

Promoting Clean Water in Nineteenth-Century Public Policy: Professors, Preachers, and Polliwogs in Kingston, Ontario

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A case study of Kingston, Ontario, reveals that growing confidence in the response of science and statistics to the threat of epidemic disease supported the development and expansion of municipal water and sewer services in the late nineteenth century. Informed by science and statistics, professional city managers and sanitary experts sought solutions combining fiduciary responsibility with public service. Preliminary evidence also suggests that, in some cases, Protestant-inspired rhetoric contributed to this support for new sanitary measures.

Une étude de cas de la ville de Kingston, en Ontario, révèle que la confiance grandissante envers la réaction de la science et de la statistique à la menace de maladies épidémiques a contribué au développement et à l'expansion des services municipaux d'aqueduc et d'égout à la fin du XIX^e siècle. Informés par la science et la statistique, les administrateurs municipaux et les experts sanitaires cherchèrent des solutions alliant responsabilité fiduciaire et service au public. Les données préliminaires semblent aussi indiquer que, dans certains cas, la rhétorique d'inspiration protestante a contribué à cet appui à de nouvelles mesures sanitaires.

IN 1881 THE CITY Council of Kingston, Ontario, appointed the first in a series of special committees to study the feasibility of a municipal takeover of the privately owned Kingston Water Works Company. By 1910 the city had so expanded and reformed water and sewer service that every downtown residence and business was required to have connections to both the water works pipes and the city drains. Like many other Canadian cities, Kingston had taken up the cause of urban reform.

In the last two decades of the nineteenth century, an urban reform movement gripped Canadian cities.¹ Reformers urged government intervention in

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¹ See, for example, Paul Rutherford, *Saving the Canadian City* (Toronto: University of Toronto Press, 1974).

the delivery of public services at both the municipal and provincial levels. They hoped to promote public health and welfare by centralization and regulation. In Ontario, Provincial Boards were created to manage Workers Compensation, Public Health, and services such as Psychiatric Hospitals and Houses of Industry. At the local level, reformers emphasized the city's role in infrastructure and urban planning, with particular emphasis on water and sewers. For some twentieth-century analysts, the fact that universal water and sewer services followed only after commercial ventures had been served confirms a materialist perspective on the consolidation of capital and power. John Hagopian sees the development of nineteenth-century water works as part of this larger pattern.² Others are more interested in how both scientific knowledge and health and welfare concerns reframed discussions of the problems of urban growth.³

Although economic limitations were never forgotten, municipal governments had developed new structural responses to the problems of urban growth by the end of the century. Modern solutions to the problems of waste disposal and disease prevention were found as managers made use of both new data about disease causation and recent engineering developments. Elwood Jones and Douglas McCalla emphasize that, although Toronto politicians had resolved to operate a public system by 1872, universal service was not possible until technical and managerial expertise were available and until circumstances made substantial municipal investment politically acceptable.⁴ Chris Warfe argues that, although the threat of increased fire insurance rates finally compelled Ottawa to improve water service after the turn of the century, public health concerns were part of the political pressure.⁵ As in Toronto, however, solutions depended on engineering and management expertise as well as political will.

These principles also operated in Kingston. The water and sewer services were not expanded until political will, management skill, and technical expertise came together. Although initial expansion was precipitated by rising insurance rates, ultimately it was made possible through expertise in the civic bureaucracy and the local scientific community. The Kingston case study points to three key factors that led to the expansion of late-nineteenth-

2 John Hagopian, "The Political Geography of Water Provision in Paris, Ontario, 1882–1924", *Urban History Review*, vol. 23, no. 1 (November 1994), pp. 32–51.

3 For example, Gene Desfor, "Planning Urban Waterfront Industrial Districts: Toronto's Ashbridge's Bay, 1889–1910", *Urban History Review*, vol. 17, no. 2 (1988), pp. 77–91; Catherine Brace, "Public Works in the Canadian City: The Provision of Sewers in Toronto, 1870–1913", *Urban History Review*, vol. 23, no. 2 (March 1995), pp. 33–43; Heather MacDougall, "The Genesis of Public Health Reform in Toronto, 1869–1890", *Urban History Review*, vol. 11, no. 1 (February 1982), pp. 1–9.

