# Water and Sanitation Services in Vancouver: An Historical Perspective

LOUIS P. CAIN

Every city must decide how it will supply necessary water and sanitation services to its residents. Vancouver's principal problem was to develop an ample supply of fresh water, a problem it shared with other cities located on salt water, but a favourable geographical location benefited Vancouver relative to other salt-water cities.[1] As was true elsewhere, the city discharged its sewage and street runoff directly into the salt water. A second factor distinguishing Vancouver from other salt-water cities was its comparative youth, which enabled the city fathers to avoid many of the pitfalls which befell older cities in the first half of the nineteenth century. The first two sections of this paper will discuss the origin of Vancouver's water supply and sewerage strategies; the third will bring these strategies up to the present. The current configuration of sanitation services in Vancouver resembles that of other salt-water cities, but the road to that configuration was both less cumbersome and less costly.

## I

In 1887, the year-old city of Vancouver lacked most urban services. Water supply and sewage-disposal practices followed those of rural areas; water was pumped from (often shallow) underground wells, and sewage was disposed onto the ground. The sandy soil quickly brought the decomposing sewage into contact with the ground water, contaminating the supply. The inevitable results were out-breaks of cholera, typhoid fever, and other diarrheal diseases. Vancouverites were aware that a safe water supply could reduce the incidence of typhus, and they demanded both water and sewer systems. The fire of 1886, although brief and devastating, was a

[1] Louis P. Cain, "The Economic History of Urban Location and Sanitation", *Research in Economic History*, vol. 2, Summer 1977, contains a description of the problems of salt-water cities vis-à-vis cities located on other types of water resources. An extended discussion of the problems of a city located on a freshwater lake can be found in Louis P. Cain, *Sanitation Strategy for a Metropolis — The Case of Chicago* (Illinois: De Kalb, 1976).



BC STUDIES, no. 30, Summer 1976

second factor leading to the keenly felt need for a regular water supply. In the short run the city constructed several 50,000-gallon underground water tanks for the purpose of fighting fires.[2] In the long run the fire argument was added to the other arguments for water and sewage systems.

Vancouver's city council laid out a sewer system as they established streets. By the end of 1888, sewers had been installed which emptied into Burrard Inlet and False Creek. Although the plan of these sewers was consistent with the best engineering practice, they proved troublesome at first because the flow available from the emergency tanks was insufficient to flush them properly. The new water supply system which was completed the following year solved the problem.

The Vancouver Water Works Co. was formed in 1886 by George Keefer and H. O. Smith under an act of incorporation of the provincial legislature.[3] These two gentlemen were associated with a clique that obtained franchises for several other urban services including electricity, gas and transit. In the winter of 1885-86, Mr. Keefer had arranged for a survey under the leadership of Henry B. Smith of all streams emptying into Burrard Inlet. The Smith group recommended utilizing the Capilano River for Vancouver's water supply. This conclusion was based on the greater water discharge of that supply, its proximity to the city, and the fact that the average fall of the river was so large that the intake point for gravity-based water supply could be established a short distance upstream. The water company was capitalized at $250,000 for the purpose of bringing Capilano River water into Vancouver via the First Narrows.

Before they received the franchise, the Vancouver Water Works Co. first had to meet the competition of the Coquitlam Water Co., which also had been incorporated by the provincial legislature and planned to supply New Westminster with water from Lake Coquitlam. This firm also had made plans to supply Vancouver, and on 25 April 1887 the city council voted by a small majority to accept the Coquitlam company. When the issue was presented to the electorate, they defeated the civic bylaw awarding the franchise to the Coquitlam group on the following June 5.[4] The reasons why the bylaw was defeated will be discussed later. Thus the city had to come to terms with the Vancouver Water Works Co., and construction began almost immediately.

[2] Alan Morley, *Vancouver: Milltown to Metropolis* (Vancouver, 1974), pp. 109-111.

[3] For a fuller account of the narrative, see Henry Badeley Smith, "Vancouver Water Works", excerpt minutes of the Canadian Society of Engineers, vol. III, Session 1889, 19th October, and vol. IV, Session 1890, 2nd January (Montreal, 1889).

[4] Morley, *Vancouver*, p. 128.

