The Soft Path Approach as a Water Management Strategy:

A Case Study in Thunder Bay, Ontario

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Abstract

The purpose of this research is to examine the criteria for a soft path approach as it may apply to municipal water management in the City of Thunder Bay. A categorization of Thunder Bay's water management practices was created to understand the city's current state. The soft path approach is a new strategy which aims to achieve sustainable water management by considering changes in social habits and practices as well as economic growth rates and structure. A framework of indicators was developed to evaluate the institutional capacity of a municipality to successfully implement the soft path approach. These indicators fit into six themes: technical, financial, institutional, social, political, and technological, and were applied to evaluate specifically the institutional capacity of Thunder Bay to implement the soft path approach.

The methodology used in this research was semi-structured interviews of thirteen individuals from a variety of sectors in water management which included municipal and provincial employees, academics and private sector workers. It was found that Thunder Bay is well-suited to implement the soft path approach. There are strengths and weaknesses associated with each capacity which need to be addressed and this research provided recommendations for each capacity type. Three goals for Thunder Bay are provided and include: evaluating, understanding and looking at specific reasons for conservation and efficiency and then quantifying it; articulating a collective vision for a new water future through public engagement; and through the use of backcasting, Thunder Bay should be creating long-term water management strategies which set goals for certain targets such as "No New Water." Overall, this research proves that Thunder Bay is one area where the soft path can be implemented. Social, technical, institutional, financial, political and technological changes have to be made in

order for this to happen, but there is a need for change and with participation and interest from local government and citizens, this change is achievable.

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Chapter 1 Introduction

1.1 Problem Context

The "myth of superabundance" is a common belief among Canadians that fresh water supply is plentiful and secure. In fact, Canada has very little natural freshwater that is located near where Canadians live (Sprague, 2007). About 60% of the country's freshwater flows north into the Arctic Ocean and Hudson Bay; too far for economically feasible transportation to southern areas of the country.

Among nations, Canada is the second highest user per capita of daily domestic water, with an average of 343 Litres used per person (Environment Canada, 2011). Municipal water management that is largely based on supply and demand type approaches enables this trend and is not considered sustainable or holistic in today's world of increasing water usage. For example, one quarter of Canadian municipalities already face water shortages for one reason or another (Environment Canada, 2004). These shortages will only increase with climate change, the increase of urban populations and an aging infrastructure, all of which strain municipal water resources. A major shift is therefore required in municipal water management if this precious resource is to be conserved and protected according to modern sustainability principles.

1.2 Research Statement and Objectives

Water conservation and efficiency are increasingly sought as solutions to address deficiencies and make water systems more sustainable (Brandes et al. 2009). Ontario, Canada has been shifting to incorporate the above since the late 1980's (Wolfe, 2008). These considerations have been termed 'soft path approaches' and are a critical first step towards more sustainable municipal water resource management. The purpose of this research is to examine

the criteria for soft path approaches as it may apply to municipal water management in the City of Thunder Bay. This study does not attempt to change how municipal water is managed, rather it is meant to make those in charge of managing Thunder Bay's water aware of the soft path and the benefits that will supplement this change.

The soft path is needed for more sustainable water management because it can reduce the overall socioeconomic costs of water, ensure the long-term supply of water and wastewater services and preserve environmentally-sensitive sources of water from exploitation (Brandes, et al., 2009). This study will investigate and describe the conditions necessary to implement the soft path approach for water management in Thunder Bay.

Specifically, the research objectives are:

- to identify city policies and programs that can be categorized as supply management, demand management or soft path management approaches;
- to determine the institutional capacity at the municipal level to implement a water soft path approach; and
- to develop goals and recommendations for a soft path implementation plan in Thunder Bay.

The methodology used in this research study is semi-structured interviews of thirteen individuals from a variety of sectors in water management which include municipal and provincial employees, academics and private sector workers. Each of these individuals deal with water management on a different level and it is this diversity of experience that makes them a good sample group for this study. The first objective will be achieved by determining which programs and policies are currently in use within the city, then categorizing these as supply,

demand or soft path approaches based on that literature review. The second objective, determining the institutional capacity to implement the soft path approach at the city level, is based on statements from the interviews as well as information on capacity from the aforementioned literature. A framework of final indicators of institutional capacity that would need to be present in Thunder Bay to implement the soft path approach for water management was created to achieve this second objective. Finally, the goals and recommendations for a soft path management plan for Thunder Bay were developed based on an overall understanding of the soft path from the literature and comments from the interview participants.

1.3 Contributions to Research

The final indicators for soft path implementation developed in the research will be useful to municipal water managers and, in the case of Thunder Bay, an applicable way to understand the need for a shift towards sustainable water and wastewater systems. This is still a fairly new topic with few case studies available in the academic literature and this research will increase the body of knowledge surrounding the capacity for soft path approaches to municipal water management.

This research will demonstrate that the goal of sustainable development for fresh water is within our grasp. It will add to the literature as a case study of a municipal area which has taken the first steps in implementing the water soft path.

1.4 Organization of the Thesis

Chapter 2 provides a literature review that outlines the three types of water management common to municipalities, case studies of municipalities that are implementing the water soft path approach, and the barriers and solutions associated with soft path. Chapter 2 also outlines the different types of capacities and indicators for assessing institutional capacity. Chapter 3

details the methodology used in the research, including a description and justification of the study area, the order of procedures for the research and information on how the analysis will be conducted. Chapter 4 presents the results of the analysis component of the research which includes interview quotes and an organization of capacities. Chapter 5 describes a framework for organizing the final indicators developed from the results in Chapter 4 and discusses them in relation to the case study. Chapter 6 summarizes the broad conclusions of the research study by addressing the research objectives and provides recommendations for future research.

Chapter 2 Literature Review

The purpose of this literature review is to introduce the concepts behind the water soft path approach. The following five main objectives will be the focus:

- to identify principles that reflect supply management and demand management, the two most common ways of managing water to date;
- to determine policies, procedures, programs, and infrastructure that reflect water soft path approaches;
- to analyse case studies of cities which have implemented water soft path approaches and potential ways of overcoming these barriers;
- to identify challenges/opportunities for implementing water soft path approaches;
- to introduce and analyse capacity and indicators for assessing institutional capacity.

There are three main approaches or principles that guide current water management: supply management, demand management, and the soft path approach (Brandes et al. 2009). They will each be reviewed to give the reader an understanding of how water was managed in the past and how there has since been a shift to a new way of thinking about managing water.

Experiences with implementing the soft path approach to water management through the use of case studies will determine the level of success and provide insight to the barriers which must be overcome in order to implement this approach in other regions. The reader will gain an understanding of the principles of the soft path approach and why is important in today's water management context.

The final part of the literature review analyses and constructs preliminary indicators of institutional capacity. These indicators will later be combined with interview codes to create a

framework of final indicators for implementing the soft path approach to water management in the case study evaluation.

2.1 Supply Management

Supply management is the traditional approach to water scarcity and uses endless supplies of water by linking water use to population growth (Prasifka, 1984). If an increase in the water supply is needed to meet increasing public demand, the response is to seek technological solutions such as extending pipelines, constructing more damns, and drilling deeper for additional water (Brooks, 2005). During the industrial revolution and population explosion of the 19th and 20th centuries, thousands of engineering projects were built to manage the natural hydrologic cycle and make water available to millions of people (Gleick, 2000). Improved sewer systems reduced water-related diseases such as cholera and typhoid, primarily in industrialized nations. Cities once incapable of surviving on limited local resources could bloom in the desert because new engineering techniques and technologies made it possible for water to be brought in from hundreds or thousands of miles away. Food production kept pace with soaring populations mainly thanks to irrigation systems which now produce 40% of the world's food. Almost one-fifth of all our electricity is produced by turbines spun by the power of falling water (Gleick, 2000).

When faced with water scarcity at the municipal level, planners and engineers may use a variety of supply-side management practices (Baumann, Boland, and Hanemann, 1998). For short-term scarcity, they may conduct audits and metering of the water supply to determine wastage, detect and repair leaks in the system, as well as transfer and divert auxiliary supplies of water. In the long term, they may continue to develop freshwater sources, add new water supply infrastructure and even desalinate ocean water (Baumann, Boland, and Hanemann, 1998).

The impacts of supply side management, however, are many. Rivers have become sluggish, water tables lowered and natural habitats have disappeared (Dziegielewski, 1999). During the 1970's, many environmental and economic conditions contributed to a decline in the feasibility of supply-side approaches providing urban water (Dziegielewski, 1999). The physical scarcity of high quality sources, the depletion and contamination of groundwater sources, difficulties in financing major facilities for transmission, treatment and distribution of water and increasing costs of treatment for regulated contaminants are all factors which make supply-side options less practical than they once were (Dziegielewski, 1999). There have also been new environmental legislations which have introduced significant barriers to the continued expansion of off-stream uses of water for agricultural and urban purposes. In the industrialized nations, most of the good dam sites have already been developed, often with major environmental sacrifices. The result is that free-flowing rivers, natural riparian systems and many aquatic species have become rarer. Overall, environmental awareness has increased worldwide and the desire to protect some of these remaining natural resources has grown (Gleick, 2000).

There are some concerns within developing nations that environmental limits may simply mean constraints on their economic development for the benefit of industrialized nations (Gleick,2000). However, there is growing opposition to these big projects due to serious local costs which include population displacement, land inundation, and ecological disruption. In addition, these major water projects include economic factors which play a role in changing the way we think about water development. New water systems are more expensive compared to non-structural alternatives (Gleick, 2000). It was relatively unimportant for the first major dam projects built to be economically justifiable. Also, all past water infrastructure development has been subsidized or fully paid for by governments and international financial organizations

(Gleick, 2000). Still, governmental budgets in Asia and many other regions are now under greater pressure and there are serious constraints on new money for major water projects. Many people are no longer willing to pay for new structures to solve water problems. Traditional water-supply approaches of building another dam or drilling another tubewell are less appropriate or more expensive. This is why unconventional supply approaches are receiving more attention with more cities now discovering that wastewater can serve as a resource for purposes ranging from landscape irrigation to drinking water (Gleick, 2000, Mohapatra and Mitchell, 2009, Asano and Levine, 1996).

2.2 Demand Management

Demand management recognizes that limits exist with water and tries to cut usage through being cost effective. This approach incorporates full cost pricing for fresh water and waste water disposal. Urban water supply planners recognize the multiple benefits to demand-side alternatives, which have the potential to improve the sustainability and cost-effectiveness of Canadian water provision (Brandes and Ferguson, 2004). As well, adopting demand management is a vital step in reducing the ecological footprints of cities which will enable human activities to better co-exist with ecological processes. This type of management reduces the pressure on aquifers and endangered aquatic ecosystems through avoiding the additional large-scale infrastructure projects such as drilling for new wells, diversions, and dams (Brandes and Ferguson, 2004, Butler and Ali Memon, 2006). In addition to the above stated benefits, reduction in demands can result in energy savings for heating water as well as for pumping and treatment, reduced costs of water treatment and distribution system capacity, savings in capital expenditures because of deferred or downsized new water supply projects, and environmental benefits of reduced withdrawals of water from streams and aquifers which leave more water

available to preserve the ecological resources of streams, wetlands and estuaries (Dziegielewski, 1999). Numerous cities have implemented demand management programs to produce reliable reductions. Waterloo's conservation program used pricing changes, education, and the distribution of water-saving devices to reduce water use by 10% in its first three years. Cochrane, Alberta, reduced water consumption by 15% by giving away low-flow showerheads and faucet aerators, therefore deferring a plan to build a multimillion-dollar water pipeline. Port Elgin, Ontario, avoided a $5.5 million expansion of its water treatment plant by spending $550, 000 to install 2,400 residential water meters as well as by implementing an intensive conservation program. Demand management has become more attractive and has been accepted as a partial solution to water supply problems in many urban areas.

The demand management approach, as practised today, starts from an emphasis on water efficiency and simple technical fixes such as low-flow shower heads and basic economic incentives like volume pricing. Demand reductions achieved in this manner can be accomplished at lower cost, more quickly and with less environmental damage than any supply alternative (Brandes et al. 2009). However, although these efforts are relatively simple, they have a fundamental limitation. They are based on an anthropocentric view as opposed to an ecosystem perspective in that demand management promotes efficiency based on the short-term cost effectiveness, rather than on long-term ecological sustainability (Brandes et al. 2009). In order to move further towards a sustainable water management paradigm, municipalities must ensure a balance between water use and ecological sustainability over the long term.

2.3 A New Paradigm – The Soft Path Approach

A soft path management approach is the next step towards sustainable water management. It focuses on reducing demand rather than increasing supply and does so by considering changes

in social habits and practices as well as economic growth rates and structure (Brooks and Holtz, 2009). The soft path approach delivers water services and qualities that match the user's needs as opposed to simply delivering quantities of water. It does not replace demand management; rather it complements it by increasing effectiveness. The policies which are the outcome of this type of management are considered 'soft' because they depend on human ingenuity rather than resource-intensive inputs to satisfy both the needs of natural resource use patterns and economic development (Brooks and Holtz, 2009). Traditional supply and demand management, or 'hard path' thinking can lead to the perception that using less water is a loss of security and comfort. This is not the case as soft path planners believe that, as long as services are produced in convenient, cost-effective, and socially acceptable ways, low-quality water or no water at all is acceptable for people. For example, farmers do not want to use water *per se*; their goal is to grow crops profitably. If irrigation technology or crop characteristics are changed, this may allow growers to produce more food per unit of water. Lower quality water could be used to grow these crops – it does not necessarily have to be clean, fresh drinking water. Likewise, in the context of municipal water use, there are many situations where treated water does not need to be the primary source for use. On a more individual level, these include activities such as washing clothes, preparing food, washing dishes, shaving, brushing teeth and flushing the toilet. On a city-wide scale, these activities include street cleaning, maintaining public areas, firefighting and maintaining local businesses such as restaurants. In each case, water is used to provide a product or service; however, it is not the using of water that is wanted by the consumer, rather the service water provides. If a large house fire could be put out by an alternate means than water, that alternative would provide the same service (putting out a fire) as water would. The activities listed above, and many others that occur in a municipality, provide a

service or product for its citizens. Water does not necessarily have to be used to carry out these tasks, it is really only important to have them completed.

There are four distinguishing characteristics of the soft path approach when compared to conventional water analysis, planning and management (Brooks and Brandes, 2011). A water soft path:

- treats water as a service rather than an end in itself;
- makes ecological sustainability a fundamental criterion;
- matches the quality of water delivered to that needed by the user; and
- plans from the future back to the present.

2.3.1 Treating Water as a Service Rather than an End in Itself

With the exception of a few uses of water (drinking, for example) water is not actually needed for itself but rather for the service it can provide. It is a way for society to accomplish specific tasks, such as carrying away wastes. A critical component in the water soft path approach is to think of water as a *means* instead of an *end.* We are not looking to flush toilets with clean water but instead are looking to remove human waste. It does not matter what method we use as long as it is removed. When practices and behaviours are changed to consider water as a service, the options for providing services increases and allows for a focus on reduced water use. (Brooks and Brandes, 2011).

An example of an innovation which treats water as a service is the ClivusMultrum composting toilet. In this toilet,urine, feces, and household organic wastes are combined and processed together in a multrum. The material is decomposed and reduced to less than 10% of its original volume. It then begins to form humus. The humus produced has a similar bacterial count as that of soil and is directly used as a fertiliser and

soil conditioner. This toilet has been in use since 1939 and there are over 20, 000 of them installed worldwide. It can save up to 60, 000 litres of water per year in the average home by simply not using any at all (ClivusMultrum Incorporated, 2010)

The ClivisMultrum composting toilet is an example of water not being used as an end in itself. Water is not necessarily needed to remove waste and the ClivusMultrum accomplishes the same end result without the use of water where conventionally, water would be the standard approach to ridding of waste. Using this type of toilet would be included in a water soft path approach.

2.3.2 Ecological Sustainability

The soft path approach recognizes ecosystems as users of fresh water and incorporates the value of water needed to sustain ecosystems within its approach. Unlike conventional proposals for water development, which leave ecological effects until the end of the analysis, soft path studies incorporate ecological constraints from the start to ensure sustainability.

Taking ecological sustainability into account when making decisions that affect nature occurred in the case of the Green River Dam located on the Green River in Kentucky (Richter et. al., 2003). This dam provides flood control and reservoir based recreational benefits. Initially, water levels were maintained at a high level in the summer and lowered in the fall by more than 3 metres. Releasing this high volume of water in such a short period of time disrupted native biota downstream. The U.S Army Corps of Engineers and The Nature Conservancy, however, are now initiating the timing of the lowering of the water level from September-October to late November to correspond with naturally higher flows in the winter rainy season. The dam releases will also be pulsed to match storm events rather than being released at a constant rate and, in doing this, will simulate some of the river's natural patterns of variability. The goal of

these two operational changes was to maintain the healthy condition of the river ecosystem. They wanted to restore ecological integrity while continuing to meet the working purposes of the dam (Richter et. al., 2003).

Changing the time releases of the dam for the benefit of the native biota exemplifies the ecological sustainability principle of the soft path approach in that it illustrates how ecological functions can be a goal of water management and balanced with economy.

2.3.3 Matching Quality of Water to that Needed by End Use

Soft path options are designed from the start to match the quality required by the specific end-use. It is possible for wastewater from one use to become an input for another use. For example, we do not need clean, fresh drinking water to flush toilets. We can use a lower quality of water for these uses, such as rainwater capture.

