CHRISTCHURCH

Swamp to City

A Short History of the Christchurch Drainage Board 1875 - 1989

Christchurch
Swamp To City

A Short History of the Christchurch Drainage Board 1875 - 1989

The city of Christchurch occupies a low-lying area of the Canterbury Plains, close to the sea. The plains rise steadily beyond the city to the foothills of the Southern Alps. In the foreground of this 1973 aerial photograph from above the estuary of the Avon and Heathcote Rivers are the oxidation ponds of the city's sewage treatment works. Drainage Board

Front Cover: *The office building of the Christchurch Drainage Board and the Avon River, 1989.*
Drainage Board

CHRISTCHURCH
SWAMP TO CITY

A Short History of the Christchurch Drainage Board 1875 - 1989

John Wilson

Christchurch
Drainage Board

Published by

Te Waihora Press
P O Box 57, Lincoln, New Zealand

for the

© Christchurch Drainage Board

ISBN 0 908714 04 1

First published 1989

Printed in Christchurch

by Teamprint
P O Box 10181, Christchurch

Contents

Foreword

At the end of this study of the work of the Christchurch Drainage Board, the author quotes a former Board Secretary to the effect that "people tend to forget the Christchurch Drainage Board exists — until they find their property under water or, worse still, their lavatories won't flush". In 1989, local government through New Zealand was reorganised. At the beginning of that year, with the Board due to go out of existence before the year's end, members of the last Board feared that in years to come people might forget entirely there had ever been such a body. To avoid this happening, the Board asked a Christchurch historian, John Wilson, to research the Board's history and write both a short, popular account of the drainage of Christchurch and also a longer definitive work that would cover all aspects of the Board's history.

Dr Wilson has worked to tight time limits to allow the members of the last Christchurch Drainage Board to enjoy the satisfaction of seeing a popular record of the Board's work in print at about the time the Board itself went out of existence. I have read many historical documents and want to state that Dr Wilson has used his special talents to make what could have been a rather uninteresting topic a very well written and complete summary of the Board's activities and work. The Board is grateful to Dr Wilson for his efforts to provide it with this "instant" memorial and looks forward to the definitive history which he has been engaged to research and write at a more leisurely pace.

Avoiding the politics of whether it is a good move or not, the Drainage Board has now passed its responsibility for the drainage of Christchurch on to an enlarged Christchurch City Council. The new Council has also inherited a remarkable legacy of achievement, documented in this book, in providing Christchurch with adequate drains and sewers. It is no empty boast that Christchurch's systems of sewerage and stormwater drainage are the best in New Zealand, perhaps in Australasia. Over the years, when the Board's separate existence was called into question, fears were voiced that the abolition of an independent drainage authority could lead to neglect of the drains and sewers which are essential to the well-being of Christchurch. The challenge facing the new Christchurch City Council, as it takes over the duties performed by the Drainage Board for more than one hundred years, is to prove that these fears are ungrounded. It is now up to the new Council to maintain Christchurch's proud record as a well-drained city built on a most unpromising site.

Newton Dodge
Christchurch Drainage Board
Board member 1971 - 1989
Chairman 1983 - 1989

Introduction

In 1849, Captain Joseph Thomas, despatched to New Zealand by the Canterbury Association to prepare the way for the emigrants the Association was soon to send out to New Zealand, decided he would place the capital city of Canterbury, Christchurch, on 1000 acres (400 hectares) of land on the plains. The Avon River ran through the site. A short distance upstream was the farm established some years earlier at Riccarton by the Deans brothers.

In the 140 years since Captain Thomas made this decision, the marshy area which he chose as the site of Christchurch has been transformed into a pleasant, habitable place. For 114 of those years, the body responsible for draining the flat, low-lying and originally swampy ground on which Christchurch is built has been the Christchurch Drainage Board. The Board was the first body of its type in New Zealand and no other similar body had its own separate Act of Parliament. In most other centres responsibility for stormwater drainage and sewage disposal has been undertaken by territorial local authorities or, as in Auckland in recent years, by a regional authority. That a separate body, with sole responsibility for drainage, was thought necessary for Christchurch from an early date is an indication of the difficulties the city's site posed for drainage and sewerage.

In 1989, the Christchurch Drainage Board went out of existence. In a far-reaching reorganisation of local government in the region, drainage and sewerage have become two of the many responsibilities of a greatly enlarged Christchurch City Council. A separate drainage board was first set up because the city was split up among a number of local bodies which could not agree on urgent action needed to solve the young city's drainage problems. A major reason for having a separate body charged with draining the city disappeared when a single local body with boundaries embracing the entire drainage district was set up.

Faced with the imminent demise of the body on which they were serving (the October 1989 local body elections were the first for more than a hundred years in which the citizens of Christchurch were not called on to elect a drainage board), the members of the Christchurch Drainage Board felt that the efforts and endeavours of former members of the Board and of the Board's staff should be properly documented and written up. This booklet is appearing in advance of a major history of the Board and its work which will be published in 1991. But the Board felt that before it ceased to exist as a separate body, the people of Christchurch should have the opportunity to learn about the largely unsung services which the Board and its staff have rendered Christchurch over more than a century.

It would have been impossible to produce this outline, illustrated history of the Board's work in the short time available before the Board went out of existence had some work not already been done on the Board's history. A basic source has been a book by Agnes Hercus *City Built Upon A Swamp*, published by the Board in 1948. This work, which had its origins in an M.A. history thesis, traced the Board's work in detail up to 1903 and in outline on up to 1936.

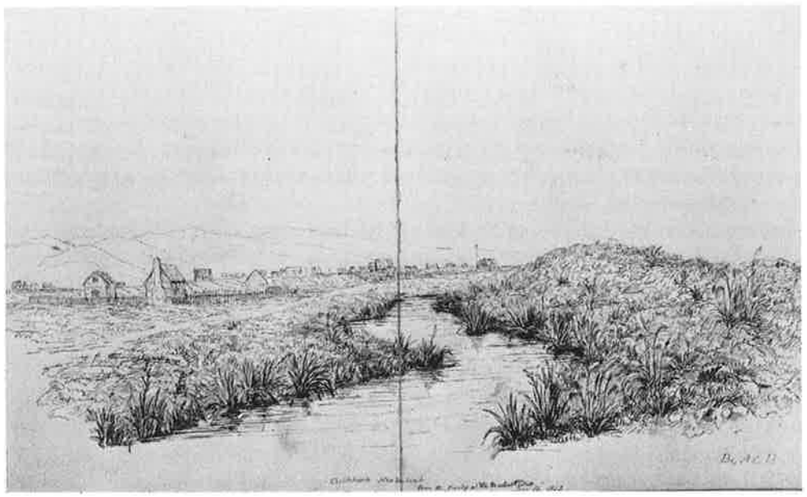
Two former employees of the Board also worked on aspects of its history. R.R. Senior, a former Board Secretary, began work on a full history of the

Board but did not get beyond its early years. More importantly, E.F. Scott, the Board's Chief Engineer from 1946 to 1963, assembled a large amount of information about the Board's systems of drainage and sewerage which was published in 1963 as *Christchurch Data: Notes and Comments on the Christchurch Drainage and Sewerage System.* This, too, was an indispensable source.

I must also record my thanks to several of the staff of the Board for their help in compiling this history. The Chief Administration Officer, N. Kelly, and his deputy, P.L. Ellis, both shepherded the project through with genuine interest and helpfulness. L.K. Rimmer, Records Clerk, was of great assistance in identifying sources in the Board's own library and records and in assembling the pictures with which this history is illustrated. K. Sibly, Deputy Chief Draughtsman, brought to the drawing of the maps both a deep knowledge of the Board's history and services and an enthusiastic interest in the project. Mr Sibly had worked with E.F. Scott on his 1963 paper and he also cast a knowledgeable eye over the text, filling in some gaps. A draft of the text was read by several other members of the Board's staff and the comments of H.P. Hunt, Chief Engineer, G.F. James, D.G.H. Cooper and P.J. Adams resulted in marked improvements at many places in the text and eliminated some errors which would otherwise have crept into print.

Two members of the Drainage Board itself, Colin Russell (a member of twenty-five years standing) and Judith Bruce, constituted a sub-committee which had oversight of the project and their interest and enthusiasm helped to bring it to a successful conclusion. It should be stressed, however, that the Drainage Board gave me an entirely free hand as an historian and made no attempt to have the text reflect favourably on the Board's role through the years.

I must also record thanks to members of the staffs of the Canterbury Public Library and of the Canterbury Museum who helped me gather the photographs needed to illustrate this book.



A.C. Barker sketched the Avon River from the bridge at the Market Place (now Victoria Square) in December 1852. Christchurch's flat, low-lying location is evident in the sketch. Canterbury Museum

Chapter 1

Captain Thomas's Choice

When Captain Thomas arrived in Canterbury in 1849, he first considered placing Christchurch at the head of Lyttelton Harbour, but eventually decided that an area of slightly elevated ground on the Avon River, out on the plains, would be a better choice of site. On this ground, the city was laid out as a regular grid of streets occupying approximately 1000 acres (400 hectares).

Although this 1000 acres was mostly somewhat higher and therefore drier than much of the surrounding land, even within the bounds of the "town belts", today's four avenues around central Christchurch, there were areas of raupo swamp and marsh, notably around Lichfield Street. Deep gullies, which held water in wet weather, creased the ground.

East, north and south of the 1000 acres on which Christchurch was laid out, the ground was even more unpromising. Between belts of higher sand dunes which marked a retreating shoreline were deep peat swamps. These depressions between the sand dunes were often lower than the rivers which drained the area so that when drains were built they had to follow circuitous routes to achieve a low enough outfall into the rivers.

To the west of the site of Christchurch lobes of gravel, the leading edges of the shingle fan of the Waimakariri River to the north, reached out into the area over which Christchurch was to grow. Between these drier, better drained areas of shingle there were further areas of swampy ground.

The map compiled from the 'Black Maps' of 1856, bound in the back of this volume, gives a comprehensive picture of the nature of the ground on which Christchurch was established. Map number 1, which shows the contours of the same ground, also illustrates the complex, low relief of the city's site.

Captain Thomas cannot have had the drainage of the area in mind when he chose this site for Christchurch, for the site was to pose difficult problems some of which were not finally solved until well into the second half of this century.

To one historian of the Board's work, R.R. Senior, "why Captain Thomas selected the area for the site of the city is a mystery". He hazarded a guess that Thomas anticipated the beauty of the Avon River meandering through the town or regarded the river as a good means for conveying goods. Certainly, Christchurch was well placed if waterways were to be an important means of transportation, with access to the sea down the Avon. Canals from the Heathcote and Avon to the Halswell and Styx Rivers would have been easy to construct. But the railway age reached Christchurch soon after the city had been founded and this possible advantage of Thomas's site was never exploited.

Thomas himself stated that he chose the site he did for Christchurch because of its easy access to "a vast quantity of land, perfectly level, well-watered and suited for all purposes of agriculture and pasturage". The city was in fact placed at the point on the plains as close to the port of Lyttelton as the intervening swamps would allow. Thomas also saw the Avon as an excellent source of water for the new town of Christchurch, at a time when the artesian supplies beneath the site had not yet been discovered.

Although Thomas had good reasons for placing Christchurch where he did, "Yet" says Agnes Hercus "when everything that can be said in favour of the site chosen for Christchurch has been said, it still stands condemned". Criticism of Captain Thomas's choice of a site for Christchurch has been voiced by people associated with the Christchurch Drainage Board from the earliest days of the Board's existence. Agnes Hercus summed up the prevailing view when she wrote deploring Thomas's "lamentable lack of insight into the problems which he was creating by attempting to build a city upon a flat site a large part of which was nothing but swamp". In the 1970s, an American engineer who was investigating odour problems at the Drainage Board's treatment works noted that Christchurch had been built upon a marsh and observed that "the original setting of Christchurch is a particularly difficult one from a sewerage and drainage point of view".

The site Thomas chose had two main disadvantages which those responsible for draining the city in future years had to overcome. First, the site was low-lying and flat. The floor of the Cathedral, in the centre of the town, is only 15 feet 6 inches (4.7 metres) above the high water mark for spring tides. Even as far out as Sunnyside and the Bush Inn at the top end of Riccarton Road, the land is still only 44 feet 6 inches (14.35 metres) and 51 feet 6 inches (16 metres) above the high-water mark. On a low, flat site it was to prove difficult to achieve sufficient fall for sewers and stormwater drains to flow by gravity.

An early view of a reach on the Avon River. Christchurch developed on a marshy site covered largely with flax, raupo and other swamp plants.
Canterbury Museum

A view of the Heathcote River, c. 1880. Thirty years after Christchurch had been founded, farmland and stands of trees have taken the place of the former swamps.
Canterbury Museum

The other major disadvantage of the site was that even when the surface water had been drained away and the groundwater level lowered, the ground conditions of former swamp land made the construction of drains and sewers difficult. The Board first encountered this problem when it was building its original pumping station in Tuam Street in the early 1880s. In the 1970s, underground stumps from old swamp forest made the reticulation of Belfast difficult and in the same decade when pipes were being laid in Richmond, more than a metre of peat had to be excavated from the base of the trench and replaced with gravel to give a satisfactory foundation for the pipes.

In the early 1960s, E.F. Scott, the Board's Chief Engineer, wrote that it would be idle to speculate how many headaches the Drainage Board would have avoided had the age of the motor car been foreseen "and Christchurch established out Rolleston way on a good shingle foundation". A Board member echoed the sentiment in 1974 when he said it would have been better if Thomas had selected Rolleston as the site for the main settlement of Canterbury.

But except for drainage problems, Thomas's choice of a site for Christchurch was an excellent one. And being built on a site that was extremely difficult to drain may not have been entirely to Christchurch's disadvantage even from this drainage point of view. The challenge of the site stimulated the will to find effective solutions to Christchurch's serious drainage problems. It is not coincidental that the New Zealand city whose site was originally the most difficult from a drainage point of view has, at least since the Drainage Board came into existence in the late 1870s, been the best drained and most efficiently sewered city in the country. The Board goes out of existence with all the urban areas of its district sewered. The Board's success in draining Christchurch has been noticed overseas and enquiries have been received from Australian cities about its solutions to various drainage and sewerage problems.

The difficult ground conditions encountered over much of Christchurch are evident in these 1918 photographs of land that was once covered by swamp forest.
Drainage Board

Chapter 2

Before The Board

A quarter of a century passed between the founding of Christchurch and the setting up of the Christchurch Drainage Board. In this time, the disadvantages of the site which Captain Thomas had chosen soon became apparent. The responses to the challenges of the site by the local authorities responsible for draining the city in those years were faltering and uncoordinated which emphasised the problems which Thomas had bequeathed to the city.

In 1844, John Deans wrote of "a river of water clearer than crystal (indeed the finest water I ever saw) running past the front" of his homestead at Riccarton. Twenty years later, the Avon was seriously polluted and water-borne diseases were rife in the city. In 1866 the water of the Avon was "not considered wholesome to use unless boiled". The situation a decade later was so serious that Parliament eventually passed special legislation bringing the Drainage Board into existence to set things right.

But the drainage of Christchurch was not entirely neglected before the Christchurch Drainage Board came into existence in 1875-76. Two bodies in particular gave attention to the problems of a city expanding over a low, flat, water-logged site. These were the Canterbury Provincial Government, which governed Canterbury from 1853 until the abolition of the provinces in 1876, and the Christchurch City Council, established in 1862. The City Council governed only the area within the town belts (Thomas's original city). From 1864 on, outside these belts, Roads Boards were constituted. Although their main responsibilities were, as their names suggest, forming and maintaining roads, these Boards also undertook some drainage work.

A major preoccupation of the Provincial Government was to protect Christchurch from the menace of the Waimakariri River, another disadvantage of the site of Christchurch which Thomas had not foreseen. This is not a problem with which the Christchurch Drainage Board has had to concern itself directly. The Provincial Government, in 1868, set up a separate Board of Conservators to deal with the problem of Waimakariri River flood waters flowing through Christchurch. The responsibilities of this Board of Conservators were later inherited by the North Canterbury Catchment Board.

The Provincial Government also cut local drains in the area of the growing city of Christchurch. In 1858, the Provincial Engineer, Edward Dobson, deplored the lack of a general drainage bill giving the Government the right to cut drains across private land. The Provincial Government then had him prepare a report on "the best means of providing surface drainage, sewerage and water supply for Christchurch". Dobson recommended immediate steps to set levels for streets so that all rainwater would flow into the rivers. On the grounds that underground sewers would be too expensive for the infant city, he recommended the use of "portable cesspools" for the disposal of sewage. One of the major works the Provincial Government undertook following Dobson's report was the construction of a stormwater drain along

the South Belt (now Moorhouse Avenue) and down Ferry Road. The Canterbury Association had begun drainage work along this line to drain the extensive raupo swamp in the south-east corner of the city and to allow the road to the port via Ferrymead to be formed.

The Provincial Government also built various smaller pipe, brick and open drains leading to the rivers and was the first body to make efforts to keep the rivers clear of watercress and other weeds, work which the Drainage Board continued up to 1989. But the concerns of the Provincial Government were surveying, roads and bridges rather than drainage.

The period in which the Provincial Government was the only body with responsibility for draining Christchurch ended in 1862 when the Christchurch Town Board, soon to become the Christchurch City Council, was set up by the Provincial Government. Indeed, the concern of residents about the lack of a proper drainage system and the accumulation of waste and refuse, which were increasingly posing a danger to health, was one of the main reasons why the Christchurch City Council was formed. One of the new body's first acts was to advertise for a Town Surveyor, among whose duties was to be the preparation of a report on surface drainage. In the same month, March 1862, the new City Council let its first contract for clearing the River Avon.

A month later, in April 1862, the City Council set up a Sanitary Commission to consider how best to remove stagnant water around the city. Following reports from a consulting engineer, W. Bray, and from its own Sanitary Commission, the City Council began levelling streets (to prevent water becoming impounded), and constructing side channels. It also built a number of open and pipe drains to carry water from low-lying areas to the rivers and inaugurated a system for the compulsory emptying of cesspools.

In November 1864, the City Council adopted a comprehensive report on the disposal of wastes in Christchurch. The report recommended that night soil be carried to an area of sandhills (where the Drainage Board was later to open its sewage farm and then, later still, to build its treatment works) and construction of a system of underground drains to carry house slops (also referred to as sullage or "liquid filth") down the canal reserve (along the line of Linwood Avenue) into the Estuary. The drains leading into this main drain were to service areas both north and south of the Avon River. The pipes ordered for this scheme arrived in Christchurch in 1866, but by then a new City Council had been elected. This new Council decided that the plan for underground drains was premature and that the ready availability of artesian water for household use meant that house slops could be drained into the river, which was no longer needed as a source of clean water. So the promise of the 1864 scheme, that Christchurch would be adequately drained, was not realised.

Outside the town belts, the Roads Boards set up in the mid 1860s undertook some drainage work, but the local bodies proved incapable of the co-operation necessary to solve the common drainage problems of the whole area. In 1871, relations between two local bodies, the Heathcote Roads Board and the Christchurch City Council, deteriorated to the point that the Heathcote Roads Board obtained a Supreme Court order forcing the City Council to discontinue using the Ferry Road drain. This drain, constructed by the Provincial Government, ran down the South Belt from Selwyn Street then on down Ferry Road to an outfall to the Heathcote River. It carried both stormwater and household slops. Without it, significant areas of the city would have again become subject to flooding and the unhealthy accumulation of "liquid filth".

The City Council thereupon engaged W. Bray to design a system of underground sewers for the city leading to a large brick sewer which would run from the corner of Tuam Street and the East Belt (Fitzgerald Avenue) eastwards down Tuam Street. Some distance down Tuam Street this brick sewer became an open timbered drain which ran to the old canal reserve. On

In this 1870s view of the Avon River, east of the city centre, Christchurch's swampy origins are still evident twenty years after the city had been founded. Wards Brewery on Kilmore Street is to the right.
Canterbury Museum

freehold land beside this reserve, the City Council constructed a main outfall drain for the city. Work began on the sewer and drain in December 1871 and the main outfall was opened on 30 January 1874. This channel has been a major outfall drain for the city's stormwater ever since. In the late 1930s, the channel was widened and excavated from the Estuary up to St John Street to form a flood storage basin. This 'canal' is thus not the remnant of an early attempt to dig a waterway from the Estuary up to the Avon River at Avonside Drive, as many generations of Christchurch people have believed, but part of the earliest attempt to provide the city with a comprehensive and effective drainage system.

The abandonment of the Ferry Road drain and the construction of the main outfall drain along Tuam Street and the canal reserve was a major result in the early 1870s of the failure of the local bodies of the region to co-operate on a desperately needed common drainage system.This lack of co-operation also resulted, eventually, with more far-reaching effect, in the setting up of a separate drainage board whose boundaries would embrace areas under the jurisdiction of several local authorities.

As the need for better drainage became increasingly pressing and as it became more and more evident that the local bodies lacked the will to co-operate among themselves to construct a common system, the only solution seemed to be to take responsibility for draining the area right out of the hands of the local bodies and give it to a body whose sole responsibility would be drainage. So, in the second half of the 1870s, the Christchurch Drainage Board was born.

When it came into existence in 1876, the Christchurch Drainage Board inherited a rudimentary but unco-ordinated system for stormwater drainage of its district and also, in the case of Christchurch City proper, a system of drains and sewers which also carried household slops away from the city to the Estuary.

The arrangements for the removal of sewage from inhabited areas which the Drainage Board inherited were, however, more primitive. The Christchurch City Council had inaugurated a system of night soil collection in 1862, individual cesspools being emptied using moveable boxes. A dry pan system, using ashes and quicklime in the pans, was recommended by the City's Night Soil Committee in 1863. The collection of night soil remained the only way sewage was disposed of in Christchurch for two decades after that. The new Drainage Board, in 1876, faced major problems that required urgent, far-reaching and expensive solutions.

Chapter 3

Troubled Beginnings

By the mid 1870s the problems arising from Christchurch having been placed on a flat, water-logged site could no longer be ignored. In 1874 Christchurch had the highest number of deaths per thousand people of any New Zealand centre. Contributing to this death rate were cases of typhoid, diphtheria and dysentery, water-borne diseases of which Christchurch had far more cases than anywhere else in the country. An epidemic of typhoid fever in 1875 provided the final push for something to be done.

The cause of Christchurch's high death rates from water-borne diseases was clearly the amount of household slop water saturating the soil and seepage from the city's numerous cesspits. In the middle of 1875, representatives of the various local bodies of the area — the Christchurch City Council and the surrounding Roads Boards, in whose districts there were already sizeable centres of population — met to discuss a common approach to the problem. The suburban areas, under the jurisdiction of the various Roads Boards, refused to become part of the city, leaving the only feasible course the creation of a separate body to deal with drainage as a city-wide problem.

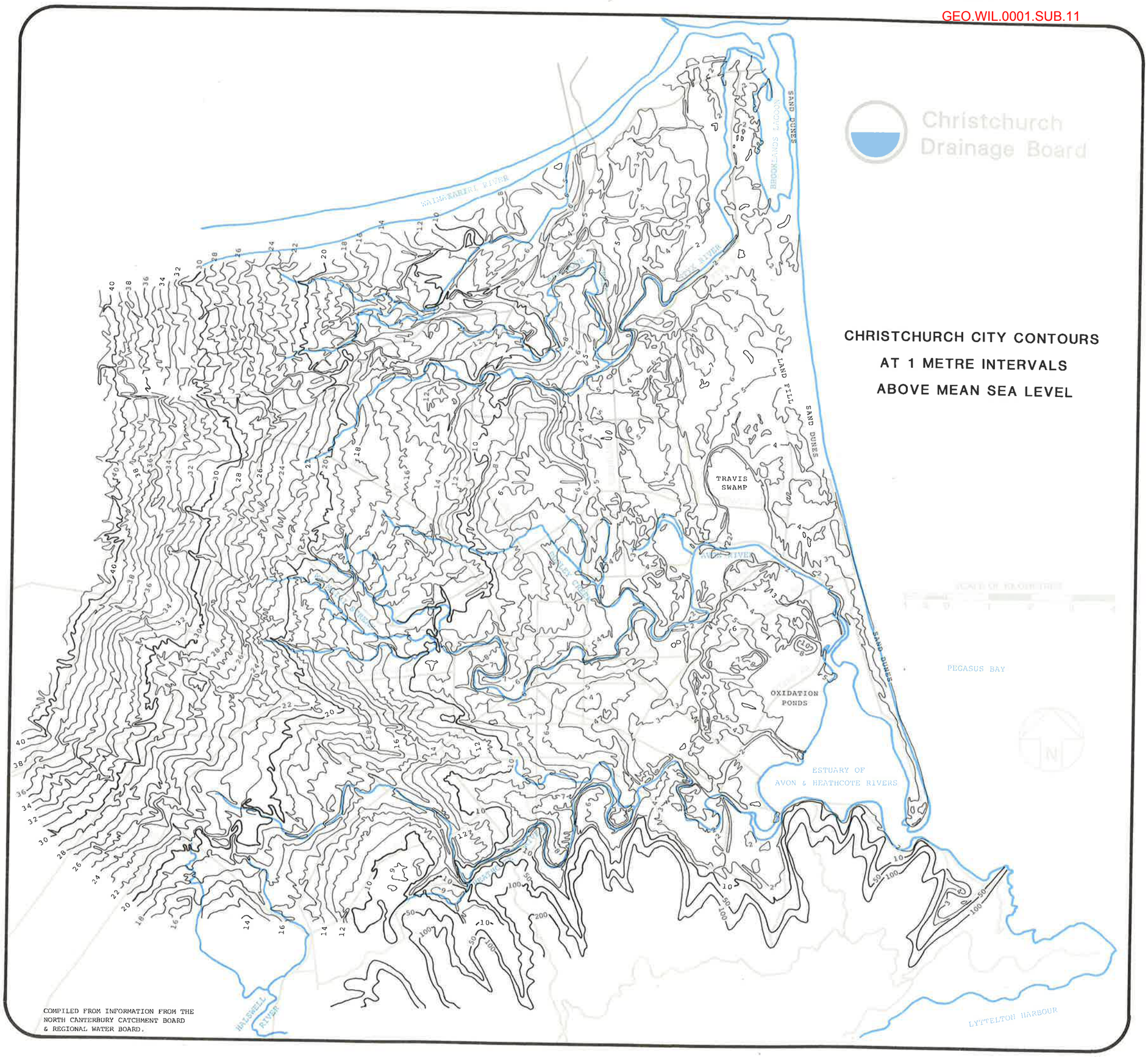
At the meeting, which was held on 10 June 1875, the local body representatives agreed that an Act of Parliament should be prepared to provide for the common drainage of the whole of Christchurch, both the city proper within the four belts and the suburbs. Events then moved swiftly. A local legal firm, Garrick, Cowlishaw and Co., drafted a bill providing for a large part of the tract of land which had a natural fall into the Estuary to become a district under elected commissioners for the purposes of drainage.

This bill was introduced into Parliament by William Rolleston, M.P. for Avon, in August 1875 and passed in October. The Christchurch District Drainage Act provided for an area of 32,000 acres (13,000 hectares) from the Heathcote River in the south to the Styx River watershed in the north and from Upper Riccarton in the west to the sea in the east to come under the jurisdiction of an elected Board. Christchurch City was represented on the Board by four members and the surrounding Roads Boards, Heathcote, Avon, Spreydon and Riccarton, by one member each. The Board was to be elected every three years and to elect its own chairman annually.

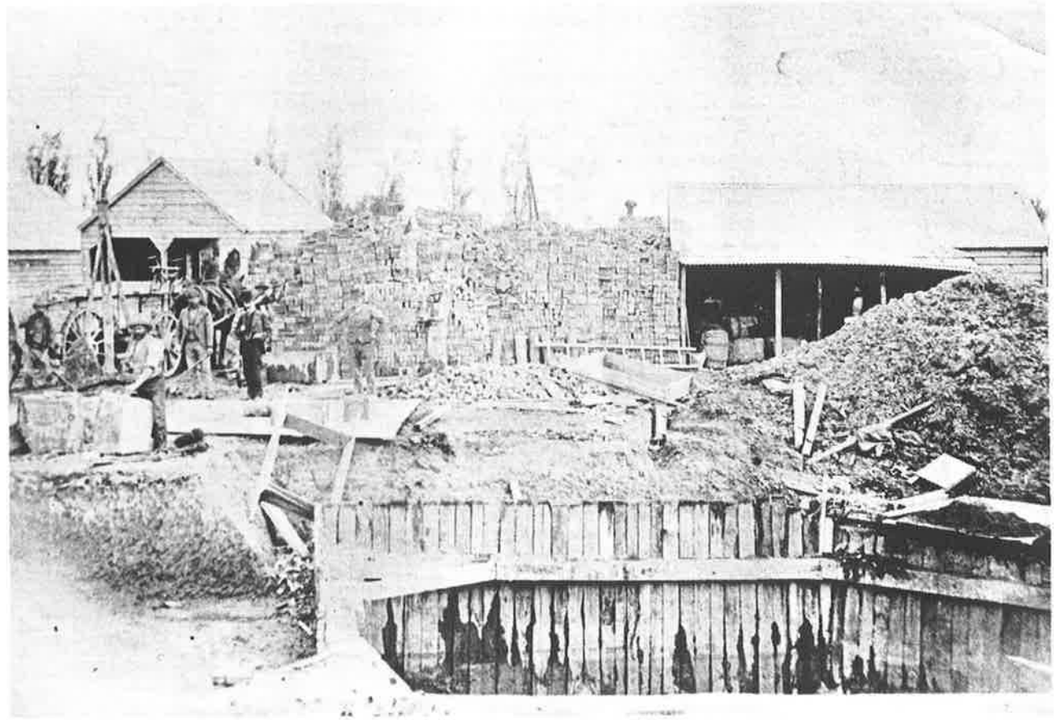
This new Drainage Board had relatively wide powers for the time. It was empowered to maintain or modify natural watercourses and to construct sewers and drains. Its powers included the power to enter upon and make drains from private land, a power for which Dobson, when he considered the drainage of the city in the late 1850s, had argued twenty years before. The Board was charged with responsibility for removing all superfluous subsoil water and stormwater from its district and for disposing of sewage. To achieve all this, the Board was given authority to borrow money and to levy rates on all properties in its district. To repay any money it borrowed, it was required to establish a sinking fund to pay back any debentures issued within fifty years.

Fold out: *Map number 1. A contour map of Christchurch with waterways and present-day roads. The regularly sloping plain is to the left. Most of the city is built on an area of low-lying, irregular topography, a retreating shoreline between the edge of the Waimakariri shingle fan and the sea.*

CHRISTCHURCH CITY CONTOURS
AT 1 METRE INTERVALS
ABOVE MEAN SEA LEVEL



COMPILED FROM INFORMATION FROM THE
NORTH CANTERBURY CATCHMENT BOARD
& REGIONAL WATER BOARD.



The Christchurch Drainage Board's first major work was building, in the early 1880s, the original pumping station on Tuam Street. This was an expensive undertaking, which gave the Board headaches because of the difficult ground conditions encountered at the site. Canterbury Museum

The original Act of Parliament which constituted the Board provided for an equal rate not exceeding one shilling in the pound on all rateable property in the Board's district (a provision which was soon to cause problems for the Board). The original Act also limited the amount the Board could borrow to an amount on which the Board could both pay the interest and pay back by making annual contributions from its rate revenue to a sinking fund. An early amendment to the Act set a monetary limit of £200,000 on the amount the Board could borrow.

The first elections under the Christchurch District Drainage Act were held on 17 December 1875 and the newly elected Board met four days into the new year, on 4 January 1876. The Mayor of Christchurch, Frederick Hobbs, was elected the Board's first Chairman and the Town Clerk of Christchurch appointed temporary Secretary to the Board. In its first flush of activity the Board met weekly. Offices were rented in the New Zealand Insurance Building on Hereford Street. The following year the Board shifted to alternative premises at 198 Hereford Street. The Board's premises were to remain on Hereford Street until the 1960s.

One of the Board's first acts was to appoint John Carruthers, the Engineer in Chief of the Public Works Department in Wellington, its Consulting Engineer to draw up a scheme for permanent sanitary sewers to serve Christchurch. Though conscious the work was urgent, the Board wisely decided it would not do anything until a comprehensive, permanent scheme had been designed. When he met with the Board, Carruthers asked whether the Board intended to drain Christchurch by underground sewers. The Chairman told him what the Board wanted were suggestions from him for a system for all time. Carruthers estimated it would take him eight months to devise such a system.

In the meantime, on Carruthers' recommendation, the Board appointed its own first Engineer. The appointee was Charles Napier Bell. Carruthers instructed Bell to make a survey of all existing sewers and drains, to ascertain exactly the high and low water levels in the Estuary and to take the essential preliminary step of fixing a datum level for Christchurch. This is a level

from which the heights of all points in a drainage and sewerage system are measured to ensure fall is sufficient in gravity drains and sewers and to establish where pumping stations are needed.

In employing the services of John Carruthers and Charles Napier Bell, the new Christchurch Drainage Board had turned to the foremost engineering talent in New Zealand at the time. Scottish born, John Carruthers (1836 - 1914) had worked on railways and irrigation works in North America, Russia, Mauritius and India before being appointed, in 1871, Engineer-in-Chief of New Zealand's new Public Works Department. He held this post for eight years of the Vogel Age of railway expansion, of drainage and harbour works and of public building construction. He returned to England in 1879 but remained Consulting Engineer to the New Zealand Government until his death in 1914.

Charles Napier Bell (1835-1906) had also come to New Zealand in 1871 with experience behind him, in Scotland, South America, Russia and Prussia, with railways, water and sewerage works and harbour works. He served the Christchurch Drainage Board from 1876 to 1881 as its Chief Engineer. For a few years after his resignation from that post, he continued to serve as a consultant to the Board. For much of the time he was working for the Drainage Board, Bell was concurrently Engineer to the Lyttelton Harbour Board.

Although any work on sanitary sewers had to await the presentation of Carruthers' report, the Board set about at once improving the stormwater drainage of the city. It bought the Tuam Street sewer and drain, which ran from the East Belt to the Estuary along Tuam Street and the canal reserve, from the Christchurch City Council and also constructed a brick stormwater sewer down Ferry Road to the Heathcote River, along the line of the open drain which had a few years earlier been a source of contention between the Christchurch City Council and the Heathcote Roads Board. This Ferry Road sewer provided relief for the flood-prone Waltham area and for the areas drained by the sewer along the East Belt.