4 Elwood Jones and Douglas McCalla, "Toronto Waterworks 1840–1877: Continuity and Change in Nineteenth-Century Toronto Politics", *Canadian Historical Review*, vol. 60, no. 3 (1979), pp. 300–323.

5 Chris Warfe, "The Search for Pure Water in Ottawa: 1910–1915", *Urban History Review*, vol. 8, no. 1 (June 1979), pp. 90–112.

century infrastructure: faith in professional management, confidence in the results of scientific study, and, for some, the evangelical conviction that the causes of contagious disease, like the temptation to sin, had to be rooted out by the force of individual will.

Cholera and Municipal Government in 1866: Foreshadowing a New Response

During the early decades of the nineteenth century, Canadian municipal governments regulated a relatively limited scope of affairs. Concerned with enforcing the organization of markets, the prosecution of criminals, and the payment of property taxes, cities such as Kingston left most modern concerns in the hands of individual residents. Although the local papers often contained complaints about sanitary matters, these were treated as unfortunate but natural occurrences. If residents were bothered by dead animals in the street, the editor of the local paper would urge the visitation of “a few carrion consuming crows”, not a municipal garbage collector.⁶ Similarly, the spring stench from a winter’s accumulation of nightsoil on the harbour ice would prompt not a call for a clean-up crew, but rather an expression of relief once the ice broke up and the filth finally sank or drifted away.⁷ Sanitation was considered a private and individual responsibility.

Accordingly, utilities were developed piecemeal, as families of the local elite arranged for their own water and drainage. Although a private water works company was established in 1850, it was primarily for fire protection in the downtown core. The city paid a modest annual stipend for water service to fire hydrants, a public fountain, and the city buildings.⁸ Some residents had water piped to their houses, but this depended on their proximity to the fire route and ability to pay up front for installing the connecting pipes. Some wealthy neighbourhoods also had drains or sewers built through subscriptions. The city paid only for the portion of drains that crossed street intersections.⁹ As Jones and McCalla note in their study of Toronto water service, politicians of the period may have considered public alternatives, but pragmatically opted for arrangements that promised to “provide a desired service quickly and economically”.¹⁰ Politicians were hesitant to

6 “Crows Wanted”, *Kingston Daily News*, March 15, 1866.

7 “The Nuisance on the Ice”, *Kingston Daily News*, April 13, 1866, p. 3, col. 3.

8 After 1850 the city was served by a private water works, with which the city contracted for water to City Hall and the public fountain. “City Council”, *Kingston British Whig*, November 21, 1849, p. 2, col. 1.

9 Residents had to petition the City Council to have the drain built, and then property owners along the drain’s course were assessed proportionally according to the frontage of each lot. The city usually paid only for culverts, street drainage fixtures, and frontage at intersections or along exempt property. Queen’s University Archives, City of Kingston Papers (hereafter CKP), vol. 105, *Bylaw Book*, chap. 8, and vol. 106, *Bylaw Book*, chap. 183.

10 Jones and McCalla, “Toronto Waterworks”, p. 306.

take on additional risk and responsibility, and residents were opposed to higher taxes.

This reticence towards public intervention was set aside during times of public crisis, such as the threat of an epidemic. In 1866, when cholera seemed to be on Kingston's doorstep, the members of City Council felt justified in taking charge of public health.¹¹ Authorized by new provincial legislation, they revived the local Board of Health, a committee of Council which only met during times of crisis. To discourage politicking, they placed a physician, assisted by two aldermen, in charge of each ward committee. No alderman was to serve on the committee of the ward in which he had been elected.¹² These actions foreshadowed the future role of local government. The structure of the Board helped to establish the idea that civic managers could have broad powers, but that they must act as disinterested parties. This concept was central to the urban reform movement that would transform civic management in the latter decades of the nineteenth century.

