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# Unintentional Influence: Exploring the Relationship between Rural Regional Development and Drinking Water Systems in Rural British Columbia, Canada

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## Abstract:

Rural drinking water systems face a number of challenges, not the least of which is a growing infrastructure deficit. While age and investment are typically highlighted as key factors influencing the infrastructure deficit, other pervasive challenges remain for rural drinking water systems in British Columbia, Canada. This raises the question of whether factors influencing the infrastructure deficit extend beyond those typically captured in the literature. The purpose of this paper is to examine the relationship between rural regional development and drinking water systems in order to provide a historically and theoretically informed lens on the relationships between the two and how these links influence present day challenges. The authors aim to temper the presentism that often characterizes current debates surrounding the infrastructure deficit and to frame current drinking water system challenges within a more contextually-informed and regionally integrated framework.

Keywords: drinking water; infrastructure; staples theory; rural; regional development

## 1.0 Introduction

Drinking water systems are critical infrastructure, providing a service that impacts the economy, the environment, and quality of life. However, drinking water systems in British Columbia (BC), Canada, face a range of challenges, including aging infrastructure, inadequate treatment infrastructure, difficulty retaining certified operators, and a lack of financial resources (Health Protection Branch, 2013; Ministry of Health Planning & Ministry of Health Services, 2002; Office of the Provincial Health Officer, 2011). These challenges are recognized as being particularly problematic in rural areas in BC, as well as across rural Canada and North America (American Water Works Association, 2001; Maxwell, 2008; Minnes & Vodden, 2014).

Unsurprisingly, drinking water systems are recognized as part of Canada's 'infrastructure deficit', defined as the gap between current investment levels and

what is needed to maintain and upgrade existing infrastructure assets, excluding any additional investment necessary to address new infrastructure requirements (American Water Works Association, 2001; Coad, 2009; Federation of Canadian Municipalities, 2012a, 2012b; Kennedy, Roseland, Markey, & Connelly, 2008; Markey, Connelly, & Roseland, 2010; Meligrana, 2003; Mirza, 2007; Roy, 2008; Ryser, Markey, & Halseth, 2014). Literature discussing the 'infrastructure deficit' typically highlights influencing factors like infrastructure age and decreased investment (Burleton & Caranci, 2004; Federation of Canadian Municipalities, 2012a, 2012b; Kennedy et al., 2008; Mirza, 2007; Roy, 2008). Despite targeted federal and provincial (re)investments in infrastructure, problematic drinking water systems remain a pervasive issue in rural BC, exemplified by ongoing water advisories (Interior Health Authority, 2013, 2014a, 2014b, 2014c). This raises the question of whether the factors influencing the present challenges faced by rural drinking water systems extend beyond those typically captured by the 'infrastructure deficit'.

The purpose of this paper is to examine the relationship between regional development and drinking water systems in order to apply a historically and theoretically informed lens to the development of rural drinking water systems in rural BC. By offering this perspective we aim to make two contributions to the current discourse: a) to temper the presentism that often characterizes current debates surrounding the infrastructure deficit; and b) to frame current drinking water system challenges within a more contextually-informed and regionally integrated framework. Through this approach we offer a lens that is informed by the past, with a better understanding of where infrastructure challenges come from, how they developed, and how this contextually and historically informed perspective might assist with solutions.

Our theoretical framework focuses on rural regional development and staples theory. We apply this framework for two reasons. First, drinking water systems do not exist in isolation from the communities they serve, raising questions about the relationship between drinking water systems and regional development. And second, staples theory provides a robust theoretical foundation that encompasses the development trajectory of rural resource-based communities in BC and across Canada. We apply this framework to a case study of drinking water systems in rural BC, specifically the Kootenay Development Region, which exemplifies both the aforementioned challenges surrounding drinking water systems, as well as characteristics typical of other rural regions across the country. The paper begins by providing an overview of the literature framing this research: staples theory, regional development, the infrastructure deficit, and drinking water systems. This is followed by a presentation of the research methods and case study region. Next we present our findings, followed by our conclusions and implications for future research. The research upon which this paper is based is part of a larger cross-Canada investigation into rural regional development entitled *Canadian Regional Development: A Critical Review of Theory, Practice and Potentials.*

## 2.0 Literature Review

### *2.1 Staples Theory and Rural Regional Development*

Within the context of our research, staples theory provides a foundational explanation for understanding how rural regions in BC developed. Staples theory

provides a common thread throughout different periods of rural regional development[1], and helps to identify some of the challenges associated with staples-led development including infrastructure development and renewal.

In BC, as with the rest of Canada, the underlying driver of regional development has been natural resource (i.e., staple) extraction and exploitation (Barman, 1996; Drache, 2014; Goldberg, 2004; Innis, 1930; Mel Watkins, 2007). Innis' staples theory offers an explanation of this pattern of development, describing the focus on natural resource exports as the leading economic driver, and recognizing the regional differences created by the varied spatial distribution of natural resources (Innis, 1930; Nelson, 2004; Pomfret, 1993; Watkins, 1963). Staples theory is described as both a framework for analyzing political, social, and economic history, as well as an explanation of economic growth (Watkins, 1963). Staples theory is noted as the most common, albeit not the only, approach to Canadian economic development, beginning with its initial application to cod and fur, and evolving in application to timber, wheat, minerals, hydroelectricity, and oil and gas (Pomfret, 1993). From a rural perspective, the staples-led development described by staples theory resulted in overreliance on single industries, providing periods of growth but eventually leading to economic instability, weak adaptive capacity, and overexploitation of resources (Clapp, 1998; Gunton, 2004; Markey, Pierce, Vodden, & Roseland, 2005).

From confederation to World War II (WWII) there was no explicit regional development policy in BC or Canada. In the absence of a regional development policy, exploration and settlement in rural BC was ad hoc, directed by the availability of natural resources as explained by Innis' staples theory (1930). As a result of the lack of explicit and coordinated development approaches, combined with other factors (e.g., small population), initial rural regional development in BC was minimal (Barman, 1996; Conway, 2006). Disparities between regions were initially noticed during the depression of the 1930s, however explicit attempts to address these disparities did not begin until after WWII (Polèse, 1999).

Explicit regional development became a priority in the post WWII period, as attention turned to the previously identified regional disparities, highlighting a need to address gaps in income and unemployment, as well as identifying opportunities for growth (Beaumier, 1996, 1998; Savoie, 2003; Weaver & Gunton, 1982). Consequently, the federal government adopted a centralized, top down regional development approach, establishing government bodies like the federal Department of Regional Economic Expansion (Beaumier, 1996; Polèse, 1999; Savoie, 2003; Weaver & Gunton, 1982). As these top down approaches to development arose, both the federal and the provincial governments deliberately and explicitly focused on staples-led development.

