Chapter 13

WATER RESOURCES

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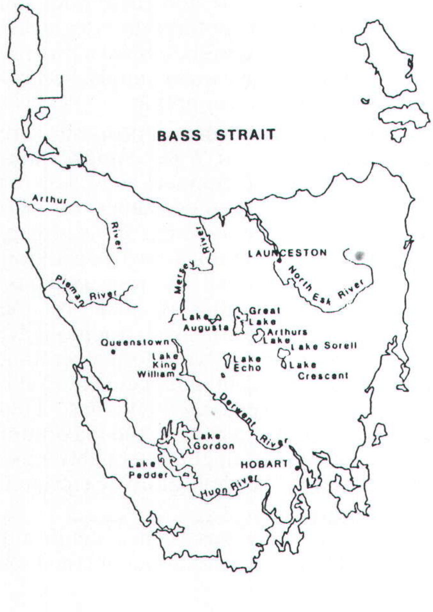
Tasmania has been called the 'Isle of Mountains', but it would be equally appropriate to use the term 'Isle of Rivers and Lakes' given the relative purity and abundance of water supplies, compared with the more arid mainland States. Moisture-laden clouds sweep across the latitudes of the 'Roaring Forties' to deposit precipitation on Tasmania's mountainous west coast and the myriad of lakes of the Central Plateau, gradually discharging rainfall in passage towards the drier east coast. While areas such as Queenstown receive approximately 2500 mm precipitation per year, some areas of the State receive 400 mm or less. The average annual rainfall is about 620 mm per year, but considerable variation occurs, creating ocasional floods or droughts.

Tasmanian rivers often pursue a relatively steep and direct route to the sea, cascading through spectacular gorges and valleys to the coastal plains, but there are a few extensive river systems draining considerable proportions of State, the principal contributors being the Derwent, Gordon and Esk catchments. But Tasmania is equally renowned for forest fringed and tranquil river reaches, where waters stained brown by peaty soil produce reflections of earth and sky, often breathtaking in beauty.



The Central Plateau of Tasmania contains a myriad of lakes and tarns which not only provide recreational opportunity and fishing prospects, but have formed the basis of hydro-electric generating capacity. Many of the major lakes have now been regulated by dams and weirs, but in the national parks, cirque girted tarns complement jagged peaks and the sound of waterfalls drift upwards from narrow ravines.

13.1 WATER RESOURCES AND USAGE OPTIONS

Water is central to the survival and economic development of all civilisations. In Tasmania the runoff is partially conserved and distributed in a variety of ways to serve a number of competing and complementary demands of the community:

- irrigation and farm production (stock, crops and pasture),
- domestic water supply,
- fisheries production (trout and other species),
- hydro-electric energy production,
- recreational opportunity.

Most of the Australian States and Territories are now producing comprehensive water management strategies, both for forward planning purposes and water pricing, but perhaps because of the ready availability of supplies, Tasmania has been slower to initiate such reforms. Overall there is very little competition between the users of water for agriculture, industry and town supply, since sources are tapped and treated at different locations along streams and the abundant supply does not usually necessitate any major rationing. Nonetheless there is sometimes an impression that communities are careless about water wastage, since they rarely identify the actual costs of water resource management, which are partially hidden away in expenditures, rates or taxes not obvious to the layman. Maintaining the quality and quantity of water supplies is not an insignificant problem, even in a somewhat sparsely populated region such as Tasmania and there are locations in the State where significant pollution problems have been identified, necessitating government regulation.

More serious conflict arises in respect of the competing demands of hydro-electric energy production in Tasmania and wilderness conservation. While it is true that the construction of access roads, dams and impoundments may result in the destruction of particular landscapes or habitats, or lead to the inundation of particular natural features, artificial lakes can also possess a beauty of their own and increase tourism potential. Where competing demands and perceptions exist, accommodation is never easily achieved and in recent decades Tasmania has witnessed two major conservation controversies which have taken on national as well as regional significance, namely the Lake Pedder case (1967–1974) and the Franklin–Lower Gordon Rivers debate (1978–1983). However traumatic at the time, there is now a clearer delineation of the use of water resources within Tasmania and much has been learned about the need for improved public participation in governmental decision-making.

by Dr Bruce Davis, Senior Lecturer, Department of Political Science, University of Tasmania.

13.2 WATER RESOURCES MANAGEMENT

Water supplies must be effectively assessed, protected, regulated and managed, usually by governmental initiatives, but it is no easy task to decide what organisational arrangements should apply. In some nations such activities are conducted on a regional or catchment basis, but in Tasmania the tasks are assigned to functionally specialised agencies, each with a particular jurisdiction.

The principal water management authorities are:

The Hydro-Electric Commission of Tasmania,
The Rivers and Water Supply Commission, and
The Hobart Regional Water Board.