The measures taken by the ward committees in 1866 were similar to those which would be adopted in the 1880s as part of an ongoing programme of disease prevention. The committees paid particular attention to garbage and waste disposal because prevailing theories of disease maintained that decomposing matter and foul odours could cause or act as catalysts for disease.¹³ A Kingston editorial in 1866 summarized this position:

[The current cases of diarrhea, typhoid fever, and dysentery] may be traced to the poisoned atmosphere generated by the exposure of a vast mass of ordure putrefying in the hot sun under the very nose of the city; to the stagnant water in cellars, and the foul emanations from half-choked drains; to the dirty streets, yards and outhouses, which, in spite of the printed directions of the Mayor, still exist.¹⁴

In response to these concerns, the Board of Health supervised regular garbage collection and the extension of existing drains so that refuse lagoons could no longer form where drains emptied into the harbour.¹⁵ The Board also made a limited survey of the private water works system. Although activities were curtailed once the threat of cholera waned, they foreshadowed what would be undertaken towards the end of the century.

In regularizing the collection of data, Kingston was following the emerg-

11 This response was based on lessons learned in the 1832 epidemic, which devastated Kingston and other Upper and Lower Canadian towns. See Geoffrey Bilson, *A Darkened House: Cholera in Nineteenth Century Canada* (Toronto: University of Toronto Press, 1989).

12 "Meeting of the Board of Health", *Kingston Daily News*, April 19, 1866, p. 2, col. 3-4.

13 Christopher Hamlin, *Science of Impurity: Water Analysis in Nineteenth-Century Britain* (Bristol: Adam Hilger/ Oxford University Press, 1990), pp. 130-134; Margaret Pelling, *Cholera, Fever and English Medicine, 1825-1865* (Oxford: Oxford University Press, 1978), p. 295.

14 "The Sanitary Condition", *Kingston Daily News*, April 7, 1866, p. 2, col. 1.

15 Drains were extended so that they emptied underwater instead of at the shore.

Table 1 Cases of the Principal Contagious Diseases in Kingston, 1885–1912

Year	Typhoid	Scarlet fever	Diphtheria	Notes
1885	0	60	10	
1886	1	52	4	
1887	2	18	20	
1888	37	6	37	
1889	27	7	55	
1890	30	26	43	
1891	124	71	39	
1892	76	60	6	
1893	53	66	12	
1894	54	24	26	
1895	35	17	70	
1896	41	9	106	
1897	7	7	56	
1898	10	2	39	
1899	11	266	15	Jan.–Aug.; Oct.–Dec.
1900	13	143	17	
1901	30	92	23	
1902	16	32	62	
1903	129	24	53	
1904	19	19	63	
1905	4	4	17	Jan.–Apr.
1906	39	26	35	Jan.–Apr.; July–Sept.; Dec.
1907	7	40	2	
1908	27	80	12	
1909	55	36	12	
1910	45	–	–	Oct.–Dec. 14
1911	66	124	40	
1912	38	22	36	

Sources: Queen's University Archives, City of Kingston Papers, Board of Health Correspondence and Minutes; *Ontario Sessional Papers*, Annual Reports of the Provincial Board of Health.

ing statistical movement in Europe. Like their continental colleagues, Kingston officials hoped that, by collecting standardized information, they would be able to see clear relationships between the spread of disease and its possible causes.¹⁶ As George Emery observes in his study of the Ontario vital statistics movement, the collection of statistics was believed to reveal the

16 William Coleman emphasizes how early hygienists in France sought to analyse the state of society through the collection of medical statistics, particularly on the causes of death. See *Death is a Social Disease: Public Health and Political Economy in Early Industrial France* (Madison: University of Wisconsin Press, 1982). Margaret Pelling similarly emphasizes in *Cholera, Fever and English Medicine* how it was hoped that the collection of broad and varied data would permit the identification of the cause of cholera.

“natural laws” governing apparently complex events such as epidemics.¹⁷ The collection of vital statistics would prove fundamental to public health campaigns on both continents. These statistics would be used to justify government regulation and management of public health concerns.