The Board also, in the years up to 1880, constructed drains down Riccarton and Stanmore Roads and Antigua and Madras Streets. The St Albans and Jacksons Creeks were cleaned out and deepened and several miles of open drains were dug in the rural areas, including several named drains which to this day play an important part in keeping Christchurch well drained, the Bullers, Philpotts Road, Kruses and Wilderness Drains.

John Carruthers presented his report on sanitary sewers for Christchurch to the Board early in 1877. What he proposed was a system of underground sewers to remove both household slops and excreta to the Estuary, with pumping stations to lift the sewage into the existing outfall sewer along Tuam Street. At the Estuary, Carruthers told the Board, the sewage could be discharged directly into the Estuary itself, be treated by the "lime process" to precipitate solids before discharge, or be pumped high enough to flow over sandhills which would both purify the sewage before it flowed into the Estuary and enrich the land.

In a manner perhaps typical of Christchurch, Carruthers' scheme ran into immediate and vigorous controversy. At public meetings, ratepayers expressed vociferous opposition to the scheme and castigated the Board on various grounds. Some of the opposition was ill-founded. *The Press* faulted Carruthers for suggesting the rivers could be used to carry sewage, although Carruthers had suggested no more than using the rivers to carry away emergency storm overflows (and to this day, the city's sewerage system allows for emergency overflows into the rivers). Others opposed the introduction of excreta (as distinguished from household slops) into the sewers and criticised the discharge of excreta into the Estuary, although this again misrepresented Carruthers' scheme, for the direct discharge of sewage into the Estuary was only one of the options he suggested for its ultimate disposal. One of the others

Above left: *John Carruthers.*
Above right: *Charles Napier Bell.*
Both photos: Alexander Turnbull Library

was to allow the sewage to flow over sandy ground, the system which served Christchurch until the middle of this century. *The Press* claimed the Board had accepted a proposal "to make the estuary a cesspool" which was patently unfair to the Board and to Carruthers.

But the strongest opposition to the implementation of Carruthers' scheme was on the grounds of expense. The Board was criticised for agreeing to a scheme without knowing what the cost of building it would be. The Board's critics argued that underground sewers and pumping stations were an unnecessary expense and that a system of side channels and surface drains to carry stormwater and sullage (household slops) along with continuation of the collection of night soil would serve the city's needs adequately at much less cost.

Though the Board was divided about the wisdom of following Carruthers' scheme, in May 1877 it voted against a motion that the scheme be held in abeyance for some months while competitive schemes for drainage of the Board's whole area were invited. In self defence, the Board published an open letter to ratepayers pointing out that because Christchurch was flat, an effectual system of drainage was bound to be difficult and to "require a very considerable expenditure of money". The Board also pointed out that no system of drainage would be satisfactory unless the main sewers and drains were at a considerable depth to remove slops quickly and to avoid saturation of the soil near the surface.

In this open letter, the Board issued an ultimatum to the ratepayers who were objecting to Carruthers' scheme: the Board would resign en bloc if a requisition condemning its plans signed by a majority of ratepayers were presented. If no such requisition was forthcoming, the Board would ignore further public meetings and carry out the work as planned.

But in the event, opposition to Carruthers' scheme was so strong the Board decided not to proceed with it. Stung by the opposition, Carruthers resigned his position as Consulting Engineer to the Board. (He was to leave New Zealand entirely before the decade was out, returning to a distinguished career in England.) A deputation of ratepayers recommended to the Board that it invite an eminent drainage engineer to visit Canterbury and report on

Carruthers' scheme for draining Christchurch. The Board took up this suggestion.

The obvious candidate for this role was William Clark, a British drainage engineer who had been in New Zealand and was then in Sydney on his way back to England. In the middle of 1877, Henry Tancred, the Board's Chairman, got in touch with Clark who agreed to return to New Zealand and advise the Board. He was not back in the country until February 1878. In March he met with the Board, was given copies of all previous reports and left "entirely unfettered" in advising the Board on the best system for the drainage of Christchurch.

Clark worked quickly and on 2 April 1878 presented the Board with a seventy-three clause report *Drainage Scheme for Christchurch and the Suburbs,* copies of which were at once sent to all the local authorities of the Board's district. Despite lingering opposition to a scheme involving underground sewers and the pumping of sewage, including excreta, to the sandhills at Bromley, the Board adopted Clark's plan on 10 May 1878. Agnes Hercus suggested that Clark's plan was acceptable where Carruthers' was not because "not being a native of the country he was recognised to be an impartial observer". Though enormously modified and expanded in the years since, Christchurch's drainage system is still recognisable, in broad outline, as the system Clark proposed in 1878.

The key points of Clark's 1878 report to the Drainage Board were that rain water should be carried by street surface channels and by brick and pipe drains to existing creeks and rivers, some of which would need to be improved to provide better drainage. Sewage was to be carried in a system of sewers ranging from nine inch pipes at the extremities of the system to an egg-shaped main sewer measuring four feet six inches by five feet. Clark insisted that "night soil" or excreta be admitted to the sewers. Otherwise, he pointed out, slops, including urine, would find their way into the street channels. He recommended that excreta be removed from each house by a covered pipe drain. To omit that use of the sewers, he argued, would be to forgo one of their most valuable advantages.

At the height of opposition to Carruthers' scheme, the Board had stated that it would not admit excreta into the sewers. It now, wisely, said its determination to abide by Clark's recommendations overrode this earlier statement and the sewers were constructed to carry both household slops and excreta.

Clark calculated levels along the routes he proposed for the main sewers. These converged at the corner of the East Belt and Tuam Street. One main sewer ran north from that point to Kilmore Street and along Kilmore Street to pass under the Avon by a syphon just below the Madras Street bridge. This main served the areas of the city west and north of the river. Another main ran south down the East Belt to the South Belt then along the South Belt. This main served the city south of St Asaph Street and Sydenham and Addington. The central city, between the Avon River and St Asaph Street was served by another main which joined up with the other two mains on the East Belt at the corner of Tuam Street. Clark recommended that the Board construct immediately the system's "arteries" to key localities where the population was dense or a particular drainage problem was present, leaving the construction of minor street sewers until they were needed.

From the corner of the East Belt and Tuam Street, Clark proposed, the sewage should flow to a pumping station to be built on land the Drainage Board already owned on Mathesons Road. There should be erected a "plain inexpensive building" to house the engines and pumps which would pump the sewage in twenty-four inch cast iron pipes to Bromley. On the question which had generated such heat when the Board first adopted Carruthers' report, what was to be done with the sewage when it reached the shores of the Estuary, Clark proposed that it be pumped onto levelled sandhills, with

drains installed to carry the filtered effluent to the Estuary. Clark described Christchurch as "greatly favoured" in having this area of sandhills available for the disposal of the city's sewage. Clark's scheme is depicted on map number 3.

Clark is generally given greater credit than Carruthers for devising Christchurch's sewerage system. Clark's scheme did differ from Carruthers', in having only one pumping station, for example, while Carruthers had suggested either a system which relied on gravitation alone or one requiring several pumping stations. Carruthers had also proposed to admit surface stormwater into the sanitary sewers, while Clark recommended a separate system of drains for stormwater. Conversely, Carruthers proposed separate drains to carry subsoil water to the rivers, while Clark would have admitted it to the sewers.

But Clark's scheme can, fairly to Carruthers, be regarded as a refinement of what Carruthers had originally proposed. Clark himself described his scheme as "a revision of Mr Carruthers' pumping scheme, which in its general features, so far as the arrangement of the sewers is concerned, I adopt".

Once it had adopted Clark's scheme, in May 1878, the Board instructed its own Engineer, Napier Bell, to begin work at once on constructing it. Clark wrote to the Board from London in October 1878 that he was "very glad indeed that you are making so vigorous a start with your drainage works". Clark handled the tenders in Britain for the manufacture of the boilers and machinery needed for the pumping station and also ordered on behalf of the Board the cast iron pipe needed for the pumping main to the sandhills. He sent Napier Bell detailed plans for the pumping station and sewage tank beneath it in April 1879.

A "Separate" System

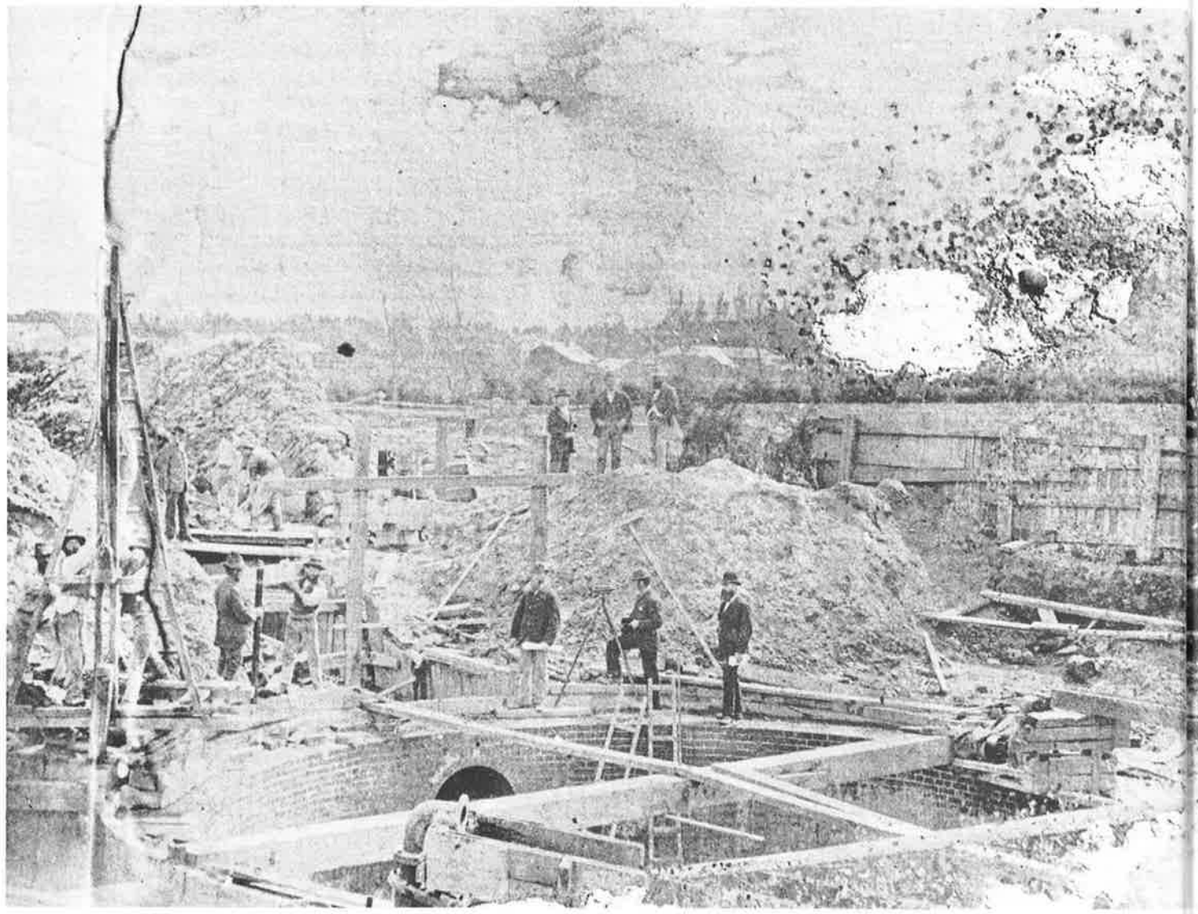
One important principle embodied in Clark's recommendations for a sewerage system for Christchurch was that stormwater and sewage should be dealt with separately. The city's sewage was to be carried in one system of sewers to the sewage farm at Bromley. All stormwater was to be carried in another system of drains to the rivers or direct to the Estuary.

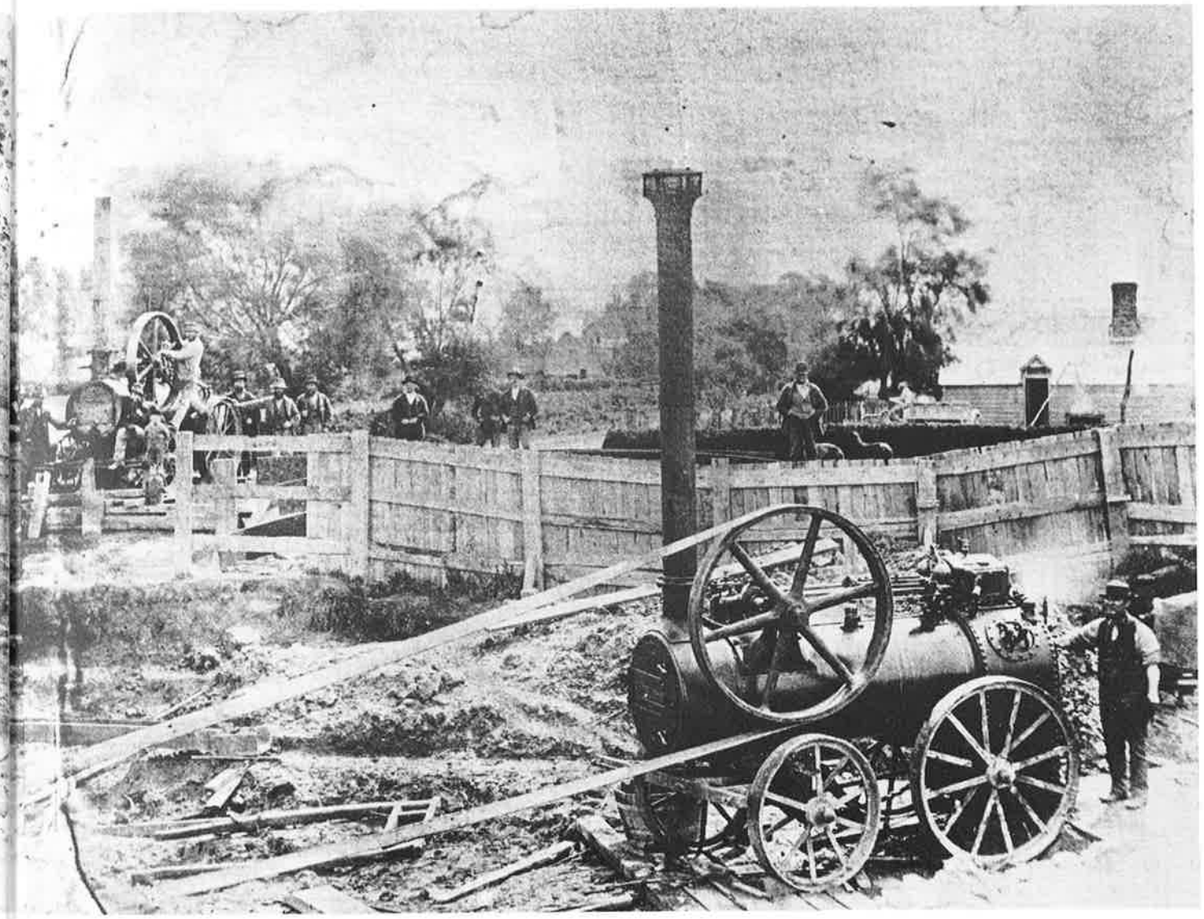
Clark did propose to admit subsoil water, as distinct from stormwater, into the sewage sewers. But as the system of sewage sewers was being constructed, its Engineer informed the Board that there was so much subsoil water that if it was admitted to the sewers, it would incapacitate the pumping station. The Board therefore decided to deviate from what Clark had proposed and to exclude subsoil water as well as stormwater from the sewage sewers. This remained the Board's policy in subsequent years. Indeed, some early sewers had separate drains laid alongside them to draw off subsoil water and conduct it to the stormwater system.

Despite efforts such as these, the infiltration of subsoil water into the sewage sewers was heavy and has been a persistent problem for the Drainage Board. Edwin Cuthbert, the Drainage Board's Chief Engineer from 1882 until 1921, first identified the problem of large amounts of groundwater entering the sewers. He suggested the cause was faulty inspection when the pipes were first laid, but suggested that this was "not altogether an unmixed evil" because it lowered the saturation level of the ground. But this infiltration of subsoil water into the sewage sewers has required the Board's pumping stations to pump much larger volumes than they would otherwise have had to, especially at times when the ground has been saturated

A certain amount of stormwater also unavoidably finds its way into the sewage sewers through manholes and ventilation grates. The volumes pumped by the Board's sewage pumping stations always rise at times of heavy rainfall and overflows from the sewage sewers into the rivers have been built into the Board's system to keep sewage off streets or private property when heavy rain taxes the sewers and the pumping stations.

But the Board has always endeavoured to maintain a "separate" drainage system, with sewage and storm and ground water kept apart in distinct drains. A later Chief Engineer, E.F. Scott, wrote in the 1960s that "Christchurch is very fortunate that from the earliest days of the scheme the sewerage system has been on the separate system and has been maintained so". In that decade, the 1960s, anxiety to keep the system separate led the Board to decline to allow cooling water to be discharged into sanitary sewers even if a suitable stormwater outfall was not available. In refusing to allow uncontaminated water to be discharged into the sanitary sewers, the Board was maintaining a principle which had been established when the city's original sewerage system was first constructed.





The Drainage Board's sewage pumping station under construction in the early 1880s. The third picture of this panorama of the construction site appears on page 17. These photographs, in poor condition, are the only ones known to have survived of this major early work.

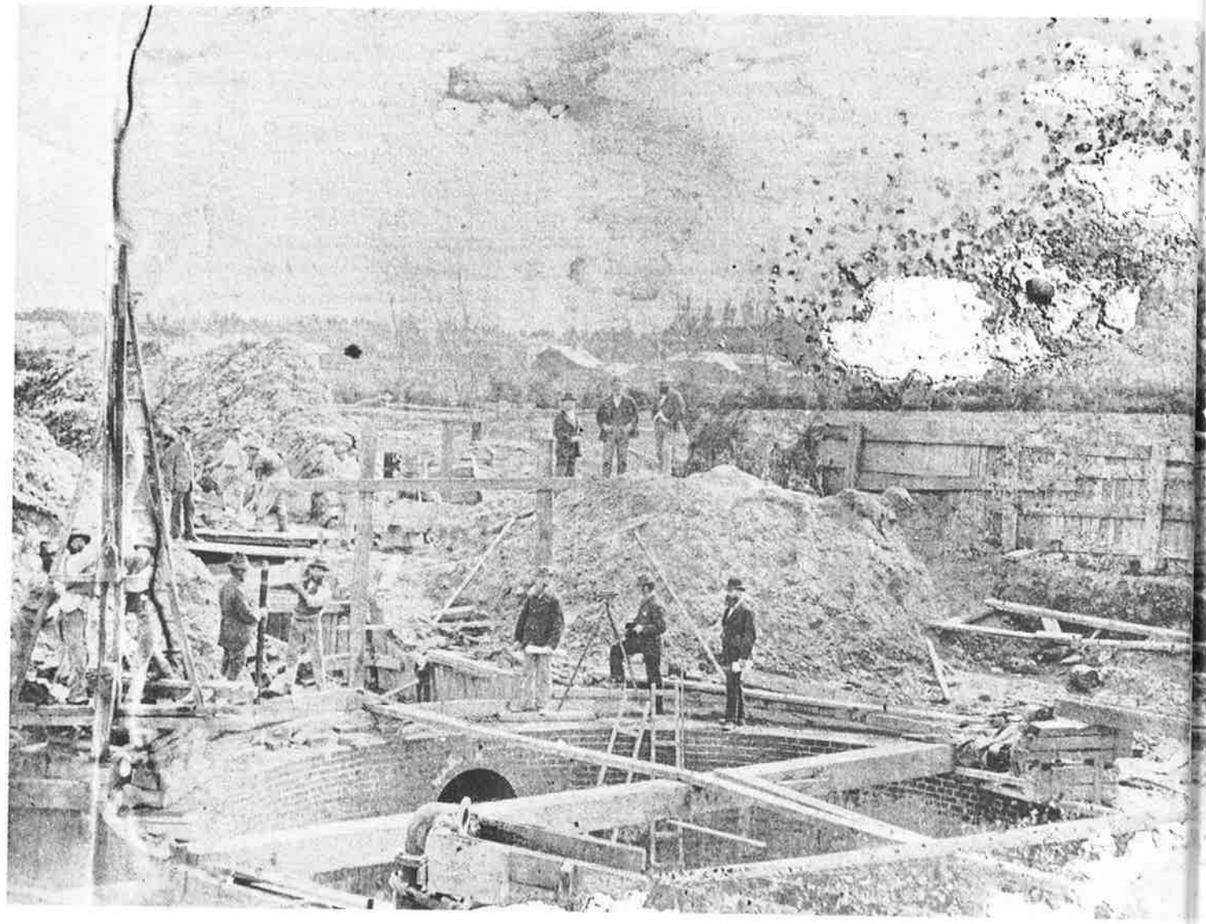
Both photos: Canterbury Museum

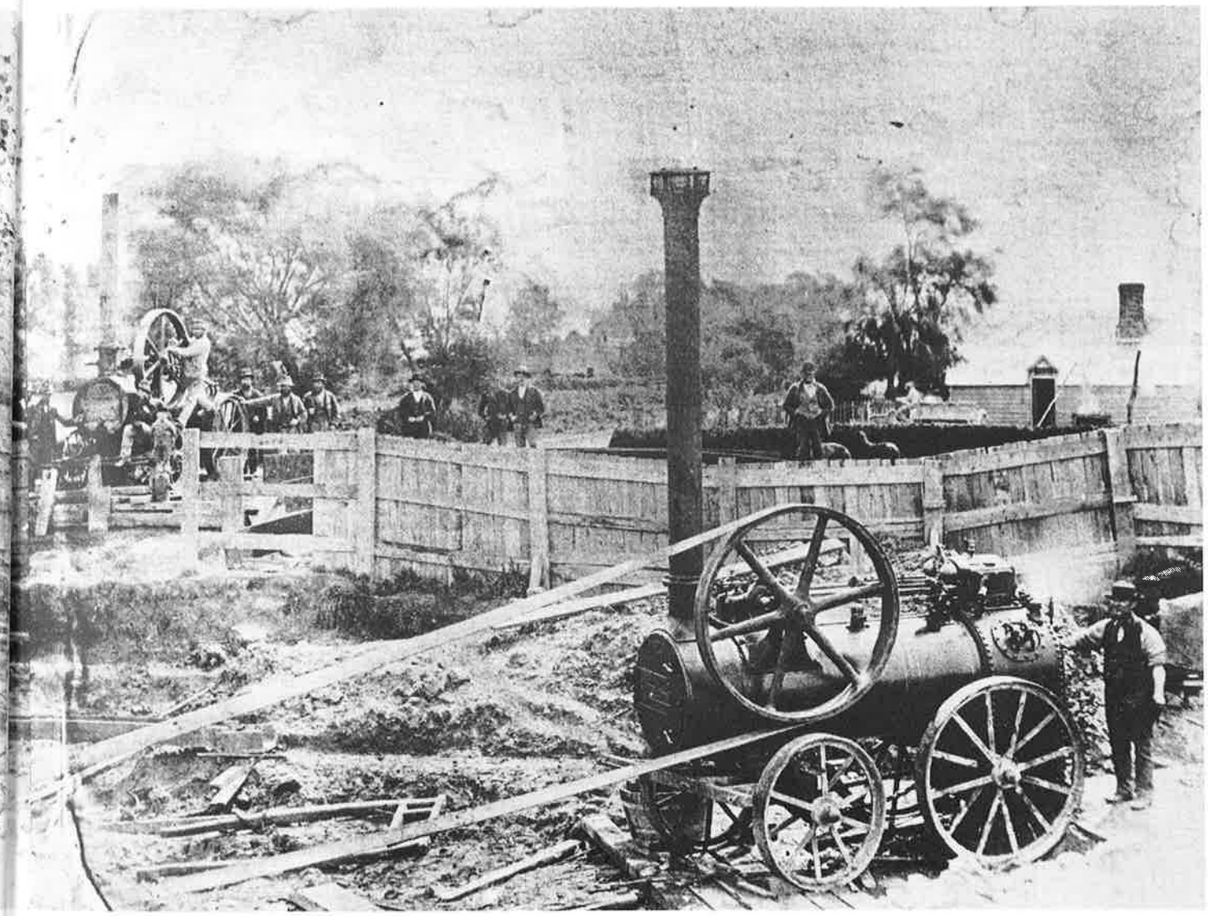
The construction of this sewage collecting tank (it measured thirty feet in diameter and was twenty-one feet deep) at the pumping station gave the Board its worst early headaches. Clark himself had warned that "great difficulty will be found in carrying out the works in a soil so saturated as is that of Christchurch". Quicksands and spring water at the site of the pumping station eventually brought work to a halt while Clark was consulted. He endorsed the solution to the problem Napier Bell had already devised, of sinking the walls of the tank through the poor ground, dredging the sand out from the interior and then plugging the bottom with concrete.

In the meantime, the Board had been busy constructing the sewers themselves and preparing the ground at Bromley. By 1880, the main sewer serving the northern and western parts of the city, up the East Belt to Kilmore Street and under the Avon River, had been finished and the settling ponds and irrigation channels at Bromley were well on the way to completion. The problems at the pumping station delayed completion of the whole system and it was not until 14 September 1882 that pumping of sewage to the sewage farm at Bromley commenced.

The completed system served an area of 2800 acres (1150 hectares). The whole of the city, except for one small area in the south-west and another in the north-east, was sewered. Parts of St Albans were served by sewers that ran north up Papanui and Springfield Roads. Sydenham was sewered between Windmill Road (Antigua Street) and Gasworks Road (Waltham Road) from the railway line to Brougham Street. A small part of Addington and Linwood as far east as Stanmore Road were also served by sewers. But large parts of the area which Clark had planned should be served by sewers were not sewered by the time the first round of sewer construction, which ended about 1882, was completed. Large areas north of the North Belt (Bealey Avenue) and east of Madras Street within Clark's sewage district were to remain without sewers for many years. Map number 3 indicates the extent of the city's sewers in 1882.

With the construction of Clark's scheme of sewers and major work completed to improve stormwater drainage of the city and suburban areas, the Christchurch Drainage Board could claim with justification that it had solved the immediate problems which it had been called into existence to deal with. It had done so in the face of opposition from ratepayers who felt a system of underground sewers was an extravagance Christchurch could not afford and against sniping and resentment on the part of the local bodies whose areas the Board had been charged with draining.





The Drainage Board's sewage pumping station under construction in the early 1880s. The third picture of this panorama of the construction site appears on page 17. These photographs, in poor condition, are the only ones known to have survived of this major early work.

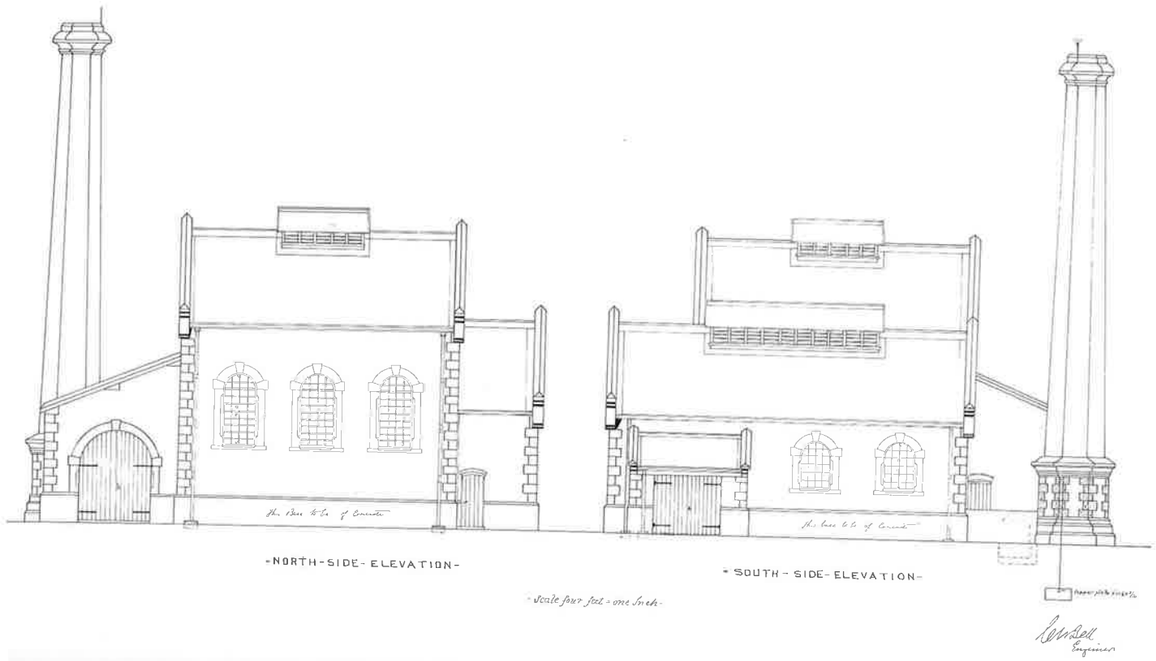
Both photos: Canterbury Museum

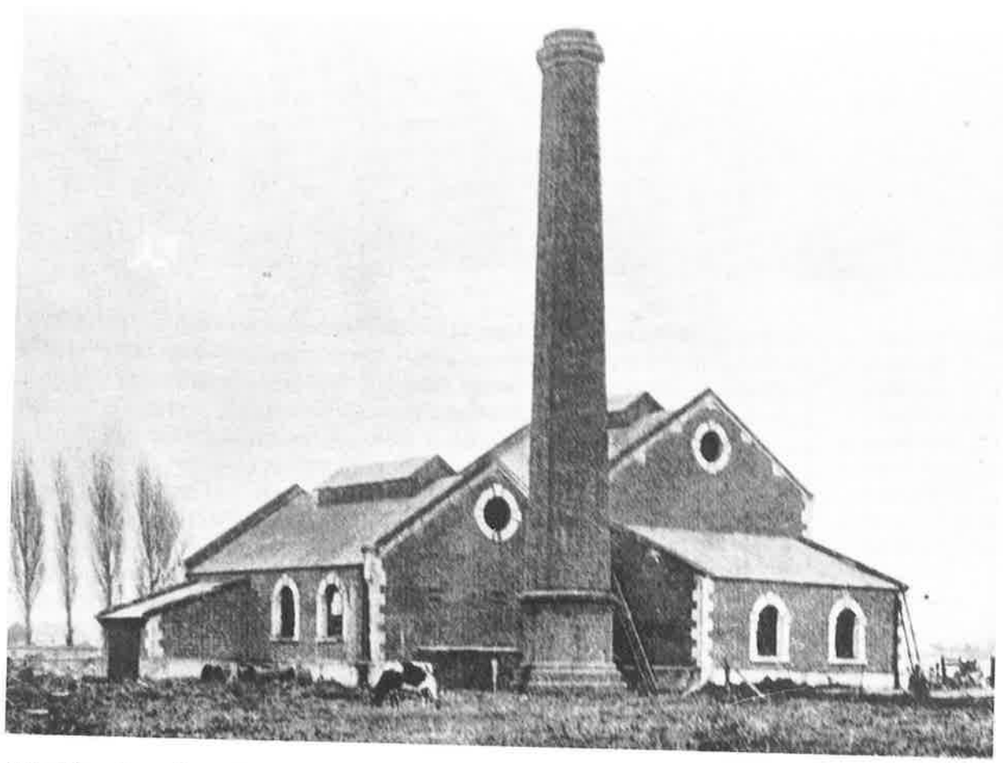
The construction of this sewage collecting tank (it measured thirty feet in diameter and was twenty-one feet deep) at the pumping station gave the Board its worst early headaches. Clark himself had warned that "great difficulty will be found in carrying out the works in a soil so saturated as is that of Christchurch". Quicksands and spring water at the site of the pumping station eventually brought work to a halt while Clark was consulted. He endorsed the solution to the problem Napier Bell had already devised, of sinking the walls of the tank through the poor ground, dredging the sand out from the interior and then plugging the bottom with concrete.

In the meantime, the Board had been busy constructing the sewers themselves and preparing the ground at Bromley. By 1880, the main sewer serving the northern and western parts of the city, up the East Belt to Kilmore Street and under the Avon River, had been finished and the settling ponds and irrigation channels at Bromley were well on the way to completion. The problems at the pumping station delayed completion of the whole system and it was not until 14 September 1882 that pumping of sewage to the sewage farm at Bromley commenced.

The completed system served an area of 2800 acres (1150 hectares). The whole of the city, except for one small area in the south-west and another in the north-east, was sewered. Parts of St Albans were served by sewers that ran north up Papanui and Springfield Roads. Sydenham was sewered between Windmill Road (Antigua Street) and Gasworks Road (Waltham Road) from the railway line to Brougham Street. A small part of Addington and Linwood as far east as Stanmore Road were also served by sewers. But large parts of the area which Clark had planned should be served by sewers were not sewered by the time the first round of sewer construction, which ended about 1882, was completed. Large areas north of the North Belt (Bealey Avenue) and east of Madras Street within Clark's sewage district were to remain without sewers for many years. Map number 3 indicates the extent of the city's sewers in 1882.

With the construction of Clark's scheme of sewers and major work completed to improve stormwater drainage of the city and suburban areas, the Christchurch Drainage Board could claim with justification that it had solved the immediate problems which it had been called into existence to deal with. It had done so in the face of opposition from ratepayers who felt a system of underground sewers was an extravagance Christchurch could not afford and against sniping and resentment on the part of the local bodies whose areas the Board had been charged with draining.





Top: *Elevations of two sides of the Tuam Street pumping station, signed by C. Napier Bell and therefore probably dating from the time the station was built.* Drainage Board ***Bottom:*** *The pumping station in 1897.* Weekly Press

Chapter 4

The Board at Work

The controversy surrounding its plans to provide Christchurch with a system of underground sanitary sewers was only one of the difficulties which the Board faced in its early years. Progress on the construction of stormwater drains and, once the Board had stated firmly it was going to proceed with Clark's scheme, of a sewerage system was reasonably expeditious. But the Board's own affairs in these years, the late 1870s and early 1880s, did not run so smoothly.

The squabbling among the local authorities which had made the setting up of a separate Drainage Board a necessity continued after 1875, with the difference that now the Drainage Board itself became a target of resentment. When the provinces were abolished in 1876, counties were set up in their place, the Avon, Heathcote, Riccarton and Spreydon Roads Boards continuing in existence under Selwyn County. The local authority situation was further complicated by the establishment of a separate Sydenham Borough in 1877 and of a separate St Albans Borough in 1881. Subsequently Woolston and Linwood also came under separate Town Boards.

