. For that, Dr. Patterson is prepared to analyze wild meat and fish for different chemical parameters, such as mercury and lead, to analyze the best country food diet for food security and food safety. Different farm management techniques to increase food security, productivity and youth training opportunities provides opportunities for research on the agriculture farm at Garden Hill (Thompson, 2015).

3) **Run projects-based community-led post-secondary education to address priority community needs**: Community-led adult education that is projects based for housing and other priorities will be developed. It will apply best practices for Indigenous education by: 1) working with/in the community; 2) being learner-centered, holistic approaches; 3) applying Indigenous learning principles; 4) involving employers to provide workplace experience through workplace training

program; & 5) having the control & ownership at the community-level with a community team/board, FN community coordinator & ideally a local teacher, which if not immediately possible can be achieved quickly with a train the trainer model (Canadian Career Development Foundation, 2014).

For housing, a new culturally-appropriate curriculum would be developed, modifying the existing carpentry or pre-employment trades programs at RRC and/or UCN to be projects-based where the course includes hands-on building of sustainable designs appropriate for this location, after learning from the two design/builds test homes. A 10-month sustainable housing certificate program would provide all the skills necessary to build a sustainable house. This sustainable housing course will be a highly marketable, stand-alone certificate, as currently there is no sustainable housing or passivhaus course offered by any university or college in Manitoba or Canada. Short 4-day workshops exist but not applied at the entry-level to provide all the carpentry skills to manage the building of a sustainable house. As part of the program, each student will build a number of houses supervised by an apprenticeship designated trainer, who are allowed to have three apprentices each in northern Manitoba. As well, students would learn principles and theory in class for passing level-1 carpentry apprenticeship, should they wish to continue to higher levels or to get Red Seal. Other trades could be apprenticed (e.g., plumbing & electrical) in the community at the entry-level if there is enough interest. The certificate training program could run each year in one or both communities for 5-years with 12 to 20 students in each class to help meet the huge demand for housing. CMHC would fund housing materials in Wasagamack FN & Garden Hill FN has affirmed that BDO would fund housing materials, based on this partnership grant.

Other education is needed in Garden Hill, which started Meechim Inc., a farm that employs 10-15 youth without a strong education or training component, which curtails the success of the farm. Horticulture education is wanted there to help grow farmers and to grow local food for the community at the Meechim farm. Drs. Settee, Singh, Shukla, Harm & Petrella could assist in curriculum development, research & training local trainers to include indigenous food system and IK. Also, community-based teacher training is wanted similar to the award-winning Brandon University Teacher Education Program (BUNTEP), which was a community-based teacher-training program that was successful in graduating local teachers before being shut down a decade ago. Garden Hill and Wasagamack communities have no or few local certified teachers to take the place of the BUNTEP teachers that are retiring.

To analyze the education's benefits & refine it, focus groups, student testing, participant observation, interviews & educational videos will be undertaken. 80 stakeholders including students, employers, educators & administrators & policy-makers will be interviewed. All students will take exit interviews &/or surveys after each course with 60 students being randomly selected for follow-up 3 years after program completion. In order to complement the narrative data, local FN college students will do Aboriginal Possible Selves mapping & photo-voice. Community workshops to share the findings & to revise educational & developmental plans will occur yearly.

4) **Maximize impact of Indigenous planning and education**: The individual activities will be monitored but also the collective impact of these activities will be analyzed (Drs. Olsen-Harper, Thompson, O'Gorman & Quarter). As well, policies & programs will be reviewed to assess their impact on housing & adult education in FN communities & to assess the need for policy change and programming to deal with the consequences of homelessness, housing insecurity & the lack of adult education (Drs. Schiff, Quarter, Olsen Harper & Thompson). A community-led housing assessment kit, as well as a community-led post-secondary education guide will be developed to facilitate uptake of programming by FN & other communities (Drs. Schiff, Olsen Harper & Thompson).

3. Team

3. 1 Project Leader - *Dr. Shirley Thompson*: Dr. Thompson is an associate professor at the Natural Resources Institute who has worked with both GHFN and WFN communities for more than ten years on community development research on food, water and land use planning projects. She has also worked with most of the diverse partners that are part of this application on at least one project.

Dr. Thompson has lots of successful experience being project director (PD) of a partnership development grant, SSHRC Insight Grants and the CIHR grant with FNs in northern Manitoba. These projects continue to develop and need further research to see their impact and grow these enterprises further. This environment is a challenging environment to do research work in for many reasons but Dr. Thompson is able to succeed here and can show others how to succeed. Dr. Thompson has demonstrated leadership, accountability as well as effective project management of research projects. Dr. Thompson teaches a course on management systems that covers strategic planning, business planning and project management and will apply these skills to this CFI and to her research partnerships. Dr. Thompson with the NRI support staff can successfully monitor fidelity to the governance & accountability framework for this CFI grant. Dr. Thompson will be meeting every month with both research and community teams. Dr. Thompson will apply her film skills to capture the designing and building the pilot houses to produce educational resources, curriculum and closely monitor the project to ensure its success. Dr. Thompson's ability to manage multi-site projects with many stakeholders is proven by her multiple-terms as co-president of ESAC and having been successful as the project director of many complex, northern research projects.

Dr. Thompson will manage an effective world-class team that will provide a new model for partnership and CFI research. Each person plays a pivotal role in the area they are experts. At the community level, employment and training will recruit the best local FN students to work on the projects-based post-secondary education that the person shows an aptitude for. The employment and training directors, Elsie Monias at GHFN and Ernie Harper at WFN, have many years of experience and a process to hire youth between 18 and 30 and have committed funding to employ them to do education that includes a theoretical and hands-on component. These directors are able to engage Apprenticeship Manitoba and have local apprenticeship trainees in carpentry and plumbing who can be local train the trainers for a sustainable housing certificate where students build sustainable houses. These two directors have committed to pay local students to design/build the two pilot sustainable houses and other sustainable houses if they take projects-based education programs with RRC or UCN. Funding for student's employment & training work, was offered by both communities and MKO in their partnership letters, to ensure this education proceeds. However, should the partnership talent grant be successful, 150 to 200 local FN students would receive $1,000/month for each student taking a 5-month or 10-month education certificate to account for 80% of the funding or $2 million. Apprenticeship supervision would occur through Apprenticeship Manitoba, as was done previously in both communities. However, without college or university support only 1 out of 40 got level 1 apprenticeship or any certification, although many houses were retrofitted for sewer & water cisterns. Having RRC and UCN as coapplicants and partners has allowed them to commit to develop sustainable Northern housing curriculum to ensure good results for certificate and level 1. For horticulture education, Drs. Settee, Singh, Shukla, Harm & Petrella could assist in curriculum development, research & training local trainers to include indigenous food system and IK.

A northern sustainable house is possible to be built in these communities. This is certain as Mr. Bjornson who built the only Passivhaus and net zero energy standards in Manitoba, volunteered to supervise local FN students, instructors and trainers to build the first sustainable house built in Wasagamack, based on his preliminary open-source design. With the key housing experts in air quality, structure and energy efficiency, Drs. Rashwan, Hill-Mallory and Kavgic, will be able to assess this house to improve the design of the 2nd building. Architecture Prof, Coar then will work with 10 to 15 graduate students and FN local students to improve the design from WFN at GHFN and

teach sustainable design and building. Many FN scholars, in land, food, water, housing and education research, will address sustainability in these key areas to ensure housing has the needed resources, such as clean water, timber on traditional lands and food.

Dr. Thompson will administrate the research funding. Dr. Thompson will hold regular project meetings both in Winnipeg for the academic researchers, social enterprises and Island Lake representatives and in Island Lake to connect with the community advisory committees. By establishing an Island Lake advisory council that includes a team from Wasagamack and team from Garden Hill to guide current research, Dr. Thompson will ensure through this advisory council that the research is meaningful, relevant, and respectful to community members. She will also help to coordinate the housing projects to ensure that they work with local labour and materials to develop a housing industry there and to coordinate the purchasing and research centres with the communities. On-going funding will be provided through researching partnerships with Sundial Building Performance Inc., Aki Energy, FNs, Wasake Co-operative, Meechim Market and through teacher, student and researcher fees for accommodation.

A northern research partnership group, organized by Dr. Thompson and Dr. Rashwan has been meeting monthly at RRC since the fall of 2015. These meetings were effective for planning and well organized. These meeting will continue to ensure the programs and research are adequately coordinated and that the teams dialogue adequately. The teams are diverse with a number of First Nation scholars taking leadership roles and all coapplicants are profiled to show the diversity of the people. To assist operations there will be teams and team leaders for both community and academic representation.

Two teams will be collaborating, having local leadership involved in each case, including:

1) Housing design and capacity-building team. Team leaders: Drs. Coar, Rashwan and Mr. Bjornson with Mr. E. Harper and Ms. E. Monias.
2) Indigenous planning and education for self-determination and sustainable livelihoods. Team leaders: Drs. Olsen-Harper, Thompson and Settee with Chief Mason and Mr. I. Harper.

3. 1.1 Housing design & capacity-building team

Mr. Dennis Ballard: Dennis Ballard, B.Sc is the community education coordinator at University College of the North. Mr. Ballard has several years of service as a policy analyst and researcher in Environment, Agriculture and Health; the last year and a half as post-secondary education and training. The majority of his service has been focused on working with representatives of First Nations communities throughout Manitoba to identify and address community based training and education needs. Following a career in the construction industry, he received a Bachelor of Science degree, specializing in physical geography and environmental sciences. Mr. Ballard has served on various boards including; Manitobans for Human Rights Inc. – Vice-President, 50 by 30, Organization Steering Committee, Mount Carmel Clinic – Finance Committee and Point Douglas Local Health Involvement Group. Mr. Ballard also served on various health and social development committees and working groups addressing health and social issues of displaced and relocated peoples in Manitoba. He is Cree and studied Indigenous Knowledge Systems. He will be developing education programming with UCN regarding housing and other trades that is project-based related to this research.

Dr. Eric Bibeau: Dr. Bibeau is an associate professor in Mechanical Engineering. His research interests are innovative renewable energy technologies for distributed applications, and increasing the renewable energy ratio of communities. Dr. Bibeau was the alternative energy NSERC/Hydro chair to encourage collaboration with the U of M, engaging researchers and students to research and develop alternative energy applications that are based on scientific and sound economic analysis including net zero housing and electrical vehicles. He hopes to promote alternative energy research that may lead to new opportunities in the interest of First Nation communities.

***Mr. Eric Bjornson*:** Mr. Bjornson is the owner of Sundial Building Performance, Inc., which was established in 2002. The primary business activity since inception has been providing performance solutions for existing buildings. These solutions address performance failures such as condensation issues, mold growth, ice damming, comfort issues, excessive energy use, structural failures, and indoor air quality concerns (radon, humidity, odours, etc.). By applying training in building science principles, and our knowledge and experience with available materials and methods, the company has resolved performance issues on thousands of homes resulting in healthier, more comfortable, durable and energy efficient homes for our clients. Sundial has transitioned to focus on designing and building homes with exceptional comfort, durability, and energy efficiency. Many in our team have received formal training in the design and construction of homes based on the principles of the Passivhaus building standard. The Passivhaus standard allows us to use ecologically thoughtful materials and cost effective solutions as guiding principles as we work with others to create very functional yet simple homes with exceptional performance.

After participating in two trips in July and August 2016 with Dr. Thompson, Mr. Bjornson assessed many aspects of housing construction, including foundation types, wall, roof, and floor assemblies, and heating and ventilation strategies Sundial drafted a housing design which includes a pier foundation, a variation of a timber frame structure, a durable air tightness strategy, a very thermally efficient building shell, and durable, natural finishing materials throughout. Knowledge translation is being considered about how local builders would be provided a set of detailed, well illustrated set of step by step assembly instructions and some guidance to build a local build team capable of transforming the package of materials components into a very high performance home.

***Dr. Lancelot Coar*:** Dr. Coar is an Associate Professor in the Department of Architecture at the UoM. Since 2007, Dr. Coar has worked closely with rural and FN communities to develop strategies for community-guided teaching for architecture students. These projects are based on guiding students to learn through inter-personal engagement with community members and working with the complex realities facing these communities. These projects have brought about the completion of both conceptual design proposals as well as fully realized design/build projects that now serve these communities. Dr. Coar has most recently been working on a two-year CIHR-funded project with researchers from the Faculty of Medicine to explore how the traditions, culture, and challenges of modern life of the Dene FN communities of Tadoule Lake and Lac Brochet, MB can inform a better home for the Dene people.

Dr. Miroslava Kavgic: Dr. Kavgic is an assistant professor in the Civil Engineering Department at U of M; her work covers energy use in buildings, sustainable building design, and indoor thermal comfort. Before joining U of M, she was a post-doctoral fellow with the Renewable Energy Storage Lab of Dalhousie University and conducted research on advanced heating ventilation and air conditioning (HVAC) control strategies designed to minimize building energy consumption while maintaining indoor thermal comfort. Dr. Kavgic holds MSc and PhD degrees in Environmental Design and Engineering: Built Environment from University College London, UK. She has considerable experience and knowledge with numerical modeling of energy systems and experimental work. She also has extensive experience working in the construction industry as a mechanical engineer and project manager. Her past contributions relevant to this project include building energy modeling, building envelope optimization, indoor air quality and thermal comfort. Dr. Kavgic developed the first housing stock energy model in Serbia to investigate technical options for energy-efficient refurbishment of Belgrade's housing stock by 2030 (Kavgic et al., 2013; Kavgic et al., 2014). She developed optimal design packages for different types of residential buildings that balance between energy performance and indoor thermal comfort (Kavgic, 2013). She conducted long-term monitoring in 96 homes in Belgrade, representative in terms of location area, type of building, year built, and heating type to investigate indoor air quality and thermal comfort (Kavgic et al., 2012).

Dr. Kavgic will address the need for sustainable housing in First Nation communities by contributing her expertise and knowledge in building energy conservation, indoor environmental;

energy modeling, and energy auditing to help designing homes that are warm, healthy, energy efficient, and affordable. Dr. Kavgic will research energy efficient housing design solutions that provide healthy indoor environment and meet the needs of the first nation community will be developed using detailed whole building energy performance tools. Dr. Kavgic will provide opportunities for students to be engaged on the housing project and gain fundamental knowledge and understanding about energy-efficient construction and its environmental benefit.

Ernie Harper: Ernie Harper is the coordinator of Employment and Training at Wasagamack First Nation. He oversaw an apprenticeship program to install water and sewer in 160 homes over four years. Mr. Harper effectively supervised the apprenticeship trainers and trainees to add the water and sewer cisterns to buildings but could do nothing at that time to fix the moldy and unhealthy housing. As well, the cheapest cisterns were purchased which created cleaning and health issues. Although Mr. Harper organized trainees under the apprenticeship program, which was approved at a 1:3 level only one youth out of twenty received level one in carpentry due to very limited theory education as part of the program and lack of funding to send people to train or to test their theory. He is dedicated to applying this program again supported by universities and colleges to allow more academic success and to solve many problems at the same time.

Dr. Shauna Mallory-Hill: Dr. Mallory-Hill is an Assistant Professor with the Department of Interior Design. She has a doctorate from Eindhoven University of Technology, The Netherlands and a Masters of Architecture from U of M. Dr. Mallory-Hill has explored the impact of green building design on human productivity and wellness including on-line occupant surveys and physical measurements of indoor environmental quality (IEQ). To date, relatively few studies have been undertaken to validate the benefits of green buildings to human behavior and health. She will assist in this project with building performance evaluation.

Elsie Monias: Elsie Monias is the director of Employment and Training at Garden Hill First Nation. She hired fifteen workers to train at Meechim Inc. She also ran a timber housing project with fifteen youth involved in the employment training program that built three five bedroom houses using local logs with Frontier Foundation. She also works with Apprenticeship Manitoba to ensure that youth employment workers receive one to three training ratios for apprenticing. However, due to the lack of local theoretical training and testing the workers were not able to evolve to level one apprentices.

