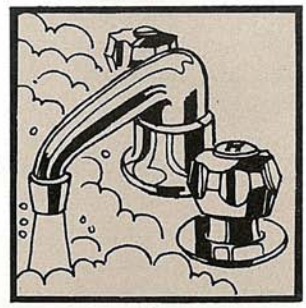
Using, and preserving, Perth's groundwater



Perth is a city built on ancient sand dunes. Underfoot, topsoil is virtually non-existent; the rich yellow, grey, or vivid white grains are beach-clean. The natural vegetation, hardy enough to survive with a dearth of nutrients, also endures an annual 6-month drought.

A surprise to the visitor, then, is that Perth is, in the English tradition, so green. Water gushes from sprinklers everywhere, helping to dispel the fierce summer heat and creating a verdant oasis.

Like drink spilt at a beach party, however, the water flows straight into the sand. To keep gardens alive, Perth's citizens consume more water per head than those of any other Australian city.

The figures for 1975–76 show that Perth used 681 litres per person per day, compared with Brisbane, 649; Adelaide, 487; Sydney, 470; and Melbourne, 343. Maximum summer demand on one day that year reached 1243 litres per person. Not surprisingly, perhaps, in normal years about 60% of the city's total water consumption (119 million cubic metres in 1978–79) spurts out of a hose or sprinkler.

Perth is a rapidly growing city, and as it grows water demand increases just as quickly. The Metropolitan Water Supply, Sewerage and Drainage Board ('the Water Board') estimates that the city's water demand will increase by about 75% by the end of the century.

In the past the extra water has been provided by damming one more river in the Darling Range inland from Perth. That procedure cannot be followed indefinitely; within the next decade or so there will be no significant river close to Perth left to dam. From then on, the only extra sources of surface water will be brackish, expensive to collect, or, for conservation or recreation reasons, preferably left alone.

Fresh water could be brought from the south-western corner of the State — but at a cost. A 1·4-m-diameter pipeline costs almost $600 per metre, so the necessary 250-km-long pipeline would cost at least $100 million. One from the Ord dam in the north-west might cost ten times as much.

But there's no need to look so far afield — one source of water lies right underfoot — groundwater. You don't have to be a water diviner to find it, either. A virtually continuous sheet of groundwater underlies nearly the whole of the Swan Coastal Plain on which Perth is sited.

Embedded in a layer of sand tens of metres thick, it extends for 3600 sq km. Dr Tony Allen of the Geological Survey of Western Australia estimates that the stored volume of water is something like 18 000 million cu m, although not all of this could be used. For comparison, the combined storage of all Perth's river reservoirs is a mere 500 million cu m. It's fair-quality water with little dissolved salt, although in places it is brown and a bit smelly, and it lies just several metres below the surface. It seems like the answer to the water engineer's problems.