1880–1884: Council and the Water Quality Experts

By the 1880s frustration was mounting over the private management of the city water service. Complaints about high rates culminated in the appointment of a series of Special Committees of Council in the early 1880s.¹⁸ Dissatisfaction increased when “little specs ... which seemed to be full of life” were observed in January 1884.¹⁹ Beneath the public’s amusement — the specks were quickly nicknamed polliwogs²⁰ — many feared the water was being contaminated either at the intake pipe in Kingston Harbour or at the open dugout reservoir.²¹ Since 1845 there had been concerns about “the verdant green coat” of algae on the Kingston harbour in summer,²² but now some were becoming more concerned about less visible threats to health. One letter to the editor warned: “people should know, for their own benefit that ... invisible contaminations may exist a thousand times worse than all the cyclops that ever swarmed in it, and yet this water appear pure and sparkling.”²³

To satisfy themselves, members of the Council Committee on Fire, Water and Gas hired Professor Goodwin of Queen’s University to analyse the water. The Water Works Company countered by hiring Professor Bayne of the Royal Military College to conduct similar tests. In late February and early March, the *Daily British Whig* published the two reports.²⁴ Between them, the two professors examined samples from seven different points in the water works system,²⁵ and each sample was tested for several different

17 George Emery, *Facts of Life: The Social Construction of Vital Statistics, Ontario 1869–1952* (Montreal and Kingston: McGill-Queen’s University Press, 1993).

18 See Brad Rudachyk, “Tempest in a Teapot? The City of Kingston and the City of Kingston Water Works Company” (unpublished manuscript, Audrey Rushbrook Library, Marine Museum of the Great Lakes, Kingston, 1979); Colleen MacNaughton, “Defining Pure Water, Defending Pure Space: Sanitary Boundaries in Nineteenth-Century Kingston, Ontario” (MA thesis, Queen’s University, 1996).

19 “Our Water Not Pure”, *Kingston Daily British Whig*, January 18, 1884, p. 3, col. 2.

20 *Ibid.*

21 “Correspondence on the Question”, *Kingston Daily British Whig*, January 22, 1884, p. 2, col. 2; “Character of our Water”, *Kingston Daily British Whig*, January 25, 1884, p. 1, col. 3–4.

22 Brian Osborne and Donald Swainson, *Kingston: Building on the Past* (Westport, Ont.: Butternut Press, 1988), p. 130.

23 “Character of our Water”, *Kingston Daily British Whig*, January 25, 1884, p. 1, col. 3–4.

24 “Kingston Water”, *Kingston Daily British Whig*, February 26, 1884, p. 3, col. 4; “Kingston Water”, *Kingston Daily British Whig*, March 11, 1884, p. 1, col. 4–5.

25 Bayne tested samples from 500 feet into the harbour, just outside the filter (a gravel crib attached to the end of the intake pipe), from the filter, and from his own tap. Goodwin tested samples from two miles into the harbour, above the Lunatic Asylum (up the lake from the harbour), outside the filter, and in the pump room.

characteristics.²⁶ Although Goodwin concluded that the “great number and variety [of organisms] in the sediment drawn from the city supply are suspicious”, he did not condemn the water. Neither he nor Bayne found high levels of ammonia or chlorine, respectively thought to indicate contamination by decomposing vegetable matter and animal waste. The public and Council seem to have been reassured by the test results. Council ordered no further analysis, and citizens ceased to complain about the water quality in their letters to the local newspapers.