***Dr. Shokry Rashwan*:** Dr. Rashwan began his career as a Project Manager for residential and commercial buildings. He has since held a number of research positions with the construction industry, including as Director of Research with the Prairie Masonry Research Institute (PMRI) in Edmonton, Alberta; Research Manager with the National Research Council (NRC) in London, Ontario and, currently, as the Construction Research Chair at Red River College (RRC) in Winnipeg, Manitoba. He also has held Adjunct Professorship posts and taught at the University of Alberta and the University of Western Ontario. He is a Professional Engineer in Alberta and Manitoba, a member of American Concrete Institute (ACI) committee 131.

3.3 Indigenous planning for water and land management

Dr. Myrle Ballard: Dr. Myrle Ballard received her master and doctorate degrees from the Natural Resources Institute at the U of M; her doctoral supervisor and post-doctoral co-supervisor was Dr. Thompson. Dr. Ballard has directed a number of films and worked on planning issues related to First Nation communities on Lake St. Martin.

Dr. Marleny M. Bonnycastle: Dr. Bonnycastle is an assistant professor at the University of Manitoba. She worked with the Northern Social Work Program in Thompson, Manitoba for the past 5 years and is currently with the Inner City Social Work Program in Winnipeg, Manitoba. Marleny has extensive experience in CBPR working with different populations. Her areas of research interest are homelessness in Northern Manitoban communities, gender and women, including post-secondary students, refugee and immigrant women and violence against women and girls. Additional areas of research include FASD, and knowledge mobilization. Her teaching approach focuses on building links

between teaching, research and the connection to social work practice. Specifically, she concentrates on community development, action-research such as feminist, collaborative, qualitative and visual methods such as photovoice. Dr. Bonnycastle's major interest is the inclusion of Indigenous voices in identifying needs and gaps related with homelessness and housing instability as well as co-constructing home. Specifically, she will focus on different groups and families affected by domestic violence.

***Dr. Becky Cook*:** Dr. Cook grew up in the fishing community of Misipawistik in northern Manitoba, where her father, grandfather and many generations before were fishermen on Lake Winnipeg and the other water bodies surrounding Misipawistik. She will partner with the Island Lake Wabung Fisheries Co-op to help the fishermen accomplish this goal by identifying important fish habitat areas for conservation and to help raise awareness about sustainable fishing practices the community is undertaking. In 2015 Dr. Cook received her Ph.D. from the University of Southampton, UK. Dr. Cook's proposed fisheries research partnership involves working closely with the local fisherman's co-op, the Island Lake Wabung Fisheries Co-op and the First Nations communities around Island Lake to integrate Traditional Knowledge, harvest weights, GIS analysis mapping of the lakebed to identify the preferred habitat for specific fish species.

Dr. Annemieke Farenhorst: Dr. Annemieke Farenhorst (PhD, University of Toronto) is a professor in the Department of Soil Science, UoM and the Prairie Natural Sciences and Engineering Research Council of Canada (NSERC) Chair for Women in Science and Engineering. Over the past six years, Dr. Farenhorst has been successful in attracting more than $2.7M in research and program funding and supervised 47 Highly Qualified Personnel (HQPs) (this number includes her current HQPs). During this time, Dr. Farenhorst and her team published 32 refereed articles and book chapters, and delivered 137 invited and other conference presentations, in addition to 26 research reports many of which were to Chief and Council in FN communities. Dr. Farenhorst directs the NSERC CREATE H2O program for FN water and sanitation security. There is a wide range of projects under this program, each addressing key questions and objectives set by the community collaborator.

Ivan Harper: Mr. Harper is the land use coordinator for Garden Hill First Nation Band and a community member there. He had been a band councilor for several terms and also worked as a researcher for University of Manitoba with Dr. Thompson. He received a diploma in Aboriginal Governance at Red River College. He is an expert in local Indigenous Knowledge Systems and is the traditional medicine person in his community.

***Dr. David Lobb*:** Dr. Lobb is a Professor of landscape ecology in the Department of Soil Science at UoM. His research and training spans the areas of land use and management, and soil and water conservation, from the field scale to the watershed scale. In 2010, he was awarded the Senior Research Chair in Watershed Systems Research, charged with the task of improving the quality of water resources in Lake Winnipeg and its watershed. Over the past 15 years, he has secured over $5 million in research funding as a principal investigator (PI) and over $9 million as a co-applicant. His research program has supported the training of 80 highly qualified personnel, and produced 67 scientific papers and chapters and over 300 scientific presentations. A major element of Dr. Lobb's research has been the use of fallout radionuclides (FRNs) in the assessment of soil erosion and sedimentation. He operates the Environmental Radiochemistry Laboratory (ERL), which is the largest facility in Canada, the third largest in the world, for the assessment of soil erosion and sedimentation using alpha and gamma spectroscopy. Dr. Lobb is the Chief Scientific Investigator from Canada in the International Atomic Energy Agency's (IAEA) research projects on the assessment of soil erosion and sedimentation using fallout radionuclides.

***Dr. Donna Martin*:** Dr. Donna Martin is a nurse and professor who is committed to promoting social justice and health equity in partnership with Indigenous peoples. During her graduate studies, Dr. Martin travelled to several FN communities to conduct an ethnographic study about northern nurses and their work. The interviews and fieldwork provided data that supported previous findings about inequities in all services in FN communities. In her doctoral dissertation, Dr. Martin explored

Indigenous nursing students' experiences at two Canadian schools of nursing. The findings revealed inequities in educational services, systemic racism, and resiliency. Dr. Martin came to the University of Manitoba in 2009 with opportunities to work in partnership with Indigenous peoples on a study about family health with Fisher River Cree Nation. The Chief and Council were supportive and receptive to the findings with a subsequent pilot program of home visits to families when an individual had diabetes, a support program for new mothers, and a change in inventory/layout of the Band-owned store. Through working with nurses and community health care workers, she will build awareness of community issues related to built environments that impact health.

Dr. Jack Quarter: Dr. Quarter is a professor with the Department of Leadership, Higher and Adult Education at Ontario Institute for Studies in Education (OISE**),** University of Toronto. He has won many awards including in 2015 the Distinguished Service Award, Association for Nonprofit and Social Economy Research. Dr. Quarter will research social enterprise and community development for Indigenous development as a case study.

Sharon Mason: Sharon Mason is the chief of Wasagamack First Nation and has a Law degree from Calgary University. She lives in the Wasagamack community with her six children. Chief Mason participated in most meetings of the SSHRC partnership meeting and led a project with Dr. Thompson to get a women's shelter in her community.

***Dr. Melanie O'Gorman*:** Dr. Melanie O'Gorman is a development economist who has been working on socio-economic issues with First Nations/Inuit communities since 2010. Dr. O'Gorman teaches and researches in the area of economic development at the University of Winnipeg. Most recently Dr. O'Gorman has been working on a research project ("The Right to Clean Water in First Nations: The Most Precious Gift") through the University of Manitoba, which is documenting the socio-economic impacts of a lack of clean drinking water and sanitation in First Nations communities. This project has involved statistical analysis of a cross-Canada data set, a survey in St. Theresa Point First Nation and advocacy work to develop an improved model of financing water infrastructure on research. Dr. O'Gorman will bring many skills developed in this project to the present project. Dr. O'Gorman has also just completed a project on the determinants of high school completion in Nunavut. This project involved fieldwork in many isolated communities that deal with similar climactic/housing/infrastructure issues as those in Northern Manitoba and which used the same methodology Dr. O'Gorman will bring to the present project. Dr. O'Gorman will be involved in three main areas of this research project: 1) Documentation and estimation of the economic impact of alternative energy sources; 2) Testing for significant impacts of adequate housing and purified water on educational attainment, health, work hours and leisure time due to not having to haul water; 3)Dr. O'Gorman will work with the nursing station to correlate housing conditions (e.g. presence of mold, improved water, improved insulation or other housing retrofits) and water conditions with health conditions, to highlight highly effective interventions.

Dr. Harms: Dr. Harms is an assistant professor in the sociology department with Brandon University. She has worked on studying the impact of consumer cooperatives on food access in FN communities. Dr. Harms is interested in looking at food access and food options as well as assisting with a curriculum for Indigenous food systems.

***Dr. Anita Olsen Harper*:** Dr. Olsen Harper has an in-depth awareness and understanding of Aboriginal issues; her contacts for research, team-building and advocacy to address Indigenous education and training are extensive. Consistent with the holism of her Aboriginal roots, Dr. Olsen Harper's thought and approach promotes interdisciplinary cohesion and creative application to educational efforts from grassroots to House of Commons Committee levels. Her university education is: B.Ed – Adult Education; M.A. – Canadian Studies (Heritage Conservation); and, PhD – Education (Society, Literacy & Cultures). Dr. Olsen Harper was recently awarded a Mitacs Elevate Postdoctoral Fellowship at the Natural Resources Institute, University of Manitoba where her project is "Our home and Native resources: Community planning and sustainable development to build

prosperity in Wasagamack and Garden Hill FNs". Her primary expertise is in Aboriginal adult education/training, community-based participatory research; anti-violence in Aboriginal communities; health and well-being; Indigenous knowledge translation; history and heritage representation. She was a Network Environments for Aboriginal Health Research (NEAHR) fellowship recipient during her PhD studies and sits on the Advisory Board of Unama'ki College of Cape Breton University. She was recruited to the Indigenous Health Advisory Committee (IHAC) for the Royal College of Physicians and Surgeons of Canada (RCPSC). In 2014, Dr. Olsen Harper was elected Trustee, Zone 5 of the Ottawa-Carleton District School Board (OCDSB); she sits on the Advisory Committee for Equity within the OCDSB. In these positions, she is an advocate for delivering education in ways that are compatible to Indigenous peoples' ways-of-thinking, and promoting their well-being as students and learners. As a post- doctoral student Dr. Olsen Harper will help build capacity related to anti-violence and land management efforts. In doing this, women and men in Garden Hill and Wasagamack FNs who are also passionate about the need to tackle the increasing violence in their FNs will be fellow-researchers since they, living in their communities, understand first-hand the dynamics taking place. Dr. Olsen Harper plans on using educational means of knowledge transmission through community relationships to unveil entire traditional systems and locations regarding family living. This, in turn, will help transform the *status quo* and a move into respectful living that reflects *minoopimatissiwin*.

***Dr. Michael Patterson*:** Dr. Paterson is the Chief Research Scientist at the IISD-Experimental Lakes Area (IISD-ELA), a whole-ecosystem research program based in northwestern Ontario focused on finding solutions to water-quality problems. He has worked as a Research Scientist at the ELA since 1992, first with Fisheries and Oceans Canada and then with the IISD-ELA. Throughout his career, Dr. Paterson has participated in and led projects on a wide variety of environmental issues including eutrophication, contaminants (especially mercury, organic contaminants, and pharmaceuticals), reservoir creation, and climate change (e.g. Kidd et al., 2014; Paterson et al., 2011; Harris et al., 2007; Paterson et al., 2006; St Louis et al., 2004). All these problems affect First Nations communities and water quality in Lake Winnipeg. The IISD-ELA is in the Lake Winnipeg watershed and much of Dr. Paterson's research has been focused on water quality issues in northern Manitoba and northwestern Manitoba. He is an author or co-author on over 55 peer-reviewed publications and is an adjunct professor at the U of M and Winnipeg. He has acted as a supervisor, committee member, or external examiner for 27 graduate students.

Dr. Paterson will assist with the assessment of the quality of water and the quality of wild foods utilized by First Nations communities. He will provide advice on ways to address water quality issues and to find solutions for problems affecting local communities. IISD-ELA has been involved in capacity building with First Nation communities in northwestern Ontario and Manitoba and would like to extend this work to eastern Manitoba. In Ontario, we are developing programs for citizen science with First Nations communities and this could hopefully be extended to the communities covered by this proposal.

Dr. Serena Petrella: Dr. Petrella is an associate professor in the sociology department with Brandon University and also chair of the Sociology department. She is coordinating the Brandon team including partnership with Rural Development Institute and other researchers at Brandon. Dr. Petrella is interested in looking at food access and food options as well as assisting with a curriculum for Indigenous food systems.

Poonam Singh: Dr. Singh is an assistant professor at Assiniboine College in the department of horticulture. She is interested in looking at sustainable food production and working in the Meechim Farm as well as assisting with a curriculum for Indigenous food systems. She has started a seed saving project working with FN communities for Indigenous plants.

***Dr. Rebecca Schiff*:** For over ten years, Dr. Schiff has been conducting research on housing and homelessness, in partnership with indigenous communities. She is the author of numerous publications on housing and homelessness in Canada, including several publications focused

specifically on housing needs in northern and indigenous communities. As part of her dedication to community engagement, Dr. Schiff has been involved with numerous groups at local and regional levels. This includes her past work with the Labrador Aboriginal Health Research Committee, as co-chair for the Research Exchange Group on Rural, Northern, and Aboriginal Health at the Newfoundland and Labrador Centre for Applied Health Research, and her current work as member of the National Aboriginal Academic Advisory Board for the Mitacs Aboriginal Community Engagement Program.

The proposed research builds on Dr. Schiff's past work on housing for indigenous and First Nations communities in Canada. In particular, that work identifies a need to understand policy and regulatory barriers as well as community needs, assets, and strengths related to housing. Methods include: scoping review to identify policy, legislative, and regulatory issues related to housing in First Nations and other indigenous communities; scoping review to inform the development of a tool for assessing housing needs and assets in communities; community-partnered consultation processes (interviews, focus groups, community meetings) to identify, needs, strengths, and assets for housing development and maintenance; interviews with key informants to identify business models for CED approached to housing development in First Nations communities.

Dr. Priscilla Settee: Dr. Settee is an Associate Professor in the Department of Indigenous Studies and Women and Gender Studies Program at the University of Saskatchewan and a member of Cumberland House Cree First Nation from northern Saskatchewan. She has developed youth leadership programs and internships in the local and international context (Fiji, the Philippines, Hawaii internships). Dr. Settee has edited one book (Coteau Publishing) called *The Strength of Women, Akemeyimow*. Her first single authored book *Pimatisiwin, The Good Life*, Global Indigenous Knowledge Systems (John Charlton Publishers) was published in 2013. In 2012, Dr. Settee received the University of Saskatchewan's Provost award for Teaching Excellence in Aboriginal Education. In 2013, she was awarded the Queen Elizabeth Diamond Jubilee award for contributions to Canada.
She was also named by Canada's Globe and Mail University Report "University of Saskatchewan's hot shot professor" in 2013. Dr. Settee serves as Adjunct Professor for the Natural Resources Institute at the U of M. Dr. Settee will help co-ordinate the land and water management team and supervise graduate students. Dr. Settee is interested in assisting with a curriculum for Indigenous food systems.

Shailesh Shukla: Dr. Shukla teaches Indigenous food system courses in the Indigenous Governance program at University of Winnipeg. He runs a course focused on indigenous food systems and is interested in assisting with a curriculum for Indigenous food systems and horticulture for certificate courses in FN communities.

Nora Whiteway: Nora Whiteway is the land use coordinator for Wasagamack First Nation Band and a community member there. Ms. Whiteway was a band councilor in the past and worked for many years doing traditional land use research at University of Manitoba with Dr. Thompson. Ms. Whiteway speaks Oji-Cree fluently and is considered an elder by the community. She has a wellness certificate from the UoM and is an expert in local Indigenous Knowledge Systems.