The chief point at issue between the Drainage Board and these various local authorities was the Drainage Board's power to levy rates on properties throughout its district. The original Act of 1875 provided for a uniform rate throughout the Board's district not to exceed one shilling in the pound. In 1876 the Drainage Board sought legislative authority to raise a loan of £250,000 and to increase its rate to one shilling and threepence in the pound. The Legislative Council, however, refused to increase the Board's rating power to one shilling and threepence and limited the amount of the loan the Board could raise to £200,000. Two loans of £100,000 each were raised on the London market, the first in 1877 and the second in 1879. These loans provided the Board with the money to pay for both its early stormwater works and the sewerage system.

What soon became apparent was that although under its original Act the Board could levy a uniform rate over its whole district, the works it was undertaking would benefit some parts of the district more than others. In 1877, the Christchurch District Drainage Act was amended and the Board required to levy different rates in different parts of its district in proportion to the amount of work done for the benefit of each part of the district. Under this amendment, however, the Board retained a right to levy a uniform rate of one shilling in the pound over its whole district if this was necessary for the Board to pay interest on borrowed money and to maintain its payments into the sinking fund from which the Board's debt would be paid when the principal became owing. This provision was to cause problems for the Board in the 1890s.

In 1881, with work on its sewerage scheme, which covered only part of its district, well under way, the Board subdivided its district. The area to be served by Clark's sewerage scheme was called the "Sewage Area". The areas outside

this "sewage area" were called "rural areas", there being one each for the four Roads Boards, Avon, Heathcote, Riccarton and Spreydon, and another for the new Sydenham Borough.

This new borough proved a particular thorn in the Drainage Board's side. At public meetings in Sydenham in 1880, the Board was roundly criticised and the accusation aired that the Board's Engineer, Napier Bell, was receiving a commission on the pipes being purchased from abroad for the sewers then being laid. The Borough declined to help the Drainage Board collect its rates in Sydenham and then sought to be excluded from the Drainage Board's district on the grounds that it was not getting full value for the rates Sydenham property owners paid to the Drainage Board. The Borough's wish was not granted, but as a compromise Sydenham was given separate representation on the Drainage Board, which increased the Board's membership to nine.

Sydenham was the most vocal, but only one, of the local authority critics of the Drainage Board. One early action of the Board in particular brought it into disfavour with all the local authorities. Conscious of its responsibility to effect an immediate improvement in the filthy conditions then prevailing in Christchurch, but unable to get a general drainage scheme under way quickly, the Board decided to accept appointment as a local Board of Health under the Health Act. This conferred on the Board significant and useful powers to eliminate risks to public health in Christchurch. Unfortunately the Board received no additional money from the Government for undertaking responsibilities as a Board of Health. It was obliged to use its own revenue from rates for these purposes.

As a local Board of Health, the Drainage Board appointed a Medical Officer and a Health Inspector who began taking steps to force improvements in the standard of public health in Christchurch. The local authorities resented the Board's acquiring additional powers and refused to give the Board any financial help to discharge its responsibilities as a Board of Health. The financial problems already looming for the Board as it undertook the heavy financial outlay for its early stormwater and sewerage works were aggravated.

The Board's Medical Officer prepared reports which highlighted "the filthy condition of Christchurch" and underlined the pressing need for drainage works in some suburban areas. The Medical Officer tried to enforce the adoption of the pan system for the disposal of night soil throughout the Drainage Board's district, but cesspits continued in use. The Drainage Board also found itself at odds with the Hospital Board over the discharge of wastes from the Christchurch Hospital into the Avon River. Though the Drainage Board's Medical Officer deplored this practice, it continued until 1884.

Flushing the Sewers

When Clark drew up his scheme for Christchurch's sewerage system, he recommended that the sewers should be laid at grades sufficient to keep them clean without regular flushing. His scheme did, however, provide for the flushing of sewers if this proved necessary. When the system was built and then extended, some of the smaller, six inch, sewer lines were laid at flatter grades than Clark had recommended. The Board got into the habit of flushing these lines. But there was no high-pressure water supply in Christchurch until 1909, nearly thirty years after the sewerage system had been inaugurated.

To provide the water needed for flushing the sewers, the Drainage Board itself sank several hundred wells to supply the flushing tanks built at various points along the sewer lines. Flushing of the sewers using water from the Board's own wells was a well-established feature of Christchurch's sewerage system by the end of the nineteenth century and regular flushing of some sewers has continued up to the present.

Later flush tanks were supplied from the city's high-pressure water supply. This spared the Board having to sink more wells of its own, but also presented the problem of preventing "back flow" from the sewers contaminating the water supply. Over the years the Board has experimented with, and installed, various devices to ensure that supplying its flushing tanks with water from the city water supply does not have this unwelcome side effect.

Christchurch Hospital in the early 1880s. The hospital's discharges into the Avon River (foreground) were a headache for the newly founded Drainage Board.
Canterbury Museum

The work of the Drainage Board as a local Board of Health annoyed the local bodies, but contributed to a dramatic drop in the death rate in Christchurch — from 30.4 per thousand in 1874 to 13.7 per thousand in 1884. This spectacular decline was attributed not just to the improved drainage resulting from the Drainage Board's new stormwater drains and sanitary sewers but also to other "superior sanitary precautions" enforced by the Board's Medical Officer.

In 1885, however, the Drainage Board was in such severe financial straits that it decided to abandon its duties as a Board of Health. An amendment to the Public Health Act had put some additional funds at the disposal of the Board as a Board of Health, but these were still meagre and local body opposition to the Drainage Board possessing additional powers as a Board of Health and using rate revenue to exercise those powers continued.

After 1885, the responsibilities the Drainage Board had exercised as a Board of Health passed to the local authorities. By this time the Board, though it was barely ten years old, was fighting for its survival.

Edwin Cuthbert

The Board's need to economise in the early 1880s had one happy effect. When the economies were imposed, the Board's First Assistant Engineer resigned after his salary had been reduced by £100 a year. When the Board advertised the position at the lower rate of £250 a year, among the ten applicants was Edwin Cuthbert. He was appointed to the position of First Assistant Engineer on 11 April 1881 and was to remain on the Board's staff for forty years.

Cuthbert had been born in County Tyrone, Ireland, in 1845 and trained as an engineer in London. He came to New Zealand in 1868 and worked in Invercargill, Wellington, Southbridge and Christchurch for the Public Works and Railways Departments. He was laid off in the Government retrenchment at the onset of the depression of the 1880s just prior to his 1881 appointment to the staff of the Christchurch Drainage Board.

When Charles Napier Bell resigned as Chief Engineer in August 1882, Cuthbert stepped up into his post. In 1885, at a time of drastic staff reductions, he became also Secretary/Treasurer to the Board. Holding these key positions, he became conversant with every detail of the Board's drainage system. He is remembered especially for having inaugurated a system for recording underground works "unequalled in any local authority in New Zealand, if not the world". He advised the authorities in Wellington on a sewerage scheme for that city and also the Wairau River Board on how to relieve Blenheim's flooding problems. With his former superior, Napier Bell, he reported on competitive designs for the drainage of Dunedin.

In 1910 he spent several months on leave abroad. He visited sewerage works in London and returned to Christchurch satisfied that Christchurch's system of house sanitation was better than any he had seen on his travels. He retired from the Board's service in 1921 and died in 1924. His long association with the Drainage Board is commemorated in the naming of Cuthberts Green and Cuthberts Road, both of which are in the neighbourhood of the sewage treatment works in Bromley.

Top: *Edwin Cuthbert.*
Left: *Drainage Board staff in 1909. Edwin Cuthbert is the bearded figure in the centre of the group.*
Both photos: Drainage Board

Chapter 5

Merely Existing

In order to make immediate improvements to the city's rudimentary system of stormwater drainage and to inaugurate its sewerage system, the Christchurch Drainage Board borrowed the large sum of £200,000 in the late 1870s. By 1882 only a small amount of this loan money was left. The remainder was duly spent on laying sewerage pipes. Then from 1884 to 1901, the sewerage system was barely extended at all, although in this period the number of connections to the Board's system increased from 639 to 2186 and the number of water closets in the city rose from 293 to 1915. Clark had recommended in his 1878 report that minor street sewers should be constructed as they were needed. By 1901, only 35 miles and 55 chains (57 kilometres) of the 57 miles (92 kilometres) of sewers which Clark had recommended had actually been laid.

Once the Drainage Board's own spending on new works dried up around 1882–83, the only significant extensions to Christchurch's sewerage system were the laying of sewers and stormwater drains at the expense of the central government to service the Addington railway workshops, the Public Hospital and Sunnyside mental hospital. By the end of the century, the Drainage Board was still without funds to extend the sewerage system and the work of laying down new sewers was "practically left to private enterprise". The *Weekly Press* noted in 1897 that a private developer had laid sewers in Holly Road, "which shows that the system is appreciated by the owners of the class of houses that are built on that road".

The financial embarrassment which prevented the Board from undertaking almost any new works between about 1884 and 1900 began in the early 1880s. Already by then the Board's financial position was so precarious, partly because of the additional expenditure it was incurring as a Board of Health but above all because of the ceiling on its rates enshrined in law, that it was obliged to reduce the wages of its staff. The salary of the First Assistant Engineer was reduced from £350 to £250 and that of the Second Assistant Engineer from £300 to £200. Other staff suffered similar cuts.

To ease its financial embarrassment, the Board attempted to oblige the local authorities to undertake some drainage work, further exacerbating the strained relations between the Board and those authorities. Prior to 1875, responsibility for cutting and cleaning drains had rested with the Provincial Government. With the setting up of the Drainage Board, this work became a charge on the Board's rates, but these were insufficient for the purpose. The Board eventually decided that it would not form side channels in streets, leaving it up to the local bodies to do so. In 1894, a deputation from the Christchurch City Council tried to convince the Drainage Board that it was legally required to form side channels, but the Drainage Board took legal advice on the question and then successfully stood its ground.

The Board's very existence was called into question before it was ten years old. In 1884, the various local authorities in the Board's district conferred

together about the desirability of abolishing the Drainage Board altogether and parcelling out its drainage responsibilities among themselves. Only the inability of the local bodies to agree among themselves and their reluctance to take over the Board's functions saved the Board from early extinction. But it was saved for an immediate future of "mere existence".

In 1885, the Board set up a special committee to consider its shaky financial position and considered asking the local bodies to undertake certain administrative duties so that it could discharge its office staff. A year later, it was obliged to seek legislative authority to be able to borrow money on overdraft in anticipation of revenue from rates.

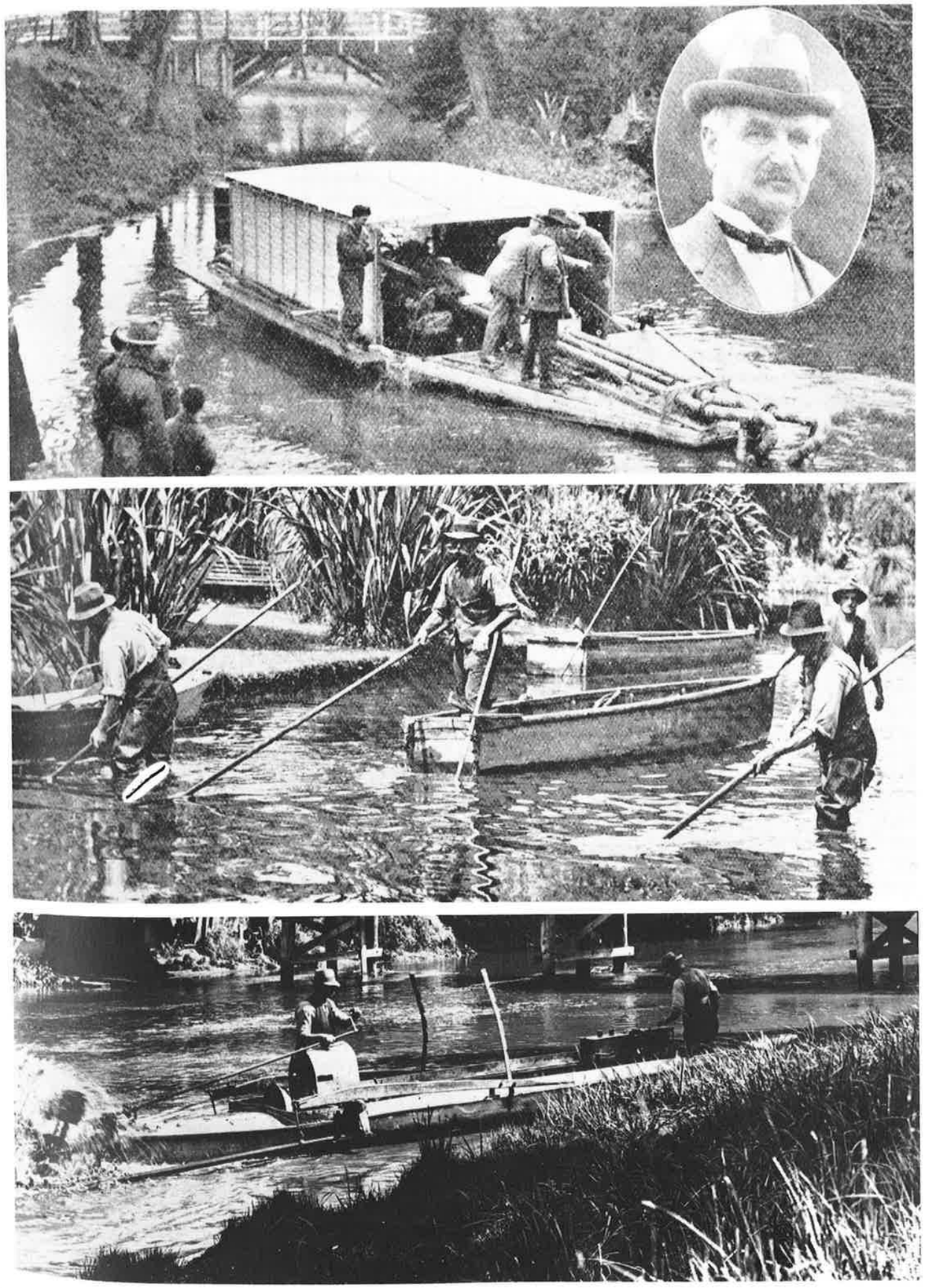
Through the 1880s, income from rates proved insufficient to cover the Board's day to day expenses of maintaining and operating its stormwater and sewerage systems together with interest payments on its debt and payments into the sinking fund. The Board allowed payments into the sinking fund to fall into arrears. But then in 1890, the Supreme Court required the Drainage Board to strike a rate over the whole rural district sufficient to ensure payments into the sinking fund were kept up-to-date. The rural districts resented this additional rate. The money borrowed had been used primarily to construct the sewerage system which benefited only the "sewage district". The rural districts had now been required to shoulder some of the burden incurred in building this system. Not until the turn of the century did the Board's income by way of rates from the sewage district alone rise to the point that enough was coming in to relieve the burden on the rural districts of contributing through their rates to the sinking fund. The rural districts eventually gained full satisfaction when a 1907 Commission found in their favour and ruled that they were entitled to an adjustment for the amount they had overpaid through the 1890s.

Through this period of "mere existence" the city's stormwater system suffered from neglect. Stretches of the rivers became choked up with weeds and silt. In 1886 a petition from the north-east ward of the city complained that willows and silting were impeding the flow of the Avon. The Board retorted that the land was not really suitable for building on and that nothing could be done to prevent it from being anything much removed from a swamp.

But clearing of the rivers was not entirely neglected in this period. In 1893, the *Canterbury Times* reported that Mr Brightling, the contractor who kept the lower reaches of the Avon clear, had just added a new contrivance to his weed–cleaning apparatus: "Horizontal knives have been fastened on to the paddle wheel of the steamer *Avonia* and as they project about a foot outside the blades of the paddle they chop the weeds up in splendid style". (Sadly no photograph of this "contrivance" has yet been located.)

In 1894, the Christchurch City Council, increasingly anxious that the drainage of the city was not receiving the attention it needed, sent a deputation to the Drainage Board to make criticisms and suggestions. But the Board refused to ask for further rating or borrowing powers on the grounds that the local bodies and ratepayers would oppose any bill giving the Board such powers. The Board can hardly be blamed for such a defeatist attitude — in the late 1880s, its attempts to persuade the local authorities and Parliament that it needed further borrowing and rating powers had been rebuffed. Still, Agnes Hercus was right when she observed that the Board had lost "something of the fighting spirit of its earlier years".

It was additionally frustrating to the Board in these years that it lacked a crucial power to ensure that the city gained full benefit from the works already in place, on which large sums of money had been spent. This was the power to compel householders on streets already served by sewers to drain their household wastes and excreta into the sewers. Many householders were reluctant to incur the expense of a connection to the sewers, with the result that the side channels of many streets continued to carry household slops,



Opposite page: *The Drainage Board employed various means of keeping the rivers free of weed to ensure they could handle stormwater adequately. What was probably the first "mechanical contrivance" for the task was used in the 1890s.*
Top: *A new river sweeper introduced in 1927. Inset is R.T. Stewart who designed the sweeper.* Drainage Board
Centre: *Manual hoeing of weeds using wooden punts in 1927.* Drainage Board
Bottom: *Weed cutting on the Heathcote River. The date of this photograph is uncertain.*
Canterbury Museum

which became offensive when the flow of artesian water flushing these channels ceased. Sydenham gave the Board particular offence as an area well served by sewers which were not being used. Through these years, the local authorities maintained a system of night soil collection, relieving householders of a compelling reason to connect their houses to the sewers.

In 1888, the Board's engineer reported that pollution of the rivers was attributable mainly to filthy matter discharged into them by side channels and that the cause of this pollution could be removed "were householders compelled to connect to the sewers". But this, he added regretfully, "is a matter over which the Board has practically no control whatever".

But despite the difficulties and frustrations of the years leading up to the new century, the Board could take satisfaction that it had more or less achieved what it had been set up to do. The Board's Engineer noted in 1889 that "Christchurch is now one of the healthiest cities in the colony". The death rate in Christchurch plummeted from 30.4 per thousand in 1875, before the Board had begun its work, to 9.77 per thousand in 1889. It remained at about this level until the end of the century. In 1875 there were 49 deaths from typhoid in Christchurch City. In 1896 there were none, in the city or its suburbs.

The 1880s and early 1890s were years of economic depression in New Zealand and it was fortunate for Christchurch that the Drainage Board had managed to get its sewerage system built and operating before the economy faltered. Towards the end of the 1890s, as the economic depression was lifting and the country entering on a period of prosperity, the Board itself took on a new lease of life. In 1897 it made a "spirited decision" to take "immediate steps to end the alleged nuisance on the South Belt" which earned it "a great access of popularity".

In 1896, the Sydenham Borough Council, still not co-operating with efforts to have householders connect to the Board's sewers, erected a night soil depot on the South Belt between Durham and Colombo Streets. From this depot, night soil was discharged into the Board's sewers. Residents complained that this depot was "a serious nuisance, dangerous to health'' and sent a deputation to discuss the matter with the Drainage Board. After hearing what this deputation had to say, the Board gave notice to the Sydenham Borough Council to abstain from discharging any matter from its night soil tank into the Board's sewers, giving the Borough forty-eight hours to disconnect the tank. This popular decision reflected a new determination to tackle the drainage problems which had accumulated in the years of "mere existence".

Fold out: *Map number 2. The boundaries of the Drainage Board's district, 1875-1989.*

The Board's District

The Board's district by 1989 embraced 290 square kilometres and included the catchments of three rivers, the Avon, twenty-six kilometres long, with the Dudley, St Albans, Wairarapa and Waimairi Streams its main tributaries, the Heathcote, twenty-five kilometres long, fed by Jacksons Creek and Cashmere Stream, and the Styx, twenty-one kilometres long, with the Kaputone its main tributary.

But it was not until the 1950s that the catchments of all three rivers were put under the Drainage Board's control. Up to that time, the Board's district was about half the size, 140 square kilometres. It had a southern boundary on the Heathcote River itself and a northern boundary along, more or less, the line of watershed between the Avon and Styx Rivers.

Prior to the doubling of the Board's area in 1951-52, small areas south of the Heathcote River were added to the Board's district under provisions which allowed for polls to be taken of ratepayers in areas adjoining the boundary of the Board's district. Sumner became part of the Board's district automatically in the 1940s when it joined with Christchurch City.

After the 1951-52 extension, there were further, mainly minor, extensions to the Board's district as further outlying areas of the city were more closely settled. In the 1980s the Board's district was extended substantially to the north to include first the Brooklands and then the Kainga districts of the Waimairi District (formerly County). The North Canterbury Catchment Board asked the Waimairi District Council to bring this small additional area within the Board's district and a poll in the area endorsed this action.

ater flushing these
ence as an area well
ese years, the local
elieving household-
he sewers.
n of the rivers was
y side channels and
householders com-
etfully, "is a matter

s leading up to the
had more or less
neer noted in 1889
e colony". The de-
nd in 1875, before
889. It remained at
ere were 49 deaths
one, in the city or

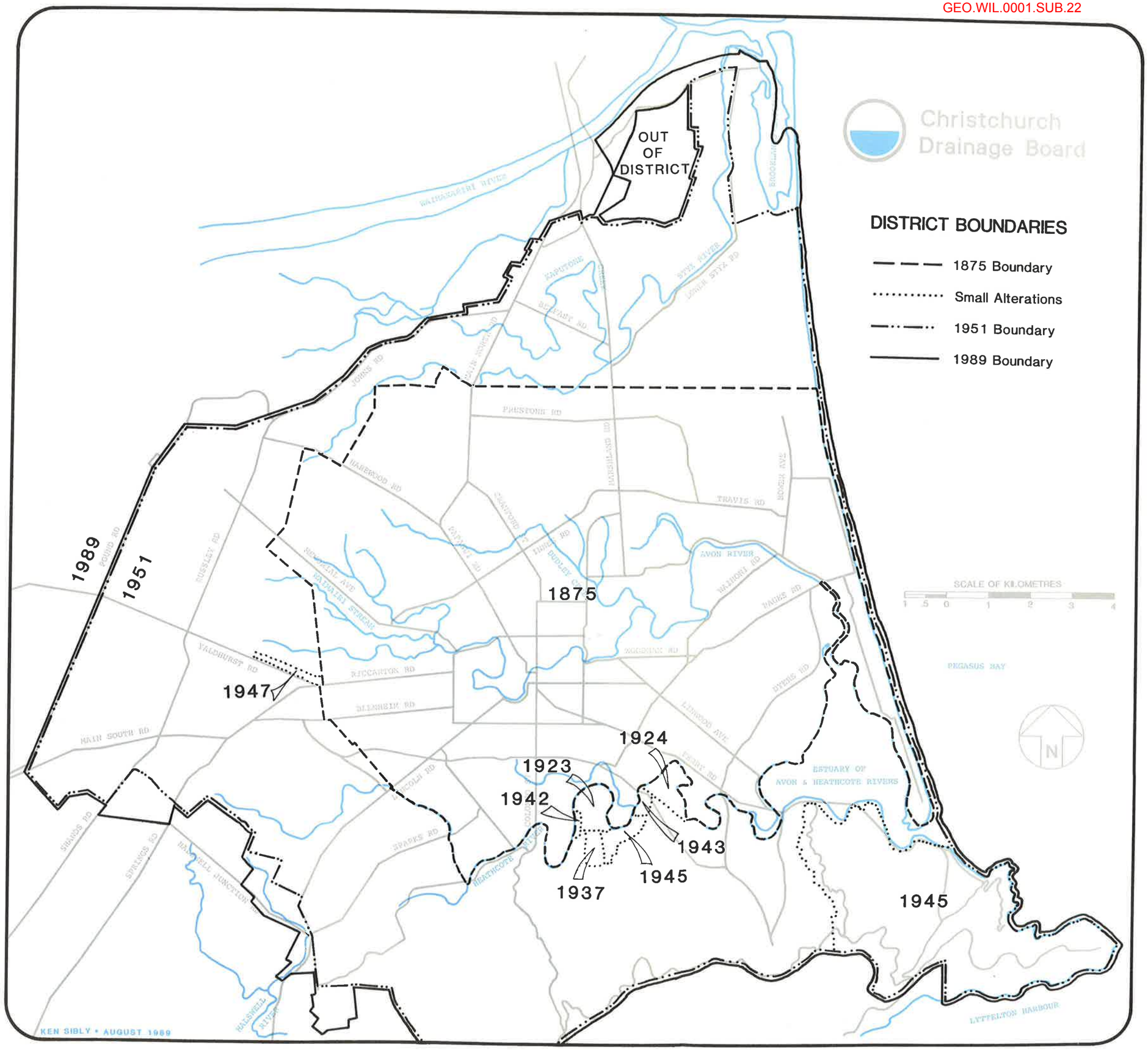
ession in New Zea-
ainage Board had
efore the economy
depression was lift-
e Board itself took
o take "immediate
earned it "a great

erating with efforts
l a night soil depot
From this depot,
s complained that
lth" and sent a
After hearing what
denham Borough
ght soil tank into
to disconnect the
on to tackle the
"mere existence".

Fold out: *Map number 2. The boundaries of the Drainage Board's district, 1875-1989.*

s District

all areas south of the Heathcote River were added to
e Board's district under provisions which allowed for
lls to be taken of ratepayers in areas adjoining the
undary of the Board's district. Sumner became part
the Board's district automatically in the 1940s when
oined with Christchurch City.
After the 1951-52 extension, there were further, main-
minor, extensions to the Board's district as further
lying areas of the city were more closely settled. In
1980s the Board's district was extended substantially
he north to include first the Brooklands and then the
nga districts of the Waimairi District (formerly
unty). The North Canterbury Catchment Board asked
Waimairi District Council to bring this small addi-
nal area within the Board's district and a poll in the
a endorsed this action.



Elections and Chairmen

Three long-serving Chairmen of the Drainage Board. ***Above:*** *John Deans* ***Below left:*** *Walter Hill* ***Below right:*** *F.R. Price*
All photos: Drainage Board

Ever since it was set up, the Christchurch Drainage Board was an elected body. Elections to the Board were held regularly every three years in association with other local body elections. Although "party politics" occasionally reared its head on the Board and the elections were in recent times fought between candidates identified with either the Labour Party or the Citizens Association, the conduct of the Board's affairs was not, by and large, marked by partisanship.

The Chairman of the Board was elected by the Board itself each year. In the first decade of its life, the Board had six different Chairmen. But in 1888 the position was assumed by John Deans and then held by him without interruption until his death in 1902. Other long-serving Chairmen this century have been Walter Hill, who held the post from 1907 until 1926, (he also died while in office), F.R Price (1960 to 1970) and M.R. Carter (1971 to 1980). The Chairman of the Board at the time of its dissolution, Newton Dodge, was elected Chairman of the Transition Committee set up to oversee the establishment of the new Christchurch City Council, the body which has assumed the duties and responsibilities of the Drainage Board. The longest serving Board member at the time it went out of existence was M.R. Carter. He had been on the Board for thirty-one years and its Chairman for nine. He had also served on the Christchurch City Council (for thirty-three years) and on the Christchurch Fire Board.

The Sewage Farm

In the early 1880s, the Drainage Board inaugurated a system for disposing of sewage which remained in use until the opening of the sewage treatment works in the early 1960s. In the original system, sewage from Christchurch flowed by gravity into the large underground tank beneath the pumping station on Tuam Street. At the pumping station were two 48 horsepower steam engines which powered four pumps. Each pair of pumps could handle 3500 gallons per minute. The sewage was pumped into a 24 inch (600 mm) iron main one and three-quarter miles (2.8 kilometres) long. From the end of this main, the sewage flowed in an open race to the sandhills.

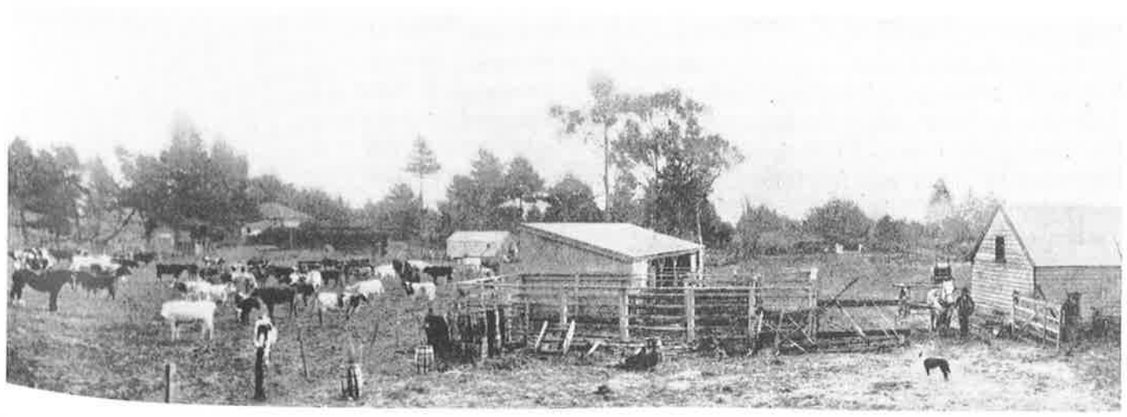
In 1882-83 an area of sandhills, some up to forty feet high, were flattened, partly by directing the flow of the main race at their bases and partly by using horse-drawn scoops. The 46 acres (18.5 hectares) which were levelled in these ways were divided into nineteen paddocks, each about two and a half acres (one hectare) in extent. Races at right angles to the main race ran between every two paddocks. The paddocks were also divided by outfall drains which carried the effluent to the Estuary after it had percolated through the sandy soil. Before the sewage was directed down the race system and then distributed through sluices over the paddocks, the solid matter was removed in settling ponds.

By the end of the century, after the sewage farm had been in use for more than a decade and a half, a nice black loam supporting a "simply marvellous" growth of vegetation had formed where previously there had been "nothing but a waste of sand". Some time after the sewage had been allowed to flow over each paddock, stock were turned out for fattening. Oats and hay were also grown for winter feed. The farming venture was not always profitable because of the low prices that were sometimes obtained for fat cattle, but the main object of the farm was not to make money but to dispose of the city's sewage in a healthy manner. The *Weekly Press* noted in 1897 that "of all the modes of disposing of sewage in a healthy and proper manner it is claimed that none can compare with filtration through and irrigation over the land".

Below: *Irrigated paddocks at the sewage farm in 1904.* Weekly Press

Left: *Drain on the Bromley sewage farm, c. 1895.* Drainage Board

Above: *A photograph taken at the sewage farm about 1895. The man standing back left is William Rowse, the first foreman at the farm, appointed in 1882. With him are five of his children.* Drainage Board ***Below:*** *A general view of the sewage farm yard in 1905.* Weekly Press



Chapter 6

Progress Again

The period of "mere existence" for the Christchurch Drainage Board came to an end with the arrival of the new century. In the late 1890s, many people in Christchurch were increasingly conscious that the sewerage system installed nearly twenty years earlier was becoming inadequate. So the Board's Engineer, Edwin Cuthbert, drew up a plan for sewer extensions. The local authorities at first either showed no interest in the scheme or rejected it outright. The Board therefore decided not to act on the recommendation of its Works Committee that it promote legislation to raise the loan needed to proceed with the extensions.

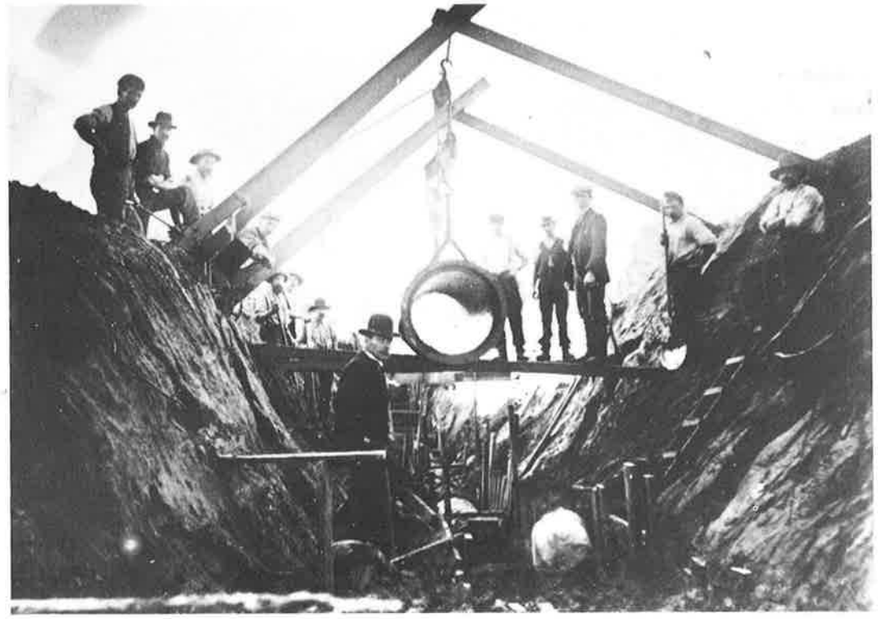
Scarcely had the Board done this than the Christchurch City Council had a change of heart and urged the Board to seek authority to raise the loan needed to complete the sewerage system (the full length of sewers Clark had recommended had still not been laid). The City Council was eager at this point to phase out night soil collection. Encouraged by this unexpected show of co-operation by the City Council (though the suburban districts continued to refuse similar co-operation), the Drainage Board promoted the proposed bill and in 1900 an Act was passed by Parliament empowering the Drainage Board to raise a new loan to complete the sewerage of the city area.

This loan, of £25,000, was raised in 1901 and the first tenders for pipe laying since 1884 were called. The following year four more tenders were called for further extensive work. By the beginning of 1903, the total length of sewers had jumped to nearly 50 miles (80 kilometres). Clark's plan was thus more or less completed two decades after it had first been drawn up. The increase in the length of sewers was matched by a surge in the number of new connections to the sewers. From 1883 to 1901 new connections had been made at the painfully slow rate of about ninety a year. In 1902 alone there were 791 new house connections.

In May 1906, the Board was given authority to raise a further loan to extend the sewers into populous suburban areas such as Merivale, Addington, Sydenham, Linwood and Richmond. Parts of most of these suburbs had been serviced by sewers when the system was first built. Up until the outbreak of World War I there was a steady extension of sewer pipes into the unsewered parts of those suburbs, until sewers were beyond the limits of the area Clark had originally proposed to service.

