TWO MODELS OF MULTI-LEVEL GOVERNANCE, ONE MODEL OF MULTI-LEVEL ACCOUNTABILITY: DRINKING WATER PROTECTION IN CANADA AND THE UNITED STATES

by

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ABSTRACT

This research examines whether binding national standards produce better policy outcomes for drinking water protection. The study involves consideration of four pairs of cases, one member of each pair in Canada (absence of binding national standards) and one member of each pair in the United States (presence of binding national standards). Through consideration of matched cases in Canada and the US, the work makes a compelling argument for greater federal involvement in Canada in this policy area that is largely under provincial control. Three hypotheses are examined and largely supported by the research findings:

1. As a result of the addition of federal involvement in 1974, the United States offers improved drinking water protection after 1974.
2. The United States offers better drinking water protection than Canada after 1974 as a result of binding national standards in the United States.
3. US cities offer greater consistency with respect to drinking water protection than the Canadian cities as a result of binding national standards.

This study argues that for best results, drinking water protection benefits from multi-level accountability. Overlap and duplication can be good for policy performance. Multi-level accountability, a form of type I multi-level governance, where governments monitor other governments in a hierarchical chain of principal-agent relationships might be considered an extension of the multi-barrier approach to drinking water protection. The application of a principal-agent framework offers a more sophisticated understanding of the relationships between provincial and municipal governments within Canada. Furthermore, it highlights the degree of hidden information within the Canadian federal system as compared with the US federal system. It also helps identify why binding national standards improve policy performance. The capability of the US federal model to offer enhanced drinking water protection turns on the distance of the federal government from the costs and the proximity of the state government to the local government agent. The study argues that federal involvement matters for policy performance in this policy area.

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I. INTRODUCTION, THEORETICAL FRAMEWORK AND METHODOLOGY

In Canada, over a one year period, the deaths of seven people and illnesses of as many as 9400[1] as a result of waterborne disease outbreaks in Walkerton, Ontario, and North Battleford, Saskatchewan, left many citizens wondering who to hold responsible (Walkerton Commission of Inquiry 2002, North Battleford Commission of Inquiry 2002).[2] National standards had been recommended by experts for several years,[3] but after Walkerton these pleas took on new meaning as environmentalists (Sierra Legal Defense Fund 2001), and politicians (Canadian News Facts 2001) including the Federation of Canadian Municipalities pointed to the need for binding national standards with the United States Safe Drinking Water Act (SDWA 1974, amended 1986, 1996) as a model.

Binding national standards have existed in the United States since 1974 when the Safe Drinking Water Act was passed by Congress. This thesis examines whether binding national standards produce better policy outcomes for drinking water protection. Comparing Canada and the United States offers an excellent opportunity to consider this question as both are federal countries with comparable economic resources, social preferences, and natural settings, including, in some cases, shared water sources. Yet the latter has binding national standards for drinking water while the former does not.

This work relies on a principal-agent framework to help explain why national standards might offer improved drinking water protection. Principal-agent models involve delegation by the principal to the agent with the principal's challenge to minimize shirking and avoid costs on the part of the agent. The agent has an informational advantage over the principal while the principal has the authority to impose costs on the agent. With its origins in economics, principal-agent theory provides a means by which to consider the incentives and disincentives of actors. In this particular study, the theory offers consideration of the information asymmetry and incentives at different levels of

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[1] According to the Walkerton Commission of Inquiry, 7 people died and 2300 became ill as a result of the Escherichia coli and campylobacter outbreak in May 2000. According to the North Battleford Commission of Inquiry as many as 7,100 people became ill in May 2001 as a result of the outbreak of cryptosporidiosis.

[2] Both Ontario and Saskatchewan held public inquiries into the tragedies. In response to the Walkerton Commission of Inquiry, successive Ontario governments committed to adopting all the recommendations of the Walkerton Inquiry resulting in the development of a complex regulatory and legal framework. Saskatchewan also passed new laws addressing drinking water protection but not to the extent of Ontario. Both Ontario and Saskatchewan introduced annual inspections.

[3] For example, in 1984, experts to the National Water Inquiry chaired by Peter Pearse called for "enforceable" national standards noting that the Canadian Guidelines were non-binding. See Chapter 6 for more detailed information.

government within federal models. Moreover, principal-agent models facilitate focus on monitoring and outcomes, aspects that are vitally important for this policy area.

The findings of this research suggest that drinking water is more reliably good in the US cases. There is also some indication of a reduced risk of waterborne illness. These findings hold for 3 of the 4 pairs of matched cities, in each case one member of each pair in Canada and one member of each pair in the United States. The exception appears to involve factors other than the presence or absence of national standards coming into play, in particular, community capacity. Even in this last set of cases, the framework sheds light on the cases and is useful for highlighting the issue of hidden information.

Application of the principal-agent framework focuses attention on information and costs. The capability of the US federal model to offer enhanced drinking water protection turns on the distance of the federal government from the costs and the proximity of the state government to the agent. The incentives within the US federal model make it more adept at uncovering hidden information as well as imposing costs to improve service delivery at the local level.

This chapter outlines the key concepts, theoretical framework and methodology used to address the research question. First, the chapter defines multi-level governance and multi-level accountability. Then a review of arguments addressing why national standards might (and might not) matter for policy outcomes is provided. Finally, the chapter presents the hypotheses derived from the principal-agent framework and outlines the methodology used in this work.

1.1 Multilevel Governance, National Standards and Policy Performance

A key conceptual distinction of this study is between multi-level governance and multi-level accountability. Gary Marks introduced the concept of multi-level governance to political science. Rather than applying conventional integration-focused approaches to understand the European Union, Marks was interested in examining the European Union as a political system. He defined multi-level governance as, "a system of continuous negotiation among nested governments at several territorial tiers" (1993:392). While the idea of multi-level governance has certainly existed prior to Marks' definition, increasing interest in multi-level governance has been the result of several factors: (1) response of citizens and governments to increasing complexity (2) the proliferation of jurisdictions including the increasing importance of subnational governments and (3) the challenges to state power including by non-state actors (Bache and Flinders 2004).

Correspondingly, within Canadian political science, increasing attention has been paid to both vertical (multi-levels) and horizontal (governmental-nongovernmental) aspects of governance. Moreover, federalism and intergovernmental relations are clearly longstanding interests of Canadian political science that are conceptually similar to multi-level governance. A distinction between conventional conceptions of federalism and of multi-level governance within Canada is that when one speaks of governments these are commonly understood as deriving their authority for jurisdiction from the constitution but if one wishes to include governments other than the federal and provincial governments - especially municipalities - "one must speak of levels" (Young 2005, Marks 1993).

Within the multi-level governance literature there is debate about the extent to which the study of multi-level governance should consider or focus on governments. A useful distinction provided by Marks and Hooghe (2004) involves Type I and Type II multi-level governance. Type I multi-level governance "echoes" federalism involving a "limited number of non-overlapping jurisdictional boundaries at a limited number of levels" with a focus on individual governments (Bache and Flinders 2004:5).By contrast, Type II multi-level governance is more fluid, includes non-governmental or non-state actors such as corporations, voluntary associations and so on along with governmental actors, and involves "innumerable overlapping jurisdictions"(Ibid.). Cameron and Simeon (2000:59) describe the phenomenon of multi-level governance in the following way:

> Federalism is just one example of 'multilevel governance' in which power and authority are distributed among a wide range of institutions and locations. These are not simply federal and provincial. Increasingly, they involve local and regional governments "below," and a vast array of international and supranational institutions "above."

Multi-level accountability might be considered a specific example of Type 1 multilevel governance in which the focus is on governments and where each level of government is accountable to each other level in a hierarchical chain of accountability that could be termed a chain of principal-agent relationships (see Moe 1984). Hierarchy is not an anathema to multilevel governance. Rosenau (2004:39) argues that the use of the terminology 'multi-levels' suggests hierarchy or 'structured layers of authority' he refers to as 'spheres of authority'. Jessop, too, notes that while the interest in multilevel governance may signal a shift to governance from governments it does so with an increasing role for governments in 'metagovernance' or the determination of the rules and

regulations surrounding governance (2004:65). For his part, Jessop is critical of this expanded role for governments explaining that 'governance' takes place in the 'shadow of hierarchy.'

Multi-level accountability emphasizes the vertical aspects of multi-level governance and turns attention to the inter-relationships among the levels or spheres of authority. In addition to needing multiple levels, the concept of multi-level accountability contributes attention to accountability defined as responsibility for one's actions (or inaction) with the expectation that one would be able to explain these actions (or inaction). Accountability is often focused on financial aspects but in keeping with the concept of governance it may be extended to encompass 'accounting for results.' Canada's Office of the Auditor General defines accountability as doing everything possible with your authorities and resources to achieve the intended results (Mayne 1999).

When we turn to consider drinking water protection, the concept of Type I multi-level governance is brought into starker relief as the role of municipalities as implementers of these types of policies is well-recognized especially in Canada, post-Walkerton. The concept of multi-level accountability as noted above might be considered one form of type I multi-level governance that involves levels of government monitoring other levels of government. Intergovernmental monitoring and compliance has been termed 'regulatory federalism' within American political science (Advisory Commission on Intergovernmental Relations 1984) and might also be understood as 'intergovernmental regulation' (Hill and Harrison 2006). Using the language of multi-level governance we may consider multi-level regulation a useful term.

However, multi-level accountability is not merely multi-level regulation nor intergovernmental regulation. Type I multi-level governance can be used to describe a provincial-local or state-local relationship without federal involvement. Multi-level accountability, by contrast, requires that there be more than one reporting relationship to ensure actions are carried out or will be carried out if another level shirks. Multi-level accountability as a form of multi-level governance distributes blame among three (or perhaps more) levels whereas federalism, another form of multi-level governance, may give rise to a situation of buck-passing (see Harrison 1996). I define multi-level accountability as a distinct form of type I multi-level governance involving (1) at least two regulators (e.g.,

federal as well as state/provincial)[4] (2) hierarchy in reporting relationships including with respect to the regulators and (3) defined roles and responsibilities within the hierarchy. In the sections that follow, this chapter further elucidates the concept of multi-level accountability using a principal-agent framework. Multi-level accountability is used throughout this work to describe the US model of intergovernmental relations under the Safe Drinking Water Act whereas both the Canadian and American models of governance with respect to drinking water protection can be termed multi-level governance.

Within conceptions of multi-level governance, the need for jurisdictional arrangements or specific roles for specific governments is not lost. One government could have primary responsibility for an area of policy as in federalism with federal and provincial powers or orders. To address the research question, the next section turns to the literature to consider arguments for federal jurisdiction and contrasting arguments for state or local level authority.

Following the Walkerton waterborne disease outbreak in Canada, Federal Environment Minister David Anderson expressed some ambivalence about which level of government should have primary responsibility for drinking water quality. In response to a question about national standards, he explained: "I reject the concept that because it's important it's automatically a federal responsibility. Sometimes provinces are better able to handle certain problems and sometimes municipalities are better able to handle certain problems" (Perkel 2000:9). Anderson's expression of ambivalence suggests that the concept of institutionalized ambivalence may apply to federalism as Tuohy (1992) has argued it does to other Canadian institutions. What does the federalism literature tell us about why the federal government might (or might not) outperform provincial or state or local governments?

The Canadian federalism literature tells us very little about policy performance. It might even be considered ambivalent on this question as it appears one is most often either an advocate of nation-building or of province-building (or a critic of both). Within the Canadian federalism literature, discussions of national standards have been largely absent. With few exceptions, Canadian federalism has focused on questions of intergovernmental

[4] The section that follows will note that the three-level hierarchy involves two principals in addressing its relationship to conventional principal-agent models. It is important to clarify that these are not 'multiple principals' in the way the principal-agent literature normally conceives. Multiple principals are argued to have the capacity to war against one another and their presence is regarded as often resulting in bureaucratic autonomy. In this case, the hierarchical nature of the relationship between the two principals, one of which is an agent of the other principal avoids this situation.

conflict or cooperation and the goal of keeping the country together rather than how well the country performs (examples of exceptions include Bakvis and Skogstad 2002, Harrison 1996, Banting 1987, Young, Faucher and Blais 1984). Canadian political science has tended to focus on how to best distribute responsibilities so that the country can remain intact rather than on which level would be better suited to delivery of services, regulation, and redistribution. Our goal has not been good public policy per se but the federation itself.

As noted above, for Canada, multi-level governance involves an expansion of the traditional understanding of federalism. Multi-level governance involves addition of governments below as well as above and thereby draws attention to the dynamics of decentralization and centralization within a federation. Multi-level governance is of concern for this research, and, in particular, the research asks whether the involvement of additional governments and especially the federal government results in improved policy outcomes. Thus, to consider arguments why we might expect national standards to matter (or not) for drinking water protection, the literature addressing the dynamic between centralization and decentralization, or what might be considered nation-building and province-building is important to examine within the Canadian context. Likewise, American political science offers debates about states' rights and federal powers which might be understood as debates about decentralization and federal authority. It is important to underscore that Canada is considered to be one of the most decentralized federations in the world while the United States is considerably more centralized. Discussion of this dynamic is addressed at greater length later in this chapter.

If we turn to the US, discussions of national standards with respect to the environment can be found within three main streams in the literature: (1) desire to avoid races to the bottom (2) comparisons of federal and state-level performance (functional federalism), and (3) debates about states rights versus federal powers. Work by Tomas Koontz (2002) comparing federal and state managed forests found that federal forests have greater capacity for environmental protection while state-level forests have greater economic profitability, timber outputs, and revenue-sharing with local governments. Other relevant work (Peterson 1995; Peterson et al, 1986) has argued that there are systematic differences between federal and state level outputs, in particular, that federal governments are better at redistribution and local level governments are better at economic development. William Lowry, too, examined pollution control policies and found that involvement of the federal government lead to greater dissemination of leading state efforts

while a lack of competition between states can result in fewer states exceeding federal guidelines (1992).

The race to the bottom literature that addresses national standards is concerned with avoiding interjurisdictional competition for capital that results in reduced taxation along with lax environmental and other standards (Pierson 1995; Peterson and Rom 1995).[5] This literature points to important questions about the local level as the level that is considered to be responsive (see Tiebout 1956). The literature also draws attention to considerations of fiscal federalism and the imposition of costs (Oates 1972; Oates and Schwab 1996; Markusen, Morey and Olewiler 1993; 1995; Landy 1999). Furthermore, the federal level is viewed as enhancing equity. The argument is that national standards ensure the general welfare of all so that economic and social well-being is not dependent on which state and/or local jurisdiction one resides in. As Danielson et al (1973:10) aptly explained, "For every state and local government that has served as an innovative laboratory, there are others that have stoutly resisted change."

In addition to enhancing equity, the federal government is seen as having unique authority distinct from that of the states (Koontz 2002), enhanced ability to deal with externalities such as air and water pollution (Ibid.; Portney 1990; Anton 1989), increased citizen involvement (Schattschneider 1960) and the willingness to impose costs on other levels of government (Landy 1999). Landy (Ibid.:248) suggests this last point noting,

> Rule enforcement is a relatively inexpensive task. Local governments, like their counterparts in private industry, actually operate polluting facilities – landfills, incinerators, sewage-treatment facilities, water systems, and power plants – all of which were required to make capital-intensive adjustments in order to comply with federal regulation.

Landy is a critic of federal involvement. He argues that environmental policy should be understood as 'think locally, act locally" (1999: 260).

Along these lines, responsiveness is a key argument regarding the benefits of the role of states or local level jurisdictions. In addition to responsiveness, it might be argued that unique knowledge exists at the local level. Those who suggest the local level enhances participation argue that America has a history of 'Jacksonian democracy' wherein citizens are involved at the local level to solve local problems about which they may have some

[5] For interesting work regarding races to the bottom within Canada see Harrison 2006.

expertise. It is considered more reasonable to have local citizens solving problems that directly affect them rather than 'distant officials' (Koontz 2002; Ostrom 1987; Oates 1972). Some argue that the local level is more capable of being responsive to citizens who can 'vote with their feet' by relocating in jurisdictions that provide preferred services and levels of taxation (Tiebout 1956). In addition, the local level provides a better matching of who pays with who benefits (Nelson 1995). The assumption is that more efficient government results when citizens compare costs with nearby jurisdictions and demand changes or move to more efficient jurisdictions. Most notably, Alexis de Tocqueville argued that local governance supports and maintains American democracy explaining, "A nation may establish a system of free government, but without the spirit of municipal institutions it cannot have the spirit of liberty" (Vol 1, Chapter V).

Furthermore, in addition to responsiveness and expertise, the local level is viewed as innovative (Walker 1969; Danielson et al 1973; Rabe 2002; Portney 1990). Having several jurisdictions try out different policies offers policy laboratories in which to test new ideas, some of which may succeed, ideas that it could be argued would not emerge if policy was imposed from the top. Most famously perhaps, in his classic work, Robert Dahl suggests that strong state and local governments facilitate "self-government at all levels" and thereby "greatly expand the opportunities for learning and practicing" democracy (1967:172; Danielson et al 1973:11). Pierre Trudeau echoed this sentiment underscoring the democratic ethos of the federal principle as permitting "each government to look after its share of the common good *as it sees fit*" (1968:80, emphasis in the original; see also Noel 1999:217)

In a somewhat similar vein, Noel (1999) has argued that the assumption the federal level would necessarily be more equity-enhancing than the local level is premised on notions of size mattering for democracy. While Noel concedes that a very small community may indeed be more homogeneous, parochial, and less diverse, he argues that the provinces and states cannot be considered "truly small communities," and therefore should not be viewed as such.

While the impact of national standards has generally not been interrogated directly, a considerable literature exists in both countries with respect to intergovernmental relations and arguments about which jurisdiction, federal or provincial/state should be responsible for particular constitutional powers. Within the Canadian political science literature, Edwin Black and Alan Cairns (1966; Cairns 1977) explained that the Canadian

provinces are engaged in 'province-building' and that they aim to extend their jurisdictional control while others have critiqued that argument (Young, Faucher and Blais 1984). Harrison (1996) has noted that within environmental policy both levels of government have declined to act in order to avoid blame for enacting stringent environmental regulations. Harrison's work, in part, addresses the question of Canada's poor performance with respect to the environment.

While Canadian political science has paid considerable attention to the question of intergovernmental relations, there has been limited consideration of municipalities (see for example Cobban 2003; Sancton 1994; Magnusson and Sancton 1983). Most recently, Aboriginal peoples have argued they should have self-government (Doer 1992), and some have modeled this on municipalities (see Nisga'a Agreement). For the most part, municipalities have been missing from the debate. While many of the arguments for provincial or state responsibility stem from considerations about the need for local representation and local input, the local level has rarely been discussed. Whether national standards result in better policy outcomes may depend on what happens at the local level. It is not surprising that gaps in understanding policy performance with respect to federalism are coupled with gaps in understanding about the role of local governments.

Perhaps in light of the practiced dichotomy of nation-building versus province-building, Canadian discussions about devolution and federalism have centred on the need to avoid overlap and duplication. This research offers an entirely different argument: Overlap and duplication can be good for policy performance. If one level of government fails to act, another level can assume responsibility. More importantly, this work focuses attention on the issue of monitoring and the incentives and disincentives of each level of government to do so effectively. Multi-level governance highlights that several levels of government are involved while the principal-agent framework assists in identification of the incentives and disincentives at those levels. Arguments for national standards have been offered here and include enhanced equity, greater ability to deal with externalities, increased citizen involvement, willingness to impose costs, and the ability to disseminate leading state efforts. By contrast, some scholars argue that local control provides superior policy outcomes citing responsiveness, innovation, local-level expertise, greater matching of who pays with who benefits, and enhanced democracy at the local level. This work examines two models of multi-level governance, one in Canada and one in the United

States, and finds that the American model which uniquely offers multi-level accountability due to federal involvement points to improved policy outcomes.

1.2 Theory

Drinking water provision is a complex task that citizens delegate to government, specifically local governments. Citizens' ability to know if government is doing its job in delivering safe drinking water is limited. In fact, it is very difficult to know if the job of drinking water provision is being effectively implemented because there is considerable 'hidden information' (see Arrow, 1985; Hammond and Knott, 1996). Information is hidden in several ways. First, citizens are ignorant about drinking water provision. Most citizens do not know where their drinking water comes from, and most citizens simply take it for granted that the water is safe to drink. Drinking water infrastructure is hidden under the ground and absent from citizen's minds or agendas in ways that issues such as transportation, schools, housing or hospital waiting-lists are more apparent. The pipes are under the ground, and the taps are in their homes. In addition to a lack of expertise with respect to drinking water protection including, for example, knowledge of their water source, treatment techniques and resultant quality issues, a second and related concern is that citizens have false assumptions about their level of knowledge with respect to their drinking water. This is because, in many cases, the public cannot tell if the drinking water is safe or unsafe merely by looking at it. Their assessments about the extent to which the system is working and drinking water is being effectively and safely provided depend largely on whether the end product appears to be safe. The problem with drinking water that highlights the issue of hidden information is that drinking water may look clean but it may not be. Moreover, gastrointestinal illness that could be related to waterborne disease will more often be attributed by citizens to foodborne causes. To further emphasize this point, the public tends to view drinking water provision as an all-or-nothing proposition, either the water is safe or it is not (Hill and Harrison 2006) whereas, in fact, water quality is a complex concept. As so much information about drinking water quality is hidden, an assessment of quality based merely on delivery of the service and water that looks safe to drink is inadequate.

Just as it is difficult for citizens to know if the job of drinking water protection is being done well, it is similarly difficult for a government regulating another government to know. Moreover, in order to reduce costs from monitoring, a government's ability to assess the extent to which the system is working and drinking water is being effectively and safely

provided may depend largely on whether the end product appears to be safe. The degree of hidden information points to the application of a principal-agent framework to better understand this policy area. Principal-agent models highlight hidden information, different preferences, and the need for monitoring; all considerations applicable to drinking water provision. Furthermore, as noted above, the principal-agent model will further elucidate the highly relevant concept of multi-level accountability.

1.2.1 Application of the Principal-Agent Approach to Canadian Federalism

Principal-agent models have not been applied to understand Canadian federalism. This new approach focusing on provincial-municipal relations offers insight into the degree of hidden information within the Canadian federal system. The work of Cameron and Simeon (2000) offers some support for application of what may be deemed a hierarchical approach to these two levels within Canada's multilevel governance. They explain, "If Canada is one of the most decentralized federations in terms of federal-provincial relations, it is one of the most centralized in terms of provincial-municipal relations" (Ibid.:107)

The discussion about national standards and state and local roles in this chapter highlights the need to interrogate further the question of national standards as a question about the benefits and, in particular, the incentives and disincentives at each level of government to understand why national standards may (or may not) make a difference for policy performance. As will be demonstrated, the principal-agent approach has the benefit of offering a structured way to consider the incentives of actors, in this case, levels of government. Furthermore, the focus on outcomes and how information and conditions or costs are related to outcomes is illuminating for this policy area. The application of the principal-agent approach underscores the degree of hidden information within Canadian federalism and the challenge of exposing that information. Finally, the principal-agent application highlights the importance of a consideration of distances from cost and distances from information when considering policy performance with respect to levels of government.

It should be noted that while this work begins with and is limited to the application of principal-agent theory to intergovernmental relations as multi-level governance, there are multiple and complex examples of other concurrent principal-agent relationships that the model does not address. For example, the framework is limited to levels of government outlined as type I multi-level governance yet there are groups of voters as principals for

each of the governments as well as principal-agent relationships between legislatures and bureaucracies that are not addressed. This work breaks new ground by applying principal-agent theory to understand multi-level governance in Canada while setting aside these other complications for future work.

1.2.2 Principal-Agent Theory

Principal-agent theory is part of a larger rational choice theory of political science (see Downs 1957; Riker 1962; Fiorina 1977; Moe 1984). This work relies on the 'thin' rather than 'thick' version of rational choice. I assume that whatever ends are pursued by actors these are through "strategic, instrumentally rational behaviours"(Friedman 1996:2). Rational choice theories enable political scientists to better understand and consider the incentives and disincentives of actors, in this case, institutions.

In principal-agent models, the principal hires an agent to carry out a task the principal either chooses not to do or that the agent can do better. Principal-agent models have been applied by political scientists to help explain delegation to agents, institutional design and agent behaviour (Kassim and Menon 2003; Pollack 1997; Fiorina 1977; Moe 1985).

The principal-agent dilemma is to ensure that the agent acts as the principal desires even though there is an information disadvantage that favours the agent. The agent has more information than the principal that is commonly referred to as 'hidden information' (Arrow 1985; Hammond and Knott 1996). The principal wants to avoid agency losses defined as "losses imposed on the principal by an inability to align the agent's self-interest with that of the principal" (Miller 2005:204). The problem of agency loss is the classic principal's problem. The principal has delegated to the agent and needs the agent to carry out their task, effectively. There are two main ways in which principals can reduce agency loss: (1) get information regarding the agent's performance and (2) impose conditions on the agent. Reducing agency loss, however, is costly to the principal, as monitoring is expensive and imposition of conditions may result in the principal having to pay to ensure the task can be carried out, as needed.

The principal-agent model has only rarely been applied to understand federal-state relations (see Chubb 1985; Scholz & Wei 1986; Hill & Weissert 1995). Chubb applied the principal-agent model to the US federal system using a formal hierarchy beginning with Congress and the President and extending to subnational bureaucrats. He analysed the impact of federal grants on state and local spending and taxing and found that, among

other things, differences in grant performance by the agents could be traced back to differences in behaviour and preferences of their principals. Hill & Weissert (1995) applied the principal-agent model to understand federal-state relations with respect to the US federal Low-Level Radioactive Waste Policy Act. They argued that implementation failure in certain areas might be explained by what they call the 'irony of delegation' where states choose strategic non-compliance. Scholz and Wei (1986) examined enforcement data for 50 states regarding the Occupational Safety and Health Administration and found state-level agencies were more willing to make concessions in response to firms' costs of compliance than were federal-level agencies.

More recently, within the European Union literature, principal-agent models have been used to understand intergovernmental relations between member-states and their supranational agents. In particular, the literature on delegation employs principal-agent theory. Among the key reasons identified for delegation are to avoid blame for unpopular decisions (Fiorina 1977; Epstein and O'Halloran 1999), to lock-in distributional benefits, and to permit delegation to specialists in areas of policy where expertise is required (Kassim and Menon 2003; Egan 1998). The application of the principal-agent model to the European Union literature has contributed to a more sophisticated analysis, in particular, for understanding the motivations of member-states (Kassim and Menon 2003).

This work extends work that arises out of the delegation literature with respect to three-level hierarchies. Application of the three-level hierarchy to understand federalism is a new approach adopted here though hierarchy as an analytic approach has been applied in the past to study US federalism (see Anton 1989). In Laffont's work (1990), he relies on a three-level hierarchy of the principal-supervisor-worker. Demski and Sappington (1987) also used a three-level hierarchy designating the regulator as "information agent" between the firm and the consumer (consumer-regulator-firm). They suggest that you can judge the effectiveness of the regulator according to the agent's outcomes.

As noted, principal-agent models focus attention on monitoring, and draw attention to costs and hidden information as means to reduce agency losses. Furthermore, the consideration of costs and hidden information within a multi-level governance framework below highlights the importance of distance when considering incentives of levels of government.

1.2.3 Application of Principal-Agent insights to drinking water case

Applying a principal-agent model to drinking water protection enhances understanding of this policy area including the incentives of different levels of government. The principal-agent model is particularly useful as it focuses attention on two key factors: (1) the problem of hidden information and (2) the need for the principal to impose conditions and/or costs on the agent. These key factors underscore that drinking water protection has lots of potential for agency loss as there is considerable hidden information. Moreover, cost imposition will have to occur at the local level where service delivery occurs. Costs for infrastructure and system improvements in this policy area can be considerable, and therefore may be difficult to impose.

Information about drinking water quality is hidden at the local level. It is hidden to citizens as principals of their elected governments and to governments as principals of other governments. Imposition of conditions and/or costs with respect to drinking water protection by another level of government may not only be costly for the local level but may also lead to local government's expectations that other levels of government will pay to improve safe drinking water provision. Moreover, information and conditions are somewhat inter-related as in order to impose conditions that will result in effective service delivery some hidden information must become known to the principal.

Key aspects of drinking water provision highlighted by the principal-agent model include: high costs and huge information gaps. It is also noteworthy that unlike some other policy areas, drinking water provision is not a program that can be carried out and then discontinued if unsuccessful. It requires sustained attention and action. Citizens expect it. There are thus few opportunities to claim credit within this policy area as action is expected yet there is lots of potential for blame as the tractability of the problem is huge (see Mazmanian and Sabatier 1981). A broader discussion of the tractability of the problem and the challenges of delivering safe drinking water can be found in Chapter 2.

Application of the principal-agent model to federalism points to these two key questions in order to minimize agency loss:

Which level of government can most effectively uncover information that is hidden at the local level?

Which level of government is most willing to impose conditions and/or costs at the local level?

This section considers the incentives and disincentives at each level of government within a federal system through a principal-agent lens.

There are three possibilities examined with respect to drinking water provision:

Model A (Self-regulation): municipal (agent)

Model B (Symbolic regulation): province/state (principal) to municipal (agent)

Model C (Arms-length regulation): federal (principal) to province/state (agent & principal) to municipal (agent)

Principal-agent models assume there are chains of principals and agents within democratic states and that the electorate is the primary principal (see Moe 1984). In this section, I have not included the incentives and disincentives of the electorate directly though these are subsumed within the municipal discussions. The model could certainly be extended to include additional principals and agents (what might be termed Type II multi-level governance) but the focus here is on federalism (Type I multi-level governance), specifically, the aim is to understand the roles of levels of government. Thus, the discussion is limited to the municipal, provincial/state and federal roles though incentives and disincentives at each level are driven by assumptions about the electorate. These assumptions are standard within rational choice theoretical frameworks such as the principal-agent model. A primary assumption is the 'negativity bias' or the argument that in order to remain in office, politicians need to minimize blame for bad decisions and maximize credit (Weaver 1986:373)

First, I consider the municipality acting alone. This model involves only the agent and underscores that regulation by other levels of government is necessary.

Model A (Self-Regulation): Municipal agent

The public expects clean drinking water. Municipal governments have considerable incentives to act to protect drinking water quality as they are the primary providers of this service. As municipalities first bought and developed water systems largely for supply and firefighting purposes, they are largely responsible for drinking water provision. Moreover, if water is contaminated, municipalities will be the first to be blamed in light of the public's expectation they will provide the service. Municipalities' incentives to act are thus based on public expectation. Municipalities can be expected to act because the public wants municipalities to provide drinking water. Moreover, if they failed to act and there was

some kind of system failure, municipalities will be the first to be blamed. Thus it might seem that the public's and the municipality's incentives are aligned as the public expects municipalities to deliver high quality drinking water and municipalities want to act as they will be blamed for failing to do so.

However, while municipalities clearly have considerable incentives to act to protect drinking water, they also have disincentives. Even though municipalities are expected to act, they can also expect to be blamed for action. They are thus in a kind of 'catch-22' - a double-bind.

Municipalities can expect to be blamed for protecting drinking water as there will be blame for increased taxation in order to pay for enhanced drinking water infrastructure. It is well-documented that the public wants safe drinking water but does not expect to have to pay for it (Swain 2005). This point is further supported by the fact that the public is largely ignorant about drinking water provision. As noted earlier, drinking water infrastructure is primarily hidden underground and many citizens do not know the source of their drinking water.

In light of the above incentives and disincentives, if we consider the municipality as an agent acting on its own, we understand that it has great incentives to provide safe drinking water but also great disincentives. With respect to hidden information, the municipality as agent is the location and the keeper of the hidden information. In terms of imposition of costs, the municipality does not want to impose costs on the public as the public can be expected to react adversely to increased municipal taxation. While the public is ignorant of drinking water infrastructure and provision, more generally, it is keenly aware of costs/municipal taxation.

Municipalities want to act and take pride in drinking water service as a vital aspect of municipal service provision yet drinking water protection is costly. While the public expects safe drinking water it is ignorant regarding drinking water provision. Thus, municipalities are in a kind of double-bind and they are unpredictable. Regulation is needed in this policy area in order to ensure costs are imposed to improve local service provision.

Let's turn then to Model B. A provincial or state level principal is added to the model to regulate the municipal agent. As Model A demonstrated, regulation is necessary in this policy area because the municipality is in a double bind.

Model B (Symbolic Regulation): Province/state (Principal) - Municipal (Agent)

Province/State (Principal)

Application of a principal-agent model points to the province/state as principal and the municipality as the agent. In this model, the principal assumes some responsibility and the agent is the primary implementer owing to its expertise regarding drinking water provision. As regulation is needed, and provincial or state-level principals can claim credit for passing regulations, we can expect that provincial or state-level principals will pass laws to ensure safe drinking water. Laws can be understood to direct the municipality to take certain actions. In order to ensure these actions are undertaken we might expect the provincial/state principal to monitor the municipal agent.

However, hidden information in this policy area is a considerable challenge for the principal. The degree of hidden information may be seen to be inversely proportional to the desire of the principal to monitor. Hidden information is costly to extract and, if negative, in this policy area also costly to expose. With opportunity to claim credit comes the possibility of sharing the blame should the public detect policy failure. The provincial/state principal needs information in order to reduce agency loss but in order to get information it must monitor and monitoring is costly. Exposure of information may lead to long-term agency losses as people's confidence in the public drinking water supply decreases.

The disincentives for the principal to regulate include the (1) grief and expectation to pay from the municipality for imposing costs, (2) culpability along with the agent if policy failure is exposed or effort is found to be inadequate including expectation to pay, and (3) costs of monitoring. Costs of monitoring are very high, proportional to the degree of hidden information. If the principal exposes the agent as not having done enough in the past to protect the drinking water, the principal might expect to also be blamed for not ensuring the water was safe to drink. Inadequate effort on the part of the agent exposes the principal as similarly inadequate. Moreover, not only are there costs for monitoring but if system inadequacies or inattention is found, the principal can expect to have to help pay for improvements. Municipalities, after all, are considered to be creatures of their provincial or state-level principals.

Thus, the principal can be expected to choose the least costly oversight model, symbolic regulation. As long as nothing appears to be wrong, all is assumed to be well. If

the apparent outcomes are that the drinking water is fine we can assume that both the agent and the principal are doing their jobs. Of course, as noted above, the problem with this policy area is that the drinking water may appear potable when it is not.

While there are considerable disincentives for provinces or states to regulate municipal provision of drinking water, including both blame for any policy failure and electoral resistance to increased costs, there are few yet important incentives. Just as the public expects the municipal agent to provide safe drinking water, the public also expects that the province is doing its job as regulator. There is an incentive to do something. By providing directions to the agent, whether specific or vague, the principal can demonstrate its resolve as a regulator. However, just as the water may look like it is clean even if it not, so too might a principal look as though it is regulating even though it is largely not monitoring and has been unable or has not attempted to uncover the hidden information as disincentives to do so are high.

Municipal Agent

Within Model B, municipal incentives are largely unchanged from Model A though blame will be shared with the principal when something does go wrong. While costs may also be shared, the municipality is still likely to be responsible for much of these costs.

The outcome of Model B is symbolic regulation. The principal has few incentives to undertake monitoring as hidden information is complex and expensive to uncover. The incentives of the municipality vary little from Model A.

Neither Model A nor B produce desirable policy outcomes. A desirable outcome would be one in which service delivery provision receives sustained attention and continuous improvements as the municipal-agent fulfills its role, and, if it shirks, action is taken by the province/state regulator. In this policy area, intergovernmental monitoring of performance is necessary because information is hidden and system failures can result in significant illnesses, even deaths. Exposure of hidden information will allow appropriate costs to be imposed in order to improve service delivery at the local level.

For Model C, we turn to the three-level hierarchy.

Model C (Arms-Length Regulation): Federal (Principal) - State (Agent & Principal) - Municipality (Agent)

The three-level hierarchy adds a supervisor to the principal-agent or boss-worker relationship. We now have a principal-supervisor-worker chain (see Laffont 1990; Demski and Sappington 1987). The supervisor is the agent of the principal and the principal of the worker-agent. Its role is pivotal. The supervisor is an extra level of bureaucracy but its role is vital as it has the capability of exposing hidden information to the principal which can enable the principal to impose costs on the worker without receiving much of the blame. An extension of the three-level-hierarchy to federalism provides a chain of principals and agents from the federal principal to the state which is agent of the federal principal as well as principal of the municipal agent. While Model B offered an example of multi-level governance, I argue that Model C offers multi-level accountability.

The three-level hierarchy of federal-state-municipal offers as important advantage not present in the other two models: regulator at a distance from costs. Moreover, this model uniquely positions the actors to engage in regulatory behaviour. There are incentives to monitor as the federal-level regulator is at a distance from costs while the state-level regulator is in proximity to the municipal agent. The federal government will not have the same expectations to pay as it is at a distance from the electoral costs. It has independence from powerful local interests, independence that the state-level government may not have. The federal government is far enough from the expectation of costs/condition to be able to impose costs and conditions on other levels, impositions that the province/state level principal was unwilling to impose as it would share costs and blame. The state-level (agent plus principal) is close enough to the municipal agent to be able to uncover important hidden information.

With the three-level-hierarchy, the incentives are aligned and more reliably good drinking water can be expected. The federal government can be expected to impose costs and conditions on the local level that are appropriate. In response, the state government monitors and uncovers hidden information within the system in order to improve service delivery at the local level.

This model works well as the federal government is in the best position to impose costs as it is the farthest from electoral accountability for the costs. Its major limitation is that it is not in the best position to obtain hidden information as its distance from costs puts it at a distance from the information. In Model C, the states monitor and act as information agents allowing the federal government to fulfill its role as arms-length regulator. The states benefit as federal imposition of costs puts them in a better position to reduce agency

losses but not to receive as much of the blame if something does go wrong. Sharing the blame is perhaps not sufficient incentive for the states to invite federal regulation. However, states can maintain some jurisdictional control by being involved. More specifically, federal unilateralism in this policy area viewed as a local concern offends them. After all, municipalities are considered to be the jurisdictional responsibility of states/provinces. In addition, the federal government is willing to impose costs on the states by removing their primacy[6] if they fail to fulfill their role in the three-level hierarchy. States are clearly in a much more effective position than the federal government to obtain hidden information - to monitor the performance of the local agents - and act as the "information-agent" within the model. States are, after all, closer to the information that is hidden at the local level.

Table 1.1: Role of Levels of Government in Principal-Agent Chain

Level of Government	**Role in Three-Level Hierarchy**
Federal - distance from costs	Arms-Length Regulator *(Principal)*
Provincial/ State - proximity to information	Information-Agent *(Agent/Principal)*
Local - location of service provision and location of hidden information	Service Delivery Agent *(Agent)*

Of the three models, Model C can be expected to be the most effective as the incentives of the three levels of government shift when the federal level asserts itself in this policy area. Model A involved the municipality in a Catch-22. Model B did not get the

[6] See Chapter 2 for an explanation of primacy as it relates to the US Safe Drinking Water Act. Chapter 3 also includes a more extensive discussion of its practical aspects as applied to Washington state.

municipality out of its double-bind as the state had incentives to issue symbolic regulations but not to monitor or to impose costs. The wisdom of the three-level hierarchy is that the federal government is at a distance from the costs while the state is close enough to the local agent to uncover hidden information.

1.3 Applying Theoretical Insights to Canadian-US context

Model C describes intergovernmental regulation under the United States Safe Drinking Water Act whereas Model B provides an illustration of drinking water protection implementation within Canada. In the United States, the federal government is ultimately responsible for setting standards and ensuring compliance through the Environmental Protection Agency (USEPA), though responsibility for implementation occurs largely at the municipal level with states delegated responsibility for enforcement. By contrast, Canada has provincial standards that are uneven with respect to both policies and implementation across the country, and no binding federal standards. For drinking water protection, the principal-agent model applied to Canada can be understood to be one of provincial principals and municipal agents (Model B). As Chapter 2 explains, federal involvement is not direct and the federal role is one of coordination in development of non-binding guidelines in concert with the provinces. We can expect that this model is largely ineffectual in terms of imposing costs or uncovering hidden information. The amount of hidden information is considerable and incentives to obtain and expose information are low while costs are high.

In contrast with the provincial principal and municipal agent model evident within the Canadian context, the US model offers a three-level hierarchy (Model C) in which the Environmental Protection Agency as the federal level delegates authority for implementation to the states that are accountable to the Environmental Protection Agency for their monitoring of municipal delivery of the service. The expectation is that the US model will involve imposition of costs when needed as well as uncover hidden information to improve local service provision.

1.4 Why Multi-level Accountability in the US but not in Canada

An important question arises from this assertion. If federal involvement in drinking water protection offers unique incentives as described above why has the United States federal government weighed into this policy area while the Canadian federal government has not? After all, there have been many demands for federal involvement with respect to ensuring potable water. After Walkerton we might expect that the federal government

could claim credit for setting binding national standards (Hill and Harrison 2006) and yet it has not. Why was the US willing to assert federal authority for drinking water protection in 1974 while Canada has still not done so?

The missing element of the preceding discussion is the costs to the federal government of intergovernmental conflict. These are higher in Canada than the United States for 3 reasons. First, there is a stronger constitutional position of the US federal government; and flowing from that, generally more centralized federalism in the United States. Moreover, there is a policy legacy in related areas in the US, specifically the policy legacy that existed in the United States after the Clean Air Act for which no similarity can be found within Canada. This policy legacy has made intervention by the US federal government easier in this policy area than it would be for the Canadian federal government. Finally, within Canada, the unique situation of Quebec nationalism is an issue not faced within the United States.

First, constitutional interpretations by the US Supreme Court regarding federal authority have been considerably more generous to the US federal government over time than the Supreme Court of Canada's interpretations of Canadian federal authority. In contrast to Canada, the history of American federalism is a history of the ascendancy of the federal level with brief retrenchments by the states. Even though the American founders desired to ensure a limited federal authority, the outcome of the civil war contributed to an ascendancy of the federal government. Subsequent Supreme Court decisions favoured the federal level over the states by a large margin (Nagel 2001). The United States is arguably a much more centralized federation than Canada owing to the Supreme Court's generous interpretation of the Commerce Clause south of the border. In the US, the federal government has been asserting its power since the civil war. Notably, the Bill of Rights mentions only the need to limit federal power as the states were not viewed as having a similar degree of power.

While American federalism has been characterized by greater federal involvement, the history of Canadian federalism is one of ascendancy of the provinces with the federal government being considered an equal player most of the time. It is not surprising that our constitution opens with the words "Whereas the Provinces." Ironically, the Canadian founders looked south and aimed to avoid a decentralized federation they thought would lead to civil war as they believed it had in the US. Thus, they reserved the residual powers for the federal government. Over time, however, the opposite of their intentions has

resulted. This is for several reasons. Unlike the US courts, the Canadian superior courts (Judicial Committee of the Privy Council and Supreme Court) tended to side with the provinces often prior to 1982 leading to what Cairns (1971) has called a "virtual nullification of the trade and commerce on the federal side" with a significant rise in the importance of provincial powers.

Canada is a decentralized federation while the US is much more centralized. The role of Quebec in the federation and its demands for autonomy, as well as the growth of all provinces post-1945 has arguably further decentralized the federation. Moreover, the 1982 constitution with the gaping hole of Quebec not having signed gave rise to a constitutional odyssey to bring Quebec back in which also resulted in further decentralization of the federation. Richard Simeon's seminal Federal-Provincial Diplomacy (1972) underscores that our model of executive federalism has also had a role to play. Canada has been more reluctant than the US to exercise its powers over time because of the desire to avoid blame for encroaching on provincial jurisdictions.

Notably, 100 percent of US transfers to the states are tied while just over 40 percent of Canadian transfers to the provinces are (Watts 2005).[7] Even after Walkerton the Canadian federal government was called upon by many to step in and did not do so. Concerns about exacerbating federal-provincial relations with the possibility of spillover into other policy areas may be reason for federal inaction. The provinces, Quebec, in particular, would have reacted harshly. Following the Walkerton water tragedy, Ontario quickly moved to call an inquiry and to re-establish its jurisdiction by agreeing to implement all of the recommendations of that inquiry. Furthermore, the legacy of the Canada Water Act is indicative of provincial disregard for federal level authority in this policy area. This attempt at water management relied on provincial involvement and cooperation but neglected to consider if the provinces would be on-side (see Harrison 1996:65-7). The provinces, for their part, maintained that water as a resource was their responsibility. In particular, the provinces addressed in this study, British Columbia, Quebec and Ontario, continued to resist the authority of the Canada Water Act (Ibid).

While federal authority in the United States and greater decentralization of the federation in Canada make it more difficult for the Canadian federal government to intervene in this policy area, it was easier for the US federal government to do so because it

[7] According to Watts, 43.6 percent of Canadian transfers to the provinces are tied. This compares with Australia at 47.1%. If the Canadian Health and Social Transfer (CHST) is considered to be an unconditional grant then only 4.3% of Canadian federal transfers are considered tied!

had already done so. The Safe Drinking Water Act came after the Clean Air Act of 1970 and the Clean Water Act (formerly Federal Water Pollution Control Act) of 1972. Canada has no similar policy legacy. While Canada has practiced 'non-interference' in this provincial jurisdiction, after 1974 the US federal government asserted its authority. The Clean Air Act served as a template for future federal environmental policy. Specifically, it offered the innovations of uniform national standards, specificity, and citizen-suits (Harrison 1997:50; Jones, 1975). The US Clean Air Act passed during a period of tremendous public concern for the environment prompting highly unusual competition between the branches of Congress and between the executive and legislative branches (Jones 1975). This dynamic was not evident during the same period in Canada given the fusion of executive and legislative functions in the Parliamentary system and the unelected Senate (Harrison 1997). This difference in environmental federalism is not only a result of the federal division of powers but also a result of the difference in legislative institutions in the two countries.

Finally, as noted earlier in this chapter, Quebec nationalism continues to be a looming issue at the heart of intergovernmental relations in Canada. The threat of Quebec secession or exacerbating Quebec's demands on the federation has contributed to greater decentralization of the federation and, arguably, it has also placed the emphasis of policy outcomes on keeping the country together by avoiding exacerbation of tensions rather than on making good public policy per se. Thus, within Canada, federal assertion of authority has been weak, at best, and rare in occurrence. By contrast, the United States has no similar ongoing secessionist threat.

The US asserted its authority in 1974 and created national binding standards for drinking water. This was the result of a policy legacy originating in the Clean Air Act, and a response to policy failure on the part of the states. Attempts to reduce intergovernmental tensions gave rise to a three-level hierarchy model wherein the federal government passes laws and regulations, the states monitor and ensure these regulations are implemented, and municipalities are responsible for service delivery provision. By contrast, within Canada, there are no binding national standards. Greater decentralization of the federation, Quebec nationalism, and the lack of a similar policy legacy as in the US means drinking water protection has been largely left to the provinces even in the face of calls to action and policy failure.

1.5 Hypotheses

The primary research question addressed within this work is whether this difference in federal involvement results in a difference in policy outcomes. As explained, the expectation is that the US three-level hierarchy model offers improved drinking water protection in comparison with the Canadian provincial-principal and municipal-agent model. In light of this, there are three distinct hypotheses this work aims to test:

1. *As a result of the addition of federal involvement in 1974, I expect that the United States will offer improved drinking water protection after 1974.*

2. *I expect that the United States will offer better drinking water protection than Canada as a result of binding national standards in the United States.*

3. *I expect that the US cities will offer greater consistency with respect to drinking water protection than the Canadian cities as a result of binding national standards.*

This work is premised on the idea that one type of federal model may offer incentives that are better aligned to perform in particular policy areas. It is expected that the three-level hierarchy model as described above is uniquely positioned to provide more reliably good drinking water in comparison with the province/state principal and municipal agent models. Thus, we would expect that the US model would provide more reliably good drinking water than the Canadian model. The American cases are expected to offer better drinking water quality, because federal principals will impose costs when needed resulting in municipal level agents offering improved service delivery. Moreover, this model did not exist in the US prior to 1974 when the Safe Drinking Water Act was passed. Before 1974, as explained in Chapter 2, the US model was similar to the current Canadian model where state-level principals had oversight of municipal agents. Thus, there is an expectation that the US cases will improve after 1974. Finally, as hidden information is uncovered and exposed we can expect that the US cases will be more similar over time than the Canadian cases.

1.6 Methods

This study argues that intergovernmental oversight is a key factor in ensuring drinking water protection. Oversight is just one of many factors that influence drinking water quality. Other important factors involve the magnitude of the challenge given untreated water quality in a particular locale and the financial and administrative capacity of various local governments to undertake this technically complex and costly policy challenge. In order to understand whether oversight makes a difference for drinking water quality, it is important to control as much as possible for these other factors. Accordingly, this study involves matched pairs of cases controlling for two factors: (1) type of source water and (2) city size as a proxy for local capacity.

This research relies on a comparative case study approach. The case studies combine documentary evidence, archival research and interviews with key informants. Case studies are commonly defined in the following way:

> [...] the central tendency among all types of case study,
> is that it tries to illuminate a decision or set of decisions:
> why they were taken, how they were implemented, and with what result
> (cited in Yin 2003:12).

This research involves a particular type of case study approach that I refer to as a 'paired-cases approach' which is a modification of the 'Two Case Study' approach used by Hooks (1990).[8] My approach pairs cases in Canada (absence of federal binding standards) with cases that are as similar as possible in the United States (presence of federal binding standards).

1.6.1 Selection of Cases

As noted, cases were selected based on two main considerations: (1) control for magnitude of threats to water quality and (2) control for capacity to respond. The magnitude of threats to water quality was operationalized as type of source water. The capacity to respond was operationalized as city size. Cases were paired according to city

[8] Gregory Hooks (1990) work compared the aeronautics industry and the microelectronics industry to show the impact of defense department support on an industry traditionally known to be supported by the department (aeronautics) and an industry not as well-recognized as being supported by the defense department (microelectronics). As Yin (2003:35) explains, "The existence of both cases, not the aeronautics industry alone, makes the author's entire argument powerful and persuasive."

similarities on these two aspects without any consideration of drinking water quality, the dependent variable.

A considerable amount of time was spent in selecting the cases for study. The Canadian cities were chosen first based on a desire to consider multiple provinces, one in British Columbia, one in Quebec, and one in Ontario.[9] Initially the study involved several additional cases with an emphasis on studying large and medium cities and some small towns/rural areas. The scope of the study was limited to large cities after initial fieldwork was conducted. As well, a less-intensive version of the medium-sized cases was retained for the British Columbia-Washington comparison.

British Columbia and Washington

Vancouver, British Columbia was selected first. The paired comparison for Vancouver was not a difficult choice. Seattle, Washington, also part of Cascadia, and similar in size, is close in proximity to Vancouver and considered by Vancouver residents to be similar in many ways. City size and similar industries were important but not sufficient criteria for inclusion in the study.

An important consideration was the water source. Upon investigation, it was determined Vancouver's water originates in the Coast mountains and is supplied via three rivers forming the Capilano, Seymour, and Coquitlam watersheds. Seattle's water comes from two rivers, the Cedar and the Tolt, that originate in the Cascade mountains. Similar water sources, and similar city sizes resulted in a decision to include Vancouver and Seattle as paired cases within the study.

When case selection was first undertaken, medium and small size cases were also identified for a British Columbia-Washington comparison. Medium-sized cities were defined as having populations greater than 25,000 and less than 100,000. Locating a mid-sized US city comparable in size with a Canadian city was challenging. Case selection drew attention to the fact that very large cities in Canada are generally not as big nor as numerous as very large cities in the US. The US has considerably more small cities than medium-sized cities. Identification of a medium-sized city was even more challenging when the second control factor, a similar water source, was considered. Primarily, rivers and streams as well as some groundwater aquifers serve as the drinking water sources for British Columbians and Washingtonians. Nanaimo was identified as a medium-sized city

[9] There was a desire to better understand the impacts of Walkerton and the timing of this research suggested it may offer some initial insights into this.

with a population of about 75,000 within the province of British Columbia. Nanaimo's water source is mountain rivers and streams in watersheds that are actively logged. A comparable city in Washington was a challenge to identify but eventually Longview was identified owing to its population of approximately 35,000 residents and a similar source (mountain rivers and streams) located in a watershed that is actively logged.

Quebec and Louisiana

Case selection for British Columbia and Washington first involved identification of the Canadian city with subsequent efforts involving location of an American city that was similar on the factors related to magnitudes of threat. Somewhat in contrast, the Quebec-Louisiana pairing began with the source water. The great river that runs through the province of Quebec, the St. Lawrence River, was an obvious choice as a drinking water source. Moreover, it provided a different type of source by which to contrast the rivers and streams originating in the mountains of BC and Washington. As Vancouver was already included in the study as representative of a large city, Quebec City was considered for purposes of variation. Quebec City has a population of 235 000 and was contemplated for the study with the expectation that its water source was the St. Lawrence River. Surprisingly, Quebec City's source of drinking water was discovered to be Lac St Charles (see Turgeon et al 2004: 365). Montreal was identified as the major city within Quebec that relied on the St. Lawrence River for its source water. The Mississippi River is a comparable American river to the St Lawrence River. Several comparable cases were identified as having locations along the Mississippi River including Minneapolis/St. Paul (the twin cities), St. Louis, and New Orleans. Minneapolis/St. Paul was considerably larger than Montreal and its source water less likely to be comparable to that of Montreal as the twin cities are located close to the headwaters of the river. St. Louis also proved to be a poor candidate for the study as its source water is primarily the Missouri River along with the Mississippi River.[10] In the end, New Orleans was selected as a comparable case for Montreal as it gets its drinking water from the Mississippi River and is similar in population size. The city sizes were also found to be similar with Montreal's population about 1.5 million and New Orleans population at 1.2 million. As Chapter 5 demonstrates the comparability owing to the great river water sources is notable.

[10] One of its major intakes is located so that the water comes primarily from the Missouri River as the two rivers have not fully mixed where the intake is located.

Ontario-Michigan

The final pairing involves an Ontario case and a Michigan case. The possibility of investigating the impact of Walkerton gave rise to the decision to choose an Ontario case study. A great lake was selected as a water source and Toronto seemed an obvious choice. The Walkerton water tragedy impacting Toronto's provision of safe drinking water could be considered significant. After all, Walkerton was a small town with groundwater sources and Toronto was a global city with a huge lake as its water source. Toronto also provided a good comparison for Vancouver and Montreal. Finding an American city with which to pair Toronto was challenging. Obviously, the city would need to have a great lake source and be similar in size as these were the proxies for threats to water quality and capacity. Chicago was initially selected but it is considerably larger than Toronto in size. With a great lake as its source it appeared comparable though the concern with size made it appear to be a poor candidate for inclusion. Detroit was identified as another large city in some proximity to Toronto. Moreover, the Great Lakes basin also served as its source water with Lake Huron and the Detroit River. It is closer in population size to Toronto and on this basis it was retained as one of the cases. As Chapter 6 suggests, Chicago may have been a better choice. Nevertheless, the comparison of Toronto and Detroit is illuminating and provides a better understanding of each city than consideration of either alone might provide. It should be noted that this match was the weakest and access in Detroit was the most difficult. Today, Toronto[11] operates a world-class utility while Detroit continues to face barriers including both with respect to environmental compliance and local water governance.

Data Collection

For the paired case studies, data was collected from multiple sources. Data sources included: (1) key informant interviews involving federal, provincial/state and municipal officials (2) archival research at the local level (3) document review and (4) literature review. With the exception of Longview, Washington, I visited all the cities to conduct fieldwork.

Interviews

Key informant interviews were undertaken with selection of informants based on (a) ability to comment on various aspects of the implementation process from the source to the tap including especially monitoring and compliance and (b) their knowledge of

[11] It should be noted that the key informants from Toronto were extremely helpful, willing to discuss their challenges as well as their strengths and perhaps had more experience with researchers because of the Walkerton tragedy.

interaction between levels of government. Some informants also recommended others to speak with and contacts with these informants were attempted. Sampling was done with letters sent to over 60 potential interviewees. The process approved by the University of British Columbia Ethics Review Board required initial contact by letter and then a phone call to follow-up. If the person was not reached on the first call, a second phone call was attempted, and messages were left. After two attempts with messages left, the approved process was to assume the potential interviewee was not willing to participate. One of the major limitations of this process was that many of the potential interviewees did not receive the initial letter as it was re-directed in their office mail to a higher authority or simply did not reach the intended informant. When it was re-directed sometimes the person it was re-directed to contacted the researcher and agreed to the interview.

In total, 40 interviews were conducted lasting, on average, about 1.5 hours. The longest interview lasted over 3 hours and the shortest was about half an hour. Just over half the interviews were conducted at the local level (n=23) with the remainder of interviews conducted at the provincial/state (n=11) and federal (n=6) levels. Twenty-three interviews were conducted in Canada with seventeen interviews conducted in the United States. Most interviews were completed in person, where possible, or by telephone where a face-to-face interview could not be arranged.

Access was, at times, difficult. Barriers to access are identified here as they underscore limitations of this study and they may prove helpful to other researchers. Barriers included the following: (1) perceived lack of interest in research, generally, on the part of the potential key informant coupled with lack of credentials (e.g., engineering expertise) on the part of the researcher (2) lack of availability as officials were, at times, overtaxed in their positions and (3) inability to reach the desired key informant due to the organization's approach to responding to requests through its communications department. These barriers existed moreso at the local level and less at the provincial/state and federal levels. Furthermore, it should be noted that the fewer number of interviews in the US cases is primarily owing to the availability of documentary evidence in those cases and should not generally be viewed as a limitation of the study.

Table 1.2: Key Informant Interviews by Case Municipality

Case	Number of Key Informants[12]
Vancouver, British Columbia	12
Seattle, Washington	10
Nanaimo, British Columbia	3
Longview, Washington	3
Montreal, Quebec	7
New Orleans, Louisiana	4
Toronto, Ontario	5
Detroit, Michigan	2

In speaking with other researchers who have interviewed municipal officials in Canada with respect to municipal drinking water, it is apparent that access can be difficult and that hidden information will not always be revealed through this method. Even though the interviews were confidential, rarely did officials wish to comment on the performance of other levels of government, and some viewed such commentary as "unprofessional." These intergovernmental relationships are ongoing and are of considerable value to the individuals involved thus commentary about the nature of the relationships was not easily forthcoming. Within the US, as well, the benefits of the Safe Drinking Water Act appeared to be well-known by those who were selected and in a few cases it was difficult to convince potential key informants to participate in the research. Some potential participants referred me to other local locations (i.e., archives and municipal libraries) suggesting that the information I wanted was to be found there.

It should be noted that the number of interviews do not adequately reflect the number of informants who may have been involved in providing information. In several cases, I requested to speak with 3 or 4 people in an office or organization yet they would nominate one person to answer my questions. For example, within an office, respondents might explain that after having had some discussion with the other people in their office to

[12] The total number within this table exceeds 40 as some relevant informants overlapped with respect to certain cases especially in British Columbia and Washington. To some degree, of course, each informant provides insight for all cases. Care has been taken here to group informants according to their having commented directly on the case municipality rather than more generally about drinking water protection.

get answers about specific aspects (e.g., source water protection, distribution systems etc.) it had been agreed that one person would speak with me.

Several of the people who were interviewed had worked at other levels of government or were very knowledgeable about the intergovernmental aspects of this policy area. Most informants had worked for at least 10 years in this field and many for much longer. If they were not directly involved in regulating they had spoken with the regulators and were aware of and offered specific examples of regulatory activities or situations. The types of people interviewed included water system/utilities managers, watershed managers, chairs of boards and/or rate-setters, environmental scientists, compliance and enforcement officers and managers, infrastructure specialists, water quality control managers, policy analysts/bureaucrats, regional-level officials, and a very few members of environmental or water-specific interest groups. I am not able to provide a more specific list here as their confidentiality extends to a knowledgeable audience and most would be identifiable if more specific information was provided.

In addition to the interviews, various federal, provincial, state and municipal level offices were contacted to confirm details of legislation. Also, archivists in several cities who either specialized in public works or in municipal infrastructure or had extensive experience conducting searches related to municipal water provided useful details and suggestions about where to look for information about federal-provincial/state-municipal relations.

Archival Materials and Approach

With one exception, the archives of each case were visited at the local level and archivists were interviewed for advice on how best to go about searching for information related to federal-provincial/state-municipal relations for drinking water over time. Archivists were extremely helpful in identifying some of the most salient events that had occurred between the state/provincial and local levels over time as well as relevant search terms.

Where these existed, annual reports spanning over a hundred years in each jurisdiction were reviewed. Many other primary sources also existed including letters of correspondence between provincial authorities and municipal superintendents for example. A limitation of this archival approach is that only the municipal archives were visited. Other researchers may find the provincial and federal archives to have additional information not held by municipal archives, with particular emphasis on the federal-

provincial and federal-state relationships over time. Nevertheless, the municipal archives included correspondences sent to municipalities as well as their responses and letters to other governmental authorities.. Moreover, annual reports up until about the 1980s, where available, provided considerable information and often offered commentary about the relationships with other levels of government. After the 1980s, reports tended to become more financial in nature, less descriptive of implementation activities, and certainly less opinionated and therefore informative about the political context in each locale.

Data on Water Quality

Originally, the project was conceived as including data prior to 1974 and after 1974 to show the impact of the SDWA in the US cases and also to show changes in Canadian water quality over time. However, data to this extent was simply not available particularly and especially for the Canadian cases. Thus, it was determined that current water quality could be compared and where more information was available attempts would be made to provide that. Data on water quality was usually accessible for the most recent five years from the local level. Provincial level authorities sometimes admitted to not having this information or I was directed to the local level. In the US, because the SDWA requires public reporting to consumers of water, water quality reports were available on websites or accessible from the EPA Safewater website or by written request. It should be noted that while specific numeric data measuring turbidity, coliforms or trihalomethanes, for example, was not always available over time, newspaper searches were conducted on 'water quality' and each locale to find reports of changing quality over time. These were available and are reflected in the histories of water quality for each case municipality in the chapters that follow.

Analysis of Data

This study has employed triangulation as a method for data analysis. Triangulation is commonly used for case study research. Triangulation involves the use of multiple sources of data and allows for development of 'converging lines of inquiry.' The researcher searches for corroborating evidence and for rival explanations using several sources of information. In this case, the sources allow enhanced reliability and validity of the findings. For example, water quality data can suggest which locale has better water while key informants might note the particular limitations of such data being able to explain the constraints and limitations posed by their context.

In undertaking the historical and archival aspects of the analysis, I asked when federal involvement occurred and whether it had an affect on how other actors acted or if I encountered evidence of action on the part of municipalities I looked for explanations as to why they had acted.

The use of the paired cases methodology allows for a triangulation of method as well as of evidence as questions can be posed between cases, across cases and within cases. In this particular study, as the hypotheses illustrate, I ask to what extent federal involvement yields improved drinking water quality and can compare Canadian cases with no direct federal laws or regulations with US cases where there is a federal law and an active enforcement agency. The Canadian and American cases pre-1974 can also be compared with the patterns strengthening the research findings as these point to impacts of multi-level governance arrangements rather than some other explanation. The study also facilitates comparison across the eight cases and across the 4 Canadian cases and 4 US cases. Finally, there is the possibility of consideration within the US cases as I can examine the question of whether federal binding standards matter by examining drinking water treatment implementation pre-SDWA (before 1974) and post-SDWA (after 1974).