Dissatisfaction with the cost and irregularity of water service continued, however, and the Special Committee on Water Works struggled to find a cost-effective method of improving the city’s water service. The Water Works Company insisted that poor service was caused by municipal underfunding, while the city councillors refused to pay more to an agent they felt had proved unreliable. A purchase of the company was considered, but the cost was deemed prohibitive. Council could find no palatable solution for improving water service until 1886, when the Queen Street Methodist Church nearly burned down during a water shortage. The resulting proposed increase in fire insurance rates finally committed the city to buying out the Kingston Water Works Company.²⁷ Although many considered the buyout expensive, they expressed confidence that city management would provide good water at a cheaper price. The editor of the *Daily News* summarized the prevailing public mood when he urged citizens to vote in favour of purchasing the water works because “it is bad for a private company to have a monopoly of a public service such as the supplying of water to a city like Kingston, and because the investment will be a paying one, and still more because he will be doing his neighbour who does need better water service a good turn”.²⁸ In 1887 the electorate approved a bill to purchase the Kingston Water Works Company.²⁹

While pragmatism prompted the city to assume management of the water works, the structure of the new service addressed both financial issues and health concerns. An expansion of the pipe network was planned, both to lower the charge per household and to reduce reliance on potentially contaminated wells. The proposed addition of a filter at the harbour end of the intake pipe would protect against disease and, by reducing turbidity, reassure consumers. Advocates assured citizens that public management would

26 Both tested levels of total solids, free ammonia, albuminoid ammonia, chlorine, and hardness. Only Bayne measured alkalinity, while only Goodwin analysed colour and microscopic particles.

27 “No Water to be Had”, *Kingston Daily British Whig*, February 2, 1886, p. 2, col. 3; “The Facts Brought Out”, *Kingston Daily British Whig*, February 2, 1886, p. 3, col. 3.

28 “Be Generous”, *Kingston Daily News*, July 20, 1887, p. 2, col. 3.

29 This purchase was supported by the majority of ratepayers, who passed the bylaw authorizing debentures to finance the sale. Freeholders, both men and women, were eligible to vote. Although 1,900 were eligible, only 998 cast ballots. “A Vote of Seven to One”, *Kingston Daily News*, August 11, 1887, p. 2, col. 4.

be more efficient than private stewardship and that any profits would be reinvested in the system, rather than lining the pockets of shareholders.³⁰

1884–1910: The Board of Health and the Water Quality Experts

The Board of Health continued to monitor changes to the water system but, as the service improved following the municipal takeover, turned more of its attention to the interconnected problems of drainage and contaminated wells. The Board's efforts were assisted by provincial regulations adopted in 1882 and 1884 that strengthened the authority of all local Boards of Health. The appointment of a Medical Health Officer was now mandatory, and his duties in overseeing public health were more clearly defined.³¹ These included the study of mortality statistics, conducting sanitary investigations and inquiries into the causes of disease outbreaks and deaths, advising local government, and distributing practical information to the public.³² In adopting these new responsibilities, Kingston officials once again followed international trends.³³

The investigation of drains and the associated problem of contaminated wells formed the core of the disease prevention work of the Medical Health Officer and the Board of Health over the next decade. The Board particularly urged eliminating cesspools by connecting all existing drains into a network terminating at the lakeshore.³⁴ While Council agreed in principle, the electorate rejected bylaws to finance sewer construction in both 1884 and 1885. When residents proved unwilling to pay higher taxes, Council funded parts of this proposal through the street maintenance budget in 1886 and 1887.³⁵ At the same time, they marshalled statistics to promote the use of city water instead of neighbourhood wells. Professor Goodwin was hired to test wells located along drainage routes, and the Board ordered the closing of those showing high levels of chlorine or ammonia.³⁶ The number of tests was increased in 1891, prompted by an increased incidence of typhoid. The Med-

30 "The Waterworks", Kingston *Daily News*, July 9, 1887, p. 2, col. 2; "About Waterworks", Kingston *Daily News*, July 11, 1887, p. 2, col. 2; "The Feelings of the People...", Kingston *Daily News*, July 16, 1887, p. 4, col. 2.

31 MacDougall, "Genesis of Public Health Reform in Toronto"; Mary Powell, "Provincial-Local Relations in Ontario: The Case of Public Health, 1882–1984" (PhD dissertation, University of Toronto), pp. 46ff.