By that time, it was evident that the Board would soon have to build more pumping stations. Reticulation was now out to the boundaries of the area which could be served by gravitation into the sewer tank at the original pumping station on Tuam Street. In the first decade of the twentieth century two new pumping stations were constructed, one on Hereford Street on the river bank opposite the Public Library (now Library Chambers) and the other on Bangor Street in the Avon Loop area. Both these pumping stations were driven by DC electric current supplied from the city destructor on

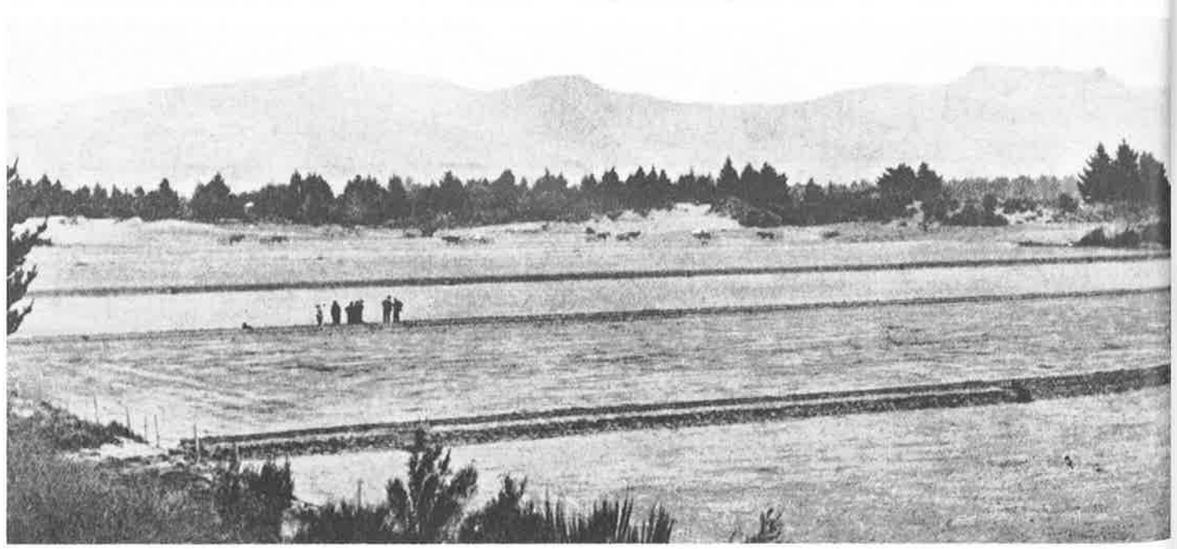
Sewer construction at the east end of Tuam Street, c. 1905.
Drainage Board



Laying a 27 inch rising main in 1907.
Drainage Board

Armagh Street. Subsequently two more small pumping stations, on Templar and Avonglade Streets, both in the suburb of Avonside, were added to the system. These pumping stations were supplied with electric power from the Christchurch Transport Board's steam generating plant on Falsgrave Street, built in the early 1900s to supply power for the city's new electric tramways.

Despite these improvements and extensions in the years leading up to World War I, the night cart continued to pay weekly visits all over the city, even in areas served by sewers. It took some time for many members of the public to realise that the dry closet was less satisfactory for the disposal of sewage than the sewers. The Christchurch City Council forced the issue in the city itself by progressively discontinuing night soil collection services in different areas. It also, at the Drainage Board's request, used the power it possessed under the Municipal Corporations Act to require the connection of premises to the sewers.



Below top: *The official opening of the new septic tanks at the Bromley sewage farm in 1905.* ***Below bottom:*** *Sewage flowing into the detritus tanks at the sewage farm on the day of the opening.*
Both photographs: Weekly Press

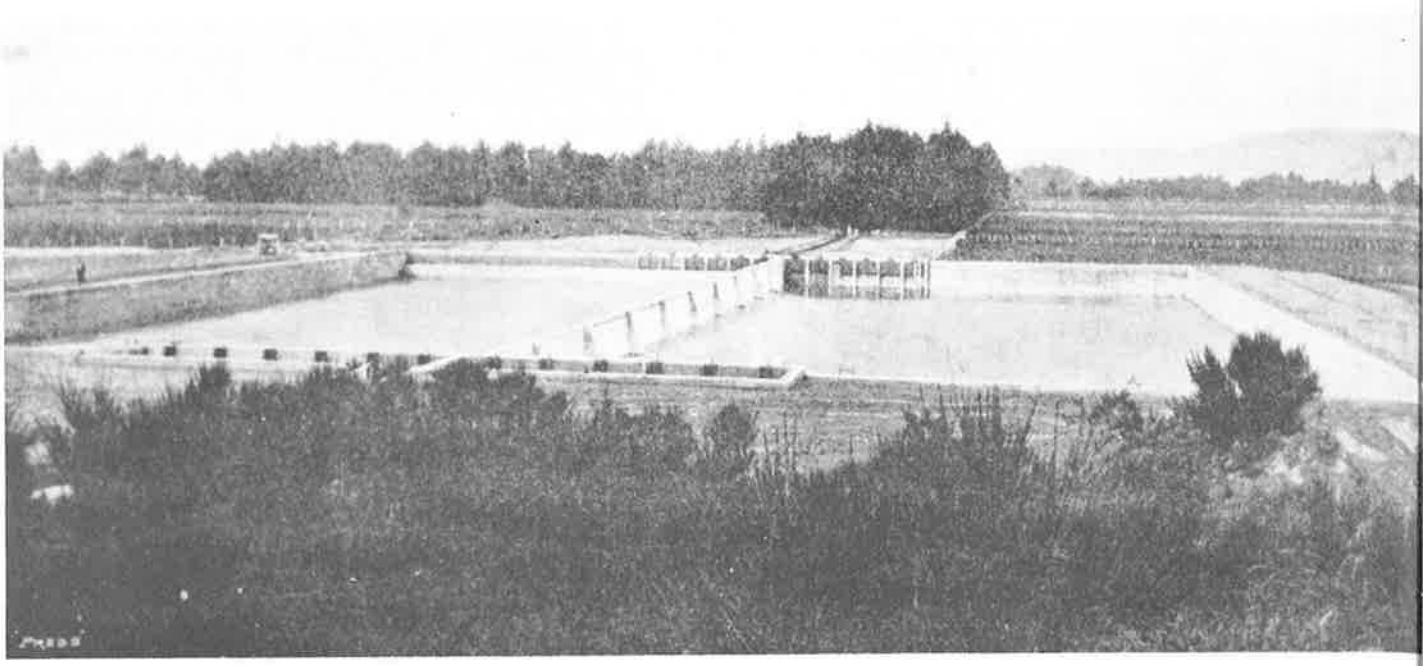
These extensions to the sewerage system in the early 1900s also required increasing the capacity of the main pumping station and the sewage farm. Nearly £3000 of the £25,000 loan raised in 1901 was spent on forming new paddocks at the sewage farm. Drays and scoops were used to level further sandhills and another eighteen acres (7.5 hectares) were added to the area of paddocks over which the sewage was allowed to flow. "The increase in the irrigable area" the *Weekly Press* noted in 1905 "was rendered necessary by the recent extension of the sewage system in the city". The paper also noted (when reporting a visit by members of the Board and visitors to see the new works in May 1905) that the question of the sewage farm paying its way was secondary "as the irrigation system is necessary as a means of purifying the sewage water, and in this respect it appears to be a complete success".

Improvements at the sewage farm in these years also involved the building of new septic tanks at a cost of £7000. The 260 foot (eighty metre) square tank was divided into two to ensure capacity would always be available. The

Top: *Levelling sandhills at Bromley in 1904 for the formation of additional paddocks at the sewage farm.* ***Bottom:*** *Formation nearly completed on some of the additional paddocks.*
Both photos: Weekly Press

new tank was opened on 4 September 1905. At the opening, Cuthbert explained how the septic tank worked and expressed confidence that after the fluid had passed through the bacteriological treatment of the tank and then percolated through the paddocks, the effluent would "to all intents and purposes be as clear as artesian well water".

At the main pumping station on Tuam Street, new electrically driven plant was installed to replace the original steam-powered plunger pumps. The old plant was retained as standby. The new consisted of two gas engines generating DC power which drove three motors directly coupled to new centrifugal pumps. These new pumps came into operation in July 1908. In 1917,



Above: *A general view of the new septic tanks at the Bromley sewage farm in 1905.* Weekly Pre

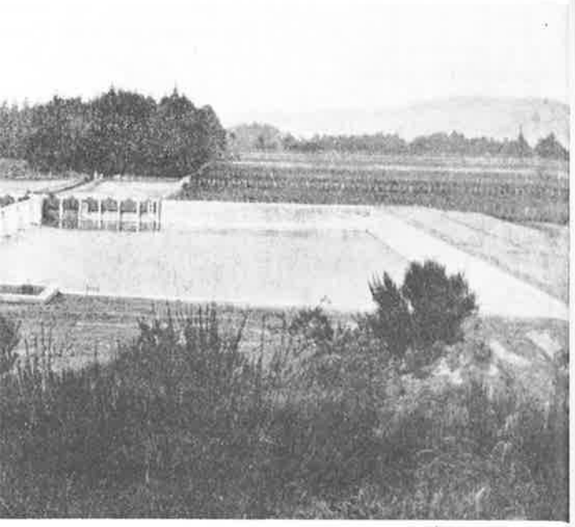
power became available from the Lake Coleridge power scheme and new AC motors were connected to the three centrifugal pumps. Again some of the old plant (the DC motors and one gas engine and generator) was retained as standby. A fourth pump was installed in July 1920.

Outside the Board's district, the Borough of Sumner built a large septic tank which discharged into the sea. The tank was opened by the Mayor of the Borough in January 1904, but Sumner and the eastern hill suburbs were not to come within the Board's district until later in the century and the area was not linked to the city-wide sewerage system until the 1960s.

From the outset, the work of the Christchurch Drainage Board had been hampered by local body parochialism. The situation improved markedly in April 1903 when Linwood, St Albans and Sydenham were all amalgamated with Christchurch City. This amalgamation was seen as a great advantage to

Fold out: *Map number 3. Christchurch's sewerage system in 1882.*

Below: *Members of the Christchurch Drainage Board and visitors at the opening of the new septic tanks at the sewage farm in 1905.* Weekly Pre



scheme and new AC
Again some of the
erator) was retained

built a large septic
ed by the Mayor of
rn hill suburbs were
century and the area
he 1960s.
age Board had been
proved markedly in
ere all amalgamated
a great advantage to

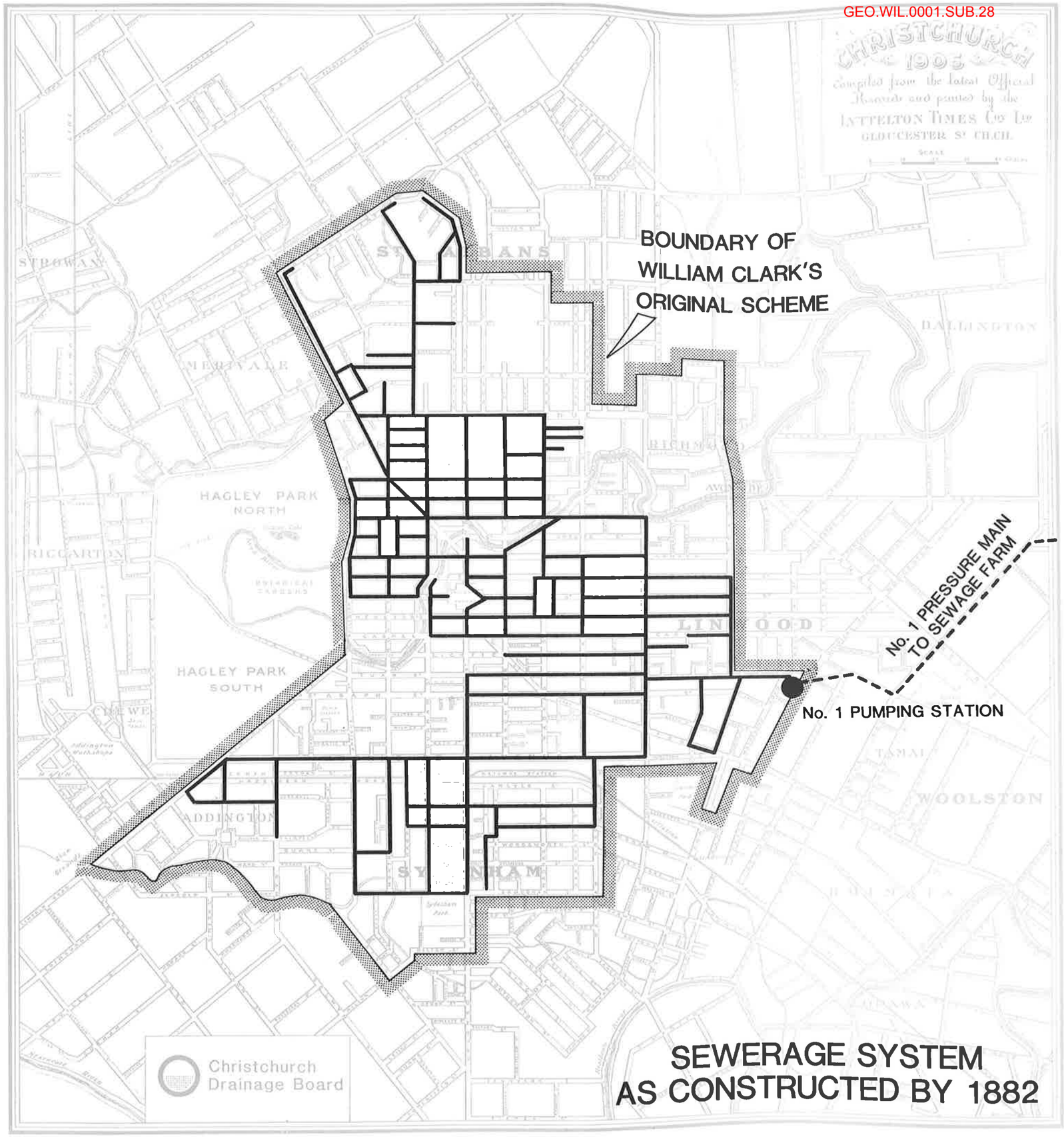
Above: *A general view of the new septic tanks at the Bromley sewage farm in 1905.* Weekly Press

Fold out: *Map number 3. Christchurch's sewerage system in 1882.*

Below: *Members of the Christchurch Drainage Board and visitors at the opening of the new septic tanks at the sewage farm in 1905.* Weekly Press

GEO.CLA.0001.SUB

GEO.WIL.0001.SUB.28



the city from a sanitary point of view. One of the major works of the enlarged city was a city-wide high-pressure water supply, inaugurated with the opening of the water works in Beckenham in 1909.

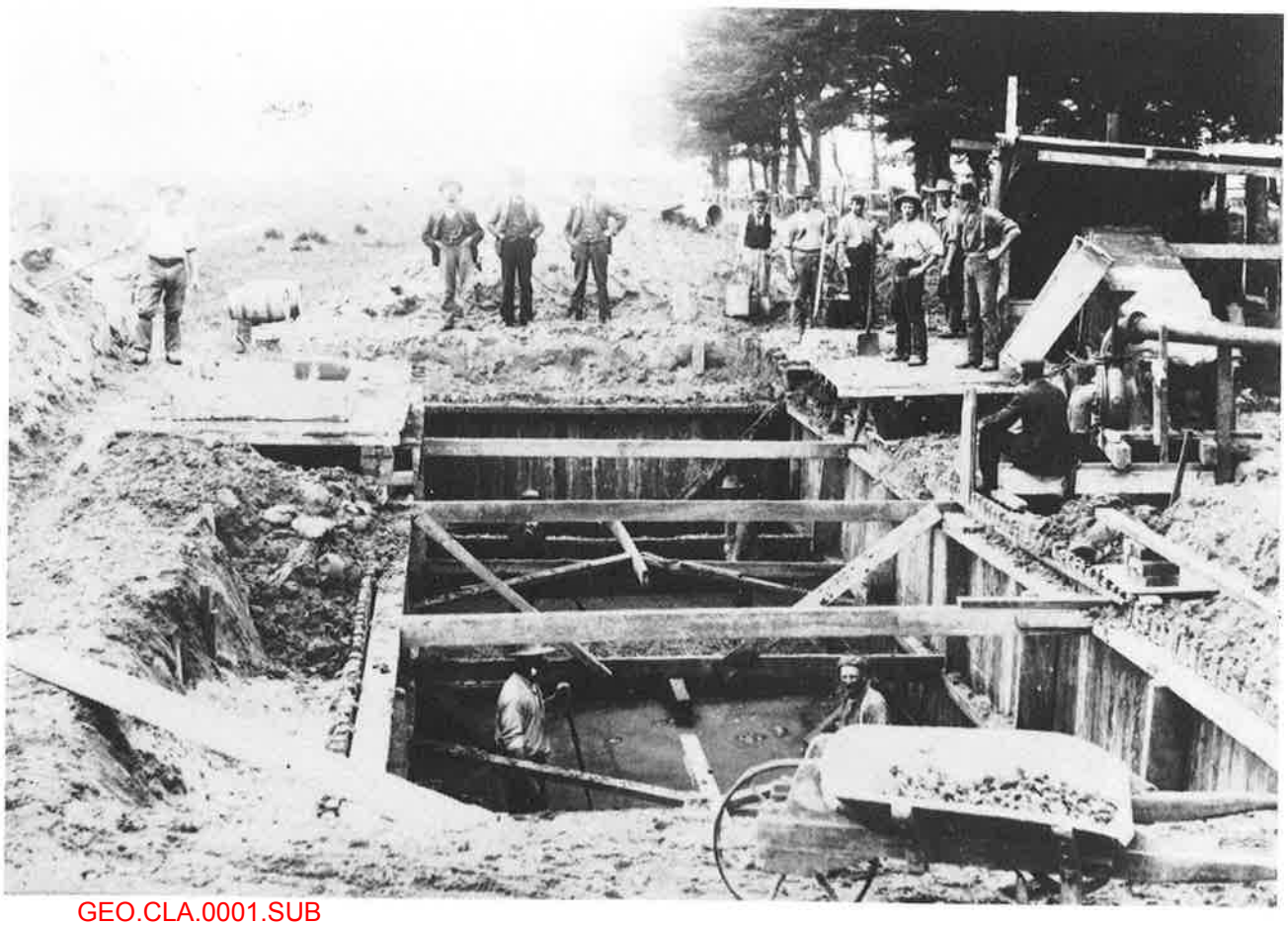
It had been a novel feature of Christchurch that because of abundant supplies of artesian water, the city had been sewered in advance of being piped for water. Sewerage and water supply usually go together as the joint responsibilities of a single body. In 1876 giving the Drainage Board control over artesian wells in its district was considered, but the Legislative Council rejected the bill providing for this extension of the Board's responsibilities. The Board did not subsequently control of water supply in Christchurch, considering sewerage and drainage full-time tasks in themselves. A host of rams, windmills and pumps drawing water from private wells allowed the Board to provide the city with sewers confident there would be sufficient water for the efficient functioning of the sewerage system even in the absence of a city-wide high-pressure water supply.

This pattern of sewers preceding water pipelines prevailed in Christchurch until beyond the middle of the century. Riccarton was sewered in 1927-29, but water reticulation of the borough was not completed until 1957. In Waimairi County, Fendalton, Bryndwr and Northcote were all served by Drainage Board sewers by 1930, but water reticulation of those areas was not completed until 1958.

The problem of a multiplicity of local authorities jealous of the Drainage Board's powers, relieved by the amalgamation of 1903, was further eased when a Commission in 1907 laid to rest the source of continuing resentment which had arisen in the 1890s when the rural districts were forced by the Supreme Court to contribute to the Drainage Board's sinking fund, though the works had been done for the benefit of, primarily, the sewage area. The Commission suggested how the "debt" of the sewage area to the rural areas could conveniently be paid back.

This Commission not only removed grounds for resentment by the outlying, rural, local authorities but also gave a clear vote of confidence in the

Below: *Building a septic tank on the Sumner foreshore in the early 1900s.*
Drainage Board



Board. It found no evidence that the Board had been wasteful, had mismanaged its funds or constructed improper or insufficient works. It cited medical testimony "that whereas before the Board was set up typhoid and diphtheria were rampant in and about the city and Rural Areas, yet now the city is one of the healthiest cities in the Dominion". It made merely a mild suggestion that the Board could improve its relations with the local bodies by keeping its accounts in a way that would make information more readily accessible to the local bodies.

At the time of this 1907 Commission of Inquiry into the working of the Christchurch Drainage Board, suggestions were made that direct election of the Board (its membership had been increased to eleven in 1902) should be abandoned in favour of a Board of members appointed by the local authorities. This, it was suggested, would keep the Board more in touch with local requirements. But the Commission rejected this suggestion on the grounds it was "opposed to the democratic notions of the age". The elected Board had not been shown, the Commission argued, to be incapable of fulfilling its trust or to lack public support.

The advent of World War I inevitably curtailed expansion and improvement of the Board's system. The Board lost employees into the forces and materials such as iron rose dramatically in price. But in the years immediately after the War, the Board continued vigorously with its work to ensure that Christchurch's sewerage and drainage systems were adequate to the needs of a steadily growing city.

Chapter 7

Between The Wars

When the Drainage Board faced the problem of continuing to provide Christchurch with adequate sewers in the years after World War I, it realised that ad hoc tinkering with its system would no longer serve. Christchurch had grown in a manner Clark had not anticipated when he designed his original scheme. Coming from Europe, he had expected that Christchurch would develop as a city with a relatively large population concentrated in a relatively small area. But Christchurch grew differently from the European cities with which Clark was familiar. Its population, growing quite rapidly, was spread rather thinly over a wide area. New areas being subdivided were within the Drainage Board's district, but outside the original sewage area and outside the area that could be served by gravity sewers flowing to the Tuam Street pumping station.

In April 1919, the Board discussed major extensions to the sewerage system involving 125 miles (200 kilometres) of new sewers. Two months later, the Board decided that before proceeding with these proposed works, it would seek an amendment to its Act to ensure that the works could be planned and constructed smoothly. A bill was framed to allow the Board to extend the sewage area without a poll of ratepayers, to borrow money on a poll provided a bare majority of ratepayers approved and to proceed with necessary works

Below: *Construction, by contractors, of the Number 8 sewer along Retreat Road in the 1920s.*
Drainage Board

Board. It found no evidence that the Board had been wasteful, had mismanaged its funds or constructed improper or insufficient works. It cited medical testimony "that whereas before the Board was set up typhoid and diphtheria were rampant in and about the city and Rural Areas, yet now the city is one of the healthiest cities in the Dominion". It made merely a mild suggestion that the Board could improve its relations with the local bodies by keeping its accounts in a way that would make information more readily accessible to the local bodies.

At the time of this 1907 Commission of Inquiry into the working of the Christchurch Drainage Board, suggestions were made that direct election of the Board (its membership had been increased to eleven in 1902) should be abandoned in favour of a Board of members appointed by the local authorities. This, it was suggested, would keep the Board more in touch with local requirements. But the Commission rejected this suggestion on the grounds it was "opposed to the democratic notions of the age". The elected Board had not been shown, the Commission argued, to be incapable of fulfilling its trust or to lack public support.

The advent of World War I inevitably curtailed expansion and improvement of the Board's system. The Board lost employees into the forces and materials such as iron rose dramatically in price. But in the years immediately after the War, the Board continued vigorously with its work to ensure that Christchurch's sewerage and drainage systems were adequate to the needs of a steadily growing city.

Chapter 7

Between The Wars

When the Drainage Board faced the problem of continuing to provide Christchurch with adequate sewers in the years after World War I, it realised that ad hoc tinkering with its system would no longer serve. Christchurch had grown in a manner Clark had not anticipated when he designed his original scheme. Coming from Europe, he had expected that Christchurch would develop as a city with a relatively large population concentrated in a relatively small area. But Christchurch grew differently from the European cities with which Clark was familiar. Its population, growing quite rapidly, was spread rather thinly over a wide area. New areas being subdivided were within the Drainage Board's district, but outside the original sewage area and outside the area that could be served by gravity sewers flowing to the Tuam Street pumping station.

In April 1919, the Board discussed major extensions to the sewerage system involving 125 miles (200 kilometres) of new sewers. Two months later, the Board decided that before proceeding with these proposed works, it would seek an amendment to its Act to ensure that the works could be planned and constructed smoothly. A bill was framed to allow the Board to extend the sewage area without a poll of ratepayers, to borrow money on a poll provided a bare majority of ratepayers approved and to proceed with necessary works

Below: *Construction, by contractors, of the Number 8 sewer along Retreat Road in the 1920s.*
Drainage Board

by Order in Council (which would make any poll unnecessary). When this bill became law in 1920, the stage was set for the Board to proceed with a complete renovation and broad extension of the system confident it would not be thwarted from building any element of a comprehensive scheme by ratepayer opposition.

Thus armed with the powers it needed, the Board went to the ratepayers with a bold proposal to borrow £700,000. The ratepayers approved this loan in a poll held on 12 July 1923. Additional loans were approved in the later 1920s, bringing the total the Board borrowed in that decade to more than one million pounds.

The money was thus available to extend the city's sewers into growing residential areas. A "sewer extension area" was created setting new outer boundaries for the area that would be served by sewers. These boundaries were Tuckers, McFaddens and Shirley Roads in the north, Cemetery Road in Bromley, St John Street and the Heathcote River in Woolston and Hansons Road in Riccarton. The boundaries embraced expanding residential areas in St Albans, Papanui, Fendalton, Riccarton, Spreydon, Beckenham, St Martins, Radley, North Linwood and North Richmond.

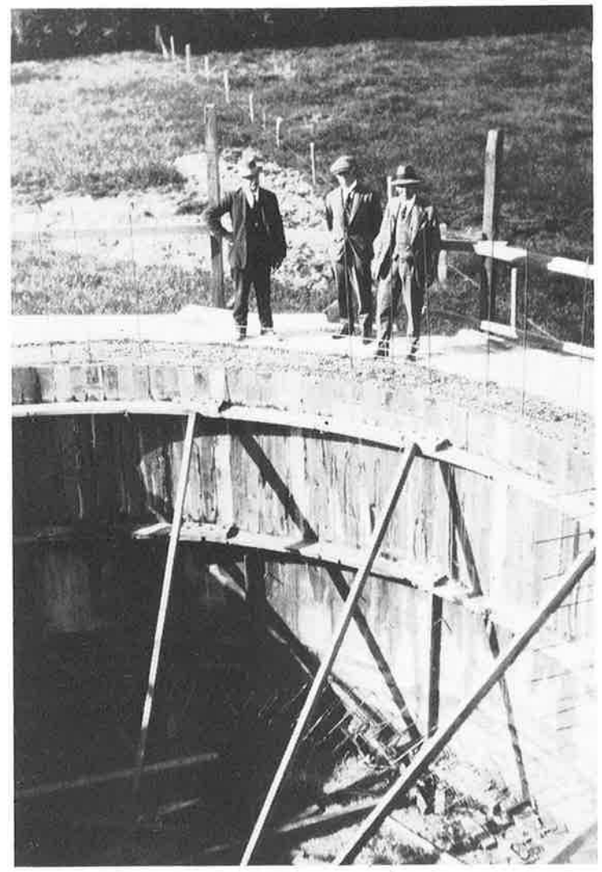
Sewers laid in the St Andrews Square, Linwood and Hillmorten areas in 1925 completed the area which could be served by gravity to the Tuam Street pumping station. An area of 4966 acres (2000 hectares) was served by 120 miles (192 kilometres) of sewers. Clark's original 1878 scheme had provided for 57 miles (90 kilometres) of sewers serving 2450 acres (1000 hectares). But while Clark had allowed for a population of 91,150 on the 2450 acres, in 1936 there were only about 50,000 people living on the larger area of 4966 acres.

For the sewer extension area (except for parts of Riccarton) pumping stations and rising mains were needed to get the sewage to the sewage farm at Bromley. The use of pumping stations was made possible by the availability of electric power from the Lake Coleridge power station. The regular supply of electricity from Lake Coleridge to Christchurch began in 1915.

The inner area of the original sewage district, from which sewage flowed by gravity to the Tuam Street pumping station, was kept separate from the sewer extension area. To service this area, northern and southern chains of pumping stations were built to get the sewage to the sewage farm at Bromley. The two main auxiliary pumping stations of the new system were on Woodham Road, serving the northern area, and on Randolph Street, serving the southern area. Both these pumping stations pumped sewage directly to Bromley, bypassing the Tuam Street pumping station, which came to be known as the Number 1 Pumping Station when the new stations were built.

The first of the new pumping stations were commissioned between April and August 1927. The last of the twenty-four new stations were commissioned in July 1931. By the end of that year more than 168 miles (270 kilometres) of sewers had been laid, some at flat grades to save the cost of putting the

A sewage pumping station under construction in 1925. It is not clear which one this is of the several pumping stations under construction in that year.
Weekly Press



***Right:** A pumping station under construction in the 1920s. It is possibly the station on Locarno Street which came into operation in 1927. **Below:** The Randolph Street pumping station under construction in 1925. This major station also came into operation in 1927.*
Both photos: Drainage Board

sewers at a great depth. More than 10,000 houses had been connected to the new sewers by the opening years of the 1930s.

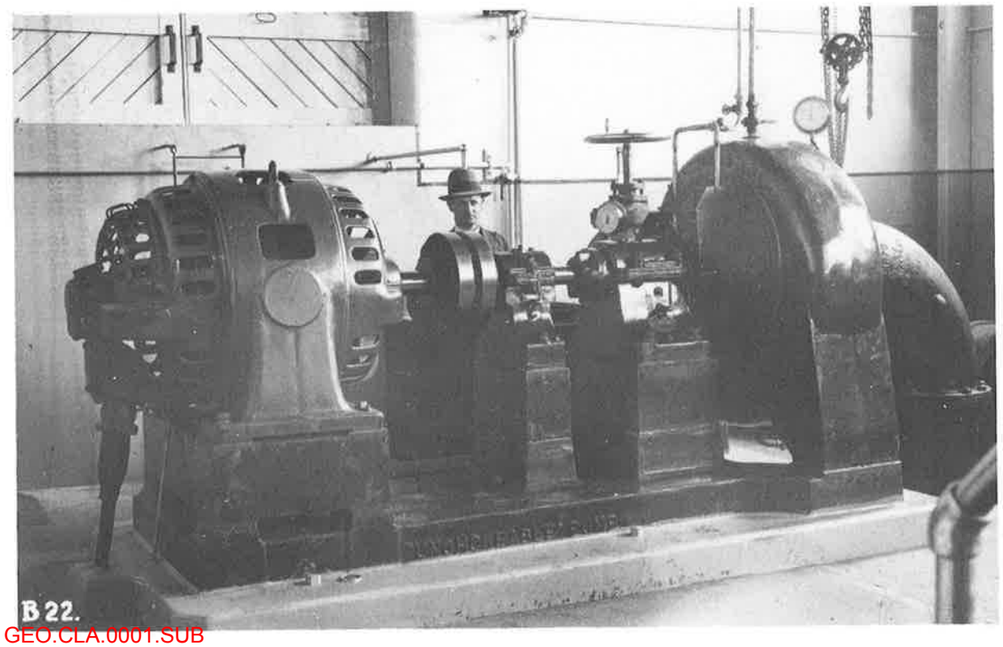
The Board had again, by good fortune, just completed major works when economic depression overtook the country. Despite the depression, new connections to the Board's sewers continued through the 1930s at an average of about 1000 a year. In 1927 there were 14,270 premises connected to the Board's sewers; by 1940 the number had more than doubled to 30,431. In 1927, the Board had at last gained the power to compel people to connect up to the sewers and it instituted a scheme under which it advanced money to householders to facilitate connection. By the time the Board gained the power it had long felt it needed, most houses already had water closets and most homeowners were anxious to have their homes connected to the sewers. The Board used its power to force people to connect their premises only sparingly. Had it had the power in the later years of the nineteenth century, when householders were reluctant to connect into the Board's sewers, it would probably have used the power more extensively.

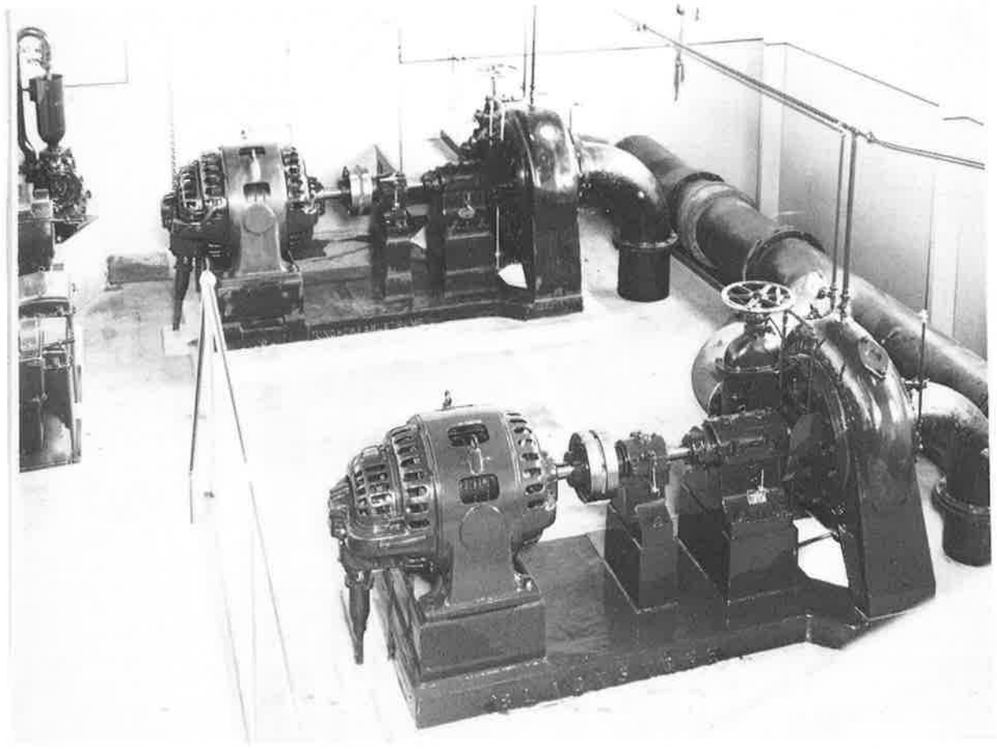
The period between the Wars also saw minor extensions to the Drainage Board's district. The original district of 1875 was 48 square miles (125 square kilometres) in extent. Between 1924 and 1945 small areas of closer settlement, mostly south of the Heathcote River were added to the district and its area grew to 54.84 square miles (140 square kilometres). Radley, St Martins and Huntsbury were among the areas which came under the Board's jurisdiction. (These small additions to the Board's district are shown on map number 2.)