The BC provincial government, under the WAC Bennett government, also took a largely centralized, top down approach to addressing disparities within the province, in particular the targeted opening up and development of rural BC (British Columbia Ministry of Community Sport and Cultural Development, n.d.-a; Markey, Halseth, & Manson, 2006, 2008; Pringle, 2011; Tomblin, 1990). While the Province used resource development in rural areas to fund ongoing province building, they also

[1] For the purposes of this paper, regional development is defined as taking a territorial approach to planning and development, and while the focus is often driven by an economic imperative, development is understood to take a comprehensive perspective, including social and environmental dimensions.

invested in rural areas, creating strong links between staples-led economic development and social development, resulting in tight relationships between rural regions and resource development (Markey et al., 2008).

In the 1960s federal advisors attempted to reject the staples model in favour of pursuing a more diversified economy (Fairbairn, 1998; Weaver & Gunton, 1982). To some degree there was a shift to secondary production in Canada, as new regional development programs and policy instruments were instituted and certain parts of the country (e.g., Ontario) focused increasingly on the manufacturing sector (Douglas, 2013; Fairbairn, 1998; Polèse, 1999; Weaver & Gunton, 1982).

Regional development also changed, having remained a priority into the 1970s with continued belief that regional disparities could be addressed through centralized, top down approaches (Beaumier, 1996; Polèse, 1999). However, toward the end of the 1970s it became apparent that the federal government could not "solve" the issue of regional disparities. This perceived failure, combined with other factors such as the 1980s recession, resulted in the dismantling of the centralized, top down federal approaches to regional development (Beaumier, 1996; Markey, Manson, & Halseth, 2007; Polèse, 1999; Savoie, 2003). Similarly in BC, the end of the Bennett era and the beginning of a new political era in the 1970s indicated a transition to a new approach to development. However, regardless of efforts to shift the economy and changes in development approach, natural resource extraction remained the economic foundation of BC, a continuation of staples-led development.

### *2.2 Rural Restructuring and the Regional Resurgence*

The post WWII 'long boom' was a thirty year, relatively stable period of deliberate staples-led regional development (Weaver, 1982; Hayter 2000). However, beginning with the recession of the early 1980s, there is reasonable consensus surrounding a thirty year period of restructuring where development shifted away from regional approaches and much of the established hard and soft regional development infrastructure from the long boom was dismantled (Beaumier, 1996, 1998; Polèse, 1999; Savoie, 2003). This restructuring reshaped the rural landscape through changes in investment patterns, governance, policies, and programs (Beaumier, 1996; Fairbairn, 1998; Savoie, 2003).

During this period of restructuring there is evidence of continued changes in development approaches, as well as both deliberate and unintentional attempts to shift away from staples reliance (Howlett & Brownsey, 2007; Markey et al., 2005; Nelson, 2004; Pomfret, 1993). This shift has been used to challenge the use of staples theory to describe the Canadian economy (Markey et al., 2005; Weaver, 1982; Watkins, 1963). However, even as the federal development approach shifted from a regional to sector-based perspective, the emphasis on natural resources continued (Beaumier, 1996; Weaver & Gunton, 1982). Any shifts away from staples products were primarily through urban diversification, as opposed to in rural areas where there remained a persistent reliance on a staples-based economy (Howlett & Brownsey, 2007; Nelson, 2004; Weaver & Gunton, 1982). Arguably, a continued focus on staples-led development continues today in BC. However, a clear change has been the shift away from strong, top down government leadership (Drache, 2014; Storey, 2010).

Tighter fiscal policies prompted the downloading of responsibilities from upper to lower levels of government. Responsibilities traditionally held by senior

governments increasingly shifted to local governments, who struggled with the dismantling of senior government and industry-oriented supports that had closely linked rural communities to resource development (Bish & Clemens, 2008; Polèse, 1999). As communities increasingly found themselves 'on their own' in terms of development there was a transition toward more decentralized, bottom up, context driven development approaches (e.g., Community Economic Development) (Barrett, 2004; Beaumier, 1996; Fairbairn, 1998; Polèse, 1999; Savoie, 2003).

Development programs and policies, once directed from the upper levels of government, could now be seen coming from multiple levels (Markey, 2011). Globalization, decentralization, deregulation, privatization, establishment of free trade agreements, improvements in technology, and many other factors resulted in changes to regional development approaches (Macleod, 2001). This period also saw the rise of concepts such as sustainable development[2] and resilience[3], inviting the inclusion of environmental and social values into what had been traditionally economic development (Folke, 2006; Roseland, 2000). During this period there was a broadening of the term development, to extend beyond economic and to focus on change as opposed to strictly focusing on growth (Roseland, 2012).

Despite these changes, the restructuring era in BC was largely characterized by deregulation and multiple, short-term, failed development projects (Markey et al., 2005). This period of restructuring saw government cutbacks, downloading, and overall changes in governance structure. However, staples theory remains important as an economic explanation, albeit differently than in the past. Restructuring brought a disruption of past regional development approaches, as well as changes to the relationships between rural regions and natural resource industries where despite its continued importance, the social contract that tied resource development to social development fragmented (Markey et al., 2008). During the long boom staples-led development closely linked regional and community development to the resource industry. Under restructuring, without a strong federal or provincial rural development plan guiding the process, the dominance of natural resources favoured private wealth accumulation (Drache, 2014).

Recently regional development has seen somewhat of a resurgence of interest in academic and policy discourses given the potential for regionalism to address issues of scale and capacity associated with processes of rural restructuring. Where rural communities face unique challenges related to factors like distance, economies of scale, and capacity (e.g., financial or human ability) in dealing with the impacts of political (e.g., senior government withdrawal of services and support) or economic (e.g., industrial flexibility) restructuring, regional development offers a potential counter to some of these limitations through collective action (British Columbia Water and Waste Association, 2013; Ivey, de Loë, & Kreutzwiser, 2006; Robins, 2007). Collaboration within a region can improve the ability to meet challenges and, conversely, a lack of collaboration is linked to disparities between communities, as

[2] For the purposes of this paper sustainable development is understood broadly as meeting the needs of the present without compromising the ability of future generations to do so (World Commission on Environment and Development, 1987).