The Keefer group had made detailed studies which located the intake point and the point of crossing the Burrard Inlet in the summer of 1886. When the politicking of the first half of 1887 was resolved, the company staked out the area of its claims and by the end of June 1887 entered into contracts for clearing the land. The intake point was located 6½ miles upstream from the mouth of the Capilano River, where the river was confined to a single channel and the banks were sufficiently high to allow the construction of a dam. The dam site was the only logical one in the canyon, as elsewhere the river divided into multiple channels and the canyon walls did not afford safe and economic construction.

Henry B. Smith assessed the significance of this source in a prophetic passage:

> Previous to the creation of this cañon, the whole valley to the north must have been one large lake. The wall of rock through which the stream penetrated ages ago . . . stands like a huge gate at the south end of the valley . . . Should the City of Vancouver increase to the magnitude predicted, it may be that its people at some future day will cause a dam to be constructed across the narrow gorge, and once again convert this valley into a lake. Vancouver will then possess a reservoir from whence to draw its water supply, which will not be surpassed by any water works system on the continent.[5]

The contract for the first Capilano dam, a stone-filled timber construction, was issued in January 1888 to H. F. Keefer and D. McGillivray, and the dam was completed three months later. This is a remarkable fact considering that everything needed for the construction had to be carried on mule-back 6½ miles into the wilderness during what has been reported as an unusually inclement winter. A second problem was that the canyon walls did not permit the river to be diverted around the dam site at an economic cost. The foundations were excavated, and the first courses laid, in three to four feet of icy water. Nevertheless, the total cost for the dam was slightly more than $15,000. When completed, this dam created a reservoir 380 feet wide and 700 feet long during high-water season which held approximately fourteen million gallons of water.

Once the water was trapped behind the dam, the next problem was to transport it via a system of mains to the city. The terrain over which the mains had to be laid presented several engineering problems. The canyon's rugged walls made it impractical to consider laying mains along its face, and their great height precluded laying mains over the summit. A tunnel, 280 feet long, four feet wide and six feet tall was necessary. Once the tun-

[5] Smith, "Vancouver Water Works", p. 6.

nel was in place the engineering problems were comparatively simple until the main reached Burrard Inlet at the First Narrows. Twenty-two-inch mains were used from the dam to the centre of the tunnel (13,530 feet), and 16-inch mains were used the rest of the way to the inlet (19,320 feet). The First Narrows is the narrowest portion of the inlet, a point where the tidal current reaches maximum velocity. Unfortunately it is not particularly deep; the water bed forms a broad, flat ridge extending from shore to shore. Three different groups of divers examined the bottom, and they agreed on all the particulars. No crevices were found in the rock ledge on which the pipe was to be laid, and the bottom was smooth and free from boulders from shore to shore along the projected route.

Some of the opposition to the Vancouver Water Works Co. scheme was the acknowledged potential for problems in the crossing at First Narrows. Breaks in water pipes lead to the temporary cessation of service, and people believed the probability of a break was greater with an underwater main than a system of mains such as that projected by the Coquitlam Water Co. which was not forced to cross a commercial waterway. Furthermore, submerged pipes were more difficult to repair. The company's answer to these objections was to project two separate lines fifty feet apart and capable of independent operation. They felt this would minimize the problems created by a breakage, since the probability was small that both lines would be broken simultaneously. Thus a Y-joint would be placed on the main from the dam and a Y-joint would be placed on the main leaving First Narrows heading across Stanley Park. The technology for laying submerged pipes had been developed by John F. Ward, the chief engineer of the Jersey City (N.J.) Water Works. His successes in several eastern cities recommended him, and a contract was issued to him in November 1887.

Ward arrived in Vancouver in the spring of 1888. After inspecting his task, he expressed his confidence that the contract could be completed easily and quickly. He began his operations on 21 April 1888. After about six weeks, Ward began to submerge pipe. He decided to substitute a steel wire cable for a wrought iron rod to help align the pipe. When this cable was stretched across the inlet, it became fouled on a small boulder, and all efforts to dislodge it failed. Ward then notified the company that he had been called to St. Paul, Minnesota, on urgent private business. He did not return.[6]

When Ward's contract was officially abandoned, the company turned

[6] For the story of Ward's visit to Vancouver, see *Ibid.*, pp. 32-34.

to Keefer and McGillivray, who had constructed the dam and were still actively working on other phases of the system. During the remaining summer months, a new hauling apparatus to replace the one which contributed to Ward's frustration was devised, the mains damaged in Ward's furtive attempt were repaired, and, with the help of a diver, a 12-inch main with flexible joints was successfully laid. The contract had been reissued on July 9, and on August 28 the pipes were submerged. The following day, a diver walked across the bed of the inlet and reported the whole line of pipes was lying in a straight line in a rock trench of its own excavating. Silt was rapidly gathering around the pipes, and the diver believed they would be entirely covered in a matter of a few weeks. The following day the system was successfully tested at the required pressure of 300 pounds per square inch. The south shore at First Narrows had been reached; the principal obstacles had been overcome.