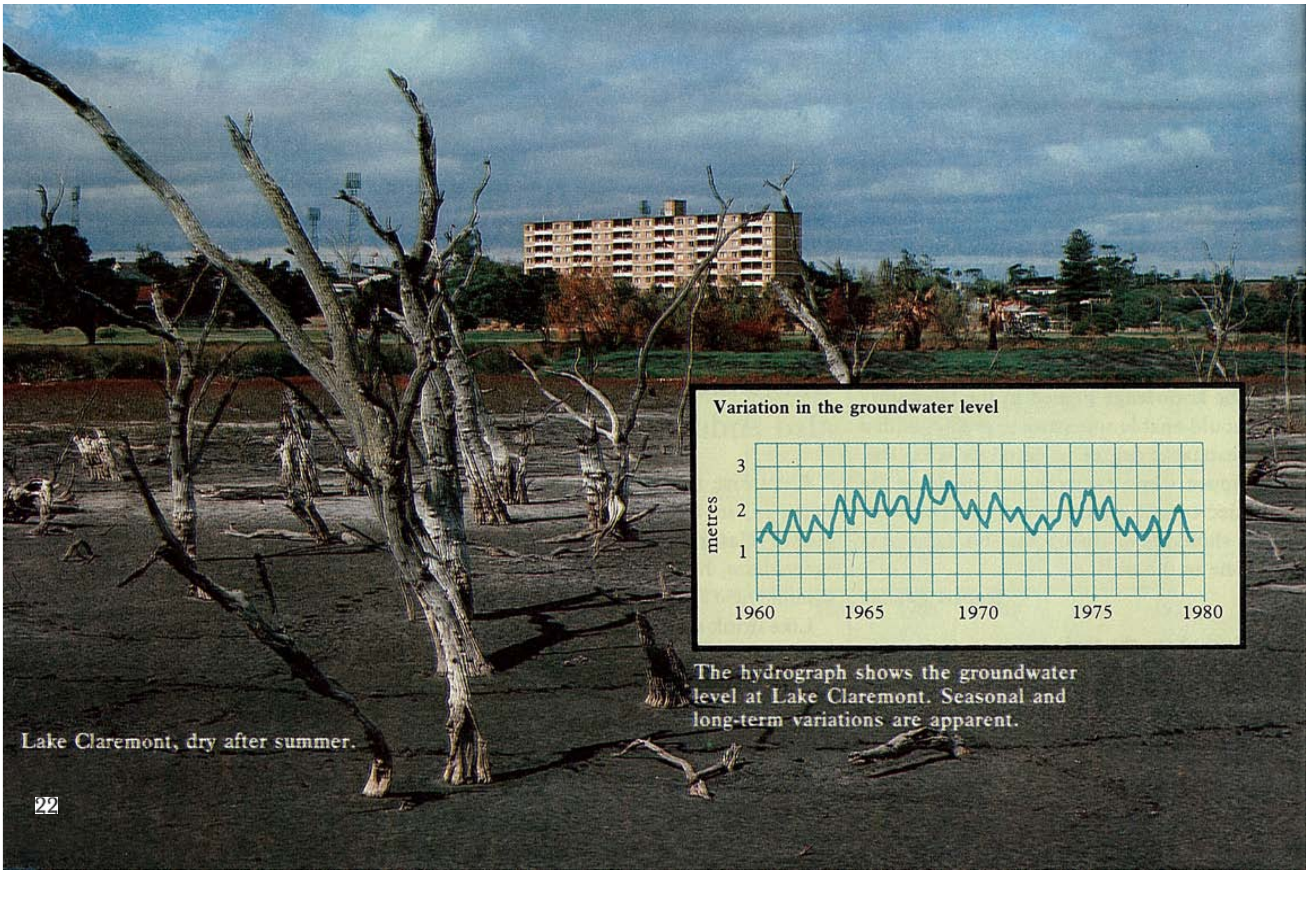
As it happens, this shallow groundwater was used last century to supply the fledgling city before superior water was procured by damming rivers in the hills. Some bore water from deeper aquifers has been tapped since the 1900s, but significant public exploitation of the shallow underground supply did not commence again until 1971, when the Water Board began the first of a series of schemes (at Mirrabooka) to augment hills water. Drawing up water from various depths, the Mirrabooka scheme treats and supplies 59 000 cu m a day. Tapping the resource has increased apace, with a second scheme at Gwelup operating since 1974 (55 000 cu m) and a third at Wanneroo since 1977 (90 000 cu m). Each of the schemes draws water from a number of bores in the locality of the treatment plant.

The centre of Perth is built upon filled-in lakes.

By 1977 Perth was in the grip of the worst drought in its history. From 1976 to 1979 stream flows were the lowest ever recorded.

To prevent exhaustion of the water supply, water restrictions were imposed. The amount of water taken from the ground reached 55 million cu m in 1977–78 — 49% of the total supply. The drought also prompted numerous private bores to be sunk so that their owners could care for their gardens unhampered by the restrictions.

Now although the groundwater resource is large, there must be limits to the amount that can be pumped out without creating problems. The Water Board, the CSIRO Division of Land Resources Management, the Environment Protection Authority (through its agent, the Department of Conservation and Environment),



The hydrograph shows the groundwater level at Lake Claremont. Seasonal and long-term variations are apparent.

Lake Claremont, dry after summer.

A lakeside scene.

and the Geological Survey of Western Australia are among the organizations engaged in studies aimed at assessing the resource and the impact of drawing on it. All provided information for this article.

Harvesting or mining

A close examination of this resource, to ensure that the water is harvested rather than mined, is demanded. The critical question is: how much can be safely drawn in the confident expectation that it will be completely replaced?

An illustration of what can happen if too much groundwater is removed comes from Carnarvon, where long-term damage was inflicted a number of years ago on the supply there. Excessive pumping, from beneath the (often dry) bed of the Gascoyne River caused sea water to intrude into the aquifer. Now wells are both licensed and metered to prevent a repetition.

The water we are most concerned about is the unconfined groundwater found in the sand dunes down to about 100 metres depth.

Two other aquifers, known as artesian and sub-artesian aquifers, occur in distinct layers down to as deep as 700 m. The Water Board supplies 15–20% of Perth's needs by pumping from them.

Some of this deep groundwater has to be cooled before it can be used, and it also may be brackish and require desalting or dilution. Water enters these lower aquifers through a narrow surface band on the foothills of the Darling Scarp. Recently, the Geological Survey established that leakage from the shallower aquifers above is also important in recharging them.

The unconfined groundwater has much larger capacities for fulfilling water needs. The risk of environmental damage resulting from overpumping is the main factor limiting the amount of water that can be extracted.