[3] For the purposes of this paper resilience is defined as the "capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources" (Martin & Sunley, 2014, p13).

well as acting as a barrier to development (Markey & Heisler, 2011; Reimer, 2009). Regional-scale efforts are also critical for addressing the challenges of fragmented governance stemming from, "the allocation of responsibility for governance among multiple actors and/or agencies, with relatively little or no coordination" (Hill, Furlong, Bakker, & Cohen, 2008: 316). The negative impacts of fragmented governance on our ability to manage water has been well documented (Bakker & Cook, 2011; Bakker, 2007).

While this research focuses specifically on the relationship between regional development and infrastructure, it is important to acknowledge that the shifts in regional development are linked to overarching changes in governance and the economy (Bish & Clemens, 2008; Pomfret, 1993), which is captured within the literature on rural restructuring (Markey et al., 2008; Ryser et al., 2014).

### *2.3 Rural Regional Development, Infrastructure, and Drinking Water Systems*

Infrastructure can be broadly defined as the built systems that connect communities to the goods and services needed to function and maintain or improve quality of life (Edwards, Bowker, Jackson, & Williams, 2009; Pollalis, Georgoulias, Ramos, & Schodek, 2012). Any development is accompanied and supported by critical infrastructure (Baldwin & Dixon, 2008; Vining & Richards, 2001). The design and quality of infrastructure can impact the economy, the environment, and quality of life (Baldwin & Dixon, 2008; Markey et al., 2010; Markey, Halseth, & Manson, 2012; Meligrana, 2003; Mirza, 2007). The direct links between regional development and infrastructure explain the specific focus of this research on changes in rural regional development, as opposed to changes in governance or the economy.

Within the context of the above discussion of regional development, there is a clear role played by infrastructure. For example, during the minimal pre-WWII development, infrastructure (e.g., transportation infrastructure) was a factor limiting the development that occurred (Barman, 1996). Following WWII during the long boom, regional development was supported by aggressive infrastructure building campaigns, such as Prime Minister Diefenbaker's 'roads to resources' campaign and, at the provincial level, Premier WAC Bennett's 'province building' (Markey et al., 2006; Tomblin, 1990). These infrastructure investments closely linked with staples theory, as infrastructure systems were designed to facilitate natural resource extraction, as well as closely link regions to resource industries (Weaver & Gunton, 1982). With the period of restructuring that followed the context surrounding this infrastructure changed, with decreased investment impacting the hard infrastructure itself (Beaumier, 1996, 1998; Polèse, 1999; Savoie, 2003). This change exposes the temporary nature of infrastructure that was put in place during the post-war period. Despite these changes, staple products remain important economically in rural regions, but without the social link between rural regions, upper levels of government, and industry.

This period of restructuring saw a decline in infrastructure investment as well as the aforementioned downloading of responsibilities to local levels of government which, combined with factors like infrastructure age, resulted in the rise of the 'infrastructure deficit' (Mirza, 2007). This gap between current investment levels and what is needed to maintain and upgrade existing infrastructure assets is a critical challenge across Canada, rural and urban alike, although rural areas face a different set of barriers as a result of factors like demographics, as well as financial capacity

and economies of scale (Coad, 2009; Federation of Canadian Municipalities, 2013; Kennedy et al., 2008; Markey et al., 2010; Meligrana, 2003; Mirza, 2007; Roy, 2008; Ryser et al., 2014).

While the above discusses infrastructure generally, drinking water systems are often left out of this discussion. Within this research drinking water systems were selected as a vehicle to further explore how the historical trajectory of staples-led rural regional development has linked with infrastructure, and how this link has helped shape the present conditions and contributed to current challenges (e.g., the infrastructure deficit). Drinking water systems are among the infrastructure systems providing a critical service to society (American Water Works Association, 2001; Government of British Columbia, 2001).

For much of this history British Columbia's Department of Municipal Affairs was responsible for assisting local governments with service provision, including drinking water provision (Bish & Clemens, 2008; British Columbia Ministry of Community Sport and Cultural Development, n.d.-b, n.d.-c, n.d.-d). Municipalities and regional districts were largely in charge of services such as drinking water, with some Provincial controls in place in terms of licensing and quality standards (Bish & Clemens, 2008). Prior to 1992 water quality was regulated under the *BC Health Act* as part of sanitary regulation, which addressed water quality but not infrastructure (Office of the Provincial Health Officer, 2007). BC brought in new standards and regulations with a new *Drinking Water Protection Act* in 2001, the *Action Plan for Safe Drinking Water* (2002), and the *Drinking Water Protection Regulation* (2003) (Office of the Provincial Health Officer, 2007). These established regulations, standards, monitoring, and other critical features of drinking water provision. However, the application of standards and regulations is often at the discretion of Drinking Water Officers, and can differ based on size and governance, as well as other factors (e.g., source).

Presently, the governance and regulation of drinking water system in BC is complex. In terms of system size, water systems are divided into large (serves over 500 people in a 24 hour period) and small (serving up to 500 people in a 24 hour period) (Government of British Columbia, 2003). Small systems are particularly common in rural areas (Office of the Provincial Health Officer, 2000). In terms of governance, drinking water systems can be managed by local governments (e.g., municipalities or regional districts), single service providers (e.g., improvement districts or water users' communities), First Nations, or individuals (Government of British Columbia, 2003).

### *2.4 Literature Summary*

This paper pulls together multiple bodies of literature and both areas of overlap and gaps are used to help identify our findings. Several key themes are critical. Staples theory allows us to understand the important and continuous role of natural resources in rural areas. Initially this was uncoordinated, but during the long boom staples-led rural regional development was deliberate and economic and social development was tightly linked. However, restructuring resulted in changes, including a severing of ties between natural resource industries and communities, as well as decreasing investment in infrastructure systems – all of which created weakness at the local level. Weakened individual communities were ill prepared for restructuring and its repercussions, particularly given their staples dependency and concordant weakness in other areas of their economy. The timing also coincides with the ageing and

degradation of much of the original infrastructure, presenting additional fiscal challenges. Regionalism has resurfaced in the literature as a way to potentially construct redefined relationships within a region and with senior levels of government in an attempt to collectively address these weaknesses. Its integrated perspective moves beyond a traditional dichotomy of top down, or bottom up to seek new co-constructed relationships to address development needs and opportunities. Drinking water systems, despite their importance, are largely absent from much of this narrative, prompting further investigation.