From the south shore, a 16-inch main led directly across Stanley Park 5,000 feet to a shallow bay of Burrard Inlet called Coal Harbour. The bed of this bay is soft mud punctuated with boulders. The point selected for crossing Coal Harbour was half a mile from the head of the bay, where land promontories jut out from both shores, leaving a waterway 870 feet wide at high water. Immediately south of Coal Harbour, the city of Vancouver was reached. The 16-inch main followed the city streets to Georgia and Granville, where a test flow was made on 26 March 1889. "On April 14, the city tested 60 hydrants, the fire department abandoned water tanks forever, Thorpe and Co. opened its new soda water factory and innumerable housewives threw out their kitchen pumps."[7] The incidence of typhoid fever was reduced immediately. The new system was approximately ten miles long from the well chambers of the dam to the corner of Georgia and Granville, and it was capable of discharging in excess of forty-two million gallons (Imp.) every twenty-four hours.

Prior to the successful crossing of Burrard Inlet there was no known case of pipes being laid in salt water subject to a tidal current of nine miles per hour in water sixty feet deep. The Vancouver Water Works Co. could take justifiable pride in that fact that they were the first to accomplish a feat which other cities at the time might well choose to emulate. The Coquitlam Water Co. had no such obstacle in its way, but its planned route was twice as long as its competitor's. Then miles of additional 16-inch main, at the price paid by the Vancouver Water Works Co. ($1.35 per foot), would have cost over $70,000. The cost of excavating and

[7] Morley, *Vancouver*, p. 129.

refilling the pipe trench, distributing the main and the like would more than likely have put the total additional cost at somewhere around $150,000. The additional cost of the submerged pipe as compared to the same length of pipe laid in the ground was considerably less than this. By adopting the Capilano scheme, Vancouverites were accepting the greater risks associated with the scheme and rejecting the greater costs of the Coquitlam scheme.

Despite the technical success of the Capilano scheme, on 15 November 1889 a break developed in the submerged main and the city was without water for eight days. The company brought water across the inlet by boat and distributed it by cart without charge. The second main had not been laid, and the need for it was now more evident. The accident had two consequences. First, the planned construction of the second main was accelerated, pipes were ordered, and bids requested. Second, the city dropped its plans to purchase the waterworks. Although the majority of ratepayers appear to have favoured a city-owned waterworks, it is doubtful the requisite bylaw necessary for the purchase of the existing waterworks would have passed in the absence of assurances that another accident was unlikely. One continuing cause for concern was the possible absence of water for fire fighting purposes. It had been only three years since fire had burned Vancouver into momentary oblivion. Why buy a waterworks which might not be operational when a fire started?

For its part, the company fought the proposed purchase with much vigour and some logic. It pointed to the expense of the works and the fact that the city's resources were fully employed in developing other necessary services. They pointed to their confidence in the future of Vancouver, the energy they had expended in the speedy completion of the works, and the large amount of private capital which had been invested in the system. However, after a few years of accident-free operation, the ratepayers voted in favour of a publicly owned water system. Thus, in 1892, the city bought out the Vancouver Water Works Co. for $400,000.