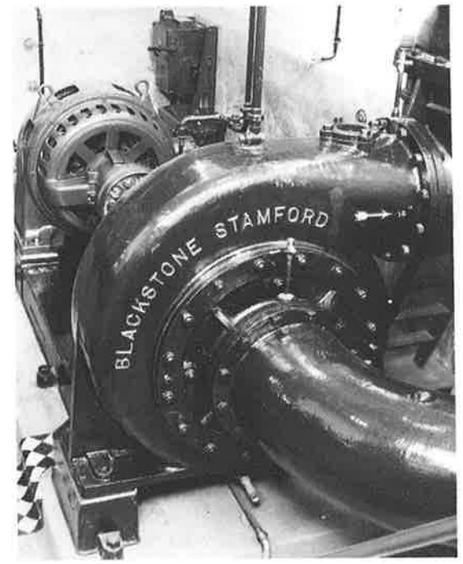
The sewerage extensions constructed in 1925-31 mostly bypassed the Tuam Street pumping station. At that station, in 1936, the Gwynne pumps installed early in the century were replaced by three more powerful Blackstone pumps which had a capacity of 13,000,000 gallons a day. These pumps remained in use until the Tuam Street pumping station was shut down in 1957.

In the 1920s, too, a problem surfaced which was to cause the Board considerable concern in coming years. This was the problem of "obnoxious" trade effluents finding their way into the stormwater system. Pollution was not to become a popular issue for many years, but from 1925 on the Board was making bi-monthly inspections of factories that generated such effluents and taking steps to bring the nuisance under control.

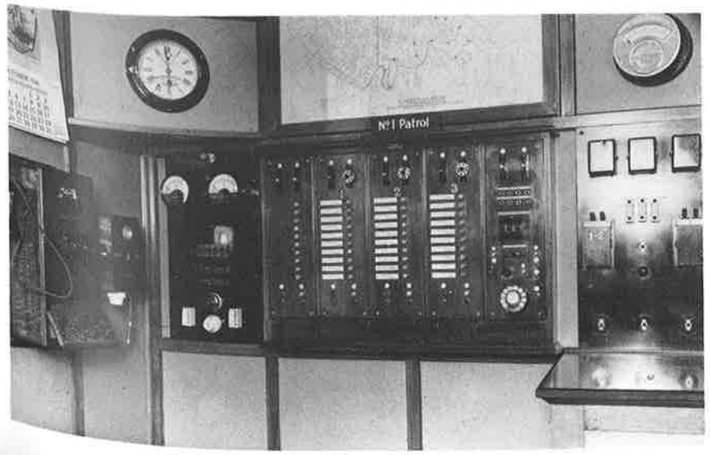
Below: *One of the new engines and pumps installed at the Tuam Street pumping station in 1936.*
Drainage Board







Above: *A general view of the plant in the Tuam Street pumping station in 1945.* ***Right:*** *A detail of one of the Blackstone pumps installed in the Tuam Street pumping station in 1936.* ***Below:*** *The control panel at the Tuam Street pumping station in 1936.*
All photos: Drainage Board



Left: *Clearing trees from Horners Drain in 1926.* Drainage Board

The emphasis of the Board's work in the 1920s was on sewerage extension, but land drainage problems were not neglected. Some of the same subdivisions which had made the sewer extensions necessary also exacerbated problems of subsoil and stormwater drainage. The Board sought yet another amendment to its Act, this time one giving it power to require drains and stormwater sewers to be laid in roads and streets which formed part of any new subdivision.

In the 1920s and 1930s, work was also done on two key drains in the city's stormwater system. Horners Drain in Papanui, an early drain first dug many years before, was deepened in Prestons Road and extended to Winters Road to carry flood water north into the Styx River. Sections of the Wilderness Drain, which kept the area between the Heathcote River and Jacksons Creek, centred on Barrington Street, free of flood waters in all but the worst storms, were also deepened. In the inner city, stormwater sewers were laid in Kilmore and Durham Streets.

In the 1930s, the depression which brought new work on sewers almost to a halt actually facilitated improvements to the stormwater drainage system. Unemployment loans were raised by the Board and relief workers set to work clearing, straightening and deepening the Heathcote River, deepening and slabbing the Wilderness Drain, widening and deepening Dudley Creek and the Bullers and Philpotts Road Drains and straightening, then later deepening and timbering, the Riccarton Main Drain in South Hagley Park. Other

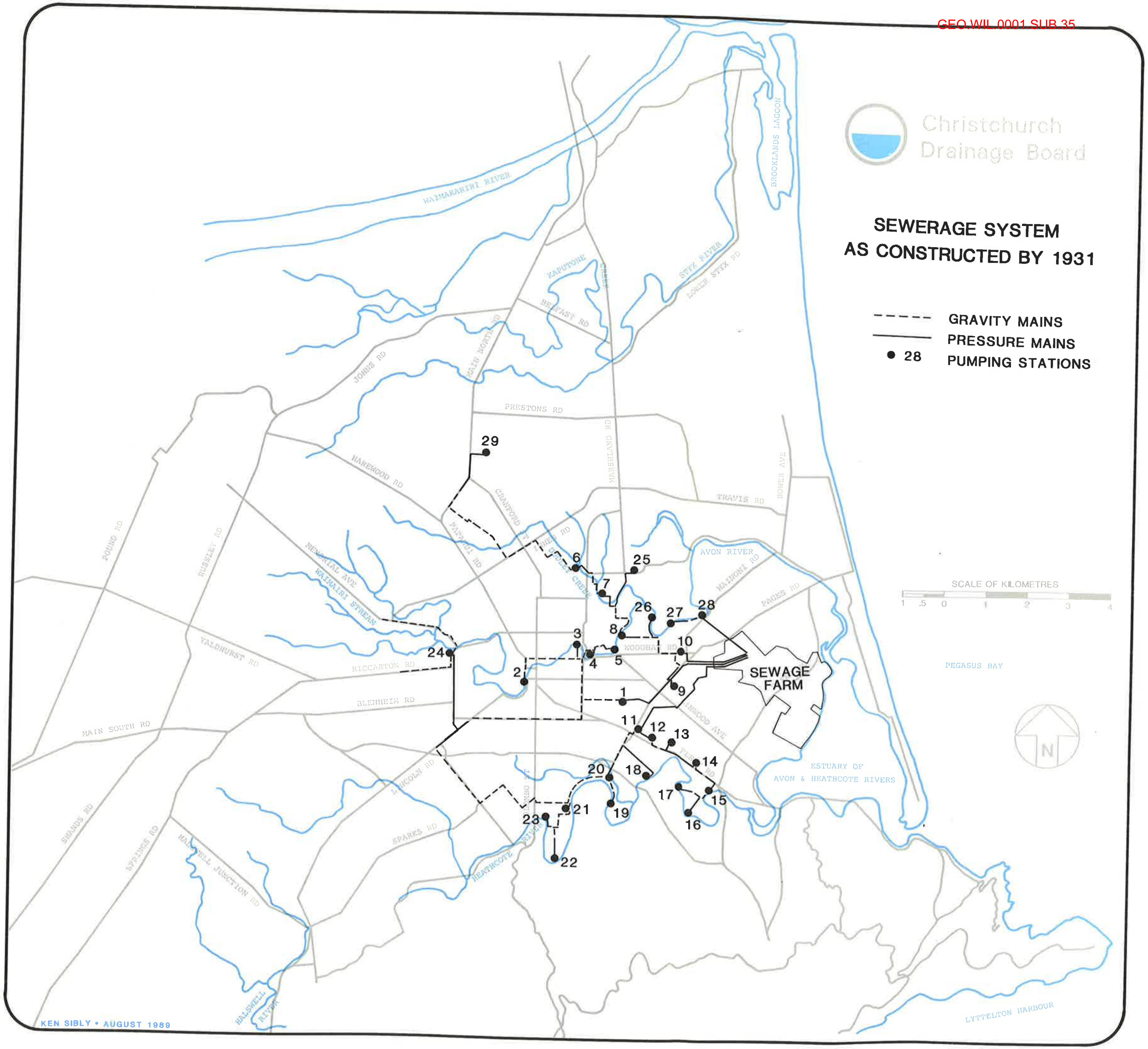
Fold out: *Map number 4. Christchurch's sewerage syst in 1931, after the constructi of new mains and pumping stations in the 1920s.*

Left: Clearing trees from Horners Drain in 1926.
Drainage Board

sewerage extension, of the same subdivi- xacerbated problems yet another amend- ains and stormwater t of any new subdi-

drains in the city's rain first dug many ed to Winters Road of the Wilderness and Jacksons Creek, it the worst storms, were laid in Kilmore

k on sewers almost er drainage system. workers set to work er, deepening and Dudley Creek and then later deepen- Hagley Park. Other



Fold out: Map number 4. Christchurch's sewerage system in 1931, after the construction of new mains and pumping stations in the 1920s.

Right: *Mechanisation of drain and river clearance in the 1920s. A digger at work in Opawa in 1926.*
Weekly Press

work included improvement of the main outfall drain and the building of tide gates at its outlet, the deepening and timbering of the Number 2 Drain which ran from Horseshoe Lake to Marshlands, the installation of a land drainage pump at the Travis Swamp and the laying of stormwater sewers in Gloucester Street, Linwood Avenue and Ngaio Street.

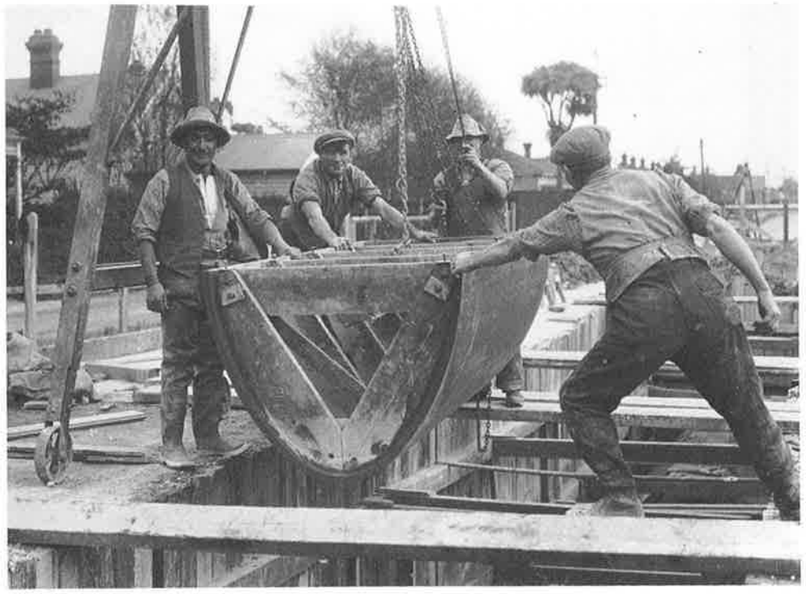
In these same decades, the Board applied greater vigour to keeping the rivers clear. In the late 1920s, a pneumatic sweeper was put to work in both the Avon and Heathcote Rivers. This swept silt ahead of itself, the silt being carried downstream as a slurry by the current of the river. Two heavy floods in 1936 emphasised the need for improvements to the rivers, creeks and drains that carried stormwater. Unemployed people were also given work on the sewage farm, as they had been in the 1880s when the Government put sixty men to work on the Board's land at Bromley.

The 1930s and 1940s saw only minor work done on the Board's sewerage system. In 1942 the Number 24 Rising Main, which ran from Matai Street down Deans Avenue to Lincoln Road, was diverted along Moorhouse Avenue to discharge into the inner area's sewers at Antigua Street. It had previously flowed into the Barrington Street sewer and so into the "southern chain" of pumping stations. This diversion reduced the flow in the Barrington Street sewer, allowing a sewer at the top end of Lincoln Road to be diverted into it. Between 1939 and 1942, locally made pumps were used to increase capacity at a number of pumping stations and between 1940 and 1946 more than 16

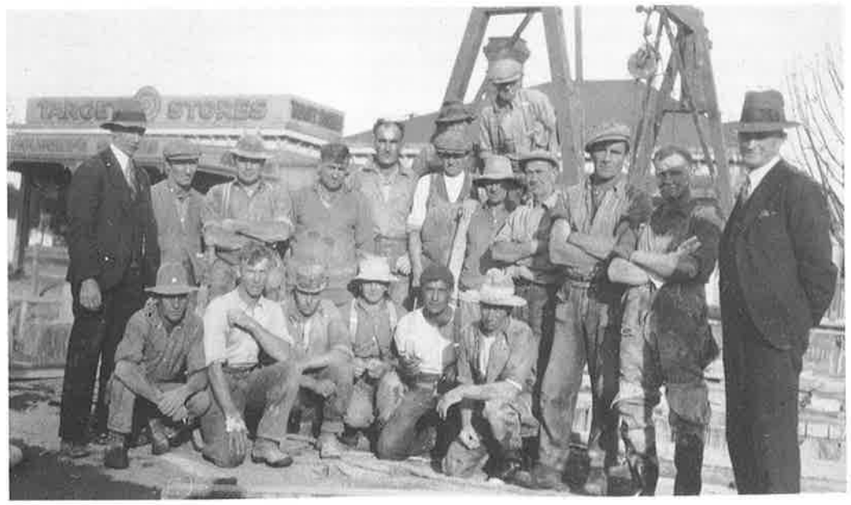
Construction of the Durham Street stormwater sewer in 1936.
Drainage Board

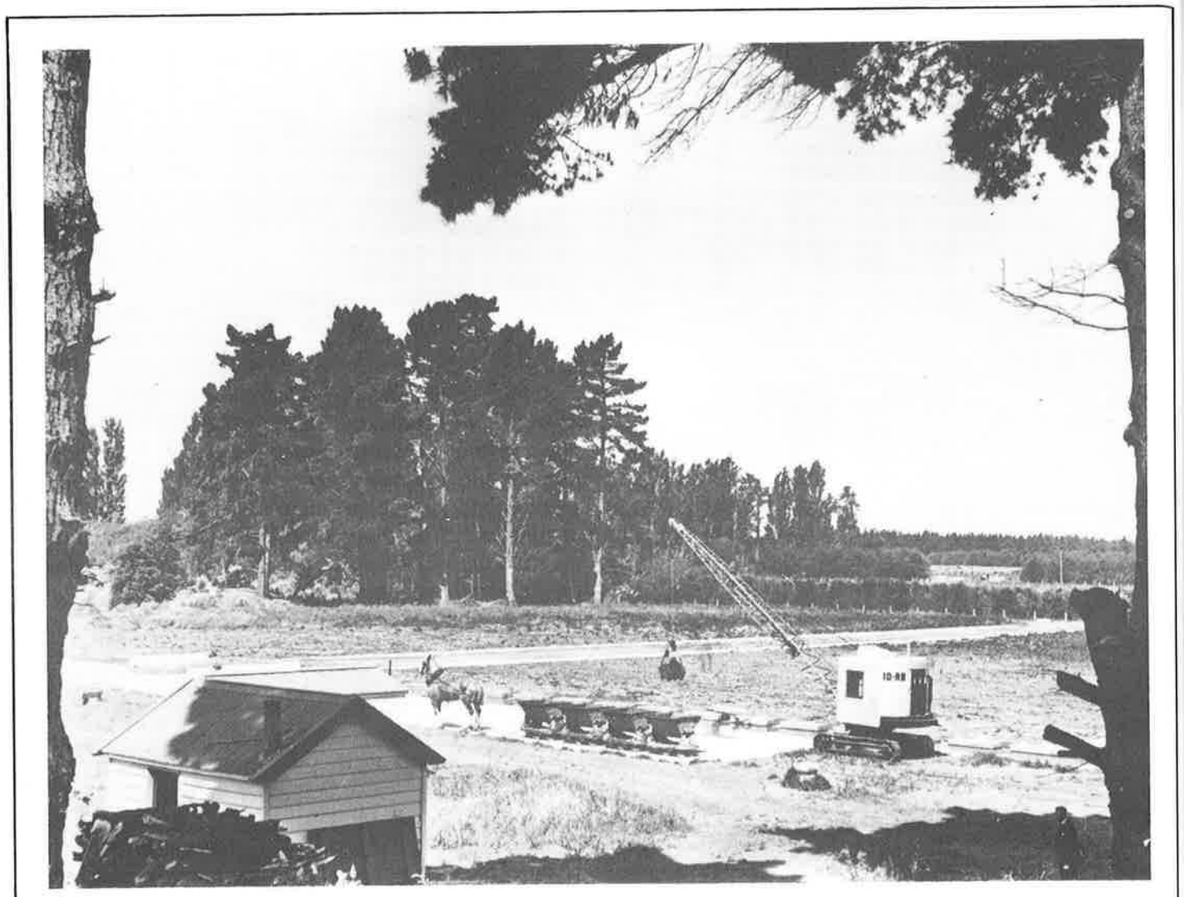
miles (25 kilometres) of new sewers were laid in various parts of the city. Most of the work was in the western parts of Christchurch, connecting to the Riccarton sewers. The Wigram Air Force station was connected in 1943.

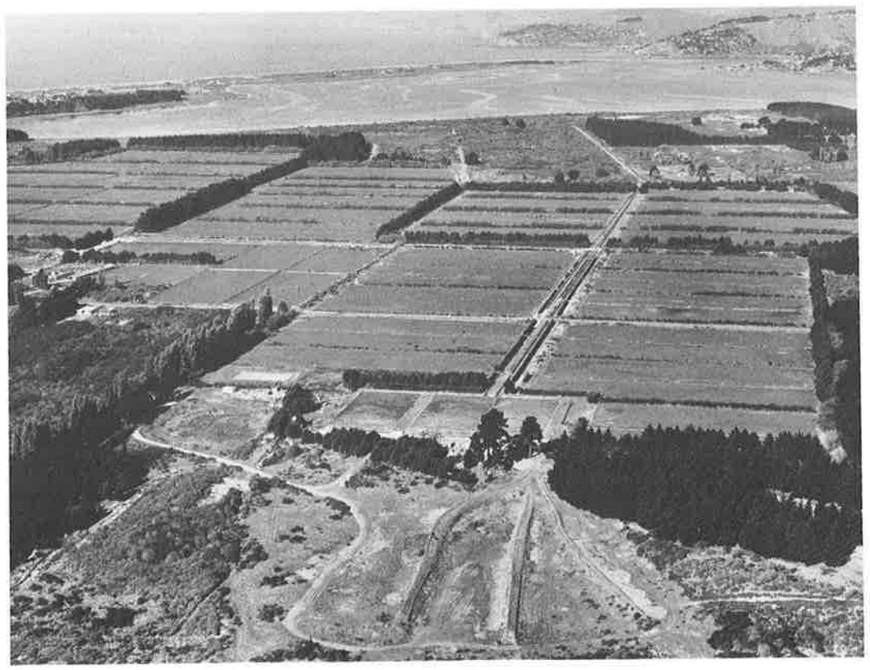
By the start of the 1940s, many recognised that the capacity of the Board's sewers was inadequate at many points and that major reconstruction of the system was again necessary. This was impossible during the war and immediate post-war years. But the 1950s were to see significant changes as the Board struggled to keep pace with the growth of Christchurch, changes more sweeping than even those of the major extension of the sewerage system in the 1920s.



Above left: *Section of the Tuam Street sewer under repair in 1935.* ***Above right and right:*** *Repairing the Tuam Street sewer in 1935.* ***Below:*** *The Board's maintenance construction crew which worked on the 1935 repair of the Tuam Street sewer.*
All photos: Drainage Board







The last years of the old sewage farm. ***Above:*** *Clearing out the septic tanks at the farm in 1945.* ***Left:*** *The sewage farm in 1957, just before construction of the new treatment works began.* Both photos: Drainage Board

Chapter 8

Keeping Pace

In the late 1940s there was talk in Christchurch of the amalgamation of the local bodies. In these discussions the suggestion surfaced that drainage become a responsibility of an enlarged Christchurch City, which is what has happened forty years on. But these efforts at local body amalgamation in the 1940s foundered and the Drainage Board instead emerged in the early 1950s with responsibility for drainage of a much larger area.

Up to 1944, the Drainage Board could extend its district only if a local authority decided to hold a poll of ratepayers in an area adjoining the district's boundary. Small areas had become part of the drainage district under this provision. In 1947, the Yaldhurst area of Waimairi County became part of the Board's district in this way. A 1944 amendment to the Drainage Board's Act provided that areas joining with Christchurch City would automatically become part of the Drainage Board's district. Thus Sumner became part of the Board's district in 1945 when the Sumner Borough decided to join with the city.

At the end of World War II it was obvious to the Board and its staff that something would have to be done to ensure co-ordination of sewerage and drainage in areas outside the Board's existing boundaries with the Board's own systems. In 1946, the Board met with representatives of the surrounding counties and with local M.P.s seeking an extension of the drainage district. The Local Government Commission hearings of 1948-49 put these negotiations on hold, but the intransigence of the Riccarton Borough scuttled plans for wide-ranging reorganisation of local government in Christchurch.

In December 1949, the Board petitioned the Minister of Internal Affairs asking that it both continue in existence and be given responsibility for drainage in an extended area, one embracing the entire catchments of the Heathcote, Avon and Styx Rivers and areas to the west where development was occurring. The 1951 Christchurch District Drainage Act made such an extension of the Board's district, from 54.84 square miles (140 square kilometres) to 112.16 square miles (290 square kilometres). (The boundaries of the Board's district in different years are shown on map number 2.) With the 1951 Act, the Board became responsible for drainage in the catchment areas of the three rivers that were the principal outlets for stormwater drainage. Included in the Board's district were all of Christchurch City, Riccarton Borough and Heathcote County, most of Waimairi County and parts of Paparua and Halswell Counties. This welcome extension came, the Chief Engineer noted, "after five ill-spared years of frustrating, vexatious and irritating delay".

His concern was well-founded because by the early 1950s the city's sewerage system was creaking along. And what the Chief Engineer did not know in 1951, but suspected, was that the city was at the beginning of two decades of considerable expansion. The Board had its work cut out keeping pace with this growth and ensuring that sewerage and drainage in the enlarged district

were adequate to the city's needs. The Board had been aware from the mid 1940s that residential growth was going to make new works on a substantial scale necessary. The unfortunate delays while local government reform and extension of the Board's district were discussed made its task of keeping pace with the city's growth that much harder.

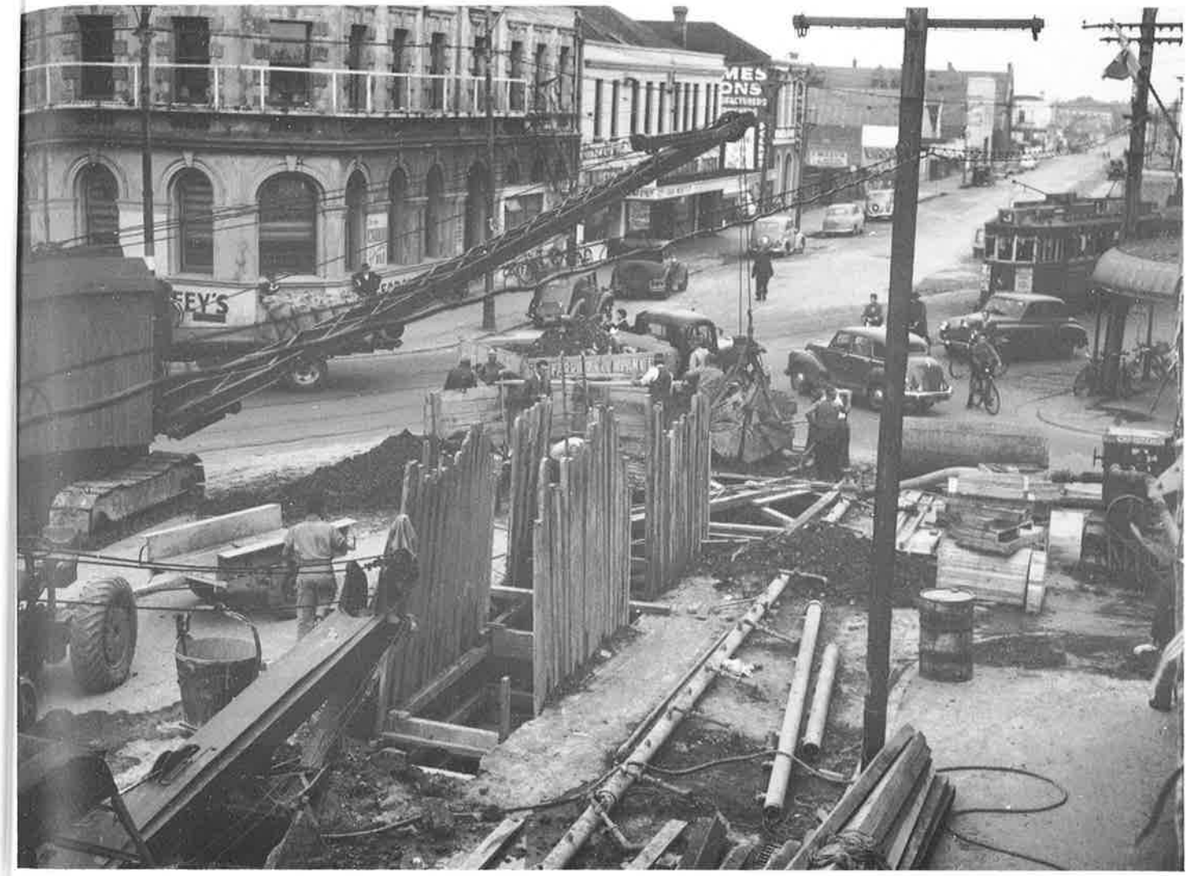
In 1946 there were reports of gorged sewers in Riccarton and St Albans and two years later, in 1948, the Board was obliged to prohibit sewer extensions and the sewering of new subdivisions in areas served by the Number 24 (Matai Street) pumping station in Riccarton and the Numbers 6 and 7 (Harrison Street and Stapletons Road) pumping stations in St Albans. Although the system was under pressure and the Board's work barely keeping ahead of the city's growth, the Board's staff felt obliged to correct an impression that gained currency that Christchurch was more poorly served by sewers than other New Zealand cities. But they had also to warn that until proposed main relief sewers were completed, the system could become overloaded at times and further restrictions could have to be placed on connecting certain new housing areas to the sewers. The original prohibitions in Riccarton and St Albans were lifted in the mid 1950s, but the extension of settlement was so rapid that reticulation of some new housing areas had to await the completion of such major works as the relief sewers and the new main pumping station.

For what was required was a complete reconstruction of the whole sewerage system. It was no longer sufficient to add areas of reticulation feeding into existing pumping stations and on to the sewage farm. By the mid 1960s Christchurch was to have a new system of trunk sewers, a new main pumping station and a new sewage treatment plant. In addition to these major works, there were long-settled areas without sewers which had to be reticulated (notably New Brighton and Belfast) and new housing areas which needed street sewers. Finally, the south-eastern hill suburbs of Mount Pleasant and St Andrews Hill and the seaside suburbs of Redcliffs, Sumner and Scarborough had to be connected to Bromley. Sewage from these suburbs had passed through communal septic tanks before being discharged into the sea and the Estuary.

The outlines of this new system were sketched by the Board's staff as early as 1945, when a southern relief sewer, a Riccarton interceptor sewer, a new northern sewer and remodelling of the sewage farm were all envisaged. But work did not begin on the new system until the 1950s. Large sums of money were needed, but until 1952 the Board's planning and execution of these major works was hampered by the requirement that it take a poll of ratepayers before raising loans. The first major loan for the new works, £425,000, was raised in 1951 on a requisition from the Board of Health, a procedure which bypassed the requirement of a poll. From the beginning of 1952, the Board had statutory authority to raise loans without taking a poll. Taking advantage of this power, the Board raised major loans in 1954, 1958 and 1962. Altogether between 1948 and 1963, the Board raised more than five and a quarter million pounds in loans for trunk sewers, the new treatment plant and reticulation. In the early 1950s, the Board encountered some difficulties in filling its loans. A 1955 tender for £359,000 for the northern relief sewer was accepted nervously because the Board's bank balance was low and its loans were not being filled. But when interest rates rose — from three and a quarter per cent in 1952 to four and three quarter per cent in 1956! — this difficulty disappeared.

The Board's work was further hampered by post-war shortages of reinforcing wire and cement (used for manufacturing pipes). In May and June 1954 pipe production ceased entirely for a period. There were shortages in these years, too, of skilled labour. But despite difficulties and shortages, the Board pushed ahead with the major reconstruction of the sewerage system which was needed.

Swamp to City



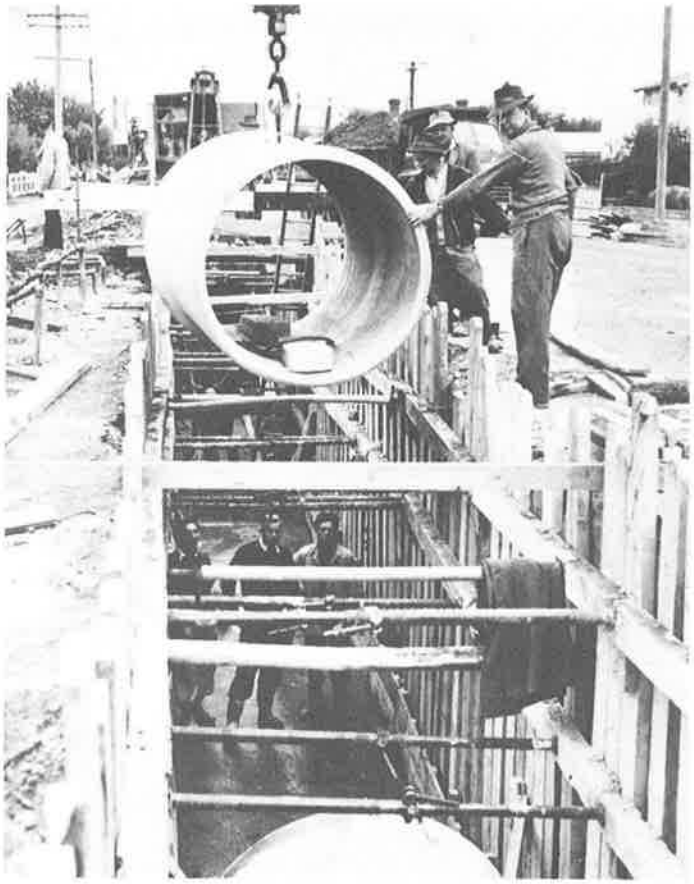
Construction work on the southern relief sewer, 1950, at the corner of Madras and St Asaph Streets.
Drainage Board

New Trunk Sewers

Key elements in the remodelled sewerage system which was planned for Christchurch were southern and northern relief sewers. The first of these new main sewers to be built was the southern relief sewer. Originally planned, in the 1940s, to run along Moorhouse Avenue, the route finally adopted was along St Asaph Street, across South Hagley Park to Deans Avenue and up Blenheim Road as far as the corner of Division Street. Work commenced on this sewer in November 1950 and it was opened four years later in November 1954. From its end an intercepting sewer was built up Division Street to Riccarton Road. This allowed a large area which had previously been served by the Number 24 (Matai Street) pumping station to be diverted by gravity to the main pumping station. The Number 24 pumping station was then able to handle the flow from Fendalton and Riccarton and the prohibition on new connections in the Riccarton area was lifted.

At its eastern end, the southern relief sewer increased the flow into the sewer down Tuam Street from Fitzgerald Avenue to the main pumping station to such an extent that a new sewer was built down St Asaph Street to Mathesons Road.

Before the main northern relief sewer was constructed, temporary relief was afforded the pumping stations of the northern ring of the sewer extensions of the 1920s by the Number 6 rising main diversion. The Number 6 pumping station handled more than half the total sewage of the northern circuit. To increase the capacity of this circuit, the flow from the Number 6 station was diverted in a rising main to the corner of Purchas and Geraldine Streets and then into a gravity sewer which fed into the main sewer in



Work in progress on the new Woodham Road sewer, built t carry the combined flow of the southern and northern relief sewers to the new pumping station on Pages Road.
Drainage Board

Kilmore Street and so on to Tuam Street. This measure was first suggested in 1943. When the Number 6 rising main diversion came into operation in February 1955, the Board was able to lift its prohibition on new connections in the St Albans area.