Limitations of study

This study has several limitations. First, the findings are limited by the sample size and must be understood in that context. However, the ability to examine the cases in multiple ways, especially to look across time strengthens the findings and, to some extent, increases the generalizability of the findings for other cases. A second limitation is the challenge of comparing across countries. While similar, the paired cities are not exact copies and must be understood as unique. Nevertheless the paired cases, as the chapters that follow demonstrate, for the most part, provide more information than simply examining the cases alone. With respect to the research question, the pairing of municipalities was useful as they are the foundations of drinking water provision in both countries. Moreover, the cases must be viewed with the knowledge that variation in information between and across cases exists. While triangulation provided the ability of overcoming this limitation on some levels it cannot be entirely eschewed. Finally, this area of research is clearly interdisciplinary and not being an engineer nor a scientist presented many challenges. Through experience and discussions with experts I have attempted to reduce my limitations in these areas but this limitation remains. The work should be viewed with these limitations in mind.

The Chapters Ahead

The next chapter provides an introduction to aspects of the science and engineering of drinking water protection as well as an overview of the intergovernmental models used in Canada and the United States. Chapters 3 through 6 discuss the paired cases beginning with Vancouver and Seattle; then Nanaimo and Longview; Montreal and New Orleans, and finally Toronto and Detroit. The closing chapter returns to the theoretical framework discussed here and the three hypotheses.

Compelling evidence regarding multi-level accountability is provided. The principal-agent framework elucidates the benefits of the US Safe Drinking Water Act. The federal government can be expected to impose costs and conditions that are appropriate as the state government monitors and uncovers hidden information within the system in order to improve service delivery at the local level.

By contrast, within Canada the provinces generally lack incentives to regulate and the municipal agents remain in a kind of double-bind, wanting to enhance their water infrastructure but without the resources to do so. Both Canada and the US offer examples of multi-level governance for drinking water protection but the US offers more reliably good drinking water over time as its intergovernmental model is an example of a the specific form of multi-level governance that I have termed multi-level accountability.

II. DRINKING WATER PROTECTION IN CANADA AND THE UNITED STATES

Water is fundamental to human survival. It is necessary for growth and development, and is also vital to many economic and social concerns of individuals. In light of this, the World Health Organization designated the 1980s as the water supply and sanitation decade. It also declared safe drinking water one of its Millenium Declaration goals at the Johannesburg World Summit for Sustainable Development in 2002. Recognizing that water is essential to sustain life, the World Health Organization (2003) recommends drinking water quality be as "high as practicable."

Drinking water is an important policy issue at the intersection of environmental and health concerns. The health of the public is of great importance and can be connected to the water that flows from rivers, streams, or underground which citizens drink. In addition to public health concerns, economic reasons to keep water uncontaminated include the large amounts of pure water required by computer chip manufacturers, food processing companies, and breweries (Graham 1998: 68). This chapter provides a discussion of the science and engineering of drinking water protection for a non-expert audience. It also offers an overview of the multi-level governance models for implementation of drinking water protection that exist in Canada and the United States.

Americans drink an average of 1 billion glasses of tap water per day (USEPA 2003). Like most North Americans, they probably take the safety of their drinking water as a given. However, in the early nineteenth century, people across the continent died from waterborne diseases such as typhoid and cholera. Public health experts pointed to the water as a cause of death and this discovery has been touted as a victory for public health. However, the challenges of drinking water safety have not disappeared. In fact, the largest known waterborne disease outbreak in the United States occurred nearly a century after public health identified the link between waterborne disease and death. In 1993, in Milwaukee, Wisconsin, at least 37 people died,[13] over 400 000 were affected, and 4000 people were hospitalized (USEPA 1997; Morris et al 1996; Hoxie et al 1997). That same year, due to groundwater contamination from bird feces 7 people died in Gideon, Missouri. One year later, Las Vegas Nevada suffered a waterborne disease outbreak of cryptosporidium even though their water treatment facility was 'state-of-

[13] Most experts provide a higher number. For example, Hrudey (2004) reports "about 50" with Hoxie et al (1997) reporting as many as 100. The disagreement centers on how numbers are counted. Some experts estimate as many 100 deaths as rates of chronic diseases such as HIV/AIDs increased in the 2 years following the outbreak. According to Hrudey, 285 cases of cryptosporidium were confirmed in the 1993 outbreak with about 4,400 hospital admissions.

the-art' (Goldstein et al 1996; Gostin 2000).[14] Even more recently, seven people died and thousands became ill because of Escherichia coli and Campylobacter contamination in Walkerton, Ontario. In Canada, major waterborne disease outbreaks have also occurred in North Battleford, Saskatchewan (2001)[15], in the Okanagan region of British Columbia including in Creston and Erickson (1990)[16] and Cranbrook (1996)[17], in Victoria, British Columbia (1993)[18], in Temagami, Ontario (1994),[19] and Kitchener-Waterloo, Ontario (1994),[20] though this is not an exhaustive list.[21]

Ensuring water is safe to drink is an important regulatory role for governments. According to the World Health Organization (2003), "Access to safe drinking-water is essential to health, is a basic human right, and an essential component of effective policy for health protection." Former EPA Administrator Christie Whitman explained, "Water is going to be the biggest environmental issue that we face in the 21st century, in terms of both quantity and quality" (Kilian 2002).

Safe Drinking Water Challenges

The tractability of the problem of ensuring water is potable is considerable. Risks are difficult to determine and subject to much debate. Moreover, different contaminants react

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[14] Goldstein et al (1996) report that 78 cases of cryptosporidium could be linked to the municipal drinking water in a 1994 outbreak.

[15] 375 cases of cryptosporidium parvum were confirmed with up to 7,100 cases estimated and 50 hospital admissions. The major failure was poor fine-particle removal performance on a surface water source using coagulation, filtration and chlorination. See Hrudey, 2004:94.

[16] 124 cases of Giardia lamblia were confirmed. The surface water source received no treatment. Even though another outbreak had been identified in 1985, residents continued to oppose chlorination and a filtration system is currently planned for their water source. According to Hrudey (2004), 'strong evidence' linked the cause to beavers.

[17] 29 cases of cryptosporidium were confirmed with about 2000 cases estimated. Grazing of cattle combined with spring runoff increased water turbidity on a chlorinated but unfiltered surface water source. See Hrudey, 2004:94

[18] More than 100 confirmed cases of toxoplasma gondii with up to 7,800 cases estimated on a surface water source using chloramination. This was the first documented case of a waterborne outbreak of toxoplasmosis in a developed country. Specific source of the contamination was not found but considered to be feces of feral cats or cougars in the watershed. See Hrudey 2004: 91.

[19] Inadequate treatment performance on a filtered, chlorinated system led to contamination by beavers (Giardia lamblia) with 26 cases confirmed and as many as 330 estimated. See Hrudey (2004), page 91.

[20] Cryptosporidium contamination on a ground and surface water source with a system that included chlorination, filtration, ozonation and coagulation. 143 cases confirmed with over a 1000 estimated. Waterborne outbreak not confirmed by epidemiology but expected to be caused by 'river bank infiltration of wells' and recycling filter backwash. See Hrudey, 2004: 90.

[21] These outbreaks were discovered through discussions with other researchers such as Yolanda Yim (for interesting work on Erickson see her MA thesis - UBC 2005) and primarily from Hrudey's work (2004). Hrudey notes that his list is not an exhaustive one especially because it relies on primarily English-language sources. Even then, the research is not exhaustive as it can be difficult to find and locate all sources/outbreaks as reporting for these is sporadic and public reporting may not be required. For example, Hrudey did not include the Las Vegas, Nevada outbreak within his work.

differently to treatments. The old standby, 'when in doubt, boil your water' would be a mistake if your water was contaminated with nitrates. Boiling the water would only serve to increase the level of contamination and toxicity (USEPA 1997). Sometimes, efforts to provide safe drinking water can also cause harm. For example, chlorine is a common disinfectant for water worldwide, but in the last few decades, it has been associated with the creation of trihalomethanes in the water which are carcinogenic at certain levels. In addition, the high cost of drinking water treatment requires a balance between protection and opportunity cost for other national or local concerns. Clearly, there are many challenges for adequate drinking water protection.

Economic growth and development have posed particular challenges for the water supply in first world countries.[22] For example, logging removes trees that act as natural filters (Sierra Legal Defense Fund 2001). Suburban sprawl, pavement, and agricultural runoff all contribute to water contamination. Population growth as well as unregulated and nonpoint sources of discharge also pose threats. "Municipal wastes, urban and agricultural runoff and industrial wastes are principal offenders" (Viessman and Hammer 1993:82; Levin et al 2002). Agriculture is the most extensive source of surface water pollution. Estimates suggest that 70 percent of contaminated rivers and 49 percent of contaminated lakes are a result of agricultural activities (Levin et al 2002: 49).

Other environmental concerns are closely connected to safe drinking water. Global climate change can affect water quality. This can happen in a variety of ways (Levin et al 2002). First, warmer temperatures can give rise to harmful algal blooms, as well as higher microbial and nutrient loadings in drinking water supplies. A rise in ocean levels can contribute to a rise in salt water infiltration of coastal aquifers affecting groundwater sources. Moreover, droughts followed by severe weather events can increase runoff and result in less infiltration to groundwater aquifers. Increased temperatures will undoubtedly result in increased water use, and if contaminated, increased exposure to waterborne disease.

Another challenge for ensuring safe drinking water is posed by data collection and statistics. The incidence of waterborne disease is difficult to determine. For example, the estimates of United States Centers for Disease Control (CDC) in the United States may

[22] The BC Auditor General (1999) in *Protecting Drinking Water Sources* outlined the following possible sources of contamination: farms, gravel pits and mines, urban development, poorly constructed or uncapped wells, pavement, logging, air pollutants, sewage treatment plants and factories.

underrepresent the incidence of disease by a magnitude of 3 to 4 times (Levin et al 2002: 46). Moreover, other evidence suggests 6 to 40 percent of gastrointestinal illness in the United States may be water-related (Ibid.) In addition to the difficulty of documenting incidence of contamination, the prevalence of contaminants is another concern. For example, the microbiological contaminant cryptosporidium parvum is highly prevalent in untreated surface water (Gostin 2000). Moreover, with gastrointestinal illness due to emerging pathogens, high levels of illness may be water-related but not easily detectable. Data suggests from 6 to 40 percent of gastrointestinal disease in the US is water-related (Ibid). In the developing world, waterborne disease is responsible for 80 percent of deaths (World Health Organization 2003).

Treatment systems can also pose challenges for public health. In the cases of Las Vegas and Kitchener-Waterloo previously noted, treatment systems were in place yet waterborne disease outbreaks still occurred. Leakage is a major issue for drinking water systems. Most systems lose between 6 and 25 percent of their water as it travels through the pipes. In addition to being a water budget and financial issue, this is also a health concern as contamination can result during 'negative pressure episodes' (Levin et al 2002). For aging pipes, water loss is a particular concern. If there are gaps in the pipes contamination may be able to enter the system. This is one reason why rechlorination is necessary after water leaves the treatment facility. Besides leakage, corrosion of the pipes can affect water quality and, for example, contaminate the water with lead or copper. At certain concentrations, lead and copper are known to cause developmental delays in children.

The financial challenge of ensuring drinking water protection is significant. Drinking water infrastructure is expensive to implement and to upgrade. There are costs associated with source protection that can include purchase of land surrounding a watershed, as well as costs associated with each step of a multi-barrier approach including disinfection, and water distribution. New techniques for water disinfection such as ozone are proven to be highly effective but may be very expensive. There are ongoing costs associated with monitoring and testing as well as operator certification and reporting. The high costs of water and wastewater management and treatment have drawn increasing attention from governments worldwide. Costs of monitoring and testing can also be high, and must be comprehensive and continuous for best results. In 1997, the US Environmental Protection Agency (USEPA) did a Drinking Water Needs Survey and concluded that Public Water Systems (PWS) needed a minimum of

$138.4 billion over a 20 year period to continue to provide safe drinking water to a majority of Americans.

Types of Water: Surface Water and Ground Water

Source water is defined as the untreated and unfiltered water that will eventually be used for drinking. Once water has been treated, it is referred to as 'finished water' (Gostin 2000:848). Source water can be categorized as of two types: surface water and ground water. These two types of water pose different challenges.

Groundwater can be defined as "water found below the water table" (Lewis 1989:896). The importance of groundwater to human health is well-documented. Groundwater provides a source of freshwater unless it is contaminated. Aquifers which hold groundwater generally have built-in, natural treatment systems that filter the water, or have already filtered the water. For example, "the number of harmful enteric organisms is generally reduced to tolerable levels by the percolation of water through 6 or 7 ft. of fine-grained soil" (Viessman and Hammer 1993:83). Groundwater is the source of water for about one-third of all community water users and is the source of water for 80 percent of Public Water Systems in the US (Levin et al 1999). Most groundwater sources serve fewer than 500 people. Some groundwater aquifers are constantly being refilled while others contain what is known as fossil water, water that is thousands of years old.

Challenges for groundwater include a rate of extraction that exceeds the rate of replenishment, and human activities that endanger its source quality (Ibid.). Human activities that are particularly damaging include industrial activities, hazardous waste sites, residential development and transportation, agriculture and animal husbandry. In some cases, groundwater and surface water are linked. If groundwater is under the influence of surface water and the surface water becomes contaminated, then it may contaminate the groundwater. The research within this study focuses on surface water sources only, but groundwater is discussed in this chapter as the US decision with respect to inclusion of groundwater within the 1996 amendments to the Safe Drinking Water Act was highly contentious with respect to state rights to natural resources and may be instructive for Canada.

Surface water sources can be defined as sources above the ground that include lakes, rivers, streams, and surface springs. In contrast to groundwater, they are more obviously susceptible to contamination from human, animal and industrial sources. Surface water quality

deterioration is primarily caused by municipal and domestic wastewater, industrial and agricultural wastes, and solid and semisolid refuse (Viessman and Hammer 1993:83). In source water assessment reports required under the 1996 amendments to the US Safe Drinking Water Act the 50 US states listed "siltation, nutrients, pathogens, oxygen-depleting substances, metals, habitat alteration, pesticides, and organic toxic chemicals as the most common causes of surface water quality impairment" (Levin et al 2002).

Health and water officials have two primary ways of identifying potential contamination of water prior to comprehensive testing. These include a common microorganism, coliforms, and high levels of suspended particles in the water, or what is known as turbidity. Turbidity in water is "caused by suspended matter, such as clay, silt, fine organic and inorganic matter, soluble coloured organic compositions, plankton and other microscopic organisms" (Federal-Provincial-Territorial Subcommittee 2002). Turbidity is measured in nephelometric turbidity units (NTUs) that "relate to the optical property of a water that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample" (Ibid.) Increased turbidity is associated with increased concentration of microorganisms in the water (Haas et al 1983). Similarly, the presence of coliforms in water indicates that the water may be contaminated with human or animal wastes (USEPA 2002).

Evidence of either of these in the water suggests contamination, and the need to further treat and/or test the water.

2.1 Drinking Water Protection: A Multi-Barrier Approach

Over the last century, drinking water protection policies have been developed that attempt to address some of the challenges outlined above. Drinking water protections may be created through laws (enacted by a legislature), regulations, permit or approval (created by an agency of the government and may be approved by a government), and guidelines (also called objectives or protocols; usually developed by an agency). Guidelines or objectives are non-binding while laws, regulations and permit standards are legally binding and have some mechanism for enforcement. Most drinking water protection policies take a public health approach involving lines of defense, or what has been referred to as a 'multi-barrier approach' (Hrudey and Hrudey 2004; WHO 2003; Health Canada 2002; Sierra Legal Defense Fund 2001). A multi-barrier approach to drinking water protection is most conducive to public health protection.

The first line of defense is protection at the source. Source water protection involves limiting discharges into the source water to avoid microbiological, chemical, and radiological contamination. Common causes of contamination include agricultural and urban runoff, sewage effluent, landfills, pulp mills, mines and chemical plants, for example. At its limit, source protection involves closure of the area surrounding the source water to humans thereby limiting exposures related to industrial, recreational, residential, or other activities. Benefits of source water protection include lowering risk by limiting contamination and reducing the costs associated with treating contaminated water. Treatment costs are "inversely related to the proportion of the watershed protected by forests, wetlands and other open space" (Barten and Ernst 2004: 121). Furthermore, the non-governmental sector in Ontario argues that the economic benefits of source water protection "over-ride the costs" of implementation (McClenaghan and Finnigan 2004: 16).

Water quality varies significantly depending on the water source. For example, water from river sources normally requires the most extensive treatment facilities due to variations over time and in river quality (Viessman and Hammer 1993:313). In the United States, 9 states have watershed protection policies (Gostin et al 2000) and the United States under the Safe Drinking Water Act requires that states undertake source water assessments. In Canada, three provinces including New Brunswick, Nova Scotia, and Newfoundland, enable watershed and wellfield protection (Sierra Legal Defense Fund 2001; Hill et al forthcoming). This type of legislation usually involves limitations or prohibitions on land use such as agriculture, forestry, gravel mining, sewage disposal and air pollution. For example, activities of animal husbandry that may contaminate water with animal waste would be limited or eliminated in the watershed area. Often the legislation provides permission to undertake certain resource extraction activities rather than necessarily to protect water sources. Human access to the watershed may also be limited. Protection of the source can reduce exposure to contaminants and enable better monitoring. Moreover, it can reduce costs associated with filtration or disinfection. In December 2005, the province of Ontario, in response to the recommendations of the Walkerton Inquiry, introduced a law to protect drinking water sources that will involve the existing municipal conservation authorities as well as some additional conservation authorities. The Clean Water Act allows source protection for the purposes of protecting drinking water to override other concerns such as resource extraction or development, for example. If passed, it

will be an innovation in source protection within Canada and go beyond the provisions of the US Safe Drinking Water Act on this aspect (see Hill 2006).

The second line of defense is water treatment. Water treatment takes two primary forms: filtration and disinfection. Filtration involves the use of filters to remove particles from the water. As cloudy water passes through sand, anthracite or other fine mediums, it becomes clearer, and some contaminants are removed. Trees and groundwater aquifers can act as natural filters. Filters can be highly effective.

Most water providers also use some type of disinfectant. Even if filtration is highly effective, microorganisms can grow in the pipes so disinfection is recommended. Moreover, if a filter gets a hole in it and until it is discovered disinfection will protect against many microbiological contaminants. There are several ways to disinfect water for drinking. The most common is chlorination. As Viessman and Hammer (1993:439) explain, "Feeding of chlorine involves controlled dissolution of the gas into a carrier water supply for delivery to the point of application and blending with the water or wastewater being chlorinated." This is a process involving water under pressure to draw a vacuum on the regulator which controls the rate of flow. Chlorination can also be done by manual control. Chlorination is preferred for its relatively low cost, ease of application, reliability and residual detectability (Ibid.:444). Its unfortunate side-effect is the by-product trihalomethanes such as chloroform and bromodichloromethane. These are formed when chlorine reacts with humic substances in raw water created by decaying vegetation and are known to cause cancer at certain levels.

A second type of disinfectant is chlorine dioxide and it is manufactured onsite at water treatment plants by mixing sodium chlorite and chlorine in controlled proportions (Ibid.). This type of disinfection is more expensive than chlorination and may create toxic chlorate and chlorite residuals. Ozone can also be used to disinfect the water but it must be manufactured on-site.[23] Ozone has few by-products with only aldehydes known to be detectable, but is rarely used for disinfection due to its high costs. A third disinfectant is a mixture of chlorine and ammonia called chloramine. It is a highly effective disinfectant but has been found to be toxic to fish and may have health risks for people (Sierra Legal Defense Fund 2001). Ultraviolet light is another means of disinfection generated via mercury lamps creating electromagnetic radiation.

[23] This is due to its half-life of 10 to 30 minutes; even less above pH of 8.

Its main drawbacks and reason for non-use are its inability to kill some protozoans, and its lack of residual disinfecting power.

The third line of defense is the distribution system. This includes the facility in which the water is treated as well as the system of pipes that takes water to the consumer's tap. Key concerns with respect to distribution systems are leakage and contamination from corroding pipes, pressure, cross-connections and backflows, for example.

The fourth and final means for protecting humans from the consequences of contaminated water is monitoring and comprehensive testing. Turbid water can mask contamination and make it difficult to test. Moreover, sudden changes in temperature and weather can have effects on the water supply. Constant monitoring is necessary to ensure the water is safe to drink.

Enforcement and compliance are also key aspects of any regulatory regime. Even with regulations in place, contraventions may occur. For example, in 1999, the USEPA reported that twenty-two percent of Public Water Systems (PWS) were in violation of the National Primary Drinking Water Regulations.[24] This means that 37,000 public water systems violated one of the main requirements of the SDWA. In 2000, this increased to 42,000 public water systems accounting for twenty-five percent of PWS (USEPA 2000:7). It should be noted that the majority of these contraventions were in areas that did not directly impact human health such as reporting annually to consumers about water quality.

Perceptions of risk are inherent in many environmental policies. In comparison to other environmental risks, the EPA ranks water high (McKay and Moeller 2002:103). For drinking water protection policies, risk is an issue because of cost constraints, and the challenge for science of determining acceptable risk. Moreover, as discussed, waterborne disease outbreaks are underreported (Gostin 2000:847).

Drinking water protection policies have also created controversy over responsibility for drinking water protection. For unitary states, the national or municipal levels of government are the focus, while in federal states, there is debate about whether the federal, subnational or local levels of government should be responsible. This question of responsibility is at the heart of this thesis. This chapter focuses on the models of multi-level governance that exist within Canada and the United States for drinking water protection. I argue that the US model

[24] See www.epa.gov/compliance/civil/programs/sdwa/index.html

provides an extension of the multi-barrier approach to drinking water protection because it adds levels of government as lines of defense thus multiplying the impact and performance of the final barrier of the multi-barrier approach, monitoring and comprehensive testing.

2.2 Drinking Water Protection in the United States of America

The history of drinking water protection in the United States began early in the nineteenth century when public health experts pointed to the drinking water as the cause for widespread typhoid and cholera. In this section I discuss the development of the federal authority for drinking water protection and separate the developments into three distinct phases: (1) limited federal regulation (USPHS standards) 1914-1974 (2) multi-level accountability (beginning of intergovernmental regulation) 1974 -1986 and (3) increasing multi-level accountability 1986- present. The first drinking water guidelines were issued for coliforms in 1914, with others such as arsenic (1942) following, later. These guidelines were issued by the US Treasury Department and the US Public Health Service. The US Public Health Service formally updated the guidelines in 1944 and 1962. Standards were binding on "interstate carrier conveyances" but states could decide whether or not to adopt the standards, themselves (Levin et al 2002). The 1914 standards had a significant impact on American cities as they instituted chlorination and filtration of water supplies to comply with the standards. Early adoption of chlorination took place in New Jersey in 1908 with most cities following by 1920.

Recent work by David Cutler and Grant Miller of Harvard University argues that the most "compelling root cause for the drop in US mortality rates in the twentieth century was the adoption of treatment technologies for drinking water supplies" (2005:1).[25] American cities were quick to adopt chlorination to meet federal standards for interstate conveyances such as trains and aircraft. However, by 1974 most states had neglected to adopt or enforce the standards (Levin et al 2002:49). These guidelines were non-binding on states, but formed the beginning of a regulatory framework in the United States. Early on, the American Public Health Service identified the need to protect the public from waterborne diseases.

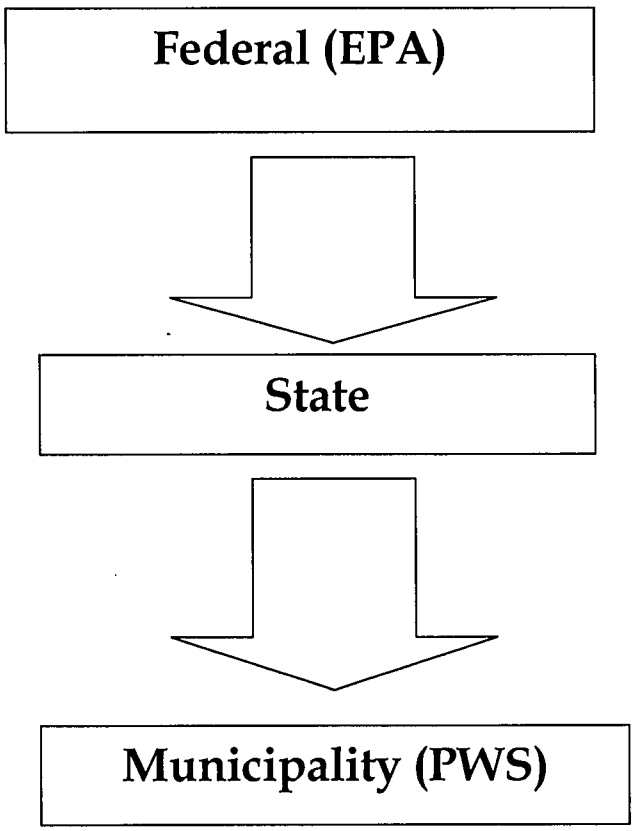
The most significant legislative changes in terms of drinking water protection in the US took place in 1974 with the introduction of the Safe Drinking Water Act (SDWA). In June 1969, the Cuyahoga River caught fire due to the wide array of flammables in the water and on its

[25] Cutler and Miller's analysis suggests infectious disease rates fell from 39.3 percent of deaths in 1900 to 17.9 percent of deaths in 1939.

surface (Levin et al 2002). This sent a major warning message to the public and the federal government about the quality and contamination of surface water sources. After passage of the Clean Air Act in 1970 and the Federal Water Pollution Control Act in 1972, the US Congress followed suit with the Safe Drinking Water Act. The impetus for this Act was several studies done by the Bureau of Water Hygiene of the United States Public Health Service that showed that drinking water quality was average to poor. The Community Water Supply Study (USPHS July 1970) surveyed 969 public water systems. The USPHS Drinking Water Standards (1962) were used to evaluate the water quality and associated health risks. The study included review of past records, surveillance programs, examination of conditions of physical facilities and sampling of water (USPHS, 1970:176). The study found that 80 percent of the 969 public water systems failed to meet one or more of the USPHS standards (Ibid.: 63).

In response to the Community Water Supply Study and subsequent hearings by the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce, in December of 1974 the Safe Drinking Water Act was signed by Congress. The SDWA resulted from the environmental decade (1969-1979) and was created to complement the Clean Water Act (Tarlock, 1997). Protection of the public was the primary reason for the Act. As the USEPA (1999b:3) explains, "Public health is the primary goal of the SDWA, achieved by ensuring that public water supplies meet strong, enforceable standards." The 1974 Safe Drinking Water Act was a federal law that delegated authority for implementation to the states via a primacy model (see Figure 2.1 below).

Figure 2.1: Multi-level Accountability - United States Safe Drinking Water Act (1974)



The role of the states was addressed at length during hearings of the Committee on Interstate and Foreign Commerce with respect to the Safe Drinking Water Act. The fact that the states had failed was mentioned by several witnesses including the head of the National Well Water Association, Dr. Lehr. An excerpt from the testimony of Dr. Lehr provides some interesting insight into questions of the federal and state roles:

> Dr. Lehr (National Well Water Association): Would you like to see 50 different laboratories doing identical research to work out the standards for each State? Wouldn't that be a greater waste?
> Mr. Schmitz (Committee Member): Wouldn't you be in favor of amending out the National Government setting the standards?
> Dr. Lehr: No, I don't think one State should be allowed to have less water quality for their citizens than another State. I think all the States will be involved in this. We are not talking about any dictatorship here.
> Mr. Schmitz: But you will admit, to pursue this one question, that if everyone is so interested in clean water, you don't have to have the Federal Government to set the standards. Despite the arguments here I imagine if there is any press here I will be cited tomorrow as the guy who is against clean water. I just have not been convinced at the Federal level we are the ones who should set a standard,

> because if everyone is interested in clean water then you don't have to come to the Federal Government to force it, right?
> Dr. Lehr: Unfortunately the answer to that is no. We have had 30 years to see what States could do and they couldn't do it. (Ibid:137-8).

Other interest groups that might be expected to stand up for states rights such as the American Water Works Association were also somewhat supportive of the primacy model as additional testimony from the hearings illustrates:

> Mr Larson (President of the American Water Works Association): We represent the water industry that provides water for about 85 percent of the population.
> Mr. Carter (Committee Member): You don't think that the Federal Government should set up minimum standards for pure water?
> Mr. Larson: I think we state that we feel like we should have standards.
> Mr. Carter: But you state that you should have State standards. I believe your paper opposes the setting of Federal Standards. Is that not correct?
> Mr. Larson: No, we oppose the Federal Government enforcing the standards. We think the Federal Government should provide the standards and the States accept these to guide them in their enforcement.
> Mr. Carter: I don't get that from your paper. If the States are below those standards, what are we going to do then? Who is going to enforce it?
> Mr. Larson: If they do not meet the standards?
> Mr. Carter: Yes.
> Mr. Larson: The State agency, and they would be using the Federal standards.(Ibid.:147)

In the end, the model adopted was one of states required to show they would enforce the standards before being granted primacy to be able to implement the provisions of the Safe Drinking Water Act. States had to pass laws at least as stringent as the Safe Drinking Water Act in order to achieve primacy. Under primacy, as the model above shows the states monitor the municipalities and the federal government delegates authority to the states yet can also step in (as the EPA) when the states fail. If we consider the principal-agent framework introduced in the previous chapter we can see that prior to 1974 states were the principals of the municipal agents but failed to act in their capacity as principals to get the agents to improve drinking water protection. By contrast, the primacy model involves the states as both principals and agents who now are agents of the federal government via delegation of authority in addition to their role as principals of the municipalities (public water systems).

The SDWA applies to every public water system (PWS) in the United States. A public water system is defined as a water system that has at least 15 service connections and serves

over 25 people for at least 60 days per year. There are more than 170,000 public water systems in the US. The SDWA distinguishes between community water systems which it defines as serving Americans year-round and non-community water systems that can be transient or intransient which provide water on a less than annual basis.[26] Responsibility is "divided among the USEPA, states, tribes, water systems and the public" (USEPA 1999). The Act states that tap water must meet National Primary Drinking Water Regulations including the maximum contaminant levels (MCLs) for physical, chemical, biological and radiological substances in drinking water. The National Primary Drinking Water Regulations "set enforceable MCLs for particular contaminants in drinking water or required ways to treat water to remove contaminants" (USEPA 1999). "USEPA, states, and water systems work together to ensure these standards are met" (USEPA 1999:1).

Amendments were made to the SDWA in 1986. Experts and politicians generally agreed that the EPA was moving too slowly. For example, the EPA had only determined 23 MCLs and no treatment techniques by 1986 (Gostin 2000). Moreover, the majority of public water systems (PWS) still did not meet minimal national standards (Gostin 2000). After 12 years, the EPA had only served to adopt most of the older US Public Health Service guidelines and adopted only one new standard : for trihalomethanes in 1979 (Levin et al 2002). As Tarlock (1997) notes, "The 1986 Amendments are a classic example of the culture of regulatory failure that has infected the EPA almost since its creation. After a decade of extensive debate, Congress strengthened the Act by micro-managing the EPA."

As Levin and his colleagues (2002:50) explain, the United States Congress, "frustrated by the slow pace of drinking water regulation, revised the SDWA" by signing and mandating the establishment and revision of 83 specific contaminants. In addition, the EPA was ordered to adopt 25 new contaminant standards every three years. In the ten years following the 1986 amendments, over 80 new drinking water rules were established. Following directions from the SDWA amendments of 1986, the EPA instituted the Surface Water Treatment Rule in 1989. This rule limited water turbidity. It also outlined filtration criteria, and disinfection requirements as well as new maximum contaminant level goals (MCLGs). The 1986

[26] An example of a non-transient non-community water system is a school with its own water supply. It does not serve the same people year-round. An example of a transient non-community water system is a rest area or a campground that provides water to visitors. See EPA, 1999.

amendments also gave rise to the Total Coliform Rule (TCR) which sets MCLs for coliforms which are well-documented indicators of contamination.

In addition to the requirements to develop new contaminants, a significant change in 1986 was the addition of regulations pertaining to groundwater. As Lewis (1989:900) explains, "The focus of the original Act was surface water because when the Act was initially passed, it was thought that groundwater was immune to contamination because it was underground." Experts soon discovered this was not the case. A 1984 report for the Office of Technology Assessment found that more than 200 contaminants were found in groundwater used for drinking and the federal MCLs were set for only 22 of these (Lewis 1989:898). In addition, a 1985 National Groundwater Policy Forum involved the Conservation Foundation and the National Governors' Association set the stage for these changes to the act. One of the main problems identified at the forum was that legislation respecting groundwater was fragmented among 16 statutes with none having primary coverage.

Table 2.1: Safe Drinking Water Act at a Glance: From 1974 through 1996

1974 SDWA	**1986 Amendments**	**1996 Amendments**
- National Primary Drinking Water Regulations (adopted USPHS standards and added a standard for trihalomethanes in 1979)	- Required disinfection for all water systems - Expanded number of regulated contaminants to add 25 every three years - Required filtration of all surface water supplies, unless strict criteria are met - Established a monitoring program for unregulated contaminants - Underground Injection Control program - Surface Water Treatment Rule	- slowed down pace - Surface Water treatment Rule enhanced - Lead and Copper Rule - Information Collection Rule - Disinfectants and Disinfection Byproducts Rule - Boxer amendment for vulnerable subpopulations - Operator Certification - Public Right-to-Know - Public Reporting - required each state to develop a Capacity Development Program

From: USEPA 1999a, 1999b

The amendments pertaining to groundwater were the most controversial of those passed in 1986. These regulations came into being during the Reagan years in office when state rights were championed. Groundwater had not been the purview of the federal government as it was seen to be a state responsibility in light of their historic rights over land use. The compromise reached was voluntary compliance along with wellhead protection (Lewis 1989:903). The program that resulted, the Underground Injection Control (UIC) program serves to control injection of wastes into groundwater. The reasons protection won out over state's rights are outlined by Lewis:

> One of the reasons advanced to justify federal regulation was the fact that groundwater is an important natural resource that is becoming polluted in all areas of the country. Another reason was the failure of the states to adequately protect this resource despite their historic control over land use. Also, both technological knowledge and money were more widely available at the federal level than at the state level (1989:904).

Other significant amendments in 1986 include changes to the compliance provisions of the SDWA. Prior to 1986, the EPA had to obtain a court order before being authorized to compel states to comply with MCLs. After the amendments, the EPA could issue administrative orders and fines on its own (Ibid:905).

Prior to the 1986 amendments, the EPA did not focus on enforcement actions. After 1986, EPA civil enforcement accelerated. For example, between 1990 and 1994 the states undertook an average of 1555 enforcement actions per year, while the EPA undertook about 2626 enforcement actions per year (Tarlock 1997). It should be noted that many of these actions would be overlapping.

With reference to the principal-agent framework discussed in the preceding chapter, it is interesting to note that when the federal level principal was not involved the state-level principals shirked resulting in the lack of implementation of the USPHS standards. With the passage of the SDWA in 1974 and its primacy model, the EPA was able to develop binding standards but moved too slowly for Congress. The 1986 amendments demonstrate an expansion of the principal-agent model to include the Congress as principals with the EPA as agents. This suggests that multi-level accountability is enhanced when links are added to the chain of principal-agent relationships.

Further developments occurred in 1992 when the EPA agreed to adopt rules to address risks posed by distribution systems such as cross connections, backflows, and other risks from pipes that deliver treated water to consumers' taps. One of these amendments was the Lead and Copper Rule. This rule addressed the lead and copper in much of the pipes that serve as the distribution system for water.

Ten years after Congress required the EPA to move faster on regulations new amendments were made. These amendments slowed down the pace of standard-setting but kept it above 1974 levels and included consideration of cost-benefit analysis in the process. The most recent amendments to the SDWA took place in 1996, and are still being implemented. According to Tarlock, the rationale for these amendments is four-fold (1997:1):

1. Small suppliers lack the financial capacity to comply with federal standards.
2. The Maximum Contaminant Levels and Maximum Contaminant Level Goals approach established by the1974 SDWA provides too much risk protection (too few health benefits) compared to the costs of compliance.
3. The process of contaminant selection can be improved by 'sound science'.
4. The appropriate level of regulation can be improved by application of 'sound and objective science' and cost-benefit analysis.

In part, these amendments repealed the 1986 changes that required the EPA to identify 25 new contaminants and issue MCLs every 3 years. The rationale for this change was, "because it did not permit scientific judgement to separate real from perceived risks" (Gostin 2000). The requirement for 25 contaminants was modified and replaced by a requirement that the EPA consult with the scientific community, periodically publish a list of hazardous contaminants and create a contaminant occurrence database. Every five years, the EPA must select no fewer than five contaminants and after giving notice and receiving public comment, decide whether to regulate them (Gostin 2000; Levin et al 2002). Along these lines, cost-benefit analysis was to be "thorough for every new standard" (USEPA 1999a).

Another change resulting from the 1996 amendments was the adoption of the Information Collection Rule (ICR). This rule mandated collection of data on water quality with specific attention to microbiological contaminants, and disinfection byproducts (Gostin 2000).

In addition, this rule required the testing of source water, and, in some circumstances, finished water, for cryptosporidium.

Another rule, the Disinfectants and Disinfection Byproducts Rule, was also added. This provision established maximum contaminant level goals (MCLGs) and maximum residual disinfectant levels goals (MRDLGs) for several common disinfectants and disinfection byproducts. Similarly, an additional rule strengthened protection for MCLs including for cryptosporidium parvum. (USEPA, 1999a).

The Surface Water Treatment Rule (SWTR) adopted by the 1986 amendments was enhanced by the 1996 amendments so that by February, 1999, there were more stringent standards for filtration, and record-keeping requirements were increased. In addition, groundwater under the direct influence of surface water had to be surveyed (Gostin 2000:849).

Recognition that those who ensure the water is safe to drink need to be properly educated about the health risks, and requirements under the SDWA, led to an operator certification amendment in 1996. By 1999, guidelines had been issued of minimum standards for certification and recertification of drinking water treatment system operators.

In addition, an amendment addressed the public's right-to-know and responsibility for ensuring the safety of public water systems. "Water systems across the nation rely on citizen advisory committees, rate boards, volunteers and civic leaders to actively protect this resource in every community in America" (USEPA 1999:3) This involved the requirement of annual reports for PWS which include the detected contaminants, possible health effects and identify the drinking water source. The public could now take action if they found their drinking water was contaminated.

In 1996, amendments included the Drinking Water State Revolving Fund which provides grants to implement the SDWA, and for the costs of improvements to drinking water treatment systems. Smaller systems receive special consideration for this fund (USEPA 1999:3). This amendment set aside 1 billion per year for system improvements, and was developed in conjunction with the Lead and Copper Rule that banned the use of any pipe or plumbing fixtures that are not lead free in facilities providing water for human consumption (Blabolil et al 1997).

The SDWA: Setting Standards

In setting standards, the EPA relies on input from many individuals and groups. It is important to note that standard-setting is beyond the scope of this study but is described here to provide context for the reader. The EPA is advised about standard setting on an ongoing basis by the National Drinking Water Advisory Council (NDWAC) which is composed of 15 members, 5 from the general public, 5 representatives of states, and 5 representatives of local agencies concerned with water hygiene and water supply including 2 associated with small rural PWS. In addition, representatives from water utilities, environmental groups, public interest groups, states, tribes and the general public can participate in public meetings and provide written comments on proposed rules. The NDWAC has several working groups of about 20 members each that advise it on a variety of technical issues. The EPA sets national standards, "based on sound science to protect against health risks, considering available technology and costs" (USEPA 1999)

Health goals are based on risk. Under the Boxer amendment of 1996, the understanding of risk includes to the most sensitive people such as infants, children, pregnant women, the elderly, and the immuno-compromised (USEPA 1999). In order to set drinking water standards, the EPA uses a process called risk assessment. It measures how much of the chemical or contaminant could be in the water, and then scientists estimate how much of the contaminant the average person is likely to drink, or what is termed 'exposure'. The EPA uses two litres per day throughout a 70 year life span to determine the level of exposure (1997:3). Cancer risks are established differently. Scientists estimate the chances that someone may get cancer because they have been exposed to a drinking water contaminant. The EPA sets MCLs limiting cancer risk to between 1 in 10,000 to 1 in 1,000,000 over a 70 year lifespan (Ibid.).

Compliance and Enforcement of SDWA

The SDWA is one of 8 environmental statutes that contain provisions for criminal prosecution in addition to its overlapping civil and administrative penalty provisions (Blabolil et al 1997).[27] Evidence of EPA enforcement is not difficult to locate. The EPA outlines means for enforcement in its documents about understanding the SDWA. These documents (1999a, 1999b)

[27] Others include Resource Conservation and Recovery Act, Federal Solid Waste Disposal Act, Toxic Substance Control Act, Federal Insecticides, Fungicde and Rodenticide Act, Comprehensive Environmental Responsibility, Compensation and Liability Act, Clean Air Act, Federal Water Pollution Control Act (also referred to as the Clean Water Act) and Refuse Act (also referred to as the Rivers and Harbours Act).

explain that the SDWA is legally enforceable by the states and the EPA. The EPA and states can take actions against systems that do not meet safety standards by issuing administrative orders, taking legal actions, or fining utilities. In addition, the EPA can revoke state authority while continuously retaining its own enforcement authority.

The SDWA is subject to both civil and criminal suits. The maximum civil penalties are $25,000 per day of violation. The Act gives any individual or organization the right to bring a civil suit against anyone violating the law including the PWS, the state or the EPA (Concerned Citizens and CELA 2001). Criminal penalties vary. The EPA emphasizes that it works to increase understanding and compliance (Ibid.).

Moreover, the EPA publishes a Water Enforcement Bulletin that outlines the cases under review, and their outcomes, primarily for EPA staff, but available on their website. A recent example is highlighted by the case *Trinity American Corp v. USEPA* (USEPA,1999c). In this case, Trinity American Corp was seeking a reversal of the EPA's decision. Trinity American Corp had allegedly contaminated the groundwater in Trinity with the toxic chemicals dichloroethene and trichloroethene. The state of North Carolina arranged a consent decree with Trinity Corp to remedy the situation in December, 1996. The EPA investigated and soon after issued an emergency order as it determined the state's efforts insufficient to protect human health. The court rejected Trinity's argument and upheld the EPA decision stating that the EPA "need not prove that anyone had consumed contaminated water, only that contamination in or likely to enter an underground source of drinking water may pose an imminent substantial endangerment to the health of persons" (USEPA 1999).

Section 1420(c) of the amended SDWA (1996) in conjunction with section 1452(a)(7)(G)(i) established the withholding of state's Drinking Water State Revolving Fund monies if the state failed to develop and implement a strategy to help PWSs acquire and maintain the technological, managerial and financial capabilities to ensure safe drinking water under the act. All 50 states were approved (USEPA 2001). States can still be subject to 20% withholding in subsequent years if they do not implement the plans they have laid out.

Moreover, under the SDWA, citizens can bring civil suits against companies or others who fail to comply, as well as against the EPA if it fails to adequately apply the law. An example of the latter is the case of *Legal Environmental Assistance Foundation (LEAF) v. USEPA (1994).* This case involved LEAF winning the case and achieving the remedy of an EPA decision being

overturned. The EPA had rejected LEAF's petition to promulgate a rule withdrawing approval of Alabama's Underground Injection Control Program because it did not regulate hydraulic fracturing activities associated with methane gas. The EPA determined these activities to be beyond the scope of the SDWA's groundwater protection regulations, but the US district court decided in favour of LEAF's position.

Three areas where criminal prosecutions can occur are for willful violations of the Underground Injection Control (UIC) program, interstate sales of drinking water coolers that are not lead-free and for tampering with drinking water systems (Blabolil et al 1997). Violators of the UIC or those who knowingly provide false statements can receive up to 3 years in prison and/or a criminal fine in accordance with Title 18. Interstate sales of drinking water coolers that are not lead-free carries a term of up to 5 years and a fine. Tampering causing harm carries a similar term of up to 3 years and/or a fine.

Criminal prosecutions have occurred under all three provisions. For example, in 1987, an oil company was fined $4000 and its Vice President was sentenced to 3 months in federal prison and 9 months probation for concealing information from the EPA.[28] The company had injected salt water and had concealed the fact that it had not passed EPA tests. Prosecutions have also occurred for providing false data to the EPA.[29]

Even though the EPA has oversight over the states, violations continue to occur. While about 75 to 80 percent of PWSs report no violations, 30 million Americans drink water from systems that report violations of health based standards (Levin et al 2002). In addition, some experts suggest data may underestimate noncompliance because EPA data audits show states reported only 55 percent of major violations and 10 percent of monitoring and reporting violations (Ibid.)

The 1996 amendments also included a requirement for states to develop capacity-building programs so that both community and non-community water systems could acquire and maintain technical, managerial and financial capacity. Each state had to report on the effectiveness of its program to its Governor and the public by 2002 and then every three years thereafter. Failure to report on the capacity development program could result in a 20 percent reduction in the annual state Drinking Water Revolving Fund (DWRF) allotment. The intent of

[28] See US v Jay Woods Oil Co. No 87-CR-20012-BC (ED Mich sentenced May 19, 1987).
[29] See US v Wright, 988 F 2d103b (10th Cir 1993).

this program was to build capacity so that compliance with drinking water standards would improve and thus the quality of drinking water protection at the local level would be enhanced.

What do the state governments do?

States can establish higher standards for drinking water, but most do not. In fact, only Connecticut exceeds the Surface Water Treatment Rule, and only one state, Louisiana, has filtration regulations that are more stringent than those of the federal government (Gostin et al 2000:849).

State drinking water programs can apply to USEPA for 'primacy', the authority to implement SDWA within their jurisdictions, "if they can show they will adopt standards at least as stringent as USEPAs and make sure water systems meet these standards" (1999:2). All states have primacy except Wyoming and the District of Columbia whose water is overseen by the EPA. In 2000, the Navajo tribe was granted primacy and "treatment as a state." Indian tribes are eligible to apply for primacy in the same way that states can do so.

With primacy, state laws grant one or more state agencies the authority to implement and administer drinking water protection laws. States direct either the state health department or environmental protection department, or both to implement and administer laws pertaining to water quality (Gostin et al 2000). 15 states and 1 territory give primary authority to the state health department[30], while 20 states and 3 territories give the same authority to environmental protection authorities[31], and the rest of the states give this authority to both health and environment departments[32] (Ibid: 849).

In terms of oversight, states are expected to perform the following tasks:

- ensure water systems test for contaminants
- review plans for water system improvement
- conduct on-site inspections and sanitary surveys
- provide training and technical assistance

[30] Arkansas, Connecticut, California, Hawaii, Louisiana, Maine, Minnesota, Mississippi, Nebraska, New York, North Dakota, Oregon, Virginia, Washington, West Virginia and Palau. See Gostin et al 2000.

[31] Alabama, Alaska, Arizona, Georgia, Idaho, Indiana, Iowa, Maryland, Michigan, Missouri, New Hampshire, New Jersey, New Mexico, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Vermont, Wisconsin, Guam. The Northern Mariana Islands and the US Virgin Islands See Gostin et al 2000

[32] Colorado, Delaware, Florida, Illinois, Kansas, Kentucky, Massachusetts, Montana, Nevada, North Carolina, Ohio, Rhode Island, South Carolina, Utah, Puerto Rico and the Marshall Islands. See Gostin et al 2000.

- take action against water systems not meeting standards (USEPA, 1999)

A major challenge and of much controversy for the EPA in relation to the SDWA has been the high costs of ensuring drinking water safety. The SDWA is perhaps the most famous[33] of 'unfunded mandates' meaning its standards are legally binding and enforceable by, in this case, a federal agency, but the funding provided by the federal government to implement the SDWA is inadequate. In a recent study, the Harvard School of Public Health (2002) identified several factors that will strain water resources over time including the deterioration of public water infrastructure such as pipes, global climate effects, waterborne disease, groundwater and surface water contamination, and ineffective government regulations. The study stated that over $151 billion needs to be spent over next 20 years. The Water Infrastructure Network (2001) put costs at $1 trillion estimating that an additional 23 billion per year should be spent on nation's 54000 community water systems to meet requirements of Clean Water Act and Safe Drinking Water Act. As noted in Chapter 1 the costs of drinking water infrastructure and safety are considerable hence the need to impose costs in order to ensure enhanced drinking water provision at the local level.

2.3 Drinking Water Protection in Canada

In contrast to the United States, Canada has non-binding Guidelines for Drinking Water Quality rather than a legally enforceable Safe Drinking Water Act. Drinking water is largely the responsibility of the provinces. In several documents in the 1980s and early 1990s, the federal government expressed its role as one of "flexibility and cooperation" with the provinces and municipalities (see Mouldey 1994:12).

While the provinces are largely responsible for ensuring safe drinking water provision and municipalities are largely responsible for implementation, the federal government is solely responsible for drinking water on aircraft and other federal areas of jurisdiction such as postal offices, for example. Its responsibility for ensuring potable water on First Nations reserves is complex. There is no federal drinking water legislation and thus no legislation regulating water in First Nations communities. Moreover, the Walkerton Inquiry requested that the federal government define its responsibility for drinking water on reserves and it responded in writing

[33] The Congressional Budget Office gave as one of its reasons for choosing the SDWA for a case study of unfunded mandates as "it has often been cited as a particularly onerous mandate." See Congressional Budget Office 1995:1.

that its responsibility was "shared among First Nation Band Councils, Health Canada, and Indian and Northern Affairs Canada (INAC)" (Chapter 15:5). The discussion of the federal role as it pertains to these areas is largely beyond the scope of this study. This work is focused on municipal provision of drinking water via public water systems.

For public water provision, Canadian drinking water guidelines have been in place since 1968, and the process for determining them has remained largely the same. The guidelines are currently prepared by the Federal-Provincial-Territorial Committee on Drinking Water; the Committee is made up of representatives from each province and territory, as well as from Health Canada. In 1968, the guidelines were established by a joint committee made up of the Canadian Public Health Association Drinking Water Standards Committee and an Advisory Committee (Mouldey 1994: 184). In 1978, a joint working group critically reviewed the 1968 guidelines. Once this task was completed, the group disbanded and the Federal-Provincial Territorial Subcommittee on Drinking Water was not struck until 1986. The Federal-Provincial-Territorial Advisory Committee on Environmental and Occupational Health established the permanent Federal-Provincial-Territorial Subcommittee on Drinking Water that year.

This Advisory Committee includes members from environment, health and labour departments of the federal, provincial and territorial governments, and appoints representatives to the permanent Subcommittee on Drinking Water. Each province and territory has one representative with the federal government having two representatives. There is a chairperson and vice-chairperson and both are elected by the Subcommittee for two year terms. The federal government provides a technical secretariat of 8 members.

The Subcommittee meets twice a year, once in Ottawa, and once in one of the provinces or territories. It reports to the Advisory Committee on Environmental and Occupational Health with one Subcommittee member attending the twice annual Advisory Committee meetings. The Subcommittee must seek final approval from the Advisory Committee on any guideline recommendations. In order to approve guidelines at the Subcommittee level, efforts are made to reach consensus. Failing this, members will vote with each member having one vote and a two-thirds requirement for passage with at least 75 percent of eligible members voting. Abstentions or disapprovals require an explanation. Once the guideline receives approval by the Subcommittee, the Advisory Committee must agree to the guideline before it can become

official. Consensus is required at the Advisory Committee level enabling any province to veto a guideline. Once a guideline is approved by both committees, it is open to comment for one year during which it is considered to be 'proposed' (Mouldey 1994:185).

The drinking water guidelines follow the public health approach of other regulatory policies that are protective in nature, and address the multiple lines of defense. Health Canada (2002) recommends a 'multi-barrier approach' to safe drinking water. Other relevant policies include the Canada Water Act, the Canadian Environmental Protection Act, and the Fisheries Act, as well as various Acts at the provincial levels. The Canada Water Act outlines federal-provincial arrangements regarding water resources management.[34] The Canadian Environmental Protection Act (1999) primarily addresses the control of toxic substances as well as pollution control. It requires that companies who use highly toxic substances provide pollution prevention plans. The Fisheries Act addresses source water protection and provides regulations limiting effluents.

Setting Guidelines for Drinking Water in Canada

The Federal-Provincial-Territorial Committee sets Guideline values for microbial, chemical, physical and radiological characteristics of the drinking water. Maximum Acceptable Concentration (MAC) is set for substances known to cause adverse health effects. Interim Maximum Acceptable Concentration (IMAC) is set for substances for which insufficient data exists to determine a MAC. The Committee also sets Aesthetic Objectives (AOs). These apply to characteristics such as colour, taste or smell and turbidity.

Guidelines are determined using Acceptable Daily Intake values (ADI) to form the basis for the recommended acceptable concentration. The ADI is determined by dividing a no-observed-adverse-effect level (NOAEL) by an uncertainty factor[35] (Mouldey 1994:88).

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[34] It should be noted that the Canada Water Act has gone largely unimplemented (with the exception of Part 3 which limits phosphates in detergents) as it required the cooperation of the provinces and federal government and allowed government to develop plans without implementing these. See Harrison 1996, especially pages 65-67 and 101. There may be more recent developments which look promising such as the creation of the Mackenzie River Basin Board involving cooperation between the federal government, Alberta, Saskatchewan, British Columbia, Northwest Territories, and the Yukon (1997).

[35] Uncertainty factors range from 1 to 10 times for the following: (a)variation between species, extrapolation to humans from animals (b) variation among species; sensitive individuals (c) less than lifetime studies (d) use of lowest-observed-adverse-effect level rather than no-observed adverse effect level (e) gaps in overall toxicity database (see Health and Welfare Canada, 1989:2).

The recommended maximum concentration is determined by multiplying the ADI times average body weight times apportionment and dividing by the average daily intake of water in L. The average body weight is assumed to be 70kg but may be adjusted if sensitive populations are considered (Ibid.). The average daily intake of water is assumed to be 1.5 L in Canada (Ibid.).[36]

For carcinogenic or cancer-causing contaminants, an acceptable risk is set at a lifetime risk of cancer as 1 case in 100 000 to 1 case in 1000 000 based upon daily exposure to the chemical. MACs for carcinogens are set as close to zero as possible. Health Canada (1988:1) explains that guidelines represent "the line between what is safe and what is harmful or criminal or, more correctly, between what is regarded as an acceptable risk for society...and what is an unacceptable risk."

Recently, the Commissioner of the Environment and Sustainable Development released a report on the federal responsibilities for drinking water. The Commissioner who is part of the Office of the Auditor General of Canada found that the pace for guideline development by the Federal-Provincial-Territorial Committee on Drinking Water (CDW) was very slow. Of 83 existing contaminant parameters, about 50 need to be updated to reflect current science. Based on current practice, the Commissioner estimated this may take 10 years. Further, the report noted that after 8 years on the Federal-Provincial-Territorial Committee's agenda, the guideline for arsenic remains at the public consultation stage.[37] Moreover, the Commissioner found that of six federal agencies it studied, there was variation in standards and guidelines across departments. Finally, it was found that while Health Canada inspects cruise ships and trains, it does not inspect aircraft due to funding constraints. A second report examined the state of drinking water on First Nations reserves. That report found that "residents of First Nations communities do not benefit from a level of protection comparable to that of people who live off reserves" (2005b, p 1). The report also explained that while the departments of Indian and Northern Affairs Canada (INAC) and Health Canada share responsibility for ensuring potable water in First Nations communities they do not operate under a regulatory framework. Instead they use administrative documents and funding arrangements to set and enforce water

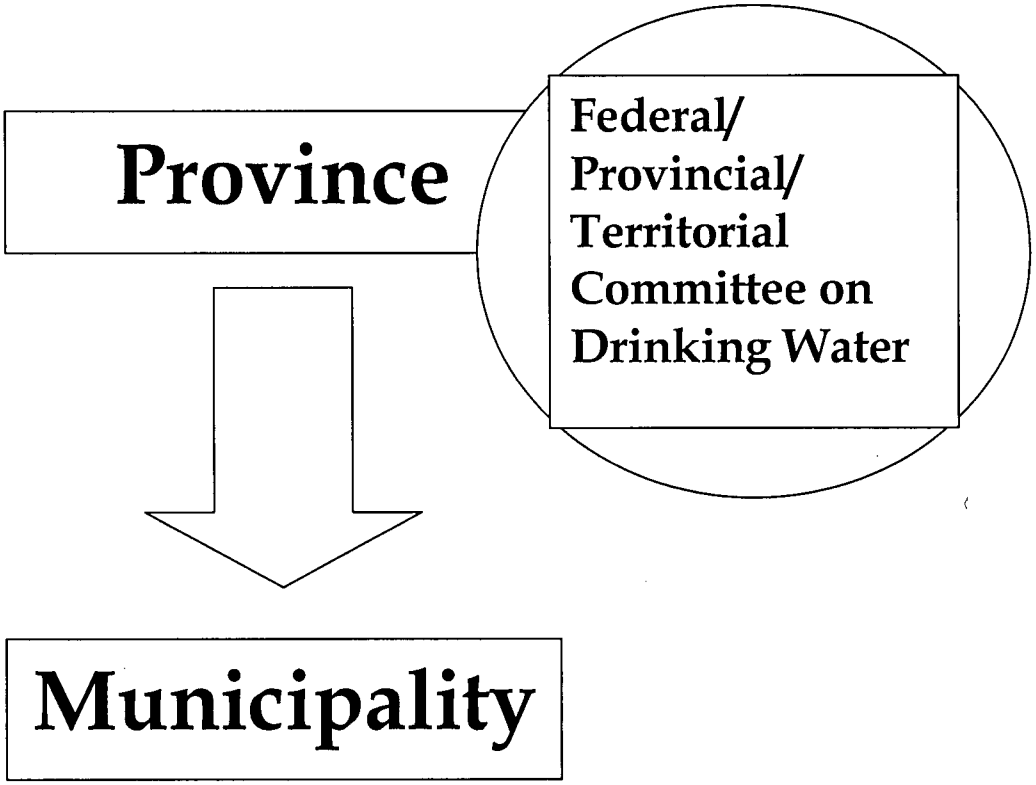
[36] Mouldey (1994) notes that the United States adopted a daily intake of 2L because their average daily intake, calculated over 9 studies, was 1.63 L/day so the larger volume of 2L was adopted to represent the intake of the majority of consumers.
[37] It should be noted by contrast that the USPHS issued a standard for arsenic in 1942.

quality requirements. The report recommended that a regulatory regime comparable to that within the provinces was needed.

In the mid- 1980s, the federal government introduced a Drinking Water Materials Safety Bill but this Bill died on the order paper and was never passed into law (Concerned Citizens and CELA). In 1990, the federal government promised a Drinking Water Safety Act as part of Canada's Green plan (Mouldey 1994). This act was never passed but would have been limited to drinking water within federal jurisdiction (e.g. military bases, territories, reservations and airlines, airports). If passed it might have been similar to the United States Public Health Service standards for interstate carriers passed in 1914.

In contrast to the primacy model adopted by the US, Canada's model of multi-level governance for drinking water protection is one of intergovernmental committee and provincial responsibility. As explained above, non-binding guidelines are set in concert with the provinces and federal government. Health Canada provides the secretariat and scientific support to the Federal-Provincial Territorial Committee. Provinces decide whether and to what extent they want to adopt the drinking water guidelines in their jurisdiction. They pass legislation at the provincial level for ensuring water is safe to drink. Initially, this role was usually addressed through public health acts but in more recent years provinces have passed stand-alone drinking water legislation or developed drinking water management strategies using a multi-barrier approach.

Figure 2.2: Drinking Water Protection in Canada - Provincial Responsibility and Intergovernmental Committee



What do provinces do?

In Canada, provinces have generally accepted primary responsibility for drinking water. This includes enacting laws, implementing treatment programs, and monitoring and testing. They are also responsible for compliance and enforcement. Within the provinces, municipal acts empower municipalities to protect the drinking water through infrastructure, for example, while public health acts address the local health issues and risks associated with water. Other relevant provincial acts include environmental protection and assessment acts that regulate pollution discharges into water, and water treatment and sewage systems (see CELA 2001: 12).

While provinces can set their own standards and all provinces participate in the intergovernmental committee that sets the Canadian Guidelines, only two provinces, Nova

Scotia and Alberta have fully adopted them. Alberta was the first to adopt them in 1972 making them binding in its Municipal Plant Regulation in 1978 (Hill et al, forthcoming). Nova Scotia adopted the Guidelines in 2000. Quebec was the first province to pass its own binding standards with 42 parameters in 1984 just prior to the formalization of the Federal-Provincial-Territorial Committee in 1986. Today most provinces have some standards for drinking water safety though several provinces only made these binding in recent years. New Brunswick is the only province where all parameters are left to the discretion of the Ministry with sampling plans set on a case-by-case basis. British Columbia has the least number of binding standards with requirements for 3 bacteriological standards and others at the discretion of the Drinking Water Officer. Currently, Ontario has 161 drinking water standards and requires monitoring for 73 of these. Prior to Walkerton, Ontario's Drinking Water Objectives were non-binding. Only Saskatchewan and Ontario require that water systems provide annual water quality reports to the public. Saskatchewan, Ontario and Nova Scotia have also instituted annual inspections with some compliance monitoring.

There is no federal enforcement of drinking water as it is primarily a provincial responsibility, and the Guidelines are non-binding. The extent to which drinking water laws are enforced at the subnational level appears to be largely unknown. As the Canadian Environmental Defence Fund notes, "It is difficult to establish the level of enforcement ... No province specifically reports prosecutions or convictions related to drinking water" (2001: 15). While this was the case prior to 2001, Ontario and Saskatchewan have both recently begun reporting compliance rates. Most provinces do not tend to discuss compliance measures directly within their legislation. Lindgren (2003:18) explains, "Provinces have generally adopted or expressed the federal MACs and IMACs through guidelines, objectives and standards. In Ontario, for example, drinking water quality, historically was addressed through non-enforceable Ontario Drinking Water Objectives." The Walkerton tragedy has given rise to changes that are discussed in more detail in the chapters that follow.

2.4 Comparing Drinking Water Protection in Canada and the United States at the Federal Level

Since the early part of the twentieth century, Canada and the United States have taken different approaches to addressing drinking water protection. For Canada, the issue was not on the agenda until 1968, while the United States began producing guidelines as early as 1914. Today, Canada still has no binding national standards while the United States Environmental

Protection Agency regulates over 90 contaminants and ensures quality through binding rules such as the Surface Water Treatment Rule and the Underground Injection Control Program.

There are few similarities between the American and Canadian approaches to drinking water protection. The main similarity is the recognition that there is a need to protect the health of the public. In addition, both the Federal-Provincial-Territorial Committee on Drinking Water along with the Federal-Provincial-Territorial Committee on Environmental and Occupational Health in Canada and the Environmental Protection Agency in the United States establish maximum levels of contamination that are recommended (Canada) or required (USA). In Canada, these are referred to as MACs (maximum acceptable concentrations) and in the US these are referred to as MCLs (maximum contaminant levels). There are some significant differences between the levels of 'acceptable' contamination. For example, Canadian guidelines for arsenic are proposed at 0.025 mg/L while American standards for arsenic are 0.010 mg/L.