4. Research infrastructure

This is the first time that research centres will be located on FN reserves. By being in the community the research centres will build capacity on reserve to meet basic needs sustainably. Research laboratories are required to bring research capabilities to the Island Lake communities and other fly-in communities on the east-side of Lake Manitoba. This is a model of doing research in situ and with traditional knowledge. In the past, with the auspices of researching to address the issues in the north and First Nation communities, research facilities have been built in urban centres where researchers are located rather than reserves. This does not address the problem of research capacity in the north or designing for the north by researching in the completely different environment of southern Manitoba does not provide a realistic scenario that can apply to devise solutions for the issues in the north considering the economic, ecological and social differences. As a result, research outcomes, which benefit FNs or adequately resolve the issues, do not emerge.

4.1 Infrastructure at Wasagamack FN -- Sustainable housing research centre

The research centre will be designed and built as pilot models for northern Sustainable Housing but serve many research functions as well as accommodation functions. One research facility/test house will be built in Wasagamack in 2017 based on designs that were developed from four workshops in two communities, as shown at: https://youtu.be/8dLtNsjeQVQ. Prior to building we will have a few more design charrettes in the Wasagamack community with the local builders and local employment training youth learning about building houses and model the house to improve and fine-tune it. The President of Sundial Building Performance Inc., Mr. Bjornson, has committed in his letter to help design and oversee the community build with his manager in 2017, if it is possible to ship the materials on winter ice roads in winter 2016/2017, with local people (and 2018 if the winter shipment does not occur in time for 2017). His design and management is volunteered at $350,000 and the community has provided $350,000 in-kind to cover labour costs of apprenticeship trainers and local post-secondary students. Item 2 is the kit for the 1024 square foot Sustainable House will be purchased from Sundial Building Performance for $235/SF including foundation, structure, all mechanicals, finishings, fixtures/major appliances and delivery at a cost of $240,640 with $650,000 inkind. Item 3 is the 10 MW of solar photovoltaic cells will be purchased to make the house net zero for energy at $32/SF for a cost of $32768. Item 4 is the grid and sewer connection at Wasagamack is estimated to cost $2000 as this is a serviced lot. Item 5 are the furnishings including desks, tables, chairs and mattresses for the bunkies (enclosed bunk beds that serve as rooms) are priced at $4200. Some desks and tables will be built as part of education program.

By the research centre being a compact house-like structure it will closely model the proposed housing for the community. This building is designed to provide sufficient space for a computer lab, workspaces, laboratory equipment, and living accommodations in a compact design. After the building in 2017, the research lab will be monitored for indoor air quality, energy efficiency, moisture and other aspects for an extended period (5 to 20 or more years). This research lab will provide research and laboratory space for researchers but also accommodation for researchers, post-secondary teachers and graduate students doing research and attending the design build in Garden Hill, as there is very limited housing available due to the severe housing crisis.

Having a hostel type environment will more accurately model housing in Northern Manitoba considering the overcrowding conditions in most houses that will remain for many years. 1500 houses are reported as being required in Island Lake to provide adequate housing. Although these are stationary labs rather than mobile labs some equipment can be mobilized by boat to Red Sucker Lake FN, St. Theresa Point FN and 19 other FN communities on the East Side that lack all-season road access. The employment training from both communities is providing the labour for this work, which typically matches or exceeds the cost of material.

4.2. Infrastructure at Garden Hill FN - Sustainable housing research centre

A different sustainable model house will be built in GHFN in the spring/summer of 2018, after design charrettes with that community and involving the local employment-training people. This design will learn from the knowledge gained from a year of monitoring the Wasagamack house and improve the design to make it more culturally appropriate and include maximum local materials. Dr. Coar has committed to carry out a design/build studio project with approximately 13 (undergraduate and graduate level) architecture students at the University of Manitoba for 2 consecutive terms. The material will be shipped up on winter ice roads in 2017/2018 for use in the spring. The project will partner directly with Garden Hill and explore a studio project that aims to develop a highly efficient and culturally appropriate house design for this community. The aim will be to learn from both the existing contemporary designs that are being proposed, as well as the traditional forms of homes that have been used in the past by this community to develop a new one that learns from both. In addition, a large focus will be energy and performance. This project will thus partner with Dr. Shauna Mallory-Hill who has expertise in building envelope performance and indoor air quality. The project will engage with community members and use their concerns and experiences to create a dialogue in the design process as well as in the expected outcome. The final result of this work will be a completed design for a home for Garden Hill First Nation with the students and the community members involved in the building and maintenance of this home. This housing design will then become open source for others to use and available in blueprints but also in Ikea-like instructions or picture book instructions to allow easy understanding and modification. The community has volunteered $650,000 in-kind to cover labour costs of apprenticeship trainers and local post-secondary students, as well as local materials using their sawmill. Item 7 is the kit for the 1024 square foot Sustainable House will be purchased from Sundial Building Performance for $235/SF including foundation, structure, all mechanicals, finishings, fixtures/major appliances and delivery at a cost of $240,640 with $650,000 inkind. Item 8 is the 10 MW of solar photovoltaic cells will be purchased to make the house net zero for energy at $32/SF for a cost of $32768. Item 9 is the grid and sewer connection at Garden Hill FN is estimated to cost $2000 as this is a serviced lot. Item 10 are the furnishings including desks, tables, chairs and mattresses for the bunkies (enclosed bunk beds that serve as rooms) are priced at $4200. Some desks and tables will be built as part of education program.

4.3 Housing tools and small equipment

Item 12 is five sets of tools and equipment for building a sustainable house which total $44,000. These tools and equipment are necessary for the design build of a home in Garden Hill FN by graduate students and local employment training youth. They will be trained on each piece of equipment to develop skills and knowledge of safety. The tools include five sets of the following tools: a tool belt with suspenders, measuring tape (30 ft.), steel measuring tape (100 ft.), speed square, framing square, Carpentry pencils, carpentry crayons, framing hammer, finish hammer, utility knife, retractable chalk line, linesman pliers, line level, torpedo level, two feet level, six feet level, cordless drill/driver, circular saw (worm drive), cordless circular saw, plunge router, Straight router, jig saw, reciprocating saw, sliding compound miter saw, portable table saw, air compressor, framing nail gun, cordless nail gun, pneumatic staple gun, finish nail gun, hand saw, block plane, plumb bob, chisel, flat pry bar, Cat's Paw (Nail Puller), Nail Sets, Clamps, Construction Calculator, Orbital Sander, Belt Sander, Hammer Tacker, Powder Actuated Nail Set Gun, Extension Ladders – 12′ (3.66m), Step Ladders – 10′ (3.05m), 8′ (2.44m), 6′ (1.83m), 4′ (1.22m), 50′ (15.24m) 10 gauge Extension Cord
12 gauge Extension Cords, Air Hose, Magnet Wheel, Brooms, Shovels, pick axe, Digging Bar, Rakes, Pen and Pocket Sized Notebook, Screwdrivers, Socket Wrench Set, Wrenches and 3,000-Watt Generator. Students will use this equipment and tools to design and build a sustainable house.

4.4 Indoor air quality monitoring

Indoor air quality monitoring will require some monitoring systems and sensors as well as direct testing equipment. Item 14 is the HOBO U30 Remote Monitoring Systems with data service, which will connect sensors that monitor particles, carbon dioxide, carbon monoxide, temperature, radon and humidity providing remote access to the data by Wi-Fi or Ethernet communications is 2200 or 2 industrial-grade with tamper proof enclosure and for $4400. Item (15) provides a service contract for receiving end for RRC's Dr. Rashwan with his students to monitor data from pilothouses and analyze the data to provide timely feedback. Data loggers will be in place in Garden Hill and Wasagamack FNs will have data loggers that both feed into local computers but also to the cloud and Dr. Rashwan's lab at RRC which provides a service costing $5000, which will be link to Dr. Kavgic's and Dr. Thompson's lab at UoM. Item 16 is the FLIR Thermal Imaging Camera will monitor temperature differences to spot air leakages and mold at $1877. Different components for sensors include (17) Current Transformer 100A ACC-0750-100 1 $65 each or 130 total, (18) 2 Watt Node Pulse WINB-3Y-208-P 1 each at $297 or $597 total, (19) 2 A2-PULSE RH/T A2-M22-H21-PULSE 1 at $299 or $598, (20) sensor for external carbon dioxide at $250 each or $500 total, (21) sensor of particulates, carbon monoxide, temperature and relative humidity $800 each or $1600 total.

4.5 (21) Water and Sewer equipment

Drs. Lobb, Farenhorst, Cook and Patterson will work on water/wastewater planning and land management. Dr. Farenhorst and her H20 create students will use a variety of methods in their research to allow for measuring parameters such as free and total residual chlorine concentrations, dissolved oxygen concentration, pH, turbidity, dissolved organic carbon (DOC), etc. For this they need Item (23) the pocket Colorimeter will allow the testing of free and total Chlorine plus pH at $788 each. Item(24) is $841 for the Extech, will measure dissolved oxygen, concentration, pH, mV conductivity, turbidity by a compact portable spectrophotometer suitable for field-testing conditions. DR 1900 Portable Spectrophotometer costing $4670 has most commonly tested pre-programmed methods are already built in (e.g., dissolved oxygen, pH, turbidity, N, etc.) in item 25. Tests can be performed with a wavelength range of 340 to 800 nm, which make this a field instrument you can use to find results typically only seen in laboratory instruments. Item 26 is to investigate many claims of substandard plumbing procedures undertaken an inspection camera system with the Forbest FB-PIC3588B Layflat Color Sewer/Drain Camera 200' Cord.

4.6 Transportation

The location of these research facilities are in Island Lake, which has no connecting roads for any of the four communities between them or to a larger centre. Also, the airports which most of the material is flown in on are on islands some distance away from each community. So boats are necessary but so are hardy utility task vehicle (UTV), which is needed in the community for transportation of materials on the very poorly maintained gravel roads, to go to the trap lines for research and to do agricultural research work with farming implement attachments and to haul the boat. Hybrid electrical vehicles have been chosen in all cases to deal with the concern of climate change that roads may not be open and allow gas shipments some years and to be more economical as the cost of gas is very high at least twice as high as other places, reaching $3.00/l. Researching the benefits of electrical for boats and vehicles is important in this environment. Item 28 is an electric cruiser pontoon boat, Tamarack Basic Loon 22 X 7.5 feet is a 12-Person Solar-Powered Electric Boat which base price is $56,686.

Item 29 is a pontoon boat trailer - bunker style, which costs $3,105. Item 30 is the lifesaving, anchor, bed kit accessories for $4800. It has a very dependable 4.0 RL electric outboard motor will have an auxiliary diesel generator power unit, as well as 760-watt solar array and maintenance-free batteries. It was chosen to be able to take water and sediment samples and visit cultural, environmental or sites important for land use planning, as well as transport students, farming and fishing equipment from

airport. This boat is stable enough to transverse the distance from Wasagamack to Garden Hill FN on a rough day with a good load and a large group of students and researchers. This electric/gas boat costs the same as a smaller Lund boat.

An electric UTV, (item 31) the 382016 Polaris RANGER EV Li-Ion utility vehicles, will be purchased for each community to assist operations when needed at a cost of $13, 580 each or $27,160 for two. The agriculture implements of a 3-point system plough and bed at $3260 (item 32), will allow us to research farming techniques in the WFN, which lacks any agriculture equipment unlike Garden Hill FN, which does not require one as it has a tractor and different components. As well, this electric vehicle will work to explore the woods and go out on the trap line and explore sites that are important for planning due to cultural or other significance. This UTV can tow up to 1200 lbs. with another 500 lbs. in the bed. For these electric powered vehicles we will analyze the cost savings with gas being very high in these communities and also consider renewable energy's suitability, maintenance issues and effectiveness in a remote environment.

4.7 Photography and videos

To provide documentation for land use, water, sustainability issues and fishery considering both science and indigenous knowledge, Dr. Thompson and students will use different high-density and broadcast quality cameras to conduct participatory and educational video making (item 34) Canon 7D with Canon EF lens from 24-105 mm to capture interviews but also landscape shots at $2900. Item will allow the interviews to have excellent sound Item (35) with Rode NTGO microphone. (Item 36) Drone - DJI Phantom 4 Quadcopter will capture aerial images to compare to traditional land use maps at $1249. Item 37 is the 4 Bushnell trophy cams, which will be used to capture wildlife for collecting information about wildlife at $480 total. Participatory video and photovoice will highlight the stories, narratives, concerns, and concepts co-constructed through photographs used and taken by both Indigenous homeless people and staff.

4.8 Computers

Computers will be needed for researchers and students in each research centre. Item 40 is the 16 sturdy desktop computers will be purchased for each facility for use of students and researchers costing a total of $16,855. Stata software will analyze the survey data.

4.9 Portable Sawmill parts.

Blade and other components of large portable sawmill to consider ash insulation and other local timber products (item 41) for $3,500.

5. Sustainability

By researching sustainability livelihoods in a way that involves community employment training programs and new educational programs, an institutional funding program for this projects-based funding will result with a business plan to ensure sustainability. The centres and equipment will be used by both fly-in university/college researchers including students but also local FN students who will undertake research and design as part of their education program. The curriculum being developed by RRC and UCN for the sustainable northern housing curriculum will build in a research component to ensure the continuous monitoring and maintenance.of the Sustainable House. As shown in Table 1 the many projects and buildings occurring would require both Sustainable House centres to be used for research and accommodation by researchers, trainers and students.

Table 1: The Schedule Activities & Outputs for Community-led Education over the 7 years

Stage	Major Activities & Outputs	YEAR						
		1	2	3	4	5	6	7
I	1) Team formation and regular meetings	24	12	12	12	12	12	12
I	2) Conduct needs assessment for education & housing including prevalence counts of hidden homelessness, photo voice & videos.	2	2	2	2	2	2	2
I	3) Consult community & needs assessment to create & review1, 5 & 10 yr plan	2	2	2	2	2	2	2
I	4) Develop innovative curriculum for train-the trainer Oji-Cree local teachers.	1	1	1	1	1	1	1
I	5) Apply ethics-approved tests, focus groups, interviews, etc. and publish results.	5	5	5	5	5	5	5
II	6) Train-the trainers (yr 1) & funded students in local community-led courses.	10	45	45	45	45	45	45
II	7) Design & build healthy sustainable houses with student employment trainees	1	3	6	9	12	15	18
II	8) Run community-led ed. projects (e.g., farm, shelter/women's house, waste).	0	2	2	2	2	2	2
III	9) Participatory & educational videos with students & community input	1	1	1	1	1	1	1
III	10) Political, crowdfunding, social media campaigns & community-led guides	1	1	1	1	1	1	1
III	11) Educational and research journal articles, films and reports	2	5	5	5	5	5	8

The housing and vehicles were designed to have low operational costs due to passive solar, solar, and electrical options. Also, we have developed a number of other partners who are committed to providing resources, with Wasagamack and Garden Hill FN promising to contribute to ongoing costs for buildings and equipment. Other partnerships will assist with covering on-going costs including the Red River College Building and Trades Program, Sundial Performance Homes, AKI Energy, Wabung Fisheries Co-operative, as well as Anikowiin Training Institute (ATI) and Manitoba Keewatinowi Okimakanak Inc. (MKO). As part of this research we will be working in partnership with Garden Hill FN, Wasagamack FN, Wabung and Wasake Fisheries Co-operatives, AKI Energy, RRC, Meechim Farm Inc. and other social enterprises, incorporating sustainable social enterprise programming to develop a self-funded model.

This research also ties into my SSHRC Insight grant, partnership development grant and finally my application for a SSHRC partnership that was successful at the letter of intent stage. I have a SSHRC partnership which has many synergies with this grant which involves all of the major, public universities in Manitoba as well as some out of province committed to providing on-going funding to this project. I have confirmed funding partners from the SSHRC's partnership grant application including RRC, Assiniboine College and Brandon University as well as University of Manitoba, as well as AKI Energy. With AKI Energy we have developed a MITACS accelerate program fund and MITACS post-doctoral fund, so we have successfully partnered with them for many years. As well, MKO wrote a letter of support that provided more than hundred thousand dollars for joint programming related to this research for youth employment training to build and research sustainable communities.