Probably 50 000 households in the metropolitan area now each have a bore.

Lakes and birds

In low-lying areas, the groundwater table actually rises above the surface, forming dozens of shallow fresh-water lakes. A chain of these lakes, originally depressions in the sand dunes, runs north and south through Perth, giving the city an asset notable for its vegetation, wildlife, and beauty. These wetlands are the only permanent fresh-water bodies of biological consequence in the entire south-west. Migratory birds, from inland and overseas, depend upon them for their existence.

Yet two-thirds of these wetlands have already been drained and reclaimed for use as farm land or, in urban areas, housing sites. Most of the remaining lakes are only one or two metres deep. Excessive pumping of groundwater, especially close by, could see their lowering or disappearance.

A further reduction in the area of wetlands would mean fewer ducks and swans and have other adverse effects on the fauna. The vegetation of the area is also closely tied in with the depth of the water table. A permanent depression in the level of the water table could lead to the loss of some of the flora.

Bore water keeps this garden lush.

The surface aquifer is, in effect, two giant puddles left over from rain and protected from evaporation by the overlying sand. The body of water to the north of the Swan River is known as the Gnangara mound, and a smaller one to the south as the Jandakot mound. The term 'mound' derives from their shape: lower where they touch draining creeks or the ocean; higher in the middle where the water has no quick escape route.

Water moves slowly from the top of the mound to the edges. Monitoring boreholes maintained by the Water Board have shown that the Gnangara mound is more than 70 m high, and that the water, moving 'downhill' at about 20–30 m a year, takes hundreds of years to percolate through the sand grains to reach the drainage lines at the edges.

Rainfall keeps replenishing the mounds. But Dr Allen estimates that only 8·5% of a rainfall of 813 mm (approximately Perth's average) becomes recharge to the groundwater. The remainder is lost by evaporation and transpiration by vegeta-

Contractors sinking a bore.

tion, particularly trees. Evaporation takes more in summer than in winter, when most of the recharge occurs (nine-tenths of Perth's rain is received between June and November). The water table consequently fluctuates with the seasons, its extremes varying in sympathy with their relative wetness or dryness.

The Gnangara mound, covering 2000 sq km, receives, on Dr Allen's estimate, an average of 150 million cu m of water a year from rain, an amount that, before exploitation of the resource began, was matched by a similar volume draining off to sea. The amount of this available for use depends on how much we are prepared to lower the water table.

Unfortunately, however, the effects of different extraction rates on groundwater levels are not easy to determine. The various inputs and losses are in dynamic balance, like a constantly topped-up leaky bucket, and it is difficult to separate the natural fluctuations from those imposed by pumping. The depth to the water table varies from place to place, mainly with undulations of the sand-dune soils over the groundwater mounds. Recharge also varies greatly; it can be as high as 25% of rainfall on higher dunes, whereas in wetlands and areas where the water table is shallow more water may be lost by evaporation than is contributed by rain.

The very heart of Perth sits on eight filled-in lakes.

When groundwater is pumped, a 'cone of depression' develops in the water-table level around the bore, with the major effect on the level at the bore site, tapering to a minimal effect some distance away. With very heavy pumping from many close sites, a general lowering of the water table takes place. Surprisingly, such an effect may be beneficial for water supply, since the water table may fall below the root zone of most trees, reducing the amount of water lost through transpiration.

On the other hand, the effect, if prolonged, will be disastrous for the trees, or for lakes and their wildlife that happen to be nearby. Of course, the water table at times falls as a consequence of dry seasons, but it recovers again. Indeed, settlement of the Perth area over the last century or more has led to a rise in the water table because vegetation has been cleared to build houses. Butler's Swamp is now Lake Claremont, and a number of old fences near lakes are now submerged. Filling in of some wetland areas may also have contributed to rises in water-table levels, because it has reduced evaporation.

But, as Mr Barry Carbon of CSIRO sees it, there is no going back to the 'natural' levels of last century. The lakes are now seen as a valuable resource, and they need to be preserved for our use, even if this means pumping water into them during summer.

The dynamic balance

The Water Board considers it can safely withdraw half the water now flowing to the sea without significant drawdowns. In 1978–79 it extracted 29 million cu m from the Gnangara mound, an amount equivalent to about 20% of the throughflow (or 1·5% of the total rainfall). Tapping of the Jandakot mound has begun: a new series of wells there has an initial capacity of 5·5 million cu m a year from the unconfined aquifer, about 10% of the throughflow.

Proceeding cautiously, the Board has sunk more than 800 wells to record water-table levels and monitor groundwater quality. The water-level information is used in computer models to assess any changes in the dynamic balance. The drawdown so far on the Gnangara mound has been less than that predicted; indeed, it is difficult to separate the effects of pumping from seasonal, climatic, and local variations in water levels.