Within a few years, the area demanding piped water extended beyond the boundaries of Vancouver. The Coquitlam Water Co. began supplying water to New Westminster in 1893 until it, too, was purchased by the city it supplied. Other areas bought water from one of these two cities. For seventeen years, the Capilano scheme served Vancouver and the adjoining towns of Burnaby, South Vancouver and Point Grey. Population growth soon strained the existing system's capacity during the low-water months of summer. Two alternatives were available: construct a higher dam or seek a second supply source. The city chose the latter alternative to ensure against the Capilano source failing, or for that matter the Capilano became insurance against the new source failing. Thus in 1908 water from the Seymour River was brought into Vancouver under the Second Narrows.[8]

These three supply sources (Capilano and Seymour Rivers and Lake Coquitlam) are the three sources supplying the greater Vancouver area today. As the city grew, there were improvements to enlarge the quantity of water which could be drawn from each source, but there has been no new source added. This experience is in contrast to the water supply history of several comparable American salt-water cities. The typical pattern has been a continual search for new sources of supply at increasingly distant points from the central city. Aqueducts of 200 or 300 miles are not uncommon. Even Winnipeg, located on two freshwater rivers, constructed a 92-mile aqueduct to tap Shoal Lake.[9] The rights of salt-water cities to use particular water resources have been contested by others. New York and San Francisco in particular were involved in long and costly legal procedures which were not resolved until they reached the U.S. Supreme Court.[10] The enlargement of dams to increase reservoir capacity has led to costly legal proceedings involving the rights of the families whose homes would be submerged by the rising reservoir.[11] And then there is Vancouver: an ample, uncontested supply from three sources in an uninhabited area, within twenty miles of the city centre.

## II

Geography and the comparative youth of Vancouver also benefited the city as it developed a sewage-disposal strategy. The 55,600-acre Burrard Peninsula (including New Westminster) is well suited topographically for sewer construction on a gravity-flow basis. As noted, Vancouver began the process of sewer construction before the waterworks were started, but there was no standard basis for design or construction.[12] These sewers and

[8] By 1908 the small reservoir built in Stanley Park was too small and at too low an elevation to serve Vancouver's ever-expanding demand for water. In 1911, a 25-million-gallon open reservoir was opened on Little Mountain.

[9] This interesting exception to one's expectations of the strategy for a river city is discussed in Alan F. J. Artibise, *Winnipeg: A Social History of Urban Growth*, 1874-1914 (Montreal, 1975).

[10] See Cain, "The Economic History of Urban Location and Sanitation."

[11] This case is vividly discussed in Charles H. Weidner, *Water for a City* (New Brunswick, N.J., 1974).

[12] The first sewers in Burnaby were built around 1908. A small collecting system, trunk sewers and outfall were built in New Westminster around 1911.

others on the peninsula drained approximately 6,000 acres directly into Burrard Inlet and False Creek. By the summer of 1911, sewage pollution had become so serious a problem that the beaches had to be closed. This spurred the city fathers of Vancouver, Burnaby, South Vancouver and Point Grey into action, and the Burrard Peninsula Joint Sewerage Committee was formed. This group hired R. S. Lea, an internationally known Montreal sanitary engineer, to investigate and report on a plan for systematic disposal of both sewage and surface water.[13] Lea's report of February 1913 was the foundation of much of Vancouver's sanitary history. In his letter of transmittal Lea noted: "The participating Municipalities are to be congratulated upon being, I believe, the first to voluntarily attempt united action in an undertaking of such magnitude in advance of pressing necessity."[14]

Lea's comprehensive report carefully developed his reasons for each step of his proposed plan. Extensive references to experiences elsewhere in North America and in Europe were included to substantiate his proposal. Detailed discussions of sanitation theory were included where they were relevant. Since Vancouver adopted Lea's plan, there are four parts of his report which are of present concern: (1) the reasoning behind the location of sewage outfalls; (2) the recommendation for a separate, as opposed to combined, sewer system; (3) the awareness that the future must be included in planning, but construction funds need not be available for future works in the present; and (4) the recommendation for a joint sewerage board to administer the plan.

### (1) *The reasoning behind the location of sewage outfalls*

The overriding principle was that the English Bay foreshore, including both the English Bay and Kitsilano beaches, be protected from pollution. The second principle was to protect the harbour, especially the shallow False Creek. Lea's discussion began with reference to the "grosser and

[13] This section is based largely on Lea's report which is contained in Vancouver and Districts Joint Sewerage and Drainage Board (VDJSDB), "Report by R. S. Lea to the Burrard Peninsula Joint Sewerage Committee", (Vancouver, 1971). Also published in this publication are C. H. Rust and R. H. Thomson, "Report on Burrard Peninsula Joint Sewerage Scheme" made to Hon. W. J. Bowser, Attorney-General, B.C., May 1913, and Lea's supplementary report of February 1917.