6. Benefit to Canada

This research and educational programming responds, at a pilot-level, to the Royal Commission on Aboriginal Peoples (1996, Vol. 3) recommendation that an "injection of capital and the integration of housing objectives with other social and economic activities in Aboriginal communities will create a synergistic effect, making housing a source of community healing and economic renewal" (p. 341). This applied research on housing holds promise to be that "source of community healing and economic renewal" (RCAP, 1996: 341). Also, this research will provide one pilot project, to address the Truth and Reconciliation Commission's (TRC) Calls for Action to: "Ensure that Aboriginal peoples have equitable access to jobs, training, and education opportunities in the corporate sector, and that Aboriginal communities gain long-term sustainable benefits from economic development projects" (Section 92, ii). This CFI grant for materials and equipment will result in two sustainable northern model homes, built by local First Nation post-secondary students and graduate students to Passivhaus Building standards & next zero energy standards as well as the National Building Code (2015). This CFI grant will also provide opportunities to create the curriculum, films and educational materials to help develop a Sustainable house certificate programs across Canada.

Community-led applied post-secondary education in remote First Nation (FN) communities has the potential to fulfill both basic (e.g., food security, healthy housing, safe water, land planning) and cultural needs (e.g., language, traditional knowledge, Indigenous governance). Applied projects-based adult education can address the lack of infrastructure and other critical FN needs to address the root causes of poverty, violence, addiction & poor health outcomes in FNs. This innovative education and research program will leapfrog Indigenous sustainable development, to promote reconciliation & support positive community change by providing access to post-secondary education in the community.

Over the course of the project, many graduate students, including the 10 to 15 graduate students in Dr. Coar's design/build course will participate in this research & at least 150- 200 FN people from Island Lake will graduate with an entry level 5 or 10 month certificate from UoM, UCN, RRC, BU, UoW, UoS, Lakehead or ACC, with some students continuing for a 2- to 5-year diploma or degree program (possibly 60 students) or Red Seal in trades. Student education will be based on Indigenous pedagogies (see Stewart, 2010, 2012, 2013) & employ practices of reciprocity, empowerment, & cultural context. The model of training will be projects-based learning and based on the train the trainer model, so that local teachers are available that know the culture & language. The PD & co-applicants will mentor new & emerging scholars, including assistant professors/teachers.

Centres for sustainability in FNs will focus research on community priorities – housing, violence against women, safe drinking water, resource access & management in traditional territories, food security/sovereignty, etc. Local post-secondary students will acquire the skills required to learn how to address the systemic problems they identify in their communities through supported projects-based learning, rather than solely from a classroom. Specifically, in solidarity with the FNs, we will identify the feasibility, optimal sustainable solutions & methods through research and applied education programming at the community/regional-level of Island Lake. Other communities can become involved through similar community-led education/training offerings that address housing and/or other priority areas. Also, this program should open colleges & universities to answer the call of communities for the applied educational programming and research they require for community development.

This research addresses the issue of the lack of critical infrastructure (such as healthy housing, safe water, sanitation & roads) and provides an option to address economic poverty (Thompson, Wiebe, Gulrukh & Ashram, 2012). According to the Royal Commission on Aboriginal People (RCAP), state dependency has tremendous socio-economic costs of an estimated $7.5 billion in 1996 or 1% of the GDP; which were to increase to $11 billion by this year, 2016 (Anderson, Dana, & Dana, 2006). Aboriginal state dependency in Canada is evident today in the low rates of secondary school

completion in FN communities & limited infrastructure on reserves (Statistics Canada, 2011; McKinnon, 2014), with Wasagamack & Garden Hill being some of the economically deprived of these communities. Safe, healthy and affordable housing is necessary for well-being and full participation in the social, political and economic fabric of society (UNHCHR, 2009; Schiff, 2015: Schiff & Waegemakers Schiff, 2016; Schiff & Brunger, F., 2015). Housing is a large crisis in FNs across Canada but particularly in Manitoba. James Anaya, Special Rapporteur on the Rights of Indigenous Peoples, reported in July 2014 that housing in Canada's Indigenous communities "has reached a crisis level" (Anaya cited in The Interim Report of the Standing Senate Committee on Aboriginal Peoples, 2015, p. 5). Many homes on reserve are in substandard condition, needing major renovations or replacement to meet standards of adequacy: 44 percent of people living on reserves in 2006 lived in homes requiring major repairs, compared to 7 percent of the non-Aboriginal population (Senate Committee on Aboriginal Peoples, 2015). Harold Calla, Executive Chair, First Nations Financial Management Board reports a housing deficit of $3-$5 billion in Canada (Senate Committee on Aboriginal Peoples, 2015). Government documents state that Manitoba FNs have the worst housing conditions in Canada and it will cost $2 billion to eliminate mould and chronic overcrowding in that province alone, which is 13 times higher than the national budget for FN housing for this year (Puxley, 2016). The Senate Committee on Aboriginal Peoples (2015, p. 2) found across the nation "that there are homes where 16 or 17 people live in a small, three-bedroom house, often in great disrepair.

Partners in this CFI will research and build capacity with remote and other FN communities to assist FN community members to improve their livelihood outcomes through strategic planning, infrastructure development and create more bridges to policy-makers As researchers, we can assist with developing sustainable housing designs, housing plans, business plans (e.g., local wood insulation, local house building company, value-added fishing products, value-added products from fur, soap stone carving, etc.), product development, marketing and branding. For example, Dr. Rashwan and others with the Centre for Applied Research in Sustainable Infrastructure and the New Building Envelope & Fenestration Test Chamber at RRC can assist with the testing of insulation to bring it to market or local community use. Also we can do the research to assist with the FNs obtaining woodlot licenses and forest management licenses, to ensure the resources are sustainably managed by local FNs.

The knowledge mobilization (KM) strategy will be based on multi-directional communication & consider diverse audiences (Marshall & Guenette, 2011). Thus, the KM plan will pursue creative & Indigenous models of communication identified collaboratively by the students, co-applicants & partners. The KM will include traditional Indigenous oral method of story telling, Facebook, FN community radio/television, art, digital media, maps, blogs, posters, brochures, academic publications, presentations, community workshops, & research reports. Assignments for local & graduate students will require multimedia ways to document & enrich their own learning (e.g., blogs, Facebook, websites, photography & filmmaking). The partners will reach out to policy makers at multiple levels.

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Financial resources for operation and maintenance

These tables outline annual costs and sources of support committed to ensuring effective operation and maintenance of the infrastructure for the first five years after it becomes operational. They do not include costs related to research and/or technology development. When applicable, funding from CFI's Infrastructure Operating fund (IOF) is included in the institutional contributions category.

Operation and maintenance budget summary

Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Personnel	25,000	25,000	25,000	25,000	25,000	125,000
Supplies	25,000	25,000	25,000	25,000	25,000	125,000
Maintenance and repairs	15,000	15,000	15,000	15,000	15,000	75,000
Services	5,000	5,000	5,000	5,000	5,000	25,000
Other (specify)	0	0	0	0	0	0
Total	**$70,000**	**$70,000**	**$70,000**	**$70,000**	**$70,000**	**$350,000**

Funding sources

Funding sources	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Institutional contributions	70,000	70,000	70,000	70,000	70,000	350,000
Other organizations	0	0	0	0	0	0
User fees	0	0	0	0	0	0
Other (specify)	0	0	0	0	0	0
Total	**$70,000**	**$70,000**	**$70,000**	**$70,000**	**$70,000**	**$350,000**

Infrastructure project funding

This table provides a summary of total contributions and eligible costs for the project..

	Total
Total eligible costs	$2,046,551
Contributions from eligible partners	$1,692,105
Amount requested from the CFI	$354,446
Percentage of the total eligible cost requested from the CFI (may not exceed 40%)	17.32%

Summary of eligible costs

This table provides a summary of the total eligible costs for each type of expenditure. Individual items are listed in the 'Cost of individual items' section.

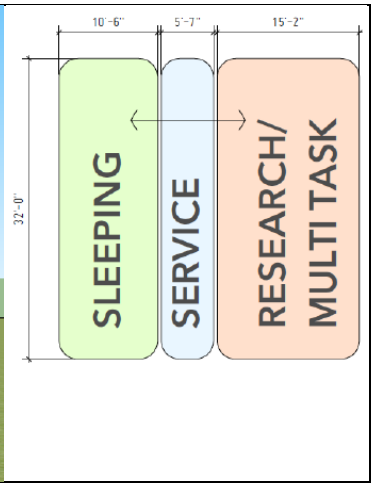
Expenditure type	Total
13. Purchase of equipment (including shipping, taxes and installation)	$247,547
14. Lease of equipment	$0
15. Personnel (for infrastructure acquisition & development)	$0
16. Components	$5,324
17. Travel (infrastructure related)	$0
18. Software	$0
19. Extended warranties / Service contracts	$0
20. Construction/renovation costs essential to house and use the infrastructure	$1,785,280
21. Initial training of infrastructure personnel	$0
22. Other	$8,400
Total eligible costs	**$2,046,551**

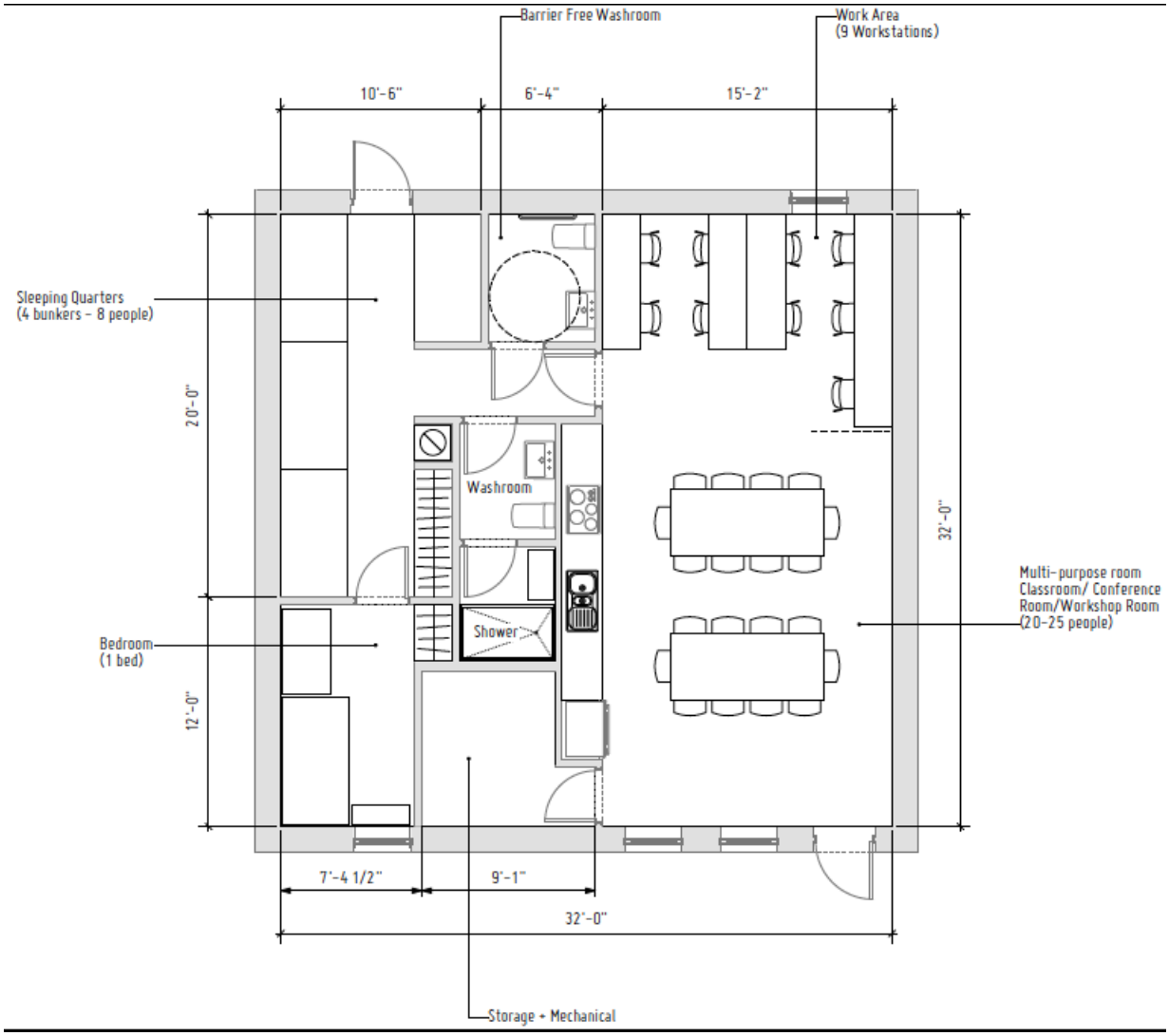
Cost of individual items

Item #	Type	Item description	Number of items	Eligible costs Cash $	In-kind $	Total $	Date acquired (YYYY/MM) or to be acquired (YYYY)
Test sustainable build by WAS locals & Sundial Building Per.							
2	20	$235/SF *1024SF high performance components, net 0 sundial	800	240,640	650,000	890,640	2017
3	13	$32/SF photovoltaic x 1010 SF = 10 MW	10	32,768		32,768	2017
4	20	Grid & sewer connection at Wasagamack	1	2,000		2,000	2017
5	22	Desks (8), chairs (30), tables (6) & mattresses (9)	53	4,200		4,200	2017
Test sustainable home built by locals, Coar & Students- GHFN							
7	20	$235/SF *1024SF high performance sundial equipment.	800	240,640	650,000	890,640	2018
8	13	photovoltaic at 32/SF*1024SF = 10MW	10	32,768		32,768	2018
9	20	Grid & sewer connection at Garden Hill FN	1	2,000		2,000	2018
10	22	Desks (8), chairs (30), tables (6) & mattresses (9)	53	4,200		4,200	2017
Building equipment for community build for student/com. use							
12	13	5 tool sets including 44 items, levels, saws, extension cord	5	44,000		44,000	2017
Monitoring equipment for housing							
14	13	HOBO® U30 Remote Monitoring Systems c/w HOBOlink Dataservice	2	4,400		4,400	2017
15	13	Service contract for data uplink with RRC Dr. Rashwan's lab	2	5,000		5,000	2017
16	13	FLIR Thermal Imaging Camera 120X90/9HZ	1	1,887		1,887	2017
17	16	Current Transformer 100A ACC-0750-100 1 $65.25	2	132		132	2017
18	16	2 WattNode Pulse WINB-3Y-208-P 1 $297 $297.00	2	594		594	2017
19	16	3 A2-PULSE RH/T A2-M22-H21-PULSE 1 $299 $299.00	2	598		598	2017

				Eligible costs			
Item #	**Type**	**Item description**	**Number of items**	**Cash $**	**In-kind $**	**Total $**	**Date acquired (YYYY/MM) or to be acquired (YYYY)**
20	16	External CO2 5000ppm EXT-CO2-5000 1 $250 $250.00	2	500		500	2017
21	13	Sensors of particles, CO2, CO, relative humidity, temp., ra	20	1,600		1,600	2017
Laboratory equipment - water, waste and food research							
23	13	Pocket Colorimeter™ II, Chlorine, (Free and Total) plus pH	1	788		788	2017
24	13	Extech DO700- Measures Dissolved O conc. pH, mV, Conductivit	1	841		841	2017
25	13	DR 1900 Portable Spectrophotometer	1	4,670		4,670	2017
26	13	FORBEST FB-PIC3588B Layflat Color Sewer/Drain Camera 200' Ca	1	2,050		2,050	2017
Transportation							
28	13	basic loon - Pontoon boat 22 X 7.5 foot, Solar boat	1	56,686		56,686	2017
29	13	pontoon boat trailer - bunker style	1	3,105		3,105	2017
30	13	Tamarack lifesaving, anchor, bed kit and other accessories	6	4,800		4,800	2017
31	13	2016 Polaris RANGER EV Li-Ion utility vehicle - 2 seats/truc	2	27,160		27,160	2017
32	13	farming attachments for UTV	2	3,260		3,260	2017
Photography and video equipment							
34	13	video camera - Canon 7d with Canon EF 24-105mm f/4L IS II U	1	2,600	300	2,900	2017
35	13	RODE NTG4 Microphone	1	280		280	2017
36	13	Drone - DJI Phantom 4 Quadcopter	1	1,249		1,249	2017
37	13	Bushnell Trophy Cam Wireless Trail Camera	4	480		480	2017
Computer							
39	13	Computer Equipment -- 16 desktop comp. + monitors.	32	16,855		16,855	2017
Portable Sawmill for local timber and insulation							
41	16	portable sawmills blades and equipment	5	3,500		3,500	2018
		Total eligible costs		**$746,251**	**$1,300,300**	**$2,046,551**	

Cost of individual items
Proposal


10'-6"
5'-7"
15'-2"
32'-0"
SLEEPING
SERVICE
RESEARCH/
MULTI TASK


Barrier Free Washroom
Work Area
(9 Workstations)
10'-6"
6'-4"
15'-2"
Sleeping Quarters
(4 bunkers - 8 people)
20'-0"
Washroom
32'-0"
Multi-purpose room
Classroom/ Conference
Room/Workshop Room
(20-25 people)
Bedroom
(1 bed)
Shower
12'-0"
7'-4 1/2"
9'-1"
32'-0"
Storage + Mechanical

The bungalow footprint will be 32 feet by 32 feet with a 1024 SF area to work with. It's interior space is divided into three zones: Research/Multi-Task, Sleeping and Service Zones.