These bodies are supplemented by a regional water system for municipalities in the West Tamar and North Esk regions, the Cressy-Longford irrigation scheme, a number of small water trusts in particular localities, various municipal water treatment systems and a number of sewerage schemes. There are historical reasons why such a complex framework has developed, but the question inevitably arises as to whether the time has come for a more integrated State-wide system to be adopted. Local autonomy would probably be strongly defended, but there are powerful economic and infrastructure developmental reasons why larger-scale units and State-wide standards should now be advocated.

The Water Act of 1957 currently governs the powers, functions and duties of public agencies responsible for water resources management in Tasmania. Apart from the Hydro-Electric Commission which has its own enabling statutes and possesses substantial powers, including the right to declare hydro-electric districts, the principal agencies are the Rivers and Water Supply Commission, the Hobart Regional Water Board, and the North-West Regional Water Authority. Each operates bulk supply schemes, piping water for distribution by the municipal authorities in the Hobart, Launceston and north-west regions and directly to certain industrial consumers.

A number of smaller population centres are served by individual water supply schemes for which the municipalities are responsible.

Because of the reliance sewerage treatment has on a reticulated water supply, the growth and development of sewerage schemes has gone hand-in-glove with the development of water schemes. It is generally true to say that municipalities with a water supply scheme have, or are currently implementing, a sewerage scheme.

Most householders pay for their domestic water supply and sewerage through rates levied by their respective municipalities. Most industrial users are charged for their water supply, according to actual metered consumption.

Water and sewerage scheme proposals are assessed by the Rivers and Water Supply Commission that they are economical as well as for their eligibility for financial assistance. Municipalities apply for subsidies and, in so doing, provide financial information as to the operation of their respective water and sewerage accounts. Determination of subsidies is made by the Minister for Water Resources and, traditionally, has been limited to 25 per cent of the operating costs of water schemes and 33.3 per cent of the operating costs of sewerage schemes. This determination also has regard to the maximum revenue a municipality might reasonably raise and is established by the application of a revenue 'standard'.

In recent years there has been a significant development from the traditional method of calculating subsidies for sewerage schemes, and this has been by way of financing of sewerage schemes called 'Front-end Finance'. 'Front-end Finance' is a method used to finance the capital cost of a scheme over the expected construction time of the scheme and is limited to 50 per cent of the capital cost. So far, this finance has been limited to four specific rural municipalities, covering five schemes. No further subsidies are then paid on these schemes, unless major upgrading is undertaken. This method of finance is attracting increasing attention because it both assists the municipality in the construction of major works, and limits the open-endedness of subsidy payments for which the Government may be liable.

13.2.1 Regional Water Schemes

South

The Derwent Water Supply

The Derwent River at Bryn Estyn, five kilometres upstream from New Norfolk provides the source of supply for the West Derwent System and the Southern Regional System. The System consists of a Treatment Plant and Pumping Station at Bryn Estyn, supplying three, nine megalitre storage reservoirs (or head tanks) with a water level of 178 metres above sea level at Box Hill, New Norfolk.

The storage reservoirs are supplied from twin rising mains 2500 metres in length. The original rising main installed in 1962 is 900 mm diameter. The additional rising main is 1372 mm diameter and was installed as the first component of the Derwent Water Supply Augmentation Scheme. This rising main was commissioned for the summer of 1982/83.

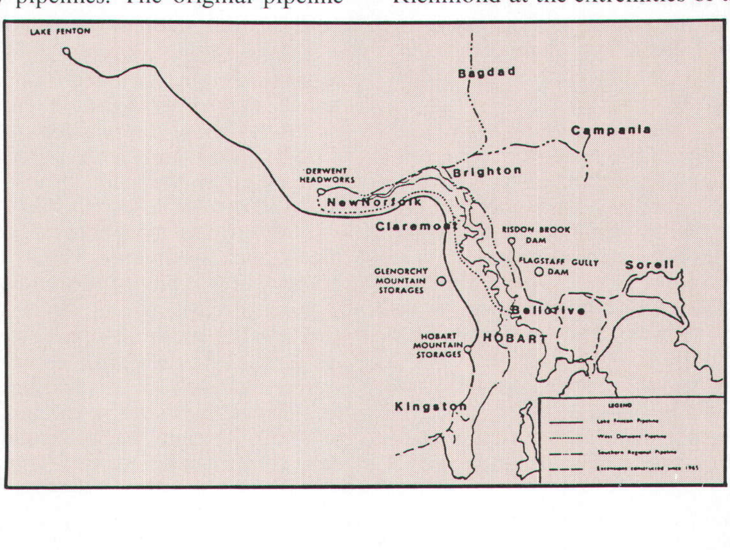
From the storage reservoirs the supply to the metropolitan area of Greater Hobart is by means of two gravity pipelines. The original pipeline installed in 1962 is 39 kilometres in length varying in size from 900 mm diameter to 450 mm diameter terminating at the Domain reservoirs in Hobart.