[14] Lea's letter of transmittal appears in VDJSDB, "Report by R. S. Lea," p. 1. The most common approach to metropolitan provision of sanitation services is the single-purpose special district. For a general discussion of the various forms of metropolitan provision of services and which services are best provided at the metropolitan level, see George F. Break, *Intergovernmental Fiscal Relations in the United States* (Washington, D.C., 1967).

more disagreeable pollution that may result from the disposal of sewage by dilution". In a properly designed system these pose no threat to human life, but proper allowance must be taken in designing a system. The additional features he discussed have to do with the turbidity and discoloration which usually attend the vicinity of a sewer outfall. Customarily, outfalls are placed where the action of winds, waves and currents will disperse "floating particles of garbage, pieces of paper and fecal matter, together with the oily sleek on the surface".[15] The main problems connected with these features have to do with the nuisance created when these solids wash ashore, particularly in recreation areas. It is the latter set of problems which caused Lea to divert sewage from the English Bay recreation area.

The "grosser" pollution constitutes a threat to the public health depending on how the water is used. In this context Lea talked about two factors: (1) the possible infection of water and ice supplies and (2) the threat to fish. Of these two, the second was of greater consequence to Vancouver. Since the water supply was not drawn from the salt water, and most of the affected waterways did not freeze in winter, the threat to the public health was concentrated in waterfront pursuits such as boating, bathing and handling logs.

The two paragraphs of Lea's report devoted to the threat to fish testify to the importance of that industry to the Vancouver economy. Presaging modern thought, Lea devoted one paragraph to the costs and the other to the benefits of sewage on the fish. Some pollutants, particularly those of industrial origin, may have "a direct toxic effect on fish, or so affect their respiratory organs that they die of suffocation". Other fish may simply leave the area. The main cost is that the sewage robs the water of the oxygen fish need to survive. The main benefit is that the "sewage may serve as the source of part of their food supply". Sewage disposal also contributes fertilizer for green seaweeds which can become offensive if they are stranded on the foreshore and start to decompose.[16]

In total, Lea discussed six objectionable features of sewage disposal by dilution. The consequences, he noted, could be minimized by carefully locating the sewage outfalls and, if necessary, by some form of sewage treatment. In recent years, Vancouver has adopted sewage treatment ostensibly for the same reasons that Lea gave for locating the outfalls away from places where Vancouverites worked and played. The six features are as follows:

[15] VDJSDB, "Report by R. S. Lea", p. 13.

[16] *Ibid.*, p. 13.

(1) The infection of water by pathogenic bacteria.

(2) The turbidity, discoloration and unsightly surface conditions in the vicinity of, and remote from the outlet; usually only mildly disagreeable, but occasionally decidedly so.

(3) The evolution of foul odours, and the unsightly appearance of the water resulting from the putrefaction of sludge deposits, or from the putrefaction of the organic matter in solution in the water, following the exhaustion of the oxygen therefrom.

(4) Pollution of the foreshores by the offensive decomposition of stranded sewage solids, and aquatic plants which thrive because of the presence of sewage.

(5) The introduction into the water of substances which are either toxic to fish or deprive them of the oxygen necessary for their preservation.

(6) The obstruction of otherwise navigable channels by deposits of organic solids and silt.[17]

## (2) *Recommendations for a separate sewer system*

In a preliminary report to the Joint Sewerage Committee in May 1912, Lea expressed his preference for the separate system, where the sewers for sewage disposal are separate from those for street runoff, since the unpolluted surface water flow could be diverted to areas such as English Bay and False Creek where domestic and industrial wastes were to be excluded. Further, such resources as Burnaby Lake, which was unsuited for sewage discharge, could handle surface water. Simply stated, where sewage has to be carried long distances by intercepting sewers, as Lea proposed in his 1913 report, or where it is to be treated, the separate system is preferred.[18]

The argument against the separate system is that it involves a greater cost, but this is necessarily true only if a common outlet is used for both sewage and surface water. Where the outlets are different, several factors worked to reduce the cost of a separate system. First, the number of miles of sewer pipe involved in draining storm water was significantly less than that involved in sewage disposal. Second, since provision did not need to be made for the depth of basements, surface-water drains could be laid in a shallower channel, saving construction expense. Third, in the case of an area subject to heavy rain, the capacity of a combined system may have to be larger than that necessary for a separate system in order to minimize the pollution potential of severe storm. Fourth, where streets were un-

[17] *Ibid.*, p. 14.