1. Research/Multi-Task Zone:
Net area: ±500 SF
This zone is further subdivided into two sub-zones:
- a 15 feet by 11 feet office room and,
- a 15 feet by 21 feet multi-purpose room.
Office room accommodates 8-9 workstations with freestanding desks. The multi-purpose room has an 18 feet long kitchen wall with possibly 9-10 feet counter space, and accommodates tables and seating for 20-25 people. This space can be reconfigured to serve as a mess hall where the researchers and visitors prepare food, socialize and eat; and as a multi purpose room where they work, have meetings and seminars. The office area and the multi-purpose room can be divided simply by a curtain, if sound-proofing is not a major concern in this context. The kitchen wall might have a roller shutter integrated into it if required for security concerns when it's not utilized.

2. Sleeping Zone:
Net area: ±300 SF
This zone is further subdivided into two rooms:
- a 12 feet by 7.5 feet bedroom with storage (for 1 person) and a desk,
- a 20 feet by 10.6 feet sleeping quarters with 4 bunker beds (for 8 people) with storage and stacked washer and dryer.

3. Service Zone:
Net area: ±224 SF
This zone is further subdivided into following rooms:
- a barrier free universal/unisex washroom,
- a unisex washroom with attached shower room, both washrooms accessible by the public and private users through-out the day,
- kitchen wall open to the multi-purpose area,
- Storage + mechanical/electrical room, open to the multi-purpose area.

Contributions from eligible partners

The following table provides details of funding from eligible partners. It does not include the amount requested from the CFI.

Partner name	Partner type	Cash $	In-kind $	Total $	Secured or expected
Garden Hill FN	Other		650,000	650,000	Secured
Research Manitoba	Provincial governments (departments or agencies)	354,445		354,445	Expected
Riddell Funds, University of Manitoba	Institutions, trust funds or foundations	37,360		37,360	Secured
Sundial Performance Building Inc.	Corporations/firms		350,000	350,000	Secured
Wasagamack FN	Other		300,000	300,000	Secured
vendors	Corporations/firms		300	300	Expected
Total contributions from eligible partners		**$391,805**	**$1,300,300**	**$1,692,105**	

Letters are provided to ensure labour and materials to complete two test sustainable houses - one in Garden Hill FN and another in Wasagamack FN. Sundial Performance Inc, Dr. Kavgic and Professor Coar will assist in the design charrettes development and development with the labour of apprentices in the community for these sustainable house designs.

The University of Manitoba is requesting from the Government of Manitoba, through Research Manitoba, matching funds for this project, which is equivalent to the CFI funding request and represents no more than 40% of total project costs. The request is submitted concurrently with the CFI application and is evaluated against departmental and governmental priorities. If a positive decision is made, a recommendation for funding will be submitted to the Research Manitoba Board and the University will then be notified once a decision on funding has been secured.

Infrastructure utilization

This table outlines the percentage utilization of the requested infrastructure by category.

Category	Percentage
Research/technology development and associated training	100 %
Education, excluding research / technology development training (not eligible for CFI support)	
Administration	
Clinical or other service function	
Other (specify)	
Total	**100 %**

This section provides a breakdown of eligible costs included in each of the above categories.

If the infrastructure will be used for non CFI-eligible purposes, the institution was instructed to explain the methodology used to estimate the percentage of utilization for each category and how the budget was pro-rated.

Sustainable homes will be designed and built with communities in fly-communities. These houses will serve as the research laboratory and also the accommodation for students and researchers studying in the area.

Identification

Family Name	Thompson
First name and initials	Shirley J.
Institution	University of Manitoba
Position	Associate Professor
Department/Division	Natural Resources Institute

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	2002	Adult Education and Community Development	University of Toronto, Canada
Bachelor's	1996	Teaching, Science and Environmental Science	University of Toronto, Canada
Master's	1993	Chemical and Environmental Engineering	University of Toronto, Canada
Bachelor's, Honours	1986	Science, Honours General	University of Waterloo, Canada

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Instructor/Researcher, University of Toronto	OISE/UT and Chemical Engineering	1997	2002

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

Thompson, S. (2016). Flooding First Nations and Environmental Justice in Manitoba: Case Studies of the Impacts of 2011 Flood and Hydrodevelopment in Manitoba. MLJ: 38(2).
Bhatarali, P. & Thompson, S. (2016). Optimizing an Off-Grid Electrical System in Brochet, Manitoba, Canada. RSERS, 53, 709-719.
Chowdhury, A.H., Hambly, O.H., Thompson, S., Hauser, M. (2015). Enhancing Farmers' Capacity of botanical pesticide innovation through video-mediated learning in Bangladesh. IJAS.
Kamal, A., Linklater, R., Thompson, S., Dipple, J. & Ithinto Mechisowin Committee. (2015). A Recipe for Change: Reclamation of Indigenous Food Sovereignty in O-Pipon-Na-Piwin Cree Nation for Decolonization, Resource Sharing, and Cultural Restoration, Globalizations, 12(4), 559-575.
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Deb, A., Haque E. & Thompson, S. (2015). "Man can't give birth, woman can't fish": Gender dynamics in the small-scale fisheries of Bangladesh. GPC, 22 (3), pp. 305-324(20).
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Thompson, S., Rony, M., Temmer, J., & Wood, D. (2014). Pulling in the indigenous fishery cooperative net: Fishing for sustainable livelihoods and food security in Garden Hill First Nation, Manitoba, Canada. JAFSCD, 4(3), 177-192.
Thompson, S. & Si, M. (2014). Strategic analysis of Energy Efficiency Projects: Case Study of a Steel Mill in Manitoba. RSER, 40, 814-819.
Thompson, S. Ballard, M. & D. Martin (2014). Environmentally and Developmentally Induced Displacement: Lake St. Martin First Nation Community Members' Experiences -"We're like refugees". Refuge, 29 (2), 75-86.
Fulford, S. & Thompson, S. (2013). Youth Community Gardening Programming as Community Development: The Youth for EcoAction Program in Winnipeg, Canada. CJNSER, 4 (2), 56-75.
Ballard, M. & Thompson, S. (2013). Flooding Lake St. Martin First Nation Community: Impacts to and Future Community Plans for Sustainable Livelihoods. CJNSER, 4 (1), 43-65.
Hossain, B.M.S., Rahman M. F., Thompson S., Rashed-Un-Nabi, M. & Kibria M.M. (2013). Climate Change Resilience Assessment Using Livelihood Assets of Coastal Fishing Community in Nijhum Dwip, Bangladesh. PJST, 21 (2), 397-422.
Thompson S., Wiebe, J., Gulrukh, A. & Ashram, A. (2012). Analyzing Food-related Economic Development in Indigenous Communities in Northern Manitoba for Impacts on Food Sovereignty, Food Security and Sustainable Livelihoods. CJNSER, 3 (2), 43-66.
Fieldhouse, P. & Thompson, S. (2012). Tackling Food Security Issues in Indigenous Communities in Canada: The Manitoba Experience. ND. 69 (3), 217-221.
Zurba, M., Islam, D. Smith, D. & Thompson, S. (2012). Food and healing: an urban community food security assessment for the North End of Winnipeg. URP, 5 (2): 284-289.
Rahman, R. Uddin, S. & Thompson, S (2012). Effective Governance Strategy: Key to Sustainable Collaborative Management in a Wildlife Sanctuary in Southeastern part of Bangladesh. IJERD, 3 (2): 174-180.
Thompson, S., Gulrukh Kamal, A., Ballard, M., Beardy, B., Islam, D., Lozeznik, V. and K. Wong (2011). Is Community Economic Development Putting Healthy Food on the Table? Food Sovereignty in Northern Manitoba's Aboriginal communities. JAED, 7(2), 15-40.

List of published contributions

Si, M., Thompson, S., Calder, K. (2011). Energy efficiency assessment by process heating assessment and survey tool (PHAST) and feasibility study of waste heat recovery in the reheat furnace at a steel company. RSER, 15 (6), 2904-2908.

Thompson et al film channel produced or co-directed https://www.youtube.com/channel/UCxatDURvcEfWUfQBboMqIlg

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	Support Period To
AWARDED				
The Micro- and Macro-Construction of Induced Displacement: Experiences, Health Outcomes and Future Plans of Little Saskatchewan First Nation Donna Martin and Shirley Thompson (co)	CIHR CIHR	$200,000	2015	2018
Building capacity for sustainable development in indigenous communities: analyzingdevelopment planning for sustainable livelihoods in Island Lake First Nation communities Shirley Thompson	SSHRC Insight	$100,000	2013	2018
Sharing the Feast of Ithinto Mechisowin (Food from the Land) and Grow North: Food-basedCommunity Development at O-Pipon-Na-Piwin Cree Nation and Northern Manitoba communities. Shirley Thompson	SSHRC Partnership Devleopment	$67,000	2014	2017
Land Use Mapping and Planning for Sustainable Development with Island Lake Communities and other East-side Communities in Manitoba." Shirley Thompson	MITACS Accelerate	$90,000	2014	2016

Identification

Family Name	Bibeau
First name and initials	Eric L
Institution	University of Manitoba
Position	Assistant Professor
Department/Division	Mechanical and Manufacturing Engineering

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	1993	Mechanical Engineering	University of British Columbia, Canada, Canada
Master's	1988	Mechanical Engineering	University of British Columbia, Canada, Canada
Bachelor's	1985	Mechanical Engineering	McGill University, Canada, Canada

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Assistant Professor, University of Manitoba	Mechanical Engineering	2003	2005
Vice-President, Entropic Energy	Energy Conversion	2002	2005
Researcher, American Flow Technology	CFD	2002	2005
Executive Officer, Process Simulations Limited	R&D	1997	2002
Research Associate, University of British Columbia	Mechanical Engineering	1997	2001
Heat Transfer Scientist, Atomic Energy of Canada Ltd	Thermalhydraulics	1993	1997

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	Support Period To
AWARDED				
Alternative energy Bibeau	Manitoba Hydro and NSERC Industrial Research Chair	$200,000	2004	2008
Using marshes as a biofilter and biopower generation Bibeau	MRAC Pollution control of lake Winnipeg	$27,000	2006	2007
Mitigation for icing of wind turbines Bibeau	NRCAN Wind Energy	$17,000	2006	2007
Demonstration of 60 kWe kinetic turbine Bibeau	Manitoba Hydro Emerging Technologies R&D	$87,500	2006	2007

Identification

Family Name	Coar
First name and initials	Lancelot
Institution	University of Manitoba
Position	Associate Professor
Department/Division	Architecture

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Master's	2001	Architecture	University of California, Berkeley, United States of America (the)
Bachelor's	1997	Architectural Engineering	Drexel University, United States of America (the)
Bachelor's	1997	Civil Engineering	Drexel University, United States of America (the)

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Associate Professor, University of Manitoba	Department of Architecture	2015	
Assistant Professor, University of Manitoba	Department of Architecture	2008	2015
Founding Partner, Co|Re Collaborative	Architectural design services	2006	2015
Adjunct Professor, University of Manitoba	Department of Architecture	2007	2008
Adjunct Professor, University of Manitoba	Environmental Design Program	2006	2007
Project Manager/Architectural Intern, Stavropoulos Associates Architects		2002	2005
Architectural Intern, Costas Kondylis Architects		2001	2001

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

***Refereed Chapters in Books:

Coar, L. (2014). Clearwater Studio: Co-imagining a Living Past and a Common Future. In M. Bose & P. Horringan (Eds.), Community Matters. (137- 150) London: Earthscan/Routledge.

Coar, L. (2011). Clearwater Design Studio. In W. Carpenter (Ed.), Design Build Studio (pages 354-373). Decauter, GA: Light Room Press Inc.

***Refereed Chapters in Proceedings:

Coar, L., Mueller, C., De Laet, L., Hare, J., Wiese, K., Oberlin, S. (2016). Fabrigami: Design and Fabrication of an Origami-inspired ice and fabric shell. In the International Association of Shell and Spatial Structures Annual International Symposium on Spatial Structures in the 21st Century, Tokyo, Japan, University of Tokyo. (forthcoming).

Coar, L. (2015). Synthesizing Design and Construction through Physical Parametrics. In the International Association of Shell and Spatial Structures Annual International Symposium on Future Visions, (pages) Amsterdam, Holland. KIVI Publishing. (forthcoming).

Coar, L. (2014). Beginning from the End: Deconstructing Context in the Design/Build Studio. In the Association of Collegiate Schools of Architecture Fall Conference, Working Out: thinking while building ACSA, Dalhousie University, (pages 136-144) Halifax, NS.

Coar, L. (2014). Fluid + Formal: Seeking Critical Progress through Congruence in Design and Construction. In C. Griffin & J. Mollner (Eds.), Sustainable Structures Symposium, 5th Annual Symposium - School of Architecture, Portland State University. (pages 205-218). Portland, OR.: Portland State University.

Coar, L., & West, M. (2012). Biomimetic Construction. In X. Costa & M. Thorne (Eds.), Proceedings of the Association of Collegiate Schools of Architecture (ACSA) International Conference: CHANGE, Architecture, Education, Practices. (pages 235-240). Barcelona: Northeastern University & Instituto de Empresa University.

Coar, L. (2012). Discovering the Meaning of Measure. In J. La Coe (Ed.), Proceedings of the National Conference of the Beginning Design Student (NCBDS) - End of/In the Beginning: Realizing the Sustainable Imagination (pages 79-84). State College, PA: The Penn State University.

Coar, L., (2012). Wobbly Structures: Exploring the Potentials of Flexible Frames and Fabric Formed Ice Structures. In J. Orr, M. Evernden, A. Darby, T. Bell (Eds.), Proceedings of the 2nd International Conference on Fabric Formwork (ICFF) (pages 92-105). Bath: BRE CICM, University of Bath.

Coar, L. (2010). (Un)build Design Build: Exploring the Role of Consequence in Architectural Education. In B. Goodwin, J. Kinnard (Eds.), Proceedings of the Association of Collegiate Schools of Architecture (ACSA) 98th Annual Meeting Conference: REbuilding (pages 26-33). New Orleans, LA: Tulane, Univ.

***Refereed Articles in Academic or Professional Journals:

Coar, L. (2011). The Lasting Meaning of Temporary Architecture. Design Principles and Practices: An International Journal, volume 5 (issue 6), pages 667-678.