## 3.0 Research Methods

As noted in the introduction, our research builds on the work of a four-year cross-country project, *Canadian Regional Development: A Critical Review of Theory, Practice and Potentials (Canadian Regional Development)*, investigating how Canadian rural regional development has evolved over the past two decades and the degree to which Canadian regional development systems have incorporated new regionalism into their policy and practice (Vodden, Markey, Douglas, & Reimer, 2015). This project used a mixed methods case study approach in order to study the complexity of regional development efforts in practice (Berg, 2009; Gregory, Johnston, Pratt, Watts, & Whatmore, 2009; Yin, 2003). For this overarching project four case study regions from across the country were chosen based on a set of characteristics typical of rural Canada:

- clearly delineated region with overlapping jurisdictions and sub-regions to reflect rural regional complexity;
- remoteness relative to major decision-making centres and major urban influences;
- accessible via ground transportation networks;
- historically natural resource based economy;
- low population density; and
- sparse population.

By using characteristics reflective of rural Canada, the case study findings are more likely to be generalizable and transferable to other locations that share similar characteristics.

Of these four overarching case study regions our research is a more in-depth exploration of an identified topic within one region, the Kootenay Development Region (the Kootenays - see Section 4). Findings from the *Canadian Regional Development* project identified water and drinking water systems as a prevalent topic in the Kootenays (Breen, 2012). As our research builds on these findings, the same case study area and approach were maintained. Various data sources were used to ensure a complete, well-rounded picture, as well as allowing for the cross referencing of data (Eisenhardt, 1989; Morse & Richards, 2002; Yin, 2003). Data sources included: a literature review of academic and government documents (e.g., historic documents, regulation, legislation, policy, plans); field observations; and targeted semi-structured interviews. Data sources were examined qualitatively, providing a narrative of the linkages between several complex subjects (Morse & Richards, 2002).

Over a four year period (2011-2014), we conducted 44 semi-structured interviews with 49 people[4], representing different branches of 32 agencies[5] (see Table 1). Interviewees were identified through a targeted internet search of relevant regional agencies (e.g., local and regional governments, provincial policy and regulatory bodies, supporting agencies, etc.). Interviews were requested via phone and email, and the majority of the resulting interviews were in person. Agencies were contacted until there was representation across the region, both geographically and in terms of agency type. Interviews followed a pre-determined question and topic guide, informed by relevant literature. Questions were open ended and the semi-structured interview process allowed for questions to reflect the specific context of each organization.

Table 1. *Interviewee Details*

| **Agency Level** | **Agency Type**[6] | **Interviewee Type** | **Interviewee Count** |
|---|---|---|---|
| Federal | Funding | Director | 1 |
| Provincial Government | Regulatory<br>Policy<br>Support (funding, program) | Resource officer<br>Director | 9 |
| Provincial Non-Government | Economic Development<br>Support (funding, program) | President<br>CEO<br>Project Manager | 3 |
| Regional Non-Government | Development<br>Support (funding, program)<br>Facilitation | Manager<br>Executive Director<br>CEO | 2 |
| Local Elected Officials | Municipality<br>Regional District Electoral Area | Mayor<br>Regional Board Member<br>Council | 13 |
| Local Government | Public Works<br>Economic Development<br>Utility Services<br>Development Services<br>Environmental Services<br>Engineering Services<br>Recreation<br>Planning & Development Services | Foreman<br>Director<br>EDO<br>Supervisor<br>Manager | 15 |
| Local Non-Government | Economic Development<br>Support (funding, program) | Team leader<br>Manager<br>Coordinator<br>CEO | 5 |

[4] Two interviews included multiple interviewees.
[5] Multiple interviews were conducted within single agencies. For example, within a regional district interviews could include planning, engineering, environment, elected officials, etc.
[6] Interviewees were assured confidentiality and due to the rural nature of the study area the names of agencies cannot be listed as interviewees would be easily identifiable given the limited number of such positions.

Of these interviews, 32 were focused on regional development broadly and 12 were drinking water system specific. Regional development interviews broadly explored themes of regional development as defined by the *Canadian Regional Development* project. These interviews identified drinking water and drinking water systems as prominent issues, highlighting various challenges, as well as providing regional context. Water specific questions focused on themes of a) history, b) jurisdiction, c) policies and programs, and d) governance. The interviews focused on drinking water systems were intended to fill gaps within the initial interviews, as well as in the literature, providing a better understanding of the drinking water systems in the Kootenays and exploring the links with development.

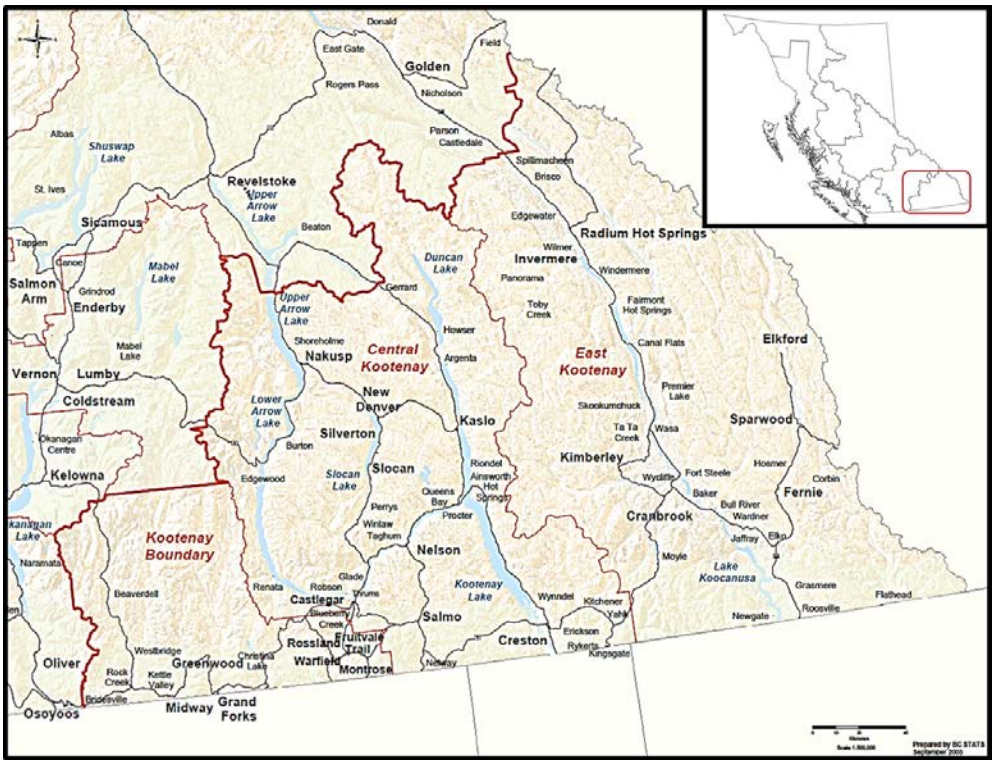
Interviews were recorded and transcribed for analysis. Qualitative content analysis of the interviews combined detailed coding based on existing theory and structural codes determined by specific knowledge gaps in the existing literature (DeCuir-Gunby, Marshall, & McCulloch, 2010). NVivo qualitative analysis software was used to code and analyze interviews. An explanation building technique was used (Yin, 2003) to explain the links between development and drinking water systems. As this research stems from a larger project, discussion and review of the analysis occurred with other team members. Due to the in-depth exploratory nature of the interviews our intention is to provide an explanation that serves as a basis to inform policy, as well as serve as a foundation for future investigation.