[18] Those areas in which combined sewers had been laid were to remain on the combined system.

paved, combined sewers often become clogged with silt from the street runoff. In such a case the only sewers which might prove necessary are those for sewage disposal. Finally, construction standards can be somewhat less for a surface-water drain than for a combined sewer. The combined sewer is subject to greater chemical interaction and the pollution potential of leaks is much greater than a surface-water drain.

Contemporary wisdom, Lea admitted, was that the separate system was the better system, but it was a luxury. He also noted that today's luxury becomes tomorrow's necessity and urged the joint committee to consider the magnitude of the project they were considering and exercise some foresight. Although he did not provide cost estimates for a separate system versus a combined system, he did argue: "The conditions tend to equalize the first costs of the two systems particularly in so far as good grades and moderate intensity of rainfall are conducive to this end".[19] He went on to note that some of the expense of the separate system could be deferred in that in many areas removal of surface water was a much less pressing problem than the removal of sewage. Lea's advocacy of the separate system did not meet with universal approval.

Two sanitary engineers, C. H. Rust and R. H. Thomson, commenting on Lea's scheme for the provincial government, noted that they felt Lea overestimated the pollution danger, and thus understated the case for a combined sewer system.[20] Rust and Thomson described Lea's scheme as "practicable and feasible", even if the separate system were adopted. They suggested that the issues involved in the decision between a separate and combined system were worthy of further consideration. The present day need for sewage treatment to minimize the pollution threat has confirmed Lea's wisdom and that of the joint committee which adopted the separate system.

### (3) *Considerations of the future*

The problems of designing a large sewerage system are made more complex by the fact that the engineer must make allowance for both present and future needs. Lea's explanation is quite succinct:

> To construct a sewer that becomes too small for the needs of a district and has to be rebuilt before the loan under which it was constructed, is repaid, is bad economics, and it is equally bad to burden the ratepayers of today with

[19] VDJSDB, "Report by R. S. Lea", p. 24.

[20] *Ibid.*, pp. 48-51.

a large capital outlay on a sewer that will not be called upon to do its full duty till many years after the completion of the payment of the loan.[21]

Lea took the usual life of sewer bonds to be forty years, so his system was designed to be consistent with his estimate of Vancouver's 1950 population — 1.4 million. He recognized that not all construction need be made in the present so he divided his cost estimates into "immediate" and "deferred" construction expenses. Both estimates summed to the same figure, $5.5 million. The "deferred" costs were obviously speculative and depended on many unforeseen events of which the most important was the future growth of the city.

The Rust and Thomson report adopted a more conservative stance and recommended that, as there was insufficient data at hand to justify all of Lea's "immediate" expenses, the province should pass legislation based on Lea's proposed scheme, but proceed slowly at the start. No basic changes in Lea's proposal were made in the Rust and Thomson report; it merely urged a conservative approach on the administrative body which would be responsible for the plan's implementation.

(4) *The recommendation for a joint sewerage board to administer the plan*

Lea was aware that his plan covered several municipalities, and he was quick to point out that, where similar schemes were carried out under the immediate supervision of the municipal councils, the lack of effective coordination led to unsatisfactory results.[22] He also noted that such schemes should not be bounded by municipal boundaries, a position well in keeping with today's best practice. Lea, however, envisaged a future where one metropolis would cover the peninsula. His proposals for a joint board, however, were for the four towns comprising the joint committee to whom he was reporting.

Before Lea outlined his proposals for a constitution and the powers of a joint board, he recounted the experience of other cities which had adopted joint boards. In particular, he pointed to the "excellent work" of joint boards in Birmingham, Boston and Melbourne. Thus the provincial legislature passed "An Act Providing for a Joint Sewerage and Drainage System for the City of Vancouver and Adjoining Districts" which was "in substantial accordance" with Lea's 1913 proposal.

[21] *Ibid.*, p. 7.

[22] *Ibid.*, pp. 40-44.