The second pipeline is 1372 mm diameter, the first stage of which is 27 kilometres in length and installed adjacent to the original line, was commissioned in July, 1984 and terminates at Berriedale (Glenorchy). It operates in parallel with the original pipeline, and has a design capacity of 150 megalitres per day.

The original pipeline capacity under gravity is 90 megalitres per day which, when boosted by pumping from an in-line station at Granton, could be increased to 136 megalitres per day. The combined capacity of the two pipelines will be such that the Granton pump is no longer required for that duty. There are major offtakes into the reticulation systems at New Norfolk, Granton, Glenorchy and Hobart and connecting pipelines across the Tasman and Bowen Bridges to Clarence.

The Southern Regional Water Supply

The Southern Regional Water Supply scheme provides water to the Clarence Municipality on Hobart's Eastern Shore and the Brighton, Green Ponds, Richmond and Sorell Municipalities. The source of the water for this scheme is the Bryn Estyn clear water storage reservoirs. An under river pipeline supplies treated water to a pumping station at Lawitta. Additional pumping stations at New Norfolk, Boyer and Old Beach provide a maximum capacity of 27 megalitres per day in the 525 mm diameter pipeline. The pipeline was brought into service in 1951 and the booster stations in 1975. The northern sections of the scheme are supplied from a storage reservoir at Cobbs Hill. Additional pumping is required to deliver water to rural towns of Kempton and Richmond at the extremities of the system.



THE MT WELLINGTON WATERWORKS

by Roy Davies

Reprinted from 'The Tasmanian Tramp', Journal of the Hobart Walking Club Inc., No. 25, 1984–1985, Hobart

During its first 25 years as a British colonial settlement, Hobart Town depended upon the rivulet running through its centre for most of its water supplies. By 1826 the demands made on this stream included the diversions of water to various mills, and at times reduced the water supply downstream to a trickle. Regrettably, the rivulet became a poorly flushed common sewer, and was generating outbreaks of typhus and bowel disorders. A stage was even reached when these problems were providing grounds for suggestions to transfer the capital elsewhere.

Lieut.-Governor Arthur alleviated the water shortage to some extent in 1829 by arranging diversion of another stream into the Hobart Town Rivulet. Arthur's further efforts to improve the Rivulet flow by piping water from the New Town Rivulet were frustrated by the Home Government's failure to provide the necessary pipes.

Between 1840 and 1848, the pioneer industrialist Peter Degraves, who had established sawmills, a brewery, a flour mill and bakehouses during the previous decade, was involved in a water development proposal which was accepted by the Government. Troubles arose because the Rivulet passed through Degraves's brewery. This led to allegations of tainting, and to suggestions that the diminution of flow since 1833 had been a consequence of the brewery's water concessions having been exceeded. In due course, Degraves's water supply contract was terminated.

The second half of the last century saw the systematic development of water-harvesting activities on the southern slopes of Mt Wellington, and the provision of storages for excess supplies of water. This phase of development continued until the completion of the Ridgeway Reservoir in 1919.

Perhaps of greatest interest to the wayfarer are the older parts of the Hobart water catchment systems, extending from the Plains Rivulet pipe-head (well known as St Crispins Well) to the headwaters of Browns River at Fern Tree Bower, and the associated distribution lines leading to the Hobart Waterworks Reserve. From the outskirts of Hobart, these waterways can be followed right through to a weir on the North West Bay River some 15 km from the Waterworks Reservoirs. Wellington Falls, on the same river, are not far beyond.

From St Crispins Well, with its attractive backdrop of tall ferns, the water collected is piped underground for most of the 8.5 km to the Fern Tree Bower. On the way, side tracks follow branch pipelines which augment the main supply with the aid of small dams across streams such as Plains Rivulet tributaries, Long Creek, and Fork Creek.

A monument at the Bower records the construction of the original waterworks installation there in 1861, and the damaging flood of 23 April 1960, when Silver Falls were practically buried in debris. This part of the gully (in the Browns River catchment) provides water for the final intake of the Hobart City Council's Mt Wellington water supply system.

There are several complications in the water collection arrangements. One is the open stone-lined gutter beside Milles Track, a minor high-level route between The Springs and Wellington Falls. Part of this aqueduct still carries water to an intake. Another, more recent pipe system reverses the trends of colonial days and diverts water from the Hobart Rivulet watershed into the Fern Tree systems. Also, there is the inconspicuous intake above Strickland Falls which still feeds a cascade brewery pipeline leading to the Mountain Lake area featured on 'penny red' Tasmanian postage stamps. Nowadays six large concrete tanks between Huon Highway and the Cascade Brewery replace the lake which served as a reflecting pool for Mt Wellington.