In Japan, there are several examples of large scale rainwater collection systems. In three multipurpose stadiums located in Tokyo, Nagoya, and Fukoka, rainwater is used for toilet flushing and the irrigation of plants. The catchment areas are 16, 000 m^2, 25, 900 m^2 and 35, 000 m^2, respectively. Tank volumes are 1, 000 m^3, 1, 800 m^3 and 1, 500 m^3. A 19-month follow-up study carried out at the Fukoka Dome showed that rainwater provided 65% of the volume of low quality water. Approximately 75% of the total rainfall on the roof was used, representing a significant economic saving (Villarreal and Dixon, 2005).

Such a simple change made to the stadium rooftops in Japan resulted in a reduction in treated water used in these facilities. Treated water was not needed for toilet flushing and the irrigation of plants, so rainwater was used in its place. The stadiums were able to match the lower quality of water needed for these specific services, as opposed to using treated water for all

services required in the buildings. This is a clear example where the soft path approach was put into practice, matching the quality of water used to that needed by the end.

2.3.4 Backcasting

The most difficult part of the soft path approach is backcasting, which requires planning from the future back to the present as opposed to starting from the present and extrapolating forward based on current use patterns. Soft path planning defines a sustainable and desirable future for a society's water use and then works backward to identify policies and programs that will connect that future to the present. Backcasting is useful because it takes into account unexpected variables such as climate change, greater or lesser precipitation, longer drought, and increased rates of evaporation. By working backward from the future to the present, these impacts are incorporated into water planning today and can be adjusted over time (Gleick, 1998).

Backcasting projects have increasingly been carried out in a variety of domains such as households, climate policy, the hydrogen economy and local or regional planning. These projects are directly related to sustainable development and look at what *should* happen in the future based on selected scenarios (Vergragt and Quist, 2011). In contrast, forecasting looks at what *could* happen in the future. Forecasting does have its benefits, as seen in the Shell scenarios of the 1970's to present. The Shell company sampled global trends, expectations, cultural shifts and other variables. This forecasting allowed them to be better prepared than their competitors for the oil crisis in the 1970's. They were able to anticipate unexpected developments such as natural disasters, government interventions and economic crises. Yet, although this type of scenario building worked for a while, it was not always helpful. There were times when Shell did not foresee crises such as with Brent Spar in the 1990's and oil

winning in Nigeria in the 2000's, nor the societal responses which resulted from them (Vergragt and Quist, 2011).

Backcasting is more appealing than forecasting for two main reasons: the time horizon is more realistic because it covers two generations and it is also far enough away to allow major changes or disruptions in technologies, lifestyles and cultural norms and values. Backcasting studies and methodologies are very diverse; in different countries varied traditions and practices have evolved. These variables can include whether and how stakeholder involvement is organized, the topics and scales of the systems addressed, the number of visions developed and the methods employed. The main question when dealing with backcasting is who develops the future vision? Can experts alone develop the vision or should it be a democratic process that involves both stakeholders and citizens? The problem with experts is that they are bound by a knowledge which reflects the current paradigms of today. They must distance themselves from present constraints while at the same time bring to the table their expertise and experience.

Backcasting is already part of many decision making processes in municipalities and although not water soft path related, the principle is the same. For example, a study was conducted in Sweden in the two cities of Salem and Danderyd (Carlsson-Kanyama et al., 2013) who were both facing challenges in connection with climate change. The purpose of the study was to investigate barriers to successful local climate change adaptation that existed due to lack of support from decision makers. Researchers used backcasting to develop a vision of an ideally adapted local society. Civil servants from the two cities were to plan ahead twenty to thirty years when more extreme weather events would occur. Other primary visions resulting from this backcasting described changes to recreational areas, waterfront living, population increase, supply of drinking water, sewage treatment and stormwater disposal, energy supply and caring

for the elderly. The aforementioned barriers to local climate change adaptation were deemed to be a result of inaction by decision makers in organisations outside the municipality itself, including locally, regionally, nationally and internationally. Tasks formerly managed by the municipalities were now taken care of by external decision makers due to out-sourcing, privatisation, specialisation, etc. This study shows how dependent municipalities with a high degree of independence are on decision makers at other levels and locations. Burch (2010) examined three cities in Canada for barriers and levels for successful adaptation and found that leadership that stimulates innovation and collaboration was crucial. Groven et. al. (2012) conducted a study in three cities in Norway, Sweden and the Netherlands and found that perceived vulnerabilities and a need for legitimacy were barriers in why climate change adaptation was not integrated into civil protection.

A changing climate and the water supply are both issues which affect the future and need addressing. Backcasting allows for changes to be made to reach a desired future by specifically describing visions which are sought after by a municipality. Backcasting also helps to create and define awareness of the barriers preventing this change so that they can be overcome.

Municipal areas meeting the above conditions through policy implementation are essentially reflecting a water soft path approach. Although a city may not completely meet these characteristics, there may be certain aspects of a policy which are in line with this management approach. Furthermore, backcasting can occur within other management sectors (ie. climate change adaptation planning) and still provide benefits to the water sector.

Soft path models are most appropriate for long-term planning (preferably thirty to fifty years) as they incorporate significant changes in lifestyles and livelihoods. There is no single best type of soft path for water use which should be implemented by a city; rather, local

preferences will choose the path best suited to their municipality. Some paths may have more or less regulation; some may have more or less use of market mechanisms; and some may require more rapid changes while others may emerge more gradually (Forsyth and Brooks, 2011). As new industries arrive, values change and climate changes, a strategic planning process should be the focus to adjust to these changes. Brooks and Holtz (2009) state that a periodic review every five years is needed for policy refinement.

Table 2 illustrates the difference between the three types of water management; supply, demand, and the soft path. These approaches differ in their philosophy, process and outcome. The spectrum of approaches ranges from supply management at one end, demand management in the middle, and soft path at the other end.

Table 1: **A Spectrum of Water Management Approaches** (Adapted from Brandes, 2005)

Policy	Dominant Discipline	Policy Choices	Fundamental Goal	Planning Process	Outcome
Supply Management	Engineering	Policies based on presumed need for new infrastructure	Meeting projected water needs given current trends in water use a population growth	Planners forecast from current consumption patterns to determine future "requirements." They then create new sources of supply to meet this projected demand	Dams, pipelines, canals, wells, and desalination systems are constructed
Demand Management	Economics	Policies based on short-term cost-benefit calculations	Reducing needs for water to conserve the resource, save money and reduce environ impacts	Planners incorporate efficiency and information programs together with improved pricing patterns to maximize use of existing infrastructure.	Efficiency gains through technical fixes and consumer education.
Soft Path	Multidisciplinary	Policies based on stakeholder consultation and political review	Delivering services currently provided by water in ways that recognize the need for economic, social and ecological sustainability	Long-term economic and social prosperity are modeled for the future. Backcasting is then used to create a feasible path to reach this desired goal.	Innovation, conservation and changing patterns of water use and re-use are used to allow for more water to be left in situ.

Both quality and quantity are important facets of water management and the soft path approach works to satisfy both these needs for water users. Soft path policies are designed from the start to match the quality and quantity of water supplied to that required for end-use. High quality water occurs less frequently in nature but we only need small quantities of it, mainly for household purposes. Under the guiding framework of the soft path approach, lower quality water for most other tasks, such as irrigation on farms and cooling at generating stations. The following figure illustrates the different end results from each of the three types of water management approaches.

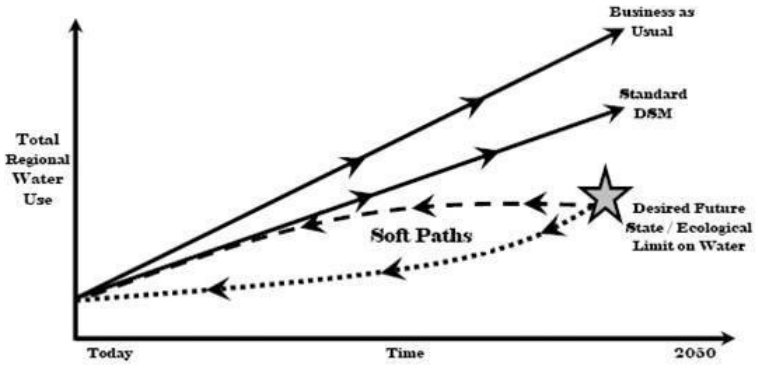

Figure 1: Planning for the Future with a Soft Path Approach (Brandes et al. 2009)

The Business as Usual line represents supply management and under this approach, if projected to the year 2050, the regional water use will continue to increase and never reach a sustainable level. Business as Usual scenarios do not take into account that the future is naturally uncertain and society complex and ambiguous. Business as Usual is best used for the short-term and for well-defined and stable systems (Vergragt and Quist, 2011). The Standard Demand Management line will eventually reach the same level as the supply management line; it will just take longer to do this because aspects of sustainability remain in its framework. The

graph clearly illustrates that the soft path approach is designed from the start to reach a sustainable level of water use, ensuring that demands on water as a source and the environment that supports as a sink do not exceed the carrying capacity of the ecosystem. The reason for the two lines is that there is not one appropriate soft path – it all depends on each unique policy governing a body of water. There are many varying paths which may be taken in trying to reach a soft path approach.

2.4 Case Studies for the Soft Path Approach

Since the term "water soft path" was first created by Peter Gleick in 1998 it has become the subject of widespread research, with several Canadian case studies conducted in recent years. Although the percentage of the population expected to adopt water saving technologies and overall population growth is not completely known, case studies demonstrate a very high potential for water use reduction in municipal, industrial, watershed and provincial contexts. The majority of these gains in efficiency are achieved using existing technologies.

The following is a review of two case studies in small urban areas in Canada and their application of water soft path analysis, as well as one case study of an urban region's public planning process that is oriented around soft path approaches. These cities include:

1. Fergus and Elora in the Township of Central Wellington, Ontario
2. Abbotsford and Mission, British Columbia
3. York Region, Ontario

The first two case studies demonstrate the potential for soft path application and provide recommendations for implementation (Maas and Porter-Bopp, 2011, Maas and Porter-Bopp, 2009) while the third study illustrates how soft path concepts and principles have been introduced into the broader planning process (Gilbride and Maas, 2012). The first two case

studies utilize a projection and two scenarios as tools to implement soft path approaches; Business as Usual (BAU) projection, Water Demand Management scenario and Water Soft Path scenario. The BAU projection extended current water-use rates forward for twenty years or more based on population and economic forecasts for the area and assumed no changes in water use patterns or new technologies. The two scenarios used the POLIS' Scenario Builder, a Microsoft Excel spreadsheet tool that follows steps to arrive at total water demand under a given scenario. The POLIS' Scenario Builder uses quantitative information about current and projected population and per capita water demand. It then uses these values to calculate current and projected average annual demand. The current and projected demands are then separated into sectors, such as residential, and then into sub-sectors, such as indoor and outdoor use. Different water conserving technologies and practices are applied to the projected demand. Values obtained using these efficiencies can be compared to the Business as Usual conditions to determine potential water savings for each scenario.

The following is a summary of the Fergus-Elora study conducted by Maas and Porter-Bopp in 2011. The Township of Centre Wellington is partially made up of Fergus and Elora. The population of these two areas is forecast to double by about 2040 which leads to a perceived need for costly infrastructure to supply more water. Currently, Fergus-Elora has a low average per capita residential use rate of 191 litres per day. More than 70% of homes already have low-flow toilets, 30% have front-load clothes washers, and about half have low-flow showerheads and faucets. Three future targets were explored in this case; Business as Usual, No Infrastructure Expansion, and Use the Same Water Tomorrow We Use Today (which is the soft path scenario). If Business as Usual is projected, the annual average daily water use will increase by 10, 500 m^3/d by the year 2040. If a demand management scenario is used, daily water demands can be

decreased by 17% by 2040 simply by implementing cost-effective efficiency measures. No Infrastructure Expansion is the target chosen for the demand management scenario and in order to achieve this, the efficiency of existing and new automatic irrigation systems needs to be improved. The water soft path scenario's goal is to use the same quantity of water in 2040 as was used in 2008. This will require the community to reduce average daily water use by 50%.

In order to help implement these scenarios, 'road maps' were used to measure progress, set goals, and help the water management team envision its end goal. These 'road maps' were created for indoor water use (institutional, commercial, and industrial sectors) and for outdoor water use (commercial, institutional, and residential sectors). To achieve the residential indoor target of 169 litres per capita per day by 2028, the best off-the-shelf technology would be used in toilets (3 to 4.8 Lpf), showerheads (7.6 to 9.5 Lmp), faucets (5.7 to 8.35 Lmp) and clothes washers (55L per load). A water-sensitive home which includes twenty-first century technology and only uses 30 to 80 Lcd is also an option. This would require toilets that use 0 Lpf and a non-potable source such as rainwater or composting, showerheads that use 0 to 7.6 Lpm, faucets that use 5.7 Lpm and clothes washers that use 0 to 55 L/load.

In the case for institutional, commercial, and industrial sectors, the 'road map' to achieve a target of No Infrastructure Expansion would focus on reaching a 5% reduction in water use from the highest users of water which include hospitals, seniors' homes, and industry. However, if Using the Same Water Tomorrow We Use Today were the goal, hundreds of fixture retrofits or efficient technology in all new institutional and commercial buildings would be required. By eliminating once-through cooling, reducing water waste through best management practices and using non-potable sources for toilets, this goal may be achieved.

To achieve the target to reduce maximum daily demand for outdoor water use, an estimated 75% of existing and new automatic irrigation systems would either need to be improved or strongly discouraged in new homes. An extra 20% of manual watering practices would have to be reduced by converting to xeriscaping (which is landscaping and gardening that lessen or eliminate the need for extra water from irrigation) drip irrigation, or by letting lawns 'go golden.' 100% of water for outdoor use must come from non-potable sources, use water-wise landscaping with native plants, or let lawns go golden. These are all measures that need to be taken in order to reach the 2040 target of using the same quantity of water as used in 2008.

This study has a list of first steps for conservation measures and tools which include metering, full cost recovery, conservation-based pricing, controlling water loss, residential programs, changing behaviour, IC&I programs, outdoor programs, and building non-potable sources of supply, along with steps for a five-year implementation plan.

In a second study conducted by Maas and Porter-Bopp (2009) the City of Abbotsford and the District of Mission, located in lower British Columbia, were researched. The former has a population of over 131, 000 and is expected to grow to 200, 000 by 2030. Mission does not expect such an increase in population growth. The water and sewer commission for these two areas provides up to 156, 000 m^3/d but it can effectively manage approximately 140, 000 m^3/d. Abbotsford is fully metered while Mission is not metered at all. Residential water use make up about 50% of the total water demand in Abbotsford and about 60% in Mission. If a BAU projection is made using the per capita demands of 281 LCD and 440 LCD for Abbotsford and Mission respectively, by the year 2031 annual average daily water demands for the water and sewer commission system will be 162, 000 m^3/d. Under a demand management scenario, savings between 6% and 48% of total average daily water demands are possible by using best

management practices such as volume-based pricing, metering, leak detection and bylaws requiring new homes to have efficient fixtures. In order to meet the target of No New Water in the water soft path scenario, an absolute reduction of about 40% in annual average daily water use over a twenty-four year span would be required. The soft path approach would be an extension of the demand management measures and would include rainwater harvesting systems, greywater recirculation and composting toilets. The following table summarizes the scenario results for water demand in Abbotsford-Mission.

Table 2: Summary of Scenario Results for Water Demand in Abbotsford-Mission (Maas and Porter-Bopp, 2009).

Parameter	Current	BAU projection	WDM scenario	WSP scenario
Year	2007	2031	2031	2031
Population	132,391	254,186	254,179	254,179
Peak day use (m^3/d)	141,600	291,800	193,000	147,000
Annual average daily use (m^3/d)	78,200	162,200	132,200	97,800
Residential use (m^3/d)	41,600	79,800	56,800	32,800
Residential per capita use (LCD)	314	314	224	129
Institutional, commercial, industrial use (m^3/d)	13,100	25,900	24,000	21,100
Agricultural use (m^3/d)	9,800	27,800	25,000	22,300
Non-revenue use (m^3/d)	13,700	28,700	26,300	21,600

A case study that demonstrates the soft path theory in action is York Region in Ontario as researched by Gilbride and Maas (2012). York Region is an upper-tier municipality made up of nine local cities that are all supplied wholesale drinking water. Ontario required York Region to

develop a long-term water conservation strategy before it was allowed to expand sewage capacity and increase withdrawals from Lake Ontario. York Region became the first community in Canada to set a formal target for No New Water and to base its planning on soft path principles. They gave themselves forty years, enough time to make the governance, societal and structural changes necessary to achieve this goal. The public portion of their process began with asking a project team to review hundreds of water efficiency and water conservation practices from around the world. They came up with potential options for the long-term strategy. York Region also realized that they needed input and involvement from stakeholders but that public consultation and public weariness were barriers. In order to encourage participation, they created "a new public," a group of people who could serve as change agents by using traditional and non-traditional pathways to engage the public. Stakeholders attended workshops that examined the value of water from various perspectives which included best practices, attitudes towards the value of water, how people might live and work in 2041, and how new water strategies could bring visions for York Region to life. These workshops led to ideas for water management and a water future for York Region, such as No New Water, ecological diversity and economic prosperity and leadership in water sustainability.