The Vancouver and Districts Joint Sewerage and Drainage Board which superceded the Burrard Peninsula Joint Sewerage Committee was inaugurated in August 1913, and received legislative sanction on 4 March 1914. The basic function of this act, and an amending act in 1915, was to guarantee the board's securities to the extent of $5 million in the present and $10.5 million overall. In the 32 years during which this board was responsible for the construction, financing and maintenance of all trunk and intercepting sewers, sewage outfalls and watercourses, it spent nearly $9 million.

When Lea's program was instituted, the basic contour of Vancouver's present-day solutions to water supply and sewage disposal problems had been adopted. There has been a widening of the area as the metropolitan population has increased, but apart from extending the joint board type of control to water supply problems in 1926, there has been no change in Vancouver's sanitation strategy. The city's youth enabled it to foresee the need to design a sewer system which was compatible with sewage treatment when, and if, population pressure necessitated such an action. All Vancouver's expeditures on sewerage have been consistent with the strategy in use today; there have been no expenditures on extraneous capital.

## III

Vancouver's sanitation history since 1914 has been the history of the several joint boards which provided these services to the residents of the metropolitan area. The details of these boards have been discussed elsewhere.[23] For present purposes it will suffice to report on how these boards altered Vancouver's sanitation strategy to meet the needs of the metropolis' ever-growing population.[24]

As the municipalities of Burnaby, South Vancouver and Point Grey began to grow rapidly in the years after World War I, they put tremendous pressure on Vancouver's waterworks, from which they purchased water. The success of the joint sewage board recommended that approach for water supply. Thus in 1924, the provincial legislature created the

[23] In particular, see the articles by Paul Tennant and David Zirnhelt, "The Emergence of Metropolitan Government in Greater Vancouver", and Robert W. Collier, "The Evolution of Regional Districts in British Columbia", both in *BC Studies*, No. 15, Autumn, 1972.

[24] This section is based largely on pamphlets and brochures of the Greater Vancouver Regional District, the Greater Vancouver Water District, the Greater Vancouver Sewerage and Drainage District and the City of Vancouver Engineering Department.

Greater Vancouver Water District, which came into being in January 1926. The original district included Vancouver, South Vancouver and Point Grey; these three municipalities were amalgamated on 1 January 1929. Burnaby jointed the GVWD in 1927; the district of North Vancouver in 1928; and the district of West Vancouver in 1929. On 7 January 1931, when New Westminster, Richmond, Coquitlam and Port Coquitlam joined the district, the GVWD covered most of the inhabited area of the lower mainland.

The district bought the existing waterworks from Vancouver (and later New Westminster) and consequently controlled the entire system developed from the Capilano, Seymour and Coquitlam sources. It sold water to each member municipality on a wholesale basis. The district's charges for water were set so that revenues and expenditures were as equal as possible; each member municipality paid the same basic rate per gallon. The water was then distributed in the member's own distribution system; consumers purchase water from the member municipality, not the district.

Today the GVWD comprises four cities and ten municipalities which encompass almost all lower mainland communities. While new dams have been constructed in each watershed, and entrance to the watersheds is controlled, they are the same three sources which date back to the city's founding. The supply remains abundant and the quality above average. The man responsible for the growth of the water supply system under the GVWD was Dr. E. A. Cleveland. His boast, "No case of disease has ever been traced to this city's water supply", caused him to feel heartbroken when chlorination was introduced at the insistence of the U.S. Navy when they were contracting for port facilities in Vancouver during World War II.[25] Once the war ended the practice of chlorination was continued, but at a much reduced rate, to ensure quality standards. The only other form of treatment currently used is screening; some thought has been given to introducing fluoridation in the future.

The main problem faced by the district has been small slides of silt or clay which discolour the water. Cleveland advocated complete isolation of the watershed to exclude all possible human disease carriers. The watershed was forested, but in 1961 a program of reforestation began to remove infested stands and aged trees which constituted a fire hazard. It is doubtful that continued urban growth will alter the geographical isolation of

[25] Morley, *Vancouver*, p. 206. The controversy was resolved in Ottawa. See Raymond Hall, Gordon Soules and Christine Soules, *Vancouver's Past* (Vancouver, 1974), p. 85.

the watershed, so Vancouverites can continue to expect water from a system which is reputed to be "one of the finest systems in the world".[26]

The Greater Vancouver Water District and the Vancouver and Districts Joint Sewerage and Drainage District were separate legal entities, but after the GVWD came into existence they had a common staff under one director, reflecting the commonalty of many engineering problems and the realization of scale economies in administration. They both had a similar authority and structure: a board of directors composed of delegates from the member municipal councils and a board chairman elected from its members by the board. These similarities were the result of the provincial legislation creating these boards.[27] Unlike water where a user-charge is assessed, revenues for the operation of the sewer system come through taxes.