What then is the limit? The Board estimates that the total amount of replenishable groundwater, at all three levels, in and around the metropolitan area is about 200 million cu m per year. Such a volume substantially exceeds the current annual consumption of hills water.

The Board has plans to extend the well-fields on the Gnangara mound so as to extract 70 million cu m a year by the turn of the century, more than twice its current extraction rate. A mathematical model of the effect of this extraction on the water table, devised by the Board's engineers, indicates that the drawdown will be greater than a metre over an area of 660 sq km, of which 45% will be within State forest. The drawdown is expected to be greater than 3 m over 240 sq km, of which 60% will be within forest. Excluding the immediate vicinity of the production wells, it should nowhere exceed 5 m.

Expenditure by the Board on exploration, monitoring, and production well-

A Landsat picture of Perth, showing the lakes where groundwater rises above the surface.

drilling has increased from about $100 000 in 1971–72 to $1·5 m in 1978–79, a worth-while investment from the Board's point of view. Groundwater bores are cheap, can be quickly installed, and can provide full output even in drought years. Furthermore, they are located close to their point of use, so expensive mains are not required.

On the debit side, the water is typically brownish, with a trace of iron. (Many fixtures in Perth show a characteristic brown stain that indicates the sprinklers have been operating on bore water.) The Board therefore incurs high costs in treating the water to a stage where it is suitable for drinking. There is promise of a reduction in cost by use of new water-treatment methods such as Sirofloc, a technique using treated magnetite as a flocculant (described in *Ecos* 21).

The first full-scale Sirofloc plant, with a capacity of 35 000 cu m a day, is being built at Mirrabooka after successful operation of a pilot plant there.

Constraints

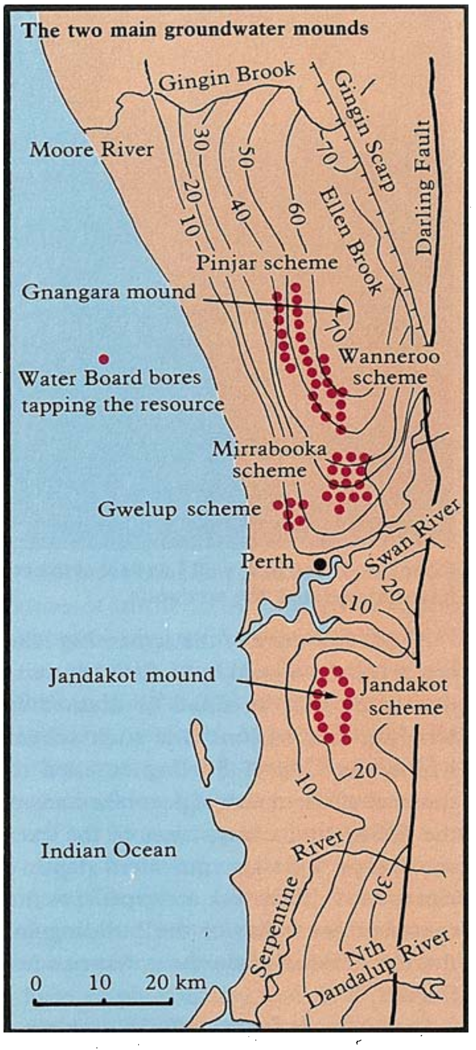
While intending to use the groundwater to its fullest, the Board has its constraints. Its elaborate system of monitoring wells is perhaps the best protection against excessive drawdowns unwittingly taking place, and all Water Board activities need the approval of the Environment Protection Authority of Western Australia. The Board submits well-field development proposals to the EPA, and reports each year on the effects of its pumping.

It keeps clear of recharge areas for the deeper artesian aquifers and takes care to avoid creating interference with private wells.

This brings us to Mr Carbon's main concern — the proliferation of back-yard bores. Unless within an 'underground water pollution control area' (these are mainly near the Water Board wells), no licence is required to sink a shallow well. There is therefore no record of the number of such bores, but three recent surveys — two done on behalf of CSIRO, the other by the Australian Bureau of Statistics for the Water Board — show a figure close to 50 000, and it is rapidly increasing. The bores require no metering, so consumption is not known, but a reasonable estimate would be 50 million cu m, substantially more than the Board's extraction.

Then again consumption by market gardens, irrigated solely from groundwater, by industry, and by local councils watering playing fields, probably adds another 50 million cu m to the figure. Unlike the Board's schemes, these other water-users are largely free of environmental constraints. Again, no licensing or metering is carried out, although the Water Board's monitoring wells check the total effect.