## 4.0 Case Study: The Kootenay Development Region

The Kootenay Development Region is 57,786.6 $km^2$ (6.2% of BC) (BC Stats, 2012a) (see Figure 1). Western exploration and settlement of the region began in the 1800s and was natural resource (staples) focused, predominantly mining and forestry, but also including recreation based on natural amenities (Parks Canada, 2009; Stevenson et al., 2011). Presently, the region is characterized by small, rural settlements and a dispersed, but stable population (~146,264 or 3% of the provincial population) (Statistics Canada, 2012). The closest major population centres (e.g., Calgary AB, Vancouver BC, Kelowna BC, and Spokane WA) are outside the region. Unemployment in the region is higher than the provincial average and employment in manufacturing and trade is dominant, particularly related to natural resource extraction, which remains economically important to the region (Baxter, Berlin, & Ramlo, 2005; BC Stats, 2012b, 2013).

Beyond the findings of the *Canadian Regional Development* project, the Columbia Basin Trust's Water Smart program also identified infrastructure as a key challenge (Hamstead, 2014). Drinking water systems vary within the region. In terms of size, the case study region includes both small and large water systems. In terms of governance, the region includes drinking water systems governed by local governments (e.g., municipalities or regional districts), single service providers (e.g., improvement districts or water users' communities), First Nations, and individuals (e.g., wells). Additionally, systems vary based on water source, treatment type, and other factors. A formal public inventory of Kootenay drinking water systems does not exist. The regional health authority, Interior Health Authority (IHA), estimates that there are 123 large water systems (serving 80% of the population) and 1,800 known small water systems (which service 20% of the population) in the IHA region, which includes, but extends beyond the Kootenays (Norlin, 2014).

*Figure 1:* The Kootenay Development Region.




Source: BC Stats, (n.d.).

The scope of this research includes both small and large drinking water systems governed predominantly by local government, but including single service providers. The focus on local government drinking water systems is a result of these systems being easily identified, as well as corresponding with the government agencies identified through the initial *Canadian Regional Development* project. In the absence of an inventory, small, single service providers are difficult to identify, however, several interviews discuss single service drinking water systems, necessitating their inclusion. This research includes drinking water systems with both surface and ground water sources, although surface water systems are more prevalent. While there are First Nations communities within the region, as a result of differences in management and jurisdiction these systems are considered outside the scope of this research as are single users (e.g., individual wells).

## 5.0 Research Findings

The above literature review details the changes in regional development in rural areas. We see the continued importance of staples theory, but a distinct shift in terms of how staples-led development is related to community and regional development – from a tightly-knit relationship following the war to the disconnection we see today. As part of this we see the rise and fall of infrastructure, from an integral part of the post war development period to today's infrastructure deficit. Our research explored this narrative through the specific lens of drinking water systems. The following section presents the results of this research, identifying and exploring the relationship between the regional development that shaped the region and drinking water systems, as informed by staples theory and regional development. We provide

our findings in two sections: (i) the historical narrative surrounding drinking water infrastructure, and (ii) related challenges and complicating factors.

### *5.1 Historical Regional Development and Drinking Water Systems*

In the Kootenay region drinking water systems corresponded to the period of regional development discussed in the literature review. Interviewees provided case study specifics to the otherwise generalized story of rural BC found in the literature (see below).

*Early regional development and initial water system establishment.* Much of rural BC was explored and settled prior to WWIII, including the case study region. Initial development (e.g., settlement) is difficult to separate from infrastructure (Vining & Richards, 2001). As noted above, development during this period was largely ad hoc and lacking an explicit development policy. The minimal development that occurred was, in part, due to the limiting role of infrastructure. Regardless of the limitations surrounding other infrastructure systems (e.g., transportation) one ubiquitous necessity is a source of drinking water. One local interviewee noted that:

> One of the standard comments that I've oft used is that nobody forms a community so that they can have a finance department. Not gonna happen. So usually a community is formed as a result of either a legal issue – somebody shooting up somebody. Or B – we got no water or the water is poisoning us and people are dying. Or C – the one that is almost as common in BC is our waste water / septic pits are contaminating the potable water and making people sick. So when you understand that as a basic core for forming local governments then you can see where some of the legislation has come from.

While development policy lacked direction, drinking water was the most frequent service requested of local governments (Bish & Clemens, 2008). BC's Department of Municipal Affairs was established to assist local governments, including local level responsibilities such as drinking water provision (Bish & Clemens, 2008; British Columbia Ministry of Community Sport and Cultural Development, n.d.-b, n.d.-c, n.d.-d). While individual systems (e.g., wells) were common at the time, multi-user water systems were also established, some of which remain today. Two interviewees were able to trace their municipal water system to this era, and parts of this original system remain in use today. For example, one local interviewee indicated that:

> … I had the [water system] documents from roughly 1925. There have probably been 3 water systems that the city has operated with, starting in 1895 or so… The majority of the pipes in town… the large majority of them were well over 50 years old. And some of them up to 80, 90, and some of them up to 100.

It was the physical geography of the Kootenays that drew development, however the physical geography also played a role in the pattern of drinking water systems. The region is remote and mountainous, with multiple, small settlements strategically dispersed across the region, each of which required drinking water. As a result, the Kootenays are anecdotally said to have thousands of water systems, mostly small systems, likely more than any other part of the province. Interviewees indicated that

these systems were built independently by community members and maintained/expanded by volunteers as needed.