The York Region Long Term Water Conservation Strategy (LTWCS) outlines the implementation of program components and is divided into three primary phases: Program Start-up and Initial Implementation; Implementation, Assessments and Adjustments; and Completion. The schedule provides for two implementation stages; 2011 to 2016 and 2016 to 2051. Re-visitation every five years will ensure that any external changes, such as new technologies or provincial regulations, are considered. If necessary, the strategy and resulting program components will be revised, terminated or new ones developed. Program categories for the

implementation schedule include governance, policies and by-laws, rebates and incentives, new development, pricing, demonstration, marketing outreach and education and region. These categories are further divided among sectors and again into the actual water conservation and efficiency program taking place. For example, the program category of policies and by-laws, under the sector of multi-family residential for the year 2011 to 2016, states that the potential of by-law for water efficiency fixtures and appliances for new development will be evaluated and opportunities for individual unit metering developed. The program category of rebates, and incentives under the sector of single-family residential for the year 2016 to 2031, states that rebate programs and new research programs will be monitored and new rebates and incentives modified or developed. Also, if feasible, free or low-cost residential landscape design services, in conjunction with garden centre retailers, as well as a hot water re-circulation system incentive program, will be implemented. These are just a few of the actions the Region of York will execute based on their Long Term Water Conservation Strategy.

York Region is also backasting and establishing and testing water saving targets to realize their vision. They have set viable targets that are quantifiable and which generate progressive and sustained water savings that are critical for success. A baseline was established and potential water savings to be achieved by different measures evaluated, calculating a total water use reduction expressed volumetrically over time. The baseline is expressed in water use per capita per day and the base year is 2011. A total system baseline has been established and as either residential or ICI. Water savings required to meet the goal of 150 lpcd by 2051 have been calculated and expressed in 5-year increments. Current water conservation and efficiency measures to meet the desired targets have been identified and qualitatively screened and evaluated. Subsequently, a quantitative assessment of potential measures, including water saving

calculations and a full cost-benefit analysis, will be undertaken as part of implementation planning. On-going measurement and evaluation throughout the LTWCS will be undertaken and whenever necessary, program modifications or adjustments will be made to reach the desired water saving targets.

York Region will proceed with its goal of No New Water by 2051 starting with the incentive based programs that already exist within the municipality. Evaluation of detailed billing data the first year of the program will be important in determining accurate consumption and seasonal changes in all sectors due to outdoor water use. This will help develop more precise saving estimates and a detailed monitoring and reporting plan. The demand for water in the York Region, as a result of the LTWCS, could decline over time even with an increasing population. To help ensure water savings targets are met, York Region has assigned $43 million over the next ten years to water conservation and efficiency programming.

Some general observations can be made from the three case studies above in regards to the potential for using water soft paths as a management approach for urban areas:

- similar results were obtained for indoor use which suggests that conservation opportunities in urban areas are generally applicable across Canada.
- differences occurred more in outdoor use because of price elasticity, meaning that volume-based pricing and other measures can be used to reduce outdoor use.
- in all sectors of water use, pricing was important to implement demand management or soft path measures. In order to reap the full benefits of soft path, a mix of conservation pricing strategies which provide additional incentives to reduce use and promote innovation in technologies and practices must be utilized.

- the biggest savings in water are most likely to occur in the institutional and commercial sectors, more-so than residential. Unfortunately, there is a high initial cost accompanying the measures needed to create these savings.

In order to move soft path concepts into mainstream water management, more imaginative public participation and active political leadership is still needed. When soft paths are used in daily practices, only then will its payoffs be evident (Brooks, 2013). Building trust and dialogue among essential stakeholders and providing a plan that is based on soft path approaches are key next steps towards experiencing the total benefits of the approach.

2.5 Challenges and Opportunities for Implementing Water Soft Path Policies

In order to develop principles for creating a soft path water management approach for any city, there must first exist a situational analysis that highlights the barriers and pathways to the approach. We must identify the ways various people and their respective institutions can shift direction and the capacity available to invest in this shift. We also have to build awareness of the new tools and other actions that the soft path employs to achieve its objective of limiting water use. Finally, we must identify the most critical barriers in need of addressing in order to concentrate our efforts on ways to overcome them (Holtz, 2009). Water soft paths do not have to be developed right away; they can be developed and implemented in stages. It is possible for water utilities to move from traditional Business-as-Usual planning to a focus on demand management, and from there to a water soft path (Holtz, 2009). The most important thing is to make sure that the right people in the right places have the understanding and commitment to advance beyond market thinking and practice alone.

2.5.1 Barriers

Barriers preventing the implementation of the water soft path approach can occur at many levels of society. The following are five categories of barriers to water soft paths as outlined by Jordaan et al. (2009).

Attitudes and perceptions – People form stubborn attachments to certain attitudes and perceptions because they are unfamiliar with alternative ways of thinking. For example, in Canada it is perceived that freshwater sources are boundless and that no water problems exist. It then becomes difficult to encourage people to conserve water because they believe sources are endless and no threats to the ecosystem exist.

Canadians, in general, highly value fresh water. In a 2011 study conducted on behalf of RBC and Unilever and sponsored by the UN Water for Life Decade, a sample of 2, 066 adults from Ipsos' Canadian online panel were interviewed about their personal water use. The findings showed that 55% of Canadians continue to believe that fresh water is the country's most important natural resource. 72% of these people, however, admit to flushing items such as left-over food, hair, bugs and cigarette butts, down the toilet when they could be disposed of in a different manner. This wastes an average of 20 litres of fresh, clean water with each flush. The study found that Albertans are the most likely to admit they flush these items down the toilet (at 83%) while Quebecers are the least likely to admit to this act (at 65%). Young adults aged 18 to 34 are 84% more likely to flush items down the toilet, whereas those aged 55 and older are 63% likely. Bob Sandford, Chair of EPCOR states:

> "This data highlights, once again, that Canadians are not making the connection between their personal water use and the true value of water. They claim to care about conserving it, yet knowingly engage in water wasting activities, including using fresh,

clean water to dispose of garbage. Until Canadians make the connection between personal use of water and its true value, our water wasting habits will continue."

Organization and Management- The structure needed to design effective solutions may be inhibited as a result of the different discipline backgrounds of the management team. Fragmented management becomes a barrier which hinders the water soft path from becoming successfully implemented. Organizations are usually fragmented because of disciplinary or departmental segregation. Effective communication, information sharing and innovation can therefore be impeded because internal structures, information systems and policies are affected by this segregation (Maas, 2003). To add to this, all levels of government in Canada may periodically change as a result of the election process or staff turnover. This constant change in government usually results in policy-making and management structures being reorganized, or short-term at best. The water soft path is affected because policies that may be officially in place are not fully implemented due to conflicts with existing supply plans or pricing structures.

Financial- Decision makers are interested in that which creates the biggest revenue. Some agencies and utilities depend on the revenue from water sales for maintaining fiscal viability. The soft path approach can result in decline of sales which threatens this revenue, causing publicly owned water utilities in Canada to question the advisability of promoting conservation (Furlong and Bakker, 2007).

In the Greater Toronto Area, many residents have begun conserving water. They water their lawns less, they replace old toilets and they install water-efficient showerheads. This is both economical and helps to preserve the ecosystem. Cliff Curtis, who was asked about declining water consumption by the *Toronto Star* ("High Cost of Using Less Water," 2008), stated that "Conservation is killing us." As a result of post-Walkerton regulations, growing

communities and a rising backlog of pipes which need repairing, costs of water are rising even while consumers are lowering their consumption. Toronto is facing $800 million worth of repair and replacement work because half of the city's water main and 30% of its sewer popes are more than fifty years old. The problem is that the revenue for the year 2007 was only $604 million.

In the Peel Region, Treasurer Dan Labrecque estimates that $7 million has been lost due to conservation ("High Cost," 2008). For example, the summer of 2007 was one of the driest summers on record, yet people watered their lawns less, resulting in a large revenue loss. In response, a proposed 16% water rate hike will be implemented to make up for this lost revenue. Labrecque suggests that billing practices should reflect conservation promotion. Fixed levies might be part of the new structure. Other ideas brought to the table by politicians and water staff include charging bottled-water producers more for using municipal water, creating block rates, and charging higher rates for people who use more water at peak times. Dan believes it is a positive that people are using less, but "how much less is very complicated. The alternative is to tell them to use more water so we can get more money." ("High Cost," 2008).

Data and Information- Managing Canada's water resources is a challenge because of gaps in the amount of useful data available. Some data is under private ownership and important historical data is non-digitized. A national standard for data needs to be developed in order to improve the ability to compare unrelated sets.

One of the barriers to introducing No New Water in the York Region case study (Gilbridge and Maas, 2012) was that local municipalities are currently responsible for their own distribution networks and for all water billing. Furthermore, a lack of standardization in data collection limits the ability to model the necessary inputs for measuring and monitoring No New Water

goals. Obtaining and compiling the information proves to be difficult for meaningful analysis and without this data it is impossible to create a region-wide breakdown of current water demand. Staff did not have enough access to existing data to make complete projections.

What was needed was coordinated action between the two tiers of government to collect, standardize, and analyze the data in order to inform decisions. The President and CEO of the Alliance for Water Efficiency concluded that "without this information it's impossible to effectively evaluate the costs and benefits of any given program, get buy-in from the public for the changes that need to happen and to target sectors of the population where changes could have the greatest impact on water use." One recommendation is for future provincial legislation to require standardized data collection, reporting, and billing of water use at the municipal level.

Policy and Governance - Poor enforcement of policy occurs because it is expensive, time-consuming, and/or difficult to monitor. A disconnect between ecological and political/jurisdictional boundaries is often present because the boundaries of a watershed never really match the political boundaries surrounding it. Political agendas which are formed from collaborative water management and inter-jurisdictional cooperation may therefore be at risk. Ontario and Manitoba have created watershed based conservation authorities, one way of overcoming this barrier. Finally, lack of public participation is a barrier; while governments often consult with the public, they rarely effectively involve them in a long-term, integrated partnership where ideas can be exchanged and public input can help shape future initiatives.

For example, the Gabcikovo-Nagymaros dam project was created in 1977 when a treaty on implementing a Danube barrage project was signed by Hungary and Czechoslovakia. Hungary withdrew from the treaty in 1992 due to pressure from environmental movements; however,

Slovakia decided to build the Gabcikovo power plant by diverting the Danube River. The two countries filed a lawsuit against each other with the International Court of Justice in 1992 and negotiations are still ongoing today.

Overall, there has been little effort made to involve the affected public in the decision-making process. An exception was demonstrated in a project undertaken by Reflex Environmental Association in 1994. Reflex created a public communication program involving the residents of two cities, one Hungarian and one Slovakian, who were most affected by the power plant. The purpose of this project was to elicit participation of the affected public in order to create recommendations for reducing the negative consequences of the plant's operation. Five meetings were held for the general public, two for local government officials and three for the representatives of local and regional research institutions and other specialists of environment and nature protection. Attendants at the public meetings were concerned about the lack of public information and the failure of regional government to take into account local experience and knowledge. The public had a general feeling that important decisions were made without considering the knowledge and interests of the local population. The participants were also distrusting of the policy makers, doubting their competence and fairness. Furthermore, they felt that the hostilities between the two countries were actually motivated to serve political purposes.

Generally, there was plenty of local interest in the public communication project and most of the meetings were well attended. Those who participated found that exchanging ideas was very useful and the meetings showed that the public on both sides of the river saw this controversy as political rather than technical in nature. The public thought that cooperation between the Hungarians and the Slovaks would be more feasible at the local level as opposed to between the central governments. To this day, however, there has been little effort made to involve the

affected communities in the decision making process. The governments of both countries continue to disregard the importance of public involvement in final decision-making.

Vari (2004) shows that participation in issues which affect the general public is hindered by the perception of citizens that their rights to involvement under the new democratic regimes are limited to voting and protesting and do not include contributions to decision making itself. A report from REC (1995:7) states: "Shortly before or during the first years of the democratic changes, citizens were more active in public participation (in the late 1980's and early 1990's) than now." Such results are particularly counterproductive to soft path approaches and must be an ongoing and vigilant focus in the watershed.

2.5.2 Removal of Barriers

At the institutional level, the above stated barriers can inhibit or prevent the adoption and implementation of water soft path approaches. Three general types of action can help decision makers in removing these barriers: multi-stakeholder involvement, monitoring and enforcement; rewards and punishments; and communication about the barriers to more sustainable or soft path policies (Jordaan et al. 2009).

Multi-stakeholder Involvement - Multi-stakeholder involvement includes those stakeholders with diverse backgrounds and agendas which can help managers to overcome the above barriers. Stakeholders can best address the barriers related to attitudes and perceptions by dispelling some of the common water myths, such as the "myth of superabundance." Barriers to the collection and sharing of data and information are best addressed by multi-stakeholder collaborations because information can be naturally shared through forums and networks. The policy and governance barriers related to a general unwillingness to include the public in decision making

can be overcome by creating collaborative working groups made up of individuals with a variety of skills, knowledge, and resources. Success can be measured by standards developed by a diverse set of values, reducing the pressure on municipalities to provide economic measures of success.

An example of how multi-stakeholder involvement can assist in making decisions is found in a Southeast Asia case study completed by the Water and Nature Initiative (Cartin et. al., 2012). The sustainability of the Mekong River Basin is essential to the natural resource-based rural livelihoods of fifty-five million people who live there. The agricultural productivity of this basin is dependent on flooding and recession, timing, extent and duration of floods and the regular inundation of habitats. The six countries that share the Mekong River face similar challenges with water authority but different priorities cause conflicting management and decision making which result in development risks.

Multi-stakeholder platforms help society to reflect on the wisdom of past actions, explore and assess future options and more openly negotiate workable strategies and agreements. These multi-stakeholder platforms provide space for the analysis of different perspectives, the development of planning scenarios and a more participatory approach to decision-making. A regional multi-stakeholder platform, called the 'Mekong Region Waters Dialogue: Exploring Water Futures Together', was organized to provide opportunity for a high quality, multidimensional debate and learning environment aimed at improving water governance in the Mekong Region (Cartin et. al., 2012). National Working Groups made up of representative experts from government, civil society/non-government organisations, the private sector, and academia were formed in each country to guide the implementation of the Mekong Region Water Dialogues.

To date, the Mekong Region Water Dialogues has been very successful in providing an opportunity for increased awareness and understanding of relevant decision-making frameworks. The dialogue was praised by all participants and seen as a 'first step in a difficult road' to enhance water governance in the Mekong region. The dialogues were a meaningful and important initiative which resulted in a shared learning and a clearer and deeper understanding of water and water-related issues in the Mekong region. It provided a common platform for interaction between stakeholders who rarely meet to discuss their common concerns about water resource use and development in the region.

Monitoring and Enforcement; Rewards and Punishments – Monitoring is a tool that should be used to determine whether or not chosen strategies are meeting performance criteria and if goals and objectives need to be reconsidered as new information and experience is gained. All sectors that use water should be accountable to their impacts on a watershed. This can include paying full costs for water use and disposal but also being rewarded for ecologically beneficial activities. Monitoring and enforcing targets can help managers recognize different stresses on watersheds and will help them to develop appropriate strategies to prevent negative impacts. Audit programs are one way this can be done.

Bring Barriers to the Attention of Policy-Makers – Barriers can change depending on different factors, such as the number of stakeholder groups or population growth. Regular evaluations should be done to identify the barriers managers are experiencing or to anticipate future issues. Managers should also be looking into whether the policies and programmes they are in charge of are causing new barriers. Some of these barriers can be dealt with by adapting strategies while others may need more senior level management action.

2.6 Capacity

The five barriers listed in Section 2.5.1 are part of the institutional barriers which prevent implementation of the soft path. Jordaan et al. (2009) state that for the successful implementation of the water soft path, institutional action and management at the municipal level is required. It is first necessary to define the capacities that exist and how they can be effectively applied. Literature analysis provides an initial information source to help develop the indicators of capacity and to gauge the ability of a city to adopt soft management approaches now and into the future.

Capacity has been discussed and applied in many case studies which include groundwater protection, source water protection, and drinking water protection. In a study by de Loë, Di Giantomasso, and Kreutzwiser (2002), the authors analyzed the factors that shape local capacity for groundwater protection in three small Ontario communities. Local capacity for each city was based on five interrelated factors:

Technical Capacity – This type deals with technical activities relating to water resource definition, threat assessment, monitoring, data management, planning and emergency response. Staff must be available with the specialized knowledge needed to undertake the activities or to process and use the information relating to these activities, particularly if data is being collected by external sources (i.e. consultants). The authors state that having up-to-date and accurate information and data is critical to making informed decisions. Access to data is also a critical step towards reducing the barriers to technical capacity (Jordaan et al. 2009).

Financial Capacity is measured in terms of revenue sufficiency, credit worthiness, and fiscal management and controls. The quantity of financial resources and their source (such as local tax

base or grants) is important to note because the size of a municipality's budget is a factor in determining how much money can be spent on resource protection. If there are no external funds available, protection initiatives could be beyond the financial capacity of a city that must provide basic services first.

In their discussion of the financial barriers preventing soft path approaches from being implemented, Jordaan et al. (2009) focus on the cost of water and the concern that water will be sold for less than what it actually costs to provide. In addition, producers and consumers are not provided with the right price signals to know when to change supply and demand and there are few incentives given to customers who conserve. In the USA, opportunities exist to develop incentives to deliver different qualities of water for different services and to charge for wastewater disposal based on the type and degree of contamination; however, government funding to cover all or part of the additional cost would be required. Currently, even if a city wanted to price water at its true value, it would be difficult to do so because convincing people why they should pay for the full value of water as opposed to just the cost of delivering it is a challenge.