Two key parameters for drinking water safety are turbidity and coliform levels. In terms of turbidity, the American standard is not to exceed 5 NTU at any time with 0.3 NTUs required for conventional filtration systems in order to ensure 3-log (99.9%) removal of giardia and cryptosporidium. Canada's guidelines were recently changed (2004) and are now similar to the American standard with 1.0 NTU for slow sand filtration, 0.3 NTU for conventional and 1.0 for membrane filtration. Yet the turbidity guideline is not binding and Canadian provinces vary in their requirements with filtration required in only half of the Canadian provinces.[38] For total coliforms, the Canadian Guideline is zero while the US maximum contaminant level goal is zero and the maximum contaminant level is 5 percent if greater than 40 samples are collected in one month. If less are collected, only 1 sample can be coliform positive. Any coliform positive tests result in requirements to undertake additional testing.

The number of differences in approaches to drinking water protection between these two countries that share a border is large. First, Canada has never adopted binding standards of any kind for drinking water at the federal level. Second, the United States has been involved in drinking water protection at the federal level for over a hundred years, while Canada has been minimally involved for about thirty-five years. Third, in terms of standard setting, there are significant and important differences. Fourth, the levels for public involvement and

[38] Filtration is required in Alberta, Saskatchewan, Ontario, Quebec and Nova Scotia.

notification are highly varied. Finally, enforcement and compliance appear to be of high concern at the federal level in the US including by Congress while within Canada this is largely left to the provinces and they are not required to report to other levels of government nor to citizens.

The Canadian federal government has not adopted any binding standards with respect to the water that Canadians drink.[39] It has had guidelines since 1968 which were revised in 1978, and since 1986 have been revisited twice yearly. This approach has been criticized as slow by Canada's Office of the Auditor General. By contrast, the US federal government has had oversight on binding standards through the EPA since 1974. These EPA standards are revisited on an ongoing basis. The major difference is that one country has binding standards while the other has non-binding guidelines. While all 50 states and the territories are required by law to adopt the US standards, only 2 provinces, Nova Scotia and Alberta, fully adopt the Canadian Guidelines.

The American century of experience in regulating drinking water compares with a thritysomething experience in Canada. The US regulations have been significantly enhanced over time, while the Canadian ones remain non-binding. Even in terms of their scope, the history of American regulation has produced treatment techniques and rules over time while the Canadian Guidelines have been focused on contaminant parameter listings. The Guidelines are similar to the National Primary Drinking Water Regulations but fail to address the issues of the Underground Injection Control program, Surface Water Treatment Rule, Information Collection Rule, and Lead and Copper Rules, for example. The United States acted more quickly to protect its citizens from contaminated drinking water by providing guidelines for contaminants as early as 1914, and environmental circumstances led to an even stronger regulatory regime in the future. Canada proposed but failed to do in 1990 with the Drinking Water Safety Act what the United States enacted in 1914.

The amount of time invested in drinking water is greater on the America side, and so is the approach to standard setting in several ways. First, the EPA has greater involvement of agencies and the public in its standard-setting process. Organizations such as the American Water Works Association can play a major and vital role. In Canada, guideline formation is

[39] The standards for spring water provided in the regulations for bottled water under the Food and Drugs Act are an exception to this point. The Canadian Food Inspection Agency regulates bottled water. Bottled water is beyond the scope of this study which is focused on public provision of drinking water.

primarily limited to the federal technical secretariat and the provinces with a period for public consultation after the Federal-Provincial-Territorial Committee discusses the feasibility of implementing the guideline. Moreover, the United States National Drinking Water Advisory Council has several subcommittees reporting to it which one would expect to provide a considerable amount of information beyond what the 15 members of the Canadian Subcommittee could collect. More important differences could be in the science used, or the understanding of risks applied. Specifically, Canadian Guidelines assume Canadians drink 1.5L of water per day while American standards assume 2L/day. Moreover, the Boxer amendment of 1996 required that vulnerable subpopulations such as children, the elderly and the immuno-compromised, be considered when the EPA sets drinking water standards. Canada has no such requirement.

In the United States, there is a recognition that the public ought to be involved in drinking water policy development. Moreover, the public must be notified about contamination to its drinking water supply or at its treatment plant, as well as the source of its drinking water. In addition, citizens can bring civil suits against those who do not comply with the SDWA, including the EPA thereby enhancing the scope of the law. The lack of public involvement in Canadian drinking water protection is apparent. Annual water quality reports are only required in two provinces, and this was a result of Walkerton. For years, public notification of contamination in many municipalities in the country was not required.

Finally, enforcement and compliance are an integral part of the Safe Drinking Water Act. Prior to 1986, implementation was low, but with the amendments the EPA took its role in enforcement and compliance, seriously. This is evidenced in references to the importance of compliance, the requirement of comprehensive testing, monitoring and reporting, and the annual publication that provides data on all states with respect to compliance. The EPA can also withhold funds from the Drinking Water State Revolving Fund (DWSRF) if states fail to comply with its requirements for plans or their implementation. Moreover, the EPA has brought both civil and criminal suits under the SDWA.

Ensuring water is safe to drink is a considerable challenge. A multi-barrier approach to drinking water protection policy is recommended by both governments and organizations concerned with public and environmental health. The United States and Canada take significantly different approaches to regulating water for human consumption. The US model involves federal policy and enforcement coupled with state primacy, if standards are met. By

contrast, the Canadian model involves no significant federal role. Guidelines are non-binding, and no laws have been made that directly address drinking water at the federal level. The American model represents significant effort on the part of a federal agency and the national government through Congress to protect citizens' health. The Canadian Guidelines leave the responsibility to the provinces. The extent to which this difference impacts water quality and consequently, the health of the public, is of concern for policymaking and the focus of the chapters that follow.

Table 2.2: A Comparison of Drinking Water Protection Policies – Overview

Aspect of Policy	**Canada**	**Year**	**United States**	**Year**
Legal means by which Drinking Water is Regulated	- Guidelines (non-binding) - Guidelines (updated)	1968 ongoing	- Guidelines (laws regulating interstate carriers binding on federal government) - SDWA (binding and enforceable) - SDWA (amended) - SDWA (amended)	1914 1974 1986 1996
Regulatory Development	- Guidelines for Canadian Drinking Water Established - Review of Guidelines takes place by Working Group - Subcommittee is established and begins to meet regularly (twice yearly) - Drinking Water Safety Act (limited to federal,locations) promised in Green Plan but never passed	1968 1978 1986 1990	- PHS and Treasury Board regulated drinking water on interstate carriers and other federal grounds - SDWA - SDWA amended - SDWA amended	1914 1974 1986 1996

Aspect of Policy	Canada	Year	United States	Year
Guidelines/ Standards Development	- 2 stage process with input from technical secretariat = Federal-Provincial-Territorial Subcommittee (15 members,one from each prov/territory and 2 from federal government) has consensus objective with 2/3 of 75 percent of participants rule to report to Federal-Provincial-Territorial Committee on Environmental and Occupational Health (15 members) in which each member has a veto (consensus rule) - Subcommittee and Committee each meet twice a year - guidelines are set for microbial, chemical, physical and radiological characteristics - use ADI and NOAEL (preferred) -assume 1.5 L/day water intake and average weight of 70 kg		- Standards (part of National Primary Drinking Water Regulations) are set by EPA on an ongoing basis; 1986 amendments required at least 25 new contaminants every 5 years; changed to at least 5 to be considered in 1996 - In setting standards EPA relies on recommendations from the National Drinking Water Advisory Council (15 members, 5 general public, 5 states, and 5 other agencies) which has several working groups each composed of about 20 members and operates on consensus; also input from the public meetings and comments - standards are set for microbial, chemical, physical and radiological characteristics	

Aspect of Policy	Canada	Year	United States	Year
	- for carcinogenic contaminants use 1 in 100 000 to 1 in 1 000 000 based on daily exposure - sensitive populations (elderly, children or immuno-compromised may or may not be considered)		- use a risk assessment approach - assume 2 L/day water intake - for carcinogenic contaminants use 1 in 100 000 to 1 in 1 000 000 based on daily exposure - sensitive populations must be considered in standard-setting under the Boxer amendment	
Source Water Protection	Does not address but falls under other statutes		Surface Water Treatment Rule Interim Enhanced Surface Water Treament Rule Enhanced Surface Water Treatment Rule Source Water Assessments	1986
Treatment System	No guidelines at federal level - recommend a multi-barrier approach		Lead and Copper Rule	1996
Monitoring and	- Health Canada recommends a multi-		Required since 1974; enforced after 1986; an annual	

Aspect of Policy	Canada	Year	United States	Year
Comprehensive Testing	barrier approach		report with respect to compliance is issued	
Operator Certification	- Health Canada recommends a multi-barrier approach		Required in 1996 amendments; certification and recertification	
Public Involvement	- members of public can comment on guidelines during 'proposed' year		- 5 members of NDWAC are from general public - public can participate in public meetings and/or provide written comments when guidelines are placed in the Federal Register	
Public Notification	- none required		- PWS are required to report annually on contaminants found in the drinking water, and the water systems and source	
Enforcement and Compliance	- two provinces (AB and NS) have fully adopted the guidelines - no enforcement at federal level		- enforcement can be at the state level both civil and criminal penalties - EPA retains enforcement authority and can revoke it from states - Drinking Water Revolving State Funds can be withheld for non-compliance	1974 1974 1996

III. COMPARING DRINKING WATER PROTECTION IN VANCOUVER, BRITISH COLUMBIA AND SEATTLE, WASHINGTON[40]

Vancouver, British Columbia and Seattle, Washington are municipalities of over 1 million people located on the west coast of the North American continent. The two municipalities are of similar size, geographic location, resources, and have similar types of industry. The similarities between Vancouver and Seattle have played a role in the imagining of a political entity encompassing both. "Cascadia" includes the states of Oregon and Washington along with the province of British Columbia.

This chapter examines policy implementation for drinking water protection in Vancouver, British Columbia and Seattle, Washington. The chapter focuses on multi-level governance for drinking water protection including consideration of provincial/state-municipal, federal-municipal and federal-provincial/state relations. The chapter begins with a brief history of intergovernmental relations with respect to drinking water protection including an analysis of principal-agent relationships. Second, the chapter describes and discusses the current state of intergovernmental regulation in the two cases. Finally, the drinking water inputs, outputs and outcomes of the two municipalities are compared in order to better understand to what extent and in what ways federal involvement makes a difference for policy outcomes.

The chapter demonstrates that the two municipalities are very similar in many ways, but the difference in the inputs, outputs and outcomes of the two drinking water programs is striking. The chapter further emphasizes the important and distinctive role municipalities play as agents in this important policy area. The differences in styles of regulation appear to lead to differences in performance. This chapter lends support to the argument that national standards matter for drinking water protection. Specifically, I demonstrate that federal involvement results in imposition of costs at the local level to improve service delivery. In this chapter, federal involvement is demonstrated both between and within Canadian and American cases. Since the advent of the Safe Drinking

[40] Parts of this chapter are published in Hill C. and K Harrison. 2006. "Chapter 10 - Intergovernmental Regulation and Municipal Drinking Water" in G. Bruce Doern and Robert Johnson, eds., *Rules, Rules, Rules... Multi-level Regulatory Governance in Canada.* Toronto: University of Toronto Press: 234-258; and in Hill C. 2006. "Chapter 9 - Source Water Protection in Canada - Local Innovation and Multi-Level Governance" in G. Bruce Doern, ed., *Innovation, Science, Environment Canadian Policies and Performance 2006-2007.* Montreal: McGill-Queen's University Press:194-212.

Water Act, Seattle's drinking water is more reliably good when compared with Vancouver's drinking water.

3.1 Vancouver, British Columbia, Canada

The Greater Vancouver Regional District (GVRD) in British Columbia is a large municipality of about 1.35 million people situated on the west coast of Canada. The area in which it is located is often referred to as the 'lower mainland'. Vancouver's water comes from mountains, rivers, creeks and streams in three closed watersheds encompassing 564 hectares, the Capilano, Seymour, and Coquitlam located in the North Shore Mountains, part of the Coast Mountain Range (Ferguson and Neden 2001).

When Vancouver was settled, it was not with a water source in mind, at least, not one for drinking. Historian James Morton noted that the decision of the Vice-President of the Canadian Pacific Railway to settle in Vancouver put it far from the most abundant source which was across the First Narrows, across the ocean's inlet (1970:39). The Capilano River was on the North Shore, and the other plentiful source, the Coquitlam Lake and River, was some twenty miles away. Two companies corresponding to these two water sources, the Vancouver Water Works Company and the Coquitlam Water Works Company, were incorporated and began to compete to be the purveyors of the city's water on the same day in 1886. A year later, the citizens of Vancouver would be asked to vote in a referendum on these two companies, one of them financed by the city and the other to provide a water system at no immediate cost to citizens with a future option to purchase. The "free" Vancouver Water Works option was favoured by the voters, and construction was begun across the First Narrows by the private company. The referendum outcome illustrates the desire of citizens to receive municipal services but their unwillingness to pay the high costs of infrastructure.

Building the water system was a considerable engineering feat, so much so that the American expert fled the scene before the system was finished (Ibid.). Nevertheless, Vancouver achieved a water system and by 1891 the system was owned by the municipality. While intergovernmental relations did not come into play during these early days, these challenges exemplify the city's concern with its water supply, and the public's involvement. Clearly, the municipality is responsible for the provision of drinking water, and is an agent with a distinctive role. As discussed in an earlier chapter, agents have information their principals do not have access to, and may have unique skills suitable to their tasks, in this case, provision of water.

Protecting the Source Water

In 1871, British Columbia became a province, and passed the Public Health Act giving the provincial government authority to regulate water systems to protect public health. The Act established the position of Medical Health Officers (MHOs) and granted them various powers to protect public health including oversight of municipal water systems. The Medical Health Officer model persists today, and is discussed more extensively later in this chapter.

While the advent of Medical Health Officers marked a regulatory moment, it was in 1905 that the provincial fact became glaringly apparent for the municipality of Vancouver with respect to its drinking water. On April 3 of that year, City Solicitor Arthur McEvoy and Alderman George Halse went to the provincial capital of Victoria to secure a 999 year lease on the Capilano watershed, source for the Vancouver Water Works. They assumed it was a formality (Morton 1970:78). The provincial government refused the lease but placed the land in reserve noting that the calculated monetary value of the land with respect to its timber resources was $100,000 in twenty years (Vancouver Province 1905). Later that same year, Vancouver Mayor Buscombe managed to negotiate a 50 year lease for a portion of the watershed amounting to 75 to 100 square miles at $2400 per year (Morton 1970:79). A year later, the Seymour watershed was added as an additional source of water for the municipality. It took over two decades until 1927 for the municipality of Vancouver to succeed in its plan to lease the Capilano and Seymour watersheds for 999 years.

In the 22 years between its first official request and the granting of that request, the city launched considerable efforts to buy parcels of land throughout the watershed focusing on the pieces closest to the water source. This move was, without doubt, innovative. Only very recently has the USEPA encouraged source water protection of this magnitude. How did these local legislators know that watershed protection was important? It is unclear, but they did speak of the "pristine purity" of the water supply and the need to protect it (Ibid.). Perhaps the struggle to deliver water at all meant a greater focus on ensuring its potability. Moreover, in light of its geographic location, protection was a real possibility. As a principal, the province clearly had conflicting priorities, protecting the health of the public

versus timber revenues for much needed government programs. Its agent, the municipality, had already invested significant time and money in buying up the watershed.

In 1924, the Greater Vancouver Water District (GVWD) was formed by provincial act, and by 1926, the cities of Vancouver, South Vancouver and Point Grey joined. The municipal efforts to purchase watershed land continued as the water district grew so that by the time the new cities joined, the city had purchased 13 000 acres of subdivided and unsubdivided lands (Cleveland 1932:818). Burnaby was added in 1927, the same year the province finally agreed to the 999 year lease. The Coquitlam watershed became a part of the GVWD with the joining of New Westminster in 1931.[41] The Coquitlam watershed had been protected by the Dominion government's Order-in-Council of March 4, 1910 that created a "reserve of 55, 670 acres of land around Coquitlam Lake for protection and preservation of the water supply" (Ibid.:819). In 1910, the Judicial Committee of the Privy Council (JCPC) determined that jurisdiction over the Coquitlam Lake watershed within the Railway belt lay with the Dominion government over the province of British Columbia. In 1913, the federal government and the province agreed that administration of this land would be transferred to the province (Ibid.).

Efforts at the local level to protect the source water were hindered by the provincial government's emphasis on the need to keep the land open for resource extraction. Eventually, however, the province agreed to a 999 year lease on 82,000 acres of land in the Capilano and Seymour watersheds. The role of E.A. Cleveland, Chief Commissioner of the Greater Vancouver Water District, in securing the lease has been emphasized by researchers, bureaucrats, and environmentalists.[42] He was formerly the Comptroller of Water Rights for the Province.

Chlorination

Even though drinking water protection falls within provincial jurisdiction, the federal government played a major role with respect to drinking water treatment in Vancouver. It forced the city to chlorinate its water during World War II. In 1937, Dr. C.E. Dolman of the Provincial Board of Health refused to certify the city's water to foreign shipping on account of its refusal to chlorinate the water. Chief Commissioner of the

[41] I note that the dramatic fire in the watersheds in 1925 has been noted in some histories of the watersheds, but that is beyond the scope of this work as are similar events of importance to those interested in watershed protection solely or primarily from a conservation perspective. See, for example, Koop 1993 and Etkin 1994.
[42] Confidential interviews. See also Morton 1970.

GVWD, E.A. Cleveland, held that Vancouver's protected watershed meant that chlorination was unnecessary.

In 1942, the federal government had taken on new powers as a result of the war. Dr. Ian Mackenzie, Minister of Pensions and Health and a Vancouverite, explained that chlorination of the drinking water was necessary to kill microorganisms, and that, even though Vancouver's water source was protected, "We would chlorinate the water if it came from heaven" (Vancouver Sun October 6, 1942). A correspondence between the chief commissioner of the GVWD and the Chairman of the Provincial Civilian Protection Committee clarified that the late Medical Health Officer for Vancouver, Dr. McIntosh, favoured chlorination "as the only recognized method of offsetting the contamination present in Vancouver water" (Vancouver Archives, 1942a). Interestingly, the GVWD commissioner, E.A. Cleveland, stated in reply that, "in eight and a half years in which he was Medical Officer to my board I cannot recall ever having heard Dr. McIntosh refer to chlorination" (Ibid. 1942b).

In response to the opposition in Vancouver which included community meetings, months of letters to the editor supporting the stand of the water board, and editorials, the federal government moved to refer the question to the Supreme Court as a reference case. However, by November, the federal government determined it could not wait for the courts and ordered the water chlorinated with the threat that any refusal to do so would mean it would come in, and take full control of the care and administration of Vancouver's water system. At this, the city of Vancouver, and E.A. Cleveland agreed to accept the chlorination order. As the Minister noted, Vancouver would not have to continue to chlorinate the water after the war: "The only authority we have is under the War Measures Act which expires with the end of the war" (Vancouver Sun, Nov. 26, 1942). The federal government paid for the chlorinating machinery which the city eventually bought at a considerably reduced price. Chlorination finally commenced in October, 1943. The federal government with its independence from local interests and local opinion was willing to impose costs at the local level, something the provincial government was unable to do on its own.

When the war ended, the chief commissioner wrote a paper providing arguments to end chlorination including the testimonies of several American experts. Morton's history (1970) suggests that the city stubbornly reverted back to its unchlorinated status but soon after, the chlorinators were turned back on, and chlorination became less controversial, perhaps because milk became pasteurized and people became more aware of the water and

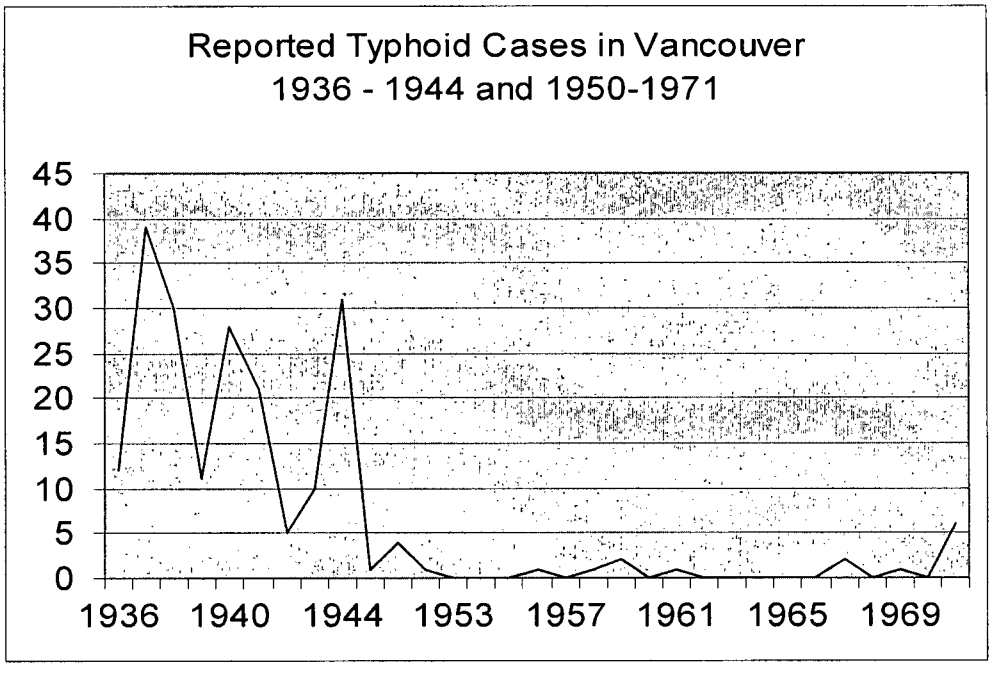
food-borne instances of disease. There is little evidence that the chlorinators were turned off, but there is considerable correspondence indicating local residents requested an end to chlorination, some even claiming they had become sick because of it.[43] In 1946, it was revealed that an employee of the water board who worked in the watersheds had been diagnosed with typhoid and Dr. C.E. Dolman is noted to have remarked, "Chlorination has safe-guarded us from a possibly disastrous water-borne epidemic and chlorination can do so, again" (Vancouver Archives 1946). Figure 3.1 below suggests that chlorination may have had an impact with respect to typhoid cases in Vancouver. It should be noted that the number of cases is low compared with other cities prior to the introduction of chlorine with the high quality of Vancouver's protected source water as a possible explanation.

The role of the provincial government and its desire to have the federal government impose costs is evident in correspondence, and perhaps further evidenced by the forced chlorination of Nanaimo, Victoria, and Prince Rupert around the same time. The province's Dr C.E. Dolman discussed Vancouver's chlorination controversy in a scathing article published in Toronto's Saturday Night magazine. The chief engineer of the GVWD, reacting to the decision to chlorinate after federal threats of force, mentioned this article and its negative effect on Vancouver's reputation in his correspondence to the President of the University of British Columbia, Leonard S. Klinck, recommending that if UBC was to "maintain its record for excellence" it "would do well to rid itself of" Dr. C.E. Dolman (Ibid 1942c). Clearly, federal officials[44] were not alone in being blamed for the chlorination of Vancouver's water during the war.

[43] The researcher searched for accounts of this in the Vancouver Archives but did not locate any. There were, however, many letters from local citizens addressed to the Water Board that requested chlorination be discontinued.

[44] In the 1950s, the Greater Vancouver Water District's decision to build a dam once again involved the federal government with the federal Fisheries department at odds with E.A. Cleveland. A federal injunction was threatened as what is now known as the Cleveland Dam provided no provisions for the several species of salmon and trout living in the Capilano River. The federal government and city finally agreed on ladders for the fish, but the efforts were largely unsuccessful as the fishery was reduced by thousands as a result of the dam-building (Morton, 1970). The costs for the ladders were borne by the water department in building the dam having been imposed on them by the federal government.

Figure 3.1: Reported Typhoid Cases in Vancouver, 1936-1944, and 1950-1971



Source: Vancouver Archives – Deputy Medical Health Officer's Records and Vancouver Health Department Fonds[45]

The federal government's intervention during the war was highly contentious yet ultimately successful and public health experts would agree, improved the safety of Vancouver's drinking water. The provincial principal had been ineffectual in convincing local authorities to chlorinate the water for decades. Public support was decidedly against chlorination and provincial authorities were not willing to impose it. Only when the federal government at a distance from the costs and willing to impose them used its authority was the Vancouver water chlorinated and safer to drink.

Following the war, a series of events brought about significant changes in the watersheds. In 1948, the province passed the Forest Act and officially adopted the concept of 'sustained yield management' (Etkin 1994:50). In 1952, chief commissioner E.A. Cleveland, tireless advocate of the closed watersheds and 'anti-chlorinationist,' died. T.V. Berry was appointed Water Commissioner and under his leadership a timber harvesting program was begun in the watersheds.

[45] No records were available for the years between 1944 and 1950.

A Highway through the Watershed?

That same year, the provincial government recommended that a highway be built through the watershed. The road was to go from North Vancouver to Squamish. At the time, residents had to take the ferry from Squamish as no roads connected it with the lower mainland. In a memo to the water board, E.A. Cleveland had stated that "there was no advantage in a road through the Capilano watershed and a public highway would greatly increase the possibilities of pollution to the water supply and add to the forest fire danger" (Vancouver Province September 6, 1942). This road never materialized and today Squamish residents have access to the lower mainland along a coastal highway rather than one through the still-protected watershed. Even though the highway was never built, it was promised for years, and illustrates that provincial and local priorities may vary with respect to protection of the water supply. In light of this, local resolve and multi-level regulation is desirable.

The idea of a highway through the watershed resurfaced in 2002 as an alternate route from Vancouver to Whistler in light of the upcoming 2010 Olympic Games. Four highway routes were proposed by the provincial government including one through the Seymour watershed and one through the Capilano watershed. Several organizations and groups including the North Vancouver District Mayor and the Society Promoting Environmental Conservation (SPEC) noted their concerns (Bohn 2002b). In the end, the province decided to upgrade the sea-to-sky highway rather than build any of the four proposed projects citing costs. The resolve of the city to protect its watersheds in the face of development supported by the province is an example of the incentives of the regulator not being aligned with the environmental concerns at the local level.

Logging in the Watersheds

As noted, while the GVWD has maintained its longstanding commitment to prohibit housing or industrial development in its watersheds, it has not always viewed logging of the watersheds as a comparable threat. Between the 1950s and mid-1990s logging was permitted in the watersheds, ranging from clearcutting in early years to selective harvesting more recently. Under the original 999 year lease negotiated with the province, forest management practices were not permitted. In February 1963, Commissioner Berry recommended to the Minister of Forests that the lease be amended. On March 7, 1967, the provincial government signed the Amending Indenture to the lease which permitted the sale of logs from the watersheds (Etkin 1994:57).

In the late 1980s, logging in the watershed became controversial. The BC Medical Association and environmentalists, in particular, the Western Canada Wilderness Committee (WCWC) expressed concern that mudslides in the watershed may be connected to logging (Etkin 1994:76; BCMA 1990). The fear is that deforestation will lead to greater runoff of soil into the watershed, and that increased turbidity of the source water will render disinfection less effective. In response, the GVWD has asserted that some logging is necessary to avert intensive fires and insect infestations that could lead to greater contamination of the resource (Economic and Engineering Services 1991) though this explanation would not seem to explain more extensive clearcuts in the 1950s.[46] This reversal of its position suggests that, at times, municipalities as agents, can be driven by other incentives than public health protection. In this case, timber revenues helped sustain the water district budget. The provincial government, too, benefited financially.

In 1989, the GVWD undertook major deliberations to plan a longterm water quality and quantity strategy for the region. This began with a comprehensive assessment of watershed policies and management programs. There had not been a technical review of watershed management since the 1960s. The GVWD noted that watershed "philosophies and social concerns have changed in the past two decades" (Economic and Engineering Services 1991). The same firm that conducted the watershed management review was also charged with examining drinking water quality in the region. At a city council meeting, the manager of GVRD's water department explained that while Vancouver's water quality had generally not changed over the past 3 decades, the review was the result of a combination of factors including changes in capacity to test water quality, in federal government standards, and in public awareness about the environment (October 18, 1990; Etkin 1994: 83). The review found that Vancouver's water did not meet all of the Canadian Drinking Water Guidelines. High turbidity, lack of rechlorination, and excessive protozoan levels in summer and fall put the water supply at risk of waterborne diseases. This review coupled with major turbidity events in 1990 raised public awareness of the issue. The Western Canada Wilderness Committee called for a moratorium on logging and a public inquiry in December (Etkin 1994:86). The British Columbia Medical Association also called for an inquiry.

[46] The view among foresters that selective logging and/or "controlled burns" are needed to mimic natural fire disturbance and prevent more catastrophic fires has emerged more recently.

In response, the GVWD moved to initiate a public consultation process in 1991. As part of its planning exercise, the district initiated extensive public consultations via public meetings, survey research, and newspaper inserts, both to educate citizens about the problems with water quality and the costs of different improvements and to solicit their preferences. In 1992, the provincial government introduced the Safe Drinking Water Regulation under the Health Act. This included binding standards for coliforms, and stated that water purveyors must deliver potable water to consumers. This regulation appears to have had little impact on the GVRD. It is notable that the GVWD failed to meet both the Canadian Guidelines and the Regulation during some periods of high turbidity. In 1994, following public consultation and review, the GVWD passed a motion to build rechlorination stations and commence filtration on the Seymour source, as soon as possible.

The Medical Health Officers favoured use of chloramination for its effectiveness in killing microorganisms and pathogens harmful to humans. However, the GVWD opted for chlorine as a secondary disinfectant. The Department of Fisheries and Oceans advised the GVRD of its opposition to the use of chloramines because of toxicity to fish. The GVRD undertook a pilot project using chloramine in South Surrey as part of the review. Two fish kill incidents in the South Surrey test site raised concern among environmentalists and the DFO (GVWD 1994). The DFO's opposition and environmental concerns impacted the GVRD's decision to use chlorine rather than chloramines.[47]

By 1998, five of the now seven rechlorination stations were operational. In November 1996, the GVRD Board approved the use of ozone as a primary disinfectant replacing chlorine. However, around the same time, the GVRD Board voted to postpone construction of some aspects of the plan to improve Vancouver's drinking water quality, including the Seymour filtration plant in order to save money. Although the GVRD's water committee voted to proceed with the original timetable at the urging of regional health officials, the Board reversed the committee's decision stating that the costs saved were worth the "minute risk" (Lee 1998). The GVRD's budget was strained at the time by another major capital project: construction of secondary sewage treatment plants. The 1994 schedules had the Seymour plant slated to be built by 2003 but construction did not commence until 2004, delaying completion until 2007.

Amidst these delays, the Walkerton tragedy occurred in May 2000. For Vancouver residents, concerns about risks of waterborne disease were further heightened as just 5

[47] Confidential interview.

months later, in October 2000, Health Canada released research linking turbidity events in Vancouver's watersheds to gastrointestinal illness including 17,500 visits to physicians and 85 hospitalizations annually (Aramini et al 2000).[48] For BC residents, a 'landmark' report by the Auditor General (1999) released a year earlier already had contributed to increased interest in BC's lax drinking water regulations. The Provincial Health Officer (2001) chose drinking water quality as the focus of his annual report for 2000 noting the number of water systems, types of treatment, number of systems in compliance, and the level of waterborne-related illness in British Columbia as information gaps.

The provincial government passed amendments to the Safe Drinking Water Regulation in 2001. The new standards resulted in a 2001 decision by the GVRD board to cancel the Capilano Ozone Project in favour of filtration on the Capilano water source as well as the Seymour source. The new Seymour-Capilano Filtration Plant is scheduled to be operational in 2007. A 2000 GVRD report noted that the Canadian Guideline of 1 NTU had been exceeded 11.6 percent of the time on the Capilano, 9.6 percent of the time for the Seymour and 4.1 percent of the time for the Coquitlam. GVRD water commissioner Johnny Carline explained that as a result of recent water tragedies, "...public concern with this issue will push the district, both directly and through senior government action, towards earlier implementation of treatment that responds to all known risks" (Simpson 2001:A15). The medical health officer explained,

> It was fast, quick, dirty. It was a response to Walkerton. It was a response to the premier saying they would bring new regulations. It has been a 16 year battle for us to get to this point where now we are saying, 'OK. We will filter these two reservoirs.' (Simpson 2001:A1).

The Coquitlam source, on which the GVWD completed a $40 million ozonation plant in 2001 and which suffers from far fewer turbidity events, is not scheduled to be filtered until 2025 at which time Vancouver's drinking water is expected to meet one hundred percent of the Canadian Guidelines (GVWD 1994). The Coquitlam watershed serves the least number of Vancouver residents, about 30 percent.

[48] This study also found that 34.7 percent of Greater Vancouver residents sampled (sample included n=1944 in GVRD and two other jurisdictions) tested positive for an antibody to giardia or cryptosporidium indicating prior exposure to either giardia or cryptosporidium. The study authors included Dr. Judith Isaac-Renton and Dr. John Blatherwick. See Simpson 2001:A14.

In 2001, the NDP government passed the Drinking Water Protection Act, but the Act did not come into force before the newly elected BC Liberal government convened a Drinking Water Review Panel to review the legislation. An amended Drinking Water Protection Act came into force in 2003 with a new Drinking Water Protection Regulation replacing the now repealed Safe Drinking Water Regulation (2001). Although the new regulation included requirements for operator certification and public notification of unpotable water, requirements for testing were limited to only total coliforms, fecal coliforms, and Escherichia coli.

In 2002, the GVRD announced that the federal and provincial governments would both contribute some funds to build the Seymour-Capilano filtration plant. It also stated that it was opting to use ultraviolet light for disinfection, and in doing so was following Edmonton, Seattle and New York (Bohn 2002:F7).

The Greater Vancouver Water District is responsible for drinking water provision in the Vancouver metropolitan area. From the outset, there has been a strong commitment to protect Vancouver's water source. However, the GVWD's commitment to protecting the watershed from development seems, at times, to have blinded local officials to the natural threats to public health. For example, the Greater Vancouver Regional District's water supply has consistently delayed expenditures to improve the system even though it has also consistently failed to meet the Canadian Guidelines for years since it began monitoring more extensively in the 1980s. In theory, these shortcomings should be addressed through formal oversight by the provincial Ministry of Health. However, in practice the provincial government does not appear to have wielded much influence over the regional government, except, perhaps, recently. As a principal, the Ministry has been ineffectual, at times, needing the assistance of the federal government to achieve chlorination. The times at which the Ministry has been most active with respect to regulation have been times the municipality was more likely to want to take action, and thereby to respond positively to regulation (Hill and Harrison 2004).

3.2 Seattle, Washington, USA

The Seattle Water District serves 1.3 million people in the Greater Seattle area. Seattle's water source is the mountains, rivers and streams of the Cascade mountains. It has two watersheds, the Cedar River Watershed and the Tolt River Watershed. The history of drinking water protection in Seattle is similar to Vancouver in some ways, but there are

important differences. In contrast to Vancouver, Seattle's settlers ensured there was a water supply near their settlement so that in the early years, residents who could afford to paid to receive their water from the Spring Hill Water System or the Union Water Company. Both of these systems were eventually sold to the city. The impetus for building a public water system was the need for fire hydrants. In 1888, one of the legislators argued,

> We ought not to be dependent in the matter of water supply which may be called the life-blood of a city on the caprize or rapacity of any corporation...Should the public own its own water system, there might rapidly be extended over the whole city a complete system of fire hydrants which it is impossible to do by our present system at present rates, as such rates would almost lead the city to the verge of bankruptcy (Lamb 1914:20).

A referendum on having a public water system with the Cedar River watershed as its source was held on July 8, less than one month after the great fire of 1889. The votes in favour of the public water system were almost unanimous (Ibid.). Like Vancouver, the emergence of the water system had nothing to do with other levels of government. Local concern for the water supply was connected to a need for fire-fighting infrastructure. Also similar to Vancouver, the public participated in a referendum to determine their water purveyor. The agents in both cases demonstrated considerable resolve and, indeed, gave rise to the water systems.

Watershed Protection: A Long Term Plan

In terms of source protection, Seattle and Vancouver share some common ground as agents that acted to protect their respective source waters in the face of challenges from other levels of government and from forestry interests. In 1901, the city of Seattle applied to the Commissioner at the General Land Office for a temporary withdrawal from entry, sale or settlement of all watershed lands still owned by the United States (Ibid.). In 1899, the Registrar and Receiver of the US Land Office had withdrawn from disposal all lands then presumed to be in the Cedar River watershed. The government required the city to pay a deposit to the Secretary of the Interior for the costs of the survey and appraisal of the timber. This cost was $8000. At that time, the city had not yet decided to buy the lands. In 1911, a bill (5432) was introduced in the Senate which would have established a forest reserve on these lands. Section 4 of the bill stated that the city of Seattle could secure patent

to these lands upon payment of the appraised value of the timber plus $1.27 per acre (McWilliams 1955). This amounted to $400000 plus annual interest of $20000; too high for Seattle's Water department. On June 15, 1922, the city released and waived claims to the land and its deposit was returned to it.[49]

As early as 1891, six companies began logging in the Cedar River watershed removing 100 million board feet, annually. As Seattle was unable to close its watershed to private interests, logging operations continued. In 1930, the city of Seattle brought a lawsuit against the Pacific States Lumber Company in an effort to cancel a contract made in 1917. The case was voided because there had not been a question brought to the electors as municipal statutes required for cancellation of the contract (Ibid.).

By 1943, Seattle successfully negotiated a deal to pursue a policy to gain control of the watershed lands. Recognizing that closing the watershed to logging interests was not possible, the city took a different approach. It pursued an agreement for land exchange with several logging companies including Weyerhaeuser, North Pacific Rail and Cascade Timber Company.. As then Superintendent of the Water Board wrote, "It is the finest deal the department ever made. Complete final ownership of the entire watershed in 40 years without cost is now assumed to the City of Seattle with a revenue of $1 million from use of city owned roads in logging operations" (McWilliams 1955: 175). In 1962, the Cedar River Watershed Cooperative Agreement would continue this process until, finally in the late 1990s, Seattle would own all of the Cedar River watershed. These agreements were between the municipality and private owners. The United States Forest Service is not permitted to give land away; it can only trade or sell it as it did in 1995. By swapping watershed land for parcels of land in 10 counties, the USFS gave Seattle control of the entire Cedar River Watershed. Seattle as the agent took on the responsibility of watershed protection and demonstrated an ability to engage in long-term planning.

When the water department interacted with the state, it was most often with the health department. In 1906, the Washington State Board of Health took notice as the Chicago Milwaukee and Puget Sound Railway Company applied to operate a railway line through the watershed for 11 miles. Consultants were hired to investigate. They concluded that the logging and sawmill camps already presented a threat to the water supply, and that the valley would "not be as much endangered by the coming of the railroad as it was

[49] The amount returned was $5217 as the survey of the lands had cost $2783 and the original deposit was $8000. See McWilliams 1955.

already by existing nuisances" (Lamb 1914:140). In order for the train to pass through the watershed, the company had to agree there would be no station, that the city could employ an inspector and that the closets would be locked so that sanitation would not enter the watersystem. A fence was also required to be built along the railway. The state's authority positively contributed to restrictions on the company in the interests of public. State resources were used to better understand the problem and negotiate a resolution.

Chlorination

Chlorination commenced in Seattle as a result of a contamination event in 1911 and no state or federal intervention was required. Chlorination was installed to avoid pollution when there was a break in two pipelines. Between 1914 and 1915 chlorination processes were improved. The state Department of Health (DOH) only became involved in 1928 when it subsequently monitored the city's application of chlorine, writing that it was "grieved that the old chlorinators were still in use, after they had approved the new ones in February of 1927" (McWilliams 1955: 148). These were installed in 1929. In this case, the state's monitoring actions contributed to improvements in the system.

USPHS Potable Water Standards

In 1944, the United States Public Health Service (USPHS) issued new potable water standards and regulations for interstate commerce. Seattle water Superintendent Morse commented on the new regulations in his annual report:

> These regulations go, in my judgment, far beyond the authority of the United States Public Health Service. They are quite difficult to comply with but we are complying at the present time almost completely, and will soon be fully complying. The number of samples to be tested was greatly increased to 250 per month. We were formerly testing approximately 50 per month. In January 1945, 240 samples were tested, not one positive.

Even though the Superintendent felt the standards were unacceptable, he still complied with them. There were no efforts to disregard the standards of the federal level of government, even if these were seen to be especially burdensome. Seattle's superintendent viewed the federal principal as having authority, even if only grudgingly.

That same year, the Cedar River Watershed Commission was convened by Seattle's City council. The commission was created to report on sanitation and forestry in

the watershed and was headed by Dr. Abel Wolman. With respect to the source water at that time, Wolman noted, "Its source is not completely closed or protected...Its safety depends upon continuous rigid treatment, practice and supervision" (McWilliams 1955:141). The report included consideration of filtration, but the superintendent viewed this as an 'emergency procedure' in light of the large capital expense (Ibid.).

A Highway Through the Watershed?

In 1951, the state proposed to build a highway through the watershed. This threat was not the first one with respect to a highway. More than a decade prior, the water department's annual report mentions the threat of a state highway through Seattle's watershed (1936:9). As described above, logging had been allowed in the watershed since the beginning of its use as a source yet the watershed was largely closed to the general public. A highway was viewed as a threat to public health as people would stop, deposit debris, as well as contribute to air pollution in the watershed. The state wanted a highway to secure a shorter route to Snoqualmie Pass and Eastern Washington. In 1953, Dr. Wolman of Johns Hopkins noted that the hazards were likely to be significant (McWilliams 1955:199). The state backed down, and proposed an alternate route, the existing Echo Lake Road.

US Safe Drinking Water Act

In 1974, the federal government passed the Safe Drinking Water Act and a new relationship ensued between the state Department of Health and the municipality. Just ten years earlier, the Tolt watershed had been added to the Seattle water system with the South Fork of the Tolt River supplementing the Cedar River source. In 1986 and 1996 the SDWA was amended. The provisions of the SDWA are addressed more comprehensively in chapter 2.

Cedar River Watershed Land Exchange Act

Dedicated to protecting the source water over the long term, Seattle's City Council voted unanimously in 1992 to make a major landswap with the United States Forest Service (USFS) to gain control of land in the upper reaches of the Cedar River watershed. The landswap was made possible by a 1992 decision by Congress to order the USFS to make the transaction (Higgins 1995:B2). For over a century the City had been

buying up tracts of land around the state and trading them with the USFS. By 1992, the city owned 81 percent of the watershed land, all but 17, 000 acres (Schaefer 1992:B1). "But for the past half-dozen years, Forest Service officials had become less willing traders feeling the city was too restrictive about what they allowed people to do in the area" (Ibid.). The city asked Democratic Representative McDermott to introduce a bill to speed up the landswaps. He did and it passed the House on September 29, 1992. Seattle Mayor Norm Rice and city chief lobbyist Tom Tierney convinced House Republicans of the importance of the bill, and the Cedar River Watershed Land Exchange Act eventually passed in October (Ibid.). The act was required as the USFS and the city had reached a deadlock over how to value the land in the watershed. The USFS valued it at $140 million while the new deed restrictions devalued the land to $8 million allowing the city to swap it. The USFS value had included considerations of timber revenues which the deed now no longer permitted (Higgins 1995:B1). In 1995, the landswap finally occurred with Seattle trading 14,420 acres totaling 70 parcels of land in 10 counties for 17,000 acres of USFS land in the upper reaches of Cedar River watershed. The local government successfully lobbied Congress to help it protect the watershed lands. The state Department of Health was supportive but did not participate, directly. The longterm planning begun in the early part of the century by the agent had paid off.

Improving the Tolt River Supply

In 1991, Seattle initiated pre-design efforts for the Tolt treatment plant including water quality and environmental studies. Seattle wanted to filter the Tolt water in order to decrease organics and increase the water supply. Filtration would add an extra barrier of protection. In addition to filtration, specifications for the new treatment plant included ozonation The cost of the plant which was absorbed entirely by the City was projected to be $101 million. Planning for the Tolt treatment plant also involved considerations of corrosion control. The state knew a federal lead and copper rule was being developed by the Environmental Protection Agency and Seattle wanted to make every effort to meet the new regulations.[50]

EPA Requires Filtration on the Cedar River Supply

While Seattle had engaged in a planning process with respect to filtration on the Tolt, in March 1993, the EPA told Seattle that it must also filter as well as disinfect the Cedar River supply (Wilson 1993:A1). In its compliance letter, the EPA noted that Seattle

[50] Confidential interviews.

had the option of finding another way to meet the federal Surface-Water Treatment Rule. In 1992, during a period of about 4 months, fecal coliform found in tests of Seattle's water exceeded federal standards. However, these samples were taken upstream from water treatment and the public was not affected. City officials note that this event occurred during a drought period. Adding a filtration plant, however, would provide an additional barrier in case something went wrong with the treatment process.

The state Department of Health also wrote Seattle ordering a comprehensive study of options including filtration, other types of disinfectant, enhanced security around the watershed, and consideration of a relocated site for drawing water samples (Ibid.). The EPA's surface water treatment rule included eleven criteria for a water source to remain unfiltered. Fecal coliform levels were one of the criteria which Seattle exceeded during a six month period.[51]

Filtration of the Cedar River supply was projected at $230 million to $350 million (Taylor 1994:C5). Ozone was also considered as an option because it could successfully kill protozoans. However, federal EPA officials expressed concerns about disinfection byproducts (Ibid) as use of ozone requires additional chlorination, and high levels of chlorination contribute to cancer-causing trihalomethanes (THMs) and haloacetic acids (HAAs).

In 1994, Congress re-authorized the Safe Drinking Water Act. The bill sponsored by the Chair of the Senate Environment and Public Works Committee, Max Baucus, Democrat from Montana, would set standards requiring water systems to filter their water, including Seattle. In the end, Baucus' bill won out.

Seattle Amendment

To address the new federal requirement that Seattle filter its drinking water, a public forum was held in September, 1994. The EPA, state and city officials debated two methods of water treatment, filtration versus ozone, and their costs. Residents were invited to send written comments to the EPA. That same month, Mike Kriedler, a House democrat, was asked by the city to sponsor an amendment to the Safe Drinking Water Act (Higgins 1994:B2). The amendment which would permit Seattle to find other less-costly ways of meeting federal standards passed the House Committee on Energy and Commerce. The

[51] The criteria limited fecal coliform microorganisms to 20 microorganisms per 100mL. The City cannot exceed the limit for more than 18 days in a 6 month period. While most readings during this period were just above the 20 limit, one reading was 310 microorganisms per 100mL.

EPA had expressed concerns that the amendment might lead cities such as New York and Boston to also avoid filtering their drinking water.

In November 1995, the "Seattle Amendment" passed. It had been sponsored by House Democrat Kriedler and backed by Republican Senator Slade Gorton and Democratic Senator Patty Murray (Seattle Times 1996:B2). The amendment permits the option of a purification system instead of a filtration plant to treat drinking water.

Violations of the Lead and Copper Rule

Around the same time Seattle was lobbying Congress for an amendment to the SDWA, the city was sent a letter of violation with respect to the "lead and copper rule." The rule addresses concerns with lead and copper leaching from the distribution system pipes into the drinking water, requires testing, and recommends actions. A bilateral compliance agreement was signed on May 15, 1997.[52] Seattle agreed to provide a public education program telling residents to let their water run when it is first turned on, and to alert them to the problems with the distribution system. The state helped to fund this program via educational resources. In 1997, another compliance agreement with respect to ultraviolet on the Cedar supply was signed with the EPA and the state. Ultraviolet and ozone were agreed to as a replacement for filtration. UV creates fewer disinfection byproducts than ozonation while both are effective at killing protozoans and viruses including cryptosporidium and giardia. In 1997, the Water department was also consolidated with the Engineering department to form Seattle Public Utilities (SPU).

Covering the In-Town Open Reservoirs

In addition to concerns about filtration and disinfection, Seattle's in-town open reservoirs present an ongoing concern of the state and the EPA with respect to Seattle's water system. Six reservoirs remain to be covered with three of nine having recently met requirements. On Feb. 1, 2001, Seattle received a compliance order with respect to the coverings. It reached an agreement to cover all of the reservoirs by 2019 and agreed to spend $171 million to do so.[53] Covering of the reservoirs is a challenge for the system as portions of the water supply have to be turned off to do so, and this limits the ability of the system to supply adequate amounts of water to citizens.

[52] Confidential interview.
[53] Confidential interview.

While federal involvement by the Environmental Protection Agency has lead to service delivery and infrastructure improvements for drinking water protection, a 2002 event demonstrates that federal agencies may also experience conflicting priorities. That year, the Bonneville Power Administration, a federal agency that operates major hydroelectric dams on the Columbia River, determined that it needed to string a new powerline through the middle of the Cedar River watershed. Using its powers of eminent domain, the Bonneville Power Administration could have simply seized the land, but Seattle Public Utilities adopted a negotiating position while local environmental groups, most notably Biodiversity Northwest, opposed any encroachment or use of the land that was home to cougars, bears, Chinook salmon and marbled murrelets (Fullerton 2002:15). In the end, the Bonneville Power Administration gave the city assurance it would not pollute the watershed and agreed to air-transport in materials.

Compliance on the Cedar River Supply

In 2004, compliance on the Cedar supply was achieved as ozonation and UV became operational. In addition to acting as a disinfectant, ozone removes odours associated with algae. UV does not change the taste and is highly effective in killing protozoans and viruses. Seattle's Cedar Treatment Plant is the largest UV treatment facility in the world (Brown 2001:18).

With respect to the intergovernmental history of Seattle's water system, there are a few patterns. When the federal government demanded compliance, Seattle eventually was forced to comply. This emphasizes the authority of the federal principal. The DOH has been an active principal since the early years, and after the passage of the SDWA, has worked with the EPA and Seattle Public Utilities to improve public health protection in Seattle.

The examination of drinking water protection in Seattle and Vancouver underscores that the federal government is a principal with authority able to hold the municipal agent to account. Provincial and state governments have demonstrated concern for public health but may have conflicting incentives with respect to drinking water protection. In particular, timber revenues, transportation, and source protection can contribute to conflicts. Also importantly, these histories emphasize that municipal agents are distinctive actors. Both cities demonstrated that they could engage in long-term planning with respect to their watersheds and live up to their commitments to protect the source. However, while municipalities have the greatest incentives to protect drinking

water, they also have great incentives to delay action. Both cities delayed filtration, and one successfully lobbied to change the rules of the game to avoid filtration on its second source. The other, in contrast, put off filtration for years, and is on a timeline to institute filtration on two of its three sources, though none are yet filtered. Federal actions have resulted in improved drinking water protection for both cities.

3.3 Comparing Vancouver and Seattle

3.3.1 British Columbia and Washington Legislation

In order to understand the ways in which the policies drive or impact implementation, it is necessary to have a clearer picture of the policies. This section provides an overview of the provincial legislation in British Columbia that impacts Vancouver and the state legislation in Washington that impacts Seattle. A key difference is that the Washington legislation must meet or exceed the federal Safe Drinking Water Act while there are no national binding standards in Canada.

In addition to providing an overview of legislation this section also discusses the roles of the Environmental Protection Agency, the Washington state Department of Health, and the Ministry of Health for British Columbia.

Table 3.1: Comparing British Columbia and Washington Drinking Water Legislation

Aspect of Multi-Barrier Approach	British Columbia		Washington	
	Pre-Walkerton	Post-Walkerton	Pre-1974	SDWA
Source Water Protection	Not addressed	Source Assessment at Discretion of Drinking Water Officer (DWO)	Not addressed	Source Protection Plans required
Disinfection and Filtration	Disinfection required (1992)	Disinfection required	Disinfection required	Surface Water Treatment Rule, Disinfection and Disinfection Byproducts Rule
Distribution Systems	No action required, MHO discretion	No action required, DWO discretion	Not addressed	Lead and Copper Rule
Operator Training & Certification	None required	Required	Early 1970s – program commenced	Required
Monitoring	Monitoring required for 3 contaminants (1992)	Monitoring required for 3 contaminants (2003)	Sanitary surveys; Monitoring required for contaminants	Monitoring required for the National Primary Drinking Water Regulations (approximately 90 contaminants with rules for surface water treatment, disinfectants and disinfection, total coliforms, lead and copper, and information collection)

For Vancouver, the key piece of regulatory legislation addressing drinking water is the Drinking Water Protection Act and Regulation. This Act and regulation as amended came into force in 2003 and replaced the Safe Drinking Water Regulation (1992) under the Health Act. It improves upon the Safe Drinking Water Regulation by including provisions for operator certification, and permits source assessments. Penalties for non-compliance have increased.

For Seattle, Washington's Safe Drinking Water Act is the key piece of legislation and has been since Washington achieved primacy in 1976. This legislation provides the same protection as the federal Safe Drinking Water Act. In addition, the Water Works Operator Certification legislation is also directly relevant. These Acts address source protection, requirements for disinfection, testing for 103 contaminants including the National Primary Drinking Water Regulations (required) and secondary drinking water regulations (optional), operator certification, and distribution systems.

3.3.2 British Columbia – Role of Ministry of Health (Drinking Water Program)

Within British Columbia, drinking water falls under the Ministry of Health, formerly Ministry of Health Planning. Environmental and Public Health Protection are "administered locally" by Medical Health Officers (MHOs). The Drinking Water Protection Act (DWPA) has provisions for Drinking Water Officers to be appointed within each of the five health regions. Vancouver is within the Vancouver Coastal Health Region. Medical Health Officers are responsible for administering and enforcing the Drinking Water Protection Act and Regulation. This model remains, in many ways, largely unchanged since the late 1800s. Medical Health Officers are responsible to the Provincial Health Officer, the Premier, and the Board of their Health Region. Dr. John Blatherwick is the Chief Medical Health Officer and has been for several years. Prior to this, he was the Medical Health Officer for the city of Vancouver for over 20 years.[54] The Ministry of Water, Land and Air Protection provides standards for water quality for recreational purposes, and, on occasion, the two ministries share information.

The Drinking Water Officers are a relatively new concept. Prior to their being appointed, the MHO was primarily responsible for drinking water and under the Act if no DWO is appointed the MHO is responsible for overseeing drinking water protection in the

[54] Throughout this chapter, I have referred to Vancouver as the Regional District – the GVRD. However, in this instance Vancouver is one city within the Greater Vancouver Regional District which also includes the cities of Burnaby, Surrey, Coquitlam, Langley, for example.

health region. Vancouver's MHO worked closely with the municipality to meet regulations relying on the Canadian Drinking Water Guidelines in addition to the provincial regulation. The MHO's discretion is considerable. For 16 years, the MHO had asked the city to filter its drinking water yet only recently did the city comply and agree to filter both the Capilano and the Seymour. Another example of his involvement in drinking water protection for the city is the daily turbidity readings that appear on the GVWD's website. It was the MHO who came up with the concept and requested the GVWD to post these readings so citizens could check and see how safe their water is on a daily basis. This is an example of how provincial discretion can help to expose hidden information by offering some transparency that could lead to improvements in the system.

The Ministry is responsible for liaising with the MHOs and for representing the province at the Federal-Provincial Territorial Committee on Drinking Water Quality. The Ministry ultimately sets provincial standards and regulations. In 2002, the Provincial Health Officer (PHO) authored "Drinking Water Quality in British Columbia: the Public Health Perspective" highlighting significant information gaps in terms of monitoring and water systems.

One of the concerns identified by the Province's Drinking Water Review Panel was that responsibility for drinking water was fragmented. The Drinking Water Protection Act identified the Ministry of Health Services as having clear responsibility for drinking water. The Provincial Health Officer (PHO) is to oversee the program including the Drinking Water Officers (DWOs). In addition, a groundwater advisory board and a drinking water advisory committee will be charged with being responsive to small systems and with providing technical advice on regulations and standards.

British Columbia's drinking water program is a decentralized one. There are 3 persons directly responsible for drinking water in the provincial offices with 2 researchers at the BC Centers for Disease Control. In the Vancouver Coastal Region, the MHO has recently appointed 17 Drinking Water Officers which account for about 10 full-time equivalents (FTEs).[55]

As noted in the previous chapter, while provincial governments are largely responsible for regulation of drinking water due to their jurisdictional responsibilities over natural resources within their boundaries, in 1986, the federal government formalized the Federal-Provincial-Territorial Subcomittee on Drinking Water Quality in response to

[55] This information was obtained in 2004.

concerns and interest by a variety of groups including the Canadian Public Health Association. This intergovernmental committee is responsible for setting the Canadian Drinking Water Guidelines. It meets twice annually, once in Ottawa and once in one of the provinces. At its meetings, provincial health or environment ministers or their designates set and revise the Guidelines. Most recently, the FPT Subcommittee created a Guideline for total trihalomethanes, for example. The lack of monitoring by governments has been cited as one of the biggest barriers to Guideline setting.[56] The committee operates by consensus. This means that British Columbia has an equal say with other provinces, even though it has not adopted all or even most of the guidelines. It sets the Guidelines yet it includes only 3 among those required for testing. MHOs can request more, and in certain areas of the province may require nitrate testing, for example. It should be noted that MHO decisionmaking in Vancouver is informed by the federal Guidelines.

3.3.3 Washington – Role of State Department of Health (DOH) (Drinking Water Program)

In the United States, the Environmental Protection Agency has responsibility for overseeing the implementation of the Safe Drinking Water Act. With few exceptions, it accomplishes this via delegation to the states. States are delegated responsibility for implementation with the EPA retaining oversight including the ability to insert itself, when required. This section describes the relationship between the EPA and the state DOH, and the relationship between the state DOH and Seattle with respect to drinking water protection.

Region 10 includes four states. In order for states to receive grant money they have to achieve primacy for each new rule that is promulgated. It must be emphasized that primacy is an ongoing process of negotiation between federal and state authorities. When the SDWA was first passed in 1974, states had to apply for primacy to implement the Act, and this took time. Washington achieved primacy in 1976.[57] Primacy review is a long process. The EPA provides states with resources, including people, to interpret the federal regulations. States must adopt language that is at least as stringent as the federal language. Some states simply "adopt by reference" meaning that instead of writing new language they simply refer to the SDWA regulation. Over the years, Washington has done a

[56] Confidential interview

[57] Oregon was the last state in Region 10 to achieve primacy. Iowa, Alaska and Oregon are the four states included in Region 10.

combination of both. Primacy review involves a layer of review including attorneys and experts at EPA headquarters.

When a new regulation is promulgated, it will be announced in the Federal Register and there will be a period of 30 days for comment. There has never been a public comment about drinking water addressed to the Region 10 office[58]. Public hearings may also be requested and this happens, on occasion. For example, the EPA called a public hearing to discuss filtration and alternatives to filtration when Seattle was attempting to meet its regulatory obligations with respect to remaining unfiltered. The Region 10 program is considered to be a small program by EPA standards with about 20 EPA employees working directly on the SDWA. By contrast, Region 5 has over 50 employees working on the Safe Drinking Water Act.

With respect to its role, the EPA office provides technical assistance, information and compliance assistance. If a state has concerns about whether one of its public water systems (PWS) is meeting the regulations, or wants to consider some strategies it can use to help the PWS achieve compliance, it can contact the EPA regional office for assistance. On occasion, PWS may also contact the office, but most often the state is the first and primary point of contact. The EPA views its relationship with the state as primarily one of "oversight." State-level bureaucrats view the relationship in terms of "partnership and oversight."

Besides technical assistance, the EPA regional office also meets regularly and communicates regularly with the state drinking water program personnel. The degree of communication varies depending on the time period. Washington state Department of Health meets with the Region 10 EPA drinking water office quarterly. It also meets once annually with the executive management of the EPA. Beyond that, there may be additional meetings or telephone communication. For example, when a new rule such as the Surface Water Treatment Rule is coming out (1989) the regional EPA office will talk to states "much more frequently" reminding them about guidance information that is available. Thus, states have incentives to be knowledgeable about new regulations in advance of utilities.

With respect to enforcement, the EPA will help to interpret rules to get an idea of enforcement needs, states can ask questions leading up to enforcement, and monitoring could lead to enforcement. The EPA will intervene if it is asked to do so by the state. It will

[58] Confidential interview

also intervene if compliance is not being achieved in order to enforce the regulations. In this way, as explained in Chapter 1, the EPA acts as a principal that can step in to force compliance is the state is unable to achieve municipal compliance on its own. Recognizing that the EPA and the DOH are both principals, the EPA asks the state to be present when it meets with non-compliant PWS. For example, Seattle had to build the treatment plant on the Cedar River source because they violated one of the avoidance criteria for remaining unfiltered. Both the EPA and the state were heavily involved in those discussions. The state is always invited to go to meetings with a PWS when enforcement or compliance discussions are occurring.[59]

A range of actions can be taken by the EPA to achieve compliance. The state and municipal water system would both receive a notice of violation. If no action is taken, the next step is to issue an order. If the order is not heeded, an administrative order will be issued and the public water system will be required to comply. In rare instances, if compliance cannot be achieved, a court case will be pursued. It must be underscored that compliance is never immediate. It is a negotiated process. The parties will sit down, and discuss options, the best way to proceed and negotiate a timeline, depending on the situation. If that timeline is not met, EPA will call another meeting and a further compliance agreement will be pursued. For example, with respect to the Lead and Copper Rule, in 1997, the EPA and state met and negotiated a bilateral compliance agreement for lead and copper requirements for the new treatment plant. The EPA follows up with the state regarding the status of the agreement, and makes sure "everything is going smoothly."[60] Depending on circumstances, it may be necessary to modify the order.

With respect to monitoring, the state provides the EPA with monitoring information about 103 contaminants, currently.[61] This information, along with information about compliance with the Surface Water Treatment Rule, Disinfection and Disinfection Byproducts Rule, Lead and Copper Rule, and Consumer Confidence Reporting requirements is entered into the Safe Drinking Water Information System (SDWIS). The public can access this information to find out if their water system has failed to comply with any regulations. One drawback of this system is that there is a timelag so that by the time the state meets with the EPA it could be several months and compliance may already

[59] Confidential interview
[60] Confidential interviews.
[61] The reader may want to compare the 103 contaminants (about 90 of which are required as the National Primary Drinking Water Standards) monitored today with the 23 contaminants required in 1986.

be achieved. The state provides the EPA with an update of the extent to which non-compliance has been remedied.

Washington states drinking water program includes three main aspects: (1) design of facilities (2) fieldwork including sanitary surveys and (3) water quality monitoring. The state has been involved in delivering these programs in some form for most of the last century. For example, the Department of Health has been reviewing designs of water systems for over 80 years. Moreover, it has had operator certification programs since the early 1970s, prior to the implementation of the federal Safe Drinking Water Act. States like the EPA will use a range of steps in order to achieve compliance. Washington state notifies the water system of any violations and offers technical assistance. It then attempts to come to an informal compliance agreement. If an informal agreement cannot be reached, it issues a departmental order. If the departmental order is not effective in achieving compliance, it will issue fines.