***Publications in non-refereed periodicals:

Coar, L. (2014). Arctic Adaptations. In B. O'Reiley (Ed.), Network (pages 11-12), ALTONA, MB.: Friesens Corporation.

Coar, L., Neustater, A., & Kroeker, K. (2011). U of M Raises the Bar on Winnipeg's River Trail. In D. Clark, B. O'Reilly, & D. Osted (Eds.), Network (pages 26-27). Altona, MB.: Friesens Corporation.

Coar, L. (2011). Roaming Engagement: Clearwater Studio. In D. Clark, B. O'Reilly, & D. Osted (Eds.), Network (pages 26-27). Altona, MB: Friesens Corporation.

List of published contributions

Coar, L. (2010). Clearwater: Shifting Ground. In D. Clark, S. Goodacre, B. O'Reilly, A. Tate (Eds.), Network (page 54-56). Altona, MB: Friesens Corporation.
Coar, L. (2010). Lancelot Coar. In D. Clark, S. Goodacre, B. O'Reilly, A. Tate (Eds.), Network (page 57). Altona, MB: Friesens Corporation.

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	Support Period To
AWARDED				
Rainwater Shelter at Rainbow Community Garden Lancelot Coar	University of Manitoba Endowment Fund	$3,500	2016	2016
A new vision: Dene First Nations perspectives on healthy housing Dr. Linda Larcombe	Canadian Institute of Health Research Population Health Intervention Research Grant	$96,000	2014	2015
Training for Modernity: Moholy-Nagy and the Onslaught of the Digital Oliver Botar	Social Sciences and Humanities Research Council Insight Grant	$89,000	2013	2014
Fostering Community-Led Approaches to Pollution Prevention and Waste Reduction Lancelot Coar	Manitoba Conservation Waste Reduction and Pollution Prevention Fund	$2,500	2011	2014
The Design and Creation of a Modeling System to Study Phase-Changing Structures made from Fiberglass, Fabric and Wax Lancelot Coar	University of Manitoba Creative Works Grant	$2,500	2011	2011
Clearwater Studio: Mobile Design Studio/ Workshop Lancelot Coar	Manitoba Conservation Waste Reduction and Pollution Prevention Fund	$4,000	2010	2011

Identification

Family Name	Farenhorst
First name and initials	Annemieke
Institution	University of Manitoba
Position	Professor and NSERC Chair for Women in Science and Engineering for the Prairie Region
Department/Division	Soil Science

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	1998	Geography and PesticideChemistry	University of Toronto, Canada
Master's Equivalent	1991	Soil Science and PhysicalGeography	University of Amsterdam, Netherlands (the)

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Professor, University of Manitoba	Department of Soil Science	2008	
NSERC Chair for Women inScience and Engineering - Prairie Region, NSERC	Chairs for Women in Science and Engineering Program	2011	2017
Acting Head, University of Manitoba	Department of Soil Science	2009	2010
Associate Professor, University of Manitoba	Department of Soil Science	2003	2008
Nil-salaried appointment, University of Manitoba	Faculty of the Environment	2002	2004
Assistant Professor, University of Manitoba	Department of Soil Science	1998	2003
Lecturer, University of Manitoba	Department of Soil Science	1997	1998
Research assistant (microbiology), Agriculture and Agri-Food Canada	SCPF Research Centre,London, Ontario	1997	1997
HTML website programmer on beneficial management practices in agriculture, Agriculture and Agri-Food Canada	SCPF Research Centre,London, Ontario	1996	1997
Teaching Assistant (7 courses in total), University of Toronto	Faculty ofGeography-variousdepartments	1991	1995

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

Selected refereed publications (SUPERVISOR AND HER HQPs IN BOLD)

1. FARENHORST, A., LI, R., JAHAN, M., Tun, H.M., MI, R., AMARAKOON, I., Kumar, A., Khafipour, E. (2016). Bacteria in drinking water sources of a First Nation reserve in Canada. Science of the Total Environment. (STOTEN-D-16-03403, submitted 06/2016).
2. LI, R., Tun, H.M., JAHAN, M., FARENHORST, A., Kumar, A., Fernando, D., Khafipour, E.(2016). Comparison of DNA-, PMA-, and RNA-based 16S rRNA Illumina sequencing for detection of live bacteria in water. Frontiers in Microbiology, Section Systems Microbiology (ID: 184678, submitted 01/2016).
3. AMARAKOON, I., FARENHORST, A., ROSE, K., CLAEYS, A., ASCEF, B. (2016). 17 β-Estradiol mineralization in human waste products and soil in the presence and the absence of antimicrobials. Journal of Environmental Science and Health, Part B. DOI:10.1080/03601234.2016.1191873 [Epub ahead of print]
4. SINGH, B., FARENHORST, A., McQUEEN, R., Malley, D.F. (2016). Near-Infrared spectroscopy as a tool for generating sorption input parameters for pesticide fate modeling. Soil Science Society of America Journal. 80:604-612.
5. MUNIRA, S., FARENHORST, A., Flaten, D., Grant, C. (2016). Phosphate fertilizer impacts on glyphosate sorption by soil. Chemosphere. 153:471-477.
6. Fernando, D.M., Tun, H.M., Poole, J., Patidar, R., LI, R., MI, R., AMARAWANSHA, G.E.A., Fernando, W.G.D., Khafipour, E., FARENHORST, A., Kumar, A. (2016). Detection of antibiotic resistance genes in source and drinking water samples from a First Nation Community in Canada. Applied and Environmental Microbiology. 82 (15):4767-4775.
7. Unsworth, J., Corsi, C., Van Emon, J., FARENHORST, A., Hamilton, D., Howard, C., Hunter, R., Jenkins, J., Kleter, G., Kookana, R., Lalah, J., Leggett, M., Miglioranza, K., Miyagawa, H., Peranginangin, N., Rubin, B., Saha, B., Shakil, N. (2015). Developing global leaders for research, regulation and stewardship of crop protection chemistry in the 21st century. Journal of Agricultural and Food Chemistry. 64(1):52-60.
8. FARENHORST, A., ANDRONAK, L.A., McQUEEN, D.A.R. (2015). Bulk deposition of pesticides in a Canadian city: Part 1. Glyphosate and other agricultural pesticides. Water, Air and Soil Pollution. 226:47, 11pp.
9. FARENHORST, A., ANDRONAK, L.A., McQUEEN, D.A.R. (2015). Bulk deposition of pesticides in a Canadian city: Part 2. Impact of malathion use within city-limits. Water, Air and Soil Pollution.226:38, 8pp.
10. ROSE, K. P., FARENHORST, A., CLAYES, A., ASCEF, B. (2014). 17 β-estradiol and 17 α-ethinylestradiol mineralization in sewage sludge and biosolids. Journal of Environmental Science and Health, Part B. 49(11):871-879.
11. ROSE, K., FARENHORST, A. (2014). Estrone and 17β-estradiol mineralization in liquid swine manure and soil in the presence and absence of penicillin or tetracycline. Journal of Environmental Science and Health, Part B. 49(5):331-337.
12. Gagnon, P., Sheedy, C., FARENHORST, A., MCQUEEN, D.A.R., Cessna, A., Newlands, N. (2014). A coupled stochastic/deterministic model to estimate the evolution of the risk of water contamination by pesticides across Canada. Integrated Environmental Assessment and Management. 10(3):429-436.
13. SINGH, B., FARENHORST, A., GAULTIER, J., Pennock, D.J. DEGENHARDT, D.A., MCQUEEN, D.A.R. (2014). Soil characteristics and herbicide sorption coefficients in 140 soil profiles of two irregular undulating to hummocky terrains of western Canada. Geoderma.232-234:107-116.
14. MESSING, P., FARENHORST, A., Waite D.T., Sproull, J.F. (2014). Current-use herbicides in air as influenced by their estimated agricultural use at various distances from six sampling locations. Water, Air, & Soil Pollution. 225:2013, 10pp.

List of published contributions

15. MESSING, P., FARENHORST, A., Waite D.T., Sproull, J.F. (2014). Air concentrations of currently used herbicides and legacy compounds in the Canadian Prairies, Subarctic, and Arctic. Journal of Environmental Science and Health, Part B. 49(5):338-343.
+ others (space limitation).

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	 To
AWARDED				
NSERC CREATE Program for Water and Sanitation Security in First Nations Annemieke Farenhorst	Natural Sciences and Engineering Research Council of Canada (NSERC) Collaborative Research and Training Experience Program	$275,000	2013	2019
Climatic and soil-landscape variations in relationto modeling pesticide fate in hummocky terrains.Farenhorst, A. Farenhorst, A.	NSERC Discovery Program	$37,716	2009	2018
Liquid scintillation counter for current-use pesticides and emerging contaminants research Annemieke Farenhorst	NSERC Research Tools and Instruments Grants Program	$133,385	2016	2017
NSERC Chair for Women in Science and Engineering (Prairies). Jayas, D. (nominator), Farenhorst, A. (nominee)	NSERC Chair for Women in Science and Engineering Program	$163,000	2011	2017
Agricultural pesticides in Alberta groundwater C. Sheedy	Alberta Innovates Energy and Environment Solutions	$20,000	2013	2016
Environmental contaminant exposure through source water and traditional foods J. Leary	Health Canada First Nations Environmental Contaminants Program	$119,000	2014	2015
Increasing sustainable food production in the region of Intibucá, Honduras, through community-based vermi composting and irrigation gardening Annemieke Farenhorst	Canadian International Development Agency (CIDA) Multiplying or Replicating Tier 2 Results	$28,250	2014	2014
Our right to clean water:First Nations youth test water quality Aud, M.	Health Canada Drinking Water Quality Program	$50,000	2012	2013
Cherishing water, claiming health: a planningsymposium on water as a holistic health right. Elias, B. + 6 others	CHIR Planning Grant	$25,000	2012	2012
Environmental sustainability of Central Americanagriculture. Farenhorst, A. + 11 others	CIDA Tier 2 Program	$199,960	2005	2012

Identification

Family Name	Lobb
First name and initials	David A
Institution	University of Manitoba
Position	Senior Research Chair / Professor
Department/Division	Watershed Systems Research Program / Soil Science

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	1998	Soil Science (soil and water conservation)	University of Guelph, Canada
Master's	1991	Soil Science (soil and water conservation)	University of Guelph, Canada
Bachelor's, Honours	1987	Physical Geography (fluvial geomorphology)	University of Toronto, Canada

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Professor , University of Manitoba	Soil Science	2008	
Senior Research Chair, University of Manitoba	Watershed Systems Research Program	2010	2015
Associate Professor, University of Manitoba	Soil Science	2003	2008
Visiting Professor, University of Exeter	Geography	2005	2005
Visiting Professor, Katholieke Universiteit Leuven	Geography	2005	2005
Adjunct Professor, Chinese Academy of Sciences	Institute of Mountain Hazards and Environment	2000	2003
Assistant Professor, University of Manitoba	Soil Science	1999	2003
Visiting Professor, Chinese Academy of Sciences	Institute of Mountain Hazards and Environment	2000	2000
Land Use and Development Officer, Government of New Brunswick	Agriculture and Rural Development	1997	1999
Soil Conservation Specialist, Universite de Moncton	Eastern Canada Soil and Water Conservation Centre	1993	1997

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Research Associate, University of Guelph	Land Resource Science	1991	1993
Research Assistant, University of Guelph	Land Resource Science	1987	1991
Undergraduate Research Assistant, University of Toronto	Geography	1985	1987

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

SELECTED PUBLICATIONS (16 of 31, plus 38 prior to 2009)

Barthod, LRM, DA Lobb, PN Owens, N Martínez-Carreras, AJ Koiter, EL Petticrew, GK McCullough, C Liu. Do color fingerprints give similar results to conventional sediment fingerprinting techniques? J Env Quality. submitted

Liu, K, JA Elliott, DA Lobb, DN Flaten, J Yarotski. Nutrient and sediment losses in snowmelt runoff from perennial forage and annual cropland in the Canadian Prairies. J Env Quality. in press

Liu, K, JA Elliott, DA Lobb, DN Flaten, J Yarotski. Conversion of conservation tillage to rotational tillage to reduce phosphorus losses during snowmelt runoff in the Canadian Prairies. J Env Quality. in press

Lobb, DA, S Li, BG McConkey. Soil erosion. In: Environmental Sustainability of Canadian Agriculture. Agri-Environmental Indicator Report Series - No. 4. Agriculture and Agri-Food Canada. Ottawa. in press

Koiter, AJ, DA Lobb, PN Owens, EL Petticrew, KHD Tiessen, S Li. 2013. Investigating the role of connectivity and scale in assessing the sources of sediment in an agricultural watershed in the Canadian prairies using sediment source fingerprinting. J Soils Sediments 13:1676-1691

Koiter, AJ, PN Owens, EL Petticrew, DA Lobb. 2013. The behavioural characteristics of sediment properties and their implications for sediment fingerprinting as an approach for identifying sediment sources in river basins. Earth Science Reviews 125:24-42

Liu, K, JA Elliott, DA Lobb, DN Flaten, J Yarotski. 2013. Critical factors affecting field-scale losses of N and P in spring snowmelt runoff in the Canadian Prairies. J Env Quality 42:484-496

Dercon, G, L Mabit, G Hancock, ML Nguyen, OOS Bacchi, M Benmansour, C Bernard, W Froehlich, VN Golosov, A Klik, Y Li, DA Lobb, Y Onda, N Popa, M Rafiq, JC Ritchie, P Schuller, P Wallbrink, DE Walling, F Zapata, X Zhang. Fallout radionuclide-based techniques for assessing the impact of soil conservation measures on erosion control and soil quality. J Env Radioactivity 107:78-85

VandenBygaart, AJ, D Kroetsch, EG Gregorich, DA Lobb. Soil C erosion and burial in cropland. Global Change Biology 18:1441-1452

Lobb, DA. 2011. Understanding and managing the causes of soil variability. J Soil Water Conservation 66:175A-179A

Li, S, JA Elliott, KHD Tiessen, J Yarotski, DA Lobb, DN Flaten. 2011. The effects of multiple beneficial management practices on hydrology and nutrient losses to a small watershed in the Canadian prairies. J Env Quality 40:1-16

List of published contributions

Li, S, DA Lobb, BG McConkey, RA MacMillan, AP Moulin, WR Fraser. 2011. Extracting topographic characteristics of landforms typical of Canadian agricultural landscapes for agri-environmental modelling: I Methodology. Can. J Soil Science 91:251-266

Li, S, RA MacMillan, DA Lobb, BG McConkey, WR Fraser. 2011. Lidar DEM error analyses and topographic depression identification in a hummocky landscape in the prairie region of Canada. Geomorphology 129:263-275

Tiessen, KHD, JA Elliott, M Stainton, J Yarotski, DN Flaten, DA Lobb. 2011. The effectiveness of small headwater storage dams/reservoirs on stream water quality and quantity in the Canadian Prairies. J Soil Water Conservation 66:158-171

Li, S, DA Lobb, RG Kachanoski, BG McConkey. 2011. Comparing the use of the traditional and repeated sampling approach of the 137Cs technique in soil erosion estimation. Geoderma 160:324-335

Li, S, DA Lobb, KHD Tiessen, BG McConkey. 2010. Selecting and applying 137Cs conversion models to estimate soil erosion rates in cultivated fields. J Env Quality 34:204-219

Tiessen, KHD, JA Elliott, J Yarotski, DA Lobb, DN Flaten, NE Glozier. 2010. Conventional and conservation tillage - influence on seasonal runoff, sediment and nutrient losses in the Canadian Prairies. J Env Quality 39:964-980

Tiessen, KHD, S Li, DA Lobb, GR Mehuys, HW Rees, LT Chow. 2009. Using repeated measurements of 137Cs and modelling to identify spatial patterns of tillage and water erosion within potato production in Atlantic Canada. Geoderma 153:104-118