Extraction by private and council bores could have a much more marked effect on the groundwater level in sensitive areas of Perth than Water Board pumping from distant well-fields. And Mr Carbon warns that, if bores continue to go down close together on suburban blocks, the time will come when the owners find they have spent more than $2000 apiece on wells that go dry. He estimates that, in the middle of the recent drought, Perth people were spending $40 million a year on new bores.



The body of water to the north of the Swan River is the Gnangara mound; the smaller one to the south is the Jandakot mound. The contours show the height of the groundwater (in metres) above sea level.

Approximately one Perth suburban block in four now has one. Calculations by Mr Carbon indicate that not more than one block in two can operate a bore and be confident of a continuing water supply. If the bores are drawn on in an excessive and wasteful manner, the figure may be as low as one in four.

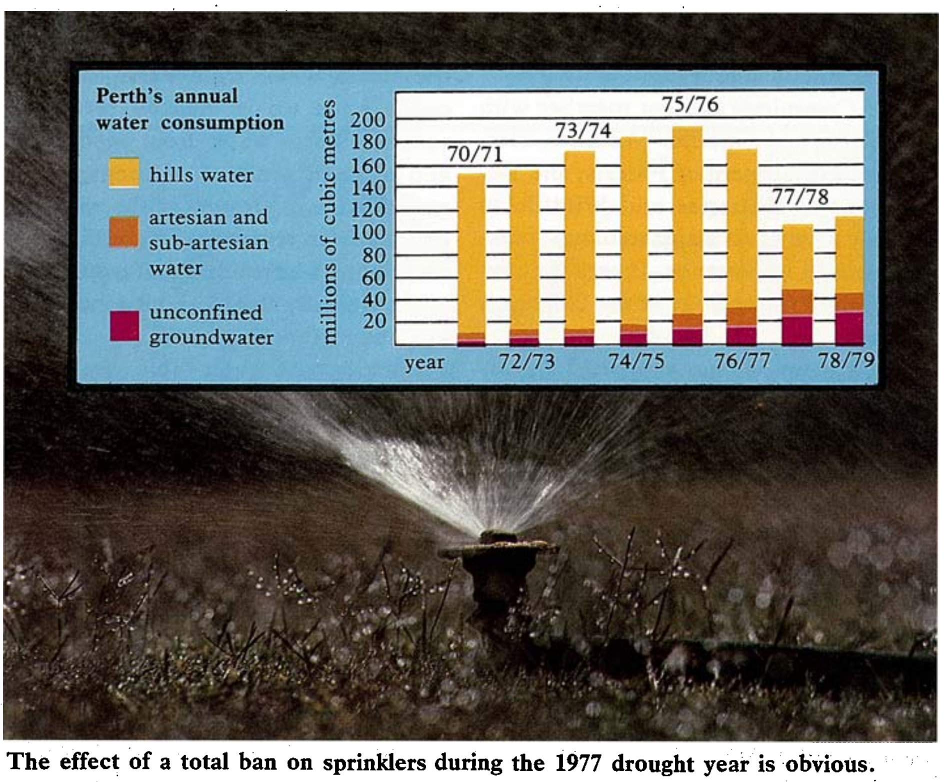
Mr Carbon suggests that, after land-clearing and housing development, an annual recharge of up to 550 mm could be expected from Perth's average rainfall. Therefore the average bore-owner, probably using between 1000 and 2000 mm on his land in summer, will remove about two to four times the maximum recharge. It is figures like these that lead Mr Carbon to doubt that all people in the Perth metropolitan area can have unrestricted access to private sources of shallow groundwater.

Groundwater has such a long memory of past abuses.

The general effect

Let us now look in more detail at the possible effects on Perth's lakes of a general depression of levels by only 1 or 2 metres. According to Mr Colin Sanders, Chief Environmental Officer of the Western Australian Department of Conservation and Environment, the effects would be severe. During Perth's recent drought, such groundwater depressions came about naturally. Lake levels dropped and shallower ones dried up completely. Birds from inland areas were forced to congregate on the few remaining shallow lakes, resulting in death from outbreaks of avian botulism and starvation.

A permanent lowering in the water table would, Mr Sanders believes, result in a shift in the vegetation cover towards species that are more drought-tolerant. The taller eucalypt woodland, dominated by jarrah and marri, would be gradually replaced by lower open woodland species, mainly banksia. Around lakes, rushes would tend to be replaced by sedges.



The effect of a total ban on sprinklers during the 1977 drought year is obvious.

As some animals depend upon a largely fixed vegetation type for habitat, they would be affected. The Western Australian Museum has surveyed the number of species of fauna in the coastal plain, and found large changes since the advent of European settlement. Only 15 native mammal species could be found, compared with the 33 thought to have been there at the beginning.