32 Powell, "Provincial-Local Relations in Ontario", p. 22.

33 See, for example, Jacinta Prunty, *Dublin Slums, 1800–1925: A Study in Urban Geography* (Dublin and Portland, Ore.: Irish Academic Press, 1998); Judith Walzer Leavitt, *The Healthiest City: Milwaukee and the Politics of Health Reform* (Princeton: University of Princeton Press, 1992).

34 See "A Bylaw", Kingston *Daily British Whig*, March 18, 1885, p. 1, col. 6–7.

35 The city thus constructed 2,000 yards of sewers in 1886 and an additional 2,680 yards in 1887. *Ontario Sessional Papers* (hereafter *OSP*) no. 14, 1887, "Report of the Provincial Board of Health", p. 137; *OSP* no. 41, 1888, "Report of the Provincial Board of Health", p. 13.

36 "Board of Health", Kingston *Daily British Whig*, November 22, 1884; CKP, vol. 237, *Minutes of the Board of Health*, May 6, 1889.



Figure 1 Typhoid fever cases, 1895–1912, in Kingston, Ontario (statistics from Queen’s University Archives, City of Kingston Papers, Board of Health Correspondence and Minutes; Ontario Sessional Papers, Annual Reports of the Provincial Board of Health).

ical Health Officer was heartened by the number of consumers who subsequently subscribed to the city water service.³⁷

By the turn of the century, quantitative water analysis was entrenched as the primary tool for preventing and tracing typhoid outbreaks. The city had arranged for regular tests through the Queen’s University School of Mining, while more detailed analyses could be arranged at the Provincial Laboratory in Toronto. Such tests were used to trace the source of typhoid outbreaks in both 1903 and 1909 (see Figure 1). Their evidence was used to justify further expansion of the water and sewer systems. By 1909, feeling that the benefits of piped water and waterborne sewage disposal had been proved, the Board imposed a 1910 deadline for their universal adoption within a defined “Sanitary Boundary” covering most of the downtown area.³⁸ Within this “Sanitary Boundary” households were required to have not only piped water but also water closets and sinks connected to the city drains. The use of outdoor privies or drainage of household fixtures into privy pits or cesspools was not permitted. The Board considered further sanitation measures, including building a sewage filtration plant or at least constructing an intercepting pipe to divert raw sewage from emptying into the city harbourfront.³⁹ Despite the *Daily British Whig*’s urging that “advanced life and science demand the purity [of

37 OSP no. 26, 1892, “Annual Report of the Provincial Board of Health” (Kingston), p. 91.

38 KCP, vol. 239, *Minutes of the Board of Health*, August 9, 1909.

39 KCP, Board of Health Correspondence, box 242, file 1903, “Report of the Board of Health for 1903”; vol. 239, *Minutes of the Board of Health*, August 9, 1909.

water] which can only be had by a different disposal of sewage”, the city considered these proposals too expensive.⁴⁰ When further typhoid cases were traced to the “grossly polluted” harbour,⁴¹ the city opted for water chlorination as a cheaper alternative to sewage treatment.⁴² Science provided not only the data to support sanitary improvements, but also new cost-effective methods of managing the threat of disease.

1894–1910: Protestant Rhetoric and Practical Problems

As the city became directly responsible for managing water and sewer services, it is clear that both scientific evidence and economic rationale were used to support this new role. However, additional factors may have been intertwined with these two motivations. The Kingston case study provides some evidence to suggest that the social reform movement sponsored by the Protestant churches at the turn of the century may have also supported municipal management of sanitary services. Just as the scientific response to the threat of disease had changed since the 1860s, so the response and role of the church had also changed.