Perhaps the most interesting section of aqueduct, disused since it was replaced by a pipeline leading directly to Ridgeway Reservoir, is that extending from The Bower via the present Fern Tree village to the Hobart Waterworks Reserve. The water passed along a covered masonry aqueduct to the top of Gentle Annie Falls.

This artificial waterfall, now dry, carried water discharged from the stone aqueduct into steeply inclined troughs cut out of sandstone outcrops. The water was fed into a high level pipe-head well, and then to a receiving house for distribution to the mains or reservoirs. Within the Waterworks Reserve picnic area, there is an attractive arched masonry bridge carrying water pipes from the vicinity of the stone receiving house, which is now a picnic shelter.

Dam construction in the waterworks area employed earth embankments with clay core walls. The lower reservoir, constructed in 1861, suffered an early failure, and because of major technical problems was not permanently restored until 1895. Meanwhile the second reservoir had been completed upstream.

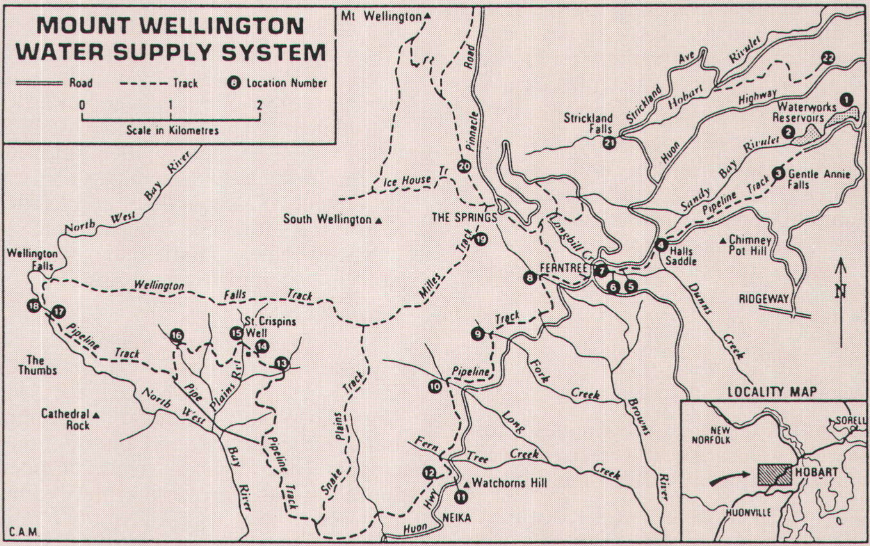
Collectors of post-cards produced early in this century may come across cards showing views overlooking the two reservoirs, and vistas of Gentle Annie Falls in full flow.

Above the Falls the path and stone troughing can be followed up an easy grade past the site of McDermott's farm to the junction between Chimney Pot Hill Road and Huon Highway. On the way to this junction is a well-preserved, all-stone valve room, originally providing for diversion of water into the gully. From the nearby picnic area, the path and underground troughing continue to Fern Tree and the Bower.

The internal dimensions of troughing on these were; height 1 ft., width 1 ft. 4½ ins.

On the way, two stone aqueduct bridges are passed. Although not improved by attachment of external water pipes and cables, these very sturdy structures are impressive in regard to design and workmanship. A plaque records that the engineer was C.W.S. James, the contractor Joseph Hawkes, and the construction date 1881. The streams bridged are headwaters of Longhill Creek.

Unexpected relics of an earlier water scheme may be found between the Pipeline Track and the section of the Huon Road just below the Pillinger Drive turnoff. On each side of the gully there are tall stone columns which supported a wooden aqueduct. The downstream part of the old adueduct route is overgrown but easily located not far below the Huon Highway.



1. Lower Waterworks Reservoir (commenced 1861; restored 1893–1895).
2. Upper Waterworks Reservoir (1887–1888).
3. Gentle Annie Falls (1881).
4. Stone Valve Room, Halls Saddle (adjoining present Ridgeway Road).
5. Overhead Aqueduct Bridge (1881).
6. Overhead Aqueduct Bridge (1881).
7. Stone Piers of former Wooden Aqueduct over Long Hill Creek (circa 1860).
8. Bower and Silver Falls Intakes, and Water Tower Plaque (1861 and 1960).
9. Fork Creek Pipe Junction ('The Wishing Well') and Intakes (3).
10. Long Creek Intakes (2).
11. 'The Old School House', Watchorns Hill, Neika.
12. Iron Shed at Tramway Terminal, *Neika.
13. Plains Rivulet Eastern Intake.
14. Plains Rivulet Intake (Close to present Hut near St Crispins Well).
15. St Crispins Well Intake (circa 1870).
16. Plains Rivulet Western Intakes (4).
17. Original Weir on N.W. Bay River (circa 1905).
18. Higher Level Weir on N.W. Bay River (circa 1916).
19. Milles Track Intakes.
20. 'The Springs' Intakes.
21. Strickland Falls Intake (Cascade Brewery Co.).
22. Mountain Lake Site (Cascade Brewery Co.)