However, the Museum believes the paucity of mammal species found is mostly due to disease and feral animals, rather than habitat changes. Possible exceptions are the short-necked turtle *Pseudemydura umbrina* (the only endemic species of the northern coastal plain), the fish *Galaxiella munda*, and the freckled duck *Stictonetta naevosa* — all rare or endangered species.

Birds have not been as seriously affected. Of the 223 species recorded originally, nine are no longer to be found and another four are on the verge of local extinction.

To preserve the remaining indigenous flora and fauna of the Gnangara mound, the Department of Conservation and Environment has initiated moves to set aside new reserves outside the areas likely to be influenced by groundwater pumping. Taking water from the Jandakot mound doesn't create the same environmental dangers. The area is mainly agricultural land where clearing has raised the water table and significantly changed the flora and fauna.

Disappearing wetlands

Whether or not the pumping rate accelerates and, in response, water-table levels drop, the future of many of the wetlands is by no means assured.

> *Since 1829, two-thirds of the original wetlands have been destroyed.*

Since 1829, two-thirds of the original wetlands have been destroyed by filling in, drainage, or refuse disposal. The very heart of Perth, the central business area, itself sits on eight filled-in lakes. A chain of lakes north of the city was, in the latter half of last century, drained and the beds used for market gardens. Bird numbers at Lake Claremont have never reverted to what they were before the lake was used as a landfill site.

Checking to see how well Landsat sensors have interpreted the wetlands.

About one-third of the remaining lakes are privately owned, and the risk exists that some will be filled or drained for building subdivision. One such scheme within the City of Stirling entailed the removal of about 4 m of peat lake-bed and the filling and compaction of the excavated area with an equivalent depth of clean sand. This was an expensive process, but the value of the building lots thereby created made the enterprise profitable.

In coming to terms with the problem of diminishing wetlands, the Western Australian Department of Conservation and Environment in 1976 established an interdepartmental Wetlands Advisory Committee. All local authorities are now asked to refer all development proposals that could significantly affect the wetlands to the Committee before the proposal is finally approved.

The Committee has got together with the Western Australian Museum, Herbarium, Department of Forests, and Department of Fisheries and Wildlife to compile a list of all major wetlands, ranking them in importance. It sees the preservation of the ecology of the Gnangara mound wetlands as imperative.

The Committee has supported a study by Dr Frank Honey of the CSIRO Division of Land Resources Management to evaluate aerial photography and Landsat imagery as a means of regularly monitoring the well-being of these wetlands. Dr Honey is using aerial images to provide information on the extent of individual lakes, the clarity and depth of their water, and the type of surrounding vegetation and its health. He is hopeful that satellite images will be a convenient way of monitoring the lakes.

Apart from seasonal fluctuations, no gross changes have yet been observed in the character of any of these lakes except Lake Gnangara, which was studied as an example. This lake dried up in the 1978 drought year. Fortunately, the resultant change in its vegetation appears to have been reversible, with conditions now similar to those in 1972 when the first detailed survey was made.

However, it is the long-term trends that need watching. It seems ironic that urban development that initially led to a rise in the water table is now lowering it again.

Effects of urbanization

Blue Gum Lake and Booragoon Lake were originally overgrown swamps that periodically dried up. Urban development has raised the water table — in the case of Blue Gum Lake, killing off the vegetation fringing it. Very little natural vegetation at all now remains around the lake. Lake Booragoon, by contrast, is still surrounded by a narrow fringe of native vegetation. However, the water level in both lakes is now artificially maintained by controlling drain flows. Is this life-saving exercise the eventual fate in store for all Perth's lakes?

In the long term, this could happen, thinks Mr Carbon. But in the shorter term it seems possible that increased pumping rates will be largely balanced by increased recharge.

Suburbs reduce the vegetation cover and it is estimated that they nearly halve the losses due to evaporation. With large areas of paved surface, they also allow rainfall to concentrate in localized areas, thereby increasing infiltration (much of the storm water from Perth suburban roads ends up in nearby rain-water sumps). Waste water from septic tanks and a small amount of seepage from garden watering (much of the water still coming from reservoirs in the hills) also contribute. The result is that groundwater levels typically rise by about a metre after suburbs replace the bush.

Luckily, the water-table rise due to urbanization tends to compensate the drawdown effect of back-yard bores. But the future looks a good deal less rosy, as pumping rates increase. When more than one household in four has a bore, the water level will not stay elevated. Integration of drainage schemes and groundwater pumping schemes may help in localized areas, particularly near lakes, where artificial recharge of lakes can also help out.

While the groundwater of the Perth

suburbs is probably destined to slowly sink deeper below the sand, it is worth considering in closer detail the role that septic tanks can play in replenishing the groundwater, perhaps staving off the day of reckoning a little further.