Nauges and Thomas (2000) conducted a study on the municipalities of France and found that the way price is negotiated between each municipality and the private operator is an important determinant of water consumption trends. Community-dependent variables such as average income and average housing characteristics are determinant in setting the price rates and contract terms. Nauges and Thomas found that residential water consumption in French municipalities is significantly lower when individual housing with meter recording is common, thus advocating for the development of water metering in housing. Subsidy programs for low-flow facilities and new technology adoption could prove useful to complement price policies

during periods of water shortages. Non-price policies such as low-flow equipment promotion, awareness campaigns and education programs should also be considered.

Institutional Capacity – In local government, this type of capacity has at two levels. The first involves institutional arrangements which include clear official plans and policies created by a municipality and are supported by zoning by-laws. The second level is the institutional environment within which a city must operate. If senior government does not support local-level government by enabling legislation, clear directions, and support from their agencies, then it may be very difficult for local governments to commit to resource protection.

Political Capacity – Political capacity requires effective leadership that can provide vision and direction as well as recognize and respond to changes. Leaders must promote an organizational culture, flexibility and teamwork. One important measure of a leader is the degree to which they will form horizontal and vertical linkages with other organizations and members of the community. Horizontal linkages refer to relationships formed at the local level, such as with other cities or conservation authorities. These are important because the administrative boundaries do not always follow the boundaries of natural resources (eg. Lake Superior is shared by both the United States and Canada). If municipalities formed partnerships with other communities, agencies or non-government organizations, they could share data, expenses, and coordinate activities. Vertical linkages are connections with senior level governments such as Environment Canada and the Ministries of the Environment and Natural Resources in Ontario. These connections provide technical and financial assistance. Also, municipal governments must follow the laws and policies set out by the provincial and federal governments now and into the future, so it would benefit them if they partnered with senior level governments in order to communicate more effectively on water issues.

Social Capacity – Social capacity realizes that members of the community can play important roles in resource protection. When citizens participate in decision making, they ensure their interests are taken into account and increase the likelihood that initiatives will be implemented successfully. These citizens will enhance a municipality's capacity by increasing knowledge, skills, credibility and financial resources. Social capacity can be measured by examining levels of community awareness and the amount and nature of community involvement. This can be done through public education and outreach programs, public recognition programs for voluntary land stewardship, identification of levels of community awareness and support and identification of relevant interest groups.

Timmer et al. (2007) developed indicators of community capacity for preventing drinking water contamination in small communities. They used five capacity components which include financial capacity, human resources capacity, institutional capacity, social capacity and technical capacity. Ivey et al. (2006) described a framework for evaluating the capacity of local governments to protect source water in the Oldman River basin in Alberta, Canada. Their framework consisted of technical knowledge (of local water sources), legal authority (to influence land and water management), public involvement (in decision-making and implementation) and land and water integration (in planning).

2.6.1 Indicators for Assessing 'Institutional Capacity'

Table 4 provides the criteria that will be applied in this research to evaluate the overall capacity of the case study. Each type of capacity is assigned one or more preliminary indicators. These indicators are qualitative descriptions of what goals or conditions must be met in order to achieve this particular capacity. A preliminary evaluative framework of the institutional capacity of Thunder Bay to implement the soft path approach will be developed from this framework.

Five themes will be chosen along with their respective indicators. Table 4 below identifies the capacities and corresponding indicators that will be used in the study.

Table 3: Preliminary Indicators to Determine Capacity

Capacity	Preliminary Indicators
Technical	• Do staff have access to current and future water demand data and population data? • Is on-going monitoring conducted at regular intervals to ensure information and data are up-to-date and accurate? • Do staff and other stakeholders share information and data with each other? • Does staff have the ability to keep up-to-date with water conservation research and developments?
Financial	• Is the city able to maintain a balanced budget from year to year? • Does the city receive funding from outside sources? • Do water rates for customers reflect the full cost of protecting and providing municipal drinking water? • Is funding available for municipal water conservation programs? • Are there incentives for consumers to use less water?
Institutional	• Does the city have a stated goal of becoming sustainable? • Has the city set long-term goals for water conservation? • Does the city have an active water conservation plan? • Does the city use the backcasting method to create future goals for water use and conservation? • Is the city willing to limit construction of new water supply infrastructure and instead use water conservation methods?
Social	• Does the municipality meaningfully involve the public in its decision-making? • Does the municipality conduct public education and outreach about water conservation?
Political	• Is water conservation promoted by elected officials? • Does the city have active partnerships with other municipalities? • Does the city have active partnerships with a conservation authority?

The literature summarized in Table 4 identifies nineteen preliminary indicators of institutional capacity for water soft path implementation in municipalities. These preliminary indicators were later combined with information gained in interviews to form a framework of final indicators. The methodology for this study, including these interviews, is explained in the following chapter.

2.7 Summary of Literature

It can be determined from the literature above that the soft path is a new approach to water management only just starting to be thought of as important. The challenge now is to convert this vision into a practical planning tool. We have to put the ideas that are the foundation of soft path into action. Implementation of a water soft path approach in any municipality will ensure that water reserves are used in the most sustainable ways possible while still being socially acceptable and economically feasible. The following research study is intended to build on the literature of how to implement the soft path approach.

First, the case study will observe the literature on types of water management and the opinions of those interviewed who work in the water management sector. A characterization of the city based on supply management, demand management, and the soft path will be created which will summarize the types of management the city is currently using. Second, based on literature obtained, conditions necessary for the institutional capacity of water soft path will be applied to the case study. Research on current policies and practises used in the city will be used to answer the preliminary indicators and create a realization of the state of the institutional capacity present. Finally, through an understanding of the above literature and first-hand interviews with those who work in the water sector, recommendations and goals will be created

for the City of Thunder Bay for its convenience in making the shift towards a city more reliant on the soft path approach for water management.

Chapter 3 Methodology

3.1 Case Study

3.1.1 Case Study Characterization

The area where the research will be carried out is the City of Thunder Bay, Ontario, a region not subject to intensive population growth. Between 2001 and 2011, the region decreased in population by an estimated 0.1% (Ministry of Finance, 2012). It is also estimated that in the year 2036 the population of Thunder Bay will decrease even further to 148, 400 people.

Table 4: Past and Estimated Population in Thunder Bay (Ministry of Finance, 2012)

Year	2001	2006	2011	2036
Population	157, 000	154, 200	151, 400	148, 400

Thunder Bay is located on the shores of Lake Superior. Lake Superior is the largest freshwater lake in the world by surface area.

3.1.2 Water Management in Case Study

Thunder Bay currently uses watershed-based source protection to manage threats at the level of river systems as a whole. Since water flows across community boundaries, activities in one community can affect the drinking water in another downstream and that's why this approach is used. The Lakehead Source Protection Plan sets policies to protect sources of municipal drinking water. The Ontario Regulation 287/07 Section 22 was created to protect existing and future drinking water sources in the Lakehead Source Protection Area. If it ever occurs that there is a significant drinking water threat, the Source Protection Plan will take effect and the activity posing the threat will cease. The Clean Water Act and the Safe Drinking Water Act, created by the Ministry of the Environment, establish the requirements governing the contents of

the Source Protection Plan. To date, no significant or moderate threats have been identified for the City of Thunder Bay. The Lakehead Source Protection Area covers a land base of 11,526 square kilometres. The Lakehead Region Conservation Authority jurisdiction is found within this area as shown on Figure 2. The areas which comprise the Lakehead Region Conservation Authority are the Townships of Gillies, Conmee, O'Connor and Dorion; the Municipalities of Neebing, Oliver Paipoonge and Shuniah; and the City of Thunder Bay.

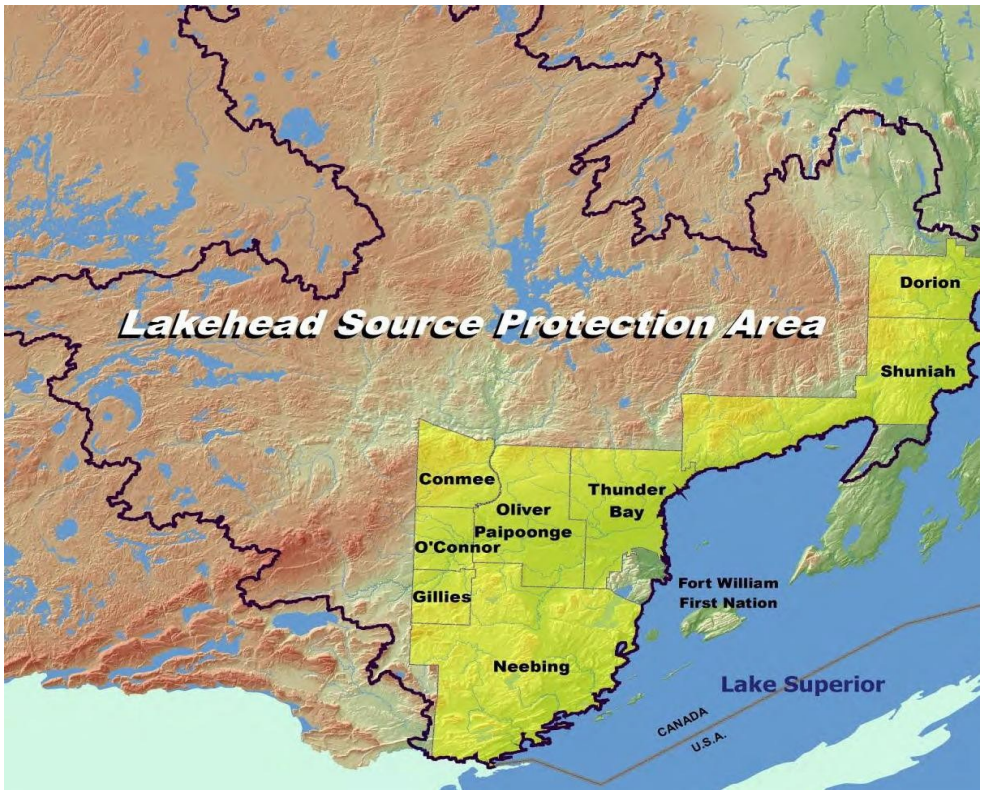

Figure 2: LRCA Jurisdictional Area (LRCA, 2014)

In Thunder Bay, drinking water (which is also water for every other use) comes from Lake Superior, delivered from the Bare Point Water Treatment Plant on Lakeshore Drive. Residents of the city are able to use endless amounts of water, which all comes to them treated from the Plant. The water is tested and fully compliant with Ontario's Drinking Water Regulations. This

is achieved through screening, filtration, disinfection, storage processes and finally delivery. After use the water becomes waste and is pumped to the Atlantic Avenue Water Pollution Control Plant for processing before it is returned clean to Lake Superior. As of 2012, the Bare Point Water Treatment Plant was operating at 36% of its potential capacity, producing an average of 41 million litres of water per day while it had the capacity to produce 113.5 million. In 2006, the total operating expenditure for Bare Point was $1,608,132.74. These operating costs are comprised of hourly wages and fringe benefits, building maintenance, electricity, chemicals, equipment maintenance, and operations and general expenditures. This total operating expenditure is an increase from the $597,494.63 total operating cost in 1985 (Drinking Water Quality Annual Report, 2006). The historical operating costs have also increased from 1985 to 2006. In 1985, the cost per million litres treated was $45.20; by 2006, it was at $111.27. This large increase in cost does not reflect the significant annual flow which went through the plant. In 1985, the total annual flow into the plant was 13, 217.80 millions of litres, which only increased to 14, 452.16 millions of litres in 2006 (Drinking Water Quality Annual Report, 2006). The total annual flow into the Atlantic Avenue Wastewater Treatment plant in 1991 was 33,987 million litres and this declined to 21,741 million litres in 2011, although the cost per million litres did not. In 1991, the cost to treat a million litres was $72.27. This amount increased to $256.35 in 2011 (Wastewater Treatment Annual Report, 2011). The reason for these increases in operating costs (detailed above) that occur yearly is simply a result of inflation. Inflation is what drives this increase in hourly wages and fringe benefits, building maintenance, electricity, chemicals, equipment maintenance, and operations and general expenditures. The increase also includes other new equipment installed or new pump stations added during specific years. A larger than normal increase from year to year is usually due to a new process being brought on

line, but otherwise there is a typical standard 3% increase due to inflation. There is no doubt that both of these infrastructures are very costly and these costs are passed down to the tax payers and those who use the services.

The City of Thunder Bay offers a range of water conservation programs, funded by the City and delivered by EcoSuperior. These include Water Wise Landscaping, Rain Barrels, Lake to Lake, and Toilet Rebates to name a few. The Wise Water Landscaping is a 12-page how-to booklet which instructs homeowners on how to create changes to their lawns to make the most use of rainwater. For a $65 fee, the Rain Barrel Program provides 220L rain barrels to capture runoff from rooftops to use in gardening. They are economical, environmentally friendly and help to reduce the load on storm sewers and the wastewater treatment plant. The Lake to Lake Program educates the public on the path municipal water takes from the Lake to our homes, then back to the Lake. Toilet Rebates of $125 are offered incentives to replace high water use toilets with efficient low-volume flush toilets. Finally, EcoSuperior provides plenty of city-wide educational programs. During Canada Water Week, for example, they presented at local libraries, gave tours of the Barepoint Treatment Plant, organized an Information Fair and screened the movie *Bottled Water Life* at the Paramount Theatre.

There are also initiatives in Thunder Bay which protect different aspects of the Lake. The Bare Point Rain Garden Project captures 80% of rainwater from the Treatment Plant's parking lots around their administration building. Also, in 2012, a piece of porous pavement was installed near the garden which prevents rainwater from travelling to the lake. The Water Bar, a portable bar that can be set up at events to provide the citizens of Thunder Bay with refreshing municipal water, is a project initiated to encourage the use of refillable water bottles and tap

water. The goal of the Water Bar is to promote municipal water as the preferred drinking water at outdoor events in Thunder Bay. The City was recognized for this initiative with the 'Most Innovative Conservation Method' award at the Great Lakes & St. Lawrence Cities Initiative Annual Meeting & Conference in Milwaukee, Wisconsin in June of 2010. The group EarthCare Thunder Bay is a partnership formed between the City of Thunder Bay and the community to work together on issues of community sustainability. The main priority of EarthCare is to implement the Community Environmental Action Plan. One goal of this plan is to focus on the quality and sustainability of Thunder Bay's potable water supply, the sustainability of water use in the region and the protection and maintenance of ecological services within the local watershed. The objectives and proposed actions of the plan include building watershed partnerships that enhance stakeholder roles and responsibilities and which encourage a soft path approach to water resource management, promoting the collection and analysis of data and publicizing to a wide range of stakeholders, and creating education and awareness programs to establish community standards.

3.1.3 Water Rates in Thunder Bay

Thunder Bay, although situated next to the largest freshwater body in the world, is not exempt from rising water prices. In Thunder Bay, water prices have been rising yearly. In a report entitled the City of Thunder Bay Water Authority Financial Plan (CTBWAFP, 2010), for example, the expenditures required to cover costs of operating day to day maintenance and administering the drinking water system are confirmed to be rising. Some of the Water Authority's main operating expenses include maintaining and administering the drinking water system, capital investments incurred in renewing and replacing its existing capital infrastructure and debt management. Operating cost of the Water Authority include personnel costs, utilities,

materials and supplies and administrative costs. The operating cost for one year was $13 million in 2010. It is projected that this figure will increase until 2014 at which time costs are projected to increase by 3% per year after that. Capital costs are the assets that enable the delivery of drinking water to the citizens and include the Bare Point Water Treatment Plant, one water testing lab, five water storage facilities, seven water pumping stations, seven water pressure zones, 721 kilometres of watermains and thousands of connections, fire hydrants, manholes and valves.

The total cash expenditures for the City of Thunder Bay Water Authority include operating expenses, debt repayments and interest charges, and capital costs which are projected to be $30 million per year in the short term and increase thereafter. In order to fund these expenditures, the City will rely on a combination of operating revenues, short term one-time government funding and new debt financing. Operating revenues will be achieved as a result of increased water rates. It is expected that annual water costs for most Thunder Bay households will increase by 5% and high consumption users will see increases of up to 29%. In regards to the one time government funding, it is anticipated that there will be some sort of receipt of this funding, however long term government funding is not assumed in creating a sustainable model. New debt will also help to pay for these costs. A new debt of $21 million will be incurred over seven years and will be repaid semi-annually over twenty years, interest being charged at 5% compounded semi-annually. It is estimated that by 2030, the Water Authority will begin to build a higher level of net financial assets which will allow it to save for future capital expenditures.

The residents of Thunder Bay have already started feeling the effects of the Water Authority trying to pay off its debt. Since 1988 the price of water in Thunder Bay has been increasing. This includes volumetric charge, fixed cost, and sewer rate. For example, as of 2012 there has

been a 7.1% rate increase. There will be a 5.6 % increase in 2014 and a 2.7% increase in 2015 before it's tied to inflation in 2016 (Price of Quality, 2013).

If we are to believe that once these increases happen there will be no more increases, then we are mistaken. The price of water will continue to increase. In an interview with Kerri Marshall (Price of Quality, 2013), the city's environmental manager stated that Thunder Bay's capital assets are starting to age. The underground water mains are estimated to be about fifty years old, while some of the pipes are as old as 100 years. These assets account for a large portion of the city's capital reinvestment which will continue on an annual basis.