The development of social concern in the late nineteenth century has been described both as the advent of secularism and as the reinvigoration of Canada’s unique evangelical creed.⁴³ The secularization thesis asserts that the true engine of this social reform movement was confidence in the developing social sciences, since religious convictions were being dislodged by the combined impact of higher criticism and evolutionary theory. Yet analysis of the rhetoric used in Kingston to promote sanitation supports the more recent assertion that late-nineteenth-century social criticism was rooted in the Protestant churches’ traditional means of reform: revival. For Protestant-based reformers, the revivalist emphasis on individual action was combined with an emphasis on the practicality of Biblical teaching. Like temperance activists and moral reformers, sanitarians employed both the “mythical content of Canadian Protestant culture” and the “formal structures of turn-of-the-century social and religious discourse”.⁴⁴ Just as ministers used “forceful yet

40 “A Disposal Works”, Kingston *Daily British Whig*, February 24, 1903, p. 4, col. 2; “Two Meetings of Civic Committees Were Held”, *Daily British Whig*, April 11, 1903, p. 2, col. 1–2; “Pipe All Right”, *Daily British Whig*, April 23, 1903, p. 6, col. 2.

41 An International Joint Commission concluded that the recent “massive explosive epidemics” of typhoid were caused by the “use of sewage polluted water without purification of any kind”. “Progress Report of the International Joint Commission on the Pollution of Boundary Waters”, January 16, 1914, p. 15.

42 *OSP* no. 20, 1911, “Annual Report”, p. 152; “Water is Clean”, *Daily British Whig*, November 24, 1910, p. 2, col. 4.

43 Ramsay Cook, *The Regenerators: Social Criticism in Late Victorian English Canada* (Toronto: University of Toronto Press, 1985); Michael Gauvreau, *College and Creed in English Canada from the Great Revival to the Great Depression* (Montreal and Kingston: McGill-Queen’s University Press, 1994).

44 Mariana Valverde, *The Age of Light, Soap and Water: Moral Reform in English Canada, 1885–1925* (Toronto: McClelland & Stewart, 1991), pp. 34–35.

simple language” and “stressed each person’s direct emotional encounter with God”, so the same rhetoric was used to encourage social action such as improved sanitation.⁴⁵

Protestant themes used to describe the fight against invisible sin were also used to prompt vigilance against the invisible causes of disease. For some, scientific evidence was not sufficiently compelling to change behaviour. Many believed that the causes of disease were always visible and sensible. For example, in 1891, despite chemical tests condemning his well, one resident remained convinced that flotsam he had seen in the harbour was more dangerous than his well water: “John O’Brien said that people had used water from his well for many years and had not been made sick by it. He claimed it was not the water in the wells that was making people sick. It was the water in the harbour, pumped by the water works. He spent thirty years working on the wharves and he knew how bad the water in the harbour was.”⁴⁶

In the face of everyday contact with dirt, drains, privies, pig pens, and cow barns, the danger of invisible organisms seemed remote and abstract. Sanitarians combated this view by drawing on Protestant themes. Although they were not numerous, the rhetoric of these Christians was colourful and persuasive. In a letter urging the closure of Kingston wells in 1891, Queen’s Principal Grant, a Presbyterian minister as well as a member of the Board of Health, expressed frustration over those who were “poison[ing] themselves and others by a slow but sure process” when the city supply was much improved:

It is disheartening to find the owners of wells shutting their eyes, ears, and hearts to the truth and forcing the board of health to waste time, to spend money, to threaten law proceedings, and generally make themselves feel unpleasant, before they will do what common sense and common humanity should have made them do before this ... it is a sign that a man is incurably ignorant, or wilful or avaricious when, with all the light that has been given, he refuses to believe the light.⁴⁷

The description drew on familiar phrases used when describing the nature of a sinful person attempting to ignore the guidance of God.⁴⁸

These appeals seem to have been heard by a broad audience. In Kingston, parishioners, the general public, and theological students listened eagerly to

45 Nancy Christie and Michael Gauvreau, *A Full-Orbed Christianity: The Protestant Churches and Social Welfare in Canada, 1900–1940* (Montreal and Kingston: McGill-Queen’s University Press, 1995), pp. 40–41.

46 “Talking About Water”, *Daily British Whig*, August 8, 1891, p. 1, col. 8.

47 “Please Use City Water”, *Daily British Whig*, July 23, 1891, p. 1, col. 6.