The Mount Wellington System

Water is collected from mountain catchments by means of intakes situated on various creeks at the North West Bay River. The catchment area, which is protected from development, is approximately 1500 hectares in area and provides a total annual average yield from run-off of 6000 megalitres. This natural run-off is collected in Ridgeway Reservoir which has a capacity of 947 megalitres at full supply level, 287 metres above sea level.

Ridgeway Reservoir is the bulk supply balancing reservoir for the City of Hobart and the Kingborough Municipality, south of Hobart. It is a concrete arch dam 59 metres in height. The Upper and Lower Reservoirs at 155 metres and 137 metres above sea level, with a combined capacity of 500 megalitres, complete the system and are replenished from the Lake Fenton Supply and by pumping from the West Derwent Supply. Ridgeway Reservoir is replenished also from this source by pumping from the Lower Reservoir.

The Hobart Mountain System provides approximately 25 per cent of the present total average annual demand, however, during the summer, because of negligible natural inflow the reservoirs only act as balancing and emergency storage reservoirs and are replenished by pumping.

Glenorchy Storages

These storages comprise the Knights Creek, Lime Kiln and Tolosa Street Reservoirs, which have a combined capacity of 1550 megalitres.

The Knights Creek Reservoir is fed from the mountain catchment and the major part of the storage is retained as an emergency supply for Glenorchy in the event of a breakdown in other supply systems. About 25 per cent of storage is fed into Lime Kiln and Tolosa Street Reservoirs. It is a concrete faced rockfill dam 40 metres in height.

The Lime Kiln Reservoir receives some water from the mountain catchment and is supplemented during the summer by pumping from the Tolosa Street Reservoir. The Lime Kiln Reservoir supplies the high level areas of Glenorchy. The dam is a rockfill clay core embankment 36 metres in height.

The Tolosa Street Reservoir is mainly a balancing reservoir which can receive water from Knights Creek and Lime Kiln Reservoir, but principally receives water by pumping from the Derwent Water Supply into the Glenorchy reticulation system. The dam is a rockfill clay core embankment 20 metres in height.

Lake Fenton Supply

The Lake Fenton Reservoir is situated in the Mount Field National Park, a distance of 120 kilometres from the Hobart Metropolitan area.

The reservoir capacity is 4550 megalitres and is replenished from natural run-off from a catchment area of approximately 800 hectares. The pipeline intake level is approximately 365 metres above sea level and the 450 mm diameter pipeline supplies water to the high levels of Hobart and Glenorchy. This pipeline was first brought into service in 1940. Surplus water discharges into Hobart's Lower Reservoir. The pipeline capacity is 20 megalitres per day under gravity flow and 30 megalitres per day when boosted.

North

Bulk water is supplied to the municipalities of St Leonards, Lilydale, George Town, Evandale and Westbury from the North Esk Regional Water Supply taking water from the North Esk at Watery Plains. The City of Launceston has its own plant drawing water from St Patrick's River at Nunamara. Another scheme, the West Tamar Water Supply, supplying all developed areas in the Beaconsfield municipality, takes water from the Trevallyn Dam on the South Esk River. The North Esk Regional Scheme and the West Tamar Scheme are both managed by the Rivers and Water Supply Commission.

North-West

The municipalities of Circular Head, Wynyard, Penguin, Ulverstone, Devonport, Latrobe and Kentish in 1976 established the North-West Regional Water Authority to upgrade and manage the storage and distribution of local supplies. Since 1977 six treatment plants, seven pump stations, 17 reservoirs and 19 km of trunk mains have been installed with two reservoirs in Devonport and a treatment plant at Barrington currently under construction. Burnie manages its own scheme.

13.2.2 Irrigation, Drainage and River Improvement

With farming important for Tasmania's prosperity, the provision of a reliable source of water for irrigation and stock use has been fundamental to increased farm productivity. Over the years a number of irrigation schemes have been developed throughout the State including Cressy-Longford Scheme and Togari near Smithton (for details see 1985 and earlier editions of the Year Book). Currently under construction are the Winnaleah Irrigation Scheme in the North East of the State and the South East Districts Irrigation Scheme, the first unit of which is a new dam on the Coal River at Craigbourne. There are seven units planned for the South East Districts and the total area to be irrigated by pumping and pipeline is some 15 750 hectares.

LAUNCESTON WATER SUPPLY: A BRIEF HISTORY

The earliest method of supplying Launceston with water was very primitive indeed and consisted of carts travelling to the North Esk River near Hoblers Bridge and filling casks and barrels with buckets of water. The supply was far from ideal, being muddy and subject to tidal flow.