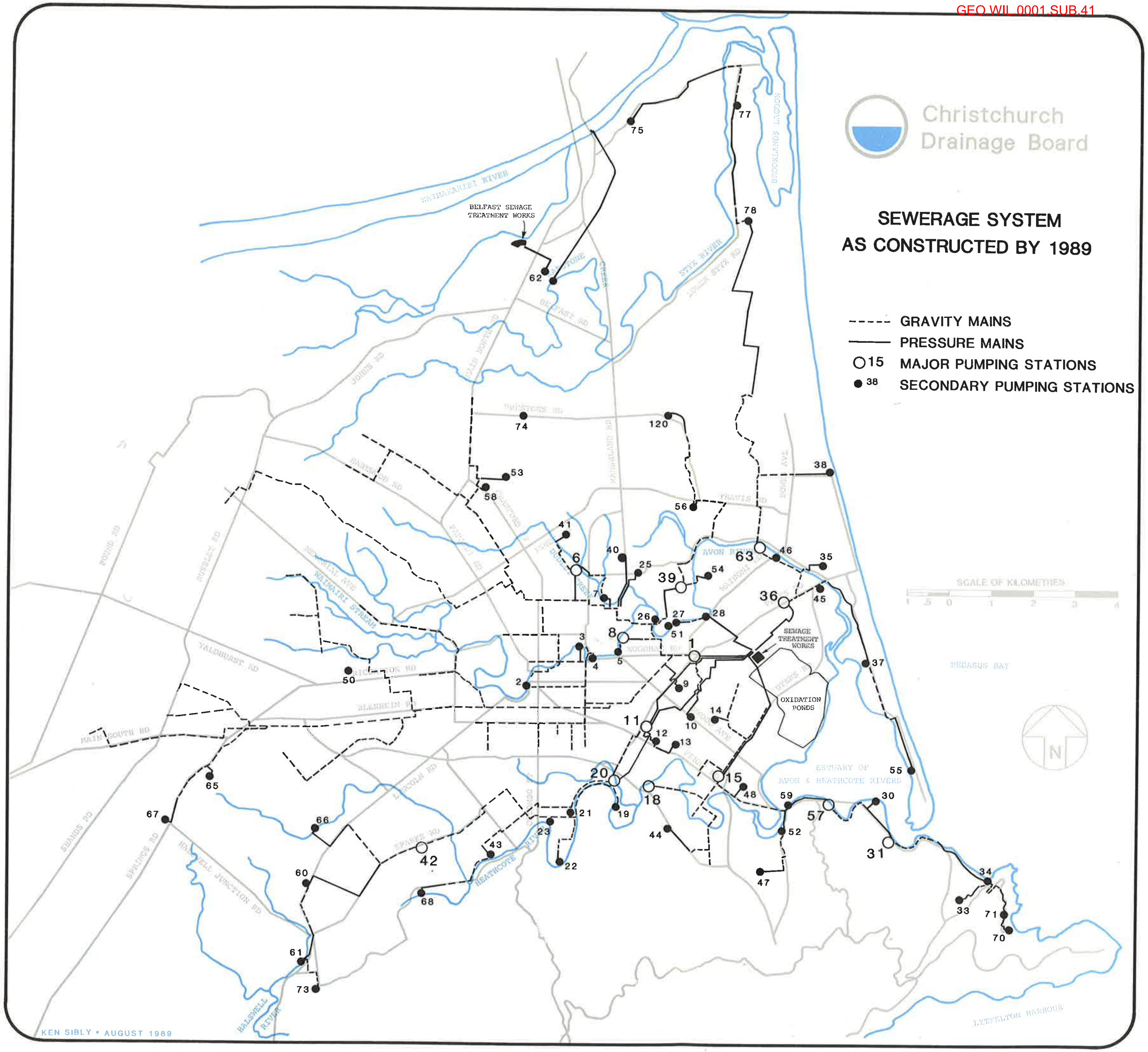
The larger project of building a new northern relief sewer was first envisaged in the 1940s as a Merivale relief sewer running along Bealey Avenue. As planning proceeded, however, the need became apparent for a major intercepting sewer further to the north. The eastern end of this sewer was at the corner of Woodham Road and Gloucester Street. From that point it followed Gloucester Street, Retreat Road, North Parade and Edgeware Road to St Albans Street where it forked, one branch leading to the Rutland Street area and the other pushing on to Wairakei Road. The existing pumping stations on the northern circuit pumped directly into this new sewer, instead of pumping the sewage on to the next station in the chain. Once it was in the northern relief sewer, the sewage flowed by gravity to Woodham Road, instead of being pumped, in some cases four or five times, around the old northern circuit. The tender for the construction of the northern relief sewer was accepted at the end of 1955. The sewer was commissioned in 1958.

A New Main Pumping Station

At the point where the northern relief sewer ended in Woodham Road a major pumping station was going to be needed to pump the sewage on to Bromley. Using modern construction techniques, it was possible to extend the southern relief sewer as a gravity sewer from the Tuam Street pumping station to the same point. With the Tuam Street pumping station working to capacity, the obvious solution was to build a new main pumping station further east to pump to the sewage farm both the sewage which had previously passed through the Tuam Street pumping station (which included

Fold out: *Map number 5. Christchurch's sewerage syste in 1989.*

...s on the new
...d sewer, built to
...ned flow of the
...orthern relief
...w pumping
...s Road.



...mber 5.
...erage system

sewage from the southern relief sewer) and the sewage flowing in the northern relief sewer.

The site chosen for this new Number 1 pumping station was on the corner of Woodham and Pages Roads. Work on the substructure of this new station began in February 1954. The work went as deep as twenty-four feet (7.5 metres) below ground level. It was the first major construction job in New Zealand on which well-point dewatering equipment was used. For the 36 inch (900 millimetre) rising mains from the pumping station to the sewage farm, reinforced concrete pipes, jointed with rubber rings, were used. The pipes were manufactured in Hornby and the mains laid in 1954-55. Six electric pumps were installed in the new station, along with two diesel generator sets to serve as a standby source of power.

When the southern relief sewer was first completed, the sewage it collected flowed down the new St Asaph Street main to the Tuam Street pumping station from where it was pumped down the original cast iron rising mains to Bromley. While the new main pumping station was being built at Pages Road, a new gravity sewer was laid from the Tuam Street pumping station along Worcester Street and Olliviers Road to Woodham Road. From the Woodham Road/Gloucester Street corner, where the northern relief sewer met up with the flow that had previously been pumped at the Tuam Street pumping station, a large concrete conduit was constructed down Woodham Road to the new pumping station. The construction of these new mains meant that the flow from the original sewage district and the flow from the area served by the southern relief sewer all flowed by gravity to the new pumping station, along with the sewage from the northern relief sewer.

The new pumping station on Pages Road came into regular operation in November 1956. Less than a year later, in September 1957, the old pumping station was closed down. This station had pumped all of the city's sewage from

Early stages of construction of the new Pages Road pumping station in 1954.
Drainage Board

1882 until the 1920s and continued to serve the original sewage area for the next thirty years, although its over-all importance in the system was reduced when the sewer extensions of the 1920s provided for sewage from the southern and northern circuits to be pumped directly to Bromley, bypassing the Tuam Street station.

The old pumping station, including the original brick buildings, was used by the Board as a maintenance depot for the next thirty years. In 1987-88 a new maintenance depot was constructed near the treatment works. With this shift of the maintenance depot from Tuam Street, the Board vacated its most historic site, where the city's sewerage system was born.

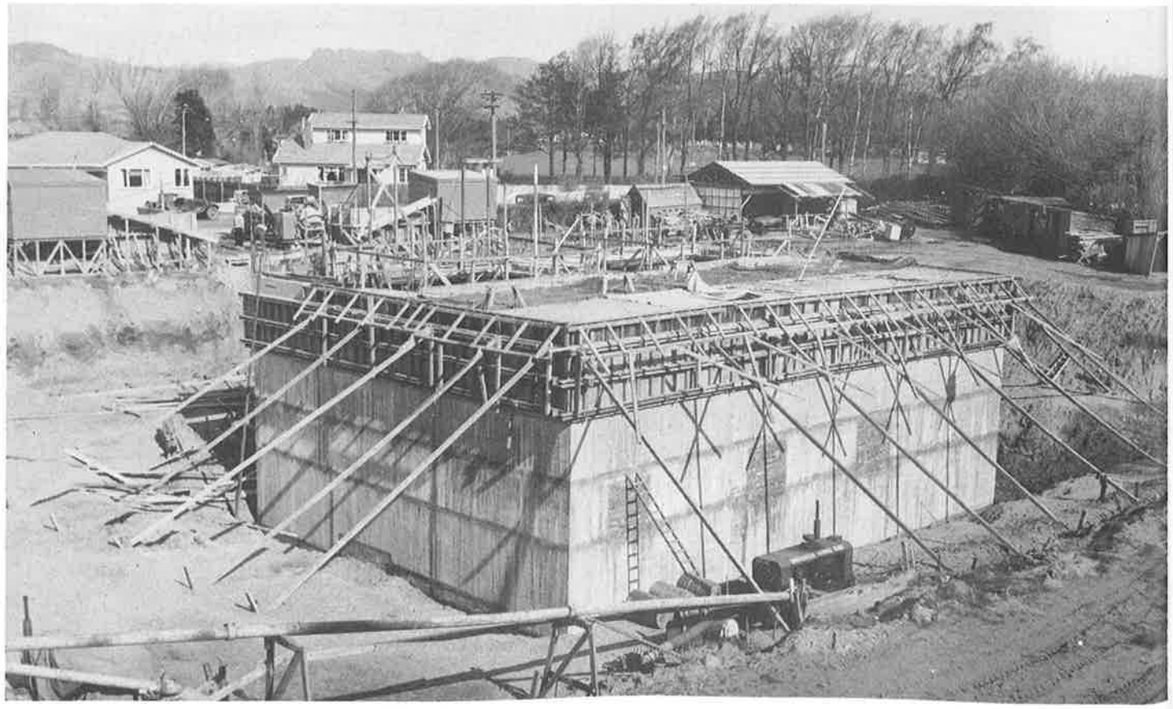
The new pumping station on Pages Road has been pumping the bulk of the city's sewage to first the sewage farm and then the treatment works from the late 1950s until the present. The plant was modified in the 1960s to increase the station's pumping capacity, the storms of April 1968 highlighting the need for additional capacity. In the early 1980s there were mechanical problems with new variable speed pumps installed at the Number 1 pumping station. In 1976-77 there had been problems of a different sort when the automation of the pumping station, with an alarm system installed at the treatment works, provoked industrial unrest. But by and large the thirty-three year history of the Pages Road pumping station has been trouble free.

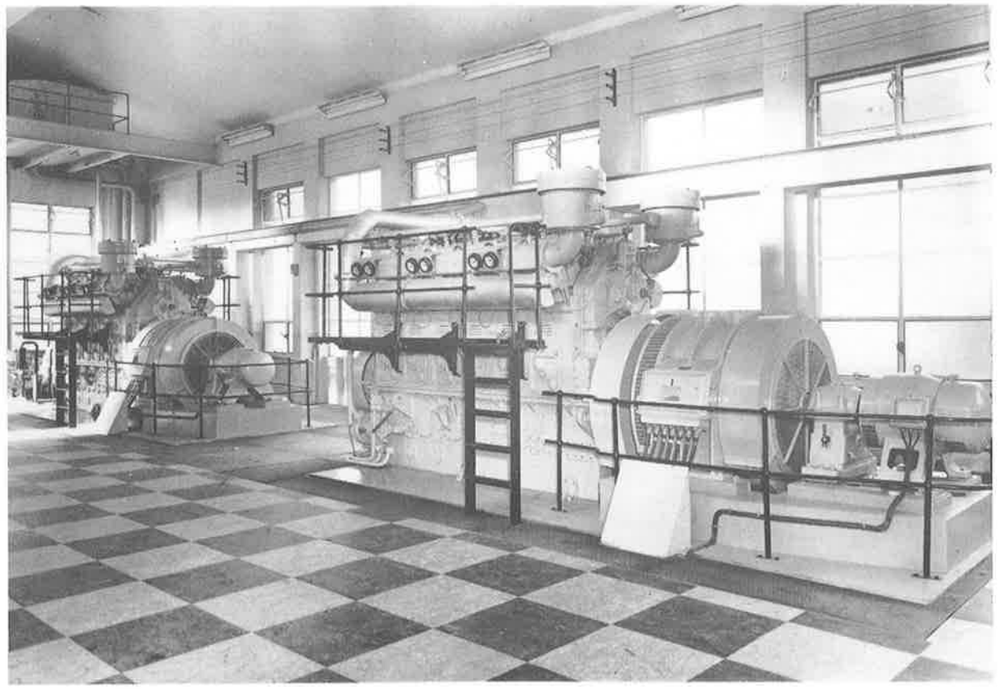
The New Treatment Works

The last major element in Christchurch's reconstructed sewerage system was a new treatment works at Bromley. The system still in use in the 1950s, of treating the sewage in septic tanks (in which the solid material was separated out and partially digested) and then letting the effluent flow out over paddocks to filter through sand before being drained to the Estuary, was by then archaic and could no longer cope with the volume of sewage flowing from Christchurch. When the weather was wet, in particular, the sewage farm became overloaded. Expanding the farm to cope with the city's ultimate expected flow of sewage was not considered economic.

This page, below: *The substructure of the new Pages Road (Number 1) pumping station under construction.* ***Opposite page, top:*** *The newly completed Number 1 pumping station.* ***Opposite page, bottom:*** *The interior of the new Pages Road pumping station soon after it had been completed.*

All photos: Drainage Board





The Board sent its Chief Engineer, E.F. Scott, overseas in 1949 to investigate modern methods of treating sewage. He was away from Christchurch from May to December and in that time studied sewage treatment plants in the United States and Europe with a view to being able to advise the Board on how to handle Christchurch's "rapidly increasing flow of sewage".

It was originally thought that primary treatment of the sewage alone would be sufficient. This involved the removal of grit and then the use of sedimentation tanks from which the sludge could be removed for digestion. But even

before Scott was sent overseas, the Board had decided the sewage should receive both primary and secondary treatment before the effluent was discharged into the Estuary.

On his return, Scott confirmed that this decision was sound. He recommended that the sewage be given primary treatment in sedimentation tanks (for which he thought the existing septic tanks could possibly be used) before being passed on for secondary treatment. He identified two choices for secondary treatment, which dealt with colloidal matter in the sewage and organic impurities in solution which could not be removed by sedimentation. These were the use of activated sludge or passing the sewage through trickling filters. "At this stage" he wrote in the report he prepared at the end of 1949, "I favour a certain form of trickling filter" and this was in fact the form of secondary treatment which the Board eventually adopted.

In addition to the information on methods of sewage treatment which Scott collected overseas, the Board had its staff gather data locally on the flow and quality of the sewage arriving at Bromley and on the condition of the waters of the Estuary into which the final effluent was to be discharged.

Once all the necessary data had been gathered, the Board engaged a San Francisco engineering firm with expertise in the design of sewage treatment works, Brown and Caldwell, first to advise them on the new works, then to design them. Brown and Caldwell first reported to the Board in 1954 and submitted the designs for the first stage of construction in August 1957. The detailed specifications covered 175 pages of single-spaced typescript. Construction began soon afterwards and the new treatment works began operation in March 1962. They were officially opened in October of that year. They had cost £1,330,000.

When the sewage arrived at this new plant it was fed through screens and then into aeration tanks in which the grit was removed. It then passed into primary sedimentation tanks. Once the sludge had settled out of it, the sewage passed on to the trickling filters. In these filters the sewage percolated through a depth of stones and was subject to biological action which purified it. From the trickling filters, the treated sewage passed into secondary sedimentation tanks and then out into the sewage ponds for a last stage of oxidation before being discharged into the Estuary. When the plant first came into operation only three oxidation ponds were in use. The sludge from the primary and secondary sedimentation tanks was pumped to the digesters and was raised in temperature to assist bio-degradation. After digestion, the now stabilised sludge was pumped to the sludge lagoons prior to disposal on land. The process of digestion produces methane which was used by the Board as a fuel.

The start of construction of the new sewage treatment works at Bromley, 1958.
Drainage Board

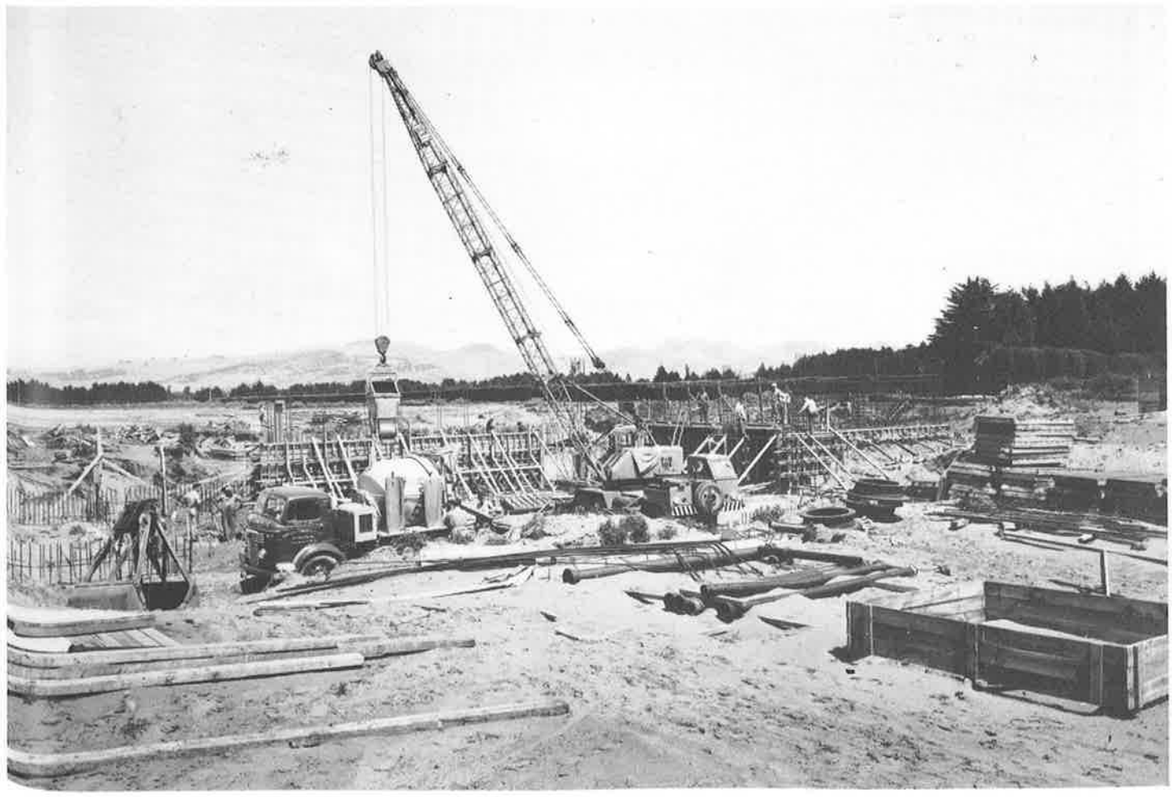
After 1962, the Board's farming operations continued but changed significantly in character. Land was now used not to filter only partially treated sewage but for the disposal of digested sludge. Steers were fattened and hay mown on the land over which the digested sludge was spread. Additional land was acquired by the Board in the late 1960s and early 1970s for the purpose of sludge disposal.

Although the new treatment works were to cause the Board serious headaches in the years after they were opened, they represented a significant advance in the handling of sewage from Christchurch. Had the Board not acted decisively in the 1950s in deciding to build a works which included both primary and secondary treatment processes, quite different problems, far more serious than those of smell, would have undoubtedly emerged in the 1960s and 1970s.

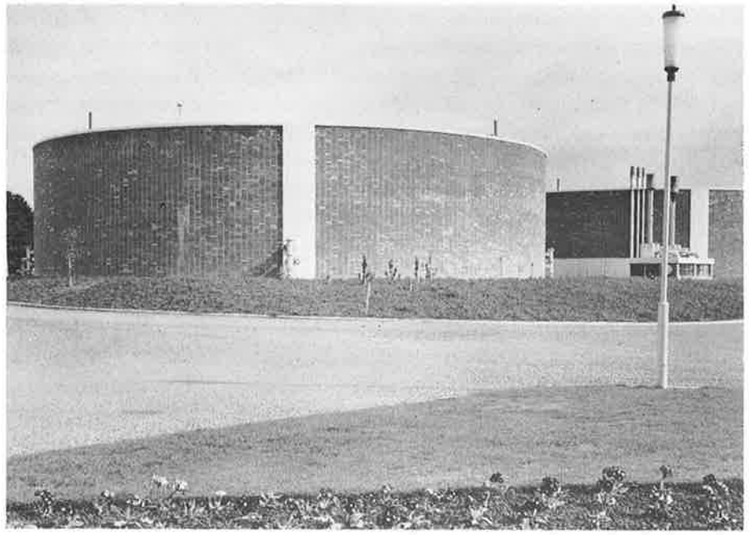
Reticulation

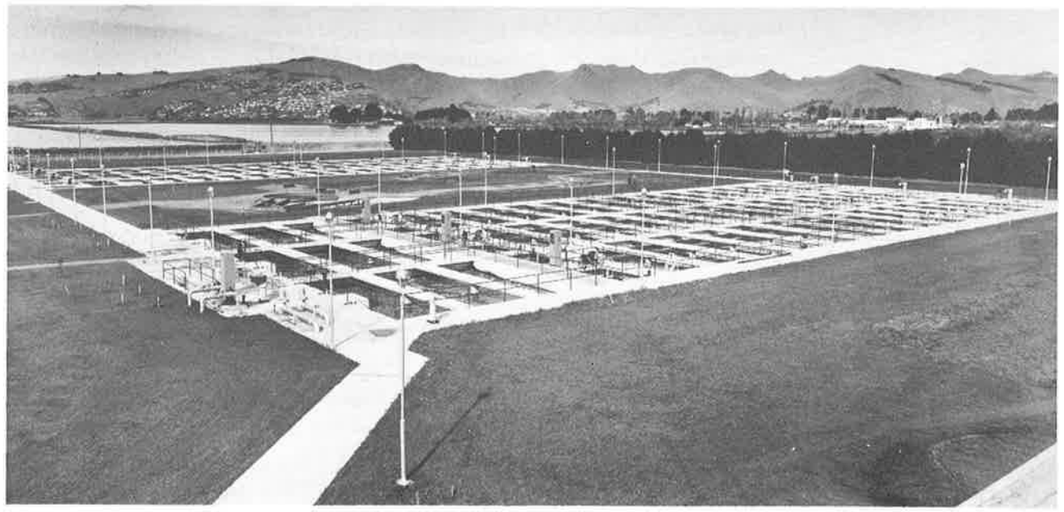
The completion of the southern and northern relief sewers, the commissioning of the new main pumping station and steady progress on the new treatment works in the late 1950s meant that reticulation of areas of Christchurch which lacked sewers could go ahead. Major extensions of reticulation began in the 1950s and continued through the 1960s until by the end of that decade most parts of Christchurch City zoned residential were served by sewers.

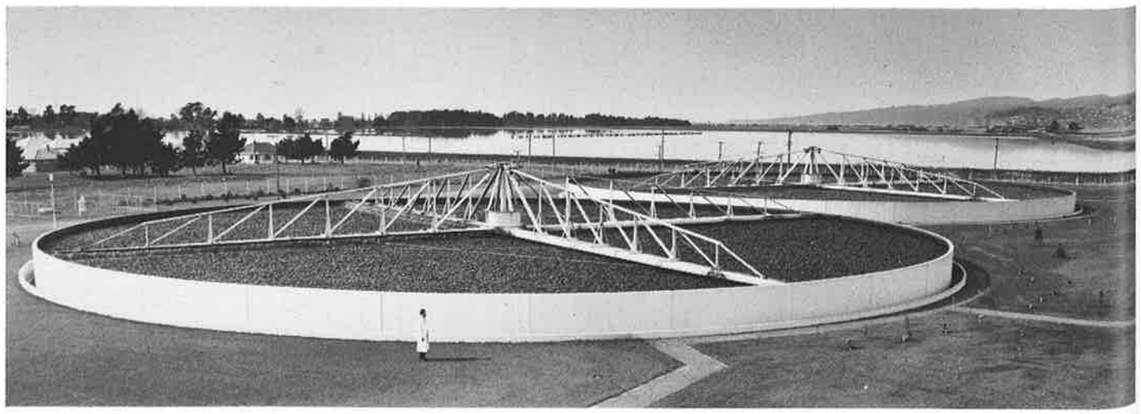
Construction under way of the new treatment works at Bromley in 1958.
Drainage Board



The New Treatment Works

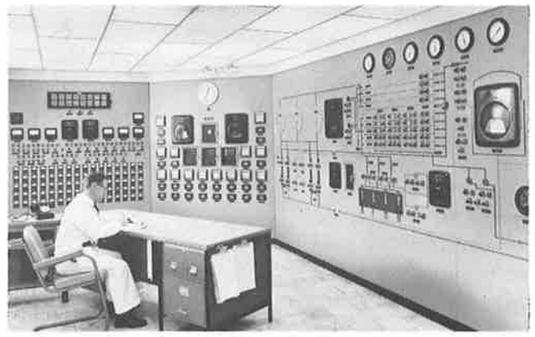


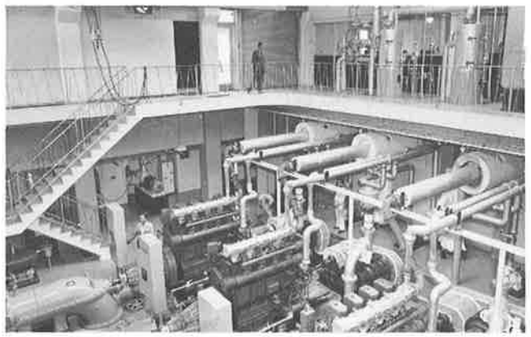


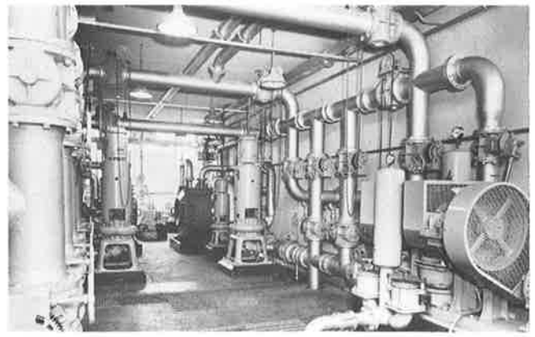


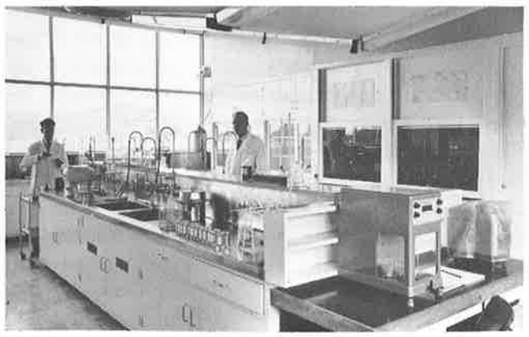
This page, top: *The sludge digesters;* ***middle:*** *the sedimentation tanks;* ***bottom:*** *the trickling filters.* ***Opposite page, top:*** *An aerial view of the new treatment works;* ***bottom, clockwise from top left:*** *the control room; the engine room; the laboratory; the sludge control room.*

All photos: Drainage Board









One major area sewered in the 1950s was New Brighton. The story of New Brighton's sewers goes back to the 1920s. In 1923, New Brighton, then an independent borough, asked to be excluded from a proposed sewerage scheme intended to serve the areas to the east of the sewage farm, but the request was not allowed. The Drainage Board's engineers drew up various schemes for sewering parts or the whole of the borough which included pumping stations, rising mains and gravity sewers. All of the 1930s were spent in fruitless discussions between the Board and the borough about the extent and costs of the various schemes.

When New Brighton amalgamated with Christchurch City in 1941, most of the suburb was still without sewers. It remained the largest area in Christchurch where night soil was still collected. With the war, any actual work on providing New Brighton with sewers had to be put aside, although detailed planning continued. In 1947, a Health Department requisition enabled the Drainage Board to raise a loan to install sewers in New Brighton without taking a poll of ratepayers. Two loans were raised in 1947 and 1954 and by 1959 all of New Brighton was reticulated, except for the South Shore area along Rockinghorse Road. There were three pumping stations, Numbers 35, 37 and 38, and also a major station in Pages Road, Number 36, between Number 35 and the sewage farm, which both boosted the flow from New Brighton and served Aranui and Wainoni. The South Shore area was sewered, with another pumping station on Rockinghorse Road, in the 1960s.

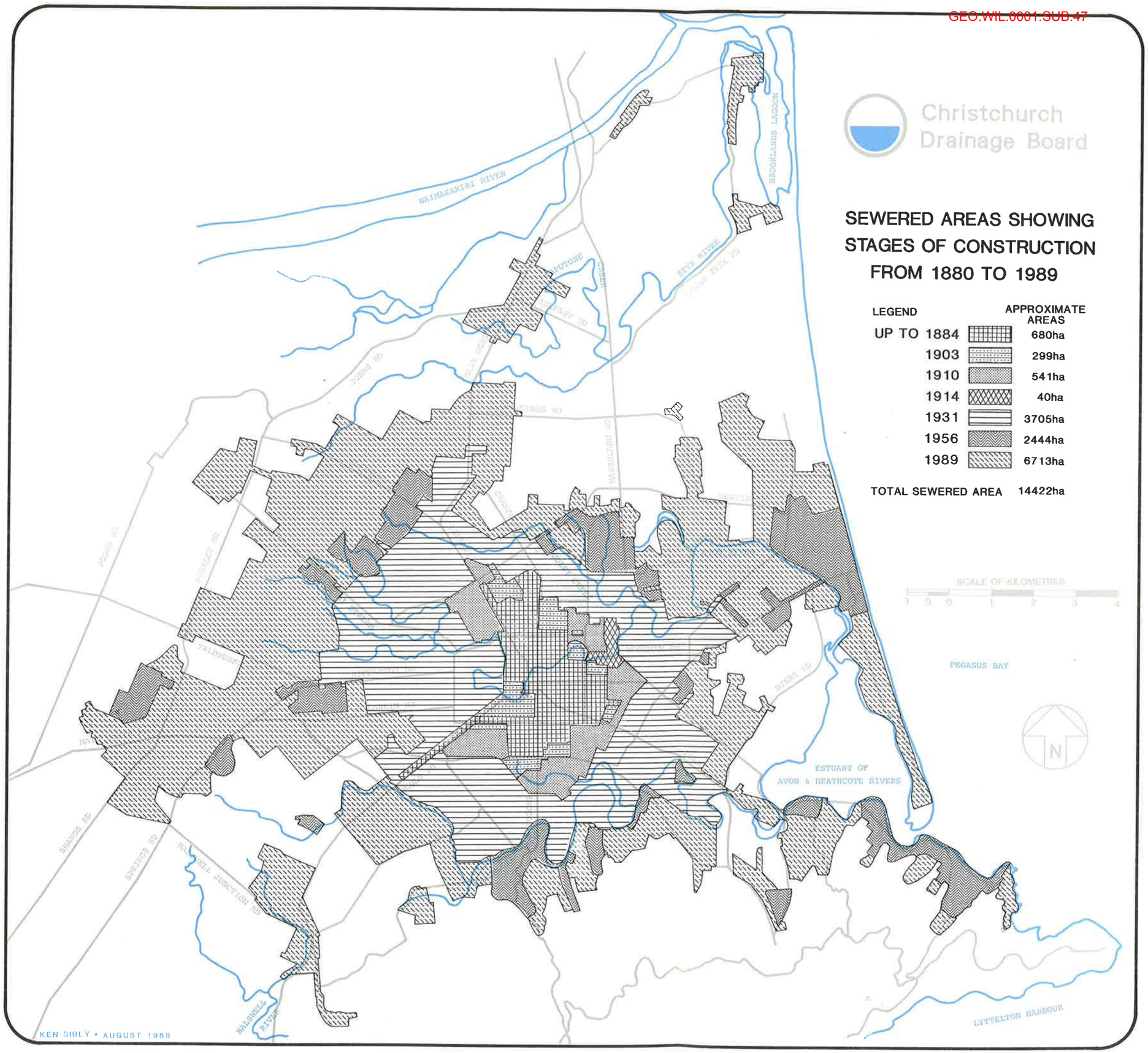
While work was proceeding on the sewering of New Brighton, sewers were also extended in Bowenvale, Huntsbury and St Martins. Much of this work was paid for out of ordinary rate revenue. But for more major extensions in such widely separated parts of the city as Northcote, Hoon Hay, Bexley, Avondale, Blenheim Road, Lower Sockburn, Yaldhurst, Windsor, the Heathcote Valley, Avonhead, Burwood, Harewood, Wainoni, Hornby, Islington, Scarborough, and Clifton, large loans were raised in the 1960s specifically for reticulation work. In some of these areas, among them Hoon Hay, extensive development had gone ahead before permanent sewers had been laid. The Riccarton interceptor sewer was extended through the University to serve Avonhead. The extension of sewers also involved the construction of a large number of new pumping stations. By early 1967 there were 54 permanent and two temporary pumping stations in the Board's system. Between 1952 and 1962 the number of connections to the Board's system rose by 19,777 to 57,248. By 1966 the total was 69,360. In that year only South Shore, Burwood and Clifton were without sewers.

Through these years of extension of the Board's sewers, its inspection and other staff was kept extremely busy. These were years when Christchurch was growing rapidly and between two and four thousand new connections were being made each year. All subdivision plans had to be scrutinised for sewer and stormwater provisions. The workload increased as the easily subdividable land was used up and more difficult, isolated blocks were proposed for subdivision. The Board's staff had also to plan and supervise sewerage and stormwater construction in subdivisions, check filling levels and issue permits for plumbing and drainage work. PVC plumbing made its appearance in the 1960s and the Board's staff prepared a paper on installation procedures for the new fittings which was in wide demand throughout New Zealand.

The Board also faced the problem in the 1960s of renewing the ageing sewers of the central business district. The existing services in this area dated back to the original scheme of the late 1870s and early 1880s. The construction of high-rise buildings would, it was feared, "increase sewer flows to an embarrassing degree". A new trunk sewer was laid in Hereford Street east from the bridge at Oxford Terrace to Fitzgerald Avenue and then on to the southern relief sewer in Worcester Street. This work had to be co-ordinated with major street works.

GEO.CLA.0001.SUB

Fold out: *Map number 6. Sewered areas of the city, 1880–1989.*



number 6.
the city, 1880-

Right: *A Drainage Board gang constructing a street sewer. The date of the photograph is uncertain, but is probably some time in the 1950s or early 1960s.* ***Below:*** *The central area relief sewer under construction along Hereford Street, 1966.*
Both photos: Drainage Board

Although most of the major works of the city's new sewerage system had been completed by the early 1960s, the decade remained a very busy one for the Board and its staff as the reticulation which these major works made possible was pushed ahead. By the end of the decade, Christchurch had an efficient and comprehensive sewerage system, with one troubling exception — problems at the treatment works.

Sewer reticulation, Avoca Valley.
Drainage Board

Sewer reticulation, Maces Road, 1969.
Drainage Board

Chapter 9

Problems at the Works

The first Chairman of the Christchurch Drainage Board, Frederick Hobbs, wrote to *The Press* in 1877 that "the Board's first duty is to remove away from the habitations and haunts of man that which is injurious and prejudicial to his health, and the second when they have got it away, to create as little nuisance as they possibly can with it". For a time in the 1960s and 1970s the Board failed to fulfil the second of these duties satisfactorily, at least as far as the residents of the suburbs close to the new treatment works were concerned.