Septic tanks help out

Although reluctant to accept the title of septic tank capital of Australia (apparently Melbourne has just as many), Perth has the highest proportion of septic tanks (50% of households) of any Australian city. Some 400 000 people using 120 000 septic tanks obviously generate a large quantity of effluent, one estimate giving a figure of 175 000 litres per system per year. Whether we call it recharging or recycling, the fact remains that all of that water, derived in the main from hills reservoirs, adds to the supply capabilities of the groundwater. As a significant asset to Perth, this contribution rises in value when it is considered that it would cost $1000m to sewer the whole metropolitan area.

However, septic tanks bring with them a serious uncertainty about whether the groundwater is thereby suffering pollution.

The sands of Perth appear to be an excellent medium for removal of readily biodegradable organic material; their ability to filter out bacteria and viruses also seems first-rate, especially where the sand is finer and more clayey. However, at present it is impossible to say with confidence whether septic tanks can be used as a permanent waste-disposal system.

Mr Brian Whelan and Dr Jim Barrow, of the Division of Land Resources Management, and Mr Bill Parker of the Queen Elizabeth II Medical Centre have joined with Mr Carbon to trace the fate of effluent from many septic tanks throughout Perth.

They found that if the groundwater level comes close to the bottom of a septic tank's soak well, there is a real risk of microbiological contamination. In such areas, household effluent would need to be discharged elsewhere. However, if the groundwater level lies more than 1 m below the point of discharge, in most situations elimination of faecal organisms is effectively complete, thanks in great measure to the well-aerated sandy soil. Where there are no fine particles in the sand, 2 m or more may be necessary for complete safety.

Of more concern, perhaps, are the quantities of nutrients — nitrogen and phosphorus — that are not removed by percolation through sand. Unlike heavier soils, the sands of Perth have very limited capacity to fix nutrients. Most soil types allow nitrogen to pass through, but the Perth sands allow phosphorus to pass too.

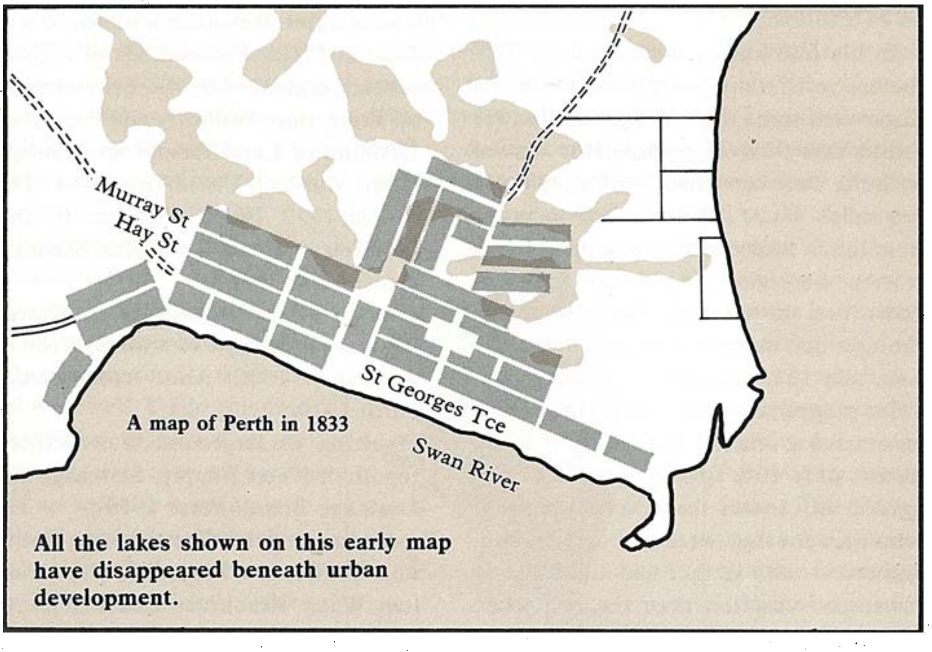
The nitrogen and phosphorus come mainly from body wastes, although a good deal of the phosphorus is provided by detergents. The scientists estimate that about 400 tonnes of phosphorus (in the form of phosphates) and 2200 tonnes of nitrogen (in the form of nitrates) are being added annually to the groundwater from septic tanks. To these quantities must be added the amounts washed in from excessive fertilizer applied to lawns.

Septic tanks are suspected of causing high nutrient levels in Lake Joondalup, promoting algal blooms and general eutrophication. People using bore water on their gardens probably don't mind the liquid fertilizer they add with the water; more caution is needed if bore water is drunk, since nitrates are toxic. However, Water Board treatment plants are designed to remove such pollutants before reticulation.

The Water Board is conducting trials at its Canning Vale sewage-treatment plant to gauge the feasibility of discharging the treated effluent onto spreading basins, thereby recharging the groundwater. It is also looking at schemes to remove phosphorus. The CSIRO Division of Land Resources Management is looking to see whether nutrients can be removed by trickle-irrigating pines with treated sewage effluent.