In 1836 the New River Scheme was commenced with the object of bringing water to Launceston from the South Esk River at Evandale by means of a cutting. The project was abandoned, mainly as a result of financial difficulties. About 1842 a scheme was designed to pump water from the First Basin by means of a large water wheel driven by water from further upstream. This project too was abandoned.

The position was relieved when a timber fluming was erected on the southern side of the Gorge to the mill at the foot of Bourke Street. A large tank was installed at the intersection of Bourke and Paterson Streets, the tank being fed from the fluming. Water carts were driven beneath the tank and the casks were filled by means of a leather hose. Small boats could also be watered by means of a longer hose.

Municipal government was established in 1852 and the first major undertaking was the preparation and execution of plans to divert water from St. Patrick's River at Nunamara to supply the city. A dam was constructed across the river about 12 miles from the city. Water was conveyed by concrete channels and a pipeline into the head of Distillery Creek and stored in a dam a few hundred yards downstream from the present Filtration Plant. Until the mid-sixties, this original storage was used to supply water to the Tasmanian Board Mills.

The scheme was completed in October 1857 and, as a mark of recognition of this important milestone in the town's progress, the ornamental fountain was erected in Prince's Square. The supply served the city, without modification for over 60 years.

After the First World War, Patons and Baldwins (now Coats Patons) agreed to set up a factory provided that they would be supplied with water suitable for the dyeing of wool. In 1925 the first stage of the present filtration plant was opened, treating water delivered to the plant by an open race. This made it possible for the water to flow through the plant by gravity, eliminating pumping costs. Today, one of the great economies of the Launceston water supply is that the majority of the city is gravity fed.

Newspaper clippings of letters published at the time show a similarity to those published 35 years later, before the advent of fluoridation. The themes were ethical ones of interfering with nature's pure water, despite the fact that 'pure', in this case, might mean the colour of tea and a gritty deposit in the bottom of the glass and, secondly, a concern that treated water would interfere with the growth of vegetables and plants.

In 1928 extensions were commissioned to double the capacity of the Plant and bring the nominal capacity up to 27 Ml/day. Over the following 25 years various improvements were incorporated to increase the efficiency of the plant and to increase the filtered water storage. Further extensions in 1954 increased the capacity to 40 Ml/day.

St. Patricks River has a catchment area of about 300 square kilometres and is estimated to have a minimum flow of 55 Ml/day. There is no reservation and both logging and farming take place within the catchment area. Since the only settlements on the river are Nunamara and Targa, sewage pollution is minimal and industrial effluents non-existent. Consequently, although the water entering the plant may be highly coloured and turbid at times, the water itself is of excellent quality.

The open race supplying the plant has been replaced by a pipeline and, more recently, improvements have been made to the headworks but, essentially, the water supply now is the same as it was 125 years ago.

Strangely enough, the water consumption has remained steady at about 9000 Ml/year for the past 25 years, but not so the number of consumers. From a maximum of 50 000 in 1955, the water population has dropped to a little over 33 000. The reduction has been partly due to the transfer of St. Leonards to the North Regional Water Supply. There has also been a continuing annual loss because business houses have been moving into the city and the population has been moving out to dormitory suburbs. The result has been that, although the base load has increased, the summer peak load has been reduced in proportion to the number of garden hoses. In recent years, the peak months of January and February have posed few problems, but to make provision for a future increase in demand, a site for a storage dam has been selected at Patersonia.

The Winnaleah Irrigation Scheme is a different concept, and is based on a disused mining dam called the Cascade Dam, constructed in 1934. In this scheme, water will be piped some 25 kilometres, to serve 1 200 hectares on 46 properties.

In 1984 the State Government established an Irrigation Office under the control of the Rivers and Water Supply Commission to promote the use by the farming community of irrigation to increase and diversify farm productivity. The RWSC for several years has been responsible for giving assistance to landowners in connection with the location, design and specifications of earth-fill dams up to a maximum of six to seven metres. In addition permits must be obtained from the RWSC for all dams or weirs on rivers, and any dam higher than 2.5 metres, or any work to hold back more than 25 000 cubic metres of water.

Monitoring water flows, the RWSC has some 200 sites around the State located in rivers, streams and creeks. These provide the statistical data from which to study the feasibility of irrigation, domestic water supply, river improvement and drainage schemes.

Drainage schemes have been established in the far north-west of the State and on Flinders Island. Works have consisted of clearing and de-snagging natural water courses and the excavation of channels, to assist with drainage and to mitigate the effects of flooding.

Landowners within the Drainage District assist with the costs of running the scheme, through the payment of rates. In return, landowners have received significant economic benefit from being participants in the schemes.

River improvement schemes also operate on specified rivers and streams. Again, by de-snagging and channel improvements, significant economic benefits flow to participant landowners. As with drainage schemes, participants are levied annual rates to assist with the running costs for the schemes. Schemes have been established on the Montagu River, Fixters Creek, Lobster Rivulet and Western Creek.