The state may ask the EPA to intervene or to work in partnership with the state. An example of partnership is EPA intervention with respect to consumer confidence reports. The EPA requires that each municipal water system provide an annual report to its citizens by July 1st. In light of low risk to human health these may be viewed as a low priority concern yet all regulations must be met according to EPA requirements. While it is not a problem for Seattle, if ownership changes or there are mail-merge issues, for example, it may be very difficult for some public water systems to comply with this requirement. There is a need to give them some time in order to comply. To increase the compliance of PWS across the state in this area, the state sent notices of violation. If PWS did not comply, it requested the EPA to send a second notice. "It's something about that EPA letterhead" that encourages compliance, explained a respondent.[62] Push letters may also be used. A push letter communicates to the public water system that if they do not take steps to comply with this initial letter they will be referred to the EPA. This often 'pushes' the PWS to comply. The federal principal, the EPA, has authority in the minds of citizens, perhaps beyond that of the state. Moreover, this example suggests that sometimes agents require the power of their principals in order to get their own agents to act. The federal level is at a distance from the costs and willing to impose them. Moreover, this example suggests that citizens and PWS also view the threat of federal authority more seriously.

[62] Confidential interview

Principals have roles and related tasks. The DOH, for example, plans ahead with respect to new contaminants, and communicates with the EPA to try and better understand expectations so information can be communicated to the local level. In this way, the DOH also demonstrates that as an agent, it is making an effort to ensure compliance in the future on the part of its agents.

There is a higher expectation of large utilities, in part because of the percentage of the population served, but also because of the desire of large utilities to provide high-quality service. Utilities have invested heavily in their water systems from the design, building the foundations to the addition of new and improved technologies. "Seattle wants to lead. It wants to be a world-class utility," echoed both state and federal authorities.

While the EPA and the state meet at least quarterly, the state DOH meets with Seattle once a week. These Friday breakfast meetings have occurred since the early 1990s. Both Seattle respondents and state respondents expressed positive feelings about this weekly meeting and ongoing relationship. They also stressed the importance of these meetings for problem solving and for being able to discuss ongoing issues with the water system. Concerns such as drought, algae blooms, how to keep the system pressurized, forthcoming SDWA regulations etcetera can be discussed. These meetings also demonstrate the "partnership" that both levels of government feel they have with one another. One Seattle respondent described the state's relationship to the utility as one of "Trust, but verify. They know we do good work. We tell them where the problems are." It is a partnership but the partners have different roles, one delivers the service, the other monitors, provides technical assistance, and together along with EPA they solve problems with the system.

3.4 Comparing Performance: Inputs, Outputs and Outcomes

In order to better understand intergovernmental regulation regarding drinking water protection , this chapter has provided an overview of relationships between levels of government. The next section considers policy performance in term of inputs, outputs, and outcomes in order to consider the impact of binding national standards when comparing between and within cases.

3.4.1 Inputs (Effort)

This section briefly looks at the following inputs: (1) timing and timeliness (2) who pays and (3) dedicated staffing/resources.

3.4.1.1 Timing of Infrastructure Improvements

The timing of improvements to the system can offer some indication of the effort governments have put into meeting regulations, achieving public health objectives, and achieving compliance. To examine the timing of improvements to the system, this section draws on the multi-barrier approach to drinking water protection as criteria.

Table 3.2: Comparing Source Protection Efforts in Vancouver and Seattle

	Vancouver	**Seattle**
Source Water Protection	Significant efforts Begin 1905; success by 1927 Reversal in 1950s with some logging; watershed closed to public Re-establish significant protection 1990s Own the watersheds Capilano, Seymour and Coquitlam Watersheds are closed to the public; development has never occurred and timber harvesting has ceased	Significant efforts Begin 1901; stop 1922 Establish logging agreement 1940s Own most of the Cedar River watershed 1990s; no longer attempting to buy Tolt Cedar River Watershed is closed to the public, and development and timber harvesting have ceased

Source protection is a key aspect of the multi-barrier approach. By limiting discharges into the water source, the amount of treatment and degree of difficulty in achieving potable water should thereby be reduced. As municipal officials in Vancouver explained, "This is not the water from Lake Ontario, this is not Regina. There are no cows up there." while Seattle officials echoed, "This is not Mississippi River water or the Potomac; we are talking about a protected source, here." Both municipalities have been committed to the goal of source protection since the inception of the water systems. Perhaps the pristine and

beautiful surroundings gave rise to a conservationist ethic. In any case, Vancouver has clearly been more successful, but it could be argued Seattle has put as much effort into source protection. Vancouver's three watersheds are all closed to the public, and development and timber harvesting are now prohibited. Seattle's Cedar River watershed allows some public access, but for the most part is closed, and development and timber harvesting are also forbidden. While state and federal officials supported Seattle's efforts to protect its source water, both pointed to the local initiative over many years as the reason for success. In both cases, local governments were responsible as agents and played a distinctive role in protecting their watersheds. Significant amounts of money, time and lobbying were expended in these efforts. Moreover, these efforts do not appear to have been driven by environmental or other public interest groups but by the local governments, themselves. Indeed, the early beginnings of these efforts were prior to the advent of any significant environmental organizations.[63]

Table 3.3: Comparing Disinfection Efforts in Vancouver and Seattle

	Vancouver	**Seattle**
Disinfection (Chlorination)	Did not chlorinate until 1944 when ordered to by federal government	Began chlorination in 1914 (USPHS directive) Tried chloramination in 1930s Various modifications and improvements since 1914.
Enhanced Disinfection	Ozonation on Coquitlam 2001 UV proposed for Seymour-Capilano plant 2007	Ozonation on Tolt 2000 Ozonation and UV online 2004 on Cedar River supply

[63] Admittedly, groups such as the Audubon Society existed at this time, but they do not appear to have had any role in these efforts in either municipality.

In terms of timing, regulations have resulted in faster implementation, especially with respect to chlorination on the Seattle water sources. As discussed at the beginning of this chapter, chlorination in Vancouver was clearly controversial leading to the need for federal involvement to ensure it occurred. Other improvements to the systems are more closely timed, but Seattle has implemented disinfection improvements at least a few years ahead of Vancouver. When asked about the delays in implementation, state officials argued that Seattle needed some certainty in order to plan. Moreover, changes to the regulations, particularly the THMs meant there was a need to slow the process in order to ensure regulations would be met into the future. The huge costs of water infrastructure meant that some certainty in terms of regulations was needed by local governments since they were the ones making the expenditures.

Table 3.4: Comparing Filtration in Vancouver and Seattle

	Vancouver	**Seattle**
Filtration	Westerly transfer system (1999) Filtration expected by 2007	Transfer system (1997) Filtration in 2000

The issue of filtration of the water has been an ongoing concern for both municipalities. The water departments of Vancouver and Seattle have tried to avoid filtration as it is very costly, and there is a sense that the protected watersheds offer additional protection for public health not shared by most other North American cities. Both cities used a screening process to get rid of larger particles in the water. As early as 1927, Seattle's sanitary engineer H.W. Nightingale recommended the addition of a filtration plant to the water treatment system. At that time, the cost of the plant would have been $2 million. Over 15 years later in 1944, the city convened the Cedar River Water Commission headed by Dr. Abel Wolman. Among his recommendations: "The hazards are operative with or without logging. Water supply protection would not be improved by insistence upon a closed watershed or virgin forest evolution. Logging practices in the past have had no discernible effect on the quality of water." He recommended a filtration plant at a capital expenditure of $3,600,000 with annual costs of $50,000. Seattle has continued to argue that filtration is not necessary on the Cedar River source, and would be too costly. Though an important

technological invention, filtration is not required by the EPA if the watershed is sufficiently protected and compliance with fecal coliforms does not fall below 90 percent in accordance with the EPA's surface water treatment rule. With respect to a multi-barrier approach to drinking water protection, filtration offers enhanced protection should water even from protected sources become contaminated. Prior to the 1996 amendments, the EPA had a category entitled 'filtration avoidance' which, as one state-level bureaucrat explained, made it sound like you would get there eventually. Seattle succeeded in convincing Congress to pass the Seattle amendment to the SDWA in 1996, allowing it to pursue alternatives to filtration. Moreover, this amendment provided some certainty to the city of Seattle that it was not going to have to institute costly filtration in the near future when, at some unknown moment, it failed one of the 11 criteria to remain unfiltered.

Seattle did, however, institute filtration on the Tolt in 2000, a full seven years before any of Vancouver's sources are to be filtered. Filtration on the Tolt was not required by the regulations, but helped improve the amount of water supplied as filtration reduces the amount of organics in the water. Moreover, when the Cedar was turned off as it is during some times of high turbidity, the Tolt could still guarantee enough and safe water.

In contrast, Vancouver has failed to meet turbidity requirements during periods of heavy rainfall even before recent changes to the recommended guidelines increasing the turbidity requirements from an allowable 5 NTUs to 1 NTU. Several respondents point to a highly publicized Health Canada study showing that increased turbidity in the water could be linked to gastrointestinal illness in the population, and hospitalizations as an argument for filtration of drinking water.[64] Moreover, the Walkerton water tragedy, and new provincial legislation all played a role in the decision to filter both the Seymour and Capilano sources. Environmental groups appear to have used this study to lobby for an end to logging in the watersheds. Others, however, have noted that a filtration plant removes the need to reduce turbidity from logging operations. Experts in Seattle also agreed that filtration threatens the protected watershed because it removes the immediate argument not to interfere with nature.

[64] This study was somewhat controversial among respondents, and they varied significantly in their assessment of it. Several felt it was very important for achieving filtration. Critics noted it has only been published by Health Canada, and has not been published in any academic journals. Moreover, some respondents emphasized that the relationship was statistically significant yet weak.

Vancouver agreed to filtration after a lengthy public consultation process in the 1990s, but then put off filtration several times before finally agreeing to filter the water in 2000, the same year that Seattle's new Tolt filtration plant went online.[65] Vancouver's filtration plant will be built on the Seymour watershed and will cost $600 million. $500 million of this will be provided by Vancouver residents through taxes and increased water rates with $50 million coming from the federal government's infrastructure funds and $50 million from the provincial government. In contrast, Seattle's Tolt Treatment Plant cost $101 million.[66]

Table 3.5: Comparing Efforts with Respect to the Distribution Systems in Vancouver and Seattle

	Vancouver	**Seattle**
Distribution System	1996 – Annual flushing and cleaning instituted Corrosion control on treatment plant - 2007	Adds calcium oxide and sodium carbonate Enhanced corrosion control on Tolt treatment plant in 2000; also on Cedar plant in 2004 Did 1997 study and found lead in water of 53 of 390 homes or 14%

Distribution systems are receiving increasing attention as a public health concern regarding drinking water quality across North America. Owing to the late nineteenth and early twentieth century origin of water systems, many of the pipes are old and corroding. Pipe corrosion can lead to copper and other minerals seeping into the water supply. In Vancouver, this creates green stains on the bathtubs and sinks. Seattle has a similar problem. In 1992, the EPA agreed to adopt rules to address risks posed by distribution

[65] For a discussion of the blame avoidance theoretical framework applied to the Vancouver case, and, in particular, the delays, see Hill and Harrison 2004.

[66] The difference in the costs of the plants should not be viewed as a difference in effort. The Seattle plant was built using a Design-Build-Operate model where companies bid on designing and operating the plant for many years. It is a form of public-private partnership that citizens in Vancouver moved quickly to oppose. Similarly, citizens in Montreal and Toronto also opposed the privatization or partial privatization of their water systems.

systems such as cross connections, backflows, and other risks from pipes that deliver treated water to consumer's taps. One of these amendments was the Lead and Copper Rule. This rule addressed the lead and copper in much of the pipes that serve as the distribution system for water.

Seattle's efforts at corrosion control began in the early 1990s. The Lead and Copper Rule required water to be tested and that action be taken if certain levels of lead and copper were found in the water.[67] In 1992 and 1993 testing was done, and Seattle and the state recognized that it did not meet the lead action level in some areas of the city. In 1996, a bilateral compliance agreement was made which included a public education campaign. The state provided materials for the campaign as well as an information line. In addition, Seattle Public Utilities partnered with Bartel Drugs, a local drugstore, to provide free water testing for local residents to find out if their homes had lead solder or copper problems. In a 1997 study, lead was found in 53 of 390 homes sampled in Seattle with copper in none. Both the Tolt treatment plant and the Cedar River treatment plant include corrosion control measures such as adding lime and soda ash to the water.

In Vancouver, in 1990, problems with leaching from the distribution system were identified by Economic and Engineering Services. The company had been contracted to write the report for Vancouver's Drinking Water Improvement Plan. The consultants noted that 64 percent of the Region contained blue or green stains on bathtubs and faucets as a result of high concentrations of copper that had leached from the pipes. They also found that first draws of water exceeded the Canadian Guideline 66 percent of the time.[68] A public education campaign was recommended. In 1996, the city began a flushing and cleaning campaign. It will also include corrosion control measures on the new Seymour-Capilano plant scheduled for 2007. Lead and copper continues to be a concern for both cities due to the low pH of their water. They are both making efforts to remedy this problem, but progress has been slow. One of the key problems is that some of the concern is a plumbing issue that can only be dealt with by individual homeowners but at considerable expense. For Seattle, this concern demonstrates that federal involvement can lead to more focused attention to a problem, as well as more timely action.

[67] For lead, the action level is 0.015 ppb and for copper it is 1.3.
[68] The guideline was 1mg/L, at that time; it is currently 1.3mg/L.

3.4.1.2 Inputs – Resources and Staffing

Other aspects of the multi-barrier approach include compliance and monitoring. These aspects can be operationalized by examining outputs, as well as by examining staffing and resources. Clearly, the SDWA has a significant impact at the state level in providing resources to ensure compliance and monitoring occur at the local level. While funds are not allocated to the local level, the state provides resources including information, website materials and staff to answer questions and consult on issues.

At the state level, just 26 people were employed in Washington state's drinking water program in the early 1970s.[69] Now, there are over 130 people with their contact information readily available on the state's website.[70] The program has grown significantly. State-level respondents had no doubt this was an impact of the SDWA on the state. In addition to ensuring compliance, the state also provides information and resources including several publications. The EPA, too, provides information about new regulations and issues. The state then adapts this information to be more applicable for local use.

While it is important to be mindful that the British Columbia drinking water program is currently undergoing significant change, it is, by contrast, a much smaller program. Moreover, it is decentralized as the MHO, or the local drinking water officer, is primarily responsible. The number of employees working directly on drinking water is 3 in the provincial office, 2 at the BCCDC and about 20 FTEs in the health regions.[71] As noted above, in the Vancouver Coastal Health Region, 17 people have been appointed as Drinking Water Officers.

3.4.1.3 Who Pays and How Much?

In terms of the resources for the drinking water programs, there is also a significant difference between the funding amounts at the state and provincial levels. While Washington spends 31.8 million annually in US dollars on its drinking water program[72], one of the DOH's core functions, British Columbia has projected to spend about half amount in Canadian dollars in 2004. Projections of $16 million Canadian annually include a $1.5 million increase in resources for monitoring (Ministry of Health Services 2002). On a

[69] Confidential interview.
[70] Ibid.
[71] This information comes from confidential interviews, communications with Ministry staff and documents. See especially Drinking Water Program Organization – Health Authorities (2005). In the province, there are about 60 people designated as Drinking Water Officers or Public Health Engineers or Environmental Health Officers but all of these persons have other roles, as well, thus it can be difficult to count and account for FTEs.
[72] This information comes from the State Department of Health, Office of Drinking Water and confidential interviews/communication addressing federal-state funding arrangements.

per capita basis, $3.54 CAD per British Columbian compared to $5.21 USD per Washington resident for a difference of about $2.76 CAD.[73] These considerations do not take into account EPA Drinking Water State Revolving Funds (DWSRF) nor EPA technical and other resources for which there is no comparable federal involvement on the Canadian side.

While it is very difficult to get a good picture of exactly how many federal funds are spent on drinking water in British Columbia due to the nature of the federal health and social transfer, it is clear that federal funds have a much larger impact in Washington. Federal grants make up 65 percent of the budget of the Drinking Water Program, state funding is responsible for 23 percent, while fees bring in 12 percent. The fees are from annual operating permits issued to water systems in Washington. The DOH uses this as a means to generate revenue for the drinking water program, as well as for evaluation of compliance.[74]

3.4.2 Outputs (Compliance and Monitoring)

3.4.2.1 Water Quality

Water quality over time is an output of the water system that can be measured using two main indicator measures: turbidity and total coliforms. Turbidity can be defined as suspended particles in the water causing cloudiness. Turbidity is measured in nephelometric turbidity units (NTUs) with the instrument, a nephelometer or turbidimeter, estimating how light is scattered by suspended particulate matter in the water. Coliforms are a group of microorganisms that act as indicators of water contamination and that may indicate the presence of human or animal fecal matter in the water.

3.4.2.1.1 Turbidity

Both Vancouver and Seattle have good source water quality as their water comes from mountain rivers and streams in protected or largely protected watersheds. However, examination of data suggests that Seattle's quality surpasses that of Vancouver when turbidity is used as a measure. In fact, it is notable that all of Vancouver's watersheds fail to meet the 1 NTU level recommended by the Canadian Guidelines at some point during the year. While Seattle's Cedar River watershed, on occasion, also fails to meet the

[73] Government expenditures do not involve a currency conversion as a US dollar is expected to buy a dollars worth of US goods while a Canadian dollar is expected to buy a dollars worth of Canadian goods. In order to do the comparison of difference a 2005 average rate of a US dollar as $1.21 Canadian dollars was used.
[74] Confidential interview.

turbidity requirement, it can be switched off, and the filtered Tolt water can be delivered to residents who usually receive water from the Cedar River source. Vancouver also has a transfer system which allows it to switch off one of its watersheds, but it still fails to meet the old regulation for NTUs of 5. Five NTUs are the amount at which turbidity is noticeable to the human eye. If your glass of water appears slightly cloudy, it has exceeded the 5 NTU limit. The EPA has updated its turbidity limit to not exceed 1NTU at any time.

Water quality data reported by the Greater Vancouver Water District for delivered water that exceeds 5 NTUs can be compared with data from Seattle Public Utilities. Over a ten year period, with the exception of one year (1994), Seattle's water has not exceeded 5 NTUs[75] while Vancouver's delivered water, with one exception (1996), has exceeded the 5 NTU limit every year save one (GVWD 2004: 12-13; see also GVWD Annual Reports especially Physical and Chemical Analysis of Water Supply). Thus, at some point annually for the past ten years, Vancouver's water has appeared to be unsafe to drink to citizens as turbidity at 5 NTUs is visible. The installation of the Westerly Transfer System in 1999 helped to decrease the days delivered water exceeded 5 NTUs as the Capilano, and later the Seymour supplies could be taken out of service with water transferred to customers from another source. However, even with this technology delivered water has, at points during the year, exceeded this limit. In 2005, the Federal-Provincial-Territorial Committee on Drinking Water Quality recommended all surface water supplies be filtered while establishing a new guideline for filtration avoidance if certain criteria are met. These criteria are explained as "Average daily source water turbidity levels measured at equal intervals (at least every 4 hours), immediately prior to where the disinfectant is applied, are around 1.0 NTU but do not exceed 5.0 NTU for more than 2 days in a 12-month period." In at least the most recent two years, the GVWD has reported the Seymour Water System exceeding this criteria (2004:42 ; 2005: 45). The Capilano has also exceeded the criteria but was switched off to avoid delivering highly turbid water during high turbidity events. It is notable that each of the three water systems (the Capilano, Seymour and Coquitlam) have exceeded the 1 NTU limit at some point each year. While 1 NTU is not visible to the human eye, the presence of turbidity in the water supply suggests there is a risk of contamination.

[75] Confidential interviews. See also Seattle Public Utilities Annual Water Quality Reports.

3.4.2.2 Total Coliforms

Overall, Vancouver and Seattle have similar levels for total coliforms. In 1992, the Cedar fell below the Surface Water Treatment Rule's 90 percent compliance for fecal coliforms which usually requires a filtration order for unfiltered supplies. It was a drought year and there were lower flows. The city worked with the state Department of Health and the EPA and came to an "agreed order" in which it would study the alternatives and implement limited filtration. As explained earlier in this chapter, this event would have lead to filtration, except Seattle lobbied Congress to amend the SDWA, and state and local officials worked with the EPA to find an acceptable, less-costly solution, ozonation and ultraviolet light, online in 2004.

3.4.3 Outcomes – Gastrointestinal Illness

While Vancouver and Seattle have similar reporting for total coliforms, their incidences of gastrointestinal illness are quite different. For several types of gastrointestinal illness, the differences are statistically significant. The gastrointestinal illnesses examined include those identified by earlier work to be more likely to be waterborne. These include campylobacteriosis, yersiniosis, giardiasis, cryptosporidiosis, shigellosis and salmonellosis.

While this is a crude measure of outcomes, reporting of gastrointestinal illness points to a significant difference in Vancouver and is consistent with prior work done with respect to Vancouver (Aramini et al 2000), as well as with the reports of the Auditor General and Provincial Health Officer of British Columbia that it has the highest rates of gastrointestinal illness in the country. In 1991, the BC Committee for Safe Drinking Water, a coalition of the BC Associations of Boards of Health, the BC Medical Association, the BC Public Health Association, the Canadian Bar Association, and the Canadian Institute of Public Health Inspectors, noted that BC has a 50 percent higher rate of waterborne disease than the national average (Hume 2000:B6).

A limitation in relying on reported cases of gastrointestinal illness is that these tend to be underreported. Most people who suffer from gastrointestinal illness do not find it severe enough to go to the doctor or hospital. In order for gastrointestinal illness to be reported, you would have to have gone to see a medical professional in either city. In addition to differences in the water systems of Vancouver and Seattle, another consideration that could affect reporting is the health systems. One might expect higher reporting of this type of illness in a public system compared with the private US model.

However, we do not find this as these reports are consistent with CDC reporting of these illnesses and Vancouver's rates of gastrointestinal illness are much higher than Canadian averages.

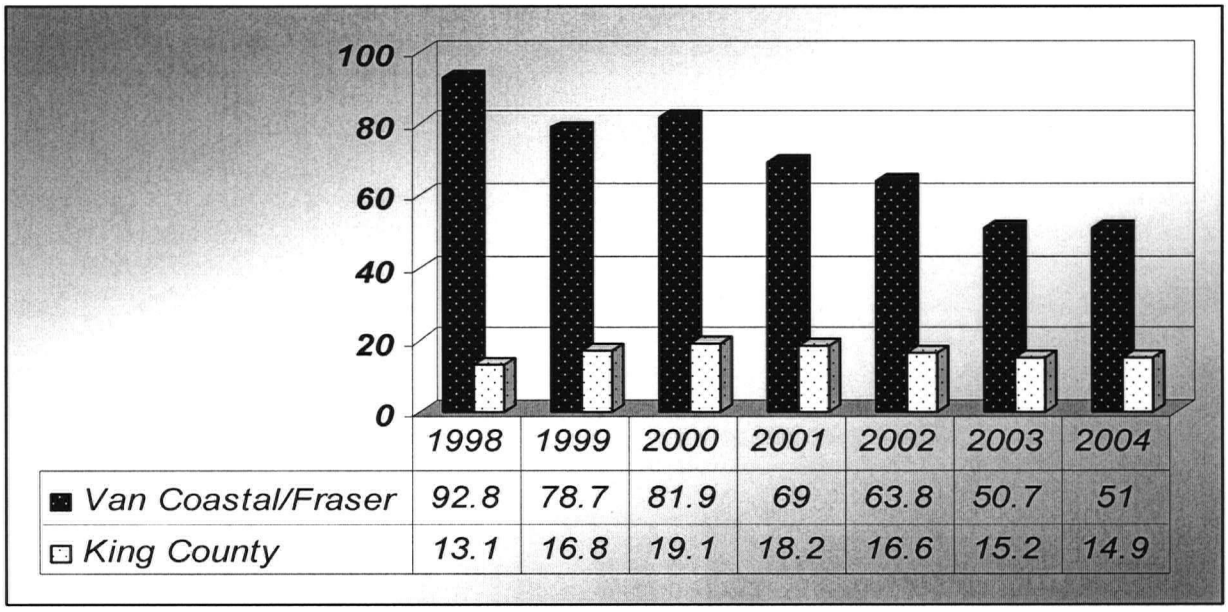
This section examines cases of gastrointestinal illness in two health regions with respect to Vancouver compared with the health region that serves Seattle. Seattle Public Utilities provides drinking water to residents in the King County health region. In Vancouver, most of Vancouver Coastal health region receives its drinking water from the Greater Vancouver Water District as do residents in portions of the Fraser Health Region. [76] For this analysis, the Greater Vancouver residents who live in health regions served by the GVWD have been included while some who reside within the health regions served, in part, by wells and other drinking water systems have been excluded from the analysis.[77]

As Figure 3.2 illustrates, the reported rate of camplyobacteriosis is significantly higher in Vancouver as compared with Seattle.

[76] Formerly Simon Fraser Health Region; Fraser North is part of Fraser Health Region and includes Burnaby, New Westminster, Coquitlam, Maple Ridge and Pitt Meadows.

[77] Originally the analysis was limited to comparing Vancouver Coastal Health region to King County. Effects were more pronounced. The inclusion of the North Fraser, formerly Simon Fraser gives a more accurate picture of waterborne disease concerns. Fraser Health Region inclusion was limited to North Fraser as it is primarily receives water from the GVRD. See Zubel, 2004. Inclusion of other portions of the region would have resulted in a similar conclusion - significant differences in the reports of cases of gastrointestinal illness in Vancouver compared with Seattle.

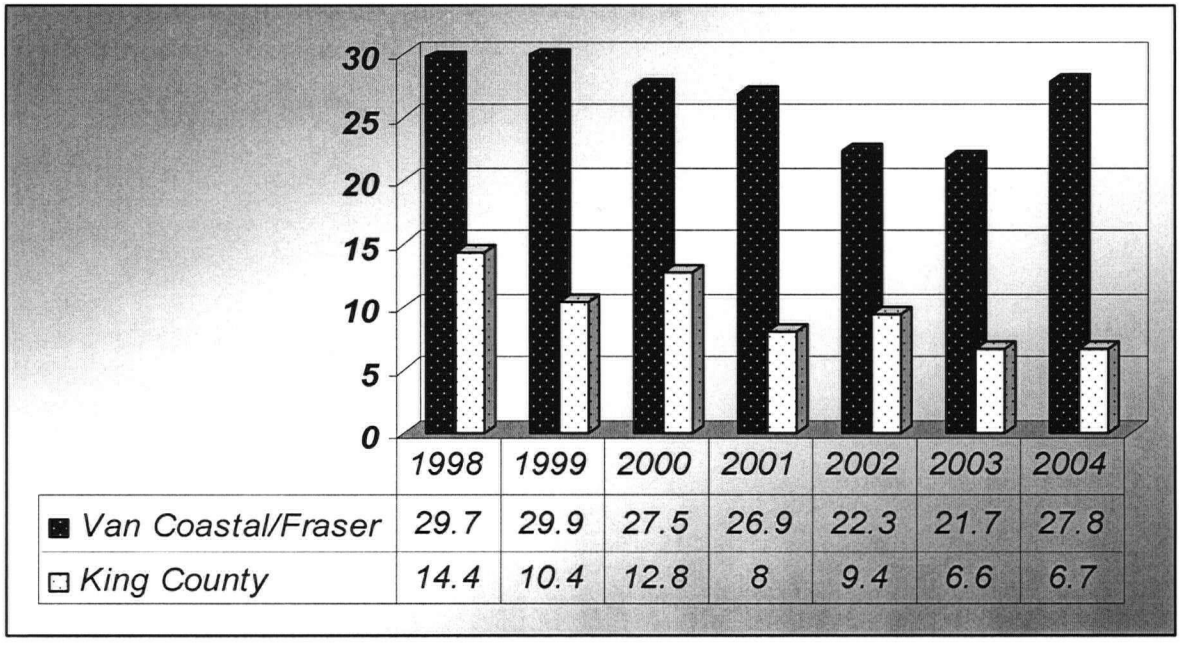
Figure 3.2: Rates of Gastrointestinal Illness per 100,000 in Vancouver (Vancouver Coastal Health Region and Fraser North) Compared with Seattle (King County Health Region) – Reported Cases of Campylobacteriosis



	1998	1999	2000	2001	2002	2003	2004
Van Coastal/Fraser	92.8	78.7	81.9	69	63.8	50.7	51
King County	13.1	16.8	19.1	18.2	16.6	15.2	14.9

Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2004 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2004 inclusive.

Figure 3.3: Rates of Gastrointestinal Illness per 100,000 in Vancouver (Vancouver Coastal Health Region and Fraser North) and Seattle (King County Health Region) – Reported Cases of Giardiasis



	1998	1999	2000	2001	2002	2003	2004
Van Coastal/Fraser	29.7	29.9	27.5	26.9	22.3	21.7	27.8
King County	14.4	10.4	12.8	8	9.4	6.6	6.7

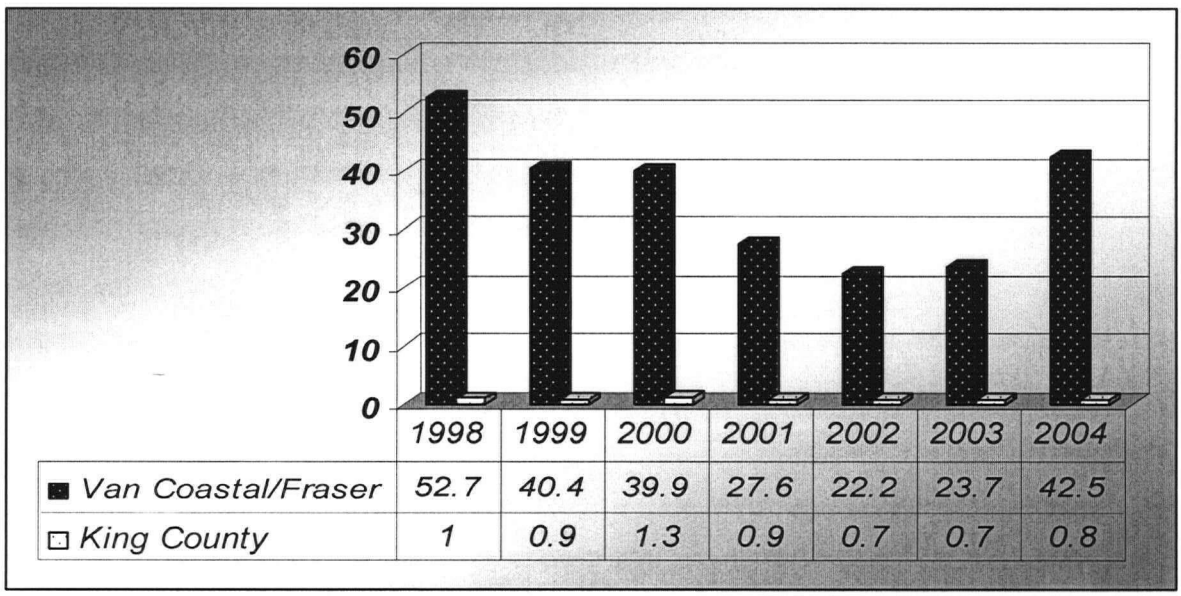
Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2004 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2004 inclusive.

Similarly, rates of giardiasis, sometimes referred to as "beaver fever" because it is transmitted through animal's fecal matter, are higher in Vancouver Coastal compared with King County as illustrated in Figure 3.3. It is important to note that watersheds in both Vancouver and Seattle are, for the most part, either closed to humans or access is very limited. Animals, however, cannot be kept out, and, in fact, both cities have fairly comprehensive habitat conservation programs in their watersheds.

This last graph, Figure 3.4, for reported cases of yersiniosis is the most striking. There are very few reported cases in Seattle compared with hundreds of cases reported in Vancouver. This difference seems anomalous. What else could explain it? Reported rates of yersiniosis by the Centre for Disease Control (CDC) are also very low, on average. Canada does not track yersiniosis on a national scale, even though it can have significant effects on humans who are diagnosed with it. It can contribute to joint pain, as well as abdominal pain, and in some jurisdictions rates of yersiniosis can be linked to appendectomies as the

symptoms appear similar.[78] Research (Ray at al 2004; Sanghyuk et al 2005) suggests that incidence of yersiniosis is higher among persons of Asian and African descent. As Vancouver has a much higher Asian population than Seattle, it was hypothesized this may be producing this significant difference. Vancouver's Asian population is approaching 30 percent whereas Seattle's is about 12 percent. In order to test this possibility, San Francisco offers a useful comparison. The Asian population in San Francisco is similar to Vancouver's at about 30 percent, but while reported cases of yersiniosis are marginally higher in San Francisco compared with Seattle (rates of 1.5 cases per 100,000 of population), they are nowhere approaching the rate of cases in Vancouver (State of California 2000).[79] This lends some support that this difference is not necessarily an artifact of something else, and that the water is a possible and even likely culprit.

Figure 3.4: Rates of Gastrointestinal Illness per 100,000 in Vancouver (Vancouver Coastal Health Region and Fraser North) and Seattle (King County Health Region) – Reported Cases of Yersiniosis



	1998	1999	2000	2001	2002	2003	2004
Van Coastal/Fraser	52.7	40.4	39.9	27.6	22.2	23.7	42.5
King County	1	0.9	1.3	0.9	0.7	0.7	0.8

Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2004 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2004 inclusive.

For Shigellosis and Salmonellosis which also falls into this disease category, there is not a similar trend. For the most part, reported cases are not significantly different, though

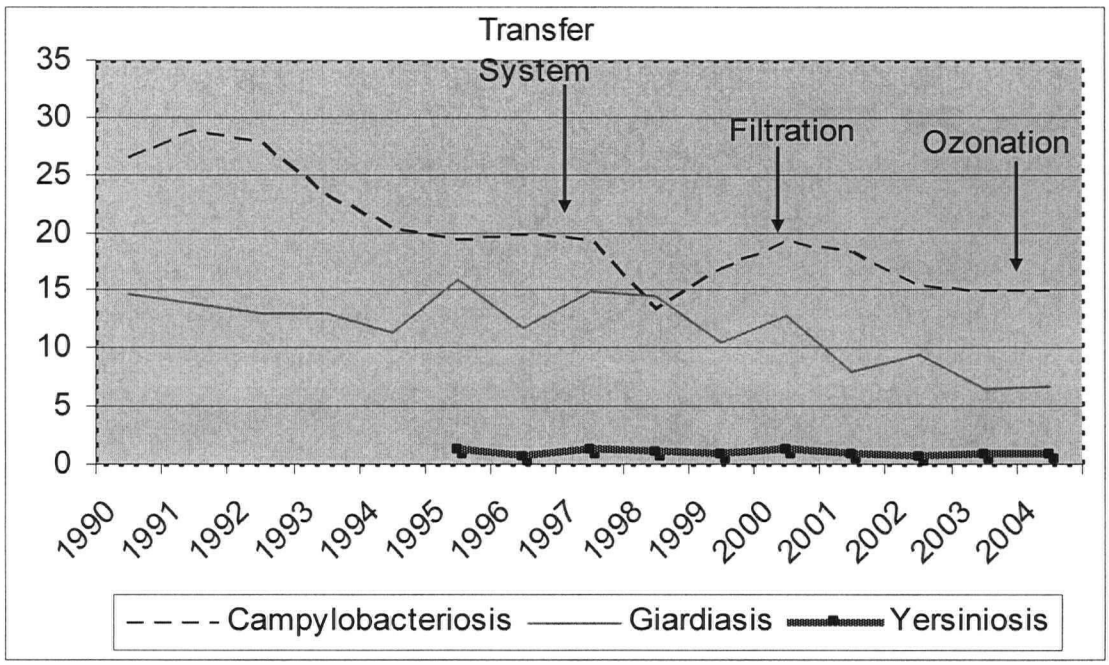
[78] See www.cdc.gov/ncidod/dbmd/diseaseinfo/yersinia_g.htm
[79] Sanghyuk et al report a total of 173 cases of yersinia enterocolitica for San Francisco from 1996 through 2003 inclusive.

in 2000 Seattle does have a higher reporting of Shigellosis, for example. Cryptosporidiosis is also a protozoal intestinal disease that can cause gastrointestinal illness and cases of it are very similar between the two cities averaging in the thirties.

Rates of gastrointestinal illness in Vancouver are clearly much higher than in Seattle. If this is due, in part, to the drinking water, as I suggest it is, it is important to note the differences in the drinking water systems over this period. Since 2000, King County has been served by a filtered source with corrosion control. Both systems operate a transfers system which allows them to turn off one of their sources and redirect water to serve residents normally served by the out-of-service source. Vancouver has had this in operation since 1999, while Seattle's has been operational since 1997. King County certainly has more attention to its water system in terms of oversight, and it also has significantly less turbidity events. Vancouver's water during periods of heavy rainfall fails to meet the 5 NTU limit for turbidity while Seattle's system has met the 1NTU consistently since the event in 1994.

Figure 3.6 below provides additional data with respect to waterborne diseases for King County Health Region. The rates of campylobacteriosis and, in particular, giardiasis appear to be on the decline. Less data is available for rates of yersiniosis as it was not a reportable disease in Washington until recently, though after 2000 with the institution of filtration rates have fallen and appear to be declining. Some impact of the water system improvements is evident when examined over time. The impact of ozonation remains to be seen. With respect to filtration, it is important to keep in mind it is only on one source, the Tolt. The Transfer system allowed Seattle to turn off the one of the systems and switch to the other during periods of high turbidity. This might be expected to have some impact as Figure 3.6 illustrates with respect to rates of giardiasis.

Figure 3.5: Rates of Waterborne Diseases per 100,000 in King County - 1990 to 2004



Source: Compiled from Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2004 inclusive.

Comparing Vancouver and Seattle

A comparison of Vancouver and Seattle with respect to inputs, outputs and outcomes demonstrates differences. While the cases are perhaps more similar than they are different in many ways, the differences are important. With respect to source water protection, the similarity is interesting. It was the agents that took on the challenge and remained committed to it for over a century.

With respect to disinfection, Vancouver delayed and the federal government used the threat of force as well as resources to achieve compliance. If we compare Vancouver and Seattle with respect to enhanced disinfection, we also see that Seattle was ahead in implementing this, as it was ahead in implementing filtration and chlorination. Timeliness is important. With respect to filtration, Vancouver and Seattle had similar planning periods, but it has been instituted much sooner in Seattle.

Seattle and Vancouver both suffer from soft water. Their pipes leach copper and lead into the water. Seattle has been directly addressing this issue for over a decade. Vancouver, too, has been aware of the issue, but its public education campaigns and its

efforts at corrosion control have proceeded more slowly. Seattle has to comply with the Lead and Copper Rule which has drawn attention to it from across the country as the Washington Post reported the levels of copper and lead in first-runs of its water. Attention has been paid to the issue, and Seattle has been forced to respond. It has not only been the attention of the media, but also of the state and federal governments.

At the state level, the number of staff and resources for drinking water increased significantly after the federal Safe Drinking Water Act came into being. They went from 20 persons to 7 times that. British Columbia's program appears to be where Washington was before the SDWA or perhaps just after. The federal government also clearly contributes greatly to Washington's drinking water program providing 65 percent of its funding while British Columbia does not benefit in the same way.

Water quality is similar in both places, but given the number of turbidity events in Vancouver compared to Seattle, Seattle's water is more often reliably good. The reported cases of gastrointestinal disease in Vancouver are significantly higher than Seattle. While this chapter does not 'prove' this is the result of drinking water, prior studies have pointed to this, and, if it is not, the comparison suggests there is a public health problem in Vancouver to be addressed.

3.5 Conclusion

This chapter demonstrates that federal involvement improves policy performance for drinking water protection. Both within and across cases, federal involvement has mattered. The federal government is willing to impose costs at the local level as demonstrated in Seattle with respect to advanced disinfection on the Cedar River supply and the requirement to cover the in-town open reservoirs. Within Canada, it is the federal level of government that forced Vancouver to chlorinate its drinking water. The two municipalities demonstrate their own resolve including considerable efforts to protect their drinking water sources. However, they also both delay actions that would improve drinking water quality. With binding national standards, costs are imposed to offer protection for public health, even in the face of local opposition in both cities.

What does federal involvement contribute? In terms of accountability, as discussed in Chapter 1, an extra layer of government shifts the incentives at the state and local levels. It provides a model where the local government as the agent is responsible for carrying out the task of providing potable water to citizens and the state government as its

principal monitors it to ensure action is taken. The federal government as a second principal monitors the state to ensure it is doing its job, and if it is not able to do its job effectively, or if it wants additional assistance the EPA is there to step in and play the more direct role that the state principal normally plays.

By contrast, the provincial decentralized model within Canada lacks incentives for the province to monitor. The federal government, with very few exceptions, will not step in. The municipality is engaged and a distinctive actor desirous of providing its citizens with safe water. The complexity of the principal-agent model in the American case offers a greater assurance of accountability whereas the Canadian model provides opportunities to shirk monitoring.

The chapter demonstrates that federal involvement has the benefit of imposition of costs. As the principal-agent framework suggests, monitoring is also key. A level of government cannot know what another is doing without paying attention. Attention involves the thought that goes into understanding expectations of the principal, and demonstrating that you, if you are the state, are meeting those expectations via reporting and communication, and that your agent is also meeting those expectations and that you know it. Regulations, especially some of the rules associated with the SDWA, can include very complicated language. Attention to what the regulations mean and why a government might require certain actions is a very different consideration than simply assuming your system is doing the best it can under the current circumstances. As noted, some respondents emphasized the amount of thought that goes into the complex problems of meeting the regulations and of designing the water system to take into account uncertainties over time. Monitoring is an important aspect of the multi-barrier approach to drinking water protection. Governments monitoring other governments and ensuring they carry out their tasks in the protection of public health might be seen as an extension of this approach.

This chapter has provided an overview of the drinking water programs in Washington and British Columbia including consideration of inputs, outputs and outcomes in Seattle and Vancouver. The data suggest greater incidence of waterborne disease in Vancouver compared with Seattle. In addition to the willingness to impose costs, and the greater degree of monitoring in the US case, the outcomes also point to improved policy performance in the US case compared with the Canadian case. The Vancouver-Seattle

comparisons support the hypothesis that national standards offer improved policy performance for drinking water protection.

IV. COMPARING DRINKING WATER PROTECTION IN NANAIMO, BRITISH COLUMBIA AND LONGVIEW, WASHINGTON

The previous chapter suggested that federal involvement improves policy outcomes for drinking water protection through increased attention via monitoring and the capacity of the federal government to impose costs on the local level, where necessary. For both Vancouver, British Columbia and Seattle, Washington, an examination of federal involvement points to results with respect to public health. Vancouver chlorinated its water because of federal pressure. Seattle instituted enhanced disinfection in order to meet the requirements of federal binding standards.

In the US case, the knowledge of laws enacted by the federal government as well as the oversight provided by it resulted in incentives for the state of Washington to act and to ensure action on the part of Seattle. In recent years, and with additional federal attention focused on Seattle because of the SDWA's filtration requirement under the Surface Water Treatment Rule, the state and city have appeared to work even closer together. Seattle has kept the state-level Department of Health informed about its problems and concerns with its water system. For Seattle, federal regulation has not only improved policy performance, it has also had the side-effect of enhancing cooperation.

This chapter provides an opportunity to further investigate and compare the drinking water programs of British Columbia and Washington. The evidence in support of the previous chapter is compelling.

Nanaimo, British Columbia and Longview, Washington are small cities with populations greater than 25,000 and less than 100,000. These two cities provide the only small city comparison in this work. The findings suggest that city size is not a significant factor with respect to the impact of federal involvement though more research would be needed to confirm this point. The two cities were chosen because of their similarities with respect to population size and river water sources. Moreover, unlike Vancouver and Seattle, these two cities depend on unprotected watersheds for their drinking water sources. Notably, Nanaimo and Longview face challenges from logging operations within and with close proximity to the watersheds. Both are also considered to be 'company towns.'

4.1 Nanaimo, British Columbia, Canada

Nanaimo, British Columbia is located on Vancouver Island and has a population of about 75,000. Unlike Vancouver, its watershed is neither owned nor protected by the city. Nanaimo's source of drinking water is the South Fork of the Nanaimo River. Nanaimo's watershed covers 230 square kilometers or three times the city size. Today, the Greater Nanaimo Water District (GNWD) consists of a 5 member board including 4 city councilors and an elected representative from Area C of the regional district.

Nanaimo was profiled in a report of BC's Auditor General on "Protecting Drinking Water Sources." The report explained that most of the South Fork is "actively harvested." The land is primarily owned by two companies that perform logging operations in the watershed area, Weyerhaueser Corporation and Timberwest. Access to the watershed is considered to be jointly controlled by the logging company and the City. Formerly, the Forest Practices Code (1995) required a buffer zone between logging and water supplies. The Forest Practices and Ranges Act (2005) does not address this issue directly, though the Drinking Water Protection Act (2002) and the Water Act (1996) offer some discretion to undertake source assessments and develop water management plans, respectively. It should be noted that Nanaimo has taken some steps to protect its source water through ongoing discussions with Weyerhaueser resulting in road maintenance, road deactivation, stream channel protection and tree planting, for example. Moreover, watershed patrols are carried out and access to the watershed is restricted (City of Nanaimo 2001; Auditor General 1999).

In terms of source protection, the city has considerable challenges as it does not own the watershed and the cost of ownership is too high for the city. In 2004, residents, health officials and drinking water management gathered to discuss drinking water protection in Nanaimo. They identified three actions to improve their drinking water: (1) Obtain better information about drinking water (2) Educate and raise awareness and (3) Protect watersheds. (Regional District of Nanaimo 2004a).

Interestingly, even though its watershed did not have the level of protection of Vancouver's watersheds, Nanaimo also failed to chlorinate its water along with other cities in British Columbia such as Victoria and Prince George. Just like Vancouver, the Minister of Pensions and Health forced Nanaimo to chlorinate the water with its powers during the Second World War.

Nanaimo's status as a company town is evident in its waterworks history as the first builders of its waterworks was a coal company (zu Erpen 1985). In 1879, the Vancouver Coal Company built the wooden pipes that would provide water to Nanaimo's residents. As Superintendent Samuel M. Robins explained, the impetus for a water system was clear: "No doubt with these improved facilities for the suppression of conflagrations, the premium on fire insurance will be materially reduced" (Nanaimo Free Press Dec. 31, 1887). In 1901, the city purchased the water system from the Nanaimo Waterworks Co. which had obtained it in 1884. By 1908, there was a supply problem and Nanaimo began to search for other sources of water in the vicinity.

The Chase River was used as the original source but by the 1930s its quality had become unsatisfactory. As a history prepared by City Hall explains, "Logging in the watershed had reduced the river to a mere trickle during the summer months when the supplementary supply was required to meet peak consumption" (Nanaimo Community Archives 1958). In these early days, the watershed was owned by the East and North Railway and under lease by the Victoria Lumber Company which became Macmillan Bloedel. Ltd.

Around the same time, and to address the supply problem related to its growth, Nanaimo acquired water licenses for the Nanaimo River and built the South Fork Dam. In 1930, the city borrowed $145 000 at 5 percent for 40 years from the federal Workmen's Compensation Board to build the improved waterworks. The Rowell-Sirois Commission on Dominion-Provincial Relations held a hearing in British Columbia's capital city, Victoria. A brief signed by the mayor of Nanaimo and each member of council to the Commission advocated that municipal governments should be able to borrow at 2 percent and not at the high rates that prevailed at the time (Nanaimo Free Press July 6, 1938). The Dominion government set aside $30 million for loans which helped to finance the Nanaimo waterworks.

Nanaimo had problems with supply and turbidity early on, and the water quality did not go unnoticed by the Medical Officer of Health. By 1939, the first report from the Medical Health Officer noting the water was contaminated resulted in a boil water advisory (Nanaimo Free Press, Aug 19, 1939). By the 1940s, both the provincial board of health and the federal Department of Pensions and National Health noted the problems with Nanaimo's water. In the end, Nanaimo was forced to comply entering into an agreement with the Department of Pensions and National Health to treat the city's water

supply with chlorine "subject to the supervision and approval" of the federal department imbued with new powers as a result of the war.

In 1946, the agreement was scheduled to end, and the Director of the Vancouver Island Health Unit, J.M. Hershey, wrote the city council explaining that the "raw, untreated water is not safe" as more than 30 percent of samples were found to contain fecal coliforms. Furthermore, he noted that since 1943 with the advent of chlorination of Nanaimo's drinking to comply with federal requirements not one sample had been found to have fecal contamination. Hershey explained, "The sole interest of the provincial health authority in this matter is to ensure a safe water supply for this community. From our point of view, there are at least several ways of doing this. These include filtration, ozone treatment, chlorination, and possibly ultraviolet radiation" (Nanaimo Community Archives). Hershey recommended buying the chlorination equipment from the federal government, and Nanaimo complied, continuing to chlorinate its water to this day.

In the 1950s, the Greater Nanaimo Water District was formed as the city needed a way to raise funds to expand the water system including new watermains (Hanna & Isaacson 1951). The authority of the board could also be increased to deal with other similar problems such as sewerage and drainage. Considerable expansion of the system occurred between the 1950s and 1970s including addition of reservoirs. In the early 1970s the Jump Creek Dam was constructed above the South Fork affording Nanaimo additional reservoir storage especially during peak summer months.

In 1996, some major improvements were made to the system of watermains and reservoir storage. A pumping station at Lost Lake was also added. The costs of these improvements were shared between the province and the federal government. Currently, Nanaimo's water system consists of 2 storage lakes, 3 dams, 8 service reservoirs, 7 pumping stations, 80 kilometres of supply mains, and 500 kilometres of distribution mains with treatment facilities at Village of Extension and Nanaimo Lakes Road.

Nanaimo does not have a filtration system but does use screening and chlorination to treat the water. Filtration would cost $30 to $40 million plus about $1.2 million annually to operate (Bennett 2001). Of 3500 public water systems in British Columbia only 35 have filtration, 25 of these are First Nations systems operated by the federal government (under which the federal government has jurisdiction).

In 2004, the city undertook a public consultation. The consultation was in response to several concerns raised by residents including watershed protection, and in recent years,

concerns about fertilizer in the watersupply from logging operations (Nanaimo Daily News 2001). The public consultation involved 91 participants including residents, representatives from the Ministry of Health, the Vancouver Island Health Authority, the Regional District of Nanaimo, and McDannold Stewart, a law firm that prepared a discussion paper outlining legal issues with respect to drinking water protection in British Columbia. The feedback report on the discussion paper offered four recommendations: (1) "Acquire land in the watersheds. (2) Raise public awareness about drinking water issues and enhance communications among all organizations with roles and responsibilities related to drinking water. (3) Enact legislations at all levels to enhance drinking water protection and (4) Institute land use, development and servicing practices" in order to enhance drinking water protection (Regional District of Nanaimo 2004c).

4.2 Longview, Washington, USA

The source of Longview's water is the Cowlitz River. Longview is located in a valley with hills in the southwest part of the state of Washington surrounded by the Cowlitz and Columbia rivers. Its population is about half that of Nanaimo with some 35,000 residents. Like Nanaimo, Longview's watershed is unprotected and partially owned by Weyerhaueser, in addition to other logging companies. Longview is a unique city as it was a 'planned' city developed by R.A. Long in the 1920s. In this sense, Longview might be considered to be the quintessential company town.

Long was a southern lumber magnate who moved to the Pacific Northwest, founded Longview, and built a large sawmill. The water system was built by Long's company about 1923, and chlorination was introduced immediately in order to meet federal United States Public Health Service requirements. By 1926, Long had invested $6.5 million in Longview including provision of services such as water, sewer and electricity (Ibid:151). As Bradley explains, "... as months then years went by the company became more anxious to shift control of the utilities ...to private hands," so that by 1927 Washington Gas and Electric had purchased Longview's water and electricity systems (Ibid.).

Long's mill opened at an unfortunate time in which lumber prices declined significantly from $227 per thousand board feet of Douglas firs in 1923 to just $19 per thousand board feet in 1928 (Ibid:156). Eventually, the city bought the waterworks from the Washington Gas and Electric Co.

Federal standards impacted Longview's water system immediately, and it chlorinated the water. In the late 1970s, filtration was introduced in order to meet federal regulations with respect to the Safe Drinking Water Act.[80] At that time, it could not meet the requirements for turbidity of less than 5 nephelometric turbidity units (NTUs).

The Cowlitz River can suffer from turbidity, seasonally. However, the biggest challenge for Longview's water system with respect to turbidity was the eruption of Mount St. Helen's in 1980. Ash and dirt covered the watershed and, for a period of time, water had to be obtained from nearby Kelso. The possibility of another eruption remains an ongoing concern.

While federal regulations have given rise to improvements in the water system, local officials have not always viewed federal regulation, positively. At a National League of Cities conference in 1994, Mayor Mark McCrady called for an end to all unfunded mandates. The Safe Drinking Water Act is often pointed to as an example of an unfunded mandate by those who oppose the downloading of costs onto local government. In the case of Longview, the mayor may oppose unfunded mandates, but it does not appear the city of Longview has been unable to meet the costs of its drinking water improvements as it has not accessed any of the drinking water revolving loan fund.

In addition, when new security measures pertaining to bioterrorism were announced in 2003, Mayor McCrady again expressed concern about federal laws that impose costs on municipalities. He explained, "It's not that much fun being at the bottom of the political food chain" (Lystra 2003). It is worth noting that some funds were made available from the federal level to meet the new challenges related to Homeland Security including as this pertains to drinking water.

Longview provides an example of a small city with a river water source and similar drinking water protection challenges to Nanaimo such as those posed by logging within and nearby its watershed. For Longview, the impact of federal regulations is evident in improvements to the drinking water system, specifically chlorination and filtration. Moreover, the federal imposition of costs has drawn the attention of local officials.

4.3 Comparing Performance: Inputs, Outputs and Outcomes

A comparison of effort in these two small cities suggests that federal regulations have had a considerable impact. While Longview's system has been chlorinated since 1923,

[80] Confidential interview

Nanaimo's system did not achieve chlorination for two more decades. Longview's water was filtered beginning in the late 1970s to meet the requirements of the Safe Drinking Water Act while the water in Nanaimo remains unfiltered with no apparent plans to undertake filtration. It should be noted that Longview's water may have more apparent threats, particularly, the possibility and experience of volcanic activity from Mount St. Helen's, but that has only initiated greater protection and an even further upgrade of the filtration system. Filtration was the product of federal regulation.[81] Interestingly, Nanaimo is the larger city with the greater tax base while Longview, half its size, instituted filtration over 25 years ago.

Table 4.1: Comparing Effort with Respect to a Multi-Barrier Approach in Nanaimo and Longview

	Nanaimo, BC	Longview, WA
Source Protection	-Access allowed and jointly controlled by Weyerhaueser and the city	- source water assessments (1996 amendments)
Disinfection	Chlorination in 1943 – federal government requires during war	Chlorination in 1923 to meet USPHS
Filtration System	None	Filtration occurs in late 1970s to meet SDWA; later upgraded

During Nanaimo's 2004 public consultation, filtration only appeared as a recommendation from two of twelve discussion groups. Residents and operators focused on the need to protect the water source. Water source protection is certainly important, but the Vancouver case suggests not sufficient. For Nanaimo, source protection is challenged by private ownership with Weyerhaueser owning most of the watershed and with the ongoing occurrence of logging. For Longview, watershed protection is perhaps an even greater challenge as there are several private owners. Like Nanaimo, Longview owns none of its watershed.

Federal regulations have given rise to both chlorination and filtration in Longview. With respect to timing and effort, Longview has clearly done more, sooner. The following section looks at aspects of water quality in the two cities.

[81] Confidential interview

4.3.1 Outputs: Turbidity

While turbidity in Nanaimo and Longview is within the 5 nephalometric turbidity unit range previously acceptable to the EPA, in recent years Nanaimo would not have met the new EPA regulations for turbidity.

Table 4.2: Annual Turbidity Ranges from 1986 through 2004 for Longview, WA

MCL	1986 to 2000	2001	2002	2003	2004
0.3 NTU	0-3 NTU	0-0.1 NTU	0-0.1 NTU	0-0.1 NTU	<0.3 NTU

Data Source: Washington Department of Health Data Obtained by Request 1986 through 2004 inclusive

Table 4.3: Annual Turbidity Ranges from 2000 – 2004 for Nanaimo, BC

MAC	1986 to 1999	2000	2001	2002	2003	2004
1 NTU	Not available	0.1-0.2 NTU	0.5-0.6 NTU	0.2-2.9 NTU	0.2-0.55 NTU	0.17-3.04 NTU

Data Source: Greater Nanaimo Water District Water Quality Reports 2000 through 2004 inclusive

Longview's water meets the requirement in all years from 1986 through 2003. Its filtration plant was built soon after the 1974 Safe Drinking Water Act was passed in order to meet regulations.

In contrast, while Nanaimo's water meets the objective of 5 NTUs, it fails to meet the maximum acceptable concentration in 2 of 5 years outlined. For not having a filtration plant this is evidence of good quality source water. However, the recent amendments to the SDWA requiring 0.3 NTUs were to ensure protection against giardia and cryptosporidium by allowing for 3-log removal of contaminants. In the case of Nanaimo it is worth noting that in 2003 parasite studies, the presence of cryptosporidium and giardia was detected.

If Nanaimo were a US city, it would be under considerable pressure from the EPA to filter its drinking water in order to meet the requirements of the Surface Water Treatment Rule. While in 1999 and 2000, Nanaimo's water was of such good quality it met even that high standard, more recently its level of turbidity has also exceeded Canadian guidelines.

4.3.1.2 Outputs: Coliforms

Data for Longview's drinking water provided by the Washington state Department of Health addressing the period from 1996 through 2003 was examined for total coliforms and fecal coliforms. There were some positive total coliform samples and on a very few

occasions positive fecal coliform samples. When resampling was completed, the water was found not to be contaminated.

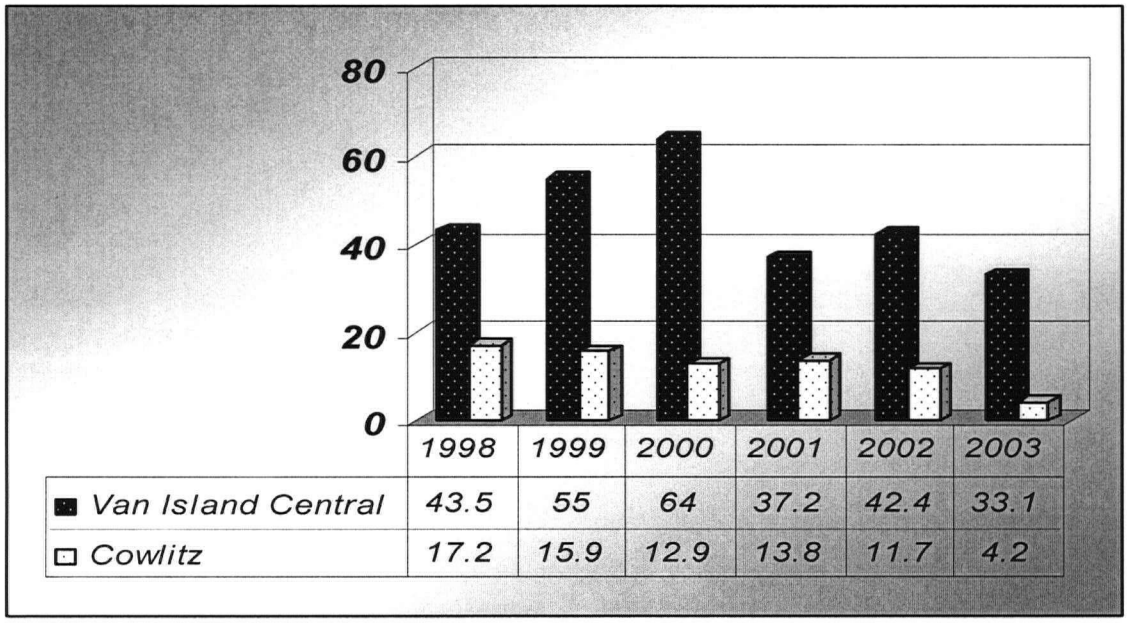
Nanaimo's water quality reports for 1999 through 2004 include information on total coliform and fecal coliform testing, as well. When positive tests for total coliform were found, tests for fecal coliforms were conducted and found to be negative. It is worth noting that during the month of August 2003, 13 of 73 tests or about 18 percent were found to be positive for total coliforms for the treated water. This is greatly over the 5 percent positive in any one month, the old Canadian Drinking Water Guideline prior to its new maximum contaminant level of zero. When subsequent tests for fecal coliform were conducted, water quality reports state the samples were negative.

While the data on coliforms is difficult to compare and may be considered inconclusive, it points to a higher water quality in Longview. The results with respect to gastrointestinal illness below support such a finding.

4.3.2 Outcomes: Comparing Gastrointestinal Illness in Nanaimo and Longview

Turbidity results for Nanaimo suggest the water is generally of good quality. Environmentalists have raised concerns about use of fertilizers as well as logging in the watershed. Comparisons of gastrointestinal illness for Nanaimo and Longview suggest a similar pattern to that of Vancouver and Seattle. These findings point to the positive public health effects of filtration. While a more comprehensive study would need to be undertaken these findings support the hypothesis that federal regulatory involvement produces better public health outcomes.

Figure 4.1: Rates of Campylobacteriosis (per 100,000) in Nanaimo (Van Island Central) and Longview (Cowlitz County)



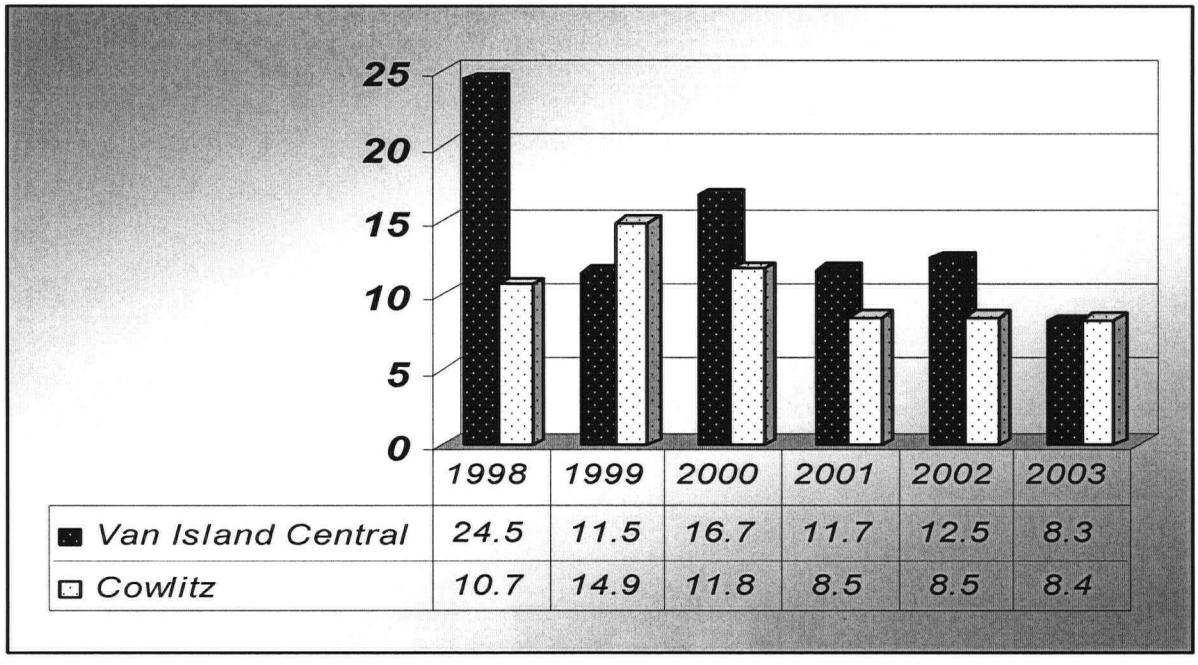
	1998	1999	2000	2001	2002	2003
Van Island Central	43.5	55	64	37.2	42.4	33.1
Cowlitz	17.2	15.9	12.9	13.8	11.7	4.2

Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2003 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2003 inclusive.