The Board's Chief Engineer, E.F. Scott, had warned on his return from overseas in 1949 that modern sewage works could "handle sewage only up to their designed load. Their efficiency drops very seriously on overloading." The treatment works at Bromley came into operation in 1962. Before the decade was out problems with the running of the works had arisen. The original sequence of treatment was followed only until 1969 when modifications were introduced and extensions to the works began. Five or six years after their inauguration, the works were already treating loads higher than those intended for the first stage. The projected completion of the Woolston trade waste system (see a following chapter) promised to increase the load on the works even more. The year 1969 saw the beginning of several years of changes at the works which were not completed until the mid 1980s.

What made changes at the works imperative was that they began generating foul odours, the notorious "Aranui smell". The first complaints of smells from the works were registered within a year or two of the works starting up. In 1964, the residents of Shortland Street instructed their solicitors to write to the Board "regarding the noticeably strong stench coming from the Board's new plant in the Aranui area". The neighbours of the plant complained of a "smell which is in the nature of a public nuisance".

The Board set its staff to work investigating the sources of the odours. To some critics of the Board, the Board seemed more concerned to demonstrate that the odours were not offensive, or not coming from the works, than to take corrective action. By the summer of 1968 "a gap between the community and the Drainage Board" had opened up. The Board suggested the gorging of local sewers or the decay of sea lettuce in the Estuary could be to blame, not the new treatment works.

The Board did undertake exhaustive investigations. Records of smell complaints were kept and an olfactometer bought. The residents of Aranui cooperated with the Board in tests using this equipment. Air collected from the trickling filters and from above the Estuary was analysed by gas chromatography, in work later judged highly competent by an American expert.

In 1968-69 the Board began to increase the capacity of the treatment works.

The changes were designed by the Board's own sewer design department, acting on the advice of local consultants, Steven and Fitzmaurice. This work included the construction of two more pre-aeration tanks and four more primary sedimentation tanks. Changes were made to the oxidation ponds so that three ponds could all be used as primary ponds. The new Number 1 pond came into use in September 1970 and most of the rest of the structural work for the changes was completed by Christmas of that year, but it was not until November 1971 that the new primary sedimentation tanks and new pre-aeration and grit removal system came into operation.

In the meantime, acting on the advice of the Department of Health about ways in which the odours from the works might be brought under control, the Board engaged a contractor to design and install facilities to recirculate the secondary effluent, free of secondary sludge. Unfortunately, the fibre-glass pipes, reinforced with plastic, which the contractor chose for installation in the secondary sedimentation tanks collapsed very soon after they were commissioned.

The failure of this measure led to the Board adopting another tack to try to minimise odours from the works. Acting again on the advice of the Department of Health, the Board in December 1971 altered the flow of sewage through the works. After primary sedimentation, most of the flow (about two-thirds) was sent directly to the oxidation ponds, bypassing the trickling filters and secondary sedimentation tanks. This meant that the

The Board's Centenary

In the mid 1970s, the Christchurch Drainage Board was the victim of one of history's ironies. Just as it became embroiled in one of the most troublesome episodes in its history — an adverse public reaction to the operation of the new treatment works of which it was so proud — it reached its hundredth birthday. The Board had significant achievements to celebrate on that occasion, but celebration seemed to some out of place at a time when the Board was being criticised by many of the ratepayers whose interests it was meant to be serving.

But the completion of one hundred years since the original Christchurch District Drainage Act had been passed was too important an occasion to ignore. The centennial medal was duly struck, despite the suggestion of one Board member that not many people would want to wear such a medal while the problem of odours at the treatment works remained unsolved. The Board also held a number of functions to mark its centenary and funds were raised for the Laura Fergusson Trust as a gesture by the Board and its staff to the community it had been serving for a full hundred years.

The Christchurch Drainage Board in the Board's centennial year, 1975. Seated, left to right: P.W. Anderson, R.A. Bamford, H.C. Blazey, N. Dodge, E.A. Graham, I.G.B. Wilson, T.B. Whelan, C.H. Russell, H.W. Thompson, J. Ryan, R.S. Leach, J. de C. Hanafin, A.F.P. Cooper, A.J. Donaldson. Standing, left to right: P.J. McWilliam (Chief Engineer), M.J. Horne (Secretary), M.R. Carter (Chairman), J.N. Rose (Assistant Secretary), D.E. Rowe (Treasurer), P.A. Baldwin (Accountant). Drainage Board

The sewage treatment works in 1973, in the middle of the period when the Board was dealing with the worst odour problems. Drainage Board

oxidation load at the works was being shared between the filters and the ponds. It was hoped that reducing the load on the filters would also reduce the odours, as the filters had been identified as a source of odours. Two years later, in 1973, all six ponds were brought into use.

These changes in the operation of the works in 1971 did reduce the smells arising from the trickling filters, but increasing the load on the oxidation ponds increased the risk of odours from the ponds. Complaints about smells continued through 1971 and 1972, but it was not until 1973, following the filling of Number 3 pond in March, that the real potential for trouble from the ponds was realised. The year was a low point in the history of the Board. "May" declared *The Press*, reporting the number of complaints in that month, "was not a merry month for the Christchurch Drainage Board". "Public confidence in the Drainage Board" said *The Star* in June "is at a low ebb over the Aranui smell". There was talk of "putrid, stinking smells" of a "sulphurous stench" and of the "long and odorous history" of the Bromley plant. The Board at about this time was considering issuing a centennial medallion. "No-one" declared a Board member at one meeting "would want to be rushing about with a Drainage Board medal on his lapel — especially in the Aranui area".

This was one occasion on which politics divided the Drainage Board. Labour members of the Board called a special meeting in June 1973 and castigated the body to which they belonged for failing to admit the problem quickly and take vigorous action to cure it. The issue also became political when other members of the Board followed a suggestion made by *The Press* and badgered the Labour Government to honour a promise to provide money for adequate sewage treatment works.

The middle of 1973 was the worst period for the Board as it grappled with the problem of odours at the works. At one point, in desperation, told by its Chief Engineer that the ponds were "in a very bad state", the Board put

a jet boat out on the ponds in an attempt to oxygenate the water, but all the jetboat did was stir up sludge from the bottom.

Although odours at Bromley were to remain a headache for the Drainage Board for some years afterwards, this low period was soon behind it. In August 1973 *The Star* headed an editorial "Action At Last At Bromley" in which the paper said the Drainage Board deserved a pat on the back for the sense of urgency with which it was tackling the problems at the treatment works. The Board had in fact acted a year earlier. The failure of the pipes installed in the secondary sedimentation tanks and then of relieving the filters of much of their load to bring the odours under control prompted the Board, in 1972, to engage the firm which had designed the works, Brown and Caldwell of San Francisco, to investigate the causes of the odours and to suggest remedial measures.

The report on odours from Brown and Caldwell was presented to the Board in May 1973. Declaring that "the problem is both scientific and social", the report identified the main causes of the odours as the condition of the wastes when they reached the works (the prolonged transit times meaning some sewage arrived in a putrefying, septic condition), turbulence in some of the treatment units and excessive loadings on the biological treatment processes at the works. The report's key recommendation was to increase oxidation capacity at the works in order to reduce the loads on the sewage ponds. The best way to do this, the report recommended, was to replace the existing rock media trickling filters with plastic media trickling filters and then alter the oxidation pond sequence.

In a trickling filter, sewage from which some of the sludge has been removed percolates through material on the surfaces of which a bacterial slime has formed. The bacteria in this slime interact with the sewage, in the presence of oxygen, purifying it. In the rock media trickling filters first built at Bromley, the material through which the sewage percolated was a considerable depth of stones. In the plastic media trickling filters with which the consultants proposed to replace the original filters, the material through which the sewage percolates is specially moulded plastic sheeting. This sheeting presents a much greater area on which the purifying slime can form. Plastic media filters can oxidise a much greater amount of sewage than rock filters.

Promptly, in June, the Board voted to adopt the report's basic recommendations. By August, the Board's local consultants Steven and Fitzmaurice had reported on the proposed works and the costs likely to be incurred. The Board then resolved that it would proceed at once with the construction of the plastic media filters. The beginning of work was delayed by negotiations with the Department of Health and the Ministry of Works, which delayed in turn approval from the Local Authorities Loans Board of the loan needed for the work. Steven and Fitzmaurice drew up plans for the two new tower filters and for a new digester and as soon as approval for the necessary loans had been given, the work began.

The first of the new filters was meant to be completed by October 1975, but the Board encountered further delays when the Government insisted on New Zealand manufacture of the plastic sheeting from which the plastic media were to be made. It was not until December 1975 that the first stone filter was taken out of commission so that construction could start on the new filter tower. The Board had an anxious time in the winter of 1976 when, with only one trickling filter in operation, it faced the possibility of having to discharge untreated sewage into the Estuary, but the crisis passed without the emergency bypass having to be used.

The first of the new plastic media trickling filters was commissioned on the last day of 1976. In 1977 problems of "nuisance odours" from the works recurred. But in January 1978 the second of the plastic media trickling filters

Looking from the top of one of the covered trickling filters across to the oxidation ponds. The second covered trickling filter is to the left. The ribs in the foreground are at the top of the fibreglass cover of the filter.
Ash Spice

was commissioned and with the load on the ponds much reduced, the worst of the odour problems at Bromley were behind the Board. The reduction in odour levels had a marked effect on the morale of the staff at the treatment works.

Nevertheless, in 1979 the Board noted that there were "regrettably still occasions when nuisance level odours could be detected". The main source of these odours was the new tower filters, though apart from the occasional emission of odours they were functioning well. There were no problems with the digesters or the ponds. To solve the residual problem, a temporary cover was erected over the Number 2 trickling filter in 1983 for pilot studies in the reduction of odours. Experiments were done using both a wet oxidation process and a biofilter to remove odours from the air extracted from above the filter. The Number 1 trickling filter was given its permanent cover, a dome of plastic reinforced with fibreglass, in September 1986. "Some members of the Board were so pleased that they welcomed this long awaited event by climbing up the filter tower and toasting the occasion with champagne." Subsequently, the Number 2 trickling filter was also covered. The air captured from above the trickling filters is deodorised using soil filters before being released into the atmosphere. With the covering of the new tower filters, the long-standing problem of odours emanating from the Bromley treatment works was to all intents and purposes solved, more than twenty years after the first complaints had been recorded.

Flooding in the 1920s

Fold out: *Map number 7. Christchurch's stormwater drainage system in 1989.*

Left: *The junction of Innes Road and Rutland Street, flooded in both 1925 and 1928.* ***Below:*** *Extensive surface flooding on Barrington Street, looking south from Howard Street, in 1925.*

Both photos: Canterbury Museum

Christchurch Drainage Board

STORMWATER DRAINAGE SYSTEM 1989

RIVERS,STREAMS & OPEN DRAINS

PIPELINES - 450mm DIAMETER & LARGER

MAJOR PUMPING STATIONS

SCALE OF KILOMETRES

1 .5 0 1 2 3 4

N

KEN SIBLY

Chapter 10

Storms and Flood Relief

Through the 1950s and most of the 1960s, the Christchurch Drainage Board was preoccupied with ensuring that the growing city was adequately provided with sanitary sewers. In these years when the city's sewerage system was being rapidly expanded and improved, work on stormwater drainage, the second of the Board's major responsibilities, fell into arrears. The Board itself was conscious of the need to continue work on improving the city's stormwater drainage system, but through these years the Government, acting through the Local Authorities Loans Board which had to approve all major local body loans, curbed work on stormwater drains in favour of new sewerage works.

It was fortunate for the Board that in these years when it was heavily committed to a major sewerage programme, there were no major floods in Christchurch and therefore no strong public demand for improvements to the stormwater drainage system. Such a demand, when the Board's resources were stretched keeping up with its sewerage programme, would have been embarrassing. But between 1945 and 1963 there was no serious flooding in the city.

Even so, in the 1950s and 1960s, the Board did not entirely ignore the need to provide Christchurch with an adequate stormwater drainage system, as well as good sewers. Stormwater works had been continued through the 1940s with improvements to the Wilderness and Riccarton Main Drains and the St Albans Creek, the laying of stormwater sewers in the Riccarton and Opawa areas and

Open and piped drains. ***Left:*** *The Wilderness Drain, Cobham Street, in 1948.* ***Right:*** *A Southern Motorway stormwater culvert under construction in 1971-72.*
Both photos: Drainage Board

Floods of 1945

Above: *Street flooding in Shirley.* ***Below:*** *Flood water lying on Colombo Street in Beckenham.*
Both photos: Drainage Board

the extension of the Durham Street stormwater sewer from Moorhouse Avenue to Carlyle Street. In 1949-50 the diversion of the Avon at Kerrs Reach was completed in order to eliminate a "throttle" against the discharge of flood waters.

In the 1950s, after the Board's district had been extended, considerable work was done on the Heathcote and Styx Rivers. Reaches of both these rivers were widened and deepened. Work continued into the 1960s on minor stormwater works in different parts of the city. As rural land in Waimairi County became urban, for example, many open drains were piped. But in the 1950s and 1960s, although some work went ahead, stormwater relief took a decidedly second place to sewerage work.

The Board's run of good fortune with the weather came to an end in December 1963. In that month there were rainstorms which caused serious flooding, especially near the Port Hills and in Waltham. The cause of the flooding was identified as an inability of the existing stormwater drains to get water to the rivers. There were further floods in March and August of 1965 and in January and November of 1966. In the November 1966 flood, the Dudley Creek overflowed, highlighting the need for major work in that catchment which the Board was soon to put in hand.

Storms in April, May and June of 1968 put the Board on final notice that it would have to turn its attention to stormwater relief. The storms "highlighted the inadequacies in many sections of the drainage system and stressed the need for major relief works". The Easter (Wahine) storm was particularly severe. The high winds brought down branches which blocked drains, making street flooding worse. The areas most severely affected were Sumner, Waltham and the suburbs adjacent to the Heathcote River.

Even before the storms of 1968 struck, the emphasis of the Board's work had begun to swing towards neglected stormwater relief. In 1968, for example, the Wairoa Street stormwater pumping station was commissioned on 28 May. There was heavy rain that very night and the station's operation prevented the serious flooding which had occurred in Bexley just a month earlier, in the April (Wahine) storm. By the time of the storms of the late 1960s, investigations and planning were already well advanced for other flood relief work, in the Sumner area, the Cavendish-Claridges area and the Brittans Drain catchment, for example. In 1965, the Board had applied to the Local Authorities Loans Board for a loan of £450,000 to proceed with stormwater works, but been allowed only £250,000 for works of the greatest priority. So the Board was not alone to blame for the inadequacies in the stormwater drainage system exposed by the storms of the late 1960s.

The storms did, however, prompt the Board to resolve formally, in June 1968, that it would change the emphasis of its works programme from sewers only and spend at least the same amounts of loan money on stormwater as

The timbering of open drains. Two views on Shirley Road in the late 1940s, left, before and right, after the timbering of a roadside drain.
Both photos: Drainage Board

The Floods of 1968

Above: *Fending off floodwaters from the lobby of a Spreydon cinema.* ***Below:*** *Canoeing on Rowcliffe Street.*
Both photos: Drainage Board

Above: *Boating on Colenso Street, Sumner.*
Below: *The Heathcote River flowing over Aynsley Terrace. The van is parked on the roadway.*
Both photos: Drainage Board

on sewer works. For the 1968-69 year, the Board allowed for contracts for land drainage to the value of $614,698, the highest commitment the Board had ever made to new stormwater drainage works in any one year. In October 1969 the Board adopted an over-all plan for stormwater drainage in its district and drew up a priority list of works.

The Board's decision in the late 1960s to change the emphasis of its work from sewers to stormwater drains and flood relief found expression in major works completed in the 1970s and 1980s. The largest of these was the Woolston Cut on the Heathcote River. From 1969 on the Board sought and was granted approval for major loans for drainage works. When a Government freeze on loan finance in the mid 1970s further reduced the amount of money available for drainage works (at a time when the extensions at the treatment works were imposing a severe drain on the Board's finances), the Board devoted some rate revenue to stormwater works to ensure that progress was not checked on important projects designed to relieve areas of the city of the threat of flooding.

In 1972-73, contracts let for drainage and flood relief works totalled $1,270,300, a sum which was almost double the previous highest amount for contracts for similar works in any single year. By 1980, the Board could note, with some satisfaction, that progress on land drainage and flood relief works meant that a considerable backlog had been almost overcome. The backlog, the Board observed, had built up during the Great Depression, World War II and the years up to the late 1960s, when loan approvals for stormwater works were denied or delayed by the Local Authorities Loans Board, obliging the Drainage Board to concentrate on trunk sewers, sewage treatment and sewer reticulation "in the more urgent interests of the health and well-being of the community". The backlog of stormwater drainage work had been largely overcome by about 1980, but well into the 1980s, the Board's planning and construction work continued to concentrate on flood relief and drainage works.

Storms in the 1970s and 1980s exposed further limitations in the city's stormwater drainage system, especially when ground water levels were high. "Torrential Rain in City" read a headline in April 1974. The papers ran pictures of residents being evacuated from their homes by boat. Storms in June, August and November of 1975 overtaxed some rivers and drains, notably the Wilderness Drain, the Heathcote River and the Dudley Creek. Flooding occurred in 1976, 1977, 1978 and 1979. This last year, the Board noted, was the sixth year in succession of high rainfall. The new decade opened inauspiciously with widespread flooding in Christchurch in January and though the rest of the 1980s were to be less plagued by floods, rain in July 1986 led to flooding from the upper Dudley Creek which demonstrated that the lower Dudley Creek diversion, by that time completed, was not enough to protect fully the area centred on Flockton Street.

Several major flood relief works of the 1970s and 1980s deserve individual notice. When William Clark prepared his report on the drainage of Christchurch in 1878, he noted Waltham as a problem area where water was often lying stagnant on the surface. The Waltham Area relief scheme was under construction by the end of the 1960s. The major work was the laying of a 72 inch (1800 millimetre) diameter pipe up Mowbray Street to Waltham Road. The work was difficult because of the high traffic density and existing services in the area, but the relief, once these difficulties had been overcome, was immediate. In the Board's 1971 annual report it was noted that the pipes just laid in the Waltham area had "already handled what would have previously been flood conditions".

In North New Brighton, an outfall to the sea from Inwoods Road, to allow residential development of the area to proceed, was completed by 1973. The initial demand, and then finance, for this outfall came from the area's residents and from the developers who were subdividing the land. Still on

Flooding in 1975

Above: *Children forging their way to school through floodwaters.* ***Left:*** *An Aylesford Street family contemplating their flooded garden.*
Both photos: Drainage Board

Waltham has been a problem area for flooding since Christchurch was first established. Flooding, left in 1942 and right in 1963, in the area.
Drainage Board

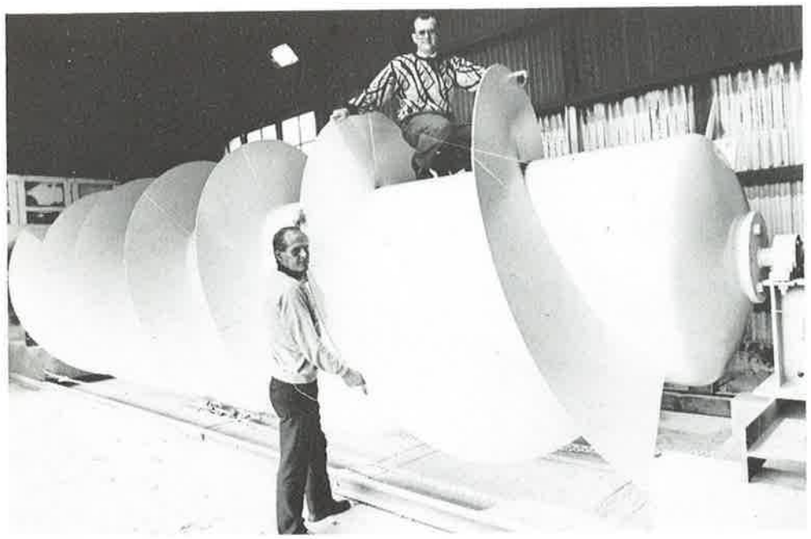
the shore, to the south, the Sumner Relief scheme was begun in 1972. The work included laying 5,000 feet (1,500 metres) of 84 inch (2100 millimetre) concrete pipe. This was the largest pipe laid in Christchurch up to that time. The work was completed in time to be tested by the April 1974 storm. After that storm, a member of the Sumner Residents Association was quoted as saying "I'm taking my hat off to the Drainage Board ... without that seven foot culvert ... you could have put Sumner at the top of your flooded list".

Planning of the Dudley Creek diversion began in 1959, when public feeling about flooding in St Albans was running high. The first properties were purchased and easements negotiated in the early 1960s, but the contractors did not actually start work on the diversion until February 1977. The scheme included the installation of Archimedean screw pumps in a pumping station in Horseshoe Lake near the Avon. The scheme came into operation in June 1979. In a storm in the following August, Flockton Street was still flooded but less seriously. Later in that year, in August, a further diversion, in the Philpotts Road area, was adopted in principle. This Upper Dudley Creek Diversion was completed in 1989 and to a large extent removed the Dudley Creek catchment from the Board's list of problem areas.

Other areas in which there have been major flood relief works completed in the last twenty years include the central business district, the area served by Horners Drain, the Claridges-Cavendish area in the Styx River catchment, the Barrington Street area drained by the Wilderness Drain and the catchments of the St Albans and Upper Frees Creeks. Work was also done on the South Canal Reserve Drain and the main city outfall to the Estuary at the bottom of Linwood Avenue.

But the largest, most important single work of these two decades was the Woolston Cut, which was to bypass a winding section of the lower Heathcote River. The Cut, it soon became evident, was an essential part of a range of works proposed to solve most of the flooding problems along the Heathcote. The Cut was first seriously talked about in the 1960s. In that decade, the Drainage Board had the Hydraulic Research Station at Wallingford in England construct a model of the Estuary to test the effects, and likely efficacy, of various works the Board was considering. These works included a barrage at the mouth of the Estuary, which never eventuated, and the Woolston Cut.

The model was used to reproduce the proposed cut, which was to reduce the length of the river by one and three quarter miles (two and three quarter kilometres) and increase the river's capacity to carry large volumes of flood water. The tests at Wallingford confirmed the Board's previous calculations of the amount by which flood levels would be reduced if the cut was constructed. In 1967, Wallingford advised the Board that it would recommend construction of the cut in its final report and at that time the Christchurch City Council agreed to show it as a proposed work on its new District Planning Scheme. The first properties needed for the cut were purchased in the mid



Left: *In the large land drainage pumping stations of Christchurch's stormwater drainage system Archimedes screw pumps are used to move large volumes of water. This Archimedes screw was manufactured in Christchurch in 1989 for the Winters Road pumping station.* Christchurch Press

1960s and in 1969 the Board began discussions with the City Council about road and bridge requirements in the area.

In 1972 Marine Department approval for the cut was granted, although the following year the Nature Conservation Council expressed concern about its possible effects. In July 1977, the Board set a target date for completion of the cut of "towards the end of 1983", but this target received a setback when the Ministry of Works and Development (responsible for advising the Local Authorities Loans Board) demanded that the Board show the cut was desirable for flood relief and drainage improvement. To satisfy this requirement, the Board instituted a major investigation of the Heathcote Catchment, the first stage of which was completed by the end of 1981. This investigation confirmed the Board's earlier assessment that the Woolston Cut was a key element in the works proposed to reduce flooding along the Heathcote. With this investigation complete, approval for the loans needed for the work was at last forthcoming and the first preliminary contracts for the work (the diversion of services and construction of the Rutherford Street bridge) were let in 1982-83.

After being so long in the planning, the project received one final setback when the actual construction was almost complete. A storm in March 1986, one week before the river was to be directed through the new channel, led to a breach in the upstream coffer dam and damage to the nearly completed works. The river was not finally diverted through the cut until 23 April 1986. Although some complementary works in other parts of the catchment had still to be carried out, the days when the Heathcote River overflowed and flooded houses further upstream were, the Board hoped, over. The opening of the Woolston Cut marked the end of a major chapter in the Board's works, when it devoted considerable resources to major works that promised an end to flooding in areas where Christchurch's swampy origins were still apparent well into the second century of the city's life.

The extent of the city's system of stormwater drainage in 1989, after the completion of these major works of the 1970s and 1980s, is shown on map number 7.

Opposite: *The start of the Woolston Cut. The Cut flows to the left with the Rutherford Street bridge visible in the distance. The channel to the right leads to the original winding course of the Heathcote River.* Ash Spice

Catchment Studies

Opposite page, bottom: *Flooding at the head of the Heathcote River catchment in 1951.* Drainage Board

Just as the sewerage extensions of the 1950s and 1960s required the Board's staff to gather more accurate and sophisticated data to ensure that planning and construction of new sewers was soundly based, so the stormwater and flood relief works of the 1970s and 1980s required the Board's staff to study the catchments of the various rivers which provide the city's main stormwater outfalls.

The first stage of the Heathcote River Catchment Study was undertaken in the 1960s and 1970s primarily in order to justify construction of the Woolston Cut. Stage 1 of the study was completed in 1981; Stage 2 was taken up to provide options for managing the whole catchment. A conflict of interest between people living in the upper and middle parts of the catchment complicated the study and the matter was still being debated in the mid 1980s. The Board received a large amount of conflicting comment on its plans for the catchment and so set up a Catchment Planning Advisory Group to resolve the differences. This group reported to the Board in March 1988, setting as the goal for managing the catchment preventing any increase in flood damage. This did not satisfy the Drainage Board, which was hoping to reduce the incidence of flooding, not merely to prevent worse flooding than was already occurring.

The Board also instituted a Styx River Catchment Study when its application for water rights needed to proceed with some flood relief work in the catchment was initially rejected. The water right was refused partly because the Regional Water Board believed the Board had not given adequate consideration to the needs of the whole catchment and it was in order to meet this criticism of its planning that the major catchment-wide study was instituted.

The Estuary

An aerial view of the Estuary, 1964, looking over its mouth to the oxidation ponds of the then-new treatment works at Bromley. Drainage Board

The Estuary of the Avon and Heathcote Rivers plays a key role in the drainage of Christchurch. Into its tidal waters flows most of the city's stormwater, down the rivers and down the main outfall drain along Linwood Avenue. The Estuary also receives all the effluent from the sewage treatment works at Bromley.

Although the Estuary is central to the operations of the Drainage Board, the Board does not control it. In 1964, control of the Estuary was given by the Secretary of Marine to the Christchurch City Council, but on the condition that nothing would be done to interfere with the Drainage Board's rights to use the Estuary to discharge stormwater and sewage effluent.

In the 1960s, the Drainage Board co-operated with the City Council in an endeavour to put the use and management of the Estuary on a sounder footing. The Drainage Board, beginning with a modest grant in 1967, provided a substantial amount of money for work to be done, under the supervision of Professor Knox of Canterbury University, on the biology of the Estuary, with emphasis on the effect nutrients in sewage effluent had on the Estuary's plant and animal life. In 1969, at a meeting attended by representatives of the Drainage Board, the Marine Department and the City Council, the Board agreed to sponsor a three-year programme of research on the ecology of the Estuary. The Ministry of Works, the Departments of Health and Internal Affairs and the North Canterbury Catchment Board were also involved in supporting this programme, but the Drainage Board made the major contribution to it. The Board also co-operated with the City Council in a programme of bacteriological monitoring of the Estuary.

Professor Knox's report on the Estuary was released in October 1973. The report basically recommended leaving the Estuary alone, coming out against some of the things the Drainage Board and City Council had considered doing, including dredging and building a tidal barrage at its mouth. It was a sign of the times that these engineering proposals gave way to ecological considerations. The Board was criticised in July 1973 by Ecology Action about the purity of the effluent it released into the Estuary. In that month, the Board, anticipating the release of the final report, agreed to stop releasing treated sewage on the flood tide. Even

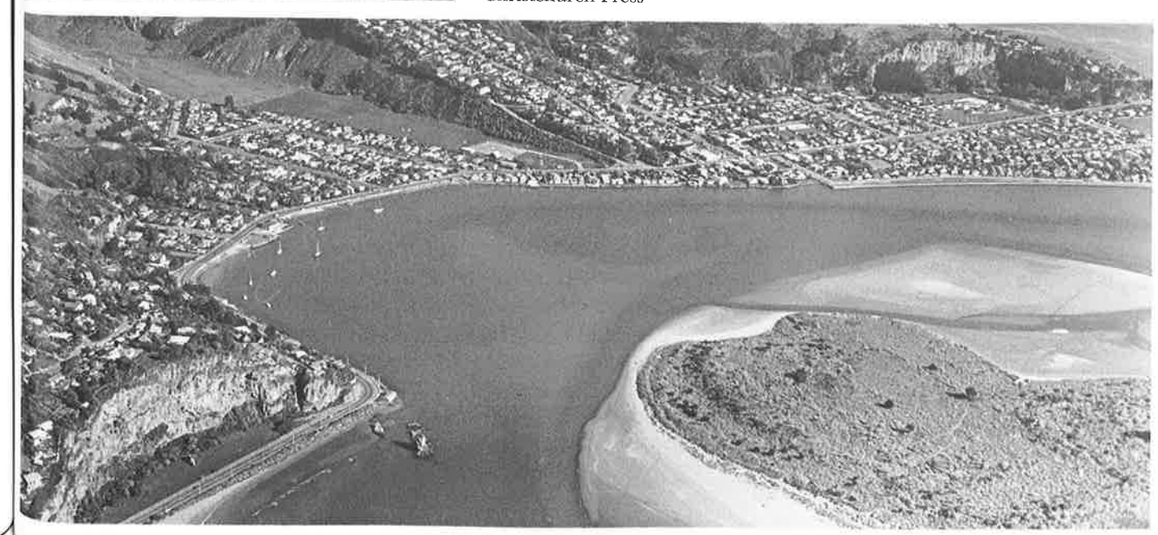
though manual operation of the gates meant that substantial overtime charges were incurred, the Board began discharging effluent only on the first half of the ebb tide. The Board also took seriously the need to consider ways of improving the effluent it discharged into the Estuary and has considered piping the effluent to an ocean outfall to keep undesirable nutrients out of the Estuary, though the cost of this has proved prohibitive. *The Press*, in October 1973, commended the Drainage Board for "a respectable record of concern for the area".

When the data gathered by Professor Knox and his research assistants was combined with the information obtained from the model studies of the Estuary undertaken in the 1960s at the Board's expense at the Hydraulic Research Station in Wallingford, England, the ground was laid for sound decisions about the management of the Estuary. Completion of this report was delayed by a lack of flood flow data. Although the model had been built by early 1966 it was not until after the storms of April and May of 1968 that the Board could send to Wallingford the information that was needed. The Board became impatient when there were further delays in receiving the results of the tests from Wallingford and it was not until well into the 1970s that the final report was received.

In 1979, the Board finally decided that it would not proceed with the construction of a barrage or of floodgates and a pumping station at the mouth of the Estuary, ensuring that the Estuary would remain, as Professor Knox had recommended, as close as possible to its natural state.

Right: *One of the discharge structures through which effluent from the sewage treatment works enters the Estuary. Foaming is less of a problem now than when this photograph was taken.*
Below: *The course of the channel from the discharge structure to one of the main channels of the Estuary.* Both photos: Drainage Board

Below: *The mouth of the Estuary, through which Christchurch's stormwater and treated effluent reach the open sea.*
Christchurch Press



Water Pollution

From its inception, one of the main responsibilities of the Drainage Board has been the removal of pollution from waterways. In the 1960s, pollution became a popular cause and other bodies and pressure groups began to take greater interest in this aspect of the Board's work. The Board's 1969-70 annual report noted an "increasing public concern with pollution and environmental matters". A Waters Pollution Act had been passed in 1953, but the Pollution Advisory Committee set up by that act had been largely ineffective. The Board kept a close eye on new legislation when it appeared in the 1960s, the Water and Soil Conservation Act coming into force on 1 April 1968. Under the provisions of this act, the Drainage Board was required to obtain from the North Canterbury Catchment Board, acting as a Regional Water Board, authorisation for its stormwater and land drainage outfalls. The Board was granted a general authorisation under the new act in 1969, but it was still required to submit an annual programme and to apply for new rights to extract water or discharge stormwater or wastes. Some other new responsibilities, including approving discharges from swimming pools and setting the standards for such discharges, also began to impinge on the Board's work. The Water and Soil Conservation Act increased the Board's administrative load and restricted its freedom of action in certain aspects of its work. The Board appears to have sometimes resented the amount of time that had to be spent on investigations to meet the requirements of the new act, which sometimes held work up, but was scrupulous in its observance of the new legislation.

At about the same time that the Water and Soil Conservation Act was passed, the Board itself became more active in protecting waterways in its district from pollution. A Pollution and By-laws Committee was set up and a new set of trade waste by-laws was framed. Under these new by-laws, those discharging liquid wastes into the Board's sewers had to make an application to the Board to do so and to list in their applications the quantity and standard of the effluent being discharged. The Board's inspectors became more active in checking discharges of oil, solvents and detergents into the stormwater system and prosecutions resulted.

One of the worst incidents of water pollution with which the Board had to deal occurred in October 1972 when a large spill of tar from the Christchurch Gas Works killed many ducks in the Heathcote River. The Gas Company had already been taken to court by the Drainage Board for failing to meet conditions laid down for the discharge of wastes into the Heathcote River. Although the Gas Company gave the Board its worst water pollution headaches, other companies and government bodies, including the Railways, had to be taken to task by the Board for polluting discharges. Nor were minor acts of pollution ignored and the illegal disposal of rubbish, including grass clippings, into waterways by individuals became of increasing concern to the Board as it responded to growing anxiety about the environment.