48 Not only is “the light” a common metaphor for Christ, but also, particularly in the Hebrew scriptures, the disobedient are described as having “closed hearts”. John 1:4–5; Exodus 7–11; II Chronicles 36:13; Zachariah 7:12.

lectures on the cause and prevention of disease and on the healthful effects of clean air and sunshine.⁴⁹ In such lectures the gospel, cleanliness, and science were often explicitly linked. As Professor A. P. Knight of Queen's asserted, "the laws of health are God's laws ... and through modern science we are becoming more familiar with God's laws."⁵⁰ By following these natural laws "[people] will have a healthy body to be the temple of a pure soul".⁵¹ Like statisticians, religious reformers sought to elucidate natural laws governing human life. For these reformers and their followers, both statistics and Protestant motifs justified changes in municipal policy and governance.

Protestant themes and references were also used by secular authorities. The same style, including the use of "sin" metaphors, is evident in the Medical Health Officer's annual report of 1892. In this case, the encouragement to improve sanitation is likened to the gospel, while failure to maintain cleanliness compared with backsliding into sin:

The public are slowly beginning to realize that "Cleanliness is next to godliness" ... still there is room for improvement along these lines. If the people would wake up to the necessities of the hour, and present a determined opposition to every kind of filth about the premises they occupy, contagious disease would find very little foothold. The price we have to pay for liberty from this scourge is "eternal vigilance" on the part of all.⁵²

These images of personal responsibility and diligent prevention of disease drew on the Protestant rhetoric describing methods of guarding against sin. Their use by the Medical Health Officer, a municipal employee, reveals the extent to which ministers' sermons and speeches had penetrated the public consciousness. Mariana Valverde, in her study of the broader social reform movement, confirms that the ideas of purity and cleanliness promoted by moral reformers were widely adopted by medical and scientific experts.⁵³

Such meetings and printed appeals drew on the traditions of religious revivals and sermons. For these activists, sanitation was a moral activity, and moral regeneration arose out of Christian conviction. Through the last decade of the nineteenth century and into the beginning of the twentieth, reformers with evangelical roots proclaimed the gospel of science and sani-

49 *Daily British Whig*, "Valuable Information", April 10, 1897, p. 1, col. 7; "How We May Avoid the Catching of Disease", October 26, 1910, p. 8, col. 2-3; "Getting Dangerous to Drink Water from Lakes or Rivers", October 27, 1910, p. 6, col. 3; "What is Required in the Way of Sanitary House Conditions", November 28, 1910, p. 8, col. 2. Of these lectures, two were specifically to Queen's theological alumni while one was held in a local Methodist church.

50 "What is Required in the Way of Sanitary House Conditions", *Daily British Whig*, November 28, 1910, p. 8, col. 2.

51 *Ibid.*

52 *OSP* no. 26, 1892, "Annual Report", p. 91.

53 Valverde, *The Age of Light, Soap and Water*, p. 129.

tation. While these ideas were not the primary force behind sanitary reform, the images and ideas promoted by Protestant reformers nevertheless informed public discussions regarding sanitation problems.

Conclusions

As Kingston grew in the nineteenth century, citizens began to favour centralized management of water and sewer services. This emerged first as a crisis response to the threat of cholera epidemics, but, as confidence in new scientific methods for disease prevention grew, a more permanent structure developed. Statistical evidence, economic arguments, and provincial regulations increased the authority of the Board of Health, and its staff became entrenched in municipal government. Together, these developments supported municipal management of water and sewer services and their expansion as the city grew. By 1910 municipal water and sewer service was provided universally in the downtown area, while service to outlying areas was expanding.

Yet this story may illustrate not only how municipal and scientific authority reinforced each other's growth in the expansion of such services. Contained within this narrative are also indications of how other power structures sought to use their influence in support of water and sewer developments. The Kingston case study suggests that Protestant public health reformers drew upon traditions of revival and rhetoric to support these sanitary reforms. Further research into both Kingston and other centres is likely to clarify the extent to which they were able to encourage the adoption of centralized, municipally managed water and sewer services. This evidence will provide a more nuanced view of how late-nineteenth-century support for municipally managed water and sewer services was gathered.