13.3 WATER TREATMENT

Since 1974 the RWSC has carried out, in conjunction with the Government Analyst, water quality analysis to test in part for abnormally high levels of pollutants. Most water in Tasmanian streams is considered to be of good quality and suitable for domestic, industrial and irrigation use.

Whilst water quality from rivers in Tasmania is generally good, treatment of bulk water occurs for most domestic use. Treatment is by the process of flocculation and the filtration of the treated water through sand filters. (See Domestic Water Treatment, Launceston Water Supply.)

One method of flocculation is the addition to the water of the chemicals aluminium sulphate and activated silica, which causes floc to form at a low concentration of alum. Floc contains most of the impurities and is drawn off to waste. After settling, the water is filtered, chlorinated and fluoridated before final delivery to consumers.

A variation on this process is that used at the Bell Bay Water Treatment Plant in the North Esk Scheme, and is called 'Sirofloc'. This process was developed by the CSIRO in the mid-1970's. In this process, magnetite and polyelectrolyte are added to the water, which has been mixed with a

Photographs showing conversion of rush infested swamps to rich arable land

small quantity of sulphuric acid. This solution is then passed over a magnet in the clarifier, where the heavy magnetite and colloidal material settles to the bottom. The clarified water is collected from the top. The magnetite slurry is collected and re-generated.

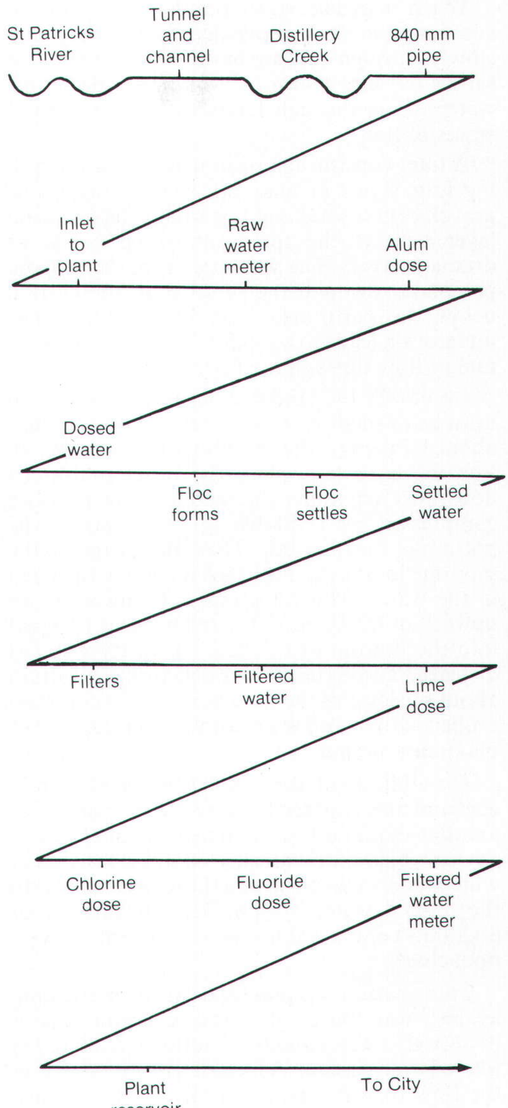
13.3.1 Domestic Water Treatment; The Launceston Water Supply

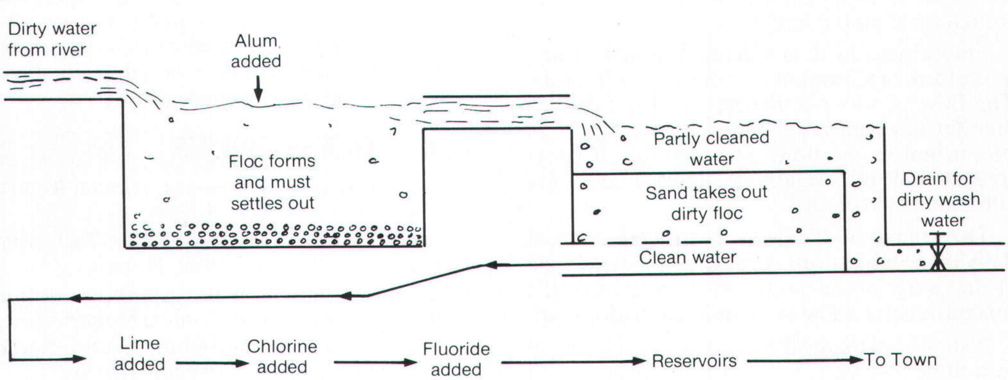
The Launceston water supply is drawn from the St Patrick's River which has a catchment area of about 300 square kilometres.