Rates of campylobacteriosis (Figure 4.1) are at least four times as high in the health region in which Nanaimo is located as compared with Longview's Cowlitz County.

By some contrast, rates of giardiasis (see Figure 4.2) do not differ as significantly. However, patterns suggest higher degrees of giardia in Nanaimo than Longview with an overall downward trend.

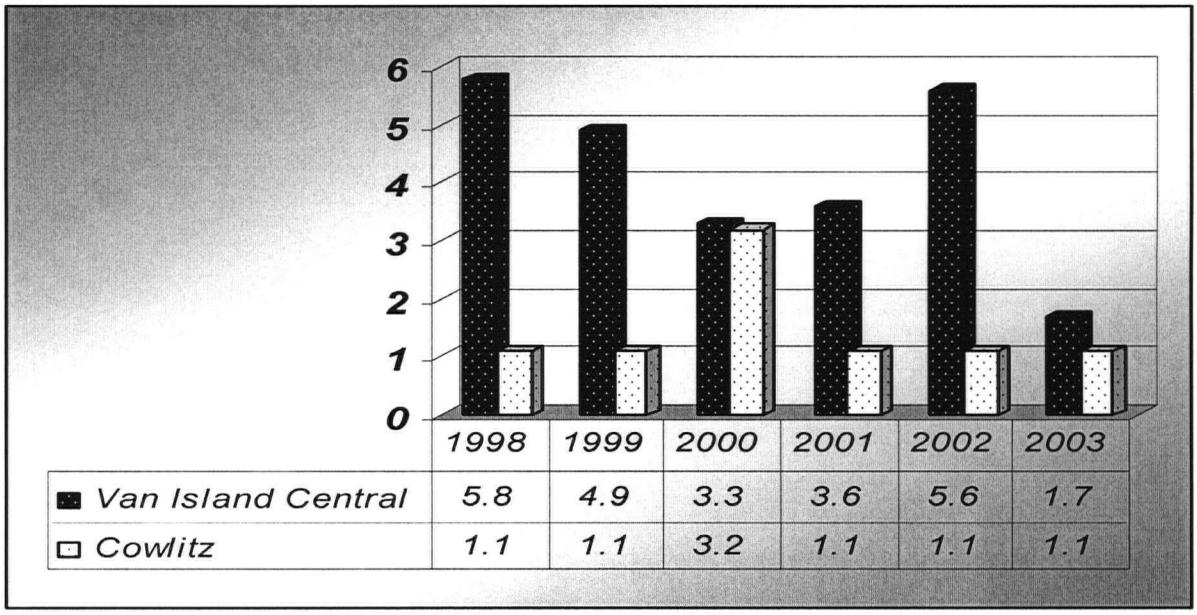
Figure 4.2: Rates of Giardiasis in Nanaimo (Van Island Central) and Longview (Cowlitz County)



Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2003 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2003 inclusive.

Shigellosis and yersiniosis have also been connected with gastrointestinal illness related to waterborne pathogens. Except for one year, rates of Shigellosis (see Figure 4.3) are significantly higher in the Vancouver Island Central Health Authority (Nanaimo) than in Cowlitz (Longview).

Figure 4.3: Rates of Shigellosis (per 100,000) in Nanaimo (Van Island Central) and Longview (Cowlitz County)

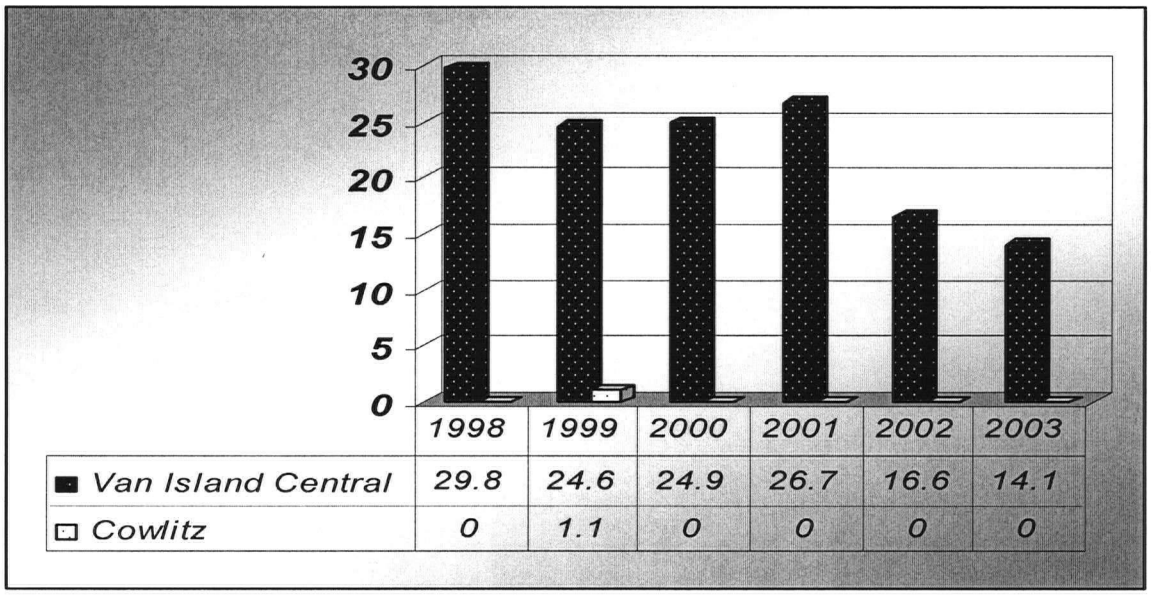


	1998	1999	2000	2001	2002	2003
Van Island Central	5.8	4.9	3.3	3.6	5.6	1.7
Cowlitz	1.1	1.1	3.2	1.1	1.1	1.1

Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2003 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2003 inclusive.

Perhaps most striking and most similar to the Vancouver-Seattle comparison are the differences in rates of Yersiniosis (Figure 4.4) in the two cities. Nanaimo's rates range from a low of fourteen times higher in 2003 to almost 30 times higher in 1998.

Figure 4.4: Rates of Yersiniosis (per 100,000) in Nanaimo (Van Island Central) and Longview (Cowlitz County)

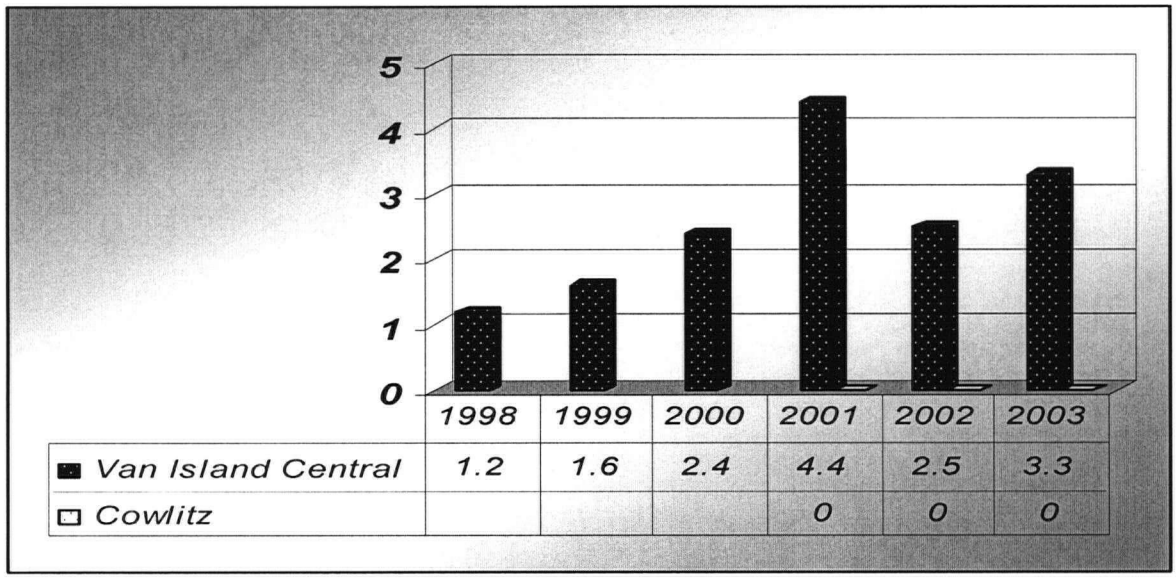


	1998	1999	2000	2001	2002	2003
Van Island Central	29.8	24.6	24.9	26.7	16.6	14.1
Cowlitz	0	1.1	0	0	0	0

Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2003 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 1994, 1999, 2000 through 2003 inclusive.

Finally, Figure 4.5 demonstrates that rates of cryptosporidiosis are clearly higher in Nanaimo. This potentially points to the impact of filtration in Longview in contrast with its absence in Nanaimo.

Figure 4.5: Rates of Cryptosporidiosis (per 100,000) in Nanaimo (Van Island Central) and Longview (Cowlitz County)



*Empty cells in Figure 4.5 are a result of unavailable data for those years. Cryptosporidiosis was not a reportable disease in Washington state until 2001.
Source: Compiled from BC Centre for Disease Control. *Summary of Reportable Diseases.* Vancouver, British Columbia: Provincial Health Services Authority. Reports from 1998 through 2003 inclusive; and Washington State Department of Health. *Annual Communicable Disease Report.* Epidemiology, Health Statistics and Public Health Labs. Reports from 2000 through 2003 inclusive.

4.3.2.1 Beyond Gastrointestinal Illness: Considering Cancer Rates in Nanaimo and Longview

As the next chapter demonstrates, an apparent connection between cancer and the drinking water in New Orleans may have impacted the implementation of the US Safe Drinking Water Act. Since about 1985, several epidemiologic studies have examined the relationship between chlorinated water and cancer incidence, especially with respect to bladder and colorectal cancers. A particular area of interest has been the effect of total trihalomethanes (TTHMs) on human health. TTHMs are byproducts of water chlorination. The US EPA has developed the Disinfection and Disinfection Byproducts Rule to address these byproducts and has established 80 parts per billion as the maximum acceptable concentration of TTHMs in treated tap water. In Canada, the Canadian Guidelines use 100 parts per billion as the MAC.

The studies suggest that the relationship between colorectal cancer and drinking chlorinated water is inconclusive (Mills et al 2000) though more positive than negative relationships have been found in the studies conducted, thus far. For bladder cancer, the

relationship is more apparent and King and Marrett (1996) even suggest that between 14 and 16 percent of all bladder cancer in Canada could be due to drinking water.

This section provides a crude comparison and it points to the need for further study as it is also supportive of the general findings in this and the previous chapter. Age-adjusted mortality rates for bladder cancer in Cowlitz County are 4.6 per 100,000 (Washington State Cancer Registry) whereas in Vancouver Island Health Authority (where Nanaimo is located) they sit at 7.0 per 100,000 (BC Cancer Agency 2005). The rate of mortality for bladder cancer in the health authority in which Nanaimo is located is 1.3 times the provincial average (Ibid.). The average for the state of Washington is 4.6 deaths per 100,000 (Washington State Cancer Registry). It should be noted that in recent water quality reports, level of TTHMs in Nanaimo appear to exceed the 100 parts per billion limit of the Canadian Drinking Water Guidelines some of the time, and more often exceed the US EPA's limit of 80 parts per billion. In contrast, Longview's water meets all federal requirements.

While the relationship between colorectal cancer and drinking water has not been conclusively established, the differences in colorectal cancer rates between the two locations are worth noting, here. This is even moreso the case as BC laws do not require testing and monitoring for any toxic substances that might be found in the drinking water and that have been linked to cancer. In recent years, Nanaimo has tested for several of these and some water quality data has been made available but it has not been required to do so consistently over time. In a 2000 study of contamination levels, 9 compounds exceeded the guidelines at least once over a 9 year period (BC Research Inc. 2000). These included bismuth, calcium, manganese, potassium, silicon, silver, strontium and titanium. With the exception of strontium, titanium, and perhaps silicon, most of these are not connected with adverse health effects. If one examines rates of cancer in the two cities, there is a marked difference that may or may not be attributable to contamination or byproducts in the drinking water.

Age-adjusted mortality rates for colorectal cancer in Cowlitz County are 20.7 per 100,000 (Washington State Cancer Registry) whereas they are 30.5 per 100,000 (BC Cancer Agency 2005), significantly higher in Vancouver Island Health Authority. The rate for Washington state is 18.6 per 100 000 and the US National rate is 21.2 per 100 000 (Ibid.).

This data is for 2000 to 2002 in Cowlitz County and for 2003 in Vancouver Island Health Authority. It provides a crude picture but points to the need for more study. Clearly cancer rates in Nanaimo are significantly higher than those in Longview. Whether this can be connected, in part, to the drinking water is a hypothesis for future consideration.

4.4 Conclusion

The comparison of Nanaimo, British Columbia with Longview, Washington lends support to the findings of the previous chapter. It contributes a medium-sized case study as well as strengthens the findings for the Vancouver-Seattle comparison further developing the British Columbia-Washington comparison. Federal involvement contributes to enhanced drinking water protection. In British Columbia, the federal government's involvement in both Vancouver and Nanaimo led to the introduction of chlorine though nearly two decades after most of the continent. While Vancouver has a protected watershed, Nanaimo's watershed is subject to logging operations and, with limited access, is open to the public. The lack of protection for Nanaimo's watershed makes it even more surprising that federal regulators were required to convince local officials of the need to institute chlorination.

By contrast, Longview's water was chlorinated when the system was built in the early 1920s. Introduction of chlorine was the result of federal regulations. Similarly, Longview's water was first filtered in the 1970s to meet the new federal Safe Drinking Water Act requirements. In contrast, Nanaimo's water does not have an advanced filtration system.

In Nanaimo, problems with water quality were evident early as were efforts on the part of provincial public health officials to act. However, in order to get the city of Nanaimo to use chlorine, federal intervention was necessary.

The impact of federal involvement in these two cases is clear with respect to effort to protect the drinking water. It also appears to be evident with respect to outcomes. Today, turbidity levels in Nanaimo would likely require filtration if it were a US city and would undoubtedly lead to some sort of compliance actions to improve the drinking water quality. Moreover, levels of gastrointestinal illness, though not conclusively linked to drinking water, are significantly higher in Nanaimo as compared with Longview. As well, the significant differences in cancer rates are, at the least, a concern and point to the need for more study.

The results from British Columbia and Washington point to a similar conclusion: federal regulatory authority produces better public health outcomes. Nanaimo and Longview support the findings from Vancouver and Seattle.

Disinfection and filtration are major engineering and technological innovations with respect to safe drinking water. The delay in instituting these within British Columbia is a particular and peculiar concern for public health that demands further study. In recent years, those familiar with the situation within the province will also be reminded of the town of Ericksen's refusal to chlorinate the water. If only the federal government had also visited the British Columbia Interior in the 1940s.

Interestingly, some EPA officials noted the 'frontier mentality' of EPA Region 10 that includes Seattle. With respect to drinking water, if Washington is a 'frontier', where does that leave British Columbia?

V. COMPARING DRINKING WATER PROTECTION IN MONTREAL, QUEBEC AND NEW ORLEANS, LOUISIANA

This chapter builds on the comparisons of the previous two chapters. The British Columbia and Washington comparisons suggest that differences in public health outcomes can be linked to federal regulatory involvement and that different levels of government can act at different times. This chapter compares two large cities in two other subnational units, Quebec and Louisiana. It demonstrates that a federal level of authority offers opportunities for capacity development while imposing costs to improve policy performance. While the comparison in this chapter may not provide as high a degree of similar-systems comparability as the chapters on British Columbia and Washington, it lends evidence to the hypothesis that federal level authority contributes to better public policy for drinking water safety. Moreover, it suggests that cross-country comparisons can be helpful in advancing understanding.

"[New Orleans] only source of water is the muddy Mississippi River. It is an abundant source but we face the greatest water purification challenge of any city in the world. Our watershed consists of 32 states and 3 Canadian provinces."

- Harold Gorman, former Executive Director Sewerage and Water Board of New Orleans to US Senate Hearing, October 18, 2001

In the fall of 2005, much of New Orleans sat under water from Hurricane Katrina. Drinking water was being provided, though very slowly and by most accounts inadequately, by the Federal Emergency Management Agency and non-profit organizations such as the American Red Cross. Apparently, one of the water system's plants was operational throughout the whole disaster but most of the system was inoperative and is damaged. Part of my initiation regarding New Orleans included an introduction to the levees holding back the water from Lake Pontchartrain. I also came to know that the pumps that all water systems have to keep pressure and send water to suburbia from the city centre had the extra task of pumping water out of the system in New Orleans. This function was necessary so that the below sea-level city did not drown. But Lake Pontchartrain is not the source of New Orleans water. The role of the pumps while important for distribution considerations of a multi-barrier approach to drinking water protection was also not my main concern. My interest was limited to drinking water and the drinking water system, specifically,

which in the case of New Orleans has successfully survived other hurricanes and challenges for more than a century.

When the disaster struck, I was reminded of an exchange I had with a colleague at the MidWest Political Science Association conference. He told me there was no place on earth like New Orleans so it would make a poor match for Montreal. Upon reflection, the colleague was certainly correct that New Orleans is like nowhere else yet the same can be said for any city. Nevertheless, the comparability of the water sources is arguably quite good. While there are no rivers like the Mississippi or the St Lawrence they are more like one another than they are comparable to other water sources in North America. This comparison offers insight into protecting drinking water when the river sources are not only waste repositories but over which governments, particularly local governments, have limited control.

As explained in Chapter One, water sources and city size as a proxy for capacity, were the factors used. In considering these factors, the Mississippi River water was identified as probably a lot like the St. Lawrence River water, and more like it than any other body of water on the continent. Moreover, these two cities are diverse places with huge tourist industries as well as a lot of manufacturing and other industries, industries which along with the sewage effluent of the municipalities themselves have considerably polluted these great rivers over time. While many have speculated on the future of New Orleans, others have noted the amazing history of the city and that it will be re-built. I sincerely hope this is the case. Whatever transpires, this comparison suggests that while New Orleans' water system has faced many challenges, in particular, pollution of its source water, it has also seen some success. When compared with Montreal, useful insights for Canadians may be gained.

Moreover, the story of New Orleans water system is central to the story of the Safe Drinking Water Act (SDWA), even possibly affecting its implementation. The city attracted considerable attention in 1974 just prior to the passage of the Safe Drinking Water Act by the US House of Representatives. Information from an EPA study showed that New Orleans tap water was contaminated with traces of toxic substances, leading citizens, journalists, and politicians across the country to ask whether their drinking water might also be at risk (Times Picayune Nov.9, 1974; see also USEPA 1975). Newspaper accounts from other large American cities such as New York and Chicago suggest these cities did not consider themselves as different from New Orleans in 1974 as they perhaps

do, today. In fact, as the EPA Administrator then pointed out to the National League of Cities, if drinking water contamination could happen in New Orleans it could happen anywhere.

Montreal, Quebec and New Orleans, Louisiana are municipalities located along major rivers they use as their source water. Both cities are French in origin, and are located in subnational units that have been at odds with the national unit over time. This chapter provides an examination of the intergovernmental relations with respect to drinking water in Montreal and in New Orleans. It then compares current legislation in both jurisdictions. Finally, the chapter compares some outputs and outcomes with respect to water quality. For New Orleans, there is no question the tap water was better in 2004 than in 1974. For Montreal, the challenge of an aging system that needs reinvestment is evident both in comparison with New Orleans and in documentation and accounts of respondents.

5.1 Montreal, Quebec, Canada

The Montreal Company of Waterworks began building Montreal's water system in 1800. In 1845, the city bought the waterworks. The need to avert fires was cited but the system proved to be ineffective for this purpose as a great fire swept the city in 1852, leading to the construction of a new aqueduct and an extended system by 1868 (Smith 1913; Linteau 2000: 131).

The source of Montreal's drinking water is the St. Lawrence River. As a source, the St. Lawrence holds considerable economic, social and historical significance for the people of Quebec (Environnement Quebec 2002). However, as early as the beginning of the twentieth century, there were concerns about the quality of its water (Linteau 2000: 224).

Typhoid, a waterborne disease, was a particular problem. In 1910, the high incidence of typhoid prompted the city to chlorinate its water. In fact, Montreal was one of the first cities in Canada to use chlorination as a treatment technique. Filtration followed 8 years later. The First World War was cited as the cause of the delay in filtering the water.

While residents of the city were provided with water by the public system, the Montreal Water and Power Co, one of the early waterworks that had been in competition with the Montreal Company of Waterworks continued to sell water privately to those who lived in the communities surrounding Montreal. This water was regularly contaminated and in 1904 delegates from these communities, including Westmount and Maissonneuve,

demanded filtration (Linteau 2000). This demand was not achieved until 1911 when Westmount renegotiated the contract. Montreal Water and Power Co was later bought by the city becoming part of the public system in 1927 (Ball et al. 1988).

Concerns about the quality of Montreal's drinking water have emerged periodically for decades. For instance, a visit by the Queen in 1959 highlighted local concerns about potable water when the Queen refused to drink the Montreal water in her train car (Prevost 1962). A decade later, studies showed detectable levels of mercury and lead in the water in Montreal and surrounding municipalities.

There are indications that the prospect of federal intervention has prompted the provincial government to take action on several occasions. In 1969, at the same time that the federal government's was engaged in developing a national water policy,[82] the Quebec government initiated a "Comite interministeriel de l'administration des eaux,"[83] and a year later opened a research centre on water quality problems in Quebec: the "Institute quebecois de Recherches sur l'eau".[84] In 1970, the Ministry of the Environment issued a press release in which the Minister of Municipal Affairs, Robert Lussier, explained, "Les provinces ont assez de maturite pour regler leurs problemes entre elles sans que le federal s'improvise en grand-frere pour regler les soi-disant conflits intergouvernementaux. Il s'agit en somme de savoir si le Quebec administera ses resources et son territoire ou si les decisions seront prises a Ottawa."[85]

A year later, the report of Quebec's Legendre Commission was released. The Commission had been formed in 1968, the same year as the Canadian Drinking Water Guidelines were established, to study "des problemes juridique de l'eau."[86] Le Soleil considered the findings of the Legendre Commission "explosive." Among the recommendations, the Commission advocated the nationalization of all water administration within Quebec including the recommendation that all water utilities and sewage plants come under provincial control, and that a coordinating mechanism between

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[82] With the advent of the Department of Energy, Mines and Resources in 1965 the federal government had also created a water division which was engaged in developing the Canada Water Act (1970). The act was formally unveiled in August 1969 with promises by Minister Otto Lang that the bill would 'put an end to the buck-passing between overlapping agencies and jurisdictions.' See Harrison (1996), page 65.

[83] The English translation is Interdepartmental Committee for Water Management.

[84] The English translation is Quebec Institute of Water Research.

[85] The English translation is "The provinces are mature enough to solve their problems themselves without the federal government pretending to be a grandfather for solving the so-called intergovernmental conflicts. It acts as if it knows if Quebec will look after its resources and its territory or if these decisions will be taken in Ottawa."

[86] The English translation is 'jurisdictional problems with respect to water' perhaps more accurately may be stated as jurisdictional fragmentation with respect to water.

the United States, Ottawa and Quebec should be established to protect the source water. Legendre, the judge who presided over the Commission, also stressed the need for legislative reform with respect to water law in Quebec pointing to the complexity of 60 federal laws, 40 provincial laws, and a number of municipal bylaws (Davies 1971).

In 1972, the Quebec government passed the Loi sur la qualite de l'environnement[87] which included article 32.7 referring to the installation and modification of infrastructure related to drinking water (Environnement Quebec 2003). Five years later, the Environment Ministry released a report on the state of the St. Lawrence River which discussed the deterioration of water quality in the Montreal region. Soon after, the government launched efforts to establish sewage treatment facilities in response to the concerns of the report.

In 1979, Montreal's second major water treatment plant, Charles-J. Des Baillets, opened. Its use of ozone in addition to chlorine for disinfection was an important innovation as ozone has been proven to be much more effective than chlorine in killing giardia and viruses (Proulx et al 2002). Even with these improvements, concern about the water quality persisted. Studies during the 1970s had found mercury and lead in Montreal's drinking water. There had also been several discussions in the local media about the possible presence of viruses given the variety of pollutants in the source water ranging from fecal bacteria and polio virus to pesticides and heavy metals (Dykstra 1979).

In 1984, the provincial Ministry of the Environment passed the Reglement sur l'eau potable with binding requirements for testing of 42 parameters including biological and chemical tests. In practice, this was expected to increase costs to municipalities by about $0.25 per person annually (La Presse 1983). The regulation required testing for parameters that municipalities had either rarely tested for or did not test for at all prior to the regulation. These regulations were informed by the Guidelines for Canadian Drinking Water Quality as well as other guidelines and parameters.[88]

Despite local investments and provincial standards, public concerns about water quality persisted. Perhaps the best available measure of declining public confidence in the drinking water was a 1988 poll that found that 28 percent of Quebecers, some 2 million people, drink bottled water, including many from the Island of Montreal (Gazette Oct. 21 1988:A4). The poll found that about 14 percent of Quebecers drank bottled water year-round with 50 of every 100 people living in the east end of Montreal drinking bottled water.

[87] The English translation is Law with respect to Environmental Quality.
[88] Confidential interview.

The poll was commissioned by the Fondation quebecoise en environnement and undertaken by Sorecom.

The year the report was issued, the Quebec government took action to protect the source water and to coordinate and harmonize activities with respect to the St. Lawrence River, partly in collaboration with the federal government. The St. Lawrence Action Plan included a joint monitoring program, development of a sustainable shipping strategy, and reduction in pesticide use. Over a 5 year period between 1998 and 2003, the Quebec government specifically committed $31,373,000 for protection of and research into human health with the government of Canada committing $15,121,000. Total commitments over the 5 year period for Quebec were $302,868,000 with Canada committing $117,665,000. The program has since been renewed as the St. Laurent Vision.

In 1999, an ad hoc provincial commission on water management was established with the mandate to prepare a Quebec Water Policy. Its report (2002) encouraged watershed-based management programs across the province and recommended according the St. Lawrence River special status. The report noted the need to clean up and improve the management of water resources. It included goals relevant to Montreal such as urging municipalities to achieve infrastructure renewal and reducing the toxicity of effluents in the St. Lawrence. As part of the new Quebec Water Policy, the provincial government passed a regulation in 2001 (Reglement sur la qualite de l'eau potable) that included reporting requirements for E coli, binding testing requirements for 77 biological and chemical parameters, and operator certification. The imposition of a minimal treatment obligation along with requirements to notify the Departement de Sante Publique (Public Health Department) and the Ministere l'environnement (Ministry of the Environment) were new and not present in the 1984 regulation. The regulation must be reviewed every 5 years. There is an expectation on the part of the Ministry that source protection will be included in revisions of the regulation.

In 2002, Montreal began a review of its local water system. Part of this review included a decision to increase water rates. The local government was elected on a platform that included the stronger efforts to protect the environment. There had not been any significant spending or attention to the water system in several years, in particular to the aging pipes and distribution mains. The cost of addressing the aging distribution system is considerable. The municipal executive committee launched a review of the system and contracted with SNC Lavalin to provide a report. This review was meant to be

comprehensive and to provide information about which pipes needed to be replaced and when. There was public concern about these expenditures and some people criticized the local government for the cost and the contracting-out of this review.

Before the consultants could report, a watermain broke on a major Montreal street, Pie IX, in 2003 and this shifted the public's attention away from the cost of the review to the need for water infrastructure. This rupture resulted in considerable damage, and no water to nearly 50,000 homes for over a one week period. Others in the region were asked to boil their water because contamination could enter the system through the broken main. The costs to the city included repair of the break, payment for damages to homes and goods, and bottled water that was required to be provided under the regulation. The Quebec government did not provide any financial assistance during this event.[89]

In response to the public concern and to avoid blame for doing nothing or not doing enough, the city held public consultations and found residents supportive of expenditures to improve the system. One of the responses to loss of confidence is willingness to pay for improvements. The usefulness of the information the consultants provided had now become the focus rather than the expense of the SNC Lavalin report. Previously some residents had viewed the executive committee as paying large companies too much money, but they now recognized the need to improve Quebec's aging water system.[90] A fund specific to drinking water was set up and is now part of residents' municipal taxes. This fund is expected to generate $25 million this year and $20 million for each of the next nine years to help pay for improvements to the water system. The city is still waiting to hear how much money other levels of government will contribute to the costly but necessary project.

Today, Montreal has a total of 7 municipal treatment plants for drinking water including the Charles Debaillets, Atwater, Dorval, Lachine, Pointe-Claire, Pierrefonds and Sainte-Anne de Bellevue. These plants serve 28 urban communities in the greater Montreal region. With the exception of the two largest plants, Atwater and Debaillets, these plants were all built after 1979. The Atwater plant is being upgraded to disinfect using ozonation and so is the Lachine plant. The other plants use a combination of chlorination and filtration. One of the plants, Sainte Anne De Bellevue, does not conform to the new regulations and the city has undertaken a review of that plant.

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[89] Confidential interview.
[90] Confidential interview.

5.2 New Orleans, Louisiana, USA

While Montreal's water source is the St. Lawrence River, the Mississippi River provides drinking water for New Orleans residents. The Mississippi is a "source on the move" (SWBNO 2003). According to the Sewerage and Water Board of New Orleans, twice the amount of water used in one day by the population of the whole United States passes through the Mississippi by New Orleans.

Today, New Orleans faces the need to rebuild after a catastrophic hurricane. It has endured many challenges over time. Early on in its history, New Orleans suffered from the scourge of fires. The city burned in 1788 and 1794. Like other urban centres, a water source was not devised simply for drinking, but more urgently for fire-fighting. "Ironically, over 300 billion gallons of water a day were pouring down the Mississippi less than 2 blocks from the fire. The amount is more than the present city uses in 6 years," explained the Water Board in its publication celebrating over a hundred years of service (Ibid.:3).

From its early days, the Mississippi River has served as the source of drinking water in New Orleans. Problems with the turbidity of the source water were noted early. For example, the Semi-Annual Report for 1899 to 1900 notes, "the admixture of the waters of the western tributaries of the North River brings to us a very fine and peculiar character of sediment..."(19). Like the other cases studied, there was debate about whether the Mississippi was the best available water source (29). Other river sources investigated included the Amite, Tickfaw, Tangipahoa and Bogu Falaya. The Mississippi was chosen as the most abundant and best available source. In 1901, the General Superintendent labelled the water quality "unusually good" but noted the River water contained small amounts of salt and chlorine (SWBNO 1901: 15).

Prior to the designation of the Mississippi River as the source of New Orleans water, the city needed to create a public water department to ensure potable water could be delivered to its citizens. The Sewerage and Water Board of New Orleans was finally established to supply water to the City of New Orleans and to Jefferson Parish businesses in 1899 by Section 32 Act No 6 of the Louisiana legislature. A women's suffrage group had petitioned the state legislature for this move on the grounds it would improve public health (Gorman 2001). Prior to this, the New Orleans Water Works Co., a private company, had supplied water to some of the city's residents.

Work could not begin on the water system until the state authorized 50 years of Public Improvement Bonds for the city of New Orleans. On April 17, 1900, the state General Election confirmed the issuance of bonds for building New Orleans water system. Eligible voters voted 32,132 in favour and 1,434 against (SWBNO Annual Report 1901). To build the system, the Sewerage and Water Board engaged the services of water purification expert George W. Fuller. His expertise included several years studying similar water challenges in Louisville and Cincinnati.

The issue of private versus public ownership of the New Orleans water system arose early. While in 1900, the state of Louisiana agreed to the issuance of bonds to create a public system, the existing private New Orleans Water Works Co. launched a lawsuit and halted the building of the system by injunction (1901:14). The New Orleans Sewer Co. also launched lawsuits. The board reports note that these 'monopoly franchises' stood as "barriers to any active operation" (Kolb 2000:8). In fact, in its early years numerous jokes existed about the busiest department in the water board being the legal department (Ibid.). Three years of litigation occurred.

In 1905, construction finally commenced. The system was operational within three years. The new system included purification (sedimentation, coagulation and filtration), along with 565 miles of pipes and mains for a cost of about $9.2 million (1914:22). In 1906, an addition was made to the system as the Algiers Waterworks and Electric Co was acquired at a cost of $150 thousand. Between 1879 and 1915, $27.5 million was spent on construction of the water and drainage systems (SWBNO 2003).

Water quality as evidenced by the turbid water continued to be a concern. In 1910, the turbidity of the raw river water was at a maximum of 1700 nephalometric turbidity units (NTUs), a minimum of 55 and an average of 550. By 1913, it had increased to 1900 NTUs with a minimum of 120 and an average of 675 NTUs (SWBNO Annual Report). The early system included filtration of the river water in order to reduce turbidity and thereby protect public health.

For most cities, the introduction of chlorine was in response to typhoid rates. For New Orleans, typhoid was a concern but malaria was a more pressing problem. In 1916, chlorine was installed at the main filter plant in accordance with federal regulations for common carriers. The introduction of chlorine resulted in a decrease of typhoid deaths from an average of 38 per 100,000 between 1900 and 1909 to 7.5 per 100,000 in 1920. Malaria, too, was significantly reduced from 26 cases per 100,000 to 1 per 100,000 in 1920

as reported by the City Board of Health to the Sewerage and Water Board.[91]The requirement of the United States Public Health Service to chlorinate the water was specifically mentioned in the 1920 report as having "very satisfying results." Upgrades to the filtration system were introduced in 1928.

By the 1950s, chloramination is mentioned in reports and appears to have been introduced sometime between 1945 and 1950. The reason for its use is to improve chlorine residual in the distribution system in order to ensure disinfection continues as the water travels to the taps. According to the "Report of the Water Purification Department," prior to improvements, residual stood at 0.48 parts per million whereas afterwards it was increased to 50 parts per million, a significant difference.

While improvements to the system took place post-war, by the 1970s, New Orleans was plagued by a series of oil barge accidents in the Mississippi River creating oil slicks and even causing oil to enter the city's water supply. In 1973, 2 barges collided in the River near New Orleans, and in 1974, a damaged oil barge with a picture showing oil entering the city's water intake was front page news in the June 24 Times-Picayune. According to the Coast Guard, 350 such spills occurred within a 240 mile stretch of the Mississippi in one year (New York Times 1974). On July 8, 1974, Sewerage and Water Board Director Stuart H. Brehm Jr. asked the EPA and the Louisiana Bureau of Environmental Health to sponsor a study to determine the quantity levels of hydrocarbon compounds in Louisiana's treated water (Times-Picayune:1).

Days later on July 11, New Orleans state representative John Hainkel requested that the Louisiana Health and Welfare Committee launch an investigation into the numerous cases of bladder cancer in the city that had been connected with the drinking water. Just prior to the 1974 spills, Dr. Robert Harris of the Environmental Defence Fund (EDF), a nonprofit Washington DC group, authored a series of articles connecting 1972 EPA tests of contaminants with cancer in New Orleans drinking water. The EDF report suggested that 50 premature deaths in "white males alone" could be averted if the water was purified including locating a new water source. The report was based on a statistical analysis of cancer mortality rates. The rate of cancer mortality in New Orleans was 32

[91] Malaria has resurfaced as a possible public health risk in the wake of Hurricane Katrina. While public health efforts including federal regulation resulted in the virtual elimination of malaria by 1920, it is important to emphasize that prior to the introduction of the water system with filtration and subsequent chlorination, malaria death rates stood at 156 per 100,000 in 1880-1889 (Annual Report of New Orleans Sewerage and Water Board, 1919).

percent above the national average. The research showed that a statistically significant relationship existed between cancer death and the Mississippi River as a source of drinking water (Wall Street Journal 1974).

By November 1974, the EPA had released its most recent tests showing traces of 66 compounds in the New Orleans tap water an increase of 20 contaminants in comparison with the 46 reported from the 1972 data the EDF had used to author its report. The 1974 data suggested that three of the compounds were slightly toxic, 17 moderately toxic, 15 very toxic, 2 extremely toxic, and 1 "supertoxic" with 28 unknown. Environmental Protection Agency toxicologist Robert Fardiff reported that the drinking water included traces of the super toxic endrin, an agricultural pesticide, as well as the extremely toxic dieldrin and acetaldehyde (Times-Picayune Nov. 9). The EPA report was released on November 9 resulting in skyrocketing bottled water sales that day. The President of the Sewerage and Water Board Ulisse M. Nolan said that sales of bottled water had increased "vigorously," noting that, "We are not taking it in an indifferent way by any means." Ozone Waters Inc reported that demand was "terrific" while Polar Bear Water Co. claimed that business was 30 times the usual (Times-Picayune: 4).

That same month, the Times-Picayune included a story about a Sewerage and Water Board lab researcher who refused to drink the city's water. Days later in November, the local paper carried a story about the intentions of the mayor and his 9 children to drink the water while awaiting the outcomes of the water quality study. When asked if the city could afford the expense of such research, the mayor explained, "There is always money available because you simply take it from something else or you add the taxes or the service changes...It is the kind of priority that is not going to take second place to anything" (Times-Picayune November 14, 1974).

In response to the controversy surrounding New Orleans drinking water, the Times-Picayune published an editorial on July 26, 1974 entitled "Safeguarding our water." In part, the editorial stated,

> It is the EPA that is testing our water at the behest of the Sewerage and Water Board. A state legislative committee, the House Health and Welfare Committee has also undertaken a pollution prevention study in connection with New Orleans drinking water. The hot issue in getting the federal bill (HR 13002) out of committee was not water purity but whether the policing would be the exclusive province of the states. The final decision was that EPA would step in only if states refused to act on violations of federal water standards. Worry about federal governments poaching on states' rights at this point is less important than getting better quality drinking water across

> the country. Last year, the GAO said that fewer than 1/7th of the water systems studied were up to federal standards – which is no rousing endorsement of state responsibility.

Furthermore, the editorial noted a recent failure of the state of Louisiana to meet federal standards for packing houses, explaining,

> Louisiana will want to cock an ear closely for its water standards are not at least as rigid as those of EPA and if its watchdog and enforcement procedures do not measure up, under the proposed law EPA can enter court to force compliance.

On November 20, 1974, the Safe Drinking Water Act overwhelmingly passed in the House of Representatives 296-85 including expenditures of $156.5 million over 3 years for grant and loan guarantees, as well as research. Environmental groups strongly supported the bill while the Ford administration opposed it on the grounds of cost and "an excessive federal role" (Times-Picayune).

In December, EPA Administrator Russell E. Train addressed the National League of Cities conference underscoring the need for the Safe Drinking Water Act by pointing to the recent concerns with the safety of New Orleans water. He argued, "If we find this sort of thing in the drinking water supply of New Orleans we are probably going to find chemical ingredients in other parts of the country"(December 3:16). Samples of municipal water supplies found some THMs as high as 780 parts per billion in New Orleans drinking water. Levels in New Orleans water at that time could be considered to be extremely high by current standards as today's regulations require levels of THMs to be below 80 parts per billion. In 1979, the EPA set a goal for trihalomethanes of 100 parts per billion by 1983.

In order to limit trihalomethanes (THMs) in the drinking water, the EPA issued regulations requiring charcoal filtration. For New Orleans, the projected costs of the new rules were $50 million. Sewerage and Water Board Director Stuart H Brehm called the regulations "arbitrary" and "capricious"(Times Picayune January 26, 1978). He also warned that water rates would have to increase in order to pay for the change in policy. Brehm stated, "Since the EPA has not received federal dollars to do this work and the state of Louisiana does not have such funds, the money will come from the water consumer on his water bill."

The Sewerage and Water Board announced that rates would increase by $1.95 [per month] with an average annual cost of water for a family of three increasing from $6 to $10 [per month] in order to generate between $350 and 450 million over a three to five year period. The Board has the authority to establish water and sewerage rates. Representation on the board is comprised of the Mayor who is the President of the Sewerage and Water Board with 3 representatives from the City Council, 2 representatives from the Board of Liquidation and City Debt and 7 appointees as described in the state statute. Appointed board members serve staggered 9 year terms.

In addition to raising water rates to meet the revised regulations, the board also directed New Orleans to join other US cities in a lawsuit to prevent implementation of the EPA regulations on the grounds these were arbitrarily imposed. The US cities formed a "Coalition for Safe Drinking Water" and argued the costs of charcoal filtration and other requirements would be prohibitive and offer minimal results.

In a report of the Sewerage and Water Board in 1984 it was noted that a lawsuit filed in 1976 by the Environmental Defence Fund (EDF) against the EPA had been won by the EDF. The EPA was now required to regulate. This was expected to cost New Orleans $5000 a day if non-compliant. In the report, the superintendent suggested that "it might be cheaper for New Orleans to ignore the regulations."

By 1979, the Board made efforts to comply but conceded in its report that "the costs are prohibitive and results minimal, therefore we are recommending termination of [this study]." A year later, it clarified, "The Sewerage and Water Board, however, will continue its neverending study to continue to furnish a potable, safe drinking water in conformance with the National Interim Primary Drinking Water regulations for the citizens of New Orleans" (10)

The challenge of providing safe drinking water in New Orleans proved to be considerable. In 1981, once again, New Orleans was affected by discharges into the Mississippi River. The Superintendent's report laments,

> During the year 1981, the Sewerage and Water Board was plagued with an ever increasing number of unauthorized waste dumpages into the Mississippi River which entered our intakes and caused excess correctional expenditures to flush out these unwanted discharges and restore a potable supply of water to the citizens of New Orleans.

The report refers to efforts to minimize THMs likely with reference to the then recent (1979) inclusion of a THM requirement by the EPA to the National Primary Drinking

Water Regulations. The report also cautioned that "the dissolution of all unwarranted chemicals is a physical impossibility." This was the final Superintendent report included with any of the Water Board's reports.

In more recent years, New Orleans has embarked on capital improvements to the water and sewerage system. In 1986, the city opened its own water quality lab staffed by chemists, microbiologists, and technicians. According to later reports of the Board (2000) an average water sampling event costs $339.97. In 1993, a 5 year plan totalling $293 million was passed to expand the Algiers Water Plant and the Carollton Water Plant.

In the 1990s, the EPA and New Orleans Sewerage and Water Board were involved in discussions over water pollution in Lake Pontchartrain that was caused by leaky sewer pipes. This action referenced the Clean Water Act rather than the Safe Drinking Water Act. Nevertheless, this pressure on the Sewerage and Water Board pushed them to outsource aspects of their wastewater operations in 1992 and later to consider privatization of their water treatment as well. In order to save money, the management and operations of wastewater treatment plants was outsourced to Professional Services Group Inc. in 1992. In 1998, the Sewerage and Water Board had signed a consent decree with the EPA ending a $29 million federal lawsuit over pollution in Lake Pontchartrain caused by leaky sewer pipes. The cost for New Orleans to meet the consent decree was estimated at $1 billion. A year after signing the consent decree, the EPA approved grants for the New Orleans' sewers.

In 2000, the theme of cost reductions and dealing with deficit budgets lead New Orleans Sewerage and Water Board to consider privatizing the water system in addition to its wastewater services. The harshest critics of the privatization were a non-profit think-tank, the Bureau of Governmental Research, as well as the League of Women Voters, and the employees of the Sewerage and Water Board. The efforts to privatize the Board elicited strong reactions and a City Charter amendment was proposed and passed by municipal ballot in February 2002 amidst the bidding for the contract by French and other multinationals. The ballot initiative required that public contracts over $5 million be put to the voters in a referendum. Suez-United Water apparently pulled out of the bidding process noting that the new law made the approval process too difficult.

In October 2002, a coalition of over 90 community, labour, faith and environmental groups had joined together to oppose the privatization. While privatization efforts began under Mayor Morial, Mayor Ray Nagin said new bids would be taken in 2003. By 2004, no

new bids had materialized. On April 20, Mayor Nagin said that officially the search for a private contractor had ended. Public support was decidedly against privatization of the system.

The challenge of meeting the consent decree coupled with the significant costs of upgrading an aging system resulted in New Orleans consideration of privatization. Citizen outcry, in particular concerns with raising water rates and loss of public control, led the Board and the bidders to reconsider attempting privatization of New Orleans' water system. In 2001, after New Orleans had embarked on a tender for bids, the Executive Director of the Sewerage and Water Board Harold Gorman addressed the Senate Committee on the Environment and Public Works in his other capacity as President of the Association of Metropolitan Water Agencies. He emphasized the excessive poverty in New Orleans with 28 percent of residents living below the poverty line, and the need for federal funds for water infrastructure. He explained,

> Funding of the major urban water systems in 1900 was accomplished almost exclusively with local dollars. The replacement of those systems today cannot be funded exclusively with local funds. In the 1900s most taxation was local in nature. There was no federal income tax. Funding of the water infrastructure today must reflect the tax structure in 2001, not the structure of 1901.

In addition to privatization, other ventures were considered in order to cut costs or generate revenue for the water board. One example included bottling and selling tap water. Mayor Ray Nagin's inaugural speech on May 6, 2002 mentioned the prospect of bottling the city's water much like companies such as Coca-Cola (i.e. Dasani) bottle other cities water. The US National Water Works Association Convention was held in New Orleans in June of that same year, and delegates were to receive bottled New Orleans tap water called "Crescent City Clear" provided through a public-private partnership with Dixie Brewing Co.

Obviously, Mayor Ray Nagin has more pressing concerns, currently. Whatever New Orleans' future, its past has been important with respect to drinking water policy in the United States, and will clearly remain important with respect to public works, the environment, and intergovernmental relations.

5.3 Comparing Montreal and New Orleans

Both Montreal and New Orleans were driven to consider privatization of their water systems in order to respond to the need to offload responsibilities and to avoid blame in raising water rates, or, as the case may be, avoid future blame when a water tragedy occurs because citizens were not willing to pay to ensure public health. The two cities also continue to suffer ongoing concern with water quality and concern with the water supply. The great rivers that serve as the sources for these two cities present significant challenges as their watersheds are spread over a wide area and subject to toxic dumping, oil spills, and wastewater effluents.

This section compares existing legislation in Quebec and Louisiana. There are significant differences with Louisiana legislation being much more comprehensive.

5.3.1 Quebec and Louisiana Legislation

In 2001, Quebec revised its regulation pertaining to drinking water entitled "Reglement sur la qualite de l'eau potable." This regulation requires review every five years. Similarly, the SDWA must be reviewed by Congress every six years.

Quebec's regulations with respect to drinking water are pursuant to the Environmental Quality Act. In contrast, Louisiana's water legislation is Part 12 of the Sanitary Code. Neither has a stand-alone law respecting drinking water. Louisiana's Department of Health and Hospitals (LDHH) has primary responsibility for drinking water quality and monitoring whereas Quebec's Ministry of Environment (MdE) holds this responsibility. Both of the departments note their cooperation with their environment or health department, LDHH with the Louisiana Department of Environmental Quality and Quebec's MdE with the Ministry of Health.

The Louisiana legislation numbers about 80 pages in comparison to the revised Quebec legislation of 32 pages.[92] In addition to a greater number of pages, a greater number of contaminants are monitored under the Louisiana legislation which follows the Safe Drinking Water Act's requirement to monitor for contaminants under the National Primary Drinking Water Regulations. Moreover, Louisiana has had an operator certification program since 1972 while Quebec only introduced one in the recent revisions to its water policy after the Walkerton tragedy.

[92] This is in the original French. In English, the legislation numbers fewer pages, about 26 pages.

Public notification is required under Louisiana's legislation whereas reporting to provincial agencies once a contravention occurs is required under Quebec's legislation. In line with the 1996 amendments to the Safe Drinking Water Act, consumer confidence reports must be provided annually to each user of a public water system in Louisiana whereas Quebec has no expectations for public reporting addressed within its safe drinking water regulations. Only if there is a boil water advisory are citizens required to be notified.

Another difference is that variances are allowed under the provisions of the SDWA. However, variances are used only as an opportunity for delinquent water systems to be brought up to the standard. In Louisiana, no variances have been allowed or requested. The new arsenic rule may make variances necessary for Louisiana for the very first time. Thus, while variances are allowed, in practice they are rarely, and currently in Louisiana, never used.

Finally, the SDWA has required source water protection in the form of source water assessments since the 1996 amendments. Louisiana was one of the first states to have its source water assessment program in place. In contrast, the province of Quebec has only addressed source protection indirectly, and some may argue inadequately, via its wastewater regulations which continue to allow the city of Montreal to dump 900 billion litres of mostly untreated sewage into its own drinking water source[93]. Source protection may be more specifically addressed in amendments to existing legislation that is currently under review however it appears that the Quebec government has decided to move towards a voluntary approach to source water protection.

[93] This sewage is treated with primary treatment which removes some solids through use of settling techniques. It is considered inadequate and in the US, cities have been required to treat sewage with at least secondary treatment since 1972, though in practice most cities did so by 1984. Other Canadian cities, notably Toronto and Calgary, treat sewage with secondary and tertiary treatment.

Table 5.1: Comparison of Quebec and Louisiana Legislation with Respect to Drinking Water Protection

	Louisiana – SDWA (1988)	**Quebec – pre Walkerton (before 2001)**	**Quebec – post Walkerton**
Legislation	Title 51 of Louisiana Administrative Code - Part XII (2002) formerly Louisiana State Sanitary Code Water Supplies Updated and Revised 1988	Environmental Quality Act (1984)	Environmental Quality Act (regulation amended 2001)
Number of Pages (Legislation + regulations)	80 pages incl Act and Rules	7 pages	32 pages
Regulations	Contained within the Code	Reglement sur l'eau potable 1984	Reglement sur la qualite de l'eau potable 2001
Ministry/Department Responsible	Department of Health and Hospitals (LDHH)	Ministry of the Environment	Ministry of the Environment
Annual Fee	Safe Drinking Water Program Management Fee 1989	Not applicable	Not applicable
Variances	Accepted, 90 days request not for filtration, disinfection of total coliforms, each request for MCL or TT must be submitted separately	Not applicable	Not applicable
Public Notification	Required for violation of MCL, TT, monitoring, waterborne disease, variance under exemption etc.; content of the public notice is listed; reporting for vulnerable subpopulation levels required beginning 2001, amended 2003	Not applicable	Boil water advisories must be made public; automatic if E coli is found

	Louisiana – SDWA (1988)	**Quebec – pre Walkerton (before 2001)**	**Quebec – post Walkerton**
Reporting to the Public	Annual Reports – Consumer Confidence Report – by July 1 of every year for previous calendar year	No reporting required	No reporting required
Contaminants listed	Includes 'health effects language' for public notification, and explanation of major sources of that type of contaminant in drinking water; Lead and Copper Rule, Disinfection and Disinfection Byproducts Rule	Includes lists of chemical, biological and radiological contaminants	Includes list of chemical, biological and radiological contaminants
Number of contaminants required to be monitored	National Primary Drinking Water Regulations (approximately 90 contaminants) plus several rules addressing surface water treatment, disinfectants and disinfection byproducts, total coliforms, lead and copper, and information collection	42	77
Inspections	Sanitary surveys every inspections as determined by the department	No inspections	No inspections

	Louisiana – SDWA (1988)	**Quebec – pre Walkerton (before 2001)**	**Quebec – post Walkerton**
Procedure to follow if adverse water quality incident	Resample, notification of state and public notification within 24 hours if E coli or fecal coliforms, within 30 days if total coliforms, only	To discretion	Automatic boil water advisory for E coli
Source Protection	Source assessments required – EPA requires states to submit these for each Public Water System (1996)	None required	Planning is underway; source protection expected to be part of revision in 2006
Treatment system requirements	Filtration and disinfection are required	Must meet parameters but no specified requirements	Filtration and disinfection required
Operator certification	Required, LDHH Program is award-winning, small fee $5 (program has existed since 1972)	None required	Required, must be accredited by Education Ministry
Penalties	1998 PA 56 fines for failure to submit reports or failure to monitor/test or to notify public from $200 to $1000 per day effective July 1, 1999; fines for failing to produce consumer confidence reports $5000	Fines between $100 and $25 000	Fines between $500 and $40 000

	Louisiana – SDWA (1988)	Quebec – pre Walkerton (before 2001)	Quebec – post Walkerton
Financial support to meet regulations	Drinking Water State Revolving Fund – is used for loans for system improvements capacity development and state human resources	None	None; some provincial funding has been allocated for drinking water but not specified for resources or capacity to meet regulations

This next section discusses the roles and relationships between different levels of government in implementing the drinking water protection policies. The relationships between the provincial/state and municipal level, between the provincial/state and federal level and the relationship between the federal-municipal level. Roles of the Quebec Ministry of the Environment, the Louisiana Department of Health and Hospitals, the United States Environmental Protection Agency Region 6, and the Canadian Federal-Provincial-Territorial Subcommittee on Drinking Water Quality are discussed.

5.3.2 Quebec – Role of Ministry of Environment (Provincial-Municipal Relationship)

The Quebec Ministry of the Environment has the lead role for drinking water in Quebec. It works closely with the Ministry of Health, in particular public health offices located at the municipal level (e.g. Montreal Public Health). The role of the Ministry is one of oversight. In terms of accountability with respect to reporting, municipalities have been required to report since 1984. The Ministry of the Environment does not do any inspections of water systems. The Ministry has a database and can easily check when a water system has not reported. Much discussion happens by telephone. With respect to large and medium municipalities there is mutual respect and the Ministry suggested they were "competent enough to do the job by themselves." The Ministry does not have adequate staff to actually visit and know all the systems and is not currently satisfied that it does.

The Montreal case provides evidence of both provincial regulation with some evidence of provincial support. On one hand, the provincial government has been quite aggressive in setting a large number of binding standards. On the other hand, municipal officials also view their provincial counterparts quite favourably, stressing the cooperative nature of their relationship and the excellent communication that exists between the two levels of government. The City

informs the Ministries of Environment and Health if it has a problem. In turn, the provincial Ministries have not seen the need to undertake inspection programs. The province has contributed funds over time for water infrastructure and research.

This relationship is also evidenced by the Quebec government's decision to involve municipal organizations in its development of drinking water policy. In order to develop the Quebec Water Policy and new regulations, the government undertook extensive public and stakeholder consultations. The disconnect between science and policy was noted as a barrier for policy development as "depending on who you were consulting with you would already know their recommendation."[94] Environmental groups tended to want very stringent regulations while municipalities desired economically achievable ones.[95] The Quebec government consulted with partners in proposing the new regulations including the Federation Quebec des Municipalities, and the Union de Municipalities de Quebec. As well, officials met with researchers from Reseau d'Environnement every two months to make sure they were targeting the certification process at the correct individuals, in this case, drinking water operators. Quebec's legislation requires anyone involved in work related to drinking water, even if on watermains or in construction to be certified.

[94] Confidential interview.
[95] Confidential interviews.

5.3.3 Quebec – Role of Ministry of Health

The Ministry of the Environment included the health department on the committee that reviewed and discussed the regulations along with municipalities and other groups. The Ministry of Health is contacted when E coli is found, and a boil water advisory is required immediately. The health ministry operates locally as Montreal Public Health. The water system operators speak to Montreal Public Health regularly when they have a question or when there is a concern to report. There appears to be very good rapport between the public health officials and the local drinking water management. They speak positively of their relationship and contact one another regularly. It should be noted this is for wastewater as well as drinking water.

The municipality, Ministry of Environment and the Ministry of Health are involved in regular dialogue. Communication is central. Inspections are not part of the regulation or in practice but the regulations have lead to additional testing of contaminants, and the research funding has resulted in projects concerning Montreal's water quality. The city informs each of the Ministries when it has a problem. The Ministry of the Environment is informed first as it is the lead Ministry. The Ministry of Health, in this case Montreal Public Health, is informed if there is a violation or in cases of problems with the system where a boil water advisory may need to be issued. Presence of E coli always elicits a boil water advisory under the new regulations. The province issued binding regulations at a point of high public concern about the drinking water. The new regulation has as its goal training for all those working on the system with respect to the effects of contamination.

5.3.4 Relationship to the Federal-Provincial-Territorial Committee on Drinking Water Quality (Federal-Provincial Relationship)

As noted in the previous section, relationships between the municipality and the province tend to be cooperative. In fact, Quebec has actively participated in the Federal-Provincial-Territorial Committee on Drinking Water Quality since its inception in 1986. It has only missed one meeting of the committee in 1995.[96]

As the committee is based on consensus, it can be difficult to arrive at decisions. The need for guidelines and standards is recognized. In 1984, Quebec introduced binding standards going beyond the non-binding Canadian guidelines. More recently, in 2001,

[96] Confidential interview.

Quebec adopted standards more stringent than the Canadian guidelines for total trihalomethanes and for turbidity. The Federal-Provincial-Territorial Committee was considered to be useful by provincial officials for purposes of information sharing and allowing comparisons with other provinces. Unlike Toronto, local officials have no relationship with federal officials associated with the Committee. It is solely a provincial-federal relationship. However, in very recent years, local officials have had more contact with other drinking water managers across the country to discuss improvements to the system and concerns.[97]

With the exception of federal funds giving rise to Medical Health Officers in communities in the late 1800s, the federal government has had little direct involvement in Montreal's provision of safe drinking water. For the most part, the federal government's involvement occurs through its relationship with the province. Quebec takes part in the Federal-Provincial-Territorial Committee on drinking water, which is responsible for setting the Canadian Drinking Water Guidelines. Arguably more important, the federal government's mere interest in water (without any particular attention to *drinking* water per se) appears to have prompted the Quebec government to take stronger actions to protect its jurisdiction with respect to water. Finally, the federal government has provided occasional subsidies and collaborated with the province to improve the quality of the source.

5.3.5 Louisiana – Role of Department of Health and Hospitals

The Louisiana Department of Health and Hospitals (LDHH) is the oldest health department in the United States. There are 9 designated health regions in Louisiana. The state achieved primacy to implement the Safe Drinking Water Act in 1988. In addition to compliance and enforcement which it does in collaboration with EPA Region 6, the state has implemented a capacity development program, the Drinking Water State Revolving Fund program, and the unique Louisiana Compliance Initiative. The state's operator certification program existed prior to the 1974 Safe Drinking Water Act and has evolved into an award-winning program recognized as "excellent" by the EPA.

As the state has primacy, it is responsible for monitoring and ensuring that public water systems meet the regulations in the Louisiana Sanitary Code Part 12. It does this through a variety of activities and programs including sanitary surveys, inspections and

[97] Confidential interview. Of course, officials have always have collegial relationships with other local service providers and professional associations, for example.

visits. As the next section explains, it works with EPA to ensure compliance.

Louisiana also has a unique program to enhance levels of compliance called the Louisiana Compliance Initiative. The Louisiana Compliance Initiative is a program involving state officials visiting the different health regions every three months, bringing the water system questionnaire and commit to resolving problems to bring the system into compliance. As explained in the next section, the LDHH has a memorandum of agreement with the EPA stating that the EPA will send first notices of violation (NOV) to water systems in violation of the Louisiana Sanitary Code Part 12 for which the EPA has granted Louisiana primacy.

Another program that was initiated through the 1996 Amendments to the Safe Drinking Water Program is the capacity development program. This program focuses on the technical, managerial, or financial capacity of a public water system. The LDHH conducts management training throughout the State to meet drinking water regulations. The Region 6 EPA has a capacity development coordinator for the 5 states. This concept recognizes that "enforcement alone will not bring states into compliance."

The LDHH also implements the Drinking Water State Revolving Fund (DWSRF) program. This program provides funds for water system infrastructure improvement as well as "Set-Aside" funding for program implementation and on-site technical assistance activities.

LDHH's operator certification program predates the EPA's program by over 30 years. Each year about one-third of certificates are updated. In 2003, 55 exam sessions were held with 410 training courses approved and 1406 certifications. The program is comprehensive. Participants pay a small user fee which helps pay for the cost of the program.

The relationship between EPA and LDHH is viewed very positively at the state level. In addition to agreements with respect to NOV for compliance and referrals made by the state to EPA, other resources were noted. For example, with respect to the Consumer Confidence Reports each water system is required to send to each resident served by the system annually, EPA helped LDHH by creating a template for the reports so they could more easily be sent out to consumers. LDHH creates all the reports for each water system from its central office using a semi-automated system. This further demonstrates that EPA recognizes that compliance requires more than enforcement.

While the relationship between Region 6 and the state is positive, collaborative, and there is clearly mutual respect, the local level is not asked for input about rules but is expected to comply. State austerity measures have created unique challenges for the drinking water program. By an Act of the Louisiana legislature, the systems have to do their own collections, rather than have LDHH do the sampling as it has in the past. This has meant that LDHH has spent a lot of time training systems because they have never done their own collections for samples. These austerity measures also mean that LDHH fears the state may lose primacy. If it is not able to meet the regulations, EPA may step in and take over the program. A major challenge is sampling, especially when the rules change. As noted, "There is a disconnect between the rulemaking and the expectations. The rulemaking process is done by committees, there is complexity and understanding...but no one can seem to understand [most] operators have a high school education."[98]

Relationships with other state level programs are also relevant. For source water assessment program (SWAP) LDHH contracts with the Department of Environmental Quality, Louisiana was one of the first states to have its SWAP done on time. The LDHH has a positive relationship with the DEQ and they provide support, on occasion

5.3.6 Louisiana – Role of Environmental Protection Agency Region 6

The EPA granted primacy to the state of Louisiana for drinking water in 1988. Primacy is granted to states that demonstrate that their drinking water regulations are at least as stringent as the National Primary Drinking Water Regulations under 40 Code of Federal Regulations, Part 141. In order to achieve primacy, it is key that the state demonstrate it has implemented adequate procedures to enforce the regulations.

EPA Region 6 has oversight for Louisiana. EPA Region 6 includes the states of Arkansas, Oklahoma, New Mexico, Texas and Louisiana. Region 6 provides oversight to ensure that federal and state rules, regulations and standards are being met. The reason for EPA oversight is "in order to instill public confidence in the drinking water." The relationship between the EPA and the state includes technical assistance, primacy rule adoption, compliance enforcement, and communication. Each state provides a workplan that is reviewed by the EPA Program Manager. "The State's workplan is funded using both State and Federal funds for activities such as sanitary surveys, the source water protection program, capacity development, operator certification, homeland security,

[98] Confidential interview.

management of the Safe Drinking Water Information System (SDWIS), training of staff and water systems in rule implementation, and responding to citizens inquiries."[99]

With respect to enforcement actions to ensure compliance, it is the EPA's job to ensure timely and appropriate actions are taken. On a quarterly basis, the EPA Region 6 prepares a targeting list which identifies those PWS in non-compliance.