During the resource boom that followed WWII the deliberate, top down, approach to regional development included strategic planning of and investment in critical infrastructure systems (Beaumier, 1996; Savoie, 2003). WWII to the 1960s was referred to as the 'Golden Age' of infrastructure investment in Canada (Federation of Canadian Municipalities, 2012a; Harchaoui, Tarkhani, & Warren, 2003; Infrastructure Canada, 2011). During this era roads were built, railways expanded, company towns established, and so on, with many of these efforts focused on opening rural regions for large scale resource extraction (Markey et al., 2006; Pringle, 2011; Tomblin, 1990). These investments created strong ties between communities and natural resource industries.

As rural regions developed further, so too did drinking water systems. In the Kootenays interviewees pointed to this as the dominant time period for the construction of drinking water systems in the region, largely as a result of investment from the province as well as industry. New systems were driven by the creation of new communities, the relocation of existing communities (e.g., the building of the Columbia River dams and subsequent flooding resulted in the relocation and construction of several new community water systems in compensation), and the arrival of new industry to communities requiring system upgrades to supply industry needs (e.g., mills). Connections between communities and industry, at least in terms of the physical infrastructure systems, remain today, as described by one local interviewee:

> What we are working with right now is kind of a unique system. We don't own the pumps, the pulp mill owns the pumps. They provide us pressure to our water treatment centre. We share an intake with the pulp mill.

*Restructuring and afterward***.** With the period of restructuring in the 1980s, the decline in top down regional development was accompanied by a decline in investment to critical infrastructure (Federation of Canadian Municipalities, 2012a; Mirza, 2007; Roy, 2008). This change in approach to regional development is indicative of an overarching change in governance, with greater levels of responsibility, surrounding both development and infrastructure, being shifted to local government (Bish & Clemens, 2008). It was during this time that, "there was a long period where infrastructure was let go" (Local Interviewee). This was mirrored in the response of a provincial interviewee who noted that:

> [In the] building boom post WWII and through the 60s and 70s we built a whole lot of infrastructure and assumed it had a long lifespan, which it does. But didn't manage it for the long lifespan. Didn't start setting aside funding to replace it when its life cycle comes up.

This era of restructuring appears to have contributed greatly to present day infrastructure challenges, not only in terms of decreased investment, but also in the transfer of responsibilities without supporting local level capacity—local communities could no longer rely on the province or resource industries for critical investments.

Since 2000 provincial and federal governments have increased infrastructure capital through efforts such as the original and new Building Canada Plan, although within

the literature the level of (re)investment is recognized as not being at the needed rate (Burleton & Caranci, 2004; Federation of Canadian Municipalities, 2014; Government of Canada, 2007; Roy, 2008). In addition to a continued need for infrastructure (re)investment, in 2000 the contaminated water tragedy of Walkerton Ontario launched drinking water quality, or at least liability, on to the agenda of the provincial government. In the years that followed, BC developed new drinking water legislation and regulations (Office of the Provincial Health Officer, 2007). These regulatory changes influenced a new wave of drinking water system construction, attempting to bring existing systems in line with new standards, as described by one local interviewee: "there is a push from the one side from on health organizations to become fully compliant with standard treatment methods."

*Present day: regional development and drinking water systems***.** Interviewees were asked about current links between drinking water systems and regional development. It was clear that largely only those interviewees specifically tied to water systems saw a strong link. For example, a local interviewee pointed to the example that it is not possible to subdivide a lot for development without providing potable water, requiring the existing drinking water system to meet current standards and regulations. Without water allocation, source security, and a compliant drinking water system, development of any sort is a non-starter. Capacity of an existing drinking water system for expansion can limit development, including not only capacity in terms of available water, but also capacity for service (e.g., firefighting). Drinking water systems can present liability issues, increase development costs (e.g., system upgrades required prior to development), impact the surrounding environment, and so on. One local interviewee summed up the relationship simply: "you can't have development without water".

However, while many interviewees identified various relationships between development and drinking water systems, some noted that these links are not always immediately apparent and that the role of drinking water systems in development can go unacknowledged. Additionally, while some interviewees found it hard to separate drinking water systems from development, one regional interviewee pointed out that on a broad scale the recognition of explicit connections between regional development, drinking water infrastructure, and community resiliency have not happened because of the complexity of this challenge,

> I think it is really hard to separate [water from development]. We're talking about infrastructure deficit, there's the community infrastructure piece, but then there's also the human infrastructure piece that goes along with that. And then there is the succession planning and knowledge management… I think it is really hard to separate them out but at the same time I think it is really hard when you say regional development it is just this huge behemoth.

### *5.2 Drinking Water System Challenges in Context*

Our research confirms that drinking water systems within the case study region are consistently facing a range of challenges, with varying degrees of severity. As discussed in the introduction, the prevalence of challenges with drinking water systems suggests issues beyond age and investment in infrastructure. Through our data analysis we identified several factors related to present challenges that illustrate the complexity of the situation: changing context, changing standards and regulation, technology, and mismanagement. This section discusses these

challenges, as well as demonstrating the influence of the legacy of past drinking water systems.

Drinking water systems are long lived (Baldwin & Dixon, 2008). Once constructed these systems remain in place for a long time. As highlighted above interviewees identified that infrastructure dating from the late 1800s to the 1960s and 1970s remains in the ground and in use today. While this raises the obvious challenge of system age, a related challenge is change in context, where present needs differ from past. Drinking water systems were closely associated with past development needs (e.g., resource extraction or agriculture). The closure of industry, change in relationships between industry and communities, growth of new development opportunities, change in community population, and so on, equate to a change in context surrounding water systems. Such changes create present day challenges as a result of a mismatch between the needs and expectations of the past and present. For example, a provincial interviewee explains that some small systems shifted from a system primarily designed for irrigation to that supporting a residential community: "So [these water systems] were never really designed to be a community water system. Just over time that's what they grew to, pragmatically the pipes are in the ground, the water is there, we'll just hook up to that."

There have been changes to the regulatory context surrounding drinking water, raising the standards that must be met in order for water to be considered potable. Required upgrades can be costly, particularly in rural areas where economies of scale are lacking. This is particularly relevant for small systems where residents end up on a boil water advisory because, as one local interviewee points out, they need:

> …to upgrade [their] water [system] because Interior Health says you have to upgrade. There are guys that have been on boil water for seven or eight years. You should never be on boil water! You need a process but there is no money. So what do you do? You boil water.