In the post-World War II years, the existing sewage facilities proved inadequate. The shore and some shore waters were becoming polluted, and it became clear that Lea's strategy needed to be re-examined. To that end a committee was established in 1949 under the leadership of A. M. Rawn, chief engineer of Los Angeles County, to study the problem. After four years, the Rawn Report was issued which provided a master plan for the greater Vancouver area. As before, the provincial legislature accepted this report and passed legislation creating the Greater Vancouver Sewerage and Drainage District on 1 April 1956. The act simply replaced the old district with the new and charged the new district with enacting the recommendations of the Rawn Report.[28]

The basic problem the Rawn Committee found was that a dozen communities were discharging untreated sewage into Burrard Inlet and the Fraser River. The problem became so acute that the city's beaches were closed once again. The Rawn Report recommended the construction of a tunnel under Point Grey and Kerrisdale to divert sewage from English Bay and to take it to a treatment plant to be constructed on Iona Island at the mouth of the Fraser River. This plant opened in 1963. Several other capital expenditures were made to fulfil the requirements of the Rawn Report; a total of $45 million was required.

In 1967 a committee was appointed to update the Rawn Report. One

[26] Greater Vancouver Regional District, "GVRD-1975", p. 12. It should be noted that the GVRD does not claim the water system is the finest, only that it is reputed to be one of the finest.

[27] Tennant and Zirnhelt, "The Emergence of Metropolitan Government in Greater Vancouver", p. 4.

[28] All financial obligations of the old district were to become obligations of the new district.

problem was that several municipalities in addition to the original members of the GVSDD (Vancouver, Burnaby, and the University Endowment Lands) were not included in the master plan of the Rawn Report. This committee's January 1969 report recommended additional treatment plants on Lulu and Annacis Island and improvement to the Iona Island and Lions Gate plants to eliminate raw sewage discharge within the region.[29] This required an additional expenditure of $66 million. By the time these works were completed, almost all the cities and municipalities in the lower mainland were included in the district. In sum, these two reports increased the annual expenditures on the non-capital account from approximately $0.5 million in 1956, before sewage treatment was adopted, to $10 million today.

In spite of the references to the growing awareness of pollution by the public officials and the public, it should not be forgotten that the Lea Report of 1913 described sewage treatment as a probable future necessity, and his master plan was designed to allow for the future construction of sewage treatment works. While a considerable amount of money has been expended in the installation of treatment works, the sum undoubtedly would have been greater if Lea's plan had been oblivious to the possibility. Once again, Vancouver's relative youth was a benefit. When Lea presented his report, many older cities had grown to the point where sewage treatment was a necessity. The experience of these older cities enabled Vancouver to construct its sewerage and drainage system as it was needed, but each new link was consistent with the earlier ones.

## IV

The strategies Vancouver has adopted for water supply, sewage disposal and drainage are consistent with those of other salt-water cities. The salt water is used for sewage disposal and drainage. The water supply is drawn from the nearest abundant source of fresh water. Vancouver is fortunate in having its water supply source within a short distance of the central city. The steps in the evolution of these strategies have been analogous to those in other cities, but Vancouver's relative youth enabled it to benefit from other cities' mistakes and to adopt consistently the best modern practices. Although this essay has not attempted to report each individual step, the general configuration should be apparent.

[29] The first stage of the Lions Gate plant on the North Shore was constructed as part of the original Rawn report. The other three treatment plants are located along the Fraser River.

Economists who study intergovernmental problems consistently have identified water supply, sewage disposal and drainage as urban services best provided at the metropolitan level.[30] It is significant, and to Vancouver's credit, that metropolitan provision has long been a hallmark of the region. The functions of the two districts have now passed to the Greater Regional Vancouver District, although they remain legally separate entities. While the GVRD is a youthful body seeking its place among the plethora of governmental jurisdictions, one thing is clear: Vancouverites will continue to enjoy the benefits of metropolitan provision of sanitation services.

[30] For example, see Break, *Intergovernmental Fiscal Relations*, p. 176.