However, it is still too early to say whether recharging groundwater with septic tank effluent or treated sewage effluent is a wise thing. If it proves not to be, the unfortunate aspect is that groundwater has such a long memory of past abuses.

The practice of using swamplands as 'sanitary landfill' sites is a dubious one.



A map of Perth in 1833

All the lakes shown on this early map have disappeared beneath urban development.

The fate of liquid waste

Possibly the biggest cause for concern from the pollution point of view is the 500 million litres or more of liquid waste that are disposed of each year around Perth. The sand's ability to cope with organic chemicals — acids, alkalis, cyanides, metal complexes, and the like — is very suspect. Some of the sites are simply areas for garbage disposal, often swamplands, set aside for the purpose.

The practice of using swamplands as 'sanitary landfill' sites is a dubious one. Although the peat and similar organic matter there help absorb pollutants, danger lies in the material being in close contact with the water table. The danger can be magnified by excavating the site to groundwater level before dumping begins, a not-unusual practice. Another risk is that peat is easily clogged, leading to a run-off of pollutants.

Sometimes disused limestone quarries are used, the danger here being that limestone contains cracks through which liquid waste can escape.

Landfill disposal sites almost inevit-


Playing fields watered from a bore.

ably end up as open spaces, usually recreation parks. It is then very easy for sprinklers to leach pollutants from the underlying rubbish into the groundwater. Breakdown products from organic matter have been known to travel through 10 m of soil.

One characteristic of groundwater pollution is that it moves away very slowly. In the mid 1950s a factory was established in the then rural area of Gosnells to manufacture the weedicide 2, 4-D. Waste was disposed of in on-site pits. Some time later, neighbouring poultry-farmers found their birds poisoned by water pumped from underground. Fourteen years later, after the factory had been removed, massive pollution was still present.

As a precaution, the Water Board regularly tests all its production wells for pesticides. It also maintains surveillance of groundwater near residue ponds filled with alkaline red mud left over from bauxite-refining (7 million tonnes of the waste are dumped into clay-lined settling ponds every year). Water from wells located near landfill sites is analysed particularly closely.

Most of the pollutants detected so far have been non-toxic. However, this will only continue if the authorities maintain strict control over the kinds of materials disposed of. If 'sanitary landfill' sites are no places for toxic liquid wastes, where in the Swan Coastal Plain can they be put? No answer is immediately apparent.

Making do

If people's demand for water fell, the pressure on supplies as Perth's population grows would not be as great. During the past drought, the consumption of reticulated water was reduced by 10% by a save-water publicity campaign and by 50% when a total ban on sprinklers was introduced. Although these figures could not be maintained permanently, they show what scope there is for curbing demand.

Dr Geoff Syme, a psychologist at the Division of Land Resources Management, has been conducting surveys of Perth householders to determine the most effective ways of holding down water consumption.

He found that 92% agreed that 'Perth people use too much water'.

In his first survey conducted in 1977 (before restrictions were introduced) he discovered some interesting attitudes. He found that 92% of respondents agreed with the statement that 'Perth people use too much water'. When asked to judge how much household consumption was wasted, they gave an average figure of 26%. Yet, on average, the respondents thought that their own households could save only 13% of current consumption.

In response to another statement, 'compared to others I don't use very much water', only 10% strongly agreed or disagreed. But it was these same people — who thought they were low or high consumers — who in fact had significantly lower consumption than the rest when water bills were examined.

A general finding to emerge from the survey was that most householders have little conception of what is normal water consumption and what is extravagant. To Dr Syme, this suggests that some form of feedback on the water-meter reading is in order. If the water bill was accompanied by a statement of where the household's consumption stood in relation to the neighbourhood's, people's consumption patterns might be modified. It seems pointless asking people to save water if they don't perceive the message as being directed at them.

Psychology aside, Mr Carbon can suggest a number of straightforward ways to reduce consumption. Spreading some fertilizer may be a better way of keeping a lawn green than using excess water. And of course plant species native to the area will hardly need extra water at all. Native gardens are catching on in Perth, Mr Carbon notes. He also considers the time has come to consider whether controls are needed to prevent excessive use of private bores.

Ultimately, the price of water will probably determine consumption levels. In a recent move, the pricing scheme was altered so that Perth residents, unlike those in most cities, now pay water rates that depend almost entirely on the amount consumed — 17 cents for each cu m (on top of a small allowance). Unless escalating consumption is brought under control, the cost will be high — in monetary terms and, if the groundwater is overexploited, environmental terms. That may be the price of living in the driest State of the driest continent.

Andrew Bell

More about the topic

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