Data verification is also an aspect of compliance with respect to monitoring and possible violations. The EPA conducts data verification audits of the state every three years. EPA staff also ensure the databases are up-to-date and in proper working order by reviewing the state-level Safe Drinking Water Information System (SDWIS) databases. The Safe Drinking Water Information System (SDWIS) allows state information to be connected to national information at the EPA and imported into the system. Citizens can go online and find out the status of their water system.[100]

In terms of evaluating their success, the Region tracks the number of Notices of Violation (NOV), Administrative Orders (AOs) and Administrative Penalty Orders (APO). Officials suggest that issuance of these orders has "dramatically improved compliance rates." If a system is a habitual violator and ignores anything it receives then EPA will send an AO by certified mail. In addition to these, end-of-year evaluations and response to state referrals have proven to be "effective tools to elevate the compliance to a much higher level."[101]

EPA Region 6 and Louisiana Department of Health and Hospitals have a collaborative relationship that is demonstrated in two specific ways as regards compliance. First, and unusually, the EPA Region 6, through a Memorandum of Understanding, has agreed to issue Notices of Violations (NOV) to drinking water systems within Louisiana, while in most States this is a State activity. With the issuance of a Notice of Violation from EPA, the State feels that systems have a greater response to return to compliance and to work with the LDHH in returning to compliance. A letter from the "EPA carries more weight."[102]

Second, the state refers problematic water systems to the EPA for compliance and enforcement activities. This further demonstrates how incentives are changed by a federal

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[99] Confidential interview.
[100] This information can be about 6 months out of date as it takes time to upload and communicate among levels of government. EPA is working on optimizing the SDWIS (Safe Drinking Water Information System).
[101] Confidential interview.
[102] Confidential interview.

level of involvement. Not only do states have incentives to ensure PWS comply but if they are unable to make PWS comply, there is a second line of defense – they can call in the federal government.

Further evidence of cooperation is that once enforcement orders have been issued, the state and EPA region discuss why the water system has failed to meet the regulation obviously to avoid similar failures in the future. "Once an enforcement order is issued by the State or EPA Region 6, staff at EPA Region 6 works in cooperation with LDHH to explore reasons (such as lack of resources and manpower etc.) for the delays of the water system failing to meet drinking water regulation."

Variances are permitted by the Safe Drinking Water Act in order to provide time for states to achieve compliance with the regulations and Act. These are rarely used, and Louisiana has never asked for a variance. This may change with the new arsenic regulation as it is particularly difficult for Louisiana to meet especially under budget restrictions imposed by the state legislature.[103]

Clear, measurable goals with respect to drinking water safety are also part of the relationship between federal and state officials. Federal officials in Region 6 are working with the states to achieve Performance Activity Measures (PAMs). The idea is to have "clear and measurable environmental and public health goals." Goals for 2008 are provided in the table, below:

[103] Confidential interview.

Table 5.2: Performance Activity Measures (PAMs) for Region 6

Measure	Goal	LDHH FY 04
Water Safe to Drink: Percentage of the population served by community water systems that receive drinking water that meets all applicable health-based drinking water standards through effective treatment and source water.	FY05: 93.0% FY06: 94.0%	94.8 %
Percentage of the population served by community water systems that receive drinking water that meets health-based standards with which systems need to comply as of December 2001	FY05: 94.0%	96.8%
Percentage of the population served by community water systems that meets health-based standards with a compliance date of January 2002 or later.	FY05: 75%	98.0%
Percentage of community water systems that provide drinking water that meets health-based standards with which systems need to comply as of December 2001	FY05: 94%	95.9%
Percentage of community water systems that provide drinking water that meets all health-based standards with a compliance date of January 2002 or later	FY05: 75%	99.0%

Source: Environmental Protection Agency Region 6 Drinking Water Section – Water Quality Division

When new rules are promulgated, the EPA provides training to the states and then the states train the utilities. Adoption of new drinking water regulations (primacy) can be a particular challenge.

5.3.6.1 Communication between Federal and State levels

Meetings between Federal and State levels occur in three possible ways: (1) annual state/EPA meeting (2) end of year program reviews and (3) as-needed. The annual state/EPA meeting is a 2 day long productive endeavour in which all six states in the region share information and lessons learned. Conference calls are also held regularly. Issues discussed during conference calls include follow-up on enforcement actions, responses to citizen inquiries and "Conference calls are held on a regular basis related to rule adoption, responding to citizen inquiries, or to follow-up on enforcement actions."

With respect to inspections, EPA rarely conducts on-site investigations as these are the purview of the state and its primacy agreement between LDHH and EPA." In advanced cases of enforcement, the EPA may visit a non-compliant utility." Primacy is

granted as the state is judged to be capable of meeting its commitments under the regulations.

According to EPA officials, "The relationship between EPA Region 6 and the States is a strong partnership and one that continues to grow stronger each year. Historically, the PWS Enforcement Team under EPA Region 6 has been at the forefront and number one (1) nationally in terms of maintaining compliance assurance, and good working relationship between the EPA and the states."

5.4 Comparing Performance: Inputs, Outputs, and Outcomes

5.4.1 Inputs (Effort)

This chapter has compared legislation with respect to Quebec and Louisiana and explored relationships between levels of government. This section considers the efforts of the local government and the resultant impact of federal level authority with respect to timing of improvements for public health. In contrast to the previous chapters, comparing timing and timeliness with respect to Montreal and New Orleans provides more information about local capacity than it does about federal-level authority as, for the most part, in these two cases chlorination and filtration occurred as a way of responding to drinking water morbidity and mortality. With fewer pressures on their source waters in Vancouver and Seattle, technological improvements for public health took place more slowly (see Hill, forthcoming; Hill and Harrison, forthcoming).

Table 5.3: Comparing Timing of Drinking Water Protection Improvements in Montreal and New Orleans

	Montreal	**New Orleans**
Source Water Protection	Primary sewage treatment since 1984	Secondary sewage treatment required since 1972 but implemented by 1984 Source Water Assessment required since 1996
Disinfection	Chlorination - 1910	Chlorination -1916
Enhanced Disinfection	Ozonation 1979 (along with chlorination)	Enhanced chlorination – 1921 (chloramination)
Filtration	Filtration since 1918 – delayed due to the war	Filtration begins when system is built - 1908

In Montreal and New Orleans while chlorination and filtration occurred at different times and offered different protections, the general level of protection prior to World War Two was probably quite similar. It should be noted that chlorination in New Orleans was introduced as a result of federal regulations to meet United States Public Health Service regulations in 1916.

Recent amendments to the Safe Drinking Water Act have drawn attention to the importance of source water protection for public health effectiveness and cost-efficiency. The cleaner the water is, the less costly it is to make it potable. Therein lies the major difference with respect to timing. Quebec currently has no legislation or regulations addressing source water, specifically. Provincial level regulations currently address sewage treatment but Montreal continues to be one of the worst polluters of its own watershed.

Prior to Hurricane Katrina, two major source protection initiatives had been implemented in New Orleans. The LDHH implemented the Lower Mississippi River Water Works Warning Network so that downstream water plants such as those serving New Orleans could be informed of sightings of spills in the source water. The Early Warning Organic Compound Detection System with instrumentation at 8 locations was also developed. This detection and monitoring network was created to protect New Orleans source water by deterring illegal discharges of pollutants, identifying the sources of unreported spills and providing warning to downstream facilities (SWBNO). However, with the devastation from Hurricane Katrina, the source water may be too polluted to continue to use. The EPA is currently conducting tests.

While it is the case that the legislation with respect to source protection differs significantly in the two cases, environmental efforts such as wastewater treatment have had a positive impact on the source waters and as the next section demonstrates, the quality of the source waters has improved over time in both locations. Nevertheless, as the data below suggest, the Mississippi River source appears to be of higher quality.

5.4.2 Turbidity and Presence of Coliforms in the Water of the Rivers

The presence of fecal coliforms at the water intakes remains higher for the Mississippi River water in New Orleans than the St. Lawrence River water in Montreal. Owing to the placement of the primary water intake, the source water quality with respect to coliforms in Montreal is quite good. While coliform levels in the St. Lawrence around Montreal have ranged as high as 28,011 UFC/100mL in 1977 remaining as high as 15,228 UFC/100mL in 1998, presence of coliforms at the intake number between 33 UFC/100mL to 100 UFC/100mL (Deschamps et al 2001). Coliforms at the New Orleans water intake on the Mississippi River were between 60 UFC/100mL to 600 UFC/100 mL in 1987 and between 0 UFC/100mL and 850 UFC/100mL in 1998.[104] While the source water at the intakes for both cities is relatively good compared with the general quality of the river waters, there is still presence of bacteriological contaminants and without chlorination or filtration, waterborne disease is likely to be present. While both cities treat their water with advanced disinfection and filtration systems, the requirements for New Orleans are more stringent. Quebec water systems will have to meet advanced filtration requirements by 2008.

As Table 5.4 below suggests, low turbidity at the water intake is another positive aspect of the location of Montreal's water intake.

[104] This data is from Sewerage and Water Board of New Orleans water quality reports that include figures for both raw and treated water on an annual basis.

Table 5.4: St. Lawrence and Mississippi Rivers Turbidity of Source Water Measured in Nephalometric Turbidity Units (NTU) -1991 and 1998

	Minimum 1991	**Maximum 1991**	**Minimum 1996**	**Maximum 1996**
St. Lawrence River Turbidity	5 NTU*	5 NTU*	5NTU*	5NTU*
Missippi River Turbidity	3 NTU	342 NTU	15NTU	262NTU

* Maximum and Minimum are not provided for the intake. The river water in the St. Lawrence around Montreal can range as high as 12.9 NTUs but this is at the Intercepteur. See Deschamps et al, 2001.

In contrast to the St. Lawrence River the Mississippi has higher turbidity and this is evidenced in its well-deserved moniker 'the muddy Mississippi." Turbidity at the source has generally been reduced over time. Nevertheless, any presence of coliforms or turbidity is cause for concern indicating the water may be contaminated. Therefore, water treatment is necessary and a vital aspect of the multi-barrier approach for drinking water protection. This section suggests Montreal's source water may be of higher quality yet the regulations for needed water treatment are currently lower than those in New Orleans. As the next section further demonstrates, implementation of water improvements has occurred earlier and to a greater degree in New Orleans than in Montreal where concerns about water quality persist.

5.4.3 Outcomes (Incidence of Disease)

While comparable water quality data available for both cities is limited to the source water as discussed in the previous section, both cities have met requirements for drinking water in recent years and suggest their city's water is of 'high quality.'

An examination of boil water advisories which are required to be made widely public including publication in the local newspapers suggests that the water quality and infrastructure challenges of Montreal's water system are significant. Drinking water management did note a specific problem with one of the plants located at St. Anne. Efforts were being made to address the problems and reconsider the role of that plant in the water system's future.

Boil water advisories can suggest incidence of disease either due to finding actual bacteria or viruses present in the water or through other structural problems such as watermain breaks which can contribute to contamination as pressure pushes bacteria and

other microbiological contaminants into the pipes, as well as increases the turbidity within the pipes.

5.4.3.1 Boil water advisories

In Quebec, post-Walkerton, the Quebec Ministry of the Environment issued boil water advisories for 90 water systems across the province giving local officials a timeline of 20 days to come up with plans to meet the regulations. One of these 90 systems was on the island of Montreal. The Environment Minister Paul Begin explained, "This exercise is taking place because of increased vigilance due to the events we saw. If we didn't draw lessons from situations like Walkerton, we would and should be blamed" (Montreal Gazette August 19, 2000).

Montreal's water system faced a total of 10 boil water advisories from 2000 through 2005. In 2001, in response to Walkerton, the Quebec government required automatic boil water orders if any contamination from E coli was found in first samples. Some of the boil water advisories were issued due to water main breaks. The concern is that an open pipe will allow contamination to enter the system. At least one-third of the advisories were issued because some kind of contamination or indicator of contamination was found.

Table 5.5: Boil Water Advisories for Ville de Montreal 2000 - 2005[105]

Date	Location, Particulars
August 19, 2000	Senneville – water from plant at St. Anne believed to be contaminated as system not working as expected
August 28, 2000	Notre Dame de Grace
July 18, 2002	E. coli is found in Aqueduct from St. Lawrence River – 13 000 people affected
August 21, 2002	Westmount – watermain break
August 22, 2002	Very large watermain breaks at Pie IX, 10 million gallons of water is flowing out of the system, close to 50 000 residents are affected and do not have water for over 1 week though it was expected to take even longer to repair the break
September 2, 2002	Montreal North
September 23, 2002	St. Anne des Plaines – E coli contamination
October 9, 2002	Montreal North
January 30, 2003	Ville St. Pierre (Lachine) watermain break – repairs caused contamination
July 14, 2003	Kirkland Borough

[105] Boil water advisories are widely communicated. These advisories were published in local newspapers including La Presse and the Montreal Gazette. In addition, advisories were identified during confidential interviews.

In contrast to Montreal, there were no boil water advisories issued over the same period for the water supplied by the Sewerage and Water Board of New Orleans. There were two boil water advisories in the Greater New Orleans area but these were both provided by other water systems. One of these was the result of a broken pipe caused by Tropical Storm Matthew. The other involved a response to the presence of bacterial contamination. It should be noted that on June 6, 2005, there was a power outage in New Orleans that brought down the triple redundant power including internal electrical generation, onsite steam turbine pipes, and external power from Entergy. After consultation between the state LDHH Chief Engineer and the New Orleans Sewerage and Water Board it was mutually decided that a boil water advisory was not required for the short duration of the incident.[106]

New Orleans public water system is required to follow more stringent regulations and it has had less boil water advisories in recent years. The presence of contamination in the tap water or even possible presence due to problems in the distribution system poses a threat to public health. A comparison of the number of boil water advisories over a recent five year period suggests that the drinking water in New Orleans is less of a risk to human health than that of Montreal.

5.5 Conclusion

A comparison of Montreal and New Orleans might lead one to reasonably expect based on the size of Montreal, its tax base, and economic capacity that drinking water policy outcomes would favour it over New Orleans. However, the stringency of federal regulations coupled with considerable cooperation between the federal and state levels provides results to the contrary. Also, federal regulations lead to increases in water rates in the 1970s in New Orleans whereas Montreal only significantly raised rates 30 years later. While Montreal may have had a greater tax base, it was not tapping it for water system improvements. The EPA raised the bar in terms of regulations which lead to improvements to the systems and caused municipalities to pass some of their costs onto citizens through increased water rates. While regulations have pushed costs onto citizens they are still paying a mere fraction of the costs of ensuring their water is safe to drink.

[106] Communication with District Engineer, Metro Region 1.

Besides changing the incentives with respect to taxation, federal level authority has several other benefits. With respect to the primacy model in use for the SDWA, there are essentially two regulators. In this case, the state of Louisiana is primarily responsible. When the debates about the SDWA were occurring in the early 1970s, one Republican from New York complained, "There will be an EPA regulator every time you turn on your tap." In fact, LDHH might be there, but the EPA comes in only when invited or needed. LDHH can call in the federal level when necessary and has a standing agreement with the federal level EPA that they will issue all notices of violation because experience suggests the presence of EPA letterhead increases compliance.

The federal level can also disseminate leading state efforts, in this case through an annual regional meeting and via communications with regional EPA personnel. Louisiana's operator certification program was noted by EPA respondents as one of these leading state efforts, and is mentioned in publications.

Furthermore, Quebec's response to the Federal-Provincial-Territorial Committee suggests that federal involvement offers opportunities to compare performance and share information. The Louisiana Compliance Initiative is a further example of multi-level governance that is state-driven that the EPA has been invited to participate in.

Drinking water is clearly an area of public policy where collaboration and cooperation among levels of government appear to be valued. This is evident in Quebec's participation in the Federal-Provincial-Territorial Committee and it is also evident in the relationship between the EPA Region 6 and the LDHH. Not only does the state appear to value opportunities the federal level provides for information sharing and resources, it refers problematic public water systems to the federal level for compliance.

Monitoring is necessary to ensure drinking water is safe. Accountability can be difficult. Two levels of government allow the blame for regulating to be shared between the two levels, and allow for information sharing of leading state efforts. The federal level is willing to impose costs at the local level to ensure safe drinking water.

Moreover, the federal level changes the incentives at the state and local levels. States have incentives to monitor and regulate ensuring the municipalities are meeting the regulations. Local governments have to follow the rules because compliance actions will occur if they do not. Moreover, they act to pass costs onto consumers because the cost of complying leads them to increase water rates even though this is a politically unpopular move. These two cases also suggest some municipalities may move to privatize the system

in order to save costs. However, public opinion is strongly against water system privatization. To avoid blame the city of New Orleans backed down from its decision to privatize. Moreover citizens passed measures limiting the power of the Board to contract with private companies.

In terms of water quality, both cities have endured many challenges especially with respect to their source waters, the St. Lawrence and the Mississippi Rivers. New Orleans drinking water is subject to higher standards and more consistently meets those standards than Montreal, at least as evidenced by boil water advisories.

VI. COMPARING DRINKING WATER PROTECTION IN TORONTO, ONTARIO AND DETROIT, MICHIGAN

Previous chapters support the hypothesis that federal regulatory involvement leads to better public health outcomes both within and across the paired cases. By contrast, this chapter provides primarily within-case evidence. The performances over time of Toronto and Detroit are similar with more recent results suggesting marginally better performance in Toronto. It should be noted that in recent years Detroit's system has consistently met federal requirements, some of which are more stringent than the Ontario Safe Drinking Water Act and regulations. Toronto's performance, too, is more about local resolve than provincial regulation. Thus, the reader may want to assume that this chapter is more about local capacity than about intergovernmental regulation. However, state and federal involvement have made a difference in Detroit if not to the extent that its water quality has surpassed that of Toronto. Even in Toronto, the impact of Walkerton and the need on the part of the province to regulate has had impacts in more recent years at the local level on the now world-class utility. Arguably, prior to Walkerton, symbolic regulation was the norm within Ontario, at least with respect to drinking water protection for the city of Toronto.

Toronto, Ontario and Detroit, Michigan are municipalities of close to 5 million people located in the centre of the North American continent. Their water sources are the Great Lakes Basin. Toronto's drinking water comes from Lake Ontario, and Detroit's drinking water comes from Lake Huron and the Detroit River. Both cities are the largest in their respective subnational units and both are or have been among the greatest polluters of their own water sources as a result of their need to discharge municipal wastewater. Other industries contribute to pollution of the drinking water sources in these two metropolitan areas including most notably refineries, chemical plants and auto manufacturers, though this is not an exhaustive list.

6.1 Toronto, Ontario, Canada

Today, the water system that serves the Greater Toronto area consists of 4 filtration plants, 18 pumping stations, 10 major ground level storage reservoirs, 4 elevated storage tanks, 510 km of trunk watermains, and 5015 km of distribution mains. This infrastructure varies significantly from the early days of one water intake in Lake Ontario. The early

years of Toronto's water system were marked by outsider influences and recommendations of the need for outside accountability. A Montreal proprietor, Albert Furniss, built the water system with Lake Ontario as the source. In 1873, the city purchased the system from Furniss' estate (Jones and McCalla 1979: 320). Other sources including reservoirs and lakes above Toronto were considered as potential sources, but, at the time, Lake Ontario was deemed the purest and most easily accessible.

The early years were also problematic ones as weeds grew over the water intake leading to increased turbidity. Moreover, citizens consumed considerable amounts of water by leaving the taps running in order to ensure their pipes did not freeze in the winter, and to overcome the heat in the summer. An extension to the water system intake was needed. In 1881, engineers in the Department of Marine and Fisheries Canada approved the location of the extension (Brough 1882:6). This appears to be the earliest federal involvement in Toronto's water system which began as largely a local solution to the local requirement of drinking water and fire-fighting capabilities.

The federal role also had impacts at the local level in those early years. Federal funding of Medical Health Officers resulted in Toronto's Dr. Canniff conducting his first sanitary survey in 1883 in which he mentioned water and sewer drainage (Bordessa and Cameron 1980:128). In 1884, the province established the authority of the Medical Health Officer under the local board of health in its "Act to make further provision respecting Public Health," improving upon its 1882 effort "Act to Establish a Provincial Board of Health" (Ibid.)

In addition to some major challenges, the early years of Toronto's water system were marked by criticisms of local management and calls for external accountability. The first scandal emerged by 1886 when an inquiry found that the chief engineer was guilty of misconduct, and that there was "no doubt" the waterworks were defective. The commission contended, "...this inquiry has demonstrated beyond question that a Committee of the Council however conscientious and well-meaning is utterly unfit to control the affairs of so important a Department as this has grown to be" (McDougall et al 1887:19). In response to the scandal, the city created the Board of Commissioners to oversee the waterworks.

In addition, public health oversight was provided, for example, by the Provincial Board of Control who recommended filtration in 1908. Public health data from Albany, New York showed significant decreases in typhoid after filtration. When the city

introduced chlorination in 1910, typhoid deaths were reduced by half. Additional public health protection was afforded when Toronto's first filtration plant was completed within a year. In 1909, the city began dumping sewage in the Lake prompting Charles J. Hastings, the Medical Health Officer, to issue a letter of understanding that filtration and chlorination were required. Chlorination was instituted in 1910 and filtration one year later. During the early years, the role of the Medical Health Officer appears to have lead to improvements in the system.

By 1912, the Province amended the Provincial Health Act to include Section 89, which stated that operators of water systems needed to submit plans, specifications, and reports about the water supply and works to be undertaken.

A year later, the Provincial Board of Health emphasized that before the water supply could be allowed to be used by the public, the sewage "shall be efficiently disinfected to the satisfaction of the Board"(Harris 1913). The local Board of Commissioners (1912) had already recommended the sewage be treated as, in their estimation, it was "abhorrent to all ideas of hygiene." These concerns might be seen as echoes of an early City of Toronto bylaw (1834) that stated it was unlawful "for any person to throw or deposit, or cause to be thrown or deposited, any Dung, Manure or filth of any description whatsoever, in front of the City upon the road, beach, or in the water in the harbour under a penalty of five shillings for each offense" (Bordessa & Cameron 1980:124). Despite the provincial requirements, and municipal bylaw, no further action was taken for decades to address the threat to drinking water posed by municipal sewage other than simple primary treatment beginning in 1910. The quality of Toronto's drinking water deteriorated over time with sewage as a particular concern (Ibid.).

In 1929, a second filtration plant was built at Victoria Park, the RC Harris. But it was not until 1951 that the first central sewage treatment plant opened, almost 40 years after Medical Health Officer Charles J. Hastings and the Provincial Board had expressed concerns about dumping sewage in the source water.

The Ontario Ministry of Health was responsible for overseeing Toronto's water system until the Ontario Water Resources Commission (OWRC) was created in the 1950s. The Ontario Water Resources Commission was charged with the following functions: (1) to exercise supervision over all water supplies, waterworks, sewage works, industrial wastes and all related matters, as well as, (2) construction and operation, under agreements with municipalities, water and sewage works (Berry 1960). The Municipality of Metropolitan

Toronto was formed in 1953, and by 1954, it assumed responsibility for the water supply with the water, sewage and recreational departments integrated. As the Department of Works later (1977) explained, "One of the main reasons for forming the Corporation of Metropolitan Toronto was to solve the environmental problems of the municipalities in the Metro region by a unified approach." The city organized the Metro Toronto Regional Conservation Authority (MTRCA) which determined that upstream plants were undesirable (Bordessa and Cameron 1980). Concerns about water quality led the Ontario government to develop the non-binding Ontario Drinking Water Objectives by 1964 prior to the first Canadian Drinking Water Guidelines which were issued four years later (Walkerton Commission of Inquiry 2002).

In 1972, the provincial Ministry of the Environment assumed responsibility for drinking water. From its inception in the mid 1950s through to the 1970s, the OWRC had made funds available to improve water systems. Significant public expenditures occurred between the 1950s and 1980s including two more filtration plants, the R.L. Clark in 1968 and the F.J. Horgan in the 1970s.

While the municipality and, to a lesser degree, the province funded Toronto's water infrastructure, the federal government also provided funds for water infrastructure via cost-sharing programs. In 1984, however, federal funding for direct assistance for municipal infrastructure was terminated (Infrastructure Canada 2004). At around the same time, provinces began downloading costs onto municipalities.

Even though significant expenditures were made in the late sixties and early seventies by the nineteen eighties studies suggested Toronto's drinking water may be at risk. Pollution Probe released two studies in 1981, "Toxics on Tap" and "Make it Safe", suggesting that pollutants found in Toronto's drinking water might be a health hazard. Those reports identified 16 chemicals in the drinking water. In response to the report, the City Board of Health ordered a study but no other action was taken (Keating 1984a).

In 1984, Toronto's Board of Health released their report suggesting that water in the Metro Toronto area was slightly more contaminated with chemical pollution than 11 other Ontario municipalities though it believed the water to be comparable with many US states. It found 83 chemicals present in Toronto's drinking water, significantly more than had been identified by the Pollution Probe study that had provided the impetus for the research. The report noted further that monitoring of Lake Ontario water had shown the presence of some 800 chemicals including from the effluent of Toronto's own sewage

system. The Board of Health called for revision of the Canadian drinking water guidelines, better testing in Toronto at the source and the tap, tighter control of water pollution for Lake Ontario, and a national survey of drinking water quality (Globe and Mail April 27, 1984).

Interestingly, the Ontario Minister of the Environment Andrew Brandt responded to the report by stating that drinking water was "at worst at the suspect stage." Moreover, he explained that, "more evidence of a health risk is needed before tens of millions of dollars are committed to new water filtration systems" (Keating 1984a). Granular activated carbon was being tested in Niagara Falls but the ministry was unwilling to commit to encouraging its widespread adoption noting the significant expense.

Later that same year, the National Water Inquiry was initiated by the federal government and chaired by Peter Pearse, a resource economist from the University of British Columbia, along with Francoise Bertrand, the administrative dean of the University of Quebec in Montreal, and James MacLaren, a Toronto consulting engineer. The inquiry focused on addressing concerns about the need to protect the Great Lakes from pollution. In doing so, it also raised questions about drinking water and federal responsibility. James Kingham, Head of Environment Canada's Ontario region, urged "consideration of a Safe Drinking Water Act for Canada to replace guidelines for drinking water, which are unenforceable" (Keating 1984b). Dr. A. S. Macpherson of Toronto's health department who was associated with the 1984 study into Toronto's drinking water told the inquiry that Canada needed a national survey of drinking water quality. When asked by Peter Pearse "if Ottawa should impose national drinking water standards, Dr. Macpherson said that almost all provinces lacked the expertise to develop their own," and that they should "pool [their] resources" (Keating 1984b).

In 1986, the Federal-Provincial-Territorial Committee on Drinking Water Quality which had previously been disbanded was formalized to meet twice annually to revise the Canadian Drinking Water Guidelines. Much like the Drinking Water Surveillance Program the Ontario Ministry of the Environment initiated that same year the Guidelines remained non-binding and voluntary. Toronto immediately signed on to the Ontario Ministry's still-existent program whose purpose includes tracking of trends and collection of data to facilitate development of new standards. It is not a compliance monitoring program but involves municipal government reporting with the intention that information

be made publicly available on the Ministry's website. By 1999, only 24.7 percent of municipalities had signed on.

In 1990, Toronto's public health officer Dr. Perry Kendall along with the board issued a report on the city's drinking water giving it a mostly good bill of health. He warned residents about possible lead contamination in the drinking water and recommended they run their tap water for five minutes before drinking it (Coutts 1990). A year later he noted that five minutes was wasteful of the water and that 30 to 60 seconds was sufficient to reduce the lead to safe levels (Toronto Sun 1991). The 1990 report also explained that one in five Torontonians surveyed was drinking bottled water over using tap water. The chair of the board, Jack Layton, included several recommendations in the report. Among these were a program to educate consumers about lead and the tap water, an end to the release of toxic substances into Lake Ontario and the whole Great Lakes ecosystem and that there be cooperation between the International Joint Commission and the provincial and federal authorities to eliminate toxins in the water. Moreover, the report echoed testimony several years earlier of Toronto Public Health to the National Water Inquiry, that a national Safe Drinking Water Act be passed that would set standards for all sources of drinking water including bottled water and would include monitoring and public information about water quality.

In 1994, the province revised the Ontario Drinking Water Objectives. That same year, Ontario's Auditor General noted that 120 of 490 water treatment plants suffered 'significant compliance problems' including not meeting guidelines and not performing required testing (William Walker November 16). None of these plants was said to be located in Metro Toronto though neither the Environment Minister nor the Auditor General was willing to provide the names of any of the locations (Ibid.).

By 1997, the province had embarked on a process of transferring ownership of small municipal water systems back to their municipalities. While this had no direct effect on Toronto's water system, it was indicative of a larger trend of downsizing that occurred within the Ministry of the Environment. The Red Tape Commission aimed to eliminate waste and costs. One of the primary ministries the Commission focused on was the Ministry of the Environment, which was the subject of 36 out of the Commission's 131 recommended changes, the greatest of any Ministry (Walkerton Commission of Inquiry 2002).

In 2000, the town of Walkerton announced that its water system had been contaminated with E coli resulting in the hospitalizations of thousands and the deaths of at least 7 people. Soon after the Walkerton tragedy, the Ministry issued the Drinking Water Regulation (2000) which included procedures for notification of the local medical health officer and the Ministry of Environment by telephone if E coli were found. The government also initiated a large-scale inquiry led by Justice Dennis O'Connor.

Following the Walkerton inquiry, both the Conservative government and opposition Liberal party agreed to implement all the commissioner's recommendations. New legislation included the Safe Drinking Water Act, Ontario Drinking Water Quality Standards[107] and Drinking Water Systems Regulation pursuant to the Act. The major differences between the new legislation and the legislation that existed prior to Walkerton are the existence of *binding* standards, enhanced operator certification, requirements for laboratory certification, source water protection, and public notification if drinking water is unsafe. The government also passed the Sustainable Water and Sewage System Act in 2002 requiring municipalities to report on the costs of their water system and their plans for cost-recovery. This was a response to the issue of water rates raised during the Inquiry. The province of Ontario through the Ministry of Public Infrastructure Renewal has also announced the convening of an expert panel on water infrastructure appointed in August 2004. In July 2005, the expert panel consisting of Harry Swain, Fred Lazar and Jim Pine issued their report. It found that maintenance of Ontario's water and wastewater systems will cost between $30 and $40 billion over the next 15 years. The Swain report also recommended that financial sustainability should come from users, that water governance should be improved, regulation should be results-based and that the Ontario Clean Water Agency be given a new mandate including 'a true arms-length relationship with the province and a 'business-oriented board' (Swain et al 2005:5).

In December of 2005 the provincial Liberal government also introduced a source water protection bill as part of its commitment to implement all of the recommendations from the Walkerton Inquiry. The purpose of the bill was "to require that drinking water source protection plans be developed and implemented locally for every watershed in the province."[108] The proposed legislation was introduced as Bill 43, the Clean Water Act. The

[107] The non-binding Ontario Drinking Water Objectives became the binding Ontario Drinking Water Standards from August 2000 through June 2003 at which time they were re-named in their current form as the Ontario Drinking Water Quality Standards.

[108] The purpose was explained in the Environmental Bill of Rights Registry Call for Comments (Registry Number

legislation establishes source protection areas province-wide and requires that source protection plans be developed. Where conservation authorities exist they will take the lead in developing source protection plans. The process of developing the legislation has involved a multi-stakeholder approach which is expected to continue once the legislation is enacted.

Ontario's approach is unique as it includes provisions for paramountcy. It also includes significant resources for implementation. Resources increase the likelihood that capacity will be built and source water protection will be sustained. The paramountcy provisions privilege water protection over other uses or other regulations. Part 5 of the proposed Clean Water Act includes a general conflict provision whereby in case of a conflict between the Clean Water Act, 2005 and a provision of another Act or a regulation made under another Act, the provision that provides the greatest protection to a drinking water source prevails.[109] Moreover, decisions under the Planning Act and the Condominium Act must conform to source protection plans. Also, the Minister's discretion to privilege conservation over development is contained within the legislation. The proposed legislation includes a significant financial commitment on the part of the Ontario government with $51 million over five years for technical studies and $16.5 million for staffing and resources for conservation authorities.[110]

Prior to retrenchment, the Ministry of Environment used a cooperative approach to ensuring local compliance with provincial standards. If there were problems with the water system, abatement officers aided the municipality and discussed options for meeting the objectives. However, the Walkerton tragedy had a profound impact on the ministry, including psychologically. Staff became all too keenly aware that people really could die from drinking contaminated water. Recently, the Ministry has hired about 100 inspectors from a range of backgrounds including water systems to law enforcement. Each municipal system must have at least an annual inspection. There is a significant amount of paperwork to fill out prior to a visit by one of the inspectors. This increases the costs of municipalities in delivering the service. Toronto had consistently met the Canadian Drinking Water Guidelines and Ontario Objectives in recent years ever since it participated voluntarily in the Drinking Water Surveillance Program. However, with the stringency of the new

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AA04E0002) on the proposed Act dated June 23, 2004. See http://www.ene.gov.on.ca/envregistry/023184ea.htm.

[109] Proposed Clean Water Act EBR Registry Number AA05E0001.

[110] Ontario Ministry of Environment. 2005. *Backgrounder - The Proposed Clean Water Act.* December 5, 2005. Accessed at http://www.ene.gov.on.ca/envision/news/2005/120501mb.htm

regulations, it had to seek relief as it would not have been able to comply with some chlorine residual requirements and with issues related to lab accreditation.

It appears this situation has strained the relationship between the Ministry and the city. The goals of both the Ministry and the city are to provide high quality drinking water to the public. In the past, this has been done using a cooperative approach while the current atmosphere is somewhat conflictual.[111] While it is laudable that the Ministry is now enforcing the new regulations, there is a need for more supporting documentation explaining the reason for the existence of specific regulations and for regular review of the regulations (Rudnickas 2004:12). It is noteworthy that, in recent years, the City of Toronto complied with provincial standards even when the Ministry was largely absent.

6.2 Detroit, Michigan, USA

While Toronto has confronted problems with contaminants in its tap water, soon after the passage of the Safe Drinking Water Act, in 1975, the EPA provided a report to Congress regarding carcinogens in the drinking water of 80 cities including Seattle, Detroit, and, to a lesser extent, New Orleans. In its report, the EPA noted that the Federal Water Pollution Control Act (that became the Clean Water Act) had helped "in gradually improving" some drinking water sources but that it was "inadequate," citing a need for further monitoring and surveillance (2). In this chapter, the city of Detroit is illustrative with respect to the impact of both of these EPA water policies.

The Detroit Water and Sewerage Board (DWSD) provides drinking water to 4.2 million residents of the city of Detroit and surrounding suburbs. Today the water system draws fresh water from the Great Lakes system with Lake Huron to the north and the Detroit River to the south. DWSD's water system consists of 3,802 miles of transmission and distribution mains, and five water treatment plants. These plants pump an average of 659 million gallons of clean drinking water each day (DWSD).

When Toronto was developing plans for its water system in the late 19th century it looked to Detroit as an example of a city with adequate infrastructure and the expertise to provide safe drinking water in addition to consulting Harvard engineers and examining other American cities such as Albany, New York. The city of Detroit is considerably older

[111] Bertels and Vrendenburg (2004: 43) note a similar finding in their work. They state that the Ontario government's "move towards compliance and authority-based regulator-operator relationships" was viewed as a "step in the wrong direction" by Toronto officials.

than the city of Toronto. Detroit was founded in 1701 by the French.[112] The British gained control in 1760, and in 1796, Detroit became part of the United States.

It was not until a full century after being founded that Detroit saw the need to develop a water system. Water was readily available from the Detroit River flowing out of Lake Huron. Just like the cities discussed in the previous chapters, it was threat of fire that gave rise to the need for a water system. The Great Fire of June 11, 1805 is pointed to as the impetus for building the water system (DWSD 2001). Wells were created but soil conditions and weather often left the water quality poor (Ibid.). A decade after the British occupied the city during the War of 1812, a town hall meeting to discuss building the water and sewer system.

In 1824, the Michigan government passed a law authorizing the creation of the water system. In 1871, the state regionalized the city's water department so that it began providing water to surrounding districts. Water Works Park was finally built in 1879.

In the early twentieth century, infrastructure improvements were made to Detroit's water system that would considerably improve the quality of its drinking water. In 1912 the in order to move its sewage downstream to prevent it from entering the water intake the city built the Detroit River Interceptor. A year later disinfection of the water supply involved the use of chlorine with stronger forms of chlorine introduced within three years. After the introduction of liquid chlorine, typhoid deaths significantly decreased to 10 per 100,000 from 25 per 100,000.

The roaring twenties brought expansion to both the system and its treatment capabilities. The world's largest filtration plant came online in Detroit in 1923. A year later a water treatment plant, the Springwells, was added to serve the rapidly expanding city.

More than a decade later, in 1939 and with New Deal money, the world's largest secondary treatment plant was built at a cost of $27 million of which $7 million was federal funds. Primary wastewater treatment first occurred in February 1940.

The 1950s brought about significant changes for Detroit's water system. During that decade, the Director of the Detroit Water and Sewerage Board, Gerald J. Remus, expanded the Metro Detroit system to serve all the surrounding communities. At this time, Detroit's water system operated at a surplus. By the end of Director Remus' tenure, 77 suburban communities had been added to the water treatment service with 125 suburban

[112] It was originally called Fort Pontchartrain after Count Louis Pontchartrain, French Colonial Minister of the Marine but was changed to Fort du Detroit in 1751.

communities using DWSD for their wastewater treatment. An additional treatment plant was also added to the DWSD system in 1964 when Wayne County joined. In 1974, the Lake Huron Treatment Plant was built to serve the growing suburban customer population.[113]

Federal involvement in water resources management both with respect to the Federal Pollution Control Act (now the Clean Water Act) and the Safe Drinking Water Act affected Detroit in several ways. One of the impacts of the Safe Drinking Water Act (SDWA), specifically the requirement to test and monitor for the Federal Primary Drinking Water Regulations resulted in increased costs to local governments. For Detroit, these costs were passed onto its customers. As costs for monitoring and compliance were downloaded to the local level, it was common for municipalities to raise rates in an effort to pay for required improvements. Between 1972 and 1982, water rates in Detroit increased an average of 155 percent (Detroit Free Press Sept 23, 1982). Since that time, and perhaps because it was coupled with the expansion of the system and the addition of new suburbs, for over 30 years, Detroit's suburbs have been at war with the Detroit Water and Sewerage Department because of water rates. Following the passage of the SDWA in 1974, Detroit raised its water rates and was cited as having the highest increase in the nation at 39 percent per year (New York Times, March 17, 1976). In response to the rate increases, the suburbs including 25 Oakland communities launched a class action lawsuit against the DWSD in 1976. Oakland circuit court found in favour of the city. The suburban communities appealed to the Michigan Court of Appeal but also lost their case at the state level.

While the focus of this work is on the Safe Drinking Water Act, for Detroit the involvement of the Environmental Protection Agency with respect to the Clean Water Act (formerly the Federal Water Pollution Control Act) impacted Detroit's municipal water system. In 1977, a court order initiated by the EPA said that Detroit must meet federal water pollution codes. A federal judge was appointed to investigate the situation and to make recommendations. As a result of his findings and since that time that judge, Judge John Feikens, has had oversight of Detroit's Water and Sewerage Department. While this is a unique situation the federal involvement in Detroit's water system cannot be disputed. It is therefore much more difficult to determine the impact of federal involvement as it is consistent rather than eventful. Regardless of the direct impact of Judge Feikens on water

[113] The construction of this addition involved a tunnel explosion that caused the deaths of 21 municipal workers. The DWSD has recently built a memorial to these workers.

quality in Detroit the SDWA gave rise to water rate increases to pay for testing and monitoring of drinking water.

In order to investigate the situation in Detroit, Judge John Feikens appointed a panel of experts including Jonathan Bulkley, Professor of Engineering (degrees in engineering and political science from MIT), David Ragone, Dean of the College of Engineering and Edward Cooper, a law professor, all from the University of Michigan at Ann Arbor, to review the sewer system's performance and rate structure. The existence of revenues in 1977-78 had caused some residents, particularly in the suburbs, to state that rates were being unfairly set. In February 1977, the Director of the Detroit Water and Sewerage Department Charles R. Scales was fined for problems at the sewage plant. On November 21, 1978 the city of Detroit Water and Sewerage department was back in court as it had violated the terms of the prior settlement. The lawsuits have been brought by state and federal environmental agencies. The panel reported in 1979 that there was no evidence of rate gouging but there were significant system performance problems. Specifically, Professor Bulkley reported that the department had hired untrained and possibly untrainable "rejects" from other city departments (Detroit News January 6, 1979).

Bulkley's findings lead newspaper reports to discuss the problems associated with residency requirements, in particular, that qualified people did not want to live in the city of Detroit. Residency requirements are designed so that people who do not live within a city cannot get employment in that city. Residence in the suburbs is not considered to meet residency requirements. One must live within the city centre. In recent years in some other American cities, most notably New Orleans, residency requirements for positions such as police forces have resulted in a shortage of qualified applicants. The issues of residency requirements and qualified operators water and wastewater systems are not limited to Detroit. Even though regulations exist, operator certification remains a challenge in many North American towns and cities and within some native communities.[114] In response to the scandal surrounding the DWSD, Mayor Young said he was willing to suspend the residency requirement to attract qualified personnel. He also moved to share the blame with other levels of government. Young is quoted, "I'm unhappy with the situation but there's enough blame to go around including the EPA and the state Department of Natural Resources" (Ibid.).

[114] For example, in the province of Saskatchewan operator certification is required and has been since [need year] but a 2005 report suggests just 54.5 percent of operators are certified. See Oborne (2005). See also Commissioner for the Environment and Sustainable Development 2005b.

On January 13, 1979, Judge Feikens ordered the city to develop a plan for sewage treatment by February 1 in order to meet the court order. If Detroit failed to develop a blueprint and timetable addressing how it would resove the water pollution problems Feikens said he would have to appoint an outside manager to operate the facility. Immediately the city asked that Jonathan Bulkley who had been involved in the earlier inquiry be disqualified as they considered him to be biased. Feikens ignored the request though he did not appoint Bulkley when Detroit failed to meet the deadline. In response to Detroit's failure to develop a plan, US Attorney James K Robinson explained on behalf of the EPA,

> We want to know specific goals in terms of manpower, training, procurement of equipment, maintenance of the plant, pollution limitations and the dates when the goals will be achieved...If the city does not produce a specific program, we could be left with no alternative but the appointment of outside management to ensure compliance with the 1977 court agreement to meet federal water pollution codes (Ball 1979).

In an effort to resolve the problems, Judge Feikens appointed Mayor Young as administrator on March 22, 1979 telling him that his responsibility was to the federal court. According to Feikens with respect to water pollution Mayor Young was to ignore the directives of City Council, the water board, or any other suburban or state agency for the next year (Ibid.). Rather than appoint an outside administrator, the federal judge did what he would continue to do for over twenty years when Detroit failed to meet its federal environmental responsibilities; he appointed the mayor as administrator. In 1979, the rationale for this action was, in part, concern that the bonds needed to finance the plant would be jeopardized by the appointment of an outsider (Ibid.). The Mayor took Feikens' directives to heart and moved to dismiss several members of the water board before the expiration of their terms. In 1980, Feikens overruled the mayor's plans to dismiss 3 new members, 1 from each county, before the end of their 4 year terms.

The oversight of the federal judge continued, and on September 17, 1982 Judge Feikens ordered Mayor Young to look for alternate firms to haul sludge as there was suspicion that the partners of the current firms may be indicted. As Feikens suspected, on February 4, 1983, a federal grand jury indicted six people in the Vista Sludge Hauling Probe (Detroit Free Press) That same year, in order to meet federal demands for water and sewage treatment, the average Detroit water rate increased by 2.5 percent with the average Detroit water bill from $15.32 per quarter to $16.80. Sewer rates also increased from

$29.07 to $31.49. All 7 members of the board which are responsible for setting rates are appointed by the mayor of Detroit including the four representatives from Detroit and three representatives from the suburbs. In response to the water rate increase, state Republican John Bennett introduced a bill to give the suburbs more say in running the metro Detroit water system. Bennett proposed a 9 member board with 5 representatives elected by an assembly of the suburbs and 4 appointed by mayor of Detroit.

The biggest polluter of the Great Lakes, the Detroit sewer plant finally met federal and state standards for water and air quality on March 19, 1984. In order to meet the standards, the sewage plant underwent $400 million in repairs with federal grants paying for $359 million (Brown 1984). The impact of the federal government was evidenced in several ways. First through standard setting. Second, the federal level delegated power to the Mayor to be able to enforce the standards while still retaining federal authority to enforce the standards if the Mayor was unsuccessful. Finally, by largely funding the improvements the federal government not only enforced compliance with federal water quality standards; they also ensured these would be met.

The relationship between the federal judge and the city of Detroit has not always been an easy one. While Judge Feikens congratulated Mayor Young saying he could be "proud of the successful cleanup" Feikens added that he was "a very poor administrator" (Brown 1984). In response, members of the local community including Judge Anna Diggs Taylor denounced Feikens comments as 'racist' while his supporters claimed otherwise (Ibid.).

For more than 15 years, state legislators have been introducing legislation to take control of the system away from Detroit and give it to a regional authority. One of the most vocal opponents of the DWSD is Oakland County Drain Commissioner George Kuhn who convinced 70 communities to pass resolutions saying they wanted a regional board (Ibid.). The relationship between Detroit and the suburbs served by the DWSD is complicated by the fact that Detroit originally funded much of the suburban infrastructure. James H Lincoln, former Detroit city councilor and Wayne County supervisor explained,

> Detroit had nearly two-thirds of the tax base of Wayne county in 1955. That was the year Detroit taxpayers voted to reach down in their pockets and give $33 million of their tax money for a county water system that was never going to benefit Detroit's taxpayers even a dime's worth. In fact, it ultimately brought about a situation that made it possible for much industry and business to leave Detroit for the suburbs. Detroit bankrolled much of the water facilities in South East Michigan" (Ball 1985).

The same controversies over governance and environmental regulation with respect to Detroit's water and wastewater system continued through the late 1980s. In 1985, mercury was found in the water lines as a result of malfunctioning water meters (Detroit Free Press December 9). The cost to DWSD to retrofit the meters was $1 million and yet more fodder for the suburbs. In 1986, state public health officials issued orders to more than double the chlorine in water going to the suburbs of Oakland, Macomb, Flint and Lapeer County as bacteria was found in Flint's drinking water on two occasions (Detroit Free Press May 30, 1986). A year later, workers at General Motors Corporation plant in Detroit complained of bad tasting water. Private laboratory tests indicated there were higher than normal bacteria counts in the water (Detroit Free Press January 13). In 1988, a dozen water department workers opened the doors to their houses to be met by salespeople trying to sell them water filters. This incident caused the city to issue a notice to residents that they did not need to filter their water (Detroit Free Press April 5, 1988).

Problems with the sewage treatment and upgrades persisted so that by 1989 the state had ordered a sewer cleanup. The city fought the order in court arguing it would have to raise sewer rates by 1800 percent in order to pay for the expected $2.6 billion in cleanup costs. The state Department of Natural Resources contested this labeling the city's figures, "[...] a fairy tale...nonsense and total garbage, dreamed up to scare people" (Detroit Free Press October 20, 1989). Representative David Rankin from the EPA Regional Office said EPA supported the DNR permit because it was consistent with the Clean Water Act. Detroit was forced to comply with the federal and state regulations and in 1997 an agreement between the state and the city was reached requiring $1 billion in improvements to the sewer system.

Detroit's water pollution woes continued to be expensive as the Public Interest Research Group in Michigan (PIRGIM) won a lawsuit it launched in 1988 when Detroit refused to divulge chemical discharges of 600 major sewer users. Then Director of DWSD Charlie Williams claimed that Detroit could not provide this information as it might compromise the trade secrets of their industrial customers (Detroit Free Press March 8, 1991). PIRGIM was awarded $157,263. The group planned to use the funds to raise environmental awareness in schools. That same year, Detroit quit the Canada-US panel studying contamination in the Detroit River citing "Detroit-bashing" (Detroit Free Press November 29, 1990). 1990 was also a bad year for some Detroit residents whose access to

water was threatened as the state Department of Social Services discontinued an emergency program to pay for water bills so the state could come up with enough money to meet a 9.2 percent spending reduction.

Two years later, amount of lead exceeding EPA standards were detected in Detroit's drinking water. Thirty-six communities were reported to be affected from Bloomfield Hills to Detroit to Grosse Ile to Oak Park and Wayne County. Lead can impair fetal and childhood development. In 1992, one of the cities served by Detroit, Hamtramck, was found to have dangerous levels of lead in the tap water of 5,516 homes (Associated Press 2001). In 1994 in response to these concerns as directed by the state Detroit began adding food gradient phosphoric acid additives which are a corrosion retardant to the water supply in order to fight the high lead levels. In 1997, the state also ordered Hamtramck to replace the city's lead pipes with copper ones. However due to the high cost of the pipe replacement the city simply ignored the order so that by 2001 it still had not responded to the state's directive (Ibid.). Additional attempts to achieve compliance are ongoing.

In 1993, the city faced several pump breakdowns leading the state Department of Health to ask Detroit to immediately come up with a plan for maintenance. The waterborne disease deaths in the neighboring state of Wisconsin which sent shockwaves throughout the mid-west were sighted as part of the rationale for the department's action. James Cleland, chief of the state water supply division explained, "What we want to avoid is what happened in Milwaukee" (Detroit Free Press April 17). On April 29, Detroit agreed to meet with state officials. The Deputy Director of Detroit's water department David Fisher responded to the state's actions, "We feel the water pressures are in a safe range. This is a state agency trying to exert control over a city agency. I don't think they're that familiar with our maintenance program" (Ibid.). State District Engineer Scarcella found the maintenance poor explaining, "It appears they don't have enough people to do everything that should be done in such a large system" (Ibid.)

In 1994, an oil spill closed the Detroit River intake. That same year, and perhaps more problematic, was the threat by the state to decertify the City of Detroit labs after failed evaluations. DWSD admitted procedures had grown "sloppy." The lab failed to detect contaminants in two federally mandated tests on two occasions in October 1992 and April 1993. Inspections of the lab by the health department and a certified private lab showed that Detroit used poorly washed glassware, expired test materials and outdated measuring devices, and failed to analyze enough samples. These incidents only gave the

suburbs more fodder for their arguments to wrest control of the system from the city. In 1995, four workers died in a water main blast and a year later the state department of Consumer and Industry Services issued fines of $448,000 for safety violations to the DWSD and the construction company it had contracted with, Weiss Construction Co.

In 1997, Flint entered into a partnership with Genessee County and cut ties with the DWSD. That same year Bill 781 was introduced in the Senate. The bill was an effort to regionalize the water system and shift control from Detroit to the suburbs. The Mayor of Detroit responded to the Bill by explaining, "Taking over the city of Detroit is unlawful and there will be no negotiation on this issue" (Detroit Free Press November 2, 1999).

To add to the Mayor's challenges on February 8, 2000 the federal court handed him extraordinary powers to make the wastewater system meet federal and state standards. From August 1997 to March 1999, the department's wastewater treatment plant dumped untreated sewage into the Detroit River violating the Clean Water Act. "The Michigan Department of Environmental Quality, as agent for the EPA, issued a violation notice and brought the pollution to the attention of Judge Feikens, who has presided over an EPA anti-pollution lawsuit against Detroit's treatment plant since 1977 (Ankeny 2000:41). On February 7, 2000 Judge Feikens appointed Mayor Dennis Archer as special administrator after a six member panel reported that "among the fundamental causes of the violations was the absence of effective leadership, coupled with a collection of DWSD and city policies that obstructed and conflicted" with their ability to comply with federal laws (Ankeny 2000). The report noted further that there was an "absence of long-term planning/priorities for the DWSD organization" and these were partly attributable to the "absentee-stewardship of Steven Gorden" Director of DWSD who during his tenure was 1998 President-Elect and 1999 President of the American Water and Waterworks Association (Crain's 2000:8). The panel which authored the report was chaired by Professor Jonathan Bulkley who has advised Judge Feikens on the case since 1978.

The need to deal with the problem was ever more apparent as Judge Feikens explained he could use his powers to impose a sewer tap-in moratorium as his counterpart had done in Atlanta "effectively bringing growth to a screeching halt"[115] (Ann Arbor News March 20, 2000). US District Judge Marvin Shoob had threatened a moratorium on development in Atlanta unless communities created a plan to meet the requirements of the

[115] This quote is from Paul Tait, former Executive Director of the Southeast Michigan Council of Governments (SEMCOG) explaining the consequences of not following the order.

Clean Water Act. Similarly, Judge Feikens ordered the Southeast Michigan Council of Governments (SEMCOG) to come up with some kind of plan or he would be forced to end development in Detroit. The sewer cleanup was expected to cost $20 billion. The Executive Director of SEMCOG noted that continuing to pollute source waters would make cleaning them for purposes of drinking considerably more expensive in the future.

The problems within the Water and Sewerage department with respect to wastewater and drinking water quality were not the only concerns reported in the local news. Detroit's fire hydrants suffered from years of neglect with respect to maintenance so that in 2001 it was reported that 400 of 30,430 did not work with 3,000 needing minor repairs. A trackable system had not been updated for decades. Within a two week period two fires occurred in which the fire hydrants were defective. Communications gaps between the fire department and the water department were being addressed and water workers moved quickly to repair fire hydrants at the rate of 100 per day.

That same year, Judge Feikens formed a Water Quality Consortium in cooperation with SEMCOG and including 40 civic and corporate leaders along with government to address problems in southeast Michigan with respect to water and water resource management (Associated Press 2003). Its first task was to examine the water and sewer system and the rate structure.

State and federal infrastructure upgrades as well as security measures required post-9/11 gave rise to new water rate controversy in 2002. Average rate increases were set at 13.5 percent for Detroit customers and 15.2 percent for suburban customers. "Right now, Judge Feikens just has jurisdiction on the wastewater side," said Gary Fujita, interim deputy director of the Water and Sewerage Department. "But if we didn't have the resources to properly operate, maintain and provide safe water, I'm sure that it would just be a matter of time before the water system could possibly come under Judge Feikens' jurisdiction"(Hill 2002). Judge Feikens issued a statement supporting the increases stating "No longer can the people of southeast Michigan look to the federal or state government for grants to finance the necessary capital improvements to the treatment plants and to the infrastructure. These costs must be borne by the users of the system. The health and welfare of the people of this region require no less"(Ibid.)

In 2002, Detroit elected a new Mayor who appointed a new water administrator. An outsider who grew up in the Bronx, New York, Victor Mercado was appointed by Mayor

Kwame Kilpatrick to head the DWSD. Mercado was the highest ranking Hispanic official appointed in Detroit and his experience was in the private water industry including a vice President of Thames Water North America and President and General Manager of Thames Water Puerto Rico. He also worked as private water administrator to United Water utilities in Pennsylvania, Virginia and Delaware. Feikens reportedly praised the choice of Mercado and noted, "What (Mercado's) real goal is, is to get me out of this." (Associated Press 2002) Since January 2001 Detroit had been in compliance with the standards of the Clean Water Act but setting the rate structure to pay for needed improvements was noted by Feikens as a challenge facing the new administrator. Not only was Mercado the first Hispanic chosen to lead the DWSD and unique for his private industry experience but his salary drew the attention of local media as it was 30 percent higher than that of the Mayor.

Mercado's efforts to finance the system included announcing that 37 percent of Detroit customers had past-due water bills though this played in the suburbs as if Oakland county and others were financing "deadbeat" Detroit city residents (see Crain's 2002). Later that year, the Water Quality Consortium that Judge Feikens convened examined setting a regional rate plan for water and sewer provision. The working chairman of the group and vice president of real estate for Ford Motor Co., Tim O'Brien, explained that the consortium was not aimed at regionalizing the Detroit Water and Sewarage Department but that there was a need to "address the issues collaboratively and constructively and sort it out, [in order to] avoid the option of unilateral action by the judge" (Crain's 2002:9).

In September 2002 a 42 inch watermain broke under Orleans and flooded basements and streets. The aging infrastructure of 3400 miles of pipe suffered 1,098 mainbreaks in the previous year. In response to the mainbreak and to contractor overruns as well as reports of lax security Livonia's Mayor Jack Kirksey asked the Attorney General Jennifer Granholm to investigate. He explained, "We don't know what's going on," Kirksey said. "The Detroit Water Board is like the Lone Ranger, and they don't want Tonto around" (Elrick et al 2002).

That same year the Michigan House Republicans introduced Bill 159 to provide the suburbs greater control of Detroit's water system. In February 26, 2003 the bill passed

through the House with of vote of 71 to 37. Days later it also passed the Senate with a vote of 23 to 14. On March 21, 2003, now Governor and a Democrat Jennifer Granholm vetoed Bill 159 calling it a "tired Battle." In response the Republicans established the "Select Committee of the Detroit Water and Sewerage Department to foster mutual cooperation and unity" with respect to the more than 30 years of conflict between the City of Detroit and its regional water customers (Taub 2004:2). Following the Governor's veto of the bill, 17 communities pledged to study leaving the DWSD. It does not appear that the struggle between the suburbs and the city has ended.

While in Ontario the province appointed a three member panel to investigate water and wastewater infrastructure in Southeast Michigan the pending billions needed for aging infrastructure was on the agenda of the SouthEast Michigan Council of Governments (SEMCOG). In addition to its concerns with the needs for regional growth of roads, transportation and energy costs, SEMCOG estimated between $14 billion and $25 billion would be needed through 2025 for water and sewers (Kosdrosky 2003).

By May, Judge Feikens formalized the role of the Water Quality Consortium by announcing alongside Governor Jennifer Granholm and Mayor Kwame Kilpatrick that he had signed an order stating "that the Southeast Michigan Consortium for Water Quality become an integral means in assisting the court in the solutions of regional water quality problems" (Associated Press 2003).

In June 2005, Judge Feikens moved to end 11 years of oversight of Wayne County and 13 suburban communities' sewer systems as well as 18 years of litigation (Detroit News June 3). Whether a new era of regional cooperation has replaced decades of federal oversight and the need for special administrative measures remains to be seen.

6.3 Comparing Toronto and Detroit

The impact of the Walkerton water tragedy on the Ontario Ministry of the Environment and the legislation that was developed as a result of Justice O'Connor's recommendations is evident in a comparison of relevant legislation in Ontario and Michigan. Before Walkerton, Ontario had no stand-alone drinking water legislation, had no binding standards only non-binding objectives for water quality, inspections were limited, reporting was largely voluntary, there were no treatment system requirements and

no source water protection in relation to drinking water concerns. Operator certification had been introduced in 1993 with 40 hours required. By contrast, Michigan in order to achieve primacy under the EPA passed the Michigan Safe Drinking Water Act in 1976 with binding standards, and treatment system requirements which over time was amended to include public notification, public reporting (consumer confidence reporting), extensive operator certification, source water assessments, and several different treatment rules.

The regulatory framework for drinking water in Ontario post-Walkerton is comprehensive and complex. In fact, it goes beyond the requirements of the Safe Drinking Water Act except for one consideration, the requirement to notify the public or to provide annual reports to the public. Since 2002, Ontario's drinking water legislation includes one Act that is a stand-alone piece of legislation, the Safe Drinking Water Act (2002). In addition, the Sustainable Water and Sewage Systems Act determines that water systems must operate as full cost-recovery which has as its goal the increase of municipal water rates across the province in order to pay for needed system improvements. The Nutrient Management Act is also important with respect to source protection as it outlines requirements with respect to effluent and agricultural runoff. Finally, the Clean Water Act for protection of drinking water sources was introduced in the fall of 2005. Extensive stakeholder consultations have been undertaken and the legislation should prove to be innovative in its efforts to address source protection rather than simply source assessment (see Hill 2006). As well, the regulations with respect to the Environmental Protection Act and the Environmental Bill of Rights are relevant. Moreover, the Ontario Water Resources Act which most of the Acts have superceded continues to exist and outlines fines for contravention.

Pursuant to the Ontario Safe Drinking Water Act (2002) are seven regulations which have all undergone amendments.[116] The Act and regulations total 251 pages.

By comparison, the Michigan legislation which was passed in 1976 and allowed Michigan to achieve primacy totals 185 pages. Michigan's drinking water legislation is also a Safe Drinking Water Act (1976 PA 399) and meets the federal requirements outlined in

[116] These regulations include the Drinking Water Systems Regulation (O Reg 170/03 amended O Reg 249/03 and O Reg 269/03), the Certification of Drinking Water Systems Operators and Water Quality Analysts, the Ontario Drinking Water Quality Standards (O Reg 169/03, amended O Reg 268/03), the Definitions of Words Used in the Act (O Reg 171/03, amended O Reg 270/03), Definition of Deficiency and Municipal Drinking Water System (O Reg 172/03), Schools, Private Schools and Day Nurseries (O Reg 173/03) and Drinking Water Testing Services (O Reg 248/03).

the SDWA. In 1978, Michigan initiated a compulsory operator certification program nearly 2 decades before the EPA required operator certification.

Table 6.1: Comparing Ontario and Michigan Drinking Water Legislation

	Michigan – post SDWA	**Ontario – pre Walkerton (before 2001)**	**Ontario – post Walkerton**
Legislation	Safe Drinking Water Act, 1976 PA 399	Ontario Water Resources Act	Safe Drinking Water Act 2002 Sustainable Water and Sewage Systems Act 2002 Source Water Protection Act (expected 2005)
Number of Pages (Legislation and regulations)	185 pages incl Act and Rules	97 pages (OWRA but not drinking water only or specific law)	251 pages incl Acts and regulations
Regulations	Within Safe Drinking Water Act	Ontario Drinking Water Objectives (non-binding)	7 regulations, most of which have been amended since 2003
Ministry/Department Responsible	Department of Environmental Quality (formerly Department of Natural Resources was responsible)	Ministry of the Environment	Ministry of the Environment
Annual Fee	Effective 1993 ranges from $250 to $83,800 (PWS over 500 000 served); also laboratory review and certification fee	Not applicable	Not applicable

	Michigan – post SDWA	**Ontario – pre Walkerton (before 2001)**	**Ontario – post Walkerton**
Variances	Accepted, 90 days request not for filtration, disinfection of total coliforms, each request for MCL or TT must be submitted separately	Not applicable	Temporary relief from strict compliance may be available (section 117)
Public Notification	Required for violation of MCL, TT, monitoring, waterborne disease, variance under exemption etc.; content of the public notice is listed; reporting for vulnerable subpopulation levels required beginning 2001, amended 2003	Not required	Public notification is not required, must report to MHO and MOE
Reporting to the Public	Annual Reports – Consumer Confidence Report – by July 1 of every year for previous calendar year	Not required nor encouraged	Reports must be made available if requested at no charge
Contaminants listed	Includes 'health effects language' for public notification, and explanation of major sources of that type of contaminant in drinking water; Lead and Copper Rule, Disinfection and Disinfection Byproducts Rule	Lists only objectives, does not include rationale nor health information	Lists only contaminants, does not include rationale nor health information

	Michigan – post SDWA	**Ontario – pre Walkerton (before 2001)**	**Ontario – post Walkerton**
Number of contaminants required to be monitored	87 plus 4 rules	104 (ODWO – year) not required objectives	161 parameters with 73 required to be monitored
Inspections	Sanitary surveys every 3 years at least; onsite inspections as determined by the department	Yes but limited	Yes – must be at least annually
Procedure to follow if adverse water quality incident	Resample, notification of state and public notification within 24 hours if E coli or fecal coliforms, within 30 days if total coliforms, only	Notification of Ministry of Environment who notifies Medical Health Officer	Additional testing, notify Medical Health Officer and Ministry of Environment
Source Protection	Source assessments required – EPA requires states to submit these for each Public Water System (1996)	None required	Source Water Protection Act expected 2006 will require assessments and allow local conservation authorities to set rules and enforce these
Treatment system requirements	Coagulation, sedimentation and filtration required	No requirements	Surface water must be chlorinated and filtered
Reporting	At least annual reporting to DEQ	Reporting of contaminants is voluntary	At least annual report to Ministry of Environment

	Michigan – post SDWA	**Ontario – pre Walkerton (before 2001)**	**Ontario – post Walkerton**
Operator certification	Required, must notify DEQ of changes in operators, non-voluntary program 1978; 1991 – renewal and continuing education; 1999 – new requirements for operators (2002)	40 hours required (under Waterworks Regulation 1993)	Must be officially accredited by Ministry of Environment
Penalties	1998 PA 56 fines for failure to submit reports or failure to monitor/test or to notify public from $200 to $1000 per day effective July 1, 1999	None	Fines between 4 and 10 million and up to 5 years in prison or both (OWRA)
Financial support to meet regulations	Drinking Water State Revolving Fund		

6.3.1 Ontario

Ontario participates in the federal Committee on Drinking Water Quality which sets guidelines for drinking water. The need for guidelines and standards is recognized. The committee allows for comparisons between provinces and information sharing. The Ontario Drinking Water Standards include and go beyond the Canadian Guidelines. Local

officials expressed considerable respect for the work of the Committee and for federal standards, more generally.