A spill from Wards Brewery on Kilmore Street into the Avon. The date is uncertain, but may be in the 1940s.
Canterbury Museum

Town Planning Problems

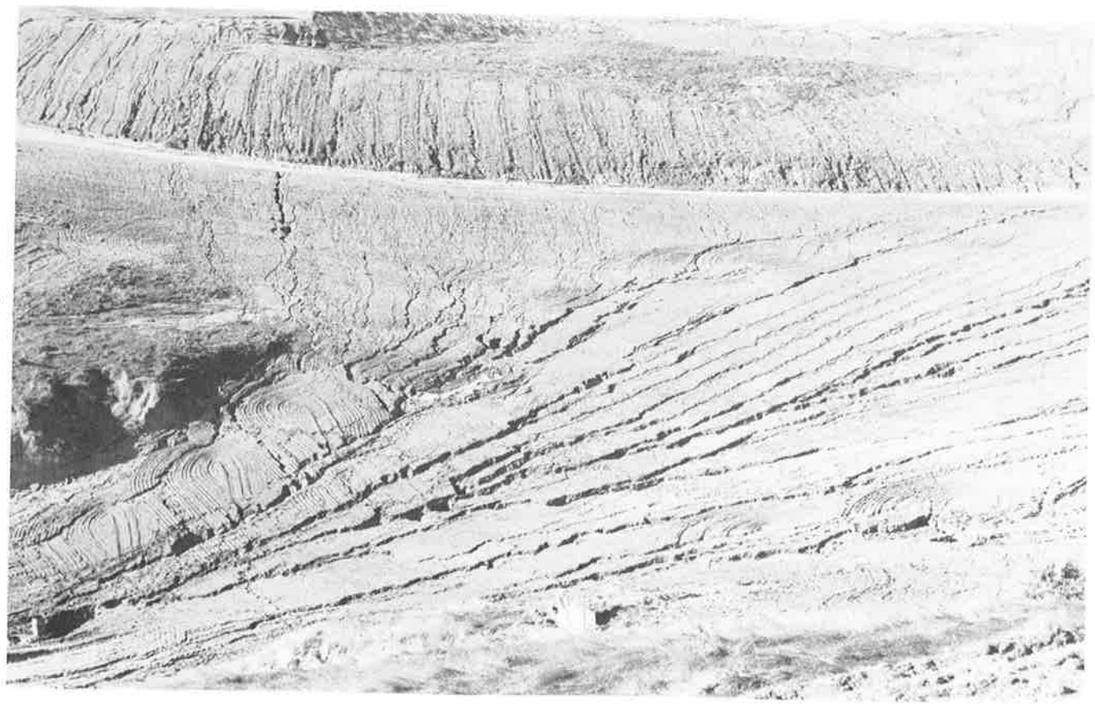
To be properly effective, much of the Board's work to extend sewers had to be done in advance of development occurring. As local bodies began to draw up district plans, the Board inevitably became involved in town planning matters. Board staff had to study draft plans and lodge objections where local bodies proposed to permit development in areas which the Board thought unwise from a sewerage or drainage point of view. Planning changes had all to be considered in relation to the capacity of the Board's sewers or the ability of the Board to provide adequate land drainage.

Unfortunately, in the 1960s and 1970s there was a certain amount of confusion about planning in the greater Christchurch area. This lack of clear town planning direction from the local bodies and the Regional Planning Authority made the Board's own planning for dealing with liquid wastes and stormwater additionally difficult. When the Board attempted a comprehensive liquid waste study in the late 1960s, engaging its consultants, Steven and Fitzmaurice, to study the region's long-term sewerage needs, its efforts were hampered because it could get no clear direction from the planning authorities about the areas of future urban expansion. The Board was mindful that during the unexpectedly large population growth of the 1950s, following years of low growth between the wars, it had barely kept up with the provision of services. To plan future sewer requirements it needed to know well in advance where urban growth would occur, but this was precisely the area in which the planning authorities failed to give the Drainage Board clear guidance, especially in the early 1970s when a satellite city at Rolleston was planned and then scrapped.

In the study on odours at the treatment works it was noted that regional planning was "in a state of frustration". When the report discussed the possibility of other sewage treatment centres in the north-west or south-west of the city, it observed that uncertainties in land use planning were making it difficult for the Board to meet the "need for a comprehensive master plan for sewerage facilities in the Christchurch region".

Specific planning decisions by local authorities also caused the Board headaches in these years. Despite warnings from the Board about the need for care in the development of hillside suburbs because of potential drainage problems, new housing areas were opened on the lower slopes of the Port Hills. The severe erosion on Worsleys Spur during the winter storms of 1975 emphasised the Board's wisdom in expressing concern about such development. When these problems became so glaringly apparent, the Chairman of the Drainage Board called a meeting with representatives of various local authorities to discuss the need for careful zoning of land on possibly unstable slopes.

Erosion on Worsley Spur, 1975.
Drainage Board



Chapter 11

Completing the Sewers

Most of the work of providing all of Christchurch with an adequate sewerage system had been completed by the end of the 1960s. But some major works carried over into the 1970s and 1980s. The two most important of these works brought areas on two extreme edges of the Board's district within the sewerage system. These areas were Belfast and adjacent districts to the north and Sumner and its neighbouring suburbs to the south-east.

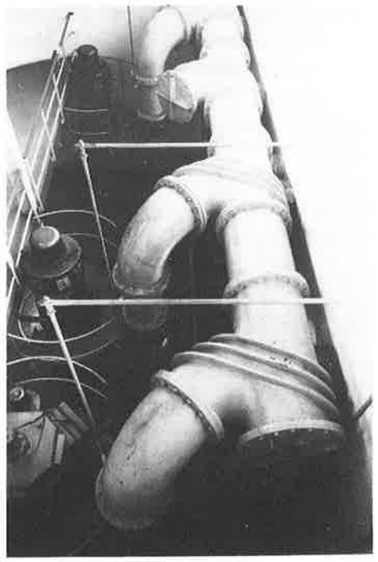
In the 1960s, the Board set out to solve two related problems in the south-eastern parts of Christchurch. These were that sewage from Scarborough, Sumner, Redcliffs, Mount Pleasant and St Andrews Hill was still being discharged, through septic tanks, into the ocean or the Estuary. A makeshift collection of sewers and septic tanks was serving a major residential area, parts of which were growing. The second problem was the large volume of trade wastes being generated in the Woolston area, most of which were discharged into the severely polluted lower Heathcote River. Although there was awareness of these problems in the 1950s, solutions to them had to wait until the main work of city sewerage, described in chapter 8, was largely completed.

The joint solution to these problems was to build a major new pumping station, the present Number 15 pumping station, the second largest in the Board's system. From this pumping station both the domestic sewage from the seaside suburbs and the trade wastes from Woolston are pumped through a long rising main (part of which had to be laid beneath the treatment ponds) to the treatment station. To allow for aeration of the sewage, and for the mains to be drained if necessary, these mains were built on a continuously falling grade from the treatment works to the pumping station. The Sumner Scheme brought domestic sewage to the new Number 15 pumping station through a system of rising and gravity mains. Five pumping stations were needed to achieve this. The Woolston trade wastes scheme brought trade wastes from the factories of Woolston through another set of new sewers to the same pumping station.

When sewage pollution was discovered on the foreshore at Scarborough in 1964, the Board decided it would have to give priority to the connection of Sumner to the treatment works at Bromley. This made installation of parts of the Woolston trade waste system, which was also planned, more critical. A major loan in 1965 allowed work to commence on the new gravity sewers, pumping stations and rising mains, but to reduce pollution immediately, the Board also instituted temporary measures to partially treat the sewage passing through the overloaded septic tanks at Scarborough, Mount Pleasant and St Andrews Hill.

The new Number 15 pumping station was the key element in the Sumner and Woolston schemes. It had a cassion substructure and a large superstructure in which were housed fixed and variable speed pumps. The station was

Above and right: *Construction, in 1966, of the Number 15 rising main from the Number 15 pumping station in Woolston to the sewage treatment works in Bromley.*
Both photos: Drainage Board



Above left: *Two Drainage Board employees inside the Number 15 Pumping Station.*
Right: *Looking down into the well of the pumping station.*
Ash Spice

designed to handle marked variations in incoming flow to avoid unnecessary retention of sewage at the pumping station. The station pumped the sewage automatically on to Bromley at the incoming flow rate. Work commenced on the pumping station in 1967 and the first equipment was installed in 1968. The station came into service on 9 January 1970. On the same day, the first sections of the Sumner scheme were diverted into the new sewers. With the commissioning of the Number 30 pumping station on 30 March, all the sewage from Sumner and the southern shore of the Estuary was being sent to the treatment works, ending pollution of the sea and the Estuary. In 1970, too, Heathcote's sewers were connected in to the main Sumner interceptor.

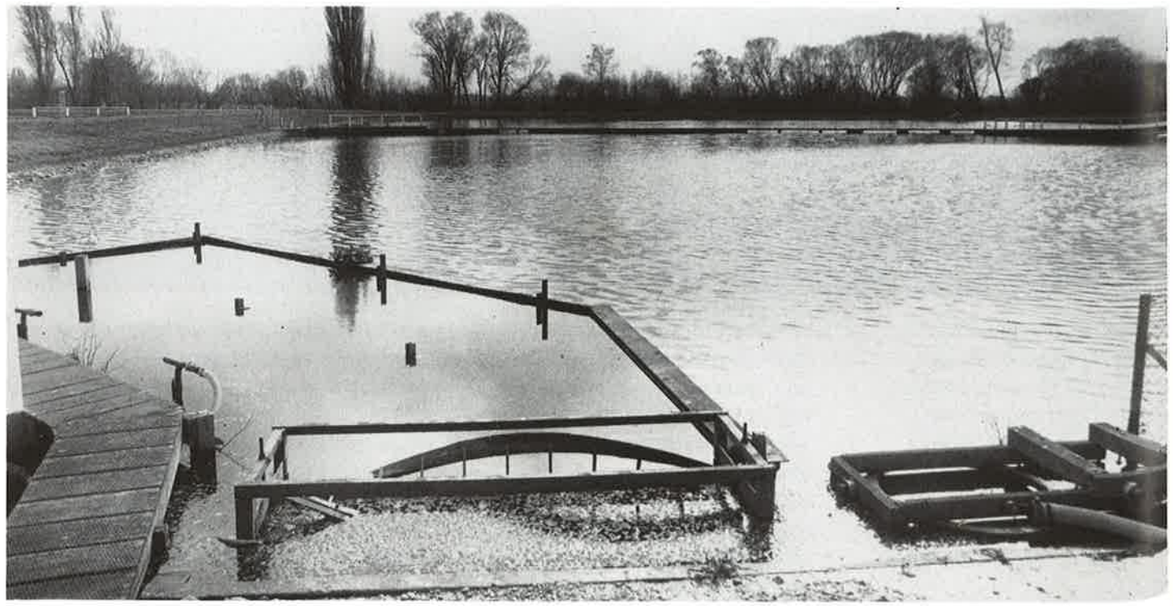
Full use of the Woolston system of trade waste sewers had to await completion of extensions to the treatment works to ensure the works had sufficient capacity to handle the additional load. Once the Number 1 pond had been completed, the system was opened for trade wastes and the hoped-for improvement in the condition of the lower Heathcote and the Estuary was immediately apparent.

As the Sumner and Woolston systems neared completion, the Board turned its attention to the northern side of the city where there were comparable problems, of domestic sewage not receiving treatment and of a considerable volume of trade wastes being discharged into natural waterways. In the late 1960s the Health Department expressed concern about the poor disposal of effluent in the Belfast area and in August 1968 the Board decided it would reticulate the residential areas of Belfast in advance of final decisions being made about the ultimate disposal of the sewage. Temporary oxidation ponds were built to treat wastes. Provision was also made for a pilot pond for experiments with the treatment of meat wastes from the Belfast freezing works.

The domestic sewers in the Belfast area were opened for connection in September 1972 on the completion of the Number 62 pumping station, the construction of which had been hampered by difficult ground conditions. In 1973 the Board accepted the advice of its staff that a permanent northern treatment plant was needed and engaged its local consultants, Steven and Fitzmaurice, to do a pre-design study of the proposed plant. Land near Chaneys was designated for this proposed major northern treatment works. In the same year, 1973, a second temporary oxidation pond for the treatment of domestic wastes from Belfast was constructed.

Planning for a new plant to serve the northern area of the Board's district continued through the 1970s. The Christchurch City Council, Waimairi County Council, Canterbury Frozen Meat Company and North Canterbury Catchment Board were all involved with the Drainage Board in discussing the siting and nature of this proposed plant. The possible use of an ocean outfall was investigated. Plans in 1974 to investigate the discharge of treated sewage into the Waimakariri River (the Board asked the Institute of Nuclear Sciences to survey flows using radioactive tracers) led to the Board being castigated by the Prime Minister, Norman Kirk. In one of the last letters he wrote before his death, Kirk attacked the Board for its "mad irresponsible plan" to discharge treated sewage into the Waimakariri and accused it of having made

The oxidation ponds in which Belfast's domestic sewage is treated before being discharged.
Ash Spice



Construction of the Wigram industrial sewer, 1972-73.
Drainage Board

a "stinking mess" of the Estuary. The Board's consulting engineers pointed out in response to this letter that the Board was in fact working to reduce the load of effluent carried by the lower Waimakariri and that all it was considering was releasing treated effluent into the tidal reaches of the river.

The Board's planning for the major new treatment works at Chaneys was hampered by a lack of information from those responsible for town planning decisions about where the city's growing population was to be accommodated. Eventually, it became evident that the number of people who would be living in the northern part of the city did not warrant a separate major northern treatment plant and plans were accordingly made to take most of the sewage from growing areas in the north of Christchurch to Bromley. The plans to build a separate northern treatment works were shelved and the designation on the land at Chaneys was eventually lifted.

In the meantime, the originally temporary works at Belfast remained in use to serve the households of that town. A pilot plant on the site of the temporary oxidation ponds was brought into operation in 1975 using two plastic media tower filters. One pilot tower was transferred from Bromley and the other constructed on the site. Experiments were also undertaken with a pilot activated sludge unit which was commissioned in December 1976. Subsequently these additional works were dismantled and Belfast's sewage treated in oxidation ponds alone.

The original plan had been to treat wastes from Belfast's freezing works as well as domestic sewage at Chaneys. When the decision was made not to proceed with the construction of a major treatment works at Chaneys, the "temporary" works became permanent for the treatment of domestic sewage. The problem of meat wastes remained. In the mid 1980s, the Canterbury Frozen Meat Company, faced with the problem of disposing of wastes from its Belfast works without being able to feed them to the now-abandoned northern treatment works, decided to build its own treatment plant for meat wastes. A pressure pipeline was built by the Drainage Board to carry the treated wastes from Belfast to the main channel of the Waimakariri River. Although the treatment works were built by the Company for its own use, the Drainage Board was closely involved in planning the works and in negotiations for the water right which the Company needed to be able to discharge its treated wastes.

Apart from these major works in the south-eastern and northern extremities of the Board's district, the city's sewerage system continued to expand, in the 1970s and 1980s, in other areas. In Halswell, a sewerage system was installed by the local county council in the late 1960s and early 1970s. The area was reticulated, pumping stations built and the system connected through

a rising main to the Board's trunk sewer in Cashmere Road. Drainage Board staff were involved in the design of this system for Halswell and in supervision of its construction. In the early 1970s, too, a major new sewer was constructed to relieve overloaded trunk sewers in the Aranui, Bexley, Brighton areas. This was, in effect, the beginning of an extensive eastern and north-eastern relief sewer system, designed in the early 1970s and constructed in the early 1980s. It was built to cope mainly with residential expansion of the North Beach and Parklands areas.

Other sewerage work of the 1970s involved the reticulation of pockets of urban development in rural areas next to the "urban fence". These pockets included Port Hills Road, Burwood Road, Hills Road and the Avoca Valley. Sewers were also laid in Hackthorne Road and Maces Road. The Wigram industrial area, centred on Birmingham Drive, was sewered in 1971-72. The reticulation of Clifton and the western suburbs of Sockburn, Hornby and Islington was also completed in the 1970s. Most of these sewerage extension works were tidying up operations, bringing sewers to pockets of developed land that had been overlooked in the major sewer extensions of the 1960s.

In 1985, the Board made commitments to sewer Brooklands and Spencerville in the northern parts of its district and Taylors Mistake in the extreme south-east. Bringing sewers to Taylors Mistake had been considered in 1970, but not proceeded with because of the high cost of the works. There were, at that time, other demands on the Board's limited finance, for works which would benefit larger numbers of people. By the mid 1980s Brooklands/Spencerville and Taylors Mistake were the only two major areas of development in the Board's district which were without sanitary sewers. Once the demands of other areas had been met, work was begun on sewers in these last two built-up areas. The work in both areas was completed by the beginning of 1989. The Drainage Board went out of existence later in the same year with every single developed area within its 290-square-kilometre district served by sewers. The extent of the sewerage system which the Board handed on to the new City Council at the end of 1989 is shown on map number 5; the area served by sewers is shown on map number 6.

Long Serving Staff

Edwin Cuthbert, the Board's Chief Engineer and Secretary/Treasurer from the 1880s to the 1920s, set a precedent for long service to the Christchurch Drainage Board which some later staff members, in recent times, have matched. When E.F. Scott retired as Chief Engineer in October 1963, he had been with the Board for nearly four decades and its Chief Engineer for seventeen years. Scott began working for the Board in 1924, when planning had commenced for the first major extension of the sewerage system. He also supervised the major works of the 1950s — the construction of new trunk sewers, a new treatment works and a new main pumping station. His role in the mid twentieth century was as pivotal as Cuthbert's had been from the 1880s to 1921. When one of Scott's successors as Chief Engineer, P.J. McWilliam, retired in October 1981, he too had served in that high position for seventeen years. At about the time the Board went out of existence, in late 1989, the Chief Engineer, H.P. Hunt, and the Deputy Chief Engineer, D.G.H. Cooper, both retired. Both had served in the positions they quit since 1981; both were also staff members of much longer standing. H.P. Hunt had first joined the staff of the Board in 1953 and D.G.H. Cooper in 1962.

Two of the Board's Secretaries in this century chalked up long records of service. When he retired in the late 1950s, R.R. Senior had accumulated more than forty years of service. He is remembered, too, for his keen interest in the Board's history. One of his successors, M.J. Horne, who was Secretary from 1970 to 1983, worked for the Board for a period of three and a half decades. Another long serving member of the Board's professional staff in recent years was J. Rourke who, just prior to his retirement, was Chief Records Draughtsman.

The turnover of unskilled staff is understandably higher, but even at that level, some staff members have chalked up impressively long records of service. When F.V. Harris retired as Foreman of Open Drains in 1970, he had just completed forty years service with the Board. A Maintenance Officer, J.B. Newton served for forty-one years and a labourer, E.A. Worsfold, for forty years.

The Board's Premises

When it was first set up, the Christchurch Drainage Board rented premises on Hereford Street. It remained in rented premises until 1908 when it moved into the first of its own buildings, also on Hereford Street. This was a handsome two-storey brick building with Oamaru stone facings, designed by a local architect, F.J. Barlow. Downstairs were the engineers' and accountants' quarters and a map room; the draughtsmen worked upstairs, where there was also a Board room. This building remained the Board's home until the mid 1960s. By that time the cramped conditions in the Board's offices (which had overflowed into adjacent buildings) were "not conducive to obtaining the best output from the staff". The Board's own committees were obliged to meet, at this time, in the staff tea room. The full Board could not gather on its own premises but had to meet in the Catchment Board's building on Latimer Square.

Staff of the Christchurch Drainage Board outside the building which the Board was occupying in 1906. Drainage Board

In the early 1960s the Board decided it would have an entirely new building erected to accommodate its staff. Paul Pascoe was engaged to design a building which is regarded as one of the best buildings of the modern movement in Christchurch. Although the Board's need for new accommodation was pressing, the Hornby Residents Association, annoyed that the Board was spending money for a new building when large parts of Hornby were still without sewers, objected to the Board raising a loan for this purpose. But the objection was over-ruled and work began on the new building at the end of March 1964. The building was nearing completion by the middle of 1966. Over a busy weekend in June of that year the staff transferred records, furniture and equipment into the three completed floors. The building was finished, with tenants occupying the fourth floor, in August. The wisdom of building a fine, substantial new building was evident in the fact that twenty years later the Board had still not outgrown the building. As late as 1989 part of the fourth floor was still occupied by tenants.

Left: *The Board's new office building on Hereford Street in 1908.* Alexander Turnbull Library ***Above:*** *Crowded conditions in the office prior to the construction of the building on Cambridge Terrace .* Drainage Board

Routine Maintenance

This history of the work of the Christchurch Drainage Board has concentrated on construction and new works. But much of the day-to-day work of the Board's staff is routine maintenance, intended to keep existing systems in good order.

The routine work in the case of drains and small creeks has meant both cleaning them out and lining them with timber or pre-cast concrete panels which makes them easier to clean and maintain. A programme to line drains was pursued actively in the 1960s.

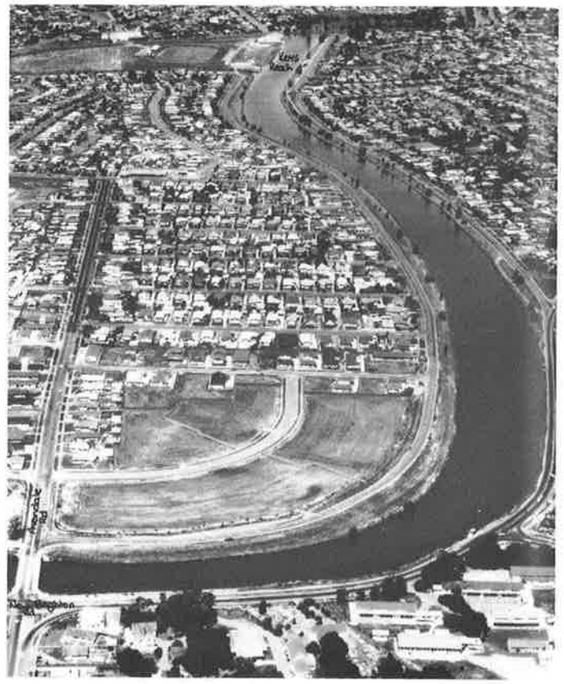
The rivers are kept clear by the regular cutting of weeds, both manually and by machine. A faster, more efficient weedcutter was purchased in 1971 which permitted the mechanical removal of weeds in areas inaccessible to previous weedcutters. At the same time the heavy, cumbersome wooden punts used for the manual hoeing of weeds were replaced by light, fibreglass models. The rivers have also to be dredged to remove accumulations of silt, especially in the lower reaches. A dragline was bought for this at the end of World War II and a new one purchased in 1970.

The disposal of the silt dredged out of the rivers' beds gave the Board a profitable "sideline". Land was purchased adjacent to the lower reaches of the Avon River, filled to a level at which subdivision was possible, and then sold, giving a return to its ratepayers, the Board noted with satisfaction. In the early 1970s, the Board was attacked by a Minister of the Crown for contributing to the inflation of land values by selling the filled land it then had available at prevailing market rates, but the Board stood by its duty to its ratepayers.

The city's sewers have also to be maintained. The 1973 study on odours at the Bromley treatment works noted that "sewer maintenance programmes are particularly important in flat sewer systems". The Drainage Board had been flushing some of its sewers since the late nineteenth century, but systematic cleaning programmes were not instituted until the 1960s. In 1966 the Board set men to work cleaning sewers using a ball. In 1970, high pressure water cleaning was instituted. At about the same time closed circuit television equipment was bought for pipeline inspection. This equipment was used partly to inspect pipelines so that any necessary repair work could be done in advance of the laying of high standard road surfaces and partly as a back-up for the sewer cleaning programme.

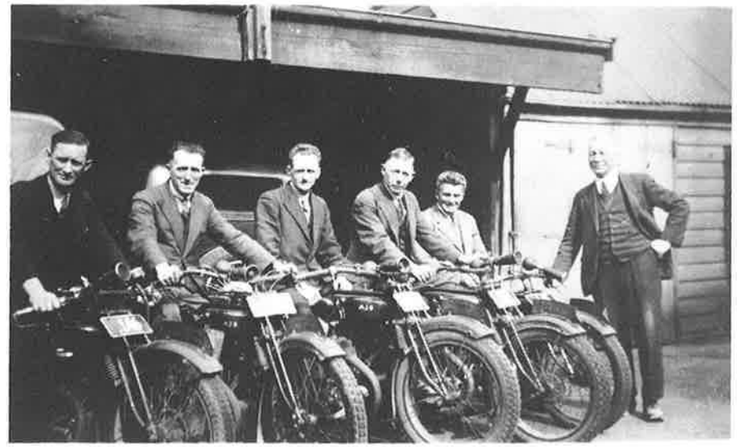
The advantages of this "preventive maintenance" of the sewers, which cleans out accumulations of sludge and grit, are operational reliability, the reduction of troublesome blockages and faster transit times for sewage to the treatment works which, by inhibiting deterioration of sewage in the pipelines, helps reduce odours.

The other important area of routine work for the staff of the Drainage Board is inspection. William Clark had anticipated the Board playing this role in his 1878 report when he insisted that the materials and workmanship of private drains should be officially inspected and approved and that competent tradesmen should be licensed by the Board to undertake house drainage work. This routine work of inspection has been going on for more than a hundred years more or less along the lines Clark recommended.



Opposite page: Above left and right: *The land at Avondale on which the Board disposed of silt dredged from the rivers, before (left) and after (right) it was filled and sold by the Board for housing.* ***Below:*** *One of the Drainage Board's draglines used for clearing silt from the rivers. It is standing in front of the old Tuam Street pumping station.*
All photos: Drainage Board

Left: *Using a flexible rod to clear a blocked sewer.* ***Below:*** *The Board's inspectors, at the rear of the old Hereford Street offices, about to leave on their rounds to inspect household drainage and plumbing. The photograph was probably taken in the 1940s or 1950s.*
Both photos: Drainage Board



Conclusion

After 114 Years....

On the eve of the Board's centenary in 1975, the then Secretary of the Board, M.J. Horne, told *The Star* that "people tend to forget the Christchurch Drainage Board exists — until they find their property under water or, worse still, the lavatories won't flush". For most of its 114 years of existence the Board was by and large ignored by the residents of Christchurch. Only when storms brought floods, when rapid expansion of the city meant new homeowners had to wait for sewer connections, or when the treatment works generated smells which plagued the eastern suburbs, did the Board's work come under extensive public scrutiny. It is a measure of the Board's success in meeting the drainage needs of Christchurch that these episodes when the Board has been in the public spotlight have been far shorter than the long periods when people more or less forgot that the Board even existed.

After the efforts in the first decade of its existence to have the Board's functions transferred to the territorial local authorities, the presence of the Board as a local body with one specific function was more or less taken for granted. Not until the late 1940s were serious proposals again raised that the Drainage Board be merged into the Christchurch City Council. This suggestion provoked a spirited defence of a Board with sole responsibility for drainage by the Board's Chief Engineer, E.F. Scott. Scott warned against dissipating the Board's powers and functions among the local authorities. The drainage problems of Christchurch, he insisted, had to be dealt with as a whole. The "average" municipality or county, he claimed, could not be relied on to devote the energies that the drainage problems of a formerly swampy, low-lying, flat city demanded. The best work was generally done, he argued, where sewerage was separated from other local authority activities.

Scott's arguments had less force four decades later when the Drainage Board went out of existence as part of a comprehensive reorganisation of local government. The danger that drainage would be neglected arose mainly from the "natural" drainage area being divided among several local authorities. The danger receded with the creation of a single large city the boundaries of which included the whole area of the former drainage district.

The threat to the Board's existence posed by the proposals in the 1940s that the Board merge with the City Council passed. In the 1960s a new threat to the Board's independence surfaced. This was the plan to set up a Regional Authority for Christchurch, a new body with region-wide responsibility for drainage, transport, milk treatment and planning. Both the Transport Board and the Drainage Board would have gone out of separate existence if such a regional authority had been set up, but once again local body jealousies thwarted the government's plans. The regional authority was given only limited planning powers and the Drainage Board retained responsibility for ensuring that Christchurch was adequately drained and served by sewers for another twenty years. The reprieve allowed the Board to celebrate its centenary as an independent body in 1975.

In the late 1980s a determined government reformed local administration throughout New Zealand. This time the Drainage Board succumbed to change. The establishment of a new "super city" of Christchurch with comprehensive powers and functions over an area which included the whole of the Drainage Board's district left no place for a body which had been brought into existence more than a century before primarily because the "natural" area within which drainage works had to be planned and executed was split up among a number of bodies which had proved incapable of co-operating on essential drainage works.

The 114 years of the Board's existence saw changes unimaginable in 1875. In the last decade of its existence computers arrived in the Board's offices and the Board was obliged to consider the implications of the "greenhouse effect" and how a rise in sea levels would affect the levels set for buildings close to the Estuary and sea. What did not change in all those years was the ruling principle of the Board's work, that "Christchurch must have drainage to survive". Christchurch's healthy existence on a site "particularly difficult ... from a sewerage and drainage point of view" is the achievement, largely, of the Christchurch Drainage Board.

One of the Drainage Board's routine tasks through the years was keeping Christchurch's waterways clear. This photograph is of one of the Board's weedcutters at work on the Heathcote River. Drainage Board

The Last Drainage Board

The last Christchurch Drainage Board, elected in 1986, was photographed in the middle of 1989, just before the Board went out of existence.

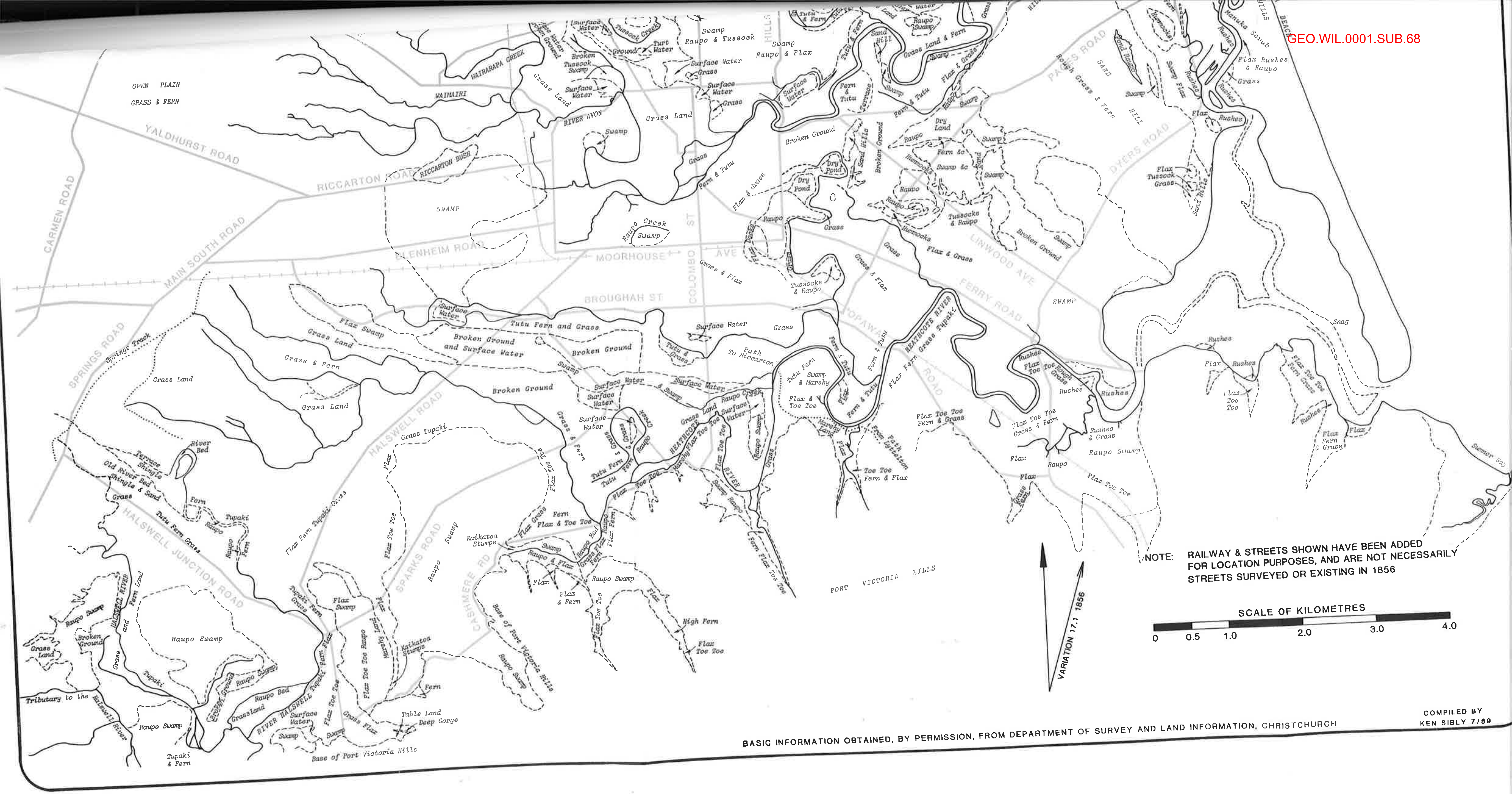
Back Row: *R.B. Wright, C.H. Russell, Mrs J.A. Bruce, C.J.J. Adlam, N. Dodge (Board Chairman), R.H. Arbuckle, Mrs A.M. Johnson, R.C. Andrews, T.B. Whelan.* ***Middle Row:*** *Mrs L.L. Moore, J.A.J. McMillan (Chairman, Development, Construction and Tenders Committee), M.R. Carter (Deputy Board Chairman), D.G. Rich (Chairman, Operations, Services and Staff Committee), R.E. Wilton (Chairman, Finance Committee), Mrs M.K. Alderdice.* ***Front Row:*** *D.G.H. Cooper (Deputy Chief Engineer), P.A. Baldwin (Assistant Treasurer), Mrs P.L. Ellis (Deputy Chief Administration Officer), N. Kelly (Chief Administration Officer).* ***Inset:*** *H.P. Hunt (Chief Engineer).*

CHRISTCHURCH AREA
SHOWING
WATERWAYS, SWAMPS & VEGETATION COVER
IN 1856

COMPILED FROM 'BLACK MAPS' APPROVED BY
J THOMAS & THOMAS CASS CHIEF SURVEYORS 1856

OPEN PLAIN

GRASS & FERN



Christchurch was founded in 1850 on low-lying, swampy ground, drained by sluggish rivers. The city's watery origins are evident in the watercolour, above, of the bridge over the Avon in the Market Place (Victoria Square), executed in December 1852 by J.E. FitzGerald.

From 1875 until 1989, the Christchurch Drainage Board was responsible for draining Christchurch — for preventing stormwater flooding of streets and residences and for removing and treating sewage and industrial wastes. From being New Zealand's unhealthiest town in the 1870s, Christchurch became, by the 1980s, the country's best drained city. This history of the Christchurch Drainage Board tells the story of the transformation of an unpromising swamp into a habitable, healthy site for a major city.

Extensively illustrated and with informative maps, the book covers an important but often ignored aspect of the history of the South Island's leading city.

CHRISTCHURCH SWAMP TO CITY

CHRISTCHURCH

Swamp to City

A Short History of the Christchurch Drainage Board 1875 - 1989