Interviewees pointed to new, alternative, and improved treatment technology (e.g., Ultraviolet treatment) as offering many potential options for meeting new standards. And while technological solutions were noted as a source of conflict (e.g., differences in perspective on the use of point of entry/point of use treatment), overall interviewees agreed that technology is not a limiting factor. Rather, the limiting factors are the cost of the technology, as well as the cost and capacity required for operation and maintenance. Relative to technology, it was capacity issues, both financial and human (e.g., certified water operators), that were widely cited as critical challenges.

A focus on treatment, in addition to the expense, can also take away from other system challenges. Distribution systems tend to be the older parts of drinking water systems. Within the study region many distribution systems are near, if not at the end of their natural lifespan. Deteriorating distribution increase system risk and costs (e.g., the loss of treated water), highlighted by a local interviewee:

> Because in our communities the loss in our municipal water systems is horrendous. It is unbelievable, it really is…A lot of them recognize this, they knew going in and for them they didn't want to go out to the public and ask them to turn off the tap when they're brushing their teeth because they knew that they were losing so much water that asking people to do that is not really going to make a difference.

Several interviewees pointed to local-level mismanagement as an issue that has contributed to today's challenges. There are some proactive examples where managers are building detailed asset management plans, including upgrading assets to reflect the current and future context. However, this is not the norm, particularly among the smaller systems. Overall, when it comes to system management the historical and present absence of full cost accounting is acknowledged, in particular the failure to adequately charge customers. As a result, the present combination of both replacing and upgrading infrastructure is causing potentially unaffordable increases in price for customers. One local interviewee indicated that:

> Some of our fees have actually doubled…it was $11 up until a year ago per user per month… So this is the same system where our challenge is introducing water treatment and renewing those assets that are failing. So obviously we have mismanaged the system over years. If we would have been at $25 [per user per month] even 10 years ago we would have some money at least to offset some borrowing costs.

Adding to the above failure to adequately charge for services are past failures to establish reserve funds to address future replacement and upgrades, as identified by another local interviewee:

> …our roads, water and recreation systems, in particular roads and water, we're not putting any money aside because we want to keep taxes low because we don't have any industrial tax base. And those assets are wearing out faster than what we can increase taxes to cover. So it is a little scary.

Interviews also indicated that mismanagement was an issue at higher levels of government, particularly at the provincial level. This included the aforementioned lack of reinvestment in infrastructure, changing regulations, downloading of responsibility, as well as issues with relationships and communication between levels of government. Infrastructure funding, while available, is uncertain, short term, and often restricted in a variety of ways (e.g., available to municipal governments and regional districts, but not water users' communities). Additionally, the majority of interviews discussed issues of jurisdiction, responsibility, and liability. Positively, provincial level agencies indicated willingness and effort to consider place and context when it comes to funding as well as water quality regulations, as exemplified by this quote from a provincial interviewee:

> The flexibility then becomes, ok we're looking for multiple barriers, what is reasonable for you? And we have put in some standards. A set of conditions of permits. Generally you should have source protection. You should have basic treatment requirements. And then it is a matter of step by step progress. The flexibility is some flexibility in technology there. But for the most part it is flexibility in timelines for compliance.

While this effort was acknowledged at the local level to some degree, a continued lack of understanding and consideration of place on the part of upper level institutions was noted by local interviewees. One local interviewee described this as:

> There is quite a disconnect with the governing body. They have never done this job, actually having to work in the field where you have to make

> something work. They just get to create these rules and regulations that are not really practical sometimes.

While few interviewees explicitly discussed the lack of integration within and between institutions, this was a consistent undertone in many interviews. Collaboration, or a lack of, as well as siloed planning and management at the local and provincial levels, appears to exacerbate issues. For example, in BC the current institutional system ties drinking water infrastructure to health in terms of regulation and is almost exclusively under the jurisdiction of the provincially designated regional health authority. Infrastructure funding however comes from another ministry, as does environmental quality monitoring and regulation.

## 6.0 Discussion

Our findings identify and trace links between drinking water systems and the trajectory of rural regional development, highlighting the legacy of staples theory, early regional development, and rural restructuring. It is our belief that understanding these legacies may provide valuable context surrounding the challenges rural drinking water systems face in the present. Three core themes are worth highlighting.

First, it is clear that regional development efforts influenced drinking water systems in terms of pattern and purpose. As rural settlement patterns mirrored the exploration and exploitation of natural resources the same staples-led development influenced the supporting infrastructure, including drinking water systems. The legacy of staples theory goes beyond economic development and can be seen in infrastructure systems. While some infrastructure systems (e.g., transportation) were deliberately planned to facilitate staples-led natural resource extraction, other infrastructure systems (e.g., drinking water) appear to be a more unintentional by-product of staples-led development.

Staples theory provides a common thread throughout the different periods of regional development, from its implicit role in the pre-WWII Canadian economy, to the explicit continuation of staples theory following WWII, and the continued emphasis on natural resource exploitation today. Although staples-led development policies were not intended to influence drinking water infrastructure, the reality is that these policies indirectly shaped the pattern and function of drinking water systems. Initial settlement patterns and economic activity are mirrored in drinking water systems today, not only illustrating the legacy of this past development, but demonstrating the link between resource-based activities and rural regional development (Wolfe, 2010). Just as a staples trap sees a lack of economic diversification and continued reliance on volatile staple products, common in rural BC (Ryser et al., 2014), the staples theory legacy on infrastructure poses issues of path dependency and constraints on future development. The challenge is how to re-shape infrastructure, like drinking water systems, to address changes in context and facilitate future development. This challenge is noted above where changes in context (e.g., land use, economic interests) surrounding drinking water systems have rendered existing infrastructure redundant, useless, or inadequate.

Second, the period of restructuring that began in the 1980s appears to have had unintended or unforeseen consequences on drinking water systems. As regional development shifted away from being top down and centralized, investments dropped and many responsibilities were passed to the local level without a

corresponding transfer of additional capacity. As a result, we see a period where many drinking water systems begin to flounder. As infrastructure reaches the end of its life cycle there is not only a deficit in terms of what needs to be rebuilt, but little local capacity, fiscal or human, to support addressing this deficit. During this period there is recognition of the limitations of both top down and bottom up approaches to regional development, highlighting a need for an approach that combines the two (Markey et al., 2008).

We also see changes in economic structure (e.g., recognition of the need for diversification) and values (e.g., recognition of sustainable development and resilience) requiring a reconsideration of what development means (e.g., economic growth versus a more holistic interpretation focused on progress and improvement) and what approaches are used (e.g., a shift from regional development to sector specific development and individual community efforts). Given that this period of restructuring took a toll on infrastructure systems, this raises the question of what approaches could offer potential for not only a more co-constructed (top down and bottom up) and integrated (able to look beyond silos) approach to managing infrastructure, but one that would incorporate concepts like sustainable development and resilience.