3.1.4 Justification of Case Study

There are five primary reasons why this area has been chosen as a case study:

1. Implementing soft path ideas may potentially lower costs of infrastructure upkeep and residents' water bills.
2. Lake Superior must be protected from exploitation and its water not treated as an endless supply which can be used and abused to satisfy all our wants.
3. EarthCare Water Working Group (a division of EarthCare) has expressed interest in the soft path approach for water management and its potential for increasing water conservation and efficiency.
4. Thunder Bay is located on Lake Superior, the largest lake in the world by surface area. If a city with so much water at its disposal decides to make changes to the end of more efficient water use, this attitude will make us a leader in forward thinking cities.
5. The location of the case study, availability of date, interview subjects, and cost effectiveness of doing local research were the practical rational for the study site.

After a thorough review of Thunder Bay's current water management condition, one might be led to the conclusion that water conservation is not terribly important and that water soft path is even less relevant. It is a common, yet understandable, belief that other priorities should supersede water use, such as employment, roads and transportation, addiction, etc. However, the rationale for focussing on water soft path when there is a massive supply available is ***because*** Thunder Bay is in a relatively stable population and tax base. Many of the case studies have had little choice in the matter; their supply of water was compromised in one way or another and/or their population had significantly increased. They were therefore required to immediately create a change in their water management strategies or be faced with serious shortages in water for their citizens. Thunder Bay is currently in a position where water supply is not a major issue and it is for this reason that water soft path approaches should be incorporated. Why wait until a crisis occurs before taking action? The City can easily make changes, not necessarily so drastic that they are impractical but enough so that citizens and politicians have the right mindset, which are reflective of soft path. In doing so, unforeseen changes in the future that affect water quantity and quality will be easier to adapt to. In the case of Thunder Bay, the water soft path should not be used as a way to react to an abrupt change in supply or demand, but rather a preventative and forward thinking strategy which will not only make the City a leader in water management amongst others, but will also prepare us for future changes unforeseen to us today but which will undoubtedly take place.

The following is the methodology which will be used to address the thesis objectives. Besides reviewing the theoretical literature, it is important that the research be grounded in water management and planning practice so that the results are practical and useful for Canadian municipalities interested in implementing the soft path approach.

3.2 Qualitative Interviews

The research was carried out through semi-structured interviews with water management and planning professionals and with one academic. Potential interview participants were chosen by purposive sampling and by snowball sampling of water management and planning professionals in local government, agencies, private firms and non-government organizations. Purposive sampling is when the participant is selected because they know the information required, are willing to reflect on the phenomenon of interest, have the time and are willing to participate (Richards and Morse, 2007). Snowball sampling involves participants already in the study who recommend other individuals to be invited to participate (Richards and Morse, 2007). The interview participants included a member from each of the following groups: EarthCare Water Working Group, EcoSuperior, Lakehead Region Conservation Authority, Barepoint Water Treatment Plant, Ministry of the Environment, The City of Thunder Bay and the Atlantic Avenue Wastewater Treatment Plant. Water management and planning professionals from Guelph, California and Calgary, one academic and one private firm employee from a company called Econics were also interviewed. There was no set minimum or limit to the number of interview participants; however the goal was to find as many participants as possible. Potential participants were contacted by an e-mail requesting their consent and participation for an interview. The interviews were conducted either face-to-face with individual participants in a private room at their workplace or over the telephone. They were voice-recorded for later transcription and analysis purposes.

3.3 Interview Structure

The reason for conducting interviews is they can be used as a means of gathering information about a person's knowledge and professional opinion and in combination with other

research techniques to follow up issues (Cohen, Manion, and Morrison, 2000). There are several different types of interviews but the semi-structured interview best addresses the aims and objectives of the research. Semi-structured interviews allow for a list of issues and questions to be covered. Additional questions may be asked as new issues arise throughout the interview (Stake, 2010). If it is required for respondents to expand on their answers, probing of views and opinions is allowed and it is this deeper level of communication which allows the researcher to access the interview participants' opinions and feelings and allows new concepts to develop. The studies' validity is increased by a collection of data from the interviewee that is rich in explanation and analysis (Hussey and Hussey, 1997). Participants may also be asked individualized questions that relate specifically to their own experiences or knowledge of their organization if it is useful to the research.

In carrying out semi-structured interviews, it is important that they measure what they are intended to measure. It should be ensured that the question content directly concentrates on the research objectives. According to Arksey and Knight (1999), validity can be strengthened by:

- Using interview techniques that build connection and trust, thereby giving informants the opportunity to express themselves;
- Prompting informants to illustrate and expand on their initial responses;
- Ensuring that the interview process is sufficiently long for subjects to be explored in depth;
- Constructing interviewing schedules that contain questions drawn from the literature and from pilot work with respondents.

They also note that the sample size of interviewees should continue to increase until no new viewpoints emerge from the data. A sample size of eight is often enough, but the interview data needs to be studied and analysed as it is collected until it becomes clear that perspectives are being repeated and no new ideas are emerging.

For those interviewed in Thunder Bay, fourteen primary questions were asked in the interviews, which were divided into three parts. The questions started off broadly and moved into greater detail to eventually discuss the soft path approach. The first set of questions allowed the participants to think about all issues and concerns in the water management field. The interviewee was asked to describe their individual roles and responsibilities and the roles and responsibilities of their organization as they relate to water management. They were then asked to discuss what they think are the most effective methods but also the largest barriers for water conservation.

The second part of the interview was about the future of water management. I asked the participants to imagine Thunder Bay a few decades in the future and to decide how they would like to see water management changed by then and what water management issues they expect will arise. This type of future thinking matches the soft path approach of backcasting and helped prepare the participants for speaking about the soft path approach itself.

The third part of the interview was specifically about the soft path approach. Participants were asked if they were aware of any city policies which are currently in line with soft path management. They were asked about the possibility of the soft path approach being implemented in the city and to identify any opportunities which exist for additional water soft path approaches and what changes would be required to accomplish it. If a participant did not know about the soft path approach, it was introduced to them by describing the four principles that distinguish

the soft path approach from conventional water planning and management as identified by Brandes et al. (2009). By listing and briefly explaining these principles, it allowed me to start a discussion with the participant. The interview questions for those living in different cities, the academic and the private industry worker were very similar to those prepared for those living in Thunder Bay. These questions were divided into two sets. The first seven questions dealt with how the city was currently managing its water and the following eight related the soft path approach to the city's water management. The questions for the academic looked at how the soft path approach related to all types of cities.

3.4 Analysis of Interviews

After the interviews were completed, they were manually transcribed verbatim into a Microsoft Word document based on the voice recordings. Each interviewee is labeled with a letter in order to keep the participant anonymous. The interview question for the interviewees, which include those living and working in Thunder Bay and those who live elsewhere and work for either their respective city or academia, are located in Appendix A.

The transcripts were analyzed using a methodology called the responsive interview model (Rubin and Rubin, 2005). This type of methodology was also used to qualitatively analyze personal interviews by Finn (2009) whose study assisted in analysing this study.

The responsive interview model methodology occurs in two phases (Rubin and Rubin, 2005). The first phase involves analyzing the transcripts to "find, refine, and elaborate concepts, themes… and then code the interviews to be able to retrieve what the interviewees said about the identified concepts, themes, and events." A concept is a word or term that represents an idea important to the research problem; themes are summary statements and explanations of what is

going on. In order to analyse the interviews, all the concepts mentioned by each participant in their answers to the questions were identified. The concepts at this stage must be coded (Rubin and Rubin, 2005). "*Coding* involves systematically labeling concepts, themes …" This is the second phase. Each label is known as a code. Not all concepts qualify as codes because sometimes different interview participants say contradictory things and have different opinions on the same issues (Rubin and Rubin, 2005). A method is needed to choose only the most important concepts that will make valid codes. The method I chose to accomplish this was to codify only the concepts that were mentioned by more than one participant. A concept was dropped if only one person mentioned it because it was deemed not significant enough based on the Rubin and Rubin methodology. The codes must then be sorted "to figure what the coded data mean" (Rubin and Rubin, 2005). This is done by looking for "patterns and linkages between the concepts and themes," sorting and grouping these concepts and themes, and then describing them.

Adding to the methodology described in Rubin and Rubin (2005), Finn (2009) used four stages to sum up data in order to find developing themes. The first step of this model is the same as the first stage described by Rubin and Rubin (2005) and which has been previously described. The final three steps make up the second stage of analysis described in Rubin and Rubin (2005) and involved three rounds of coding to combine the data into groups. In trying to carry out Finn's stages, the codes from the previous stage were copied and pasted into a new Word document. From there I sorted them into groups with similar characteristics. The final stage allowed significant themes to appear which were similar to the themes identified in the literature review. Each grouping comprised a new code for that level. As many codes as possible were grouped under the themes identified in the literature review which made it easier to identify final

indicators later on, when the themes of the literature review were combined with those of the interviews. If a code did not fit with one of the identified themes, new code groupings (and themes) were created. Descriptions were created for each of the themes to compare and contrast the responses of interview participants. The interview transcripts were rechecked throughout the process of writing these descriptions to ensure that these comparisons and contrasts were being used within their proper context and to ensure that personal views and perceptions were not interfering with the interpretation of data.

Chapter 4 Results

4.1 Interview Analysis

Using the process outlined in Section 3.3, the key concepts from the interviews were coded and then regrouped into themes. The themes are shown in Table 5 along with the codes that formed them. Level I Codes, the first column, are the concepts mentioned by each interview participant in their responses to the interview questions. Level II Codes, the second column, is the result of the concepts in Level I being coded based on if the concept was mentioned by more than one participant. The third column organizes the themes that emerged equivalent to the themes identified in the literature review or which, if not in the literature review, were mentioned by the interview participants.

Table 5: Breakdown of Interview Codes

Level I Codes (Interview Sources)	*Level II Codes*	*Type of Capacity these codes fit in with*
Participants A,E,G,H Change is uncomfortable Feeling of entitlement Lack of knowledge Money drives behaviours	Changing public perceptions about water	
Participants B,C,D,F,H,J,M LID and green technologies Pollution prevention and proper disposal of hazardous waste General understanding of soft path and how to achieve it Planting the seeds with young people Citizens taking the initiative to learn on their own Provide tools, information, and incentives	Educational strategies for citizens	Social Capacity
Participants I,J Participation and awareness critical Community support	Public Participation	
Participants B,E,G,M	City leadership	

City doing projects on their own City council needs to create change Changes on city owned sites Lead by example **Participants D,E,I,** Term itself is hindrance No one understands term Lack of understanding of concepts **Participants C,G,M** Existing bylaws and existing development standards Changes to city requirements Confines of the regulations Triple bottom line approach in decision making **Participants C,F** Not enough water being used to keep plant running efficiently Wise use of water program more effective **Participants A,B,C,I** Training decision makers Seminars to train residents Public hands on workshops Workshops for water professional and local politicians	Understanding the term Policy and regulation Summer watering restrictions Training and Workshops	Technical Capacity
Participants A, B Showing other cities how they can be efficient with their water Cities take pride in being a leader **Participants A,I,L** Limited motivational champions Media and political champions Elected officials need to show leadership and bravery	Relationship with other cities Staffing	Political Capacity
Participants B, K,M Invite the public and developers to pilot projects Use of greywater on landscape Use of wastewater effluent for industrial purposes	Research and Pilot Projects	Institutional Capacity
Participants H,J,K		

Efficient toilets, showerheads, washing machines, and xeriscaping Reducing household water use **Participants B,D,J**	Indoor technologies	
Stormwater master plan should be green technology, LID, soft path, less hard infrastructure, not just bigger pipes Low impact development used throughout the city Incentives for those choosing to install LID practises **Participants J, K,M**	Outdoor technologies	Technological Capacity
Cost effectiveness of leak detection Programs to minimize leakage implemented 100% metering reduces leakage issues	System-wide technologies	
Participants G,I,J,	Cost-benefit analysis	
Water future dependent on cost-benefit analysis Inclusion of environmental benefits from avoiding new water supply schemes Benefit should be tangible **Participants C,G**	Incentive based methods	
Strong financial incentives for every sector Toilet rebate program successful **Participants F,G,J,K,L**	Full cost accounting	Financial Capacity
Conservation reinforced Water priced cheaply Residents not paying enough for water Price should reflect cost to treat and manage water after use Not cost-effective to use alternative technologies **Participants D,E,F,L**	Future costs for infrastructure	
Future maintenance costs Infrastructure improvement costly Water price increases accelerated Raising rates a virtuous cycle **Participants C,D,F,G**	Future costs for treatment	

Higher cost of treatment Stringent criteria will affect cost More expensive technologies in the future		

The following discussion provides detail of the codes formed, divided into the six different capacity types developed from the literature review and interviews. It was found that most of these themes were comparable to the literature with the exception of one that emerged separately. Most codes were grouped into the five capacities identified in the literature review while one set of codes had a different theme which was not mentioned in the literature. This theme dealt with technological solutions for water efficiency that were thought to be feasible and effective if implemented or that had already been implemented.

4.1.1 Social Capacity

Changing Public Perceptions about Water

There were a number of participants who noted that the public's perception of water related issues was a hindrance. Interviewees brought up the idea that the general public tend to feel uncomfortable about changing the way they normally use water and that a large amount of education is required. It was also stated that the attitudes of people pose a problem because they see us living near Lake Superior as "an invitation to use as much water as we want and take it for granted," (Participant G). Finally, if money is involved, if there is a financial sacrifice, a behavioural change is more likely to occur among people but otherwise it's business as usual. As was noted by Bob Sandford of EPCOR in the literature review, "until Canadians make the connection between personal use of water and its true value, our water wasting habits will continue."

Education Strategies for Citizens

More than half of the interviewees mentioned that changing public thinking and actions could occur through different educational strategies. This education should include information about what the soft path is and how to achieve it, the types of LID technologies that are out there as well as how street drain systems work, proper disposal of hazardous waste and pollution prevention. "Education of the public means ensuring that information on options, costs, technology,

and regulations are fully available to water users. Smart choices will only be made when those choices are known and understood," (Wolff and Gleick, 2002). Participant F stated that much education should be focused on the younger generation because it's easier to "plant the seeds" with them. Educating young people on how to be more efficient with water use is currently happening; however participants noted that a drawback to this is it would take about 20 years to see the results. Participant J noted that in the case of his city, many citizens educated themselves and came to city meetings prepared with ideas and examples. Another interviewee offered they were able to educate customers on how to match the quality of water to use by providing tools, information and incentives.

Public Participation

No concrete examples were given on how to educate the public on the issues noted above. It was suggested that participation is needed, as well as awareness and solutions, but no one gave any specific ideas on how this might be done. As stated by Slovic (1993) the decision-making role of the public can range from none, in the case of a focus group, to a direct decisional role

in ratifying an agreement arrived at through mediation. Mechanisms which give the public a direct decision-making role are likely to be better at achieving the goal of trust in governments to deal with environmental issues than those which do not. It is therefore necessary that public participation is used as a means to create these decisions which affect the environment. The same interviewee who spoke of how his city's residents came prepared to meetings also told of how among them, "…there was a great amount of community support to grow within our resources and means locally." The public is interested in voicing their concerns and should be given an opportunity to do so.

4.1.2 Technical Capacity

City Leadership

This first category of technical capacity deals with changing the way municipal staff implement water conservation and efficiency. Participants discussed the need for the City of Thunder Bay to take charge and make mandatory certain aspects when looking at water management plans. Participant E stated that "the city council, city manager level needs to say 'when you're looking at water management we want you to consider these things and incorporate these things into your plan." It should be up to the city to take a lead and begin projects and inform the public and developers of these projects. "Good governance and leadership by publicly accountable authorities are critical to ensure desirable outcomes. Governance must be adaptive and inclusive if it is to be successful at creating sustainable water management solutions," (Brandes and Kriwoken, 2006). One interviewee's city made upgrades to their water treatment plant in order to reduce water river withdrawals by 10% and have also begun stormwater reuse on golf courses and other city properties. This city is very proactive in leading its citizens through example.

Understanding the Term

Noted as well is a lack of understanding and awareness on the part of the city about what soft path actually means. There is a misconception about the term and therefore those in a position of making a change are against committing to soft path. "The city doesn't want to commit to soft path because no one understands it," said Participant E. It was suggested that it might be beneficial to talk about the concepts of soft path but not directly use the term itself. The approach does not need to be labelled soft path to be effective. Also, when it came to the word 'conservation' some participants suggested using the word 'efficiency' instead because 'efficiency' or 'wise water use' is more effective and reasonable a concept than trying to not use water.

Policy and Regulation

The second category of codes in this capacity deals with existing bylaws and development standards, as well as the elimination of the summer watering restriction. It was mentioned that existing development standards and bylaws need to be changed in terms of their requirements. "Regulatory tools include government policies to encourage water conservation and efficiency improvements, including appliance efficiency standards, landscape ordinances, and efficient building codes," (Wolff and Gleick, 2002). It was suggested that a developed area such as a new subdivision would be a good place to start implementing this change because it would be easier to start fresh instead of going back to older buildings and changing their required standards. Participant M stated that in the city he lives in, "regulations are seen as a constraint because we are only able to help customers match quality to use within the confines of those regulations before us."

Summer Watering Restrictions

The final mention of policy and regulation during the interviews dealt with the summer watering restrictions that were eliminated. Participant C stated that the city is not concerned with water conservation because "the plant needs to operate effectively and the summer watering restrictions were preventing that." On the other hand, Participant F commented that the odd-even watering restriction was eliminated because "residents wouldn't water their lawn on the one day but then on the day they were allowed to water they would water twice as much, so it really wasn't conserving as the program was meant to." It was mentioned again that the city is not concerned with water conservation but this time a different reason was offered, this being; the odd-even day watering restriction wasn't working and therefore the city is more concerned with the wise use of water.