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	Support Period To
AWARDED				
Tobacco Creek Model Watershed. Lake Winnipeg Basin Research Node McEwan L	NSERC Network Centres of Excellence (CWN) (3 years funding)	$200,000	2013	2015
Watershed Systems Research Program Lobb DA	Province of Manitoba Manitoba Research Innovation Fund (5 years funding)	$117,500	2011	2015
Development of environmental fingerprinting techniques for sources of sediment and associated phosphorus within agricultural watersheds of Canada Lobb DA	NSERC Strategic Projects (3 years funding)	$174,640	2012	2014
Effectiveness of BMPs in reducing sediment and nutrient losses from agricultural land in the South Tobacco Creek Watershed Lobb DA	Agriculture and Agri-Food Canada Watershed Evaluation of Beneficial Management Practices (4 years funding)	$75,200	2010	2014
Soil erosion risk indicator modelling, validation using 137Cs, and uncertainty analysis Lobb DA	Agriculture and Agri-Food Canada National Agri-environmental Health Analysis and Reporting (2 years funding)	$85,082	2012	2013
Use of 137Cs and delta 13C to assess the redistribution of soil and its biophysical impacts within topographically complex agricultural landscapes at the field scale and watershed scale Lobb DA	United Nations (UN) International Atomic Energy Agency (IAEA) Co-ordinated Research Project (IAEA CRP D1-20-11) (5 years funding)	$5,000	2009	2013
Determining the effective use of riparian areas to filter sediments and phosphorus Lobb DA	Environment Canada Lake Winnipeg Basin Stewardship Fund (1 year funding)	$105,600	2012	2012
The feasibility of integrated surface water management on agricultural land in Manitoba McEwan L	Agri-Environment Program Manitoba Rural Adaptation Program (1 year funding)	$23,000	2012	2012
Modelling soil movement by tillage Lobb DA	NSERC Discovery Projects (5 years funding)	$19,090	2008	2012
Effectiveness of BMPs in reducing sediment and nutrient losses from agricultural land in the South Tobacco Creek Watershed Lobb DA	Agriculture and Agri-Food Canada Watershed Evaluation of Beneficial Management Practices (3 years funding)	$31,550	2007	2009

Identification

Family Name	Mallory-Hill
First name and initials	Shauna SMH
Institution	University of Manitoba
Position	Assistant Professor
Department/Division	Interior Design, Faculty of Architecture

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	2004	Architecture	Eindhoven University of Technology, Netherlands (the)
Master's	1996	Architecture	University of Manitoba, Canada
Bachelor's	1986	Environmental Studies	University of Manitoba, Canada

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Assistant Professor, University of Manitoba	Department of Interior Design, Faculty of Architecture	2002	
Treasurer, Board of Directors, Environmental Design Research Association		2015	2016
Chair, Board of Directors, Environmental Design Research Association		2014	2015
Treasurer, Board of Directors, Environmental Design Research Association		2010	2013
Doctoral Fellow (OIO), Eindhoven University of Technology	Department of the Built Environment	1996	2002
Director, Canadian Institute for Barrier-Free Design		1993	1996
Sessional Lecturer, University of Manitoba	Department of Environmental Design	1992	1995
Intern Architect / CAD Consultant, Geremia Balckie Architecture		1991	1992

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Senior Intern / Research Assistant, University of Manitoba	Computer Aided Design research Lab [CADLab], Faculty of Architecture	1990	1992
Intern Architect / CAD Coordinator, Gaboury Associates Architects		1988	1990
Teaching Assistant, University of Manitoba	Continuing Education	1988	1988
Editor / Graphic Designer, Canadian Paraplegic Association		1987	1987
Research Assistant, Barrier-Free Design Center		1985	1985

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

Mallory-Hill, S., Watson, C., Preiser, W. (2012). Enhancing Building Performance. Oxford: Wiley-Blackwell.
Mallory-Hill, S. (2004) Supporting the Strategic Design of Workplace Environments with Case-Based Reasoning. Bouwstenen 83 Eindhoven, NL: Eindhoven University Press.
Mallory-Hill, S., Gorgowleski, M. (2016). "Mind the Gap: Studying Actual vs. Predicted Performance of Green Buildings in Canada" in Building Performance Evaluation: From Delivery Process to Life Cycle Phases. A. Hardy, U. Schramm, W. Preiser (eds). NY: Springer (Forthcoming)
Callaghan, A., Mallory-Hill, S. (2016). Biophilia and nature-based features to support stress reduction in knowledge workers. Proceedings from SBE2016 Toronto: Sustainable Built Environment Conference, 19-20 September 2016, Toronto, Canada (forthcoming).
Gorgolewski, M., Brown, C., Chu, A.M., Turcato, A., Bartlett, K., Ebrahimi, G, Hodgson, M.,Ma llory-Hill, S., Ouf, M., Scannell, L.2.(2015) "How well do our green buildings perform?" Journal of Green Building. College Publishing (submitted)
Mallory-Hill, S., Westlund, A. (2012). "Evaluating the impact of green buildings on worker productivity - A literature review" in Enhancing Building Performance. S. Mallory-Hill, C. Watson, and W Preiser (eds). Oxford: Wiley-Blackwell.
Mallory-Hill, (2016). Feeding-forward for higher quality workplace environments: A post-occupancy evaluation case study. Proceedings from EDRA47: Environmental Design Research Association 47th Annual Conference, Raleigh, NC.
Mallory-Hill, S., Gorgolewski, M., Brown, C., Scannell, L., Ouf, M., Chu, A.M., Hodgson, M., Turcato, A., Klassen, K. (2015). "Integrative research process: Opportunities, challenges & good practices in green building performance evaluation." Proceedings from EDRA46: Environmental Design Research Association 46th International Conference, 27-30 May 2015, Los Angeles, CA. Mallory-Hill, S., Voordt, T. van, Dortmont, A. van, (2004) "Chapter 15: Evaluation of Innovative Design in the Netherlands" in Assessing Building Performance. Preiser, W. and Vischer, J. (eds.). The Netherlands: Elsevier.
Mallory-Hill, S., Everton, B. (2001) "Accessibility Standards and Universal Design Developments in Canada" in Universal Design Handbook. Wolfgang Preiser and E. Ostroff (eds.) New York: McGraw-Hill. pp. 16.1-17
Mallory-Hill, S. (2003) "Feeding-Forward Workplace Performance Evaluations into the Early Phases of the Design Cycle." Proceedings from EDRA34 - People Shaping Places Shaping People, Minneapolis, MN. 22-25 May 2003. Edmond, Oklahoma: Environmental Design Research Association. p. 256.

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	Support Period To
AWARDED				
Sustainable Built Environment Conference of the Americas Shauna Mallory-Hill	UM-SSHRC Travel Grant Program	$700	2016	2017
Northern teaching lodges: Learning partnership for building human resources, community development and improving infrastructure in First Nation communities Shirley Thompson	SSHRC Partnership Grants - LOI	$19,996	2016	2017
Evaluating the impact of workplace environmental quality of employee health and wellness. Shauna Mallory-Hill	MITACS Inc. Accelerate & Globalink programs	$15,000	2014	2016
Building Performance Evaluation Laboratory (BPEL) Field Measuring Equipment Acquisition Shauna Mallory-Hill	University of Manitoba Faculty of Architecture Student Technology Fee Investment Fund	$20,000	2011	2016
Building performance evaluation of leading Canadian green buildings. Mark Gorgowleski	Ryerson University NSERC - Collaborative Research	$24,000	2014	2015
Measuring indoor environmental quality - Tools & techniques Shauna Mallory-Hill	University of Manitoba URGP	$3,500	2011	2013
Environmental Design Research Association 40th Annual International Conference Shauna Mallory-Hill	University of Manitoba UM-SSHRC Travel Grant Program	$1,000	2009	2010
Measuring the impact of green buildings on worker productivity and wellness Shauna Mallory-Hill	University of Manitoba URGP	$2,000	2007	2010
The nature of work - pre-occupancy study Shauna Mallory-Hill	Manitoba Hydro Research & Development	$16,070	2006	2006
UNDER REVIEW				
The impact of renovations in long term care living spaces on residents with dementia and the families and the staff that care for them Michelle Porter	Riverview Health Center RHC Alzheimer Center of Excellence Research Grant	$100,000	2016	2019

Identification

Family Name	O'Gorman
First name and initials	Melanie
Institution	The University of Winnipeg
Position	Associate Professor
Department/Division	Economics

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	2007	Economics	University of Toronto, Canada
Master's	2000	Economics	Queen's University, Canada
Bachelor's, Honours	1999	International Development Studies	University of Guelph, Canada

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Associate Professor, University of Winnipeg	Economics	2011	2016
Assistant Professor, University of Winnipeg	Economics	2006	2011
Instructor, Trent University	International Development Studies	2005	2006
Research Assistant, University of Toronto	Economics	2004	2005
International Development Management Fellowship, Aga Khan Foundation Canada	International Development/Education	2000	2001

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

* "The Keeyask Hydro Dam Plan in Northern Canada: A Model for Inclusive Indigenous Development?" joint with Jerry Buckland, forthcoming, Canadian Journal of Development Studies.

* "Explaining low high school attainment in Northern Aboriginal Communities: An analysis of the Aboriginal Peoples' Surveys" with Manish Pandey, Canadian Public Policy/Analyses de Politiques, Volume 41(4), pages 297-308 (December 2015).

* "Cultivating the Arctic's Most Valuable Resource: An Analysis of the Barriers to High School Completion Among Arctic Youth", joint with Manish Pandey, Policy Report submitted to the Nunavut Department of Education and other education stakeholders in Nunavut (September 2015).

* "Africa's Missed Agricultural Revolution: A Quantitative Study of the Policy Options", B.E. Journal of Macroeconomics, Volume 15, Issue 2, pages 561-602 (July 2015).

* "Why the CCM Won't Lose: The Roots of Single Party Dominance in Tanzania", Journal of Contemporary African Studies, Volume 30, Issue 2, pages 313-333 (April-May 2012).

* "Racial Earnings Inequality in South Africa: A Quantitative Assessment of the Policy Options", Journal of Policy Modeling, Volume 32, Issue 6, pages 703-718 (November-December 2010).

* "Cross-Country Disparity in Agricultural Productivity: Quantifying the Role of Modern Seed Adoption", with Manish Pandey, Journal of Development Studies, Volume 46, Issue 10, pages 1-18 (November 2010).

* "Education Finance and the Persistence of Racial Earnings Inequality in the Post-Brown Era", Economics of Education Review, Volume 29, Issue 4, pages 526-542 (August 2010).

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	To
AWARDED				
Wa Ni Ska Tan - Cross-Regional Research Alliance on the Implications of Hydro Development for Environments and Indigenous Communities in Northern Canada Stephane Mclachlan	Social Sciences and Humanities Research Council (SSHRC) Partnership Grant	$300,000	2016	2021
The right to clean water in First Nations: the most preciousgift Karen Busby	Social Sciences and Humanities Research Council (SSHRC) Partnership Development Grant	$70,000	2013	2016
Cultivating the Arctic's Most Valuable Resource: An Analysis of the Barriers to High School Completion Among Aboriginal Youth in Northern Communities Melanie O'Gorman	Social Sciences and Humanities Research Council (SSHRC) Insight Development Grant	$25,000	2011	2013
Cherishing water, claiming health: a planning symposium on water as a holistic health right Brenda Elias	Canadian Institutes of Health Research (CIHR) Planning Grant	$20,000	2011	2011

Identification

Family Name	Olsen Harper
First name and initials	Anita
Institution	University of Manitoba
Position	Post Doctoral Fellow
Department/Division	Natural Resources Institute

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Postdoctorate	2017	Natural Resources Institute	University of Manitoba, Canada
Doctorate	2011	Society, Literacy & Culture	University of Ottawa, Canada
Master's	1999	Canadian Studies	Carleton University, Canada
Bachelor's	1996	Education (Adult Education)	University of Alberta, Canada
Diploma	1986	Telecommunications Engineering Technology	Southern Alberta Institute of Technology, Canada

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
School Board Trustee, Ontario Ministry of Education	Ottawa Carleton District School Board (OCDSB)	2014	2018
Patient Engagement Researcher, Ottawa Hospital Research Institute (OHRI)	Chronic Pain Management	2015	2015
Researcher(these 2 positions were 4-month contracts in each of the 2 years identified), Government of Canada	Department of Justice	2011	2015
Research Consultant, Sr. Policy Analyst, National Aboriginal Circle Against Family Violence (NACAFV)	Research	2004	2015
Curriculum Specialist, Whitefeather Forest Management Corporation	Forest Ecosystem Management Technician Program	2012	2014

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Researcher, Government of Canada	Office of the Federal Interlocutor for Métis & Non-Status Indians, Human Trafficking	2012	2012
Researcher, Evaluation, Government of Canada	Aboriginal and Northern Development Canada	2011	2011
Researcher, Consultant, CIET Canada (Community Information, Empowerment and Transparency)	Knowledge Translation	2004	2010
Researcher, Evaluation, Government of Nunavut	Health & Social Services	2008	2009
Researcher, Evaluation, Government of Canada	Public Health Agency of Canada(Aboriginal Head Start Program)	2006	2007
Instructor, National Taiwan University of Science & Technology	College of Engineering	2006	2006
Team Lead, Research and Communications, Native Women's Association of Canada	Sisters in Spirit	2006	2006
Research consultant, Donna Cona, Inc.	Research	2006	2006
Research Associate, Nation Media & Design	Contracts	2001	2006
Researcher/ Policy Analyst, Assembly of First Nations	Health	2002	2003

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

2016. Structural oppressions facing Indigenous students in Canadian education. Submitted to R. Ryser, Fourth World Journal
Center for World Indigenous Studies. Co-authored with Dr. Shirley Thompson, University of Manitoba, NRI.

2016. Sisters in Spirit. In D. Memee Lavell-Harvard & J. Brant (Eds.), Forever loved (pp. 79-107). Bradford, ON: Demeter Press.

2015. Understanding the colonial causes of IPV in Aboriginal communities. Thee Westerner. Retrieved from http://theewesterner.com/understanding-the-colonial-causes-of-ipv-in-aboriginal-communities/

2012. What Olive did for me. Native Studies Review, 21(2), 73-79. (Tribute to Metis historian Olive Dickason).

2009. Is Canada peaceful and safe for Aboriginal women? In P.A. Monture & P.D. McGuire (Eds.), First voices: An Aboriginal women's reader (pp.333-342). Toronto: Inanna Publications.

2009. Sisters in Spirit. In G. Guthrie Valaskakis, M. Dion Stout & E. Guimond (Eds.), Restoring the balance: First Nations women, community and culture (pp. 175-199). Winnipeg: University of Manitoba Press.

2009. Is Canada peaceful and safe for Aboriginal women?. In B.A. Crow & L. Gotell (Eds.), Open Boundaries: A Canadian Women's Studies Reader (3rd ed.), (pp. 207-215). Toronto: Pearson Prentice Hall.

2008. Silence and articulating: Lived histories of the Trout Lake Anishinawbe. First Nations Perspective: The Journal of the Manitoba First Nations Education Resource Centre, 1, 41-56. Retrieved from www.mfnerc.org/images/stories/FirstNationsJournal/Volume1/anita%20harper.pdf

2006. Is Canada peaceful & safe for Aboriginal women? Canadian Woman Studies, 25(1-2), 33-38.

2006. Ending Violence in Aboriginal Communities: Best Practices in Aboriginal Shelters & Communities. Ottawa: The National Aboriginal Circle Against Family Violence.

1999. The Merman of Olsen's Island. In G. Kirkland & R. Davies (Eds.), Inside Stories II (2nd ed.), (pp. 292-299). Toronto: Brace & Harcourt. [Anthology, Canadian high-school textbook.]

