9 Conclusions

An environmental condition associated with approval for the construction of the Harris Dam was that the salinity of Wellington Reservoir should be reduced to potable levels. The State's Salinity Strategy set a target date of 2015. To achieve the aims in the Collie Catchment with full involvement of stakeholders, Water and Rivers Commission has established the Collie Recovery Team.

As well as the Commission, the Collie Recovery Team has representatives of landholders from the main salt-affected areas of the Collie catchment; from the Shires of Collie and West Arthur; and from Agriculture WA, CALM, Western Power and the Water Corporation. The Team has divided the catchment upstream of Wellington Reservoir, referred to as the Collie Recovery Catchment, into 8 Management Units based on the boundaries of subcatchments. The Team wants more than to simply meet the inflow water quality target: it has a vision of the Collie Recovery Catchment with a healthy and productive environment; delivering adequate potable water to Wellington Dam, while sustaining a stable and prosperous community.

This review of the salinity situation in the Collie Recovery Catchment concludes that:

- Since 1990 there has been no trend of increasing salinity of inflow to Wellington Dam. This is thought to be due in part to the rises in groundwater following clearing being substantially complete, and in part to the effects of plantations established by then.
- Further reduction in salinity is expected once all existing and planned plantations have been fully established. This will not, though, be sufficient to meet the inflow salinity targets.
- There are other technically feasible management options with potential to reduce the inflow salinity to its target, including engineering options and/or further tree planting.
- Full effects of treatments can be expected to be realized within 10 years of commencement. Hence all required treatments should be in place by 2005 to meet the 2015 target.
- Continuing protection of remnant native vegetation is important to maintain its water-use functions, loss of which negates efforts to reduce salinity by other means.

Geographic data relevant to land management decisions has been prepared in a digital format. To give an overview of the data, the report presents small scale maps, and tabulates different categories of areas within Management Units areas; this is adequate for general information, but for more intensive studies more detail can be made available from the digital data. Topics covered are: cadastre and roads; rivers, gauging stations and isohyets; geology and airborne magnetic data; soil-landscape systems and airborne radiometric data; elevation as digital elevation models and contours; natural vegetation complexes, Landsat scene showing current vegetation cover, and mapping of the status of trees over the catchment.

The clearing history is shown as a map with associated area tabulations. 677 km^2 of the total catchment area of 2823 km^2 had been cleared by 1977, when Clearing Control legislation was introduced, including areas cleared by CALM to plant pines near Wellington Reservoir. 184 km^2 of the 677 km^2 had been replanted to plantations by 2000, with about 37 km^2 more identified as future planting areas.

The records of stream flow and stream salinity are summarised for the mainstream gauging stations at Mungalup Tower, Collie River South, Bingham River, Collie River East, James Crossing and James Well, and also the estimated total inflows to Wellington Reservoir. The trend analysis shows that since 1990 the Wellington inflows, Mungalup Tower and Collie River East may have reached a maximum salinity of 870, 1130, and 1990 mg/L respectively at mean annual flow. Collie River South, James Crossing and James Well had reached 920, 5900 and 2400 mg/L respectively by 1993, and prior to that showed increasing trends of 9, 157 and 34 mg/L/yr respectively. The salinity of Bingham River continues to be less than 300 mg/L.

The trends in groundwater level were reviewed in three land use types: cleared land, reforested land and native forest. In cleared and reforested areas, three stages could be recognised: 'pretreatment' (before the clearing or before reforestation); a transition stage; and a final, steady, stage. The transition stage starts 2 or 3 years after the date of clearing or tree planting. In the Lemon catchment,

cleared from the watershed to the streamline, the transition stage lasted 10 years. As there has been only minor clearing over the last 25 years, it is concluded that groundwater levels have substantially reached their maximum throughout the catchment. At reforestation sites the transition was 5 years. Thus the full impact on groundwater levels in areas successfully planted with trees can be expected within 10 years.

The relationships between water in the landscape, geological formations, vegetation and salinity have been explained with reference to experimental sites in the Collie catchment. The effects on salinity of diverting stream flow, pumping groundwater, or constructing drains have also been examined. As land managers better understand groundwater flow processes associated with dryland salinity, the success rate of treatments should improve. It is important to recognise that there are two distinct objectives: to reduce the salinity of inflow to Wellington Dam, and to improve productivity on land currently salt-affected; and that any one treatment, such as planting trees, may further one more than the other.

The gross quantities of stream flow and salt load coming from the Management Units give an indication of the salt load reduction required to meet the inflow salinity target: 500 mg/L flow-weighted average for the year, in a year of average flow. The salt load input to Wellington Dam needs to be reduced by about 50%, with some variation depending on where in the catchment reductions are made, and allowing for the expected stream flow reduction caused by treatments.

A range of feasible management options has been assessed. Most of the catchment was computer modelled, and this used to estimate the effects of planting trees, use of lucerne and shallow drainage. Modelling requires some assumptions and generalised data where detailed information is lacking. While results are the best available at present, estimates should be revised with future improvements in information and modelling.

The options considered were: tree plantations on land already committed for such use; alley farming using commercial trees on other suitable land; other suitable tree-species on land not suitable for commercial trees or plantations; lucerne on suitable land; shallow drainage on pasture land; groundwater pumping; and partial or total diversion of stream flow from upstream tributaries.

A summary table was made of the results for each option being applied to its feasible maximum throughout the catchment. As well as affecting inflow salinity, each option had an effect on the volume of stream flow and the areas in the catchment affected by shallow water table and seepage of deep groundwater.

While no single option could achieve the target, Table 9.1 shows that the target could be met, or substantially met, by adding separately any of a variety of options, assuming the committed tree plantations are in place.

Reduced alley density of upland commercial trees, or planting only part of the suitable land, would give proportionately less salinity reduction; the reduction would also be less if not all land suitable for lowland trees was planted, or if groundwater pumping was installed in only some areas. Shallow drainage by itself gave very marginal benefits (approx 1%) for the inflow salinity target.

Even so, these results indicate that a combination of treatments to meet the target salinity can be found.

Table 9.1 Summary of effects of management options

Case	Predicted Mean Inflow Salinity (mg/L)	Predicted Mean Inflow volume (GL/yr)	Estimated shallow water-table area (includes seepage area) (km^2)
State of catchment in 1995	885	145	127
Current and planned plantations	758	134	104
Option added to all plantations			**Further reduction in shallow water-table area**
Diversion of Collie East Branch	597	126	9%
Groundwater pumping	522	130	No estimate, but a substantial reduction expected
Lowland trees on all land not suitable for Upland Commercial trees	524	114	44%
Commercial trees on all suitable land	577	106	37%