Training/Workshops

The interview participants provided practical advice about how to implement water conservation and efficiency programs. Many of them mentioned how training and workshops have been important in the past to creating change and should be implemented in the future. They said that decision makers should be sent to training because of the great results that can arise. The city is already putting on seminars to train people on the benefits of current technologies. Workshops aimed at water professionals and local politicians would be beneficial to compare possible water futures for the city. "Workshops with local stakeholders or with community or regional officials are often helpful for thinking of possible options (and rejecting others)," (Brooks and Holtz, 2009). While training for water managers and politicians was seen as important, it was noted that hands-on workshops for the public have already been successful,

providing tools needed for conservation. In the words of Participant C, these workshops "were successful because they were 'show me' rather than 'tell me.'"

4.1.3 Political Capacity

Relationship with other Cities

Participants discussed the need for the city to become a leader in water management in relation to other cities. It was thought that the city of Thunder Bay, although with a large supply of water, should none-the-less be taking charge in showing other cities how to be efficient with water. This would make Thunder Bay a leader in Northwestern Ontario. In the words of Participant B, "cities like to see how well of a leader they are being to others and how well they're doing in the race."

Staffing

Three of the interviewees talked about the importance of having local heroes and champions who possess the courage to make a change. These champions and heroes would need to be either in administrative or leadership roles within utilities as well as elected officials in order to give water soft path the proper attention. Having these champions present would be motivational and encouraging for our community and encourage co-operation in order to do things better. It was noted by Participant A, however, that "we have few champions and few great examples near us to motivate us and to encourage us as a greater community and corporation on how we can do better."

4.1.4 Institutional Capacity

Research and Pilot Projects

A few participants mentioned that the use of pilot projects would be important to implementing new ideas. Participant B stated that Thunder Bay has a few of these pilot projects

set up and encouraged the public and developers to come out and view these projects to educate themselves. An interviewee from another city told of how his city was interested in setting up a pilot system to show how greywater systems could be more efficiently used on landscapes and also addressing the health concerns associated with them. As well, there was an area mentioned where wastewater effluent (reclaimed water) was used for industrial purposes and this was being done as a pilot project. A pilot program implemented in Orange County has allowed the landscape to be irrigated according to its climate needs without requiring any involvement from the homeowner and this has resulted in a 24% reduction in outdoor water use (Hunt, 2001). This is just one of many examples of pilot projects which can be used within a city.

4.1.5 Technological Solutions

Indoor, Outdoor and System-Wide Technologies

Technological solutions were a large component of the interview codes. Participants mentioned installing efficient appliances and technologies in homes and businesses, or replacing existing fixtures and appliances as a way to reduce water usage. For inside the home, it was suggested that the older model 13L toilets be changed to 6L toilets, shower heads to low-flow and that washing machines be front-loading. These were identified as the most cost effective solutions to reducing household water use. For an outside modification, the biggest change suggested was xeriscaping, which would involve getting people to exchange their turf in favour of low water use landscapes.

Another major technological solution suggested was low impact development, or LID. This type of development involves using natural means as a treatment for stormwater instead of hard infrastructure such as a rain garden. Installing rainwater harvesting systems, rain gardens, and

other types of LID is just as important as wastewater management and, noted the interviewees, poses great opportunities for customers to conserve.

Finally, a system-wide technology in the form of leak detection was suggested. Leaky pipes waste money due to water loss and could save the city a lot of money if they are fixed. In some cities there are already programs in place to help water suppliers tighten up and replace older pipes in order to reduce leakage and create more efficient water usage. One city was better able to detect system leaks by being 100% metered. Participant M stated; "Our aim is to be 100% metered by the end of 2014 which helps in non-revenue water monitoring for in the system because of leaks." Overall, technological solutions were seen as a major component in implementing the water soft path. There are many technologies available to municipalities and "with technological improvements there is enormous room for economic growth without growth in water use," (Wolff and Gleick, 2002).

4.1.6 Financial Capacity

Cost-Benefit Analysis

The most frequently addressed topics in all of the interviews were related to the economics of water conservation and efficiency programs. The first type of this concern was the cost-benefit of programs. Participant G clarified that for Thunder Bay's water future, if the cost-benefit analysis showed that the "savings in achieving conservation are worth the investment required to get there, then it's a good idea but if cost in achieving the reduction is more, then it isn't." It was suggested that Thunder Bay might develop a better long-term cost-benefit analysis, which would include the environmental benefits of with avoiding new water supply schemes. One participant's city defined 'benefit' as something that was tangible to the public and local politicians which proved useful in their situation.

Incentive Based Methods

Two participants talked about how incentives were a method which could alter people's mindsets and therefore their actions. If strong financial incentives were put in place for every sector, the result would be drastic reductions in water use. "Water reuse-recycling and metering with conservation-based pricing incentives stand out as promising opportunities to reduce water use and promote water sustainability," (Brandes and Kriwoken, 2006). One incentive based method has already been implemented in Thunder Bay and "locally we've had good success with incentive based methods which include the toilet rebate program," offered Participant G.

Full Cost Accounting

Full cost accounting, which means maintaining rates that reflect the true cost of the product, was also a frequent topic of discussion during the interview. Most participants felt it important to increase water rates for consumers because as stated by participant F, "pricing water right reinforces conservation and ensures sustainability of required utility revenue." Water is seen as a relatively cheap commodity and people should be paying a price that reflects delivery cost and also the cost of treating and managing the water after use. If water was priced correctly and not so inexpensive, alternative technologies such as those mentioned above would be accepted as viable options for conservation.

Future Costs for Infrastructure

Many of the interviewees predicted significant future increases in infrastructure. "As infrastructure ages there will be maintenance so costs could go up in that vein," said Participant D. This has already become evident in Thunder Bay as water prices have accelerated to make up

for lack of funds for maintaining infrastructure. It was the general view of some of the interviewees that increasing water rates would help overcome infrastructure deficits.

Future Costs for Treatment

Another future cost brought up by interviewees was that of treatment. Higher costs required for actually treating the water would arise as new technologies were put in place. Participant G: "I think where you're going to see more cost is at the water treatment end as opposed to the water delivery end."

Chapter 5 Discussion and Case Study Evaluation

Many concepts were addressed throughout the interview process. Participants talked about each of the five indicators listed in the literature which include financial capacity, institutional capacity , political capacity, technical capacity and social capacity, and introduced a new theme; technological capacity. Based on the interviews conducted and the literature, it is possible to bridge the theory-practice gap existing in the water management sector of a municipality.

To reiterate, the objectives of this thesis are:

- to identify city policies and programs that are currently in line with supply, demand and soft path management;
- to determine whether Thunder Bay has the institutional capacity to implement a water soft path approach
- to develop key principles, goals, and recommendations for a soft path management plan in Thunder Bay.

Each of these will be dealt with separately in this discussion.

5.1 City Policies and Programs Currently in Line with Supply, Demand and Soft Path Management

Before one begins to understand what changes need to be made to the city's current water management, it is imperative for one to know what the current type of management is. The literature outlined three types of water management: supply management, demand management and soft path. Based on these descriptions and the case study analysis done in Chapter 3, Thunder Bay can be classified as a city which primarily utilizes a supply management but which is also making the shift to aspects of demand management. Thunder Bay uses Lake Superior as

its source for all water usage in the city. Water gets purified through the Barepoint Treatment Plant, is used by all sectors of the city including residential and commercial and, finally is treated at the Atlantic Avenue Treatment Facility and then returned to the Lake. This system is reflective of supply management in the sense that endless supplies of water are being used to service the city. If more water is needed, then more water will be made available for use.

While the above may be true, Thunder Bay also has initiatives in place which are reflective of demand management. Initiatives with EcoSuperior have enabled the city to implement a variety of programs which focus on using residential water more wisely. A second step forward for the city has been achieved through a group called EarthCare, formed by various members of the city's innovative thinkers. The objectives of EarthCare's Water Working Group are to build watershed partnerships that enhance stakeholder roles and responsibilities as well as encourage a soft path approach to water resource management, promote the collection and analysis of data to be publicized to a diverse range of stakeholders and create education and awareness programs to establish community standards. EarthCare has had great success to date with its education and outreach, promotion of best water management practices and research initiatives.

Finally, a new stormwater management master plan is currently being developed for Thunder Bay. One component of this plan will include the identification of Low Impact Development or other technologies that should be promoted as part of any new development, redevelopment, upgrades or infrastructure replacement.

The following table details the activities mentioned above which are reflective of supply management, demand management, or soft path.

Table 6: Water Management Approaches in Thunder Bay

Supply Management	Delivering Water Treating Water	• All water delivered to residents come in the form of high quality water that is used for drinking and other uses • Water is treated at the Treatment Plant and returned to the lake with no large-scale recycling
Demand Management	Programs Delivered by EcoSuperior City Policies	• Water Wise Landscaping • Rain Barrel Program • Lake to Lake • Toilet Rebates • Water rates increasing, but still not reflective of true cost
Soft Path Approach	Barepoint Treatment Plant Initiatives City Polices Technologies	• Bare Point Rain Garden Project • Porous Pavement at Bare Point • Educational Programs • Optimization of cleaning of ultrafiltration membranes • Aspects of the new Stormwater Master Plan • 4 LID stormwater management technologies at 4 locations • Leak detection from Thunder Bay's water distribution operation and maintenance

Thunder Bay does exhibit certain aspects of the soft path whether the city recognizes this or not. It is encouraging to see that there are steps being taken this direction but there are still many changes that need to occur. It should be noted that the table does not include actions individual residents may be taking on their own; it only lists the activities which Thunder Bay is a part of.

5.2 Institutional Capacity in Thunder Bay to Implement a Water Soft Path Approach

Tables 7-12 display a framework of final indicators of institutional capacity that would need to be present in Thunder Bay in order to implement the soft path approach for water

management. Hopefully this information will be used by municipal water institutions to identify needs and opportunities for implementing the soft path approach.

Final indicators have been created from a combination of the preliminary indicators developed in the literature and the codes developed in the analysis of the interviews. The letters 'Lr' represent the literature as the source and the letter 'I' represents the interviews. Tables 7-12 include six themes and within each theme there are indicators phrased into the form of a question. A 'Yes' response to an indicator means that there is capacity present for that indicator and a 'No' means there is no capacity present. It is possible for it to be unknown if an indicator is present or not, in which case the letters 'Unk' will be used.

Table 7: Social Capacity Indicators (Note: 'Lr' represent the literature as the source and 'I' represents the interviews)

Capacity	Indicator Question of Capacity	Source of Indicator	Is Indicator Present within Case Study area?
Social Capacity	• Does the municipality meaningfully involve the public in its decision-making?	Lr, I	Yes
	• Does the municipality conduct public education and outreach about water conservation?	Lr, I	Yes
	• Are people's attitudes challenged on the myth of superabundance?	I	Yes
	• Is anything being done to influence behavioural change?	I	Yes
	• Is anything being done to educate the younger generations of water users?	I	Yes

Thunder Bay provides many opportunities for citizens to get involved and have a say in what happens in their city. Policies and major decisions are made by City Officials with the

input of residents. Residents can be members for the board on the Lakehead Region Conservation Authority as well as attend municipal meetings and information sessions. Residents are also welcome to attend EarthCare Water Working Groups meetings to express concerns regarding any water issues they may have. The City of Thunder Bay, through its contracts with EcoSuperior, delivers educational and outreach programs to city residents. In its Annual Report (2011) EarthWise (the name prior to EarthCare) talks about public education and outreach occurring through hands-on workshops that teach how to construct a rain garden and instal permeable paving. Tours of the Bare Point Water Treatment Plant and Atlantic Avenue Wastewater Treatment Plant are also promoted, with about 1700 people touring these operations in 2011. Behavioural changes are influenced mainly through the rebates provided by Thunder Bay's water program. Younger generations are educated on municipal water management through the twenty-one Lake to Lake presentations and nine WaterWorks presentations given to more than a thousand students in over thirty public schools. All of this information can be found on the City of Thunder Bay's website and in the EarthWise Annual Report (2011).

Table 8: Technical Capacity Indicators (Note: 'Lr' represent the literature as the source and 'I' represents the interviews)

Capacity	Indicator Question of Capacity	Source of Indicator	Is Indicator Present within Case Study area?
Technical	• Does staff have access to current and future water demand data and population data?	Lr	Yes and No
	• Is on-going monitoring conducted at regular intervals to ensure information and data are up-to-date and accurate?	Lr	Yes
	• Do staff and other stakeholders share information and data with each other?	Lr	Yes
	• Does staff have the ability to keep up-to-date with water conservation research and developments?	Lr, I	Yes
	• Is city staff aware of new types of water management, such as the soft path?	I	Yes

Thunder Bay keeps up-to-date records on its daily water use, then compiles that data to find the yearly amount used from Barepoint Treatment Plant. The City also keeps records on the number of residents that immigrate or emigrate yearly. The city is aware of its current population and water use; however, there is no clear indication that future projections have been considered when making decisions. In conducting business, the City shares information and data with relevant stakeholders. The City's Environmental Division collaborates with external environmental groups, a representative on the Lake Superior Binational Forum, the Source Water Protection Committee and the Remedial Action Plan Advisory Committee. EarthWise Water Working Group also partnered with EcoSuperior in the preparation and planning of a Stormwater Conference and with the Environmental Division to advise a Stormwater Management scoping study. City staff are able to attend different types of workshops and training sessions which

allow them to keep up-to-date on new ideas and technologies currently available. For example, The Environment Division participates in the Ontario Municipal Benchmarking Initiative Water and Wastewater Expert Panel which allows the sharing of practice, policies and development of best practices to improve operating performance. Through these types of training sessions, city staff has been made aware of different ways they can manage the city's water.

Table 9: Political Capacity Indicators (Note: 'Lr' represent the literature as the source and 'I' represents the interviews)

Capacity	Indicator Question of Capacity	Source of Indicator	Is Indicator Present within Case Study area?
Political	• Is water conservation promoted by one or more elected officials?	Lr, I	Yes
	• Does the city have active partnerships with other municipalities?	Lr	Yes
	• Does the city have active partnerships with a conservation authority?	Lr	Yes
	• Does the city take the initiative to become a leader for other municipalities on new, innovative strategies for water management?	I	Yes

Two members of City Council, Andrew Foulds and Rebecca Johnson, are members of EarthCare. While these two individuals do not necessarily promote water conservation, their participation in EarthCar provides a voice which speaks to all levels of community sustainability. City Council has also adopted the Community Environmental Action Plan in their 2011-2014 Strategic Plan – Goal 10 and this, more specifically related to water, will create a stormwater management plan to reduce stormwater outflow, flooding, and which will protect Lake Superior and its watershed. Thunder Bay is part of the Great Lakes and St. Lawrence Cities Initiative in which forty other cities and their respective mayors, including Thunder Bay's Keith Hobbs,

made a 'Declaration on Water Sustainability', adopting a Sustainable Municipal Water Management Framework of common sustainable management practices to protect the Great Lakes and St. Lawrence. The City of Thunder Bay is also actively partnering with the Lakehead Region Conservation Authority (LRCA). For the Lakehead Source Protection Area, the Source Protection Plan has set out policies to protect sources of Municipal drinking water and determines how drinking water threats will be reduced, eliminated, or monitored, who is responsible to taking action, the timelines involved and how progress will be measured. Finally, Thunder Bay is as clear leader in the water management sector. The City was a recipient of the Innovation in Water Conservation Award and the Leadership in Water Pollution Prevention Award, two of five awards given to Cities Initiative members in recognition of their progress and leadership in the areas of water conservation, pollution prevention and sustainability. The first award recognized the optimization of cleaning of ultrafiltration membranes used at Bare Point Water Treatment Plant which resulted in chemical use reductions and a reduction in the use of over 70 million litres of water and wastewater. The latter award was received for the Effluent Discharge UV Disinfection and Stormwater Bioswale initiatives. The UV Disinfection is a process which makes wastewater from the wastewater treatment plant even cleaner and the biofiltration swales planted at the wastewater treatment plant parking lot demonstrate an effective way of capturing stormwater on-site.

Table 10: Institutional Capacity Indicators (Note: 'Lr' represent the literature as the source and 'I' represents the interviews)

Capacity	Indicator Question of Capacity	Source of Indicator	Is Indicator Present within Case Study area?
Institutional	• Does the city have a stated goal of becoming sustainable?	Lr	Yes
	• Has the city set long-term goals for water conservation?	Lr, I	No
	• Does the city have an active water conservation plan?	Lr	Yes and No
	• Does the city use the backcasting method to create future goals for water use and conservation?	Lr	No
	• Is the city willing to limit construction of new water supply infrastructure and instead use water conservation methods?	Lr	No

Thunder Bay has developed a living document entitled the Community Environmental Action Plan through EarthCare. This document takes an integrated approach to promoting a more sustainable community and has the goal of focusing the energy, involvement and collevtive wisdom of the community in securing local environmental health and improving the social and economic well-being of future generations. The section of the Plan that addresses water use explains the soft path and its principles, and proceeds to outline objectives and proposed actions the city aims to introduce. These objectives and proposed actions include building watershed partnerships that enhance stakeholder roles and responsibilities and encourage a soft path approach to water resource management, promoting the collection and analysis of data and, finally, creating education and awareness programs to establish community standards. The Community Environmental Action Plan through EarthCare is used by the city when making decisions which relate to water and has clear sustainable guidelines.