At Nunamara, about 20 kilometres from the City, a portion of the flow of the river is diverted by means of channels and a tunnel into Distillery Creek. About a mile from the Plant site, a small weir diverts the necessary flow into an 840 millimetre pipeline which delivers 'raw' water to the Plant.

The incoming water is controlled by two valves which automatically regulate the flow according to the requirement. A flow meter measures the quantity of raw water and makes a continuous record on a chart.

Treatment commences with the addition of a solution of aluminium sulphate ('alum') to the raw water. The quantity of chemical added is dependent upon the condition of the water. Dirty water requires more alum than cleaner water. The necessary amount of alum solution is fed continuously by a proportioner which automatically regulates the dose to compensate for changes of flow. The alum reacts with the natural alkali in the water to produce a floc. This consists of minute particles which coagulate to form visible particles of jelly-like material which trap solid matter and also remove colour from the water.





When coagulation is complete, dirty floc is suspended in clean water. By flowing the water slowly through settling basins most of the floc settles out and is run off to waste. The settled water is run through filters to remove the last traces of floc.

A filter consists of a rectangular tank containing four layers of material; coarse gravel, fine gravel, course sand and fine sand. The fine sand layer acts as the filter and those below as drainage layers. The water enters at the top and percolates through the sand to an underdrain below the perforated base of the filter. The underdrain leads to a module which controls the rate of flow through the filter.

Eventually the sand bed becomes clogged and must be washed. While in operation the filter has about 1.7 metres of water above the sand. When washing is to take place the water is drained down to 15cm above the sand and low pressure compressed air is blown up from jets in the bottom of the filter bed. The bubbles agitate the sand and loosen the dirt which remains suspended in the water. This air scour is followed by an upwash in which clean filtered water is pumped into the bottom of the bed. The dirty water is displaced and is run off to waste through a drain about the level of the sand bed. The filter is then refilled with settled water and is again capable of maximum output.

The addition of alum makes the water slightly acid and lime is added to correct this acidity. The amount required is determined by an electrical device which automatically controls the rate at which lime, in the form of a thin slurry is fed into the filtered water stream. The pH (acidity or alkalinity) of the water is recorded continuously on a chart.

Chlorination is practised as a precaution against waterborne diseases. Chlorine gas is dissolved in water and the solution is fed into the filtered water stream. A metering device measures the flow of water and controls a feeder which delivers the required amount of chlorine. The weight of chlorine being delivered can be read from a scale on the feeder.

Fluoride is added, as a dental health measure, in the form of a solution of sodium silicofluoride. The flow of water is metered and the desired amount of chemical is added automatically in proportion to the flow. The quantity of water treated and the weight of fluoride used are continuously recorded.

The accuracy of the chemical dosage is checked daily in the laboratory. Tests are also performed at each stage of the treatment to ensure that the final product shall be clear and free from colour.

From the plant the filtered water is discharged into three reservoirs with a total capacity of 18 megalitres and from thence into the City reticulation system.

The plant operates continuously, working three shifts per day, throughout the year.

Miscellaneous Information

Average amount of chemicals used per megalitre of water —

Alum	20	kilograms
Lime	8	kilograms
Chlorine	1	kilograms
Sodium silicofluoride	1.65	kilograms
equivalent to fluoride	1	kilogram

The plant has eleven filters with a total nominal output of 41 megalitres of filtered water per day. the annual output is approximately 9 000 megalitres, equivalent to about 250 kilolitres per head of population.

13.3.2 Computerisation of Water Treatment

A first for Tasmania, and Australia, has been the installation by the RWSC of a computerised control system for monitoring water flows in the North Esk and West Tamar Schemes. Known as the Kent 115 Telemetry Monitoring Control System, it uses a series of UHF radio links for the transmission of data between reservoirs, treatment plants and the central unit at Launceston, to monitor and control water flows. At any time, from the central unit, the status of outstations can be observed and modifications and adjustments made, as required. This has led to a dramatic increase in efficiency, and has reduced overtime payments to staff who were required to actually visit pump stations and reservoirs to control water flows.

The computer system is currently being upgraded to colour and graphics, and additional sites are being added to the monitoring process.

There is little doubt that in the years ahead other innovations in water resources management will change a field where traditional methods have sometimes been unquestioningly adopted. Often such practices were based upon sound experience, but technological and economic factors now dictate a more scientific and rational approach. Water will continue to be a valuable element of Tasmania's natural resource endowment.

13.4 REFERENCES

Hobart Regional Water Board, Annual Report, Government Printer, Hobart.

Hobart Walking Club Inc., *The Tasmanian Tramp*, No 25, 1984–1985, Hobart.

North-West Regional Water Authority, *Annual Report*, Government Printer, Hobart.

Rivers and Water Supply Commission, *Annual Report*, Government Printer, Hobart.