1999. Real Life Case Study: Lower Fort Garry Treaty 1 Interpretation Project. Canadian Tourism Human Resources Development: Heritage Interpretation.

1995. A Study of the First Nations in Canada (Unit 5), Intermediate Social Studies, Adult Basic Education. Vancouver: Open Learning Agency.

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period	
			From	To
AWARDED				
Strategy for Patient-Oriented Research: SPOR Networks in Chronic Disease Dr. Norm Buckley	Canadian Institutes of Health Research SPOR Networks in Chronic Disease	$5,000,000	2016	2021

Identification

Family Name	Paterson
First name and initials	Michael
Institution	IISD-Experimental Lakes Area
Position	Chief Research Scientist
Department/Division	

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Chief Research Scientist, IISD-Experimental Lakes Area, International Institute for Sustainable Development, Winnipeg, Canada		2014	
Adjunct Professor, University of Manitoba, Winnipeg, Canada	Entomology	1997	
Senior Fellow and Associate, International Institute for Sustainable Development, Winnipeg, Canada		2013	2014
Research Scientist, Fisheries & Oceans Canada, Winnipeg, Canada	Environmental Sciences/Ecosystem Research	1992	2013
Environmental Consultant, North/South Consultants, Winnipeg, Canada		1991	1992
Environmental Consultant (part-time), P. Lane and Assoociates, Halifax Nova Scotia		1986	1990

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

Kidd, K.A., M.J. Paterson, M.D. Rennie, C.L. Podemski, D.L. Findlay, P.J. Blanchfield, and K. Liber. 2014. Direct and indirect responses of a freshwater food web to a potent synthetic estrogen. Phil. Trans. Royal Soc. B.: dx.doi.org/101098/rstb 2013.0578.

Mailman, M., R.A. Bodaly, M.J. Paterson, S. Thompson, and R.J. Flett. 2014. Low-level experimental selenite additions decrease mercury in aquatic food chains and fish muscle but increase selenium in fish gonads. Arch. Environ. Contam. Toxicol. 66: 32-40.

Paterson, M.J., D.W. Schindler, R.E. Hecky, D.L. Findlay, and K.J. Rondeau. 2011. Comment: Lake 227 shows clearly that controlling inputs of nitrogen will not reduce or prevent eutrophication of lakes. Limnol. Oceanogr. 56: 1545-1547.

Paterson, M.J., C.L. Podemski, L.J. Wesson, and A.P. Dupuis. 2011. The effects of an experimental freshwater cage aquaculture operation on Mysis diluviana. J. Plank. Res. 33: 25-36.

Paterson, M.J., C.L. Podemski,W.J. Findlay, D.L. Findlay, A.G. Salki. 2010. The response of zooplankton in a whole-lake experiment on the effects of a cage aquaculture operation for rainbow trout (Oncorhynchus mykiss). Can. J. Fish. Aquat. Sci. 67: 1852-1861.

Shurin, J., M. Winder, R. Adrian, W. Keller, B. Matthews, A. Paterson, M. Paterson, B. Pinel-Alloul, J. Rusak, N. Yan. 2010. Environmental stability and lake zooplankton diversity- contrasting effects of chemical and thermal variability. Ecol. Lett. 13:453-463.

Schindler, D.W., R.E. Hecky, D.L. Findlay, M.P. Stainton, B.R. Parker, M. Paterson, K.G. Beaty, M. Lyng, and S.E.M. Kasian. 2008. Eutrophication of lakes cannot be controlled by reducing nitrogen input: Results of a 37-year whole ecosystem experiment. Proc. Nat. Acad. Sci. USA 105: 11254-11258.

Harris, R.C. et al. 2007. Whole-Ecosystem Study Shows Rapid Fish Mercury Response to Changes in Mercury Deposition. Proc. Nat. Acad. Sci. USA 104: 16586-16591.

Orihel, D.M., M.J. Paterson, P.J. Blanchfield, R.A. Bodaly, and H.H. Hintelmann. 2007. Experimental evidence of a linear relationship between inorganic mercury loading and methylmercury accumulation by aquatic biota. Environ. Sci. Technol. 41: 4952-4958.

Paterson, M.J., P.J. Blanchfield, C. Podemski, H.H. Hintelmann, C.C. Gilmour, R. Harris, N. Ogrinc, J.W.M. Rudd, and K.A. Sandilands. 2006. Bioaccumulation of newly-deposited mercury by fish and invertebrates: an enclosure study using stable mercury isotopes. Can. J. Fish. Aquat. Sci. 63: 2213-2224.

Bodaly, R.A. et al. 2004. Experimenting with hydroelectric reservoirs. Environ. Sci. Technol. 38: 346A-352A.

St.Louis, V.L., J.W.M. Rudd, C.A. Kelly, R.A. Bodaly, M.J. Paterson, K.G. Beaty, R.H. Hesslein, A. Heyes, and A.R. Majewski. 2004. The rise and fall of mercury methylation in an experimental reservoir. Environ. Sci. Technol. 38: 1348-1358.

List of published contributions

Paterson, M.J., D.L. Findlay, A.G. Salki, L.L. Hendzel, and R.H. Hesslein. 2002. The effects of Daphnia on nutrient stoichiometry and filamentous cyanobacteria: a mesocosm experiment in a eutrophied lake. Freshwater Biol. 47: 1217-1233.

Jeremiason, J.D., S.J. Eisenreich, M.J. Paterson, K.G. Beaty, R.E. Hecky, and J.J. Elser. 1999. Biogeochemical cycling of atmospherically-derived PCBs in lakes of variable trophic status: a paired-lake experiment. Limnol. Oceanogr. 44: 889-902.

Paterson, M.J., D.C.G. Muir, B. Rosenberg, E.J. Fee, C.Anema, and W. Franzin. 1998. Does lake size affect concentrations of atmospherically-derived PCBs in water, sediment, zooplankton, and fish? Can. J. Fish. Aquat. Sci. 55: 544-553.

Paterson, M.J., J.W.M. Rudd, and V. St.Louis. 1998. Increases in total and methylmercury in zooplankton following flooding of a peatland reservoir. Environ. Sci. Technol. 32: 3868-3874.

Paterson, M.J., D. Findlay, K. Beaty, W. Findlay, E.U. Schindler, M. Stainton, and G. McCullough. 1997. Changes in the planktonic food web of a new experimental reservoir. Can. J. Fish. Aquat. Sci. 54: 1088-1102.

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	To
AWARDED				
Indicators of fish productivity for monitoring on the Manitoba Hydro System S. Higgins	Manitoba Hydro Manitoba Hydro Research and Development Program	$113,000	2016	2019
Ekati Diamond Mine Aquatic Effects Monitoring Program Re-evaluation and Re-design M. Paterson	Independent Environmental Monitoring Agency	$5,000	2016	2016
Governance Review Oil Sands Monitoring, Evaluation and Reporting G. Greene	Alberta Environmental Monitoring, Evaluation and Reporting Agency AEMERA		2015	2015
Impacts of nanosilver on a lake ecosystem C. Metcalfe	Natural Sciences and Engineering Research Council Canada Strategic Grants Program	$245,400	2011	2014
Evaluation of ecosystem measures for assessing impacts to fish productivity S. Higgins	Fisheries and Oceans Canada Strategic Program for Ecosystem-Based Research and Advice	$57,000	2013	2013
Effects of experimental sulfate additions on nutrient cycling, cyanobacterial abundance and mercury methylation in Lake 227, Experimental Lakes Area L.A. Molot	National Science and Engineering Research Council of Canada Strategic Grant Program	$225,000	2010	2012
UNDER REVIEW				
Natural Stable Isotopes of Iron: A new tool to trace Fe cycling for management of risk from harmful cyanobacterial blooms in lakes and reservoirs S. Schiff	Natural Sciences and Engineering Research Council Canada Strategic Grants Program	$200,864	2016	2019
Determining the effects of a pipeline spill in Canadian Boreal lakes: Experimental additions of diluted bitumen (dilbit) to in-situ enclosures at the IISD-Experimental Lakes Area J. Blais	Natural Sciences and Engineering Research Council Canada Strategic Grants Program	$263,763	2016	2019
Climate impacts on multiple stressor interactions: The effects of environmental change on aquatic food web structure and function S. Arnott	Natural Sciences and Engineering Research Council Canada Strategic Grants Program	$196,666	2016	2019

Identification

Family Name	Rashwan
First name and initials	M. Shokry
Institution	Red River College of Applied Arts, Science and Technology
Position	Paul Charette-Manitoba Applied Research Chair in Sustainable Construction
Department/Division	School of Construction and Engineering Technologies

Academic background

Degree type	Year received or expected	Discipline/Field/Speciality	Institution and country
Doctorate	1988	Civil Engineering	University of Manitoba, Canada
Master's	1983	Civil Engineering	University of Manitoba, Canada
Bachelor's	1977	Civil Engineering	Cairo University, Egypt

Work experience

		Period	
Position/Organization	**Department/Division**	**Start date**	**End date**
Paul Charette - Manitoba Applied Research Chair in Sustainable Construction, Red River College	School of Construction and Engineering Technologies	2013	
Research Manager, National Research Council of Canada	Institute for Research in Construction	2009	2013
Project Engineer, The Puratone Corporation	Research and Continuous Improvement Dept	2000	2009
Owner/General Manager, Integrated Construction Engineering Systems Inc.		1994	2000
Director of Research, Prairie Masonry Research Institute	Research	1989	1994
Civil Technology Instructor, Red River College	Access North Program	1987	1989
Research & Teaching Assistant, University of Manitoba	Civil Engineering	1980	1987
Site Engineer, Saini Construction & Contracting		1978	1980

List of published contributions

This section provides a list of the most significant published contributions (e.g. submitted and/or published articles, patents, technical reports).

Refereed Journal Publications

Goyal, A., Rashwan, M.S., Hatzinikolas, M. and Zervos, S. "Structural Performance of Cavity Walls Constructed With Concrete Units Containing Sawdust and Shear Connected to the Brick Veneer". CSCE Journal, Vol. 21, No. 4, August 1994. pp. 576-584

Rashwan, M.S., Hatzinikolas, M. and Zmavc, R. "Development of Light Weight/Low Cost Concrete Block Using Wood Residue". Forest Product Journal, Vol. 42, No. 5, WI, USA, May 1992. pp. 57-64

Bector, C.R., Rashwan, M.S., Goulter, I.C. and Glanville, J.I. "A Goal Programming Approach to Masonry Construction". Journal of Information and Optimization Science, Vol. J, No. 3, Delhi, India, 1986. pp. 323-333

Rashwan, M.S., Goulter, I.C. and Glanville, J.I. "Mixed Integer Programming for the Optimal (Least Cost) Design of Eccentrically Loaded Masonry Bearing Walls - Part I. Low Eccentricities". Journal of Engineering Optimization, Vol. 11, Great Britain, 1986. pp. 217-232

Rashwan, M.S., Goulter, I.C. and Glanville, J.I. "Mixed Integer Programming for the Optimal (Least Cost) Design of Eccentrically Loaded Masonry Bearing Walls - Part 2. High Eccentricities". Journal of Engineering Optimization, Vol. 11, Great Britain, 1986. pp. 233-244

Conference Papers

Rashwan, M.S. and Hassan, MD. "Monitoring and Measuring Systems for Assessing Long-Term Performance of Tire Derived Aggregates (TDA) Used in Residential Home Basements Construction". Proceedings of the annual conference for Canadian Society for Civil Engineering (CSCE) - Resilient Infrastructure, June 2016

M. Issa and Rashwan, M.S., "A Review of Research Investigating Indoor Environmental Quality in Green and Conventional Residential Buildings". Proceedings of the annual conference for Canadian Society for Civil Engineering (CSCE) - Resilient Infrastructure, June 2016

Joshua B. Akom, Abdul-Manan Sadick, Mohamed H. Issa, Martin Duhoux, Rashwan, M.S."A mixed-methods research methodology for evaluating indoor environmental quality (IEQ) in green and conventional residential homes", paper to be published at COBRA, July 2016, Toronto, Ontario

Rashwan, M.S. and Marten Duhoux: "Benchmarking Energy Performance for LEED Residential Homes in Manitoba". Paper presented at the annual IEEE conference in London, Ontario, October 2015

Rashwan, M.S., Greg Rennie, and Neil Chandler, "Investigating the Feasibility of Using Tire Derived Aggregate (TDA) for Basement Construction Applications in Manitoba". Paper presented at the 16th National Conference on Non-Conventional

List of published contributions

Presentations and Guest Speaker:
Numerous presentations made including the following:

Rashwan, M.S. "A Preliminary Analysis of the Energy Performance of LEED Residential Homes". Presentation at the National Conference of Building Facility Operations. Vancouver, BC. October 2014

Rashwan, M.S.: "The Role of College Education in Establishing Sustainable Commissioning of Buildings". Presentation at the National Conference of Building Facility Operations. Vancouver, BC. October 2014

Rashwan, M.S., and Marten Duhoux: "Using Hydro Data to Benchmark Performance of LEED Homes in Manitoba". Presentation at the Building Lasting Change Conference in Vancouver, BC. June 2015

Patents
-Rashwan, M.S. and Burrows, B. "Mobile Crushing Plant".
A compact plant for recycling concrete and masonry R&D waste.
U.S. Patent # 5,445,330

-Rashwan, M.S. and Abou Rizk, S.M. "Reclamation of Left-Over Concrete".
A method and apparatus for recovering concrete returned to ready mix plants.
U.S. Patent # 5,766,524

-Rashwan, M.S. "Composting using air from livestock housing".
A method and device for processing dead animals' carcasses into safe, neutralized and valuable compost in a very short time with very little cost.
Canadian Patent # 2,465,685

Research or technology development funding

This table lists support held over the past five years as an applicant or co-applicant for grants and contracts from all sources, including industry and academic/research institutions. Maximum of ten entries.

Title of proposal Name of Principal Applicant / Project Leader	Funding source Program name	Average amount per year	Support Period From	To
AWARDED				
Investigating the Feasibility of Using Tire Derived Aggregate (TDA) for Basement Construction Applications in Manitoba M. Shokry Rashwan	Industry	$80,000	2014	2017
Benchmarking Energy Performance for LEED Residential Homes in Manitoba M. Shokry Rashwan	Industry	$5,000	2014	2015

Suggested reviewers

The decision whether or not to use the suggestions remains with the CFI.

Name	Quarter, Jack
Institution/Organization	OISE/UT
Country	Canada
Email	jquarter@oise.utoronto.ca
Telephone	1-416-9780820
Fax	1-416-9780820
Online CV or biography	
Area(s) of expertise (keywords)	community economic development, sustainable livelihoods

Name	Cunsolo Willox, Ashlee
Institution/Organization	Cape Breton University
Country	Canada
Email	ashlee_cunsolowillox@cbu.ca
Telephone	1-902-5631949
Fax	
Online CV or biography	http://www.ashleecunsolowillox.ca
Area(s) of expertise (keywords)	indigenous issues, sustainability northern

Name	Bharadwaj, Lalita
Institution/Organization	University of Saskatchewan
Country	Canada
Email	lalita.bharadwaj@usask.ca
Telephone	1-306-966553
Fax	1-306-9665553
Online CV or biography	https://www.usask.ca/sph/Meet%20Our%20People/faculty/lalita-bharadwaj/index.php
Area(s) of expertise (keywords)	Barriers and Key Issues to the Access of Safe and Sustainable Drinking Water Sources in First Nations Communities; Commu

Name	Schiff, Rebecca
Institution/Organization	Lakehead University
Country	Canada
Email	rschiff@lakeheadu.ca
Telephone	1-807-7667199
Fax	
Online CV or biography	https://www.lakeheadu.ca/users/S/rschiff
Area(s) of expertise (keywords)	homelessness, food security, social justice, poverty, sustainability, health equity, housing

Name	Ling, Chris
Institution/Organization	Royal Roads University
Country	Canada
Email	chris.ling@royalroads.ca
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