Although water sustainability is a clear goal for Thunder Bay, water conservation is not. There are no documents stating that the city is looking to conserve water. Some interview participants believe that the city is not really interested in water conservation. "The way that my manager explained it," said one interviewee "is that anyone who wants to pay for the water can have it." That being said, the city does utilize a form of water conservation plan. It is not a living document stating objectives and proposed actions, but rather programs delivered through EcoSuperior. These programs include the Toilet Replacement Rebate Program and the Rain Barrel Program. The former program offers residents an incentive of $125 to replace an existing water-guzzling toilet with a water-efficient model and the latter makes rain barrels available to the public through EcoSuperior at the subsidized price of $65.

Backcasting is not incorporated as a planning method in the case study. When interviewed, City staff did not have an understanding of backcasting or how it could be implemented and stated that it was not a current method of planning.

The City of Thunder Bay Water Authority Financial Plan clearly projects that operating costs to be maintained in 2010, increased 1.5% in 2011, 2.0% in 2012 and 2013, with inflationary increases of 3.0% thereafter. In total, capital infrastructure investment for the drinking water system up to 2030 is expected to be around $200 million. The financial plan mentioned means of obtaining monetary funds to help pay this cost of upkeep; they included operating revenues, one time government funding and incurring new debt. Conservation methods are not mentioned. The City plans on up-keeping our current supply infrastructure and will require consumers to assist in paying for this.

Table 11: Financial Capacity Indicators (Note: 'Lr' represent the literature as the source and 'I' represents the interviews)

Capacity	Indicator Question of Capacity	Source of Indicator	Is Indicator Present within Case Study area?
Financial	• Is the water institution able to maintain a balanced budget from year to year?	Lr	No
	• Does cost-benefit analysis allow for conservation	I	Unk
	• Does the city's water institution receive funding from outside sources?	Lr	Yes And No
	• Do water rates for customers reflect the full cost of protecting and providing municipal drinking water?	Lr,I	No
	• Is funding available for municipal water conservation programs?	Lr, I	Yes
	• Are there incentives for consumers to use less water?	I	Yes
	• Are there any foreseeable costs which will need to be addressed?	I	Yes

The City of Thunder Bay Water Authority Financial Plan has $200 million in total capital infrastructure invested in the drinking water system up until the year 2030. The city is therefore not able to maintain a balanced budget until this debt is repaid.

The only money set aside for water conservation, according to the City of Thunder Bay website, is for the toilet rebates and for the subsidized rain barrels. There is a limit on the amount of toilet rebates given and rain barrels that will be subsidized as there are times throughout the year when the toilet rebate program is closed and the rain barrels may sell out in a given year.

There has been no analysis undertaken which compares the costs and benefits of conservation and current supply schemes. Interview participant 'J' suggested Thunder Bay needs long-term cost-benefit analyses with the inclusion of environmental benefits from avoiding new water supply schemes, but as stated by participant I, if the savings in achieving conservation are worth the investment required to get there, then it's a good idea but if the cost in achieving the reduction is more, then it isn't. In other words, if residents are not using enough water, then the city will not receive enough money to pay for the upkeep of their supply infrastructure and water conservation will not be seen as a feasible goal for the city. That being said, a cost-benefit analysis of conservation vs. consumption has not been completed, so it is hard to say what is really best for Thunder Bay.

Thunder Bay's Water Authority may be eligible to receive funding from outside sources, in the form of one time government funding; however, although this type of funding is projected, long-term government funding is not assumed in creating a financial plan. It is not a certainty that funding from outside sources will be received so Thunder Bay doesn't rely on these outside sources as a source of income.

Although water rates in Thunder Bay are rising, many of those interviewed agreed that the price residents and businesses pay for water is still not enough. They noted that "water is still a relatively cheap commodity."

The only two water conservation incentive programs Thunder Bay funds are the aforementioned toilet rebate program and the rain barrels, both programs carried out through EcoSuperior.

The Water Authority Financial Plan did not outline any foreseeable future costs, however, many interview participants pointed out that there will be higher costs for treating water as a result of more stringent criteria put in place, expensive technologies used to filter out organic and inorganic chemicals and further infrastructure improvements and maintenance.

Table 12: Technological Capacity Indicators (Note: 'Lr' represent the literature as the source and 'I' represents the interviews)

Capacity	Indicator Question of Capacity	Source of Indicator	Is Indicator Present within Case Study area?
Technological	• Are high-efficiency appliances (e.g. toilets, washing machines) included?	I	Yes and No
	• Are high-efficiency fixtures (e.g. showerheads, faucets) included?	I	No
	• Are automatic irrigation systems mandated to include controls and sensors to reduce unnecessary watering?	I	No
	• Has an effort been made to emphasise low water use landscapes?	I	Yes and No
	• Is anything being done to implement low-impact development?	I	Yes
	• Are leak detection systems included?	I	Yes
	• Is there a leak repair program?	I	Yes

Thunder Bay provides rebates for high efficiency toilets, but not to purchase or retrofit existing high efficiency water appliances and fixtures such as washing machines, showerheads and faucets. That said, Union Gas and the City of Thunder Bay will provide a free showerhead and aerator to those interested through the Union Gas Conservation Kit and the City of Thunder Bay Water Saving Initiative.

It is not mandatory for homeowners and businesses to replace irrigation, automatic rain gauges and soil sensors for irrigation systems; however, the Net-Zero Business Guide for Thunder Bay, written by EarthCare, does suggest that water can be saved by disabling any associated automatic timer systems and by using sprinklers only when absolutely needed. They also point out the option of xeriscaping; low water use landscapes designed to look attractive that do not require as much water. As well, they suggest using rain barrels for all outdoor watering needs. While controls and sensors on automatic irrigation systems and low water use landscapes are mentioned in the Guide, there is unfortunately not a very strong effort on the part of the city to make these activities more common in. Solutions exist but because they are not mandatory they are not utilized to their full potential.

Quite a bit is being done in Thunder Bay in regards to Low Impact Development (LID). Four locations where innovative and LID stormwater management technologies have been applied in the City are the Thunder Bay Regional Health Sciences Centre, the Sister Margaret Smith Centre, the McIntyre Building at Confederation College and Bare Point Water Treatment Plant. A new pilot project is also being built on the corner of Beverly St. and High St. This stomwater retention and management area will help mitigate flooding issues and will help with water quality. In addition to keeping excess water out of storm sewers, the site will also trap pollutants and chemicals and keep them out of the storm system.

Thunder Bay's water distribution operation and maintenance activities do include leak detection and repair. Through the use of electronic locating equipment, the City has been able to reduce water loss through proactive leak repairs. The cost of the program to the City of Thunder Bay is around $80,000 per year. During the several years the program has been in operation, significant leaks have been detected. Although Thunder Bay has not metered water loss and is

not able to estimate the savings achieved over the last ten years, the City is confident that their approach does promote savings and is effective. By implementing these practices for leak detection and repair, Thunder Bay has reduced water loss in its distribution system and improved the condition of the system resulting in savings for water treatment and pumping requirements.

5.3 Goals and Recommendations for Thunder Bay

As the case study demonstrates, it is possible to successfully use indicators to determine which elements of institutional capacity are present or lacking in a municipality for implementing the soft path. It was possible, through the indicator questions, to gain a fairly good idea of the strengths and weaknesses in the case study in regards to institutional capacity. The following are a list of the strengths and weaknesses obtained through the analysis:

Strengths

Societal Capacity

- Thunder Bay meaningfully involves the public in its decision-making.
- Thunder Bay conducts public education and outreach on water conservation.
- People's attitudes are challenged on the myth of superabundance.
- Younger generations of water users are being educated about water conservation and the wise use of water.

Technical Capacity

- City staff has access to current water demand data and population data.
- Staff and other stakeholders share information and data with each other.

- Staff has the ability to keep up-to-date with water conservation research and developments.
- City staff is aware of new types of water management, such as the soft path.

Political Capacity

- Water conservation is promoted by one or more elected officials.
- The City has active partnerships with other municipalities.
- The City maintains an active partnership with a conservation authority.
- Thunder Bay takes the initiative to become a leader for other municipalities on new, innovative strategies for water management.

Institutional Capacity

- Thunder Bay has a stated goal of becoming sustainable.
- Thunder Bay has a very limited water conservation plan.

Financial Capacity

- The City's water institution may be eligible to receive funding from outside sources.
- Funding is available for municipal water conservation programs.
- There are incentives for consumers to use less water.

Technological Capacity

- High-efficiency appliances such as toilets and washing machines are included in the city's action plan.
- An effort has been made to emphasise low water use landscapes.
- Low-impact development is part of the city's action plan.

- There are leak detection systems put in place.
- A leak repair program exists.

Weaknesses

Technical Capacity

- City staff should have data on future population and water demand projections.

Institutional Capacity

- Thunder Bay has not set long-term goals for water conservation.
- Thunder Bay should create an active water conservation plan.
- Backcasting should be incorporated into planning future goals for water conservation.
- Thunder Bay should be willing to limit construction of new water supply infrastructure and focus more on water conservation methods.

Financial Capacity

- Water rates should reflect the full cost of water provision.
- Thunder Bay's water institution needs to be able to maintain a balanced budget from year to year.
- Cost-benefit analysis will allow for conservation.
- Future foreseeable costs will need to be addressed.

Technological Capacity

- High-efficiency fixtures such as shower heads and faucets should be made mandatory.

- Automatic irrigation systems should be mandated to include controls and sensors to reduce unnecessary watering.

The literature has outlined a number of barriers and opportunities that are associated with the implementation of soft path. The five main barriers indicated by Jordaan et al. (2009) were attitudes and perceptions, financial, policy and governance, organization and management and data and information. A wide variety of barriers also emerged from some of the themes addressed in the interviews. These barriers were part of some of the themes that emerged from the interviews. In regards to human resources, what stood in the way of change occurring was a lack of local heroes and champions who would devote themselves to making change happen. One large barrier was public perception about water, whether it was the low cost of water which gives a false sense of security or simply a fear of change. This barrier existed not only at the public level, but also at the municipal level. It was widely viewed by the interviewees that there was a lack of understanding on the part of decision makers, that they do not clearly understand the concept of 'soft path' and therefore do not make the appropriate changes to city bylaws that could significantly change the way water is managed. Finally, the largest barrier discussed by interviewee participants was finances. It was found that the low cost of water does not reflect its true value to consumers.

All of these barriers discussed by the interviewees are reflective of the barriers discussed in the research done by Jordaan et al. (2009), with the exception of data and information. The following section will explore each of the identified barriers.

Attitudes and Perception

As is evident in the literature, people see change as a hindrance. This was exemplified in the study conducted by RBC and Unilever (2011). Many Canadians do not perceive water as a precious resource they need to care for. They feel there is so much of it available that polluting or wasting it isn't an issue. This is just one example among many of how people form attitudes and perceptions out of ignorance and an unwillingness to change their ways of thinking. This type of mindset was also brought up in the interviews. The interviewees felt that perceptions of both citizens and municipal workers were a significant barrier in creating change. They saw residents view water as an abundant, inexpensive resource. Unless those residents notice a change in their water bills, there will be no significant behavioural change in how they think about and utilize water. The same hindrance was an issue with municipal workers. The participants believed that those in a position of decision making are often stuck in older ways of thinking and they are not keen on learning new concepts, in this case the soft path.

Organization and Management

Jordaan et al. (2009) viewed organization and management barriers occurring when people of different backgrounds and disciplines worked together but could not agree on certain decisions because of this gap in their understanding of one another's knowledge. This exact situation was not brought up at all in the interviews, however other themes which dealt with other types of organization and management were. The major idea acknowledged was that there is a need for local heroes and champions within management. There is a lack of these types of people who provide motivation and who will ensure new changes are made. These types of

people need to be in administrative roles and leadership roles within utilities and would encourage new and better changes.

Financial

The financial barrier noted in the literature maintained that if soft path were to be implemented, it would cause a reduction in revenue for water utilities, which would discourage decision makers from making soft path a component in management. This type of financial barrier was pin-pointed as a cost-benefit analysis of Thunder Bay's future. It is slightly different from the literature in that it looks at the cost needed to create change instead of the cost produced as an outcome of usage. They are still very similar, however, in the respect that they both deal with finances and will both affect decision makers' opinions of soft path. In the interviews, it was noted that if savings in achieving conservation are worth the investment needed, then it would be a good idea but if the cost to achieving reduction is more, then it would not be a good idea. Everything comes down to cost-benefit and if the city's water utility does not benefit from a change being made, then there really is no incentive to create this change.

Also not discussed in the financial section of barriers mentioned by Jordaan et al. (2009) is a fact brought up by many interviewees which is that water is simply too cheap. The price that customers pay for their water is not enough to reflect the true cost of treating it, delivering it to the tap, and managing it after they are done with it. This financial issue is really a barrier in creating change because no incentive exists for people to use alternative technologies in order to be more efficient with their water use. The technologies are more expensive than the water itself so why should they buy them? People really only stand up and take notice of their water use behaviour if they see it reflected on their water bill. Full cost accounting needs to be

implemented in order for people to realize their actions and possibly make simple changes around their homes that are more reflective of soft path.

Data and Information

Data and Information barriers are related to the gaps in data available. Whether the data is under private ownership or historical data is non-digitized, there are issues with obtaining useful data needed to make changes. Although this lack of information was seen as a barrier in the literature, it was not by the interviewees. In fact, no one brought up anything related to missing pieces of data or information that could hinder making a change in water management possible. Whether no one thought of this as being a possibility or whether there really are no gaps in Thunder Bay's data, or that of other cities that took part in the interviews, is unknown, but either way it was not mentioned and therefore is very likely not a major impediment in implementing the soft path.

Policy and Governance

There is a fairly strong correlation between what the literature viewed as barriers to why the soft path, or any type of change in the way water is managed, is not easily incorporated into everyday practises and what the interviewees viewed as barriers. The literature viewed attitudes and perceptions, organization and management, financial, data and information, and policy and governance as the five biggest barriers to implementing soft path. The interviewees did mention these same themes with the exception of data and information, although their descriptions of the barriers differed somewhat. This variance can be expected because theory is different from practise, as has been identified by the theory-practise gap. Now that the barriers have been

identified by both the literature and the interviewees, it is important to learn how they might be overcome.

If Thunder Bay is to overcome the weaknesses and barriers it faces in regards to implementing the soft path, changes will need to be made by both the citizens who use water and those who manage it. Based on the literature and the interviews, a few recommendations and goals can be developed. The following is list of recommendations that can be used by city officials in their attempt to implement the soft path. They are divided into the capacity types as developed from the literature review:

Political Capacity Recommendations

- Thunder Bay needs local visionary heroes and leaders in administrative and leadership roles within utilities as well as elected officials. People in the organization that are willing to make a push and slowly yet consistently pursue the agenda are critical to change. The Water Working Group is a great example of leaders who are pushing for change to happen and their thoughts and suggestions should be taken seriously by management.

Social Capacity Recommendations

- An informed public is necessary to the implementation of the soft path because it is the public who will be required to make changes to how they view and use water. There are plenty of ways for water users to become more informed about the sustainable use of water, including creating recognition programs, encouraging the public in the design of new water policies and review of alternatives to new infrastructure and creating more rebate programs for better types of technologies that save on water usage such as composting toilets or front-loading washers.

Institutional Capacity Recommendations

- Small workshops can be conducted in the City. Friends of the Earth Canada has a workshop module, a useful tool for filling in existing information so that a discussion can focus on the future, not the past.

Technical Capacity Recommendations

- City planners need to be aware of water use on an individual level in order to better identify what is preventing people from changing their behaviours. For example, why do people over water their lawns? Do they not know about alternative groundcover? Is there peer pressure from neighbours, a lack of information about the water needs of soil? Market research and better techniques to understand individual level barriers is needed so that policies and regulations can be changed to meet the true needs of water users.

Technological Capacity Recommendations

- Low impact development and less hard infrastructure should be a goal for the city. These could include rainwater harvesting systems or rain gardens.

- Flow metres within the distribution system to measure water in and identify water loss at the time of an event.

- Changing the types of landscapes planted and installed could be a great and fairly easy way to reduce water, or at least the quality of water, needed to maintain a lawn.

Financial Capacity Recommendations

- A complete short-term and long-term cost-benefit analysis with the inclusion of the environmental benefits of avoiding new water supply schemes should be conducted. We need to understand what the reasons are for us to conserve and we can do this by quantifying it. We

need details to determine exactly what we are going to achieve by using water more sustainably. A business case needs to be made for why the soft path is necessary.

Goals

Thunder Bay is already making significant changes to become a wiser user of water. Through its programs with EcoSuperior, the new stormwater master plan, the development of LID projects such as rain gardens and the innovative thinkers who make up the Water Working Group for EarthCare and who come up with ideas to improve all aspects of water in the city, Thunder Bay is well on its way to creating a soft path approach to water management. The answers for the city are not going to be black and white. The changes made need to be created based on a practical point of view, not an ideological one. This can be accomplished by looking at the specifics of an individual location and answering questions based on that.

After a thorough review of the literature and interviews with those in the water management sector, three main goals for the City of Thunder Bay can be developed that are practical achievements for the city, yet still very important in the implementation of the soft path.

1) We need to understand our reasons for conserving by quantifying it. What exactly are we going to achieve by using water more sustainably? By evaluating, understanding and looking at specific reasons for conservation and efficiency and then quantifying it, we will treat the soft path as a practical approach rather than just an ideological one. One way this can be done is to hire a company called Econics. For a fairly low price, Econics helps municipal water service providers and other agencies to set rates, control demand, forecast revenue, manage infrastructure and engage with municipal councils and the community. The company has worked with many local governments, as well as provincial and federal governments,

associations and non-for profits. Econics can help Thunder Bay to quantify everything associated with water which is a critical step if the soft path is to be implemented.