Finally, we found several present day challenges seemingly unrelated to development (e.g., changes in standards and regulation, technology, management). Within the context of the development legacies discussed above, we find that these present day challenges are exacerbated. For example, on its own, aging and degrading infrastructure would have posed a challenge in rural areas. However, changing regulation mean that not only were systems aging, but the systems were largely inadequate. These changes in water quality regulations alter the relationship between development and drinking water systems. As noted above, initially this relationship was one where development directed the pattern and purpose of drinking water systems. With changes in regulation, rather than drinking water systems simply supporting regional development, present and future development can now be limited by drinking water systems as existing infrastructure fails to meet new regulations (e.g., where lots cannot be subdivided and developed without providing potable water). Beyond that simple example, interviewees noted that new developments (e.g., a housing subdivision) face additional expenses, as well as lengthy and complex processes as a result of drinking water licensing and regulation. In addition to limitations to development dictated by drinking water system capacity, both new systems and systems that cannot provide potable water face additional hurdles. This is not to say that new regulations do not serve a purpose. However, in comparison to early regional development when there was little regulation surrounding the planning, establishment, and operation of drinking water infrastructure, present day regulation affords drinking water systems more influence over development than in the past.

New standards and regulations requiring expensive treatment technology also present rural communities with the choice of potentially debilitating costs or accepting a potentially damaging, economically and health wise, boil water advisory. As noted above, while technology is not a limitation, rural capacity – financial and human – is. These capacity challenges stem in part from the downloading of responsibilities without support from the provincial to local governments during the restructuring period. In short, the legacy of rural restructuring plays a role in present day challenges.

Additionally, we found challenges related to failures of management and the complexity of present institutional structures. The majority of interviews discussed issues of jurisdiction, responsibility, and liability – all institutional elements that became more complex during the period of restructuring. Operating a compliant drinking water system is not an easy task, particularly given the aforementioned rural capacity limitations. Addressing questions surrounding infrastructure systems that fit the present and future context, as well as incorporating sustainable development and resilience is a formidable challenge, one which is influenced by the past. It is a challenge further complicated when current institutions are not set up to address these links. This is highlighted when one considers the different, overlapping, and occasionally conflicting provincial ministries related to water. In order to manage drinking water systems in a co-constructed and integrated fashion local water system managers face the challenge of individually interacting separately with each ministry, and potentially departments within ministries, as well as interacting with other drinking water systems within their region, both physical (i.e., the watershed) and political. Current institutional structures are both siloed and tiered, which hinders an already difficult situation, and is unsupportive of concepts like sustainable development and resilience. Within this context it is little wonder that links between drinking water systems and development are not explicitly recognized and addressed through management and planning.

## 7.0 Conclusions

Drinking water systems have been deteriorating, leaving all levels of government to face a critical infrastructure deficit. The present as well as the future are shaped by events of the past. Viewing this current drinking water infrastructure deficit, as well as other present day water system challenges, through a historically and theoretically informed lens allows us to clarify why drinking water systems remain a challenge, despite (re)investment efforts. It is clear that links with development play a role and that infrastructure goes beyond the stereotypical role of supporting development. Our findings suggest that rural regional development has influenced and impacted drinking water systems in the past and that this relationship has shifted with the growing influence of drinking water systems on development. The research also shows that the legacies of both staples theory and rural restructuring exacerbate present day challenges creating a situation more complex than one would assume if only infrastructure age and degradation were considered. Moving forward, the challenge of breaking with the past will be in how to manage drinking water systems, as well as other infrastructure, in order to address changes in context as well as facilitate sustainable development and resilient rural regions.

This research attempts to speak to what can be learned from the past. Interviewees noted that complexity is a key issue when it comes to proactively linking infrastructure to regional development. While some drinking water systems have managed to use the flexibility of the local governance system to create explicit linkages between the drinking water system and development, most drinking water systems face challenges in meeting basic requirements and despite all efforts drinking water systems remain a challenge. Presently, drinking water systems are deteriorating in many regions, and they may not be capable of meeting future needs given their pattern and purpose largely mirrors the past. Our research identifies and highlights factors beyond age and investment, highlighting that the legacy of the past combined with the challenges of the present will undoubtedly impact the future.

Infrastructure provides the foundation upon which society functions (Vanegas, 2003). Overall, the relationships we identify between drinking water systems and development are important and should be considered. These connections help to explain how we got to where we are presently, and where we are going in the future. How drinking water systems are planned and managed will impact future development (Connelly, Markey, & Roseland, 2009; Dale & Hamilton, 2007; Kennedy, Roseland, Markey, & Connelly, 2008; Mirza, 2007). Presently, there is a need for considerable (re)investment in drinking water systems. However, without careful consideration of factors beyond financial needs, such as past and present interrelationships with development, it is unlikely that we will see substantive changes to the current situation, which will exacerbate future conditions.

The infrastructure deficit presents a window of opportunity for renewal, to replace and rethink drinking water systems to support future development. A growing body of literature is exploring links between sustainability and resilience, including potential approaches to fostering these links (Connelly, Markey, & Roseland, 2009; Dale & Hamilton, 2007; Kennedy et al., 2008; Pendall, Foster, & Cowell, 2009; Pollalis et al., 2012; Robinson et al., 2008). However drinking water systems continue to play catch up as opposed to proactively building resilience by integrating infrastructure into development (Pollalis et al., 2012). In order to best take advantage of this opportunity we require a better understanding of the factors that brought about this situation.

Rural regions need two key resources to support development: financial resources and appropriate infrastructure (Ryser & Halseth, 2010). At the moment, the case study region exemplifies that rural regions arguably have neither, and are suffering both from a lack of capacity, but also the degradation of infrastructure. Challenges surrounding capacity, collaboration, equity, and integration extend beyond drinking water systems and are found in many rural issues, suggesting larger systemic challenges. If factors like development are not considered alongside infrastructure systems when opportunities arise for re-investment, there is the potential for infrastructure to lock development onto an unsustainable path (Connelly et al., 2009; Dale & Hamilton, 2007; Markey et al., 2010). While the infrastructure deficit opens the door for the consideration of new approaches that would help integrate infrastructure with development, this opportunity is only temporary. Regions should address the infrastructure deficit with full knowledge of the past, building resilience as opposed to duplicating the past.

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