The Ontario Ministry of Environment has been responsible for drinking water since its creation in 1972. Prior to this, the Ontario Water Resources Agency was responsible. As the Walkerton Inquiry demonstrated, the reduction in funding to the Ministry of Environment also contributed to a decrease in capacity including with respect to the drinking water program. Prior to Walkerton, the Ministry did not have stand-alone drinking water legislation and drinking water was regulated primarily via the Ontario Water Resources Act and with non-binding Drinking Water Objectives. As Ministry officials noted, the Walkerton tragedy had a "profound effect on the Ministry, we realized people really could die from drinking the water."[117]

With cutbacks to the MOE it is clear little in the way of monitoring or reporting was going on, at least in about the ten years prior to Walkerton. Inspections or visits occurred rarely and were informal. After Walkerton, the Ministry hired 100 additional inspectors and the SDWA now requires that annual inspections take place as was recommended by Justice O'Connor. The Ministry is also committed to having at least one unannounced inspection for each water system every three years.

After Walkerton, the Ministry created the Drinking Water Management Division and appointed a Chief Drinking Water Inspector in 2003. The Inspector is also the Assistant Deputy Minister who leads the division. It is their job to ensure standards are met, monitoring and inspections occur, to develop training programs and to provide an annual report on the state of the province's drinking water. The first annual report is expected to be available in fall 2005.

Drinking water inspectors inspect the source water, treatment system and distribution system as part of their inspection protocol. Inspections are aimed at mandatory abatement rather than voluntary abatement so orders may be written for any findings of non-compliance. Inspections are based on six principles outlined in the Walkerton Inquiry recommendations: effectiveness, the precautionary approach, consistent application, independence from outside influence, transparency and adequate resources. In July 2005, the Compliance and Enforcement Regulation was passed to ensure that the Ministry lives up to its commitments to inspect and enforce the legislation.

[117] Confidential interview.

The range of actions that the Ontario MOE undertakes with respect to drinking water include (1) compliance promotion (2) issuing an order (3) recommendation to investigations and enforcement branch and (4) notice of emergency response in which a water system may be turned over to the control of an outside agency if the municipality is unable to operate according to the Act and regulations. This range of actions is from least concern to greatest concern for public health.

As the Ontario Ministry of the Environment has recently introduced mandatory abatement and annual inspections, information is available and broadly comparable to that available from Michigan's Department of Environmental Quality. It should be noted this is the only chapter in which such a comparison or examination is possible as the two other Canadian cities, Vancouver and Montreal, do not undertake inspections specific to the drinking water system. While BC does do sanitary surveys, requirements with respect to drinking water regulations are significantly fewer than the monitoring for 73 contaminants that is required of Ontario municipalities.[118]

In Table 6.2, below, actions are limited to the Safe Drinking Water Act and regulations in both Ontario and Michigan.

In Ontario, a more serious violation is considered to be one of six different types of violation: (1) failure to report an adverse test result (2) failure to take appropriate corrective action (3) inappropriate operator certification (4) lower than required disinfection level in the distribution system (5) failure to comply with required sampling (6) all treatment requirements not met.

Table 6.2: Comparing Ontario and Michigan - A Year of Enforcement Actions and Penalties

	Ontario MOE	Michigan DEQ
Violation letters issued	255 orders for minor violations	154 violation letters issued
Escalated enforcement actions	87 orders for more serious violations	7 escalated enforcement actions
Administrative Consent Orders	16 convictions	5 administrative consent orders
Total Civil/Administrative Penalties Collected	$176 500	$82 476

For purposes of comparability over one year with complete data this table compares Ontario from June 2003 – 2004 and Michigan DEQ from August 2004-2005

[118] There are 161 parameters for the Ontario Drinking Water Standards but the Ministry requires monitoring for 73 of these. The Ministry will probably be reducing the number within the next year.

6.3.2 Michigan – Role of Department of Environmental Quality (DEQ)

The Michigan Department of Environmental Quality (DEQ) has eight divisions, two of which are relevant to the drinking water program. One of its roles is compliance enforcement and monitoring, as evidenced above. The Water Bureau is responsible for all state activities with respect to water and wastewater including setting water quality standards and providing regulatory oversight of public water systems. The Bureau also reviews and approves plans for public water systems. The Land and Water Management Division is responsible for some aspects of source water protection. As well, the Office of the Great Lakes, established in 1985, is the lead agency within state government to develop policies and programs to protect the Great Lakes and is responsible for focusing on toxic and nonpoint sources of pollution. The Environmental Science and Services Division provide laboratory services and technical assistance. This office provides education on aspects such as water sampling.

Michigan's compliance and enforcement process includes inspections. Letters of compliance are sent noting corrective actions if required. Serious violations can result in escalated administrative or civil enforcement. Usually escalated enforcement is associated with fines.

In addition to compliance and enforcement, the Michigan DEQ has also implemented a capacity development program as required by the 1996 amendments to the Safe Drinking Water Act. The purpose of the program is to enhance technical, managerial and financial capacity of public water systems. The bulk of the Michigan program is focused on technical assistance.

Communications between field staff and water systems occur at periodic regional operator meetings to address regulations and regional issues and to allow operators to network. In addition, district staff may attend municipal board meetings or local council meetings to discuss compliance issues. As the report to the Governor explains, "Community leaders need to hear the benefits of agreeing to a course of action that allows them time to address their problems without further enforcement or penalties."

Despite local challenges the Michigan DEQ has noted it successes in comparison with other jurisdictions in recent years including Ontario. In its triennial report to the Governor, the DEQ underscores, "An even more critical measure of the effectiveness of the

Michigan Capacity Development Program is the absence of any major waterborne disease outbreaks like those that have occurred in neighboring states and provinces" (2005:19).

EPA Region 5 is responsible for the states of Illinois, Indiana, Wisconsin, Minnesota, Ohio, and Michigan as well as 35 Tribes.[119] With respect to drinking water, the EPA Region 5 has a Water Division which includes Groundwater and Drinking Water and there is an Enforcement and Compliance Assurance department within this division. With respect to Michigan, the EPA has been involved in compliance actions including lawsuits with respect to Detroit's failure to comply with the Clean Water Act.

The Region collaborates with the states in several ways, but in particular, provides help to overcome budget problems. The Region works with the states to reduce contaminant levels and maintain water system capabilities. Moreover, the Region will begin closely tracking and accounting for watershed protection efforts as it expects these will provide a better picture of overall efforts to improve drinking water quality.

Like EPA Region 6, Region 5 has developed measurable goals with respect to drinking water. These goals address both water treatment and source protection activities.

[119] Only the Navajo have applied for and been granted primacy. All other tribes are under EPA regulatory enforcement.

Table 6.3: Performance Activity Measures for EPA Region 5

Measure	Goal
Water Safe to Drink: Percentage of the population served by community water systems that receive drinking water that meets all applicable health-based drinking water standards through effective treatment and source water.	FY08: 95%
Percentage of the population served by community water systems that receive drinking water that meets health-based standards with which systems need to comply as of December 2001	FY05: 95%
Percentage of community water systems that provide drinking water that meets health-based standards with which systems need to comply as of December 2001	FY08: 95%
Percentage of community water systems that provide drinking water that meets all health-based standards with a compliance date of January 2002 or later	FY08: 80%
Percentage of states that will implement a program to promote protection of drinking water sources	FY05: 100%
Percentage of community water systems that will implement source water protection programs	FY05: 10%

Source: Environmental Protection Agency Region 5 Drinking Water Section – Water Quality Division

Region 5 has the unique position of being responsible for the EPA's Great Lakes National Program Office. As the Great Lakes serve as the primary source of drinking water in the region, recent efforts and initiatives to address source water protection are relevant. In May 2004, by executive order, President Bush designated the Great Lakes a national treasure. With regional collaboration including federal agencies, state governors, local mayors, tribes and congressional delegates, a strategic plan is in the process of being developed and is expected to be finalized in December 2005.

The draft strategic plan notes that the 31 areas identified as being of concern over 15 years ago remain so, today, and that while efforts have been helpful, these have "not been effective enough." The need to protect drinking water sources and improve drinking water infrastructure has been noted. Among the recommendations are enhanced flexibility in administration of the drinking water revolving loan funds, development of strategies to protect the source water, funding for infrastructure upgrades, and improved intergovernmental coordination. Interestingly, Ontario members of the Lake Ontario

Lakewide Management Planning Team, a binational effort, have been involved in the strategic planning sessions.

Michigan communicates with EPA Region 6 with respect to primacy issues as well as an annual report outlining capacity development. Failure to provide an annual report to he EPA or to report every three years to the Governor can result in loss of drinking water revolving loan funds.

Clearly the relationship between the city of Detroit and the EPA has been a difficult one with the EPA continuing to impose significant costs for non-compliance on Detroit. On the other hand, the federal judge has responded to local concerns about financing local improvements by appointing the Mayor as administrator rather than outsiders. The presence of the federal judge has focused attention on problems with the water and wastewater systems. The state has enforced regulations, as well as been supported by the federal authorities in doing so. The need for environmental protection and to be responsive to environmental regulation while weighing local concerns has meant that the federal government has paid for significant amounts of the system improvements required by the regulations. However, the federal judge warned the regional water quality consortium that he assembled that consumers would have to take more responsibility for costs. Financing of systems is an issue that will continue to be on the agenda and a challenge at the local level for both Detroit and Toronto.

6.4 Comparing Performance: Inputs and Outputs

6.4.1 Inputs (Effort)

Table 6.4: Comparing Timing and Timeliness of Drinking Water Protection Improvements in Toronto and Detroit

	Toronto	**Detroit**
Source Water Protection	Wastewater treatment plant – 1951 Sewer Use Bylaw Source Water Protection Act (expected 2005)	Wastewater treatment plant – 1940 (primary treatment) Source Water Assessments 1996
Disinfection	Chlorination -1910	Chlorination – 1913 (calcium hypochlorite) Liquid chlorine - 1916
Enhanced Disinfection	Ammoniation and Chloramination are also used to improve the effectiveness of the chlorine throughout the distribution system	Ozonation - 2004
Filtration	Filtration – 1911	Filtration – 1923

Similar to the previous chapter, a comparison of timing for drinking water protection is more informative about local initiative than about federal regulation. Comparisons of Toronto and Detroit with respect to chlorination and filtration are in sharp contrast to Vancouver and Seattle. Detroit and Toronto began to filter the water out of obvious necessity rather than because of regulatory requirements. The water was turbid enough that they actually could tell it needed some form of treatment. The quality of the source waters and the amount of pollution rendered different approaches to water treatment. Moreover, the relationship between water and wastewater is relevant in the Toronto and Detroit cases as the water sources are also the wastewater sewers. For Vancouver and Seattle, wastewater is not discharged into the sources of their drinking water. For Detroit source protection has been a major and costly challenge for which it has received both federal regulation and federal funding. The timing of improvements to the systems has been similar over time due to similar challenges. The key to federal involvement in this chapter is not timing of improvements but monitoring of agents. Detroit has received federal oversight and been forced to comply with federal regulations. Moreover, the state and federal authorities have made efforts to regulate Detroit with

respect to its drinking water. By contrast, while local authorities in Toronto have responded to public and environmental concerns about the drinking water until Walkerton the Ministry of the Environment has been largely ineffectual.

6.4.1.1 Water Rates

In addition to the timing of improvements for source protection and various actions to protect the drinking water including federally mandated tests of the laboratories and monitoring by the state federal regulation also created incentives to raise water rates at the local level. This was an important impact of the SDWA. Most experts agree that across North America water rates have been kept low though improvements to systems were needed to protect public health. Water rates provide evidence of the federal impact of pushing costs down to the local level. While some may dispute the benefits of this for Detroit it also offers evidence of the efforts required to clean up the source water. Detroit's water and sewer rates are considerably higher than those of Toronto. In 2003, water and sewer in Toronto averaged $27.67 per month CDN (DeMara 2002) whereas in Detroit the costs of water and sewer averaged $32.50 USD per month (DWSD 2003). Average US water rates were about $40 per month in 2003. Based on 2003 figures Detroit's water rates are 21 percent higher than those of Toronto. Toronto has a five year plan to raise water rates but it will not catch up to Detroit. Moreover, concerns about financial sustainability and finding ways to pay for significant infrastructure improvements that will be needed in water and wastewater in the next twenty years have been on the minds of several expert panels recently including the Swain panel appointed by Ontario's Ministry of Public Infrastructure Renewal. Canada's water rates, according to the OECD (1999) are about half those of US cities. Ontario's rates are some of the lowest in Canada with only BC, PEI, Newfoundland and Quebec having lower rates on average (Swain, 2005). These low rates, in part, may be an artifact of the absence of federal regulation and the inability to impose costs at the local level to ensure improvements in drinking water protection.

6.4.2 Outputs - Monitoring and Compliance

Consideration of drinking water quality over the most recent five years yields somewhat mixed results. With respect to total coliforms both Toronto and Detroit met their respective requirements though Toronto's water appears to be of somewhat higher quality (see Table 6.5 below). For this section, data has been compiled from water quality annual and quarterly reports issued by Toronto Works and Emergency Services, Water

and Wastewater Services (2000 – 2004) and reports issued annually (2000 – 2004) from the Detroit Water and Sewerage Department.

Table 6.5: Total Coliforms, Percent Positive Samples

Year	Toronto	Maximum Acceptable Concentration	Detroit	Maximum Contaminant Level
2000	<1%	0	2%	5%
2001	<1%	0	3%	5%
2002	<1%	0	3%	5%
2003	<1%	0	3%	5%
2004	<1%	0	5%	5%

When one turns to turbidity, however, Toronto exceeds the maximum acceptable concentration in 2004 and has exceeded EPA's maximum contaminant level in two of three years. It has met the Canadian Guidelines which are not as stringent. By contrast, in the past three years for which data is available Detroit's water has met all EPA requirements for turbidity.

Table 6.6: Turbidity (NTUs)

	Toronto	Maximum Acceptable Concentration	Detroit	Maximum Contaminant Level
2002	0.3	1	0.25	0.3
2003	0.37	1	0.29	0.3
2004	1.9	1	0.24	0.3

Examination of total trihalomethanes (Table 6.7) suggests mixed results once again as Detroit's TTHM levels are higher than Toronto's but within acceptable limits. It is interesting to note that the guidelines for Toronto are less stringent than the requirements for Detroit under EPA's disinfection and disinfection byproducts rule. Trihalomethanes are known to cause cancer at certain levels. Haloacetic acids, also disinfection byproducts, have similar effects.

Table 6.7: Total Trihalomethanes (ppb)

	Toronto	Maximum Acceptable Concentration	Detroit	Maximum Contaminant Level
2000	28.7	100	25	80
2001	28.7	100	31	80
2002	22.2	100	30.6	80
2003	22.2	100	27.3	80
2004	19.7	100	48.5	80

Table 6.8: Haloacetic Acid (ppb)

	Toronto	No Regulation Set	Detroit	Maximum Contaminant Level
2002	19.3	-	19	60
2003	9.2	-	25	60
2004	13.3	-	40.1	60

Table 6.9: Lead (ppb)

	Toronto	Maximum Acceptable Concentration	Detroit	Action Level
2000	3	10	7	15
2001	5	10	6	15
2002	21	10	11.6	15
2003	0.5	10	11.6	15

Monitoring for lead contamination (Table 6.9) is also included here as it has been identified as a concern in both cities. Lead pipes have been used in the building of many homes. Lead contamination has been linked to developmental delays in children and concentrations of lead are thought to be related to Alzheimer's disease. Both cities will have to continue to monitor this contaminant as levels are approaching or exceeding acceptable or actionable limits. One concern about the EPA requirements for lead monitoring was that EPA required first-draws of tap water to be reported whereas if most residents ran the water for a brief period of time, less than one minute, it would be considered safe to drink.

With respect to boil water advisories between 2000 and 2005, these were rare for both Detroit and Toronto. Both experienced these when water main breaks occurred. Water main breaks result in boil water orders as a precaution from potential cross-contamination.

For Detroit, the 2003 blackout resulted in a boil water advisory for a five day period from Thursday August 13 through Monday August 18. Even though the water system was online by Saturday, state level and local level officials wanted to allow time for adequate sampling to ensure the water was safe for drinking. In contrast, Toronto was able to borrow power from the grid and keep the system running thus, a boil water advisory was unnecessary. The provincial government was involved in the negotiations with respect to the power grid allowing hospitals to have a continuous supply of clean water.[120] People were asked to conserve as much water as possible. If the blackout lasted longer, Toronto would have had to issue a boil water advisory.

As both Toronto and Detroit have had filtration systems in use for a considerable amount of time comparisons of gastrointestinal illness for outcomes would not be a helpful measure. While disinfection byproducts have been linked to bladder cancer, it is difficult to separate cancer caused by drinking water with other causes attributable to cancer. Thus this section does not include discussion of outcomes for these two cities. Given the similar water sources and contamination by wastewater and industries along with the similarities in water quality over time one would expect similar health related outcomes with respect to drinking water. That is certainly an area for further research.

6.5 Conclusion

Toronto and Detroit did not turn out to be matched on one important criterion that was not fully controlled for in the study, community capacity, yet the outputs point to comparable water quality, nonetheless, and, in the case of Detroit, as a result of federal pressure. The imposition of costs is evident in Detroit, in particular with respect to water rates. Arguably, Detroit has faced more challenges than Toronto including economic ones, and concerns with unqualified operators in the 1970s. The impact of federal regulations and their enforcement has been significant for Detroit and can be evidenced by greater attention to water quality concerns, improvements to the system, and improved water quality over time. The role of Judge Feikens until very recently has been central as has his appointment of Detroit's mayors Young, Archer and Kilpatrick as special administrators to ensure water resource management measures as required by the EPA were prioritized over other considerations and concerns of the local government. The federal government, at a distance from the costs, was willing to impose these in the Detroit case.

[120] Confidential interview.

By comparison, in Toronto, prior to Walkerton, the Ministry was largely absent and when the Ministry was informed of problems with Toronto's drinking water, it stalled. A considerable shift took place in the Ministry as a result of the Walkerton water tragedy. The impact on Ontario is evident in the amount of legislation and degree of enforcement activities discussed in this chapter. The recommendations of Justice O'Connor have pushed the province of Ontario closer to the United States in terms of regulatory requirements as well as compliance and enforcement. The staying power of the Walkerton response remains to be seen.

It is interesting that the Walkerton tragedy highlighted the need for operator certification and that this issue was a consideration of the inquiry by Jonathan Bulkley in the 1970s when Detroit's water and sewerage system was investigated. Again, in the early 1990s, when the state investigated water quality monitoring issues in Detroit, the district engineer noted that there did not appear to be enough staff to undertake the necessary measures to meet federal requirements. The need to train new personnel and to ensure that institutional history is passed on has been identified as an ongoing challenge with respect to providing potable water.

Toronto was not immune to charges of incompetence and scandal, especially in the early years of the water system. Concerns with avoiding similar indignities in the future have drawn attention to the challenges of infrastructure and resourcing water systems with qualified operators. As an exodus of experience occurs due to a significant number of retirements in the water industry in Canada, this will also bring to the fore the issue of financial sustainability in order to finance the improvements and adequately pay the skilled personnel. In recent years, experts have consistently suggested that consumers should pay more.

As the closing chapter argues, and as this and the three other paired case studies have demonstrated, the federal government is uniquely positioned at a distance from the costs to be able to impose costs for needed water infrastructure to improve service delivery at the local level. The federal government can have an independence from local interests and local opinion - a distance - that may not be available to subnational governments in the same way.

VII: CONCLUSIONS AND CONSIDERATIONS FOR IMPROVING DRINKING WATER PROTECTION IN CANADA

Do binding national standards improve policy performance for drinking water protection? I argue that the introduction of binding national standards via the Safe Drinking Water Act in the United States has enhanced policy performance for drinking water protection. Moreover, the study finds that drinking water is more reliably good in the US compared with Canada after the introduction of binding national standards via the US Safe Drinking Water Act in 1974. The research involves consideration of four pairs of cases, one member of each pair in Canada (absence of binding national standards) and one member of each pair in the United States (presence of binding national standards). Through consideration of matched cases in Canada and the US, as well as consideration within US cases pre and post 1974, the work makes a compelling argument for greater federal involvement in Canada in this policy area that is largely under provincial control. Moreover, the similar patterns within the Canadian and US cases prior to 1974 as well as changes within the US cases post-1974 strengthen the conclusion regarding the importance of multi-level accountability and underscore that the findings are not merely a function of cross-national differences in legislative-executive or voter-government relations.

A subnational government regulating a local government has few incentives to do so. By contrast, multi-level accountability, as exemplified by the United States Safe Drinking Water Act, offers a form of type I multi-level governance involving more than one level of intergovernmental regulation and a hierarchy of reporting relationships. Through the addition of a level of regulation above, the regulating government is positioned at a distance from the costs resulting in greater incentives for it to impose costs to improve local level service delivery. The study argues that federal involvement matters for policy performance in this policy area. Binding national standards enhance drinking water protection.

Type I multi-level governance is a relatively new term within Canadian political science involving the addition of levels of government, in this case, municipalities, to the understanding of federalism as intergovernmental relations between the federal government and the provinces. In light of service provision at the local level, drinking water protection requires multi-level governance. This study argues that for best results, drinking water protection benefits from multi-level accountability. As explained in Chapter 2, public health experts agree the multi-barrier approach to drinking water protection is most conducive for public health. Multi-level

accountability where governments monitor other governments in a hierarchical chain of principal-agent relationships might be considered an extension of the multi-barrier concept.

In addition to offering a more sophisticated understanding of the relationships between provincial and municipal governments within Canada, the application of the principal-agent approach elucidates why the US model is more effective than the Canadian model. Furthermore, it highlights the degree of hidden information within the Canadian federal system as compared with the US federal system. Principal-agent models facilitate focus on monitoring and outcomes. The preceding chapters demonstrate that monitoring of agents by principals occurs with greater consistency in the US model thereby contributing to improved policy performance.

The capability of the US federal model to offer enhanced drinking water protection turns on the distance of the federal government from the costs and the proximity of the state government to the local government agent. The incentives within the US model make it more adept at uncovering hidden information as well as imposing costs to improve service delivery at the local level. By contrast, within Canada, the provinces generally lack incentives to regulate and the municipal agents remain in a kind of double-bind, wanting to enhance their water infrastructure but without the resources to do so.

The findings of this research largely confirm the three main hypotheses introduced in Chapter 1:

1. As a result of the addition of federal involvement in 1974, the United States offers improved drinking water protection after 1974.
2. The United States offers better drinking water protection than Canada as a result of binding national standards in the United States.
3. US cities offer greater consistency with respect to drinking water protection than the Canadian cities as a result of binding national standards.

This chapter summarizes the main findings of this study. It also considers the cases with respect to their national contexts. In addition to offering comparisons between Canada and the United States, this chapter briefly addresses comparisons within Canada and within the United States across the cities studied. The key empirical, conceptual, theoretical, and methodological contributions of the work are outlined. Finally, policy options with respect to improving drinking water protection in Canada are provided.

7.1 Contributions of this Research

This work makes contributions on several levels. From an empirical standpoint, the work sheds light on an important question for both political science and public and environmental health. The importance of a more centralized federalism for the achievement of effective outcomes for drinking water protection is a major contribution of this work. Furthermore, the multi-barrier approach to drinking water protection is widely accepted by public health experts and the inclusion of multi-level accountability can be viewed as an extension of that approach. Conceptually, the study contributes a new term - multi-level accountability - advancing conceptualizations of scholars such as Marks, Hooghe and Lisbet with respect to multi-level governance. Theoretically, the work identifies a key variable for consideration with respect to intergovernmental regulation and for federalism, more generally: distance. Further, the identification of this variable is via application of the principal-agent framework that this work newly applies within Canadian federalism. The methodology involving the matching of cases within Canada and the United States allows for a multiplication of cases as cases can be considered between, within, and across countries.

7.1.2. Empirical Contributions

Empirically, this works sheds light on the question of participation of governments in public health and environmental protection, specifically drinking water protection. With some exceptions (see Landau 1969, Bendor 1985, Sancton 2003, Ting 2003), overlap and duplication have often been viewed as distasteful for public administration. In particular, in Canada, with governments jockeying for jurisdictional control, arguably much attention has been paid to maintaining and controlling jurisdictions, rather than involving levels of government. This work demonstrates that overlap and duplication offered by the US SDWA model of multi-level accountability contributes to enhanced policy performance.

Specifically, the work makes a contribution to a longstanding debate about whether the Canadian federal government should become more involved in drinking water protection. This study provides compelling evidence for federal involvement. I find that drinking water is more reliably good in the US cases than in the Canadian cases. In all the pairs of cases we see that monitoring and compliance occur more often and with greater regularity in the US compared with the Canadian cases. In Seattle compared with Vancouver, costs are imposed earlier even though there is no public pressure to do so. In Longview compared with Nanaimo, significant costly public health improvements to the system occur earlier and without public pressure. In pre-Katrina New Orleans compared with Montreal the drinking water quality is arguably less at

risk as evidenced by the number of boil water advisories in each locale. The exception is the Detroit-Toronto comparison where there is no significant obvious difference in the drinking water quality. Importantly, in Detroit, we see costs imposed at the local level as a result of federal involvement and even in the face of negative local reaction offering some support for the theory.

Moreover, the case for federal involvement is further illustrated by two of the Canadian cases. The federal government forced Vancouver and Nanaimo to chlorinate their water during the Second World War with its powers under the War Measures Act. This is an exceptional situation, nevertheless, the British Columbia government proved ineffectual in convincing local authorities to chlorinate the water for decades prior even though most North American cities had introduced chlorination by the 1920s. As the case studies demonstrate, public support was decidedly against chlorination with local authorities too close to the electoral costs to be willing to take action, or perhaps even to support action, and the provincial government unable to impose costs. Only when the federal government at distance from the costs and willing to impose them entered the fray was the local level forced to disinfect the drinking water in the two municipalities.

7.1.3 Conceptual Contribution

This work also makes a conceptual contribution. The term 'multi-level accountability' is identified as a distinct form of type I multi-level governance. I define multi-level accountability as involving (1) at least two levels of regulators (e.g., federal as well as state/provincial) (2) hierarchy in reporting relationships including with respect to the regulators and (3) defined roles and responsibilities within the hierarchy. While, at a minimum, multi-level governance may entail two governments, multi-level accountability entails at least three governments as in a three-level hierarchy. As the theoretical framework demonstrates, one government regulating another has few incentives to monitor and enforce regulations. When an additional government is added there is a shift from two governments to additional chains of governments. No longer is there merely provincial-municipal/state-municipal. A multiplication of linked principals and agents is

achieved with the addition of an extra government above. With the addition of the federal government, federal-provincial, federal-municipal and federal-provincial-municipal chains of principals and agents are added. The term 'accountability' is used for several reasons: (1) highlights monitoring (2) points to costs and acceptance of costs (3) emphasizes roles and responsibilities of actors and (4) places the focus on outcomes.

Successful regulatory enforcement usually requires the imposition of costs. As Nakamura and Church explain, "Regulation is never popular with those who are regulated because it makes them do things they don't want to do, usually with accompanying costs in money, time, and aggravation" (2003:14). The addition of the term 'accountability' to the concept of multi-levels within the understanding of multi-level governance shifts the emphasis to performance. Rather than merely a process of governance, drinking water protection requires results. As the study demonstrates, the three-level hierarchy as an example of multi-level accountability has greater potential for performance than other forms of governance, in particular, a state-municipal or provincial-municipal relationship.

In light of its emphasis on monitoring and costs, and as demonstrated within this work, multi-level accountability can be elucidated via application of a principal-agent framework that similarly focuses on these two concepts.

7.1.4. Theoretical Contribution

The application of the principal-agent framework to the study of Canadian federalism is a new approach adopted within this work. This approach highlights the 'hidden information' within Canadian federalism as well as federal countries, more generally, at the different levels of government, and, in particular, at the local level. Most importantly, this approach offers a structured way to consider the incentives of actors, in this case, levels of government. Similar to the concept of multi-level accountability, the framework focuses on outcomes and how information and imposition of costs are pertinent to outcomes.

The model allows for identification of a key variable with respect to policy performance for regulation and within federalism more broadly: distance. Application of the principal-agent framework to this policy area and across these comparative cases highlights the importance of consideration of distances of government from costs and distances from information.

7.1.5. Methodological Contribution

Finally, the work makes a methodological contribution to Canadian political science using a comparative matching of cases to shed light on Canadian federalism. Case comparisons are between cases, across cases, and within cases. By matching cases that are as similar as possible on variables other than the presence or absence of binding standards, we can shed new light on the question. In this study, cities in the US (presence of national binding standards) were matched with Canadian cities (absence of national binding standards) and specifically the independent variables considered for matching (similarity) were population size (proxy for capacity) and source water (proxy for magnitude of threat). For the most part, this approach worked well. The matching of cases enables comparison between cases. Moreover, with the consideration of time, within-case comparisons can also be addressed. Thus, consideration of drinking water protection in the US prior to 1974 (absence of binding national standards) and after 1974 with the introduction of the SDWA (presence of binding national standards) offers insights regarding the extent to which binding national standards improve policy performance for drinking water protection. Furthermore, the methodology enables comparisons across cases so that Canadian cases can be compared cross-nationally as the American cases can also be compared cross-nationally. A key challenge with this approach is case selection and ensuring appropriate matching. The last pairing presented some difficulties in relation to this challenge and underscores the need to select carefully.

In addition to comparing the US cases over time, examination of the Canadian cases across time provided insights into federal-provincial-municipal relations in Canada. In particular, the Vancouver and Nanaimo cases demonstrated that federal insertion of authority in Canada has been used to impose costs at the local level within this policy area. If the study had only focused on the current state of policy within Canada important and relevant events would have been missed. Political scientists in Canada might pay more attention to the variable of time with respect to intergovernmental relations. Certainly, examination of evolving relationships is insightful for understanding the federation.

7.2 Findings

If we return then to the principal-agent framework, we are reminded that it highlights two key aspects regarding drinking water protection: (1) hidden information and (2) the need to impose costs to reduce agency losses. Prominent examples of hidden information include citizen ignorance about drinking water sources and the hidden nature

of water infrastructure which is primarily underground and out of sight and mind of citizens. Importantly, the water can appear to be safe to drink even when it is not. Information is not only hidden to citizens, it is also hidden to governments responsible for regulating local governments. Finally, costs within this policy area can be significant and therefore challenging to impose.

In Chapter 1, three models were outlined. The first model, Model A, involves municipal self-regulation. The argument is that municipalities have great incentives to ensure safe drinking water but also great disincentives. As they can be expect to be blamed for doing nothing as well as doing something (owing to costs passed onto the public), it is argued they are in a double-bind. Thus, self-regulation is insufficient to ensure public safety. If we consider the eight cases discussed within this study, we can see that Model A is evident only, initially. In terms of municipal water provision all of the systems within the study were privately built and then later purchased by the municipalities. Early on, as an initial act of governance, provinces and states issued public health legislation in response to concerns about waterborne diseases among other matters. As noted in Chapter 2, and demonstrated by several of the cases, typhoid was a particular health concern with the potential to result in deaths of epidemic proportions which local and subnational governments were forced to confront.

With the involvement of provinces and states, Model B offers a useful illustration of the relationship between the provinces or states and the regulated municipalities. Model B is demonstrated in two main ways by the cases: (a) the four Canadian cases after provincial public health acts passed (around 1900s to present) and (b) the four American cases prior to 1974. Model B has been referred to as 'symbolic regulation' whereby laws are passed but little in the way of monitoring and performance occurs as there are few incentives to take action. Actions can be expected to be costly resource-wise as well as electorally.

The passage of the Safe Drinking Water Act gives rise to Model C. The first two hypotheses were developed based on assumptions about the effectiveness of Model C. With respect to the models, the principal-agent framework highlights two key questions:
Which level of government can most effectively uncover information that is hidden at the local level?
Which level of government is most willing to impose conditions and/or costs at the local level?

Model C as explained in Chapter 1, and demonstrated in subsequent chapters, illuminates that the federal government, in light of its distance from the costs, is more willing to impose costs. The federal government is both at a distance from electoral costs and at a distance from costs for system improvements. It can choose to pay for improvements but even if it does not it

is unlikely to suffer electoral losses for imposing costs at the local level. Even though the federal government is at a cost-imposing advantage thereby enhancing policy performance, it is at a distance from the information and thus suffers an information-disadvantage. The information-disadvantage is considerable within this policy area as information is largely hidden. Municipalities have few incentives to expose hidden information as it is likely to result in imposition of costs with possible side-effects that citizens may lose confidence in the system. Thus, provincial or state level governments in proximity to the information and wanting to reduce agency losses can more effectively obtain hidden information than the federal government. The states act as information-agents in the three-level hierarchy as they are at an information-advantage.

Through application of the principal-agent framework and comparison of the effectiveness of Model C offering multi-level accountability over Model B offering symbolic regulation, the hypotheses are largely confirmed. In the sections that follow, I discuss the hypotheses, and summarize the findings from the cases.

The first hypothesis is as follows:

1. *As a result of the addition of federal involvement in 1974, the United States offers improved drinking water protection after 1974.*

The first hypothesis is confirmed in every US case in the study. The four US cases demonstrate that drinking water is more reliably good after 1974 because the federal government is willing to impose costs through the implementation of binding national standards with the passage of the US Safe Drinking Water Act. In Seattle, Washington, the Environmental Protection Agency requires hundreds of millions of dollars of improvements to the Cedar River supply and to cover open reservoirs. Even in the face of local opposition, the EPA imposes significant costs on Seattle. Seattle and state-level officials are also keenly aware that future costs may be imposed and work together to be informed in order to be able to meet future regulations. Moreover, in Longview, Washington, a filtration plant is introduced in the late 1970s as a result of a requirement to meet the new federal regulations.

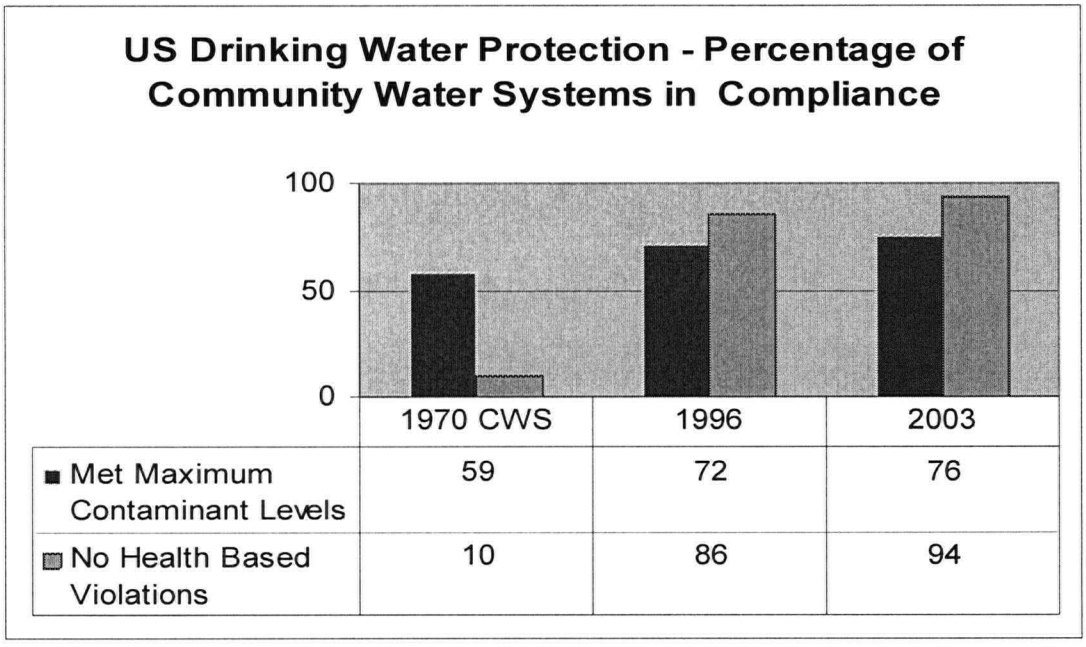
In New Orleans, we see significant improvements over time as, for example, cancer-causing total trihalomethanes are reduced from 780 parts per billion in 1974 to less than 80 parts per billion today. Similarly, while in 1974, the EPA released tests showing traces of 66 compounds in the New Orleans tap water with 15 of these being very toxic, 2 extremely toxic,

and 1 "supertoxic," nearly 30 years later in the year 2000 the entire state of Louisiana reported no violations of the maximum contaminant levels for chemicals regulated by the National Primary Drinking Water Standards. In Detroit, too, in order to meet federal regulations, water rates increase even in the face of considerable opposition from the suburbs. Owing to requirements for compliance with the Clean Water Act, Detroit's source water also improves with a federal judge overseeing the Detroit Water and Sewerage Department until very recently.

Furthermore, the application of the theoretical model is also helpful for understanding the US cases as prior to 1974 the states fail to impose costs not being at a distance from the costs. For example, the United States Public Health Service's Community Water Supply study of 1970 finds that only 10 percent of systems studied met the criteria for sampling. Prior to the introduction of binding national standards, ninety percent of systems did not take enough required samples or samples taken were of poor bacteriological quality or both (p.vii). Insufficient numbers of samples were taken in 85 percent of the cases (Ibid.). Moreover, in those systems that had records from the previous year, 48 percent had exceeded the coliform limits in at least one of twelve months on record (Ibid.).

From the perspective of public health there is little doubt the drinking water in all four cases is better today than it was in 1974. As Figure 7.1 below demonstrates, the percentage of public water systems that meet drinking water standards today is much greater than before the Safe Drinking Water Act. It should be noted that the data available in 1970 was significantly limited compared to that available in 2003. The 1996 and 2003 data cover all US community water systems while the 1970 Community Water Supply study focused on 969 systems that served varying populations of citizens. Figure 36 demonstrates that compliance has improved in recent years, especially with respect to health-based violations. The reader should also keep in mind that the standards required in 2003 are significantly more comprehensive than those of the US Public Health Service in 1970. Thus not only are more systems in compliance but they are complying with even tougher federal standards. Contaminants addressed in 1970 included coliform organisms, fluoride, lead, iron, total dissolved solids, manganese, sulfate, and nitrate. By contrast, meeting standards today includes testing for the approximately 90 contaminants and parameters of the National Primary Drinking Water Standards as well as requirements regarding information collection, surface water treatment, disinfectants and disinfection byproducts, total coliforms, lead and copper, and public reporting. With this in mind, the drinking water is no doubt more reliably good after binding national standards are introduced.

Figure 7.1: US Drinking Water Protection - Percentage of Community Water Systems in Compliance



Source: Compiled from United States Public Health Service. 1970. *Community Water Supply Study - Analysis of National Survey Findings.* Bureau of Water Hygiene. Environmental Health Services. Department of Education, Health and Welfare. July. And
United States Environmental Protection Agency. 1996. *Providing Safe Drinking Water in America – 1996 National Public Water System Annual Compliance Report and Implementation of the 1996 Safe Drinking Water Act Amendments.*. Washington, DC.; and
United States Environmental Protection Agency. 2003. *Providing Safe Drinking Water in America – 2003 National Public Water Systems Compliance Report.* Washington, DC. July.

In addition to imposition of costs, the effectiveness of the US model is due, in part, to its capability in uncovering hidden information. This is in several ways. First, the passage of binding standards resulted in a requirement to monitor. Municipalities, in order to demonstrate they were doing their jobs and following the regulations, had to report to the states who reported to the federal government. Regular reporting and monitoring was required to enforce the regulations. If the states failed to do their jobs, the federal government could step in and impose costs. In order to know when to do this and what costs to impose monitoring and reporting were needed. Second, amendments to the SDWA in 1996 required consumer confidence reports meaning public water systems had to provide reports of water quality to each user of their system outlining the maximum contaminant levels, violations, and explaining the source of their drinking water.

The surveillance function of the SDWA was identified early on. The US Public Health Service notes in the Community Water Supply Study (1970) that contaminant levels had been

determined without information on existing levels of contamination. The need to collect data in order to set future contaminant levels was recognized. Along these lines, a Canadian respondent noted that the lack of data collection in Canada means that sometimes parameters are set without knowledge of existing levels of contamination. The BC Provincial Health Officer's report on Drinking Water also noted a concern for information gaps with respect to the number of water systems and the number of water systems in compliance (2001). In the US, the passage of the US SDWA and the requirement that states monitor lead to the identification of water systems that were unknown to the states prior.

These differences in data collection support the second hypothesis that addresses the Canada-US comparisons. The argument is that:

> 2. *The United States can be expected to offer better drinking water protection than Canada as a result of binding national standards in the United States.*

In general, the case comparisons support the hypothesis that the US cases offer more reliably good drinking water than the Canadian cases. The high quality of drinking water in the US is the result of two main aspects: (1) the US model of multi-level accountability enables exposure of hidden information and (2) the US model of multi-level accountability involves imposition of costs where needed to enhance local service provision. When we compare Vancouver with Seattle we see that the willingness of the federal government to impose costs on Seattle results in expensive improvements to the system compared with Vancouver where without the occurrence of the Walkerton water tragedy, the local government might not have gone ahead with its plans for filtration. The Medical Health Officer noted that it took 16 years to get Vancouver to where it was at, and this was a 'response to Walkerton.' Seattle's determination not to comply provides support for the hypothesis as the EPA eventually forces Seattle to take action to improve its water system in order to meet federal standards. Moreover, in addition to advanced disinfection on the Cedar River system, Seattle received a compliance order from the EPA imposing considerable costs of $171 million with a timeline to cover all of its open reservoirs by 2019. Arguably, as a result of federal regulation, Seattle has also made a greater effort to monitor and address concerns with lead and copper leaching into the system than has Vancouver that is confronted with similar lead and copper issues. Finally, and in further

support of the hypothesis, evidence of waterborne disease in Vancouver is considerably more apparent than in Seattle, as well.

In Longview, as compared with Nanaimo, advanced filtration is in place and the turbidity levels are lower. Moreover, as in the Vancouver-Seattle case-comparison, evidence of waterborne disease is also higher in Nanaimo than Longview. To its credit, Nanaimo has made efforts to reduce the degree of hidden information by making water quality reports available on its website and holding public consultations.

The Montreal-New Orleans matched comparisons addressed great river sources. The findings from these two cases lend further support to the hypothesis as Montreal appears to have more contamination or potential for contamination in its system than New Orleans. New Orleans has had no boil water advisories during the five year period prior to Hurricane Katrina while several were issued in Montreal. Moreover, the Montreal case highlights the degree of hidden information at the local level. The Ministry in Quebec does not know all the systems and does not conduct inspections while the state Department of Health and Hospitals in Louisiana has seen that one of the benefits of the SDWA is its requirement to track water systems. In addition, while water quality reports are required to be issued to New Orleans residents on an annual basis, no similar requirement can be found in Montreal nor is it exercised. There is clearly a higher level of surveillance in the US case than the Canadian one. While with the passage of binding standards in 1984, Quebec arguably offered the greatest degree of protection within Canada pre-Walkerton, the water quality in Montreal still suffered episodes of concern including some loss of public confidence.

Compared with Toronto, Detroit demonstrates little difference in water quality though the small differences point to Toronto, suggesting acceptance of the null hypothesis for this set of matched cases. Detroit underscores that case selection should have also considered community capacity in addition to the variables of population (as a proxy for capacity) and source water (as a proxy for magnitude of the threat). Nevertheless, when the theoretical arguments are considered, some support for the hypothesis is evident. If we consider evidence of monitoring we find that in pre-Walkerton Toronto, the provincial Ministry was largely absent. We can recall, too, that when citizens through Pollution Probe and then the local public health board expressed concerns about the levels of chemicals found in Toronto tap water the Ministry responded by doing nothing even suggesting the costs of action were too high. Not only did the Ministry fail to monitor, it failed to impose costs when hidden information was exposed by local level authorities. In Detroit, by contrast, we see evidence of monitoring and enforcement. Moreover,

costs are imposed at the local level with water rates increasing 155 percent between 1972 and 1982. Thus while the water quality outcome of the Toronto-Detroit pairing does not appear to support this second hypothesis, the outcome is due to factors others than those controlled for within the study, specifically local community capacity. As noted in Chapter 1, this pairing should be viewed more tentatively as it relies on more secondary sources than the other case comparisons.

Taken together, the results of the paired comparisons generally point to the US cases offering more reliably good drinking water. In the next section, additional support for this hypothesis is provided as the degree of monitoring and opportunities for exposure of hidden information in the US cases are greater than those of the Canadian cases.

In order to address the third hypothesis, it is necessary to examine the Canadian cases cross-nationally and the US cases cross-nationally. The third hypothesis is indicative of arguments within the literature that argue federal-level involvement is welfare-enhancing. We would expect binding national standards to produce greater harmonization of standards, greater expectation that a citizen located in one American city who then relocates to another will be provided a similar high quality of drinking water. In the Canadian cities, we would expect more variation owing to variations in provincial standards and also as regulation is largely symbolic some municipalities may choose to spend in this policy area whereas others may not view it as a high priority. Local differences in source quality and other challenges may also contribute to differences in quality that would be overcome by binding national standards. The third hypothesis below is addressed in the sections 3 and 4 that follow:

3. *US cities offer greater consistency with respect to drinking water protection than the Canadian cities as a result of binding national standards.*

7.3 Multi-Level Governance in Canada: Comparing the Canadian Cases

Fragmentation both between and within Canadian provinces with respect to water policy has been noted (Hill et al 2005). Some of the greatest variation occurs with respect to drinking water protection. Both the type and form of legislation varies across provinces. If we examine provincial legislation, one of the only points of convergence is that all three provinces require operator certification post-Walkerton. Prior to Walkerton, and somewhat ironically, operator certification was only required in Ontario. Not surprisingly, Ontario's response to Walkerton was significant resulting in the development of the most comprehensive legislation in the country

surpassing the binding standards that had existed in Quebec since 1984. As Table 7.1 below demonstrates, while Quebec has had binding standards since 1984 and has required municipalities to report to the province it has not implemented compliance measures.

Moreover, across the three provinces, there is variation in the number and types of contaminant monitoring required. As a result, comparisons across provinces are difficult and surveillance is a challenge. Of the three provinces in the study, only Ontario appears to be willing to impose costs and only post-Walkerton. Under the auspices of its Chief Drinking Water Inspector, Ontario now publishes, on an annual basis, summaries of compliance orders and fines issued under the Ontario SDWA. The Ontario provincial government agreed to implement all the recommendations of the Walkerton Inquiry, enforcement among them. However, enforcement is costly both from a monitoring and cost-imposing perspective. How long this will last remains to be seen.

Table 7.1: Comparing Intergovernmental Regulation for Drinking Water Protection across Provincial Cases Post-Walkerton

	British Columbia	**Ontario**	**Quebec**
Legislation	Drinking Water Protection Act (2001) o Drinking Water Protection Regulation (2003)	Safe Drinking Water Act (2002) o Drinking Water Systems Regulation o Certification of Drinking Water Systems Operators and Water Quality Analysts o Ontario Drinking Water Quality Standards o Definition of Words Used in the Act o Definition of Deficiency and Municipal Drinking Water System o Schools, Private Schools and Day Nurseries o Drinking Water Testing Services Sustainable Water and Sewage Systems Act (2002) Ontario Clean Water Act (proposed in 2005, not yet enacted) Ontario Water Resources Act (regs. 1993, 1998, 2000, 2001) Nutrient Management Act (2002) Environmental Bill of Rights (1993)	Environment Quality Act (2005) o Regulation respecting the Quality of Drinking Water Public Health Act (2001)

	British Columbia	Ontario	Quebec
Number of Pages of Legislation	35 pages	251 pages	32 pages
Number of contaminants required to be monitored	3 bacteriological with additional at the discretion of the Drinking Water Officer	73 required including bacteriological, 70 chemical and no radiological with 161 total parameters	77 required including 41 organic, 4 microbiological, 17 inorganic as well as parameters such as turbidity and PH
Inspections	Permitted but not required; no annual inspections	Annual inspections; inspections can also be by surprise	Permitted but not required; rare
Annual Water Quality Report by Water System to Consumers	No but a provincial report is required	Yes, must be made available free of charge to the public	No

When Table 7.1 is compared with Table 7.2 one conclusion that might be drawn is the considerable impact of Walkerton in all three provinces. There is certainly some evidence of impact yet it should be noted that Quebec was already in the process of revising its water policy. For contrast, one of the interesting ways in which Walkerton appears to

have had little impact outside Ontario is with respect to public reporting on drinking water quality. It is neither required in British Columbia nor Quebec. In fact, outside Ontario annual public reports are only required in Saskatchewan and Newfoundland, and in both cases only in recent years. This lack of impact highlights the degree of hidden information within the system and the lack of desire to expose it for fear costs may need to be imposed.

Table 7.2: Comparing Intergovernmental Regulation for Drinking Water Protection across Provincial Cases - Pre-Walkerton

	British Columbia	Ontario	Quebec
Legislation	Health Act o Safe Drinking Water Regulation	Ontario Water Resources Act Ontario Drinking Water Objectives (non-binding)	Environment Quality Act (1984) o Regulation respecting Drinking Water
Number of Pages of Legislation	Less than 5 pages	97 pages (OWRA - much of it not specific to drinking water)	7 pages
Number of contaminants required to be monitored	3 with additional at discretion of Medical Health Officer	Ontario Drinking Water Objectives are non-binding	42 required
Inspections	Permitted but not required	Permitted but not required	Permitted but not required
Annual Report to Water System Consumers	No	No	No

The tables above provide helpful comparisons between the provinces in the study. Consideration of the provincial role cannot ignore the Federal-Provincial-Territorial Committee on Drinking Water Quality. All the provinces and territories participate in this committee as explained in Chapter 2. Multi-level governance by intergovernmental committee appears to offer (a) opportunities for information-sharing and (b) the possibility of a greater federal research role in supporting the provinces in standard development. However, the Canadian model lacks multi-level accountability and may offer watered-down standards (see Harrison 1996; Scharpf 1988). Moreover, as the Commissioner for the Environment and Sustainable Development has recently found, progress on guideline-setting is slow (2005).

Comparing water quality across the Canadian cases is difficult as reporting on water quality is neither transparent nor generally required. Thus data has been collected from different levels and corresponds to slightly different time periods. Nevertheless, the case studies suggest, over time, the water quality of all four cities has improved. Vancouver has seen some improvement with its re-chlorination efforts and can expect significant improvements after filtration in 2007. Montreal has an aging system that suffers from water main breaks which necessitate boil water advisories but for which the city has developed a plan to address. The province of Quebec took a leadership role in drinking water protection within the country by issuing binding standards in 1984 but with weak enforcement. This offers further support to the argument that a level of government above at a distance from the costs is a key factor for performance of drinking water protection policies. Toronto faced concerns with its drinking water quality in the 1980s with inaction on the part of the provincial Ministry. Toronto has improved the quality of its water even with the ministry being largely absent. In Nanaimo, efforts have been made to expose some of the hidden information through public consultations and posting information on the local website. Levels of waterborne disease remain high in the two British Columbia cities compared with their American counterparts.

While Toronto appears to stand out today due to its good quality water, the problems it faced in the 1980s drew the attention of environmental groups and the media. The Ministry's response was to suggest that "more evidence" of poor quality would be needed before actions could be taken. For the city of Toronto, which took it upon itself to improve its system, perhaps the challenges posed by the Lake Ontario source, open for business, recreation and drinking has made Toronto attentive. By contrast, Vancouver has not been as open to outside influences nor has its watershed been as open to threats. The major pipe break under a busy Montreal street in 2003 drew public attention to the problem and moved the out-of-sight out-of-mind concern to the

top of the local agenda in that city. Drinking water quality and related concerns have clearly been on the radar of local agendas from time to time but attention to these has not been sustained.

Within Canada, drinking water protection legislation varies significantly from province to province. Moreover, monitoring and enforcement also vary though the trend is largely weak enforcement frameworks where compliance is addressed, at all. Ontario post-Walkerton has implemented a comprehensive approach including an enforcement regime.

7.4 Multi-Level Governance in the US: Comparing the US cases

When we shift our attention from Canada to the US we see less variation across the US states and we also see more reliably good drinking water no matter which state one resides in. Citizens can expect the drinking water to meet federal standards no matter where they live. Moreover, they will receive water quality reports on an annual basis regardless of which utility is providing their drinking water. The hidden information is thereby clearly reduced.

Table 7.3: Comparing Intergovernmental Regulation for Drinking Water Protection across US States

	Louisiana	Michigan	Washington
Legislation	Title 51 of Louisiana Administrative Code - Part XII (2002) formerly Louisiana State Sanitary Code Water Supplies Updated and Revised 1988	Safe Drinking Water Act 1976 PA 399	Ch 70.119A RCW Washington Safe Drinking Water Act
Year Achieved Primacy	1988	1976	1976
Number of contaminants required to be monitored	National Primary Drinking Water Regulations (90 contaminants) plus several rules addressing surface water treatment, disinfectants and disinfection byproducts, total coliforms, lead and copper, and information collection	National Primary Drinking Water Regulations (90 contaminants) plus several rules addressing surface water treatment, disinfectants and disinfection byproducts, total coliforms, lead and copper, and information collection	National Primary Drinking Water Regulations (90 contaminants) plus several rules addressing surface water treatment, disinfectants and disinfection byproducts, total coliforms, lead and copper, and information collection
Inspections	Annual on-site inspections with Sanitary surveys at least once every 3 years (5 years for some systems); additional inspection as determined by the department	Sanitary surveys at least once every 3 years (5 years for some systems) with inspections as determined by department	Sanitary surveys at least once every 3 years (5 years for some systems) with inspections as determined by the department
Annual Report to Water System Consumers	Yes	Yes	Yes

In contrast to the Canadian examples, the American cases with respect to drinking water legislation offer much greater harmonization. This was the impact of the SDWA. In order to achieve primacy, states had to adopt legislation at least as stringent as that of the federal act. This effort involves lawyers and much discussion, back-and-forth between the federal level and state levels and is illustrative of the intergovernmental negotiations that characterize multi-level accountability. As noted in a previous chapter, some states that do not want to write their own legislation in full or in part can adopt "by reference" the SDWA sections. Adoption by reference probably accounts for the only significant difference among the legislation of the three states, the number of pages.

7.5 Comparing Canada and the United States

Key differences between the SDWA and Canadian Drinking Water Protection

Though on a national scale it is difficult to make comparisons as within Canada there is considerable legislative fragmentation, some key differences between the US SDWA and Canadian drinking water protection legislation more generally are noted by this study:

- source water assessments required (1996) in US
- filtration is required (1986) in US
- citizen suits in US (1974)
- public right-to-know reporting (1996) in US
- ongoing enforcement in US (1974)
- federal resources (1996) in US
- formal review (1986 and 1996, ongoing) in US

While the US SDWA source assessments go beyond what is required in most Canadian provinces, it should be noted that Ontario's recent introduction of the Clean Water Act for source protection as part of an integrated water management framework, if passed, will surpass the requirements of the SDWA.

Within the US, the requirement to filter since 1986 has posed a particular challenge in the case of Seattle. Compared with the US, only half of Canada's ten provinces require both disinfection and filtration in their drinking water legislation.[104] Filtration can filter out unwanted chemicals, other microbes or other kinds of waste that might be present in drinking water.

[104] These include Nova Scotia, Alberta, Saskatchewan, Ontario and Quebec. It should be noted that as PEI relies entirely on groundwater filtration may not be required on most supplies.

As noted throughout this chapter and this study, the hidden information within the Canadian system is considerable in comparison to the more transparent approach of the US. Indeed, the participation of Canadian citizens in drinking water protection is largely absent. By contrast, the USEPA encourages citizen participation especially but not limited to reporting to the public. Since 1996 every public water system has been required to provide a consumer confidence report annually to its users by July 1. Failure to do so can result in fines and will result in compliance letters from EPA. States often provide templates to help local systems comply with the order. Compliance with this amendment has been difficult to achieve but states have monitored and enforced this rule with considerable improvements in compliance. In addition, the ability of citizens to sue if the EPA fails to act is an important and vital aspect of the multi-barrier approach and not available in the same way to Canadian citizens

Enforcement has been the result of the introduction of the SDWA in the 1970s. The incentives at the state level changed. In order to keep primacy the states had to show they were doing their jobs as regulators.

In addition to the attention paid to enforcement and citizen participation, the federal level also began to provide some resources in 1996, in part in response to the labeling of the SDWA as an unfunded mandate that could be cancelled by Congress.[105] Drinking water state revolving funds were introduced and have been accessed by all three states in this study. These funds are not sufficient to cover all the costs of drinking water infrastructure and monitoring/surveillance activities. Moreover, it is important to emphasize with reference to the theoretical model that the federal level is neither required nor needed to provide funds yet can choose to do so. Imposition of costs within the model is distinct from resources provided. Multi-level accountability involves imposition of costs where necessary to improve local service provision, regardless of whether there are resources from above.

Finally, the SDWA has formal review periods. The National Primary Drinking Water Regulations must be reviewed every 6 years. Any changes must maintain or improve public health. This is part of the transparency created with a federal act. In order to ensure limits are put on the federal government and to ensure accountability, the SDWA is reviewed. Significant changes have been made since 1974. The SDWA has evolved over time and responded to criticisms. Moreover, its provisions have also been expanded to involve and inform citizens.

[105] The Unfunded Mandates Act passed in 1995 and allowed acts with state and local costs over $50 million to be stopped by a point of order raised in Congress. The point of order could be overruled by a majority, however. See Colby 2002.

What has emerged within the US is that the pipes are no longer simply under the ground, with water being quietly supplied to citizens' taps. Now water quality is in question, it is a goal, it is a consideration at three levels of government and by citizens and advocates.

By contrast, decentralization without citizen participation or involvement produces fewer opportunities for accountability. Federalism, by its nature, expands the scope of conflict and it also expands the possible actors. Limiting the actors in the name of avoiding duplication and overlap misses out on the wisdom of multi-levels - different actors can act at different times or play different roles.

"Trust but verify" was the expression used by one of the Seattle respondents to describe the relationships between levels of government for drinking water protection in the United States. The phrase offers a meaningful way to think about accountability. We know that regulation can be merely symbolic. Trusting government to follow through on implementation and enforcement of regulatory laws is naïve. Verification is good public policy. For drinking water, monitoring is the prescribed approach – a multi-barrier approach offers lines of defense in case something goes wrong at another level. As the Canadian and American cases suggest, verification occurs much more often in the US where accountability has been built into the system.

7.6 Theoretical Argument and Policy Relevance: Multi-level Accountability - Options and Opportunities for Canada

This work has argued that the federal level of government is uniquely positioned at a distance from the local level to be willing to impose costs while state-level governments are in proximity to the information hidden at the local level which can help improve service provision. I have applied a principal-agent framework to multi-level governance and have argued with respect to intergovernmental regulation that the particular form of principal-agent framework involving a three-level hierarchy can be termed 'multi-level accountability.'

I have considered three models to demonstrate this point and discussed how the models offer insight regarding the cases. Specifically, I have argued that drinking water quality and efforts to improve quality have been enhanced by the introduction of the SDWA in the US cases and that, in comparison with the Canadian cases, the US cases generally offer more reliably good drinking water. Further, I have examined the Canadian cases and found them to be more dissimilar to one another than the American cases are to each other. Thus, in relation to the three hypotheses, considerable evidence has been provided. Ultimately, the study demonstrates that

binding national standards enhance policy performance for drinking water protection. Finally, I have noted the limitations of this work and re-emphasize them here: (1) sample size (2) the challenge of comparing two countries (3) the variation in information between and across cases and (4) the interdisciplinary nature of the research. The work should be viewed with these limitations in mind.

The findings of this study suggest that Canada needs to do more to improve drinking water protection. In order to identify options for Canada with respect to drinking water protection, it is useful to consider the variables highlighted by multi-level accountability, and specifically, by the application of the principal-agent framework.

Table 7.4 highlights the two key variables that have been consistently emphasized throughout this work: hidden information and imposition of costs. Table 7.4 provides questions policymakers can ask that might be applied to other similar policy areas including public health, environmental protection and public safety and emergency preparedness.

Table 7.4: Factors of Multi-Level Accountability that Contribute to Policy Performance

Monitoring to Uncover Hidden Information	**Authority to Impose Costs**
• Which level of government can most effectively obtain hidden information? • Which level(s) of government(s) is/are paying attention to the problem or potential problems? How do we know? Have other levels been informed about the extent to which attention is being paid? • At what levels has research capacity been developed to address complex problems?	• Which level of government is most willing to impose costs? • Is authority exercised when necessary to solve problems? • Have adequate resources been allocated to the problem or in relation to potential risks? Do costs need to be imposed?

Federalism as multi-level governance can offer additional levels of protection if levels are involved or engaged in solving the problem whether by monitoring, imposing costs or service provision. Canadian federalism may not be well-suited to public health or environmental protection in its current form. A complete restructuring of the federation along American lines is not possible, of course, nor perhaps desirable. With much evidence presented on the importance of federal involvement and the need for multi-level accountability yet bearing in mind the unique nature of Canadian federalism, what can Canada do to improve drinking water protection? This section highlights that we may not be able to re-create institutional structures yet application and consideration of the principal-agent framework helps to identify missing elements and consider other means to develop or implement these. In this way, the research may also be relevant to policymakers. This points to an additional contribution of this work as there exists a considerable gap with the policy implementation literature having been criticized for being of little use to policymakers.