2) Thunder Bay's second goal should be to articulate a collective vision for a new water future through public engagement. Public engagement can be achieved through outreach at community events in order to identify a vision for the future of water in Thunder Bay. Questions such as "How do you want to live in the future?" might be asked. This can even include the opinion of children and businesses. The public events will provide key learning for in-depth public engagement. Best practices, attitudes towards the value of water, how people will live and work in the future as a context for future water use and new water strategies can result from these public events. Instead of merely asking open-ended questions about how individuals feel about water or their thoughts about the future of water, people need to tap into a broader conversation about the future of water. Questions that are philosophical and belief-based identify ideal water futures. Thunder Bay can follow in the steps of York Region and set up 'Water Cafes,' whose objectives can be to generate ideas using design or creative methods to deepen the probe and widen the range of options available for consideration for the future of water and to inspire new visions, perspectives, contexts, patterns and possibilities for the future of water.

3) Through the use of backcasting, Thunder Bay should be creating long-term water management strategies which set goals for certain targets such as "No New Water." These strategies should include the implementation of program components and a schedule and have a specific budget set aside. 'Road maps' can be created to outline specific goals the city wants to achieve and detail how they will be completed. Fergus-Elora in the Township of Centre Wellington and York Region are both already using these strategies for their water management

and are great examples of cities Thunder Bay can look to for ideas. While Thunder Bay does have a few examples of water soft path approaches, they are not in place because of a specific goal set to achieve a sustainable use of water. The City should be experimenting with backcasting exercises which will require major inputs such as total annual average daily demand, current water demand for each sector, current and projected population and target future water demand. The Quickstart Guide for the Watersmart Scenario Builder is a soft path analysis tool which can help with these calculations of desired futures. Along with these backcasting exercises Thunder Bay might create 'road maps,' specific actions needed to reach the desired future developed.

Chapter 6 Conclusions

The purpose of this study was to research the following three objectives: (1) identify city policies and programs that are currently in line with supply management, demand management and soft path management (2) examine whether Thunder Bay has the institutional capacity to implement a water soft path approach and (3) produce goals and recommendations for a soft path management plan in Thunder Bay.

In an attempt to achieve these objectives, it was first necessary to define certain concepts, as occurred in **Chapter 2** of the literature review**.** Here, supply management, demand management and the soft path approach were discussed. The concept of capacity was introduced and defined and five dimensions for capacity were developed. In the process, preliminary indicators for institutional capacity were derived from the literature.

Once merged, the preliminary indicators and the knowledge obtained from the interviews gave birth to six capacities of final indicators: social capacity, technical capacity, political capacity, institutional capacity, technological capacity and financial capacity. These frameworks of final indicators are presented in **Tables 6-11.**

A case study for water management in Thunder Bay, Ontario was evaluated and discussed according to the framework of final indicators in **Chapter 5**. The study demonstrated that the framework could be meaningfully applied to a real-life situation and allowed for identification of what elements of the case study needed or did not need improvement for the implementation of soft path. The indicators are grouped into themes based on the type of capacity they fall into. The indicator questions that accompany these types of capacity are intended to determine

whether or not the indicator is present in the case study's municipal water management institution.

6.1 A New Water Future for Thunder Bay

The framework of indicators for soft path implementation is intended to be beneficial to municipal water managers as a real way to help shift the paradigm towards sustainable water and wastewater systems in Thunder Bay. This study assumes that difficult issues can be resolved and that there are many ways to resolve them.

There are many short-term, practical solutions proven to provide a reduction in overall water usage but these have not yet been fully implemented in Thunder Bay. They include water metering for all residences and businesses and making mandatory the retrofitting of high-efficiency appliances and fixtures in homes, businesses and institutions. These solutions are simple yet good places to start the paradigm shift because they don't require much behaviour modification from consumers.

Another way to shift the paradigm is by advocating for water conservation through community-based social marketing that explains to the public how water is used and why it is needed in the first place. Marketing directed at homeowners must be personalized, showing them how using less water will lower their water bills and help them save money. Saving money is the biggest incentive for people to reduce their water use; however, there are some barriers which prevent water users from realizing the full cost of water they use. The first is that water bills don't reflect the true cost of water. Although the cost is still being paid by municipal taxes, the true cost is 'hidden' from view. Social marketing should be utilized to make individuals aware that there is a cost for water and how it is being paid for, and as well to dispell the myth of

superabundance. Although not every community in Canada is experiencing a water shortage, water conservation today can reduce the impact of water shortages in the future and can make Canadian cities better prepared for future uncertainties like climate change.

If a successful water conservation program is to be implemented, a dedicated, full-time and qualified staff will be required. In order for them to give informed and effective recommendations to decision makers, this staff should have access to up-to-date data which is regularly monitored for accuracy.

Water management in a city should encompass a long time period. If water management decisions are made based on just one fiscal year they do not allow for the benefits of water conservation to be appreciated.

One of the most effective ways to provide incentive for the reduction of water usage is to implement full-cost pricing of water. Full-cost pricing would mean that drinking water is not subsidized by municipal taxes and the full cost of providing drinking water is reflected in consumer's water bills. This would include the cost of water treatment, distribution, maintenance and source water protection. This action would give consumers better price signals of when to change water supply and demand and when to reduce waste water. One of the difficulties with implementing full-cost pricing would be political opposition. If a politician decides to implement an action which will greatly increase consumers' water bills, there is a great chance they will not be re-elected. Very likely, full-cost pricing will not be a municipality's first choice for action unless they are forced by a higher level of government to do so, or there is a sudden crisis in water supply that will require a drastic change. Much water is wasted by consumers due

to the fact that they don't fully pay for the cost of the water they are using and this creates economic, social and environmental costs to society.

The research found that in some cases, a municipality may actually want to increase water usage in order to increase municipal revenue. This is because water conservation could cause revenue loss. Selling water to gain revenue is however, a short-sighted strategy. By implementing water conservation efforts, the money made from selling water in the short-term can be offset by overall money saved in the long-term. Increasing water demand can also lead to the need to build more expensive infrastructure in the future, so although there are short-term benefits, there are long-term costs which follow.

It is important for a triple bottom line to be analysed when making water management decisions. Decision makers should be thinking not only about economics, but also social and environmental considerations when creating a sustainability framework for water conservation.

Overall, this research suggests that Thunder Bay is an area in which the soft path can be implemented. Social, technical, institutional, financial, political and technological changes have to be made in order for this to happen, but there is a need for change. Supply management is not a sustainable way of using water and we can't be blind to future generation's needs, as they will require water just as much as we do. It is up to present generations to not misuse or mismanage water to the point where ecosystems and future supplies are put at risk.

6.2 Broader Applications of the Research

Although this research sought to determine the indicators of institutional capacity required to implement the soft path in Thunder Bay, aspects of this research can exist beyond solely Thunder Bay. The sustainable management of water can occur throughout the world in

the form of water soft path; the only difference is the specific path taken. Different cities have different desires for their water future and therefore will have different policy and program combinations which will lead them to the desired future. This research defines the institutional capacity in the case of Thunder Bay and although this may differ for other municipalities, the soft path mind-set is the same.

It should be a lesson to all municipalities that changing water management strategies to reflect soft path, although likely an unfamiliar process which requires time and effort, is something that has the potential to improve cities ecology, social connectedness with the environment, and future water reserves. As in the case of Thunder Bay, soft path does not necessarily need to be implemented with a sense of urgency. This is one situation where the institutional capacity is present which allows aspects of the soft path to exist and although Thunder Bay is not in a position that requires immediate action, small steps can and, very likely in the near future, will be taken which will move us in that direction. Municipalities do not need to feel pressured that they have to be either 100% soft path or not at all.

Second, this research indicated certain capacity indicators that should be present in a municipality for soft path to be implemented; these included social, technical, political, institutional, financial, and technological. Each of these capacities had indicator questions which help to understand if the capacity is present by answering 'yes' or 'no' questions. If a municipality is interested in moving towards the soft path, they should begin by understanding where their city currently stands, based on the answers to these questions, and from there make decisions about what they think they are capable of achieving for their future. These indicator questions developed in this research are a useful tool for determining the institutional capacity of adopting the soft path in ***any*** city.

Finally, this research has identified many tools which currently exist that are useful for municipalities. The first is The Water Smart Scenario Builder, which is a spreadsheet-based calculator that allows users to explore the potential for water savings through the application of water efficiency and conservation measures. The Scenario Builder is designed to develop and test various future water scenarios using a backcasting framework. The calculator is not intended to replace a detailed conservation audit or water efficiency plan, but assists communities with a preliminary evaluation of various scenarios under a water soft path planning approach. In addition to the Scenario Builder, a list has been developed which aids in creating a soft path plan. These steps include identifying water services, adopting a projection for the region, establishing a desired future condition, analyzing water quantity and quality, reviewing water supply options, backcasting, and finally to write, talk and promote. These steps and further explanations to their meanings can be found in the Annex of The Soft Path for Water in a Nutshell (Brandes and Brooks, 2005). These are just two of many more tools that exist to help municipalities begin their first steps to the water soft path. Help is available for anyone wanting to move towards the soft path; what is really needed, which is lacking in most cities, is the motivation to seek out this help and create a change.

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Appendix A – Level I Interview Codes (Interview Sources)

Change in paradigm, community mindset (A,E,G,H)

Changing perspectives

"We need to change perspectives from a modern way of thinking to a more progressive way."

"You have to do a huge amount of learning and you have to change how you're doing things which are uncomfortable because what if that new thing doesn't work, you know what works so the tendency is to not change."

"People think that because we live beside the largest freshwater in the world, we can take it for granted. People's attitudes are a problem."

and

"They don't understand that there's a cost to running water when brushing your teeth, that there's an impact to that behaviour."

"People respond to things when it costs them money. They need to notice a difference in their water bills for a behavioural change."

Education (B,C,D,F,H,J,M)

"Educating people on what the soft path approach is, what green technologies or LID technologies are out there."

"I think there's lots of education opportunities where pollution prevention, proper disposal of hazardous waste, making people aware of the street drain system."

"We need to have a general understanding of what soft path is which can be overcome by education of what it is and how to achieve it."

"Because I think people would not do bad practises if they honestly knew that it's a bad thing."

"Education with young people is where it's possible to plant the seeds. Efforts with education of young people and their water habits is being done but we won't know until about 20 years if this has worked."

"People came educated to these public consultation meetings with ideas and examples from other jurisdictions of what we should be doing."

"We work with customers to increase technical knowledge. We do this by providing tools, information and incentives."

Public participation (I,J)

"We need participation, we need awareness, we need solutions that resonate with the community itself."

"…there was a great amount of community support to grow within our resources and means locally."

City taking a lead (B,E,G,M)

"A better enforcement tool is carried on with the city taking a lead and doing these projects on our own and informing the public and the developers that are doing it."

"The city council, city manager level needs to say 'when you're looking at water management we want you to consider these things and incorporate these things into your plan."

"A better enforcement tool is carried on with the city taking a lead and doing these projects on our own and informing the public and the developers that are doing it."

"We do stormwater reuse on our own sites such as golf courses and other recreational sites."

And

"Our goal is to lead by example. We've made upgrades to our water treatment plant to reduce water rive withdrawals by 10%."

Lack of understanding/awareness (D,E,I,)

"It doesn't have to be labelled soft path to be effective. So I think the term itself, people are against it whether they know what it is or not I think there's a misconception of what it is. It's not a known term and I think that's part of the issue."

"The city doesn't want to commit to soft path because no one understands it."

"The most common barriers are lack of understanding of soft path concepts…"

Existing bylaws and development standards (C,G,M)

"I guess a lot of it has to do with existing bylaws and existing development standards."

"Changes need to be made to the city's requirements, say for a developed area like a subdivision."

"We can only help customers match quality to use within the confines of the regulations that are before us."

And

"We follow a triple bottom line approach in our decision making. We take into consideration economics, social and environmental impacts."

Elimination of summer watering

restrictions (C,F)

"We used to have summer watering restriction, but that was eliminated a few years ago because they weren't using enough water to have the plant operate effectively. The city is not that interested in water conservation"

"If you were wisely watering your lawn that's what you would do. But what we found is that's what would happen. People would not and then put three times as much. But we weren't able to say…well how can you say use a little bit today and a little bit tomorrow if we only have a conservation program? So now we have a wise use of water program. So you can water your lawn everyday but please only put this much on. Put this much on today, just enough to keep it fresh, that's all you need."

Training/Workshops (A,B,C,I)

"Training up those decision makers. Sending people who are overseeing this stuff to some pretty phenomenal training. It's amazing what those kinds of experiences can do."

"The City also puts on seminars throughout the year to train people to let them know there's technologies out there and to show them the benefits of it."

"Locally, we've had good success with public hands on workshops, giving them training and tools they need to conserve water. It's hands on where it's 'show me' rather than 'tell me.'"

"Workshops for water professional and local politicians to work out and compare alternative water futures for the city."

Becoming a leader with other cities (A, B,)

"Thunder Bay does have Lake Superior, we do have a large supply of water, that doesn't mean that we, as a leader in Northwestern Ontario,

shouldn't be taking the charge to show other cities how they can be efficient with their water."

"Cities like to see how well of a leader they are being to others and how well they're doing in the race."

Local heroes, champions (A,I,L)

"We have few champions and few great examples near us to motivate us and to encourage us as a greater community and corporation on how we can do better."

"Look for media champions and political champions who can ensure WSPs get the proper attention."

"We need to have visionary and brave leaders in administrative roles and leadership roles within utilities and also elected officials need to show leadership and bravery."

Pilot projects (B, K,M)

"The City has a few pilot projects and we invite the public and developers who want to see how they're built, designed and what they look like in the end."

"We would like to set up pilot systems to demonstrate the better use of greywater on landscape and address some of the health concerns that might be associated with it."

"We do have a few projects where we are using wastewater effluent, so reclaimed water, and that's used for industrial purposes."

Rain barrels, low-flow toilets, showerheads, washing machines, xeriscaping, leak detection (H,J,K)

"In homes, the 13L toilets must be changed to 6L, showerheads changed to low-flow, washing machines should be front-loading, and xeriscaping should be done."

"If we look at a residential focus and

use in the home, essentially we look at clothes washing, toilets, and showering as what are the largest pieces of the pie and what are the most cost effective solutions to reducing household water use."

"So there's a lot of emphasis on trying to get people to take out their turf and put in these low water use landscapes."

Low impact development (B,D,J)

"Again I think a large part of the stormwater master plan should be green technology, LID, soft path, less hard infrastructure, not just bigger pipes. Like we're saying, try to keep the pipes that we have and reduce the flows coming in to keep the infrastructure the way it is."

"Low –impact development is another term people may not understand. I mean it really is just, instead of using infrastructure to treat something for instance, why not just use rain gardens and depressions in plants for instance."

"…the reallocation of costs among customer groups and what might be incentive models for those choosing to install rainwater harvesting systems or rain garden or other kind of LID practises, there's a whole frontier of conservation there that shares a similar business case as the water and wastewater side of things but I think is a great opportunity for us moving ahead."

Leak detection (J, K,M)

"Leak detection is certainly a very cost effective venture for municipalities in the fact that if there's water being produced and not sold."

"It's estimated that roughly 10% of the distribution systems of water is lost in those pipes and we have a number of programs to help water suppliers tighten up and replace older pipes so

that there's less leakage and more efficient use of water." "Our aim is to be 100% metered by the end of 2014 which helps in non-revenue water monitoring for in the system because of leaks."
Cost-benefit (G,I,J,) "Thunder Bay's water future comes down to cost-benefit analysis: if the savings in achieving conservation are worth the investment required to get there, then it's a good idea but if the cost in achieving the reduction is more, then it doesn't" "Better long-term cost-benefit analyses with inclusion of environmental benefits from avoiding new water supply schemes" "We've defined benefit as something that's tangible to the public or local politicians" **Incentive based methods (C,G)** "We would need strong financial incentives for every sector for a drastic reduction in water use" "Well locally we've had good success with incentive based methods which include the toilet rebate program" **Full cost accounting. Rates that reflect true cost of water (F,G,J,K,L)** "Pricing water right reinforces conservation and ensures sustainability of required utility revenue" "Water is still a relatively cheap commodity" "People are paying far too cheaply for water" "When a person gets their water bill it should reflect not only the cost to get that water delivered to their tap but also the cost to treat it and manage it after they're done with it"

"The price of water is too cheap and as a result the alternative technologies, decentralized systems, on-site systems, even simple indoor technologies, it's just not worth it to spend that kind of money when water is so cheap"

Infrastructure (D,E,F,L)

"As infrastructure ages there will be maintenance so costs could go up in that vein"

"Infrastructure improvement is going to cost money"

"We've had to accelerate water price increases because there wasn't enough money to maintain costs and we were on a path where everything would have broken down at the same time"

"Raising the rates is a virtuous cycle because it helps us overcome our infrastructure deficits"

More cost in future for treatment (C,D,F,G)

"If the price of water does go up it will be to account for the higher cost of treatment"

"The prices will probably increase as more stringent criteria is put in place"

"In the future there will be more expensive technologies than simply sand filtering or membrane technology to take out certain organic and inorganic chemicals"

"I think where you're going to see more cost is at the water treatment end as opposed to the water delivery end"