First, regulation of drinking water as a food under the Food and Drugs Act is an option for the federal government. Currently, the federal government is responsible for regulation of bottled water in Canada under this Act. The requirement within the Act that no one can sell food that contains "poisonous or harmful substances" is remarkably similar to early public health acts that stated the drinking water must be made potable. This research has demonstrated the need for standards and specificity in legislation. In contrast to Canada's Food and Drugs Act, the Quebec Regulation for Bottled Water specifically defines potable as "bacteriologically pure and contaminant free." The Food and Drugs Act is not prescriptive and is likely inadequate for the complexities of regulating public drinking water systems. Moreover, the federal government has not established binding standards for drinking water. The Guidelines are non-binding and neither for regulation of drinking water on native reserves nor for other areas of federal jurisdiction with respect to drinking water do binding national standards exist. To put this in perspective, prior to Walkerton, Ontario relied on non-binding drinking water objectives. These objectives only became binding standards after the Walkerton water tragedy.

Moreover, federal regulation alone may fail to address the concern of multi-level accountability. With just one level of government, the federal level, being relied upon to regulate public water systems, we cannot be sure of adequate protection. While the federal government may be willing to impose costs, it is arguably not close enough to the information to be able to regulate effectively. Unless some arrangement was made with the provinces, it is unlikely regulating drinking water as a food in Canada would get us closer to an enhanced multi-barrier

approach. The drinking water protection failure at Kasechewan suggests that the federal government acting as the lone regulator is inadequate. Furthermore, evidence of failure when there is merely intergovernmental regulation but not multi-level accountability can be found in the implementation of federal regulations for drinking water on aircraft in both Canada and the United States. In the US, the EPA alone is responsible where in Canada the federal government alone is responsible. In both cases, recent studies found that the drinking water quality on airplanes was often poor. Federal-direct regulation is beyond the scope of this work yet may offer an extension of the models proposed here. For the purposes of this study, federal regulation alone cannot be assumed to be effective nor is it likely to occur as the provinces are unlikely to cede this important jurisdiction involving an essential natural resource.

Introducing multi-level accountability in Canada is improbable at best as it would be viewed as top-down. Canadian federalism values equality over hierarchy and if asymmetry not asymmetry with respect to the federal role. What can governments do to enhance regulatory policy performance where a multi-level accountability arrangement is not possible?

Putting the province at a distance from costs by placing a regulatory agency in between or building a regional level of authority between the municipality and the province appears to be another option. Interestingly, consideration of this suggestion points to why the federal government may be uniquely positioned to impose costs. After all, provincial governments might expect to be blamed for imposing costs on municipalities, even with an agency between them and the expected electoral costs. The wisdom of the SDWA in the US may be that the level of government was added 'above' not 'below' thereby distancing the regulator from the local level. Adding a level in between the states and the municipalities may not have worked in the same way as the distance may be viewed as artificial. Moreover, this option is not something that provinces appear likely to agree to. For example, Ontario considered this option after Walkerton and decided not to implement it within its new complex drinking water regime. A similar option of creating a Drinking Water Protection Agency as the single lead agency for drinking water in British Columbia was rejected by the government though recommended by the Drinking Water Review Panel (2002) it had appointed.

Thus, rather than attempting to replicate the institutional structures, it may be helpful to consider the aspects highlighted by the principal-agent framework. Uncovering hidden information may be more realistic within the Canadian federation than imposition of costs, though information exposure will doubtless also prove challenging. There are two primary ways hidden information might be uncovered within this policy area in Canada to improve policy

performance: (1) Strengthening the Public's Position as Principals and (2) Strengthening the Knowledge Base regarding Drinking Water Protection.

(1) Strengthening the Public's Position as Principals

In light of current federal-provincial-municipal arrangements, there are two levels of interactions at which progress might be made: (a) federal-provincial and (b) provincial-municipal. With the agreement of the provinces, the Federal-Provincial-Territorial Subcommittee on Drinking Water Quality could issue an annual report on the state of drinking water in the Canadian provinces. This example of report-card federalism is likely to generate some public oversight that within a multi-level governance framework offers an additional level of protection/attention though arguably not as significant as a government-regulator. If an annual report was available, some citizens and drinking water advocacy groups might perform a monitoring role.[106]

Provincial-municipal activity that would further strengthen the public's position as principals involves passage of regulations requiring public water systems to provide an annual report on their drinking water quality. Reporting to citizens modeled on the US SDWA consumer confidence reports would serve to educate citizens about the source and quality of their drinking water. It would serve to uncover hidden information. This type of reporting also provides opportunities for environmental and other advocacy groups to pay attention to the problem and sound the alarm complementing opportunities that an annual report from the federal-provincial-territorial subcommittee may offer. Public reporting allows attention to be paid to the problem. It provides citizens with an opportunity to act as monitors by uncovering hidden information usually available only to experts or insiders.

(2) Strengthening the Knowledge Base regarding Drinking Water Protection in Canada

There are gaps with respect to research capacity within this policy area at perhaps all levels of government. Research capacity at the federal level has shown some promise in making a difference with respect to uncovering hidden information. Arguably, it did so in Vancouver. The federal-provincial-territorial subcommittee offers information sharing and is well-attended and participatory. It is also a committed working group and has a secretariat. More resources to build

[106] In British Columbia, the auditor general has already drawn attention to the problem of drinking water policy performance noting the significant gaps in information available. Auditor generals, however, cannot be relied upon to take on this role as they have many other significant responsibilities and would be unable to provide the monitoring required for accountability.

its research capacity provided there was some transparency would be a starting point. Interestingly, in the Report of the Commissioner for the Environment and Sustainable Development (2005) on the federal role in drinking water, it was noted that the budget for the unit responsible for the Committee on Drinking Water Quality has been reduced by Health Canada from 3.38 million to 2.7 million, a 20 percent reduction between 2001 and 2005. Obviously, more resources are needed so that attention can be paid to the problem of drinking water protection.

Drinking water protection in Canada would also greatly benefit from a Community Water Supply study. Over twenty years ago, the Federal Water Inquiry heard Dr. A.S Macpherson of Toronto Public Health argue that Canada needed a national survey of drinking water quality. This has not yet materialized. The US Public Health Service undertook such a study in 1970. As this work illustrates, the US study uncovered considerable hidden information and served as a baseline for moving forward. Canada has no baseline. We do not even know all the water systems in the country. The surveillance and data function that the federal government could provide or support is lacking. The Canadian Senate's Standing Committee on Energy, the Environment and Natural Resources (2005) heard two prominent Canadian scientists report that the federal government had significantly decreased its monitoring of water quantity and groundwater records. That committee described the federal government's role in water policy as "in retreat" (Ibid: 5). The federal government could work with the provinces and with researchers to improve drinking water protection by improving surveillance. There is little doubt this move would also be helpful in setting contaminant levels.

Along similar lines, the federal government could commit some funding to research addressing drinking water contaminants. In 1976, the US Congress gave two million dollars to universities, research institutes, and operating water utilities to "develop the technology needed to control economically the concentrations of carcinogenic contaminants in drinking water" (USEPA 1975:37). While the challenge of carcinogenic contamination persists, the US continues to play a role in finding solutions while Canada has been, to a great degree, a free-rider with respect to the US research enterprise in this area. Canada should do its part to address this pressing problem.[107] Concerns with chlorine byproducts persist as do problems with contamination from arsenic, and nitrates, for example.

[107] Even without ongoing dedicated federal funds for this field of research, Canada has developed some excellent researchers including Steven Hrudey, Peter Huck, Judith Isaac-Renton, and Pierre Payment, to name a few. With greater federal resources, much more capacity could be developed.

(3) Imposition of Costs and Provision of Resources

Uncovering hidden information will undoubtedly pose challenges yet remains important for demonstrating the commitments of the three levels of government to public safety in this vital policy area. Implementation of the other key aspect of multi-level accountability, imposition of costs, can be expected to be even more challenging. It is noteworthy that the Ontario government has included such actions in its post-Walkerton regulatory framework. In the absence of cost-imposition, provision of resources may improve policy performance in this area provided the resources are aimed at needed infrastructure improvements. Thus, two additional options for improving policy performance in this area relate to provision of resources via tied funding and imposition of costs at the local level to improve drinking water protection.

After Walkerton, Ontario legislators agreed to implement all the recommendations of the Inquiry. As outlined in Chapter 6, Ontario has adopted a complex regulatory framework including annual reporting that is a source to tap approach. While hidden information is clearly being exposed, the key question is the extent to which the province will continue to be willing to impose costs in the face of local-level opposition. Moreover, there is an expertise gap at the provincial level and questions about its ability to uncover hidden information. For example, in Toronto, the knowledge is primarily at the local level and that has been the case over time. There is a need within the Ministry to build its research capacity and expertise. The Advisory committee it has set up is a good starting point but it may want to take this further and involve additional experts within or as consultants to the ministry. Local level retirees may provide options especially as many of these local-level 'experts' are nearing retirement age. The author does not expect that Ontario's requirements for compliance are sustainable within the current model but supposes an impact of Walkerton could be its staying power.

Besides Ontario, only Saskatchewan has undertaken to implement annual inspections of water treatment facilities. This is in line with the argument that provinces lack the incentives to regulate especially with respect to imposition of costs. The unique situations in Ontario, and, to a lesser extent, Saskatchewan, are the result of attention focused on the problem due to significant illnesses that resulted in deaths from contaminated water.

With local governments needing funds for improvements but unwilling to impose significant costs on themselves, and the provinces lacking the incentives to do so, the federal government might consider spending in this policy area, and using tied funds in contrast to its usual approach. With respect to an agenda for cities, the federal government can live up to and expand its commitments to fund drinking water infrastructure. The city of Montreal, in particular, is

depending on this. Montreal, for its part, has already asked its citizens to pay some of the costs through additional municipal taxation.

None of these solutions alone is likely to be effective but some combination may be helpful. I am skeptical as to the extent to which any of these solutions would serve to meet the bar set by the SDWA and multi-level accountability. Nevertheless, efforts to enhance safe drinking water provision in Canada should be supported and these steps are informed by considerations about important variables with respect to policy performance.

7.7 Conclusion

When it comes to drinking water protection, Canada is not taking full advantage of multi-level governance. Seminal work by Martin Landau (1969) argued that redundancy in public administration offers some benefits. This work builds on his argument, to demonstrate that overlap and duplication, in this case, with respect to intergovernmental regulation, can lead to improved policy performance. Landau explained,

> ...redundancy serves many vital functions in the conduct of public administration. It provides safety factors, permits flexible responses to anomalous situations and provides a creative potential for those who are able to see it. If there is no duplication, if there is no overlap, if there is no ambiguity, an organization will neither be able to suppress error nor generate alternate routes of action (Ibid, p. 356).

The multi-barrier approach to drinking water protection is an example of reliability engineering which Landau relied on to make his classic argument. I argue in this work that multi-level accountability wherein governments regulate other governments in a three-level hierarchy and exemplified by the model of the US SDWA offers an extension of the multi-barrier approach to drinking water protection. By contrast, Canadian federalism has primarily been focused on who does what and has not paid much attention to the extent to which jurisdictional arrangements work well. Hidden information largely remains hidden in the system and costs are rarely imposed to improve service provision at the local level. This study had demonstrated that the US cases improved after introduction of binding national standards, the US cases offer more reliably good drinking water than the Canadian cases, and the US cases are more similar with respect to their regulatory frameworks than the Canadian cases. Furthermore, the study has argued that the federal government being at a distance from the costs is best positioned to impose costs while the subnational level of government is in proximity to the information held by municipal agents to

effectively uncover the hidden information. The model of multi-level accountability offered by the US SDWA is an innovation worthy of the attention of political scientists and policymakers interested in multi-level governance and policy performance.

BIBLIOGRAPHY

Advisory Commission on Intergovernmental Relations. *Regulatory Federalism: Policy, Process, Impact and Reform*. Washington. 1984.

Ankeny Robert. 2000. "Court condemns city management in wastewater treatment case" *Crain's Detroit Business.* 16 (7) February 14.

Anton Thomas J. 1989. *American Federalism and Public Policy - How the System Works.* Philadelphia: Temple University Press.

Aramini J., M. McLean, J. Wilson, R. Copes, B. Allen and W. Sears. 2000. *Drinking Water Quality and Health Care Utilization for Gastrointestinal Illness in Greater Vancouver.* Health Canada, Population and Public Health Branch. October.

Arrow, Kenneth. 1985. "The economics of agency" in J. Pratt and R. Zeckhauser, eds., *Principals and Agents: The Structure of Business*. Boston: Harvard University Press. pps. 37-51.

Associated Press Newswire, 2001. "Studies find dangerous lead levels in Hamtramch water" March 13.

Associated Press Newswire. 2002. "Detroit Water and Sewerage Department gets new director" June 13.

Associated Press Newswires. 2003. "Judge formalizes role of water consortium" May 5.

Bache Ian and Matthew Flinders. 2004a. "Themes and Issues in Multi-level Governance" in Bache Ian and Matthew Finders., eds., *Multi-level Governance*. New York: Oxford University Press.

Bache Ian and Matthew Flinders. 2004b. "Conclusions and Implications" in Bache Ian and Matthew Finders., eds., *Multi-level Governance*. New York: Oxford University Press.

Bakvis Herman and Grace Skogstad., eds., 2002.*Canadian Federalism - Performance, Effectiveness and Legitimacy.* Toronto: Oxford University Press.

Ball, Don 1978, "Professor to report in sewage suit" *Detroit News*, November 21.

Ball, Don 1979, "Young seeks help with sewage plant" *Detroit News,* March 22.

Ball, Don 1985, "City Paid for Water – how Detroit helped Suburbs Grow" *Detroit News.* February 3.

Ball, Norman R, William D Hurst, Robert F. Legget, Phyllis Rose, eds.,1988. *Building Canada – A History of Public Works.* Toronto: University of Toronto Press.

Banting Keith G. 1987. *The Welfare State and Canadian Federalism.* Kingston: McGill-Queen's University Press.

Barron, Robert 2003. "Nanaimo's self-sustaining water system" *Nanaimo Daily News.* September 5.

Barten Paul K. and Caryn E. Ernst. 2004. "Land Conservation and Watershed Management for Source Water Protection" *American Water Works Association Journal* 96(4) April. 121-135.

BC Cancer Agency. 2005. Regional Cancer Statistics 2003. Surveillance and Outcomes Unit. Population and Preventive Oncology. Andy Coldman, Norm Phillips and Sherry Reid. June.

BC Research Inc. 2000. *Greater Nanaimo Watershed Fertilizer Risk Assessment.* Prepared by Occupational and Environmental Risk Management Group for the City of Nanaimo. Nanaimo, British Columbia. Project No. 4-02-856. December 5.

Bendor, Jonathan B. 1985. *Parallel Systems: Redundancy in Government.* Berkeley: University of California Press.

Bennett Nelson 2001. "Bugs lurk, are hard to detect" *Nanaimo Daily News.* May 10.

Berry, A.E. General Manager Ontario Water Resources Commission on Water Pollution Problem in Ontario. 1960. "A Brief to the Committee on Mines, Forests and Waters of the House of Commons of Canada" May 9. Toronto: City of Toronto Archives.

Bertels S. and H Vredenburg. 2004. "Broadening the Notion of Governance from the Organisation to the Domain: A Study of Municipal Water Systems in Canada" *Journal of Corporate Citizenship* 15(Autumn):33-47.

Blabolil Sandee, Ines Cho, Scott Haenni, Joe Kuffler, Susan K. Leachi, Kara Little. 1997. "Environmental Crimes" *American Criminal Law Review.* 34(2): 491-554.

Black Edwin R and Alan C. Cairns. 1966. "A Different Perspective on Canadian Federalism" *Canadian Public Administration.* 9: 27-44.

Board of Control. 1908. *Report of the Vice-Chairman Board of Control, the Medical Health Officer and the Deputy City Engineer Re; Sewage Disposal and Water Filtration.* 18 May. City of Toronto Archives.

Bohn G 2002a, "Federal, BC cash goes to water plant" *Times-Colonist* December 7: F7.

Bohn G 2002b "Highway plan threatens to spark war over watershed: Seymour route would cost 3.85 billion - also faces political hurdles" *Vancouver Sun,* September 10.

Bordessa R and JM Cameron. 1980. "Sanitation, Water and Health: Two Centuries of Public Health Progress in Toronto" in Frank A. Barrett, ed., *Canadian Studies in Medical Geography.* No. 8.

Bradley, Lenore K. 1989. *Robert Alexander Long – A Lumberman of the Gilded Age*. Durham, North Carolina: Forest History Society.

British Columbia Medical Association. 1990. "BCMA policy resolutions relating to water quality and marine environments." Environmental Health Committee.

British Columbia Ministry of Health Services. 2005. Drinking Water Program Organization – Health Authorities.

British Columbia Ministry of Health Services. 2002. "New Plan to Deliver Safer Drinking Water" News Release 2002HSER0017. June 19.

British Columbia Office of the Auditor General. 1999. *Report 5: Protecting Drinking Water Sources.* Office of the Auditor General. Victoria. http://www.bcauditor.com/pubs/1998-99/report-5/water.pdf

British Columbia. Provincial Health Officer. 2001. *Annual Report of the Provincial Health Officer 2000. Drinking Water Quality in BC: The Public Health Perspective.* Victoria.

Brough, Redmon J. 1882. *Annual Report of the Engineer and Manager – City of Toronto, 1881.* Toronto: E.F. Clarke.

Brown, Jeff 2001, "Seattle Returns to DBO for Drinking Water Treatment Facility" *Civil Engineering* 71 (7):18.

Brown, Peter 1984, "Water-Sewer War pits City, Suburbs" *Detroit Free Press*. March 27.

Cain L.P. 1976, "Water and sanitation services in Vancouver: a historical perspective" *BC Studies*. No. 30.

Cairns Alan C. 1971."The Judicial Committee and its Critics" *Canadian Journal of Political Science.* Volume 4 No. 2. pp.s 301-345.

Cairns Alan C. 1977. "The Governments and Societies of Canadian Federalism" *Canadian Journal of Political Science.* Volume 10 No. 4 pps. 695-725

Canadian News Facts.2001. "Drinking water standards urged" July 17.

Cantor KP, R Hoover, P Harge, TJ Mason, DT Silverman, R Altman et al. 1987. "Bladder Cancer, Drinking Water Source and Tap Water Consumption : A Case Control Study" *Journal National Cancer Institute.* 79, pages 1269-79.

Cameron David and Richard Simeon. 2000. "Intergovernmental Relations and Democratic Citizenship" in Peters B. Guy and Donald J. Savoie. *Governance in the 21st Century - Revitalizing the Public Service*. Canadian Centre for Management and Development. Montreal: McGill-Queen's University Press. pps. 58-118.

Centre de securite civil de ville de Montreal. 2004. "Le plan integre sur l'eau potable" *Le Lien.* 10(3). Montreal: Ville de Montreal. P.4-5.

Chubb John E. 1985. "The Political Economy of Federalism" *The American Political Science Review.* 79(4). p.994-1015.

City of Nanaimo and Greater Nanaimo Water District. 2001. *H20 - Nanaimo's Most Precious Resource.* Nanaimo, British Columbia.

Cleveland E.A. 1932, "The water supply of Greater Vancouver" *Journal of the American Water Works Association.* 24(6):795-821.

Cobban, Timothy. 2003. "The Political Economy of Urban Redevelopment: Downtown Revitalization in London, Ontario, 1993-2002" *Canadian Journal of Urban Research.* Volume 12, No 2. pps. 231-248.

Commissioner of the Environment and Sustainable Development. 2005a. *Report of the Commissioner of the Environment and Sustainable Development to the House of Commons - Chapter 4 - Safety of Drinking Water - Federal Responsibilities.* Canada: Minister of Public Works and Government Services. Office of the Auditor General of Canada.

Commissioner of the Environment and Sustainable Development. 2005b. *Report of the Commissioner of the Environment and Sustainable Development to the House of Commons - Chapter 5 - Drinking Water in First Nations Communities.* Canada: Minister of Public Works and Government Services. Office of the Auditor General of Canada

Concerned Walkerton Citizens and Canadian Environmental Law Association. 2001. *Tragedy on Tap – Why Ontario Needs a Safe Drinking Water Act Volume 1: An Overview.* May 15.

Congressional Budget Office. 1995. *The Safe Drinking Water Act: A Case Study of an Unfunded Federal Mandate.* United States Government Printing Office: Washington, D.C. September.

Congressional Budget Office. 1997. *Federalism and Environmental Protection: Case Studies for Drinking Water and Ground-Level Ozone.* United States Government Printing Office: Washington, DC

Crain's Detroit Business. 2000. "Look at privatizing system" Vol. 16 No.7 p.8

Crain's Detroit Business. 2002. "Problem bigger than water deadbeats" September 9, page 9.

Cutler David and Grant Miller. 2005. "The Role of Public Health Improvements in Health Advances: The Twentieth Century United States" *Demography.* Volume 42 (1) pages 1-22.

Dahl Robert A. 1967. *Pluralist Democracy in America.* Chicago: Rand McNally.

Danielson Michael N., Alan M. Hershey and John M Bayne. 1973. *One Nation So Many Governments - A Report to the Ford Foundation.* Lexington: Lexington Books. DC Heath and Co.

Davies, Roger. 1971. "Le rapport 'explosif' du Quebec" *Water and Pollution Control.* March.

DeMara Bruce. 2002. "City water rates to rise 9%; More hikes likely, report suggests Proposal sought for TTC site" *Toronto Star.* December 2.

Demski Joel S. and David E.M. Sappington. 1987. "Hierarchical Regulatory Control" *The RAND Journal of Economics.* 18(3) p. 369-383.

Department of Health 2004, *Fact Sheet - Operating Permits for Drinking Water Systems*, Washington Publication, May #331-168.

Department of Works. 1913. *Report of the Commissioner of Works on the Extension of the Toronto Waterworks System.* Toronto: City of Toronto Archives

DeRouen TA and JE Diem. 1975. "The New Orleans Drinking Water Controversy: A Statistical Perspective" *American Journal of Public Health* 65, pages 1060-1062.

Deschamps G, S Primeau, R Mallet, JP Lafleur et C. Tremblay. 2001 La qualite de l'eau autour de l'ile de Montreal , 1973-2000. Montreal Service de l'environnement de la Communaute Urbain de Montreal et ministere de l'environnement du Quebec.

Detroit News. 2005. "Federal judge ending oversight of Wayne County sewer systems" June 3.

Detroit Water and Sewerage Department. 2001. *The First 300 Years.* Michael Daisy, Editor.

Detroit Water and Sewerage Department. 2003. *Retail Rate Comparison.* Detroit: DWSD Prepared by Black and Veatch.

Doer, Audrey. 1992. "Building new orders of government – the future of aboriginal self-government" *Canadian Public Administration* 40(2): 274-289.

Donnelly David, Shehrina Tabassum and Burkhard Mansberg. 2001. *Ebb and Flow of Environmental Enforcement in Ontario.* Canadian Environmental Defence Fund. www.edcanada.org/pub/Enforcement%20Paper.pdf

Downs Anthony. 1957. *Economic Theory of Democracy.* New York: Harper.

Drinking Water Review Panel. 2002. *Final Report: Panel Review of British Columbia's Drinking Water Protection Act.* February 13.

Dykstra, Rob. 1979. "St Lawrence River system 'melting pot of sewage and chemicals'" *Montreal Star.* March 10.

Economic and Engineering Services Inc. 1990. *Drinking Water Quality Improvement Plan – Final Summary Report Greater Vancouver Water District.* Bellevue, Washington.

Economic and Engineering Services. 1991. *Greater Vancouver Watershed Management and Evaluation and Policy Review. Final Technical Report.* September.

Egan M. 1998. "Regulatory Strategies, Delegation and European Market Integration" *Journal of European Public Policy* 7(4), p. 532-553.

Elrick M., Marsha Low and Alex Capeloto. 2002. Detroit Residents Argue for Change in Water System, as Waves Wash over Area. *Detroit Free Press.* September 26.

Environnement Quebec. 2002. *Politique Nationale de l'eau.* Quebec.

Environnement Quebec. 2003. *Bilan de la qualite de l'eau potable au Quebec Janvier 1995 – Juin 2002.* Quebec.

Epstein David and S. O'Halloran. 1999. *Delegating Powers: A Transaction Cost Politics Approach to Policy Making Under Separate Powers.* New York: Cambridge University Press.

Etkin, Alan. 1994. *When Common Sense Fails: Public Debate Over Watershed Management in British Columbia – A Case Study.* Simon Fraser University: MA Thesis. Unpublished.

Fafard Patrick C and Kathryn Harrison., eds., 2000. *Managing the Environmental Union, Intrgovernmental Relations, and Environmental Policy in Canada.* Kingston: McGill-Queen's University Press.

Federal-Provincial-Territorial Subcomittee on Drinking Water. 2002. *Summary of Guidelines for Canadian Drinking Water Quality.* April.

Federal-Provincial-Territorial Subcomittee on Drinking Water. 2002. *Summary of Guidelines for Canadian Drinking Water Quality.* April.

Ferguson Mark D and Neden DG 2001, "Greater Vancouver's Drinking Water Treatment Program" *Canadian Journal Civil Engineering* No. 28, pp.36-48

Fiorina M. P. 1977. *Congress: Keystone of the Washington Establishment.* New Haven: Yale University Press.

Fleury Marc-Antoine. 2003. "Unearthing Montreal's Municipal Water System – Amalgamating and Harmonizing Urban Water Services" *Faculty of Environmental Studies Outstanding Graduate Student Paper Series.* Vol.8(3). York University. June.

Friedman Jeffrey, ed., 1996. "Economic Approaches to Politics" in *The Rational Choice Controversy - Economic Models of Political Science Reconsidered"* New Haven: Yale University Press.

Fullerton, Kevin 2002, "Troubled Waters" *Seattle Weekly*, March 21, p.15.

Globe and Mail. 1984. "To Your Health - Is Toronto's Drinking Water Safe?" April 27. Editorial. P 6.

Goldstein, Susan T. , Juranek, Dennis D. , Ravenholt, Otto, Hightower, Allen W., Martin, Debra G. , Mesnik, June L. , Griffiths, Sean D. , Bryant, Angela J. , Reich, Rick R., Herwaldt, Barbara L.,. 1996. "Cryptosporidiosis: An Outbreak Associated with Drinking Water Despite State-of-the-Art Water Treatment" *Annals of Internal Medicine* Volume 124, pages 459-468.

Gorman Harold J. 2001. "Association of Metropolitan Water Agencies Testimony before the Subcommittee on Fisheries, Wildlife and Water, Committee on Environment and Public Works of the United States Senate" October 18.

Gostin LO, Zita Lazzarini, Verla S. Neslund and Michael T Osterholm. 2000. "Water Quality Laws and Waterborne Diseases: Cryptosporidium and Other Emerging Pathogens" *American Journal of Public Health.* 90 (6): 847-854.

Graham Mary. 1998. "Why States Can Do More - The Next Phase in Environmental Protection" *The American Prospect.* 36: 63-70.

Greater Vancouver Water District. 1994. "Minutes of a Meeting of the Greater Vancouver Water District Administration Board." June 29.

Greater Vancouver Regional District 2002, *Seymour-Capilano Project Definition Report – Executive Summary*, Prepared by Pacific Liaicon and Associates Inc., December.

Great Lakes Regional Collaboration. 2005. *A Strategy to Restore and Protect the Great Lakes* Draft Action Plan. July.

Hanna FA and SVW Isaacson. 1951. "Report on Nanaimo's Water Situation" December 28. Nanaimo Community Archives.

Harris R.C. 1913. *Report of the Commissioner of Works on Extension of the Toronto Waterworks System.* City of Toronto Archives.

Harrison Kathryn. ,ed., 2006. *Racing to the Bottom? Provincial Interdependence in the Canadian Federation.* Vancouver: UBC Press.

Harrison Kathryn. 2000. "The Origins of National Standards: Comparing Federal Government Involvement in Environmental Policy in Canada and the United States" in Patrick Fafard and Kathryn Harrison., eds., *Managing the Environmental Union, Intergovernmental Relations, and Environmental Policy in Canada.* Kingston: McGill-Queen's University Press.

Harrison, Kathryn 1996, *Passing the Buck: Federalism and Environmental Policy*, UBC Press, Vancouver.

Harrison, K. 1996b "The Regulator's Dilemma: Regulation of Pulp Mill Effluents in the Canadian Federal State." *Canadian Journal of Political Science* **29**: 469-496

Harrison, K. and G. Hoberg 1994, *Risk, Science and Politics: Regulating Toxic Substances in Canada and the United States.* Kingston, ON, McGill-Queen's University Press.

Hammond and Knott. 1996."Who Controls the Bureaucracy?: Presidential Power, Congressional Dominance, Legal Constraints, and Bureaucratic Autonomy in a Model of Multi-Institutional Policymaking" *Journal of Law, Economics and Organization.* 12(1). April pps. 119-166.

Health Canada. 2002. *From Source to Tap: The multi-barrier approach to Safe Drinking Water.* Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Environmental and Occupational Health. May 16.

Health and Welfare Canada. 1969. *Canadian Drinking Water Standards and Objectives.* Canada: Joint Committee on Drinking Water Standards of the Advisory Committee on Public Health Engineering and the Canadian Public Health Association.

Health and Welfare Canada. 1979. *Guidelines for Canadian Drinking Water Quality.* Canada: Federal-Provincial Working Group on Drinking Water of the Federal-Provincial Advisory Committee on Environmental and Occupational Health.

Higgins Mark 1994, "A Toast to Kriedler – With Cheap Water" *Seattle Post-Intelligencer*, September 22, p.B2.

Higgins, Mark 1995, "Watershed Land Swap Nears Completion" *Seattle Post-Intelligencer,* November 28, p.B1.

Higgins, Mark 1995, "City OKs outlay for Tolt River Project" *Seattle Post-Intelligencer* December 5, p. B2

Hill C. 2006. "Source Water Protection in Canada: Local Innovation and Multi-level Governance" in G. Bruce Doern., ed., *Innovation, Science, Environment - Canadian Policies and Performance, 2006-2007.* Montreal: McGill-Queen's University Press.

Hill C. 2004. Regulatory Federalism: A Comparative Study of Safe Drinking Water Policy Implementation in Vancouver, Canada, and Seattle, USA, Paper presented to the Canadian Political Science Association, June 5.

Hill Carey, Kathryn Furlong, Karen Bakker and Alice Cohen. forthcoming. "Appendix - Water Governance in Canada - A Legislative Review" in K. Bakker, ed., *Eau Canada: the Future of Canada's Water.* Vancouver: UBC Press.

Hill C. and K. Harrison. 2006. "Intergovernmental Regulation and Municipal Drinking Water" in G. Bruce Doern and Robert Johnson, eds., *Rules, Rules, Rules, Rules: Multi-Level Regulatory Governance in Canada.* Toronto: University of Toronto Press.

Hill C. and Harrison K. 2004. "Intergovernmental Regulation and Municipal Drinking Water" Paper presented to the Conference on Multi-level Regulatory Governance in Canada. Ottawa. October 27-28.

Hill James G. 2002. "Detroit-Area Officials, Consumers Complain about Proposed Water-Rate Increase." *Detroit Free Press.* February 8.

Hill Jeffrey S. and Carol S. Weissert. 1995. "Implementation and the Irony of Delegation: The Politics of Low-Level Radioactive Waste Disposal" *Journal of Politics* 57(2). P.344-369.

Hooks G. 1990. "The rise of the Pentagon and U.S. state building: The defense program as industrial policy. *American Journal of Sociology.* 96:358-404.

Hoxie N.J., J.P. Davis, J.M. Vergeront, R.D. Nashold and K.A. Blair. 1997. "Cryptosporidiosis-associated mortality following a massive waterborne outbreak in Milwaukee, Wisconsin" *American Journal of Public Health.* 87:2032-2035

Hrudey Steve E and Elizabeth J Hrudey. 2004. *Safe Drinking Water - Lessons from Recent Outbreaks in Affluent Nations.* United Kingdom: IWA Publishing.

Hume Stephen 2000, "BC leads way in disease attributed to drinking water" *Vancouver Sun.* June 10: B6.

Jessop Bob. 2004. "Multi-level Governance and Multi-level Metagovernance - Changes in the European Union as Integral Moments in the Transformation and Reorientation of Contemporary Statehood" in Bache Ian and Matthew Finders., eds., *Multi-level Governance*. New York: Oxford University Press.

Jones Charles O. 1975. *Clean Air - The Policies and Politics of Pollution Control.* Pittsburgh: University of Pittsburgh Press.

Jones, Elwood and Douglas McCalla. 1979. "Toronto Waterworks, 1840-77: Continuity and Change in Nineteenth-Century Toronto Politics" *Canadian Historical Review* 60(3). Pages 300-323.

Kahrer Gabrielle 1989, *The Seymour River Valley 1870s to 1980s A History of Resource Use* GVRD Parks Department.

Kassim, Hussein and Anand Menon. 2003. "The Principal-Agent Approach and the Study of the European Union: Promise Unfulfilled?" *Journal of European Public Policy* 10(1), p. 121-139.

Keating, Michael. 1984a. "Study of new water treatments urged" *Globe and Mail.* April 25, p M1.

Keating, Michael. 1984b. "Lack of political will to protect lakes, inquiry told" *Globe and Mail.* October 31, p. M5

Kerwin, James and Ball, Don 1979, "Judge orders sewage plan by Feb 1" *Detroit News*, January 13.

Kilian, Michael. 2002. "EPA chief sounds alarm on water for U.S., world" *Chicago Tribune.* March 28.

King WD and LD Marrett. 1996. "Case control study of bladder cancer and chlorination byproducts in treated water (Ontario, Canada)" *Cancer Causes Control* Vol 7, pages 596-604.

Kolb Carolyn. 2000. "Trickle by Trickle: Municipalization of the New Orleans Water System in the Nineteenth and Early Twentieth Centuries" Paper presented to the 25th Anniversary Meeting of the Social Science History Association, Pittsburgh, Pennsylvania, October 27.

Koontz, Tomas M. 2002. *Federalism in the Forest – National Versus State Natural Resource Policy*. Washington: Georgetown University Press.

Koop, Will. *Wake Up Vancouver: An Historical Outline of the Policies, Administration, Including Some of the Debates, Circumstances, and Controversies of the Greater Vancouver Watersheds*. Unpublished Report. 1993

Kosdrosky Ted 2003. Dollar signs get attention as cost of growth starts to weigh : SEMCOG pushes regional view of land use. *Crain's Detroit Business.* Vol 19 No 7, p 18. April 28.

Krewski Daniel, John Balbus, David Butler-Jones, Charles Haas, Judith Isaac-Renton, Kenneth J. Roberts, Martha Sinclair. 2002. *Managing Health Risks From Drinking Water - Walkerton Inquiry Commissioned Paper 7.* Ontario: Ontario Ministry of the Attorney General.

Laffont Jean-Jacques. 1990. "Analysis of Hidden Gaming in a Three-Level Hierarchy" *Journal of Law, Economics and Organization.* 6(2). p.301-324.

Lamb, John. 1914. *The Seattle Municipal Water Plant – Historical, Descriptive, Statistical.* Seattle Water Department.

Landy, Marc K. 1999. "Local government and environmental policy" in M. Derthick, ed., *Dilemmas of Scale in America's Federal Democracy*. USA: Cambridge University Press.

Landau, Martin. 1969. "Redundancy, Rationality and the Problem of Overlap and Duplication" *Public Administration Review.* 29(4). July-August. pps. 346-358.

La Presse. 1983. "Les municipalities devront assumer a leurs frais l'analyse de l'eau potable" 5 aout.

Lee Jeff. 1998. "GVRD postpones water projects" *Vancouver Sun.* January 31:A3.

Legislative Assembly of British Columbia. 2000. *Protecting Drinking Water Sources*. Select Standing Committee on Public Accounts Report.

Le Journal de Montreal. 1984. "Les Municipalities forcees de purifier leurs eaux" 29 mai.

Levin Ronnie B., Paul R. Epstein, Tim E Ford, Winston Harrington, Erik Olson, Eric G. Reichard. 2002. "US Drinking Water Challenges in the 21st Century" *Environmental Health Perspectives Supplements.* February. 110 (suppl 1): 43-52.

Lewis Sarah E. 1989. "The 1989 amendments to the Safe Drinking Water Act and their effect on Groundwater" *Syracuse Law Review*. Summer. 896-918.

Lindgren R.D. 2003. "In the Wake of the Walkerton Tragedy: The Top 10 Questions". *National Symposium on Water Law - Canadian Bar Association.* March 28 & 29.

Linteau, Paul-Andre. 2000. *Histoire de Montreal depuis la Confederation.* Quebec: Les Editions du Boreal.

Longview. 2003. *Water Quality Report.* City of Longview: Washington.

Lowry, William. 1992. *The Dimensions of Federalism – State Governments and Pollution Control Policies*. London: Duke University Press.

Lussier, Robert. 1970. *Allocution de l'Honorable Robert Lussier, m.d., Ministere des Affaires municipals.* A l'occasion du 8ieme congres annuel de L'Association quebecoise des techniques de l'eau. Montreal, le 20 Avril.

Lystra, Tony 2003. "Water Security may Soak City's Budget" *Longview Daily News.* July 17.

MacPherson Peter and Chris Tollefson. 2001. "A Fluid Situation: Evolving Drinking Water Law and Policy in British Columbia" *The Advocate*. 59:4 527-542. July

Magnusson Warren and Andrew Sancton. 1983. *City Politics in Canada.* Toronto: University of Toronto Press.

Marks Gary and Liesbet Hooghe. 2004. "Contrasting Visions of Multi-level Governance" in Bache Ian and Matthew Finders., eds., *Multi-level Governance*. New York: Oxford University Press.

Markusen James R. Edward R. Morey, and Nancy D. Olewiler. 1993. "Environmental Policy When Market Structure and Plant Locations are Endogenous" *Journal of Environmental Economics and Management* 24 (1): 69-86.

Markusen James R., Edward R. Morey and Nancy D. Olewiler. 1995. "Competition in Regional Environmental Policies When Plant Locations Are Endogenous" *Journal of Public Economics and Management* 56(1):55-77.

Mayne John. 1999. *Addressing Attribution Through Contribution Analysis: Using Performance Measures Sensibly.* Discussion Paper. Office of the Auditor General of Canada. June.

Mazmanian Daniel and Paul A. Sabatier. 1981. eds., *Effective Policy Implementation.* Lexington: Lexington Books.

McClenaghan Theresa and Darryl Finnigan. 2004. Protecting Ontario's Water Now and Forever – A Statement of Expectations for Watershed-Based Source Protection Planning from Ontario Non-Governmental Organizations. Canadian Environmental Law Association and Environmental Defence. November 10.

McCubbins, Mathew D. and Thomas Schwartz 1984, "Congressional Oversight Overlooked: Police Patrols versus Fire Alarms" *American Journal of Political Science* 28, pp.165-179.

McDougall Judge, JJ Mason, CF Hanson, Professor Galbraith and Edwin Jones. 1887. *Toronto Water Works Investigation.* Toronto: EF Clarke. City of Toronto Archives.

McKay Jennifer and Anthony Moeller. 2002. "Are mandatory regulations required for water quality in Australia?" *Water Policy* 4:2. p.95-118.

McWilliams, Mary. 1955. *Seattle Water Department History 1854-1954 Operational Data and Memoranda.* Seattle: Water Department. Dogwood Press,

Meier, Kenneth J., Polinard JL and Wrinkle RD, 1999, "Politics, Bureaucracy and Farm Credit," *Public Administration Review*, vol. 59 no. 4, pp.293-302.

Messina Edward J. 1995. "Filtration Avoidance Under the Safe Drinking Water Act" *Vermont Law Review*. 19, p.557-588.

Metro Toronto Department of Works. 1977. *Report on the Organization and Function of the Engineering and Planning Division.* City of Toronto Archives. RF2745.

Michigan Department of Environmental Quality. *Guide to DEQ Divisions and Offices.*

Michigan Department of Environmental Quality. 2001. *Annual Report to EPA on Capacity Development.* Drinking Water and Radiological Protection Division.

Miller Gary. 2005. "The Political Evolution of Principal-Agent Models" *Annual Reviews of Political Science.* 8. p. 203-225.

Mills Christina J, Richard J Bull, Kenneth P Cantor, John Rief, Steven E Hrudey, Patricia Huston and an Expert Working Group. 2000. "Workshop report – Health Risks of Drinking Water Chlorination Byproducts: Report of an Expert Working Group" *Chronic Diseases in Canada.* 19(3).

Moe, Terry M. 1984. "The new economics of organization" *American Journal of Political Science.* 28, p. 739-777.

Moe, Terry M. 1985. "Control and feedback in economic regulation: the NLRB" *American Political Science Review* 79, p.1094-1116.

Moe Terry M. 1987. "An assessment of the positive theory of Congressional dominance" *Legislative Studies Quarterly.* 12, p. 475-520.

Montreal Gazette. 1988. "Drinking Water going fast: poll" October 21. A4.

Montreal Gazette. 2000. "Boil water, officials say: Environment Minister targets 90 Quebec municipalities" Sean Gordon. August 19, p.A5.

Morris Robert D., Elena N. Naumova, Ronnie Levin, and Rajika L. Munasinghe. 1996. "Temporal Variation in Drinking Water Turbidity and Diagnosed Gastroenteritis in Milwaukee" *American Journal of Public Health.* 86(2): 237-239.

Morton, James W. 1970. *Capilano – The Story of a River.* Toronto: McClelland and Stewart Limited.

Mouldey Sarah Elizabeth. 1994. *Managing for Safe Drinking Water: A Review of Drinking Water Management in Alberta with Specific Reference to Calgary.* MA Thesis. University of Calgary.

Nagel Robert F. 2001. *The Implosion of American Federalism.* New York: Oxford University Press.

Nakamura Robert T and Thomas W. Church. 2003. *Taming Regulation - Superfund and the Challenge of Regulatory Reform.* Washington: Brookings Institution.

Nanaimo Community Archives. 1946. Letter dated February 18 from JM Hershey Director Central Vancouver Island Health Unit to Mayor and Alderman, City of Nanaimo.

Nanaimo Community Archives. 1943. Letter dated May 17th, 1943 from Department of Pensions and National Health AH Perry Public Health Engineering Division and H. Hackwood, City Clerk.

Nanaimo Daily News. 2001. "Water Safety Report Not Reliable: Lee" September 1.

Nanaimo Free Press. 1887. "Water! The Nanaimo Water Works Turned On" SM Robins. December 31. Nanaimo Community Archives.

Nanaimo Free Press. 1938. "The Water Works Project" July 6.

Nanaimo Free Press. 1939. "Boiled Water Makes Problem for Cafes and City Hospital" August 19.

Nanaimo Times. 1971. "Water Story Follows Nanaimo's History" AW Macdonald. July 21.

Nelson, Robert, ed. 1995. *Public Lands and Private Rights: The Failure of Scientific Management.* Maryland: Rowman and Littlefield.

Nelson, Robert. 1994. "The Murky Issue of Clean Water Focus of Debate – What's Clear Water in Seattle May Not Be to DC Lawmakers" *Seattle Times,* March 28: B1.

New Orleans City Business. 2000. "SWB Grapples with Budget, Efficiency Issues" January 10.

New York Times. 1974. "Dangerous Water" December 2, page 32.

New York Times. 1976."Utilities that Supply Water Raising Rates" March 17.

Noel, Alain. 1999. "Is Decentralization Conservative? Federalism and the Contemporary debate on the Canadian Welfare State" in Robert Young, ed., *Stretching the Federation: The art of the state in Canada.* Queen's University: Institute of Intergovernmental Relations.

North Battleford Commission of Inquiry. 2002. *Report of the Commission of Inquiry into Matters Relating to the Safety of the Public Drinking Water in the City of North Battleford, Saskatchewan.* The Honourable R.D. Laing, Commissioner. March 28.

Oates, Wallace E. 1972. *Fiscal Federalism.* New York: Harcourt, Brace and Jovanovich.

Oates, Wallace E. and Robert M. Schwab. 1996. "The Theory of Regulatory Federalism: the Case of Environmental Management" in Wallace E. Oates, ed., *The Economics of Environmental Regulation.* United States: Edward Elgar.

Oborne Bryan. 2005. "Saskatchewan Provincial Case Study Analysis of Water Strategies for the Prairie Watershed Region" Working Draft for Comment presented to the Prairie Water Policy Symposium. International Institute for Sustainable Development. September.

Ontario Ministry of Environment. 2005. *Progress Report on Ontario's Municipal Residential Drinking Water Systems 2003-2004 Results and Interim Results for 2004-2005.* Chief Drinking Water Inspector. May 31.

Ontario Ministry of Environment. 1998. *Drinking Water Surveillance Program - 1996-1997 Executive Summary Report.* Ontario: Queen's Printer. June.

Ontario Ministry of Environment and Energy. 1997. *Executive Summaries Report for 1993, 1994 and 1995 Drinking Water Surveillance Program.*

Ostrom Vincent. 1987. *The Political Theory of the Compound Republic: Designing the American Experiment.* Lincoln: University of Nebraska Press.

Payment Pierre, Aminata Berte, Michele Prevost, Bruno Menard, and Benoit Barbeau. 2000. "Occurrence of pathogenic micro-organisms in St. Lawrence River (Canada) and comparison of health risks for populations using it as their source of drinking water" *Canadian Journal of Microbiology* 46 (6), pages 565-576.

Patrick Robert J. 2005. "Protecting Drinking Water Sources and Public Health" *Longwoods Review* Vol 3 No. 3 p2-7.

Perkel, Colin. 2000. "Regulation won't protect water: critics" *St. Johns Telegram.* June 7:9.

Peterson, Paul. 1995. *The Price of Federalism.* Washington: Brookings Institution.

Peterson Paul and Mark C. Rom. 1989. "American Federalism, Welfare Policy, and Residential Choices." *American Political Science Review.* 83 (3). Pps. 711-28.

Peterson, Paul, Barry Rabe and Kenneth Wong. 1986. *When Federalism Works.* Washington: Brookings Institution.

Phelps, Myra L. 1978. *Public Works in Seattle – A Narrative History 1875-1975.* Roy W. Morse: Seattle Engineering Department.

Pierson, Paul. 1995. "Fragmented Welfare States: Federal Institutions and the Development of Social Policy." *Governance: An International Journal of Policy and Administration* 8, pps. 449-478.

Pollack M.A., 1997. "Delegation, agency and agenda-setting in the European Community" *International Organization.* 51(1). p.99-134.

Portney, Paul R. 1990. ed., *Public Policies for Environmental Protection.* Washington: Resources for the Future.

PR Newswire. 2000. "Detroit Mayor Archer Makes Advancements in His Role As Special Administrator of City's Sewerage Plant" February 23.

Prevost, Roland. 1962. "Elizabeth II aurait-elle bu l'eau polluee de Montreal?" *La Presse.* August 18.

Proulx Robert, Pierre Desmarais, Howard Brown, and Nathalie Periche. 2002. *Ville de Montreal Etude Comportant La Collecte d'informations et le Portrait Technique des Infrastructures de la Gestion Publique de l'eau Rapport Final.* Ville de Montreal: Consortium SNC Lavalin. Octobre.

Public Works. 1894-1972. *City Water Department Annual Reports.* Board of Public Works. Seattle, Washington

Rabe Barry G. 2002. "Permitting, Prevention and Integration: Lessons from the States" in Donald F. Kettl., ed., *Environmental Governance: A Report on the Next Generation of Environmental Policy.* Washington DC: Brookings Institution Press.:14-57.

Ray SM, SD Ahuja, MM Farley, M Samule, T Fiorentino, E Swanson, M Cassidy, JC Lay, T Van Gilder, Emerging Infections Program FoodNet Working Group. 2004. "Population-based surveillance for Yersinia enterocolitica infections in FoodNet sites, 1996-1998: higher risk of disease in infants and minority populations" *Clinical Infectious Diseases.* April 15; 38 Supplement: S181-9.

Regional District of Nanaimo. 1999-2004. Water Quality Reporting.

Regional District of Nanaimo. 2004a. "Drinking Water Quality Discussion Paper" April 30.

Regional District of Nanaimo. 2004b. "Drinking Water Quality Workshop Report" May 27.

Regional District of Nanaimo. 2004c. "Feedback Report – Drinking Water Quality Discussion Paper" May 31.

Riker William. 1962. *The Theory of Political Coalitions.* New Haven: Yale University Press.

Rosenau James M. 2004. "Strong Demand, Huge Supply: Governance in an Emerging Epoch" in Bache Ian and Matthew Finders., eds., *Multi-level Governance.* New York: Oxford University Press.

Rudnickas J. 2004. "A Review of the Regulatory Process in Post-Walkerton Ontario - A Utility Perspective" City of Toronto Department of Works and Emergency Services, paper presented at the 111th Canadian National Conference and 2nd Policy Forum on Drinking Water, Calgary, Alberta.

Sancton 1994. *Governing Canada's City Regions - Adapting Form to Function.* Montreal: Institute for Research on Public Policy.

Sancton, A., and Janik, T., 2002, "Provincial-Local Relations and the Drinking Water in Ontario," Walkerton Inquiry Commissioned Paper 3, Toronto, Ontario Ministry of the Attorney General

Sancton, Andrew. 2002. "Municipalities, Cities, and Globalization: Implications for Canadian Federalism" in Bakvis and Skogstad, eds., *Canadian Federalism: Performance, Effectiveness and Legitimacy.* Ontario: Oxford University Press.: 261-277.

Sanghyuk S, MS Shin, S Abbott, MC Samuel. 2005. "Epidemiology of Yersinia enterocolitica in the San Francisco Bay Arear, 1996-2003" Poster presented at the 43rd Annual Meeting of the Infectious Diseases Society of America, San Francisco: October 6-9.

Schaefer David 1992, "Politicians' Hidden Tug of War" *Seattle Times* October 18.

Scharpf, Fritz. 1988. "The Joint-Decision Trap: Lessons from German Federalism and European Integration" *Public Administration* 66: 239-278.

Schattschneider, E.E. 1960. *The Semi-Sovereign People: A Realist's View of Democracy in America.* Chicago: Holt, Rinehart, and Winston.

Scholz John T and Feng Heng Wei. 1986. "Regulatory Enforcement in a Federalist System." *American Political Science Review.* 80(4):1249-70.

Seattle - City Water Department.1936. *Annual Report*, City of Seattle Archives, Seattle Washington.

Seattle - City Water Department. 1944. *Annual Report.* City of Seattle. Superintendent W.C. Morse. Archives, Seattle Washington.

Seattle Public Utilities. 2001. *Water System Plan Update.* April.

Seattle Times 1996, "City's Clean Water Efforts Win Praise" *Seattle Times*, August 27, p.B2.

Sensel, Joni. 1999. *Traditions Through the Trees – Weyerhaeuser's First 100 Years.* USA: Weyerhaeuser Company.

Sewerage and Water Board of New Orleans. 1901. *Semi-Annual Report of the Sewerage and Water Board of the City of New Orleans, LA From December 1, 1899 to June 30, 1900.*

Sewerage and Water Board of New Orleans. 1901. Report of the General Superintendent.

Sewerage and Water Board of New Orleans. 1975. *Annual Report.*

Sewerage and Water Board of New Orleans. 2003. *The Sewerage and Water Board of New Orleans – How it Began, the Problems it Faces, the Way it Works, the Job it Does.* October.

Sewerage and Water Board of New Orleans. 2000. *Comprehensive Financial Report Year Ended December 31.*

Sierra Legal Defense Fund. 2001. *Waterproof – Canada's Drinking Water Report Card.* Prepared by Randy Christensen and Ben Parlin.

Sierra Legal Defence Fund. 2003. *Watered Down - A Report on Waterborne Disease Outbreaks in British Columbia.* Vancouver: Randy Christensen and Ben Parfitt.

Simeon Richard. 1972. *Federal-Provincial Diplomacy; the making of recent policy in Canada.* Toronto: University of Toronto Press.

Simeon, Richard. 2002. *Political Science and Federalism – Seven Decades of Scholarly Engagement.* Kingston: Institute of Intergovernmental Relations.

Simpson Scott. 2001. "Chasing microscopic enemies from our water supply" *Vancouver Sun,* October 23:A14

Simpson Scott. 2001. "Under pressure to take on silt: MHOs lead the drive to force the GVRD to change the treatment process" *Vancouver Sun.* October 23:A15

Simpson Scott. 2001. "GVRD told to toughen water standards: Move to cost an extra $25 a year on water bill" *Vancouver Sun.* May 16:A1.

Smith, F. Clifford. 1913. L'aqueduc de Montreal – son histoire pour la periode comprise entre l'annee 1800 et l'annee 1912. Montreal: Archives.

State of California. 2000. *California Morbidity – Foodborne Disease Active Surveillance Network (FoodNet).* California Site 1996-1998.

Stewart WH. 1975. "Editorial – Fact and Fancy about Drinking Water" *American Journal of Public Health.* 65, page 1111.

Sunstein, Cass R. 2002. "The Arithmetic of Arsenic". *Georgetown Law Review* July 90:7. p 2555-2310.

Swain Harry & Water Strategy Expert Panel. 2005. *Watertight - The Case for Change in Ontario's Water and Wastewater Sector.* Ministry of Public Infrastructure Renewal. Toronto, Ontario.

Tarlock A. Dan. 1997. "Safe Drinking Water: A Federalism Perspective" *William and Mary Environmental Law and Policy Review* 21: 104-182.

Taub, Shelley 2004, "Report of Select Committee of the Detroit Water and Sewerage Department Created by HR159 Section 8," September 20

Taylor Rob. 1994. "Upgrades Planned for Water System" *Seattle Post-Intelligencer,* February 11: C5.

Taylor Rob. 1996. "Seattle to get $600 Million Water System Upgrade" *Seattle Post-Intelligencer.* October 10.

Tiebout, Charles. 1956. "A Pure Theory of Local Expenditures" *Journal of Political Economy* 64(5): 416-24.

Times Picayune. 1973. "100 000 Gallons of Fuel spilled at Vicksburg" February 1.

Times Picayune. 1974. "SWB Executive Director Stuart H. Brehm Jr. ask EPA and LA Bureau of Environmental Health to sponsor a study to determine quantities of hydrocarbon compounds in Lousiana's treated water" July 8:1

Times Picayune. 1974. "Orleans Water Study Bill Ok'd" July 11., Section 002: 1

Times Picayune. 1974. "Safeguarding our Water" July 26. Section 1:16.

Times Picayune. 1974. "Water Report Preface" November 5. Section 1:14.

Times Picayune. 1974. "Treat Water, End 50 New Orleans Cancer Deaths Yearly - Study" November 8. Section 1:1.

Times Picayune. 1974. "Organics Total 66 in Water" Section 1:1.

Times Picayune. 1974. "Bottled Water Sales Flow" Section 1:4.

Times Picayune. 1974. "Mayor says he thinks Orleans Water is Safe; Sewerage and Water Board seeks $180,000 for Study" November 14. Section 1:19.

Times Picayune. 1974. "SDWA Passed" November 20.

Times Picayune. 1974. "New Orleans Water Ills Nation-wide" December 3. Section 1:16.

Times Picayune. 1978. "Water Rules to Cost New Orleans $50 million?" January 26.

Ting Michael M. 2003. "A Strategic Theory of Bureaucratic Redundancy" *American Journal of Political Science.* 47(2). pps.274-292.

Tocqueville, Alexis de. 2000. JP Mayer, ed., "The American System of Townships and Municipal Bodies" in *Democracy in America.* USA: Perrenial Classics.

Trudeau, Pierre Elliot. 1968. *Federalism and the French-Canadians.* Toronto: Macmillan.

Tuohy Carolyn Hughes. 1992. *Policy and Politics in Canada - Institutionalized Ambivalence.* Philadelphia: Temple University Press.

Turgeon Steve, Manuel J. Rodriguez, Marius Theriault, Patrick Levallois. 2004. "Perception of drinking water in the Quebec City Region (Canada): the influence of water quality and consumer location in the distribution system" *Journal of Environmental Management.* 70:363-373.

United States Environmental Protection Agency. 1975. *Preliminary Assessment of Suspected Carcinogens in Drinking Water: Report to Congress.* Office of Toxic Substances. December.

United States Environmental Protection Agency. 1997. *Water on Tap: A Consumer's Guide to the Nation's Drinking Water.* Office of Water. Washington, DC. July.

United States Environmental Protection Agency. 1999a. *Understanding the Safe Drinking Water Act – Celebrating 25 Years Protect Our Health from Source to Tap.* December.

United States Environmental Protection Agency. 1999b. *25 Years of the Safe Drinking Water Act: Protecting Our Health from Source to Tap.* Office of Water.

United States Environmental Protection Agency. 1999c. "October 1997-September 1998 – Cases in Review." *Water Enforcement Bulletin.* 15. April.

United States Environmental Protection Agency. 2000. *Providing Safe Drinking Water in America – 2000 National PWSs Compliance Report.* Washington, DC. July.

United States Environmental Protection Agency. 2001. *State Strategies to Assist Drinking Water Systems in Acquiring and Maintaining Technical, Managerial, and Financial Capacity: A Comprehensive Summary of State Responsibilities to Section 1420(c) of the SDWA.* July. EPA 816-R-01-019.

United States Environmental Protection Agency. 2002. *Providing Safe Drinking Water in America – 2000 National Public Water Systems Compliance Report.* Washington, DC. July.

United States Environmental Protection Agency website. 2003.www.epa.gov/safewater. Tuesday, April 29.

United States Environmental Protection Agency Region 5. 2003. *A Plan for Achieving the Agency's Goals and Objectives in Region 5 2004-2006.*

United States Public Health Service. 1970. *Community Water Supply Study - Analysis of National Survey Findings.* Bureau of Water Hygiene. Environmental Health Services. Department of Education, Health and Welfare. July.

Vancouver Archives 1942a, Letter dated November 10, 1942 from WC Mainwaring, Chairman of the Advisory Council Provincial Civilian Protection Committee to E.A. Cleveland, Chief Commissioner, Greater Vancouver Water District.

Vancouver Archives 1942b, Letter dated November 26, 1942 in reply from Chief Commissioner E.A. Cleveland, Greater Vancouver Water District to WC Mainwaring, Chairman of the Advisory Council Provincial Civilian Protection Committee.

Vancouver Archives 1942c, Letter dated December 3, 1942 from Engineer, Greater Vancouver Water District to Dr. L.S. Klinck, President, University of British Columbia.

Vancouver Archives 1946, Letter dated February 19, 1946 to Editor of "Water and Sewage", Toronto Canada from Chief Engineer, Greater Vancouver Water District.

Vancouver Province. 1905. *Refuses Lease of Capilano Lands – Government Turns Down the Proposal.* April 7.
_____. 1951. *Squamish Road Start in '52 Opposed by Water Board.* September 6.

Vancouver Sun. 1942. *Ottawa's Sham Fight Against Sham Bacteria.* October 6.
_____. *Mass Rally Sunday to Fight Edict – City Council's Attitude Stiffens in Line with Cornett.* October 7.
_____.*'Not Good Enough for Ottawa' - 'Recognized' Water Standards Ignored'.* October 8.
_____. *Politicians Plan to Educate Public on Doped Water.* October 22.
_____. *What Goes on Behind the Scenes.* October 23.
_____. *A Doctor on Chlorination.* October 23.
_____. *Treatment Only for Duration.* November 26.
_____. *Chlorination Out of Court.* November 30.

Viessman Jr. Warren and Mark J. Hammer. 1993. *Water Supply and Pollution Control Fifth edition.* USA: HarperCollins College.

Wall Street Journal. 1974. "Mississippi River cited by New Study for Cancer Deaths – Louisiana Tests Pose National Questions About Drinking Water, Private Group Says" November 8.

Walker Jack. 1969. "The Diffusion of Innovations among the American States" *American Political Science Review.* 63(3), pps. 880-99.

Walker, William 1994. "Water plants fail to meet standards Ontario's auditor finds problems at treatment sites serving 1 million" *Toronto Star.* November 16, p. A1.

Walkerton Commission of Inquiry. 2002. "Chapter 13: Legislative, Regulatory and Policy Framework." Toronto: Publications Ontario

Walkerton Commission of Inquiry. 2002. "Chapter 15, Part 2: First Nations and Drinking Water" Toronto: Publications Ontario.

Washington Department of Health. 2003. "The Health of Cowlitz County" Deaths for Chronic Diseases. Centre for Health Statistics.

Washington State Cancer Registry. 2000-2002.

Waterman Richard W and Meier, Kenneth J, 1998, "Principal-Agent Models: An Expansion" *Journal of Public Administration Research and Theory* vol. 8 no. 2, pp.173-202.

Watts, Ronald. 1999. *Comparing Federal Systems* 2nd edition. Kingston: Institute of Intergovernmental Relations.

Weaver, R. Kent. 1986. "The Politics of Blame Avoidance" *Journal of Public Policy* 6(4): 371-98.

Wilson, Duff 1993, "Bacteria in City Water Brings EPA Call for Filters" *Seattle Times* March 27, p.A1.

World Health Organization. 2003. Guidelines on Drinking Water Quality. Third edition. www.who.int/water_sanitation_health_GDWQ/Updating/3rdedition.htm

Wright Deil S. 1985. "Models of National/State/Local Relations" in Laurence J. O'Toole Jr. *American Intergovernmental Relations* Washington: Congressional Quarterly Inc. USA.

Yin Robert K. 2003. *Case Study Research - Design and Methods.* London: Sage Publications. Third Edition.

Young Robert A, Philippe Faucher and Andre Blais. 1984. "The Concept of Province-Building: A Critique" *Canadian Journal of Political Science* 17(4): 783-818.

Young Robert A. 2005. *Public Policy in Municipalities Project Overview.* Accessed at http://www.ppm-ppm.ca/projectoverview.asp.

Zubel Marc. 2005. *Overview of the Fraser Health Authority Drinking Water Program.* Fraser Health. April.

Zu Erpen Meyer. 1985. *Towards an Understanding of the Municipal Archives of 19th Century British Columbia: A Case Study of the Archives of the Corporation of the City of Nanaimo, 1875-1904.* Master of Archival Studies Program Unpublished Thesis. University of British Columbia

Appendix I - Copy of Ethics Certificate

The University of British Columbia
Office of Research Services and Administration
Behavioural Research Ethics Board

Certificate of Approval

PRINCIPAL INVESTIGATOR	DEPARTMENT	NUMBER
Harrison, K.	Political Science	**B03-0245**

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT

UBC Campus ,

CO-INVESTIGATORS:

Hill, Carey, Political Science

SPONSORING AGENCIES

Social Sciences & Humanities Research Council

TITLE :

Safe Drinking Water - Federalism and Implementation

APPROVAL RENEWED DATE	TERM (YEARS)	AMENDMENT:	AMENDMENT APPROVED:
JUN 1 1 2004	1	May 31, 2004, Study location	JUN 1 1 2004

CERTIFICATION:

The protocol describing the above-named project has been reviewed by the Committee and the experimental procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval of the Behavioural Research Ethics Board by one of the following:
Dr. James Frankish, Chair,
Dr. Cay Holbrook, Associate Chair,
Dr. Susan Rowley, Associate Chair
Dr. Anita Hubley, Associate Chair

This Certificate of Approval is valid for the above term provided there is no